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INSTITUTO DE CIÊNCIAS NATURAIS, HUMANAS E SOCIAIS
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS AMBIENTAIS

Fabiana Aparecida Rego Ciecoski

PARMELIACEAE **(FUNGOS LIQUENIZADOS) EM TRÊS ÁREAS DA AMAZÔNIA MATO-GROSSENSE, BRASIL**

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Orientadora: Prof.ª Dra. Flávia Rodrigues Barbosa
Coorientador: Prof. Dr. Adriano Afonso Spielmann (UFMS)
Coorientador: Prof. Dr. Marcelo Pinto Marcelli (IPA)

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Tentei tocar as estrelas...

O Sol já dava sinais de que iniciaria mais um daqueles espetáculos de cores e brilho. Na margem do Rio Fontourinha, a última checagem do material necessário para mais uma coleta; desta vez, de barco... e partimos. Os sinais de outrora, em nada se assemelhavam ao espetáculo que meus olhos tiveram a graça de contemplar naquele instante. O tempo foi generoso e fez-se estático; aquela inércia, ainda regada de lucidez e intensa emoção, guiou o registro que seria guardado em gavetas especiais em meu coração. É assim que componho minhas memórias.

[...]

No retorno, o espetáculo de cores foi substituído pela ausência total de luz. Já o brilho de uma única estrela de antes, agora estava fragmentado em milhares de Sites luminosos. Já havia observado o céu à noite e não foram poucas as vezes. No entanto, desta, no ímpeto de tentar tocá-las estendi os meus braços em direção ao firmamento. Eram tantas e pareciam estar tão próximas que por um lapso, esqueci-me do conceito de medidas astronômicas e lá estava eu... esticando já os dedos das mãos como se realmente fosse possível... Breves segundos depois, já trazendo de volta as mãos e posicionando-as sobre meu coração, em prece, agradeci por ter experimentado a sensação de transcender. E claro, ri, afinal tentei tocar as estrelas.

[...]

Ontem, ao visitar a gaveta desta memória provei novamente da emoção que senti naqueles breves instantes. Percebi também que na verdade, não poucas foram as vezes que ergui meus braços em direção aos meus sonhos... No entanto, o que experimentei, não guardo na mesma gaveta que citei acima. E se juntei minhas mãos sobre meu coração nestes momentos, não foi para agradecer, mas, para pedir. Pedir que fosse breve. Que fosse leve. Que trouxesse paz. Que o toque fosse aveludado e o perfume inebriasse. Que aquecesse o coração. Que levasse embora tudo o que não tivesse cor e brilho... E muitos foram os pedidos.

[...]

Hoje, quando olho para o “firmamento” constato que as lacunas deixadas por sonhos antigos não realizados, estão sendo preenchidas. Quanto aos meus pedidos, é o que tenho recebido como resposta a cada um deles que me faz transcender... e, desde então, quando junto minhas mãos sobre o coração é sempre para agradecer.

[...]

Muitas são as memórias construídas ao longo das expedições: o cheiro da serapilheira, o sabor da água de cipó, o frescor da neblina em meio aos primeiros raios do Sol, o gosto de frutos que não conhecia, a temperatura da água dos rios, o perfume das flores, das cascas, a (doce) companhia..., mas, se me perguntares qual delas é a mais especial, não vou hesitar em dizer que foi o dia em que me permiti “tocar as estrelas”.

(Fabiana A. R. Ciecoski, 12 de maio de 2021)

RESUMO

A Amazônia se destaca por apresentar a maior biodiversidade do planeta, sendo esse patrimônio natural de imenso valor econômico e ambiental. No entanto, as atividades vinculadas à exploração dos seus recursos naturais, como o crescente desmatamento das florestas, por exemplo, corroboram para que informações importantes sobre diversos grupos biológicos se encontrem negligenciadas, como é o caso dos fungos liquenizados. Este trabalho teve por objetivo ampliar o conhecimento acerca dos fungos liquenizados da família *Parmeliaceae* na Amazônia mato-grossense. As coletas ocorreram em três áreas de estudo: as Unidades de Conservação Parque Estadual do Cristalino e Parque Estadual do Xingu e nas parcelas e trilhas do PPBio na Fazenda São Nicolau. Amostras de fungos liquenizados foram coletados com o auxílio de faca e martelo em deslocamento ao acaso em 30 pontos distribuídos nas áreas de estudo. As amostras foram acondicionadas individualmente em sacos de papel e encaminhadas ao Acervo Biológico da Amazônia Meridional, onde foram visualizadas sob estereomicroscópio e microscópio óptico, a fim de visualizar estruturas de importância taxonômica e proceder com a identificação ao nível de gênero. Os táxons foram identificados ao nível de espécie no laboratório particular do Prof. Dr. Marcelo Pinto Marcelli situado em São Roque (São Paulo) por meio de análises morfológicas e anatômicas detalhadas, testes químicos complementares, cromatografia em camada delgada e microcristalização. Foram analisadas um total de 71 amostras de fungos liquenizados foliosos da família *Parmeliaceae* resultando em 39 espécies pertencentes a 5 gêneros: *Bulbothrix*, *Parmelinella*, *Parmotrema*, *Pseudoparmelia* e *Canoparmelia*. Destas, 3 espécies são novos registros para o Mato Grosso e 34 são espécies novas para a ciência. As espécies foram descritas a partir da última versão do Protocolo do Grupo de Estudos Liquenológicos (GEL) do Instituto de Botânica desenvolvido pelo Prof. Dr. Marcelo Marcelli aprimorado a partir de particularidades anatômicas presentes nos espécimes amazônicos e tratadas em 5 publicações diferentes de acordo com os grupos químicos e o gênero das espécies. Esta pesquisa mostrou que, nas três áreas de estudo, a ocorrência dos liquens foi mais abundante em locais mais iluminados e de dossel aberto e que o grande número de espécies novas encontradas caracteriza as áreas de estudo como reservatórios de biodiversidade, que carecem de mais estudos também para as demais famílias. *Parmotrema* foi o gênero mais representativo com um total de 33 espécies das quais 30 são espécies novas, seguido de *Bulbothrix* com três espécies (duas novas) e *Canoparmelia*, *Pseudoparmelia* e *Parmelinella*, com uma espécie cada. Esse estudo também pode alicerçar políticas públicas ambientais que visem a conservação do bioma Amazônia.

Palavras-chave: Biodiversidade, Sistemática de Liquens, Taxonomia, Protocolo GEL

ABSTRACT

The Amazon stands out for having the greatest biodiversity on the planet, being this natural heritage of immense economic and environmental value. However, activities linked to the exploitation of its natural resources, such as the increasing deforestation, for example, confirm that important information about different biological groups is neglected, as is the case of lichenized fungi. This work aimed to expand the knowledge about lichenized fungi of the family *Parmeliaceae* in the Amazon of Mato Grosso state. The collections were carried out in three study areas: the Cristalino State Park, the Xingu State Park, and the Fazenda São Nicolau. Samples of lichenized fungi were collected with aid of a knife and hammer from in random displacement at 30 points distributed in the study areas. The samples were individually packed in paper bags and sent to the Acervo Biológico da Amazônia Meridional, where they were viewed a stereomicroscope and optical microscope, in order to visualize structures of taxonomic importance and proceed with the identification at the genus level. Taxa were identified at the species level in Dr. Marcelo P. Marcelli's laboratory (IML) located in São Roque city (São Paulo state) through detailed morphological analysis, complementary chemical tests, thin layer chromatography and microcrystallization. Altogether 71 samples of lichenized foliose fungi of the *Parmeliaceae* were analyzed, resulting in 39 species belonging to 5 genera: *Bulbothrix*, *Parmelinella*, *Parmotrema*, *Pseudoparmelia* and *Canoparmelia*. Of those, 3 species are new records for Mato Grosso State and 34 are new species for science. The species were described under the latest version of the Protocol of the Lichenological Studies Group (GEL) of the Instituto de Pesquisas Ambientais developed by Dr. Marcelli (added with anatomical particularities present in Amazonian specimens) and prepared for 5 different publications observing chemical groups and the genus of the species. This research concluded that in the three studied areas the occurrence of lichens was more abundant in more illuminated places with an open canopy, and that the large number of new species found characterizes the study areas as reservoirs of biodiversity that are in need of further studies on this and other families. *Parmotrema* was the most representative genus with a total of 33 species of which 30 are new species, followed by *Bulbothrix* with three species of which two are new, and *Canoparmelia*, *Pseudoparmelia* and *Parmelinella*, each of them with one new species. This study can also support public environmental policies aimed at the conservation of the Amazon biome.

Key words: Biodiversity, Systematics of Lichens, Taxonomy, GEL Protocol

SUMÁRIO

INTRODUÇÃO GERAL

A biodiversidade encontrada nos diferentes biomas brasileiros exibe uma variedade de espécies com alto potencial ecológico e econômico para a humanidade (MENIN, 2010). Dentre os biomas, a Amazônia destaca-se por ser a maior floresta tropical úmida do mundo, abrangendo 5% da superfície terrestre do planeta e 40% da América do Sul, totalizando uma área de aproximadamente 4,8 milhões de quilômetros quadrados (LEMOS; SILVA, 2011). No Brasil, a Amazônia ocupa cerca de 61% do território e abrange nove estados: Acre, Amapá, Pará, Amazonas, Rondônia, Roraima, Mato Grosso, Tocantins e Maranhão (ASSAD, 2016; MENIN, 2010).

Segundo Menin (2010) a Amazônia possui uma imensa quantidade de espécies ainda desconhecidas pela ciência. Essa biodiversidade vem sendo fortemente ameaçada (FISCH *et al*., 1998), fazendo com que informações sobre importantes grupos biológicos se encontrem negligenciadas (GARRIDO-FILHA, 2002; IRIGARAY *et al*., 2013), em risco ou mesmo perdidas, como é o caso dos fungos liquenizados.

Para a Amazônia, espécies de fungos liquenizados têm sido reportadas de forma fragmentada entre os estados abrangidos pelo bioma. Cáceres e Aptroot (2017) a partir de pesquisas na Reserva Florestal Adolpho Ducke, no Amazonas, totalizaram 350 espécies para o estado. No Pará, Brako *et al*. (1985) realizaram coletas na Serra do Cachimbo e amostraram um total de 91 macroliquens e 1900 exsicatas de fungos liquenizados. Já Monteiro *et al*. (2018) registraram para o Pará 177 espécies distribuídas em 65 gêneros. Para Rondônia, Aptroot e Cáceres (2013, 2014a, 2014b, 2014c) registraram 122 espécies das quais 37 foram novas para a ciência. Cáceres *et al.* (2014) apresentaram a descrição de 75 novas espécies para a ciência a partir de material coletado em Rondônia, totalizando 502 espécies para o estado.

Cáceres e Aptroot (2016) registraram 209 ocorrências para o estado do Amapá, das quais, oito foram novos registros para o neotrópico, uma foi nova ocorrência para a América do Sul e outras sete foram novas ocorrências para o Brasil. Ainda segundo os autores, o gênero *Astrothelium* Eschw. é o mais rico em número de espécies nos estados do Amapá e Rondônia, podendo ser também em toda a Amazônia. Para o Tocantins, Feuerstein *et al*. (2013), realizaram um levantamento de fungos liquenizados predominantemente em áreas de cerrado, registrando 64 espécies. Já Aptroot *et al*. (2017) catalogaram 127 espécies como novas para o estado do Tocantins, 126 para o Maranhão e 73 para o Pará, 22 como primeiros registros para o Brasil. No Acre, 304 espécies de liquens são conhecidas; destas, 247 são corticícolas e 59 espécies são foliícolas (APTROOT *et al*., 2021). Em uma expedição para Chapada dos Guimarães, estado do Mato Grosso, Aptroot e Souza (2021) relataram 191 espécies, 14 das quais são novos registros para o Brasil e os demais são novos registros para o estado. Para o estado de Roraima, dados são inexistentes.

O fungo liquenizado é aquele onde o fungo (ou micobionte), obrigatoriamente, se associa a alga e/ou cianobactéria (ou fotobionte) formando estrutura conhecida como líquen (MARCELLI, 1998). Nesta associação, o micobionte fornece proteção ao fotobionte, porém, em troca, se beneficia dos produtos da fotossíntese do fotobionte (MARCELLI, 2006). Dentre as espécies que compõem o micobionte, 98% pertencem ao Filo *Ascomycota* e 2% ao Filo *Basidiomycota* do Reino *Fungi*. Já o fotobionte, são algas pertencentes ao Reino *Plantae* ou cianobactérias do Reino *Monera* (ALEXOPOULOS *et al.*, 1996; FLEIG *et al.*, 2008; NASH, 2008; SPIELMANN, 2005). O fungo liquenizado pode também ser descrito como um fungo que aprisionou uma população de algas e/ou cianobactérias com as quais ele vive em simbiose (FLEIG *et al*., 2008).

Os fungos liquenizados podem ser encontrados nos mais variados hábitats, sendo mais abundantes em regiões bem iluminadas e com alta umidade do ar. Por essa razão, os liquens habitam a superfície dos substratos (cascas de árvores, folhas, rochas, telhados, muros, paredes, vidro e outros) em busca de luz para favorecer o fotobionte. Segundo Lücking (1998), os fungos liquenizados podem habitar até os substratos não convencionais como o plástico, por exemplo.

O talo liquênico apresenta grande variação de formas e cores. As formas de crescimento mais comuns são: filamentoso, crostoso, folioso, fruticoso, esquamuloso e dimórfico (MARCELLI, 2006). Já a coloração varia de acordo com o fotobionte. Quando o fotobionte presente é uma alga verde, o talo apresenta coloração entre o branco e o cinza com possíveis tons esverdeados; quando é uma cianobactéria, o talo apresenta variações entre o preto, marrom e cinza-chumbo; entretanto, cores como o amarelo, laranja ou vermelho, podem ocorrer em determinados grupos e são resultantes da produção de substâncias coloridas que podem ser produzidas tanto pelo micobionte quanto pelo fotobionte, ou ainda, substâncias resultantes da associação que agem como filtros solares para proteção dos fotobiontes contra efeitos da radiação solar (RIKKINEN, 1995).

A reprodução do fungo liquenizado pode ser direta ou indireta. Na reprodução direta, o micobionte e o fotobionte formam juntos estruturas especializadas na reprodução; na indireta, micobionte e fotobionte reproduzem-se separadamente e posteriormente se liquenizam (MARCELLI, 2006; SPIELMANN; MARCELLI, 2006).

Os fungos liquenizados podem ser utilizados como biomonitores da qualidade do ar (APTROOT; van HERK, 2007; KÄFFER, 2011), bioindicadores de alterações ambientais e poluição do ar (BLASCO *et al*., 2008; LEONARDO *et al*., 2010; NASH III; GRIES, 1991) e como bioindicadores da saúde da floresta (FLAKUS, 2013). Além disso, são utilizados na produção de cosméticos, biotecnologia, alimentação, agricultura, produção de tintas e no monitoramento do aquecimento global (APTROOT; van HERK, 2007).

Dados mais recentes mostram que existem 19.409 espécies de fungos liquenizados (1.002 gêneros, 119 famílias e 40 ordens de fungos) catalogados no mundo (LÜCKING *et al*., 2017a, b) e podem existir ainda 40.000 espécies a serem descobertas (HAWKSWORTH, 1995). De acordo com Aptroot (dados não publicados), organizador do *Checklist of the lichens of Brazil*, atualmente se tem registrado 4.342 espécies para o Brasil e os números tendem a aumentar exponencialmente.

Dentre as famílias de fungos liquenizados, *Parmeliaceae* é a de maior ocorrência no mundo (BENATTI, 2005) com 2.765 espécies distribuídas em 80 gêneros (LÜCKING *et al*., 2017a, b: THEL *et al*., 2012). No Brasil, apresenta 509 espécies distribuídas em 26 gêneros (APTROOT, dados não publicados). A família possui um talo tipicamente folioso, com uma estrutura laminar anatomicamente composta por camadas (estratos) bem definidas. O **córtex superior** atua na proteção do talo e fica sobre a **camada de fotobiontes** e, logo abaixo dela, existe uma **medula** com hifas frouxamente organizadas. Por fim, existe o **córtex inferior**, um revestimento do qual se projetam estruturas especializadas de fixação denominadas **rizinas**. Apresentam lobos (divisões irregularmente arredondadas) ou lacínios (divisões alongadas) bem definidas (HALE, 1979; MARCELLI, 2006; SPIELMANN; MARCELLI, 2006).

Segundo Marcelli (comunicação pessoal) a família *Parmeliaceae* é cosmopolita podendo ocorrer em áreas florestais ou urbanizadas (ainda que pouco poluídas), em campos abertos, restingas e costões rochosos de orla marítima, manguezais, formações de cerrado, regiões montanhosas e campos rupestres sobre os mais variados substratos sendo corticícola, saxícola, terrícola ou muscícola. Ocorrem também em uma variada amplitude de latitudes e altitudes (BENATTI; MARCELLI, 2008)

A sistemática moderna dos fungos liquenizados apoia-se em caracteres morfológicos, químicos e anatômicos (MARCELLI, 2006), bem como na ontogenia dos ascomas e estrutura dos ascos e na cladística (TEHLER, 1988), PCR (Reação em Cadeia Polimerase) para análises filogenéticas (LUMBSCH *et al*., 2011; LUTZONI *et al*., 2004). O Código Internacional de Nomenclatura para Algas, Fungos e Plantas determina que o nome dado ao líquen se refira à espécie de fungo que o constitui (TURLAND *et al*., 2018).

Os resultados deste trabalho foram divididos em cinco capítulos brevemente descritos a seguir:

O primeiro capítulo trata de 8 espécies do gênero *Parmotrema* com ácido protocetrárico na medula. Das 8 espécies, 7 são novas e uma (*P. subochraceum*) é um novo registro para o Mato Grosso. O trabalho também apresenta a última versão do Protocolo do Grupo de Estudos Liquenológicos do Instituto de Botânica e explicações detalhadas de novas terminologias anatômicas observadas em espécimes brasileiros ao longo dos últimos 20 anos e aspectos anatômicos observados exclusivamente nos espécimes da Amazônia mato-grossense.

O segundo apresenta 7 espécies de *Parmotrema* com ácido salazínico na medula. Das 7 espécies, 6 são novas e uma (*P. cristiferum*) já foi registrada para o Mato Grosso.

O terceiro apresenta 9 espécies novas de *Parmotrema* com ácidos graxos na medula.

O quarto e último sobre o gênero *Parmotrema*, traz 9 espécies com componentes químicos diversos como: ácido alectorônico, ácido α-colatólico, ácido norstíctico, ácido girofórico e ácido vulpínico. Das 9 espécies, 8 são novas e uma (*P. sulphuratum*) é um novo registro para o Mato Grosso.

Finalmente, o último capítulo apresenta 6 espécies de *Parmeliaceae* distribuídas em 4 gêneros: *Bulbothrix* (3 espécies, das quais 2 são novas e uma (*B. tabacina*) é um novo registro para o Mato Grosso), *Parmelinella* (1 espécie), *Pseudoparmelia* (1 espécie nova) e *Canoparmelia* (1 espécie nova).

O presente trabalho teve como objetivo realizar o estudo taxonômico da família *Parmeliaceae* em três áreas na Amazônia Mato-Grossense: Parque Estadual do Cristalino, Parque Estadual do Xingu e Fazenda São Nicolau ampliando o conhecimento da liquenologia brasileira e criando recursos para estudos futuros de biotecnologia e conservação.

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CAPÍTULO I.

Some new species of *Parmotrema* (*Parmeliaceae*) from the Brazilian Amazon with protocetraric acid described according to a new protocol

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O presente manuscrito seguirá as padronizações adotadas pelo periódico *Acta Botanica Brasilica*, ao qual o presente trabalho será submetido (Anexo A).

Original article

Some new species of *Parmotrema* (*Parmeliaceae*) from the Brazilian Amazon with protocetraric acid described according to a new protocol

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Abstract

For about 20 years the Group of Lichenological Studies (GEL) has worked in the development of a protocol that could effectively describe the morphological characters of foliose *Parmeliaceae* guaranteeing distinction of species and reflect the actual knowledge on this group. During a survey on *Parmeliaceae* from Amazon rainforest in Brazil we found seven new species of *Parmotrema* (*P. bagaglii*, *P. castagnae*, *P. latericulosum*, *P. lavineae*, *P. pseudolatericulosum*, *P. spielmannii*, and *P. sublatericulosum*) and *P. subochraceum*, a new occurrence for Mato Grosso State. All species produce medullary protocetraric acid, and are described and commented under the new protocol as demonstration.

Keywords: Amazon, lichen systematics, protocol, Xingu, *Parmotrema*, Cristalino, taxonomy, satin, pustules.

Introduction

The Amazon Rainforest is the largest tropical rainforest on the planet. Its 4,800,000 km2 occupy 5% of the entire dry surface of the world and 40% (nine countries) of South America (Lemos & Silva 2011). In Brazil, the Amazon spans nine states, representing about 61% of the territory (Assad 2016; Menin 2010).

In addition to its enormous extension, the Amazon has the greatest biodiversity on the planet, and is believed to hide an immense number of unknown species (Menin 2010). According to Magalhães *et al*. (2012), 20% of all the planet's biodiversity is in the Amazon, which is heavily threatened by anthropic actions.

Recently, several works from different taxonomic groups of lichenized fungi collected in Northern Brazil, resulted in many new species (Aptroot *et al*. 2017; 2021; Cáceres & Aptroot 2016; 2017) but none in *Parmeliaceae* Eschw. or in *Parmotrema* Massal specifically.

Parmeliaceae is one of the most numerous families of lichenized fungi with a worldwide distribution, with 2,765 species distributed in 80 genera (Thel *et al*. 2012; Lücking *et al*. 2017a; b). In Brazil there are approximately 500 species in 26 genera (Aptroot, personal communication).

The genus *Parmotrema* is recognized by the foliose thallus with rounded and broad lobes and commonly with ciliated margins, by the upper cortex that can usually present macules, isidia, soredia or pustules, by the underside usually black in the center with margins ranging from brown to white, by ellipsoid, non-septate, hyaline ascospores with thick epispore and emerged pycnidia. *Parmotrema* has 350 species cataloged (Elix 1993; Brodo *et al*. 2001; Nash & Elix 2002) and in Brazil, more than 196 species are cited to now (Aptroot, unpublished data).

This work aimed to carry out a taxonomic study of some species of *Parmotrema* with protocetraric acid in three areas of the Mato Grosso Amazon, Cristalino State Park, Xingu State Park and São Nicolau Farm, and to provide subsidies for public environmental policies for the conservation of the Amazon.

Material and methods

The study areas are located in the extreme north of the Mato Grosso State, inside the Amazon biome (Figure 1). The expeditions for the collection of lichenized foliose fungi were carried out from May/2020 to March/2021.

The Cristalino State Parks I and II have together an extension of 251,800 hectares between the cities of Novo Mundo and Alta Floresta (9°28'17.45"S, 55°49'22.20"W) in a hot and humid climate type Am (tropical with alternance of dry and rainy seasons), with annual average temperatures above 24 °C and annual average rainfall above 2,400 mm (Rodrigues *et al*. 2015; Sasaki et al. 2008), possess several types of Amazon rainforest vegetation (Borges *et al*. 2014), and the relief varies from undulate to mountainous with elevation of 100 to 400 m (Sasaki *et al*. 2008).

The Xingu State Park, in the city of Santa Cruz do Xingu, is in an area called Middle Xingu (9°53'47.15"S, 52°30'36.37"W), part of the Amazon basin (Lima et al. 2018) and occupies about 95,000 hectares. The principal vegetational types are the Seasonal Semidecidual Submontane Forest and the Forested Savanna (Borges *et al*. 2014). The climatic seasons are rainy and dry and well defined, the dry one during four to six months (IBGE 2012). The temperatures range from 21 to 32 ºC and the rainfall from 2,000 to 5,000 mm/year on a plane to strongly undulate relief 100 to 300 m elevated (Lima *et al*. 2018).

The São Nicolau Farm has a private preservation area with 7,000 hectares of little impacted Amazon rainforest (Rodrigues *et al*. 2011; Sonoda & Rebellato 2016) in the municipality of Cotriguaçu next to the Juruena River. It is covered by an open and dense Ombrophilous Forest (Veloso *et al*. 1991), has an elevation of 200 to 300 m, climate and average temperature like those of the Cristalino State Parks, and an average rainfall of 2,034 mm (Noronha *et al*. 2015).

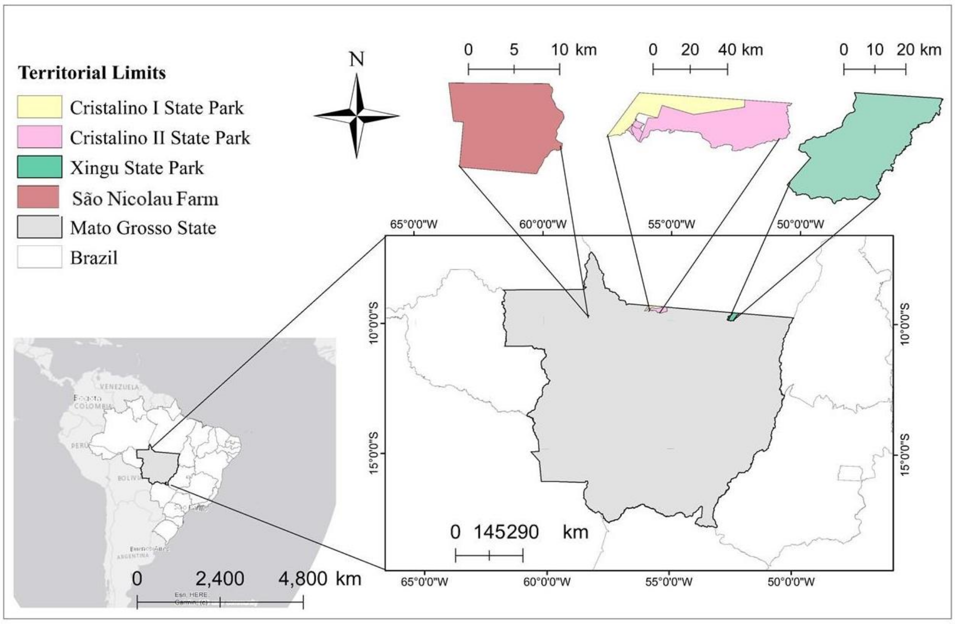

Figure 1. Location of Cristalino I and II State Park, Xingu State Park and São Nicolau Farm in Mato Grosso. Datum SIRGAS2000. Source: IBGE – Brazilian Institute of Geography and Statistics, BC250, Version 2019. Prepared by F.A.R. Ciecoski.

Samples of *Parmotrema* (*Parmeliaceae* family) were obtained with the aid of a knife and hammer. Each sample was individually packed in paper bags where data such as collector number, location and substrate were noted. Then, the material was sent to the laboratory of the Acervo Biológico da Amazônia Meridional for analysis.

The methodology adopted for collection and herborization was based on Brodo *et al*. (2016), Fidalgo & Bononi (1967; 1989), Peixoto & Maia (2013), and adjustments were made when necessary.

Specimens were morphologically studied using stereomicroscope and light microscope. Anatomical sections, including those of apothecia and pycnidia, were hand made with razor blades. The chemical constituents were checked by spot tests with potassium hydroxide (K), sodium hypochlorite (C) para-phenylenediamine (P), and examined under UV light (360 nm). Microscopic measures were taken in water. Chemical constituents were identified by thin-layer chromatography (TLC) using solvents B, C and G (Huneck & Yoshimura 1996; Orange *et al*. 2010; White & James 1985), and compared with authentic samples.

The descriptions were made using the protocol developed by the Group of Lichenological Studies (GEL) of the Instituto de Botânica (São Paulo city, Brazil) during the last 20 years and improved constantly according to the faced problems and found solutions when attempting to pattern descriptions that efficiently and adequately distinguish species and specimens of *Parmeliaceae*.

The illustrations made from the high-resolution digitization (1200 to 3600 dpi) of the type specimens.

The types were deposited in the Centro-Norte-Mato-grossense Herbarium (CNMT) of Universidade Federal do Mato Grosso (UFMT) and the isotypes will be deposited in the Herbarium of the Universidade Federal do Mato Grosso do Sul Foundation (CGMS).

Results and discussion

Among the 23 specimens of *Parmotrema* containing protocetraric acid found, seven new species were found, and *P. subochraceum* Hale is a new occurrence for Mato Grosso State. They are described, illustrated and commented below.

Parmotrema bagaglii Ciecoski & Marcelli **sp**. **nov**. (Fig. 2)

MycoBank MB842955

Parmotrema bagaglii is an applanate, lobate, maculated, eciliated species that has a bicolored medulla and develops apical pustules that dismantle into farinose soredia on marginal dichotomous lacinules, develops cicatrized ramified fissures on the underside, and produces medullary protocetraric acid and stictic acid.

Type. BRAZIL, Mato Grosso State, municipality of Cotriguaçu, São Nicolau Farm, Site 11: 9°48'59.15"S, 58°16'70.42"W, elevation 244 m, open ombrophilous Forest, on tree trunk, *F. Ciecoski 475,* 07-VI-2020.

Holotype. CNMTf 495

Etymology: The epithet is in honor of Prof. Dr. Eduardo Bagagli, from Universidade Estadual Paulista (UNESP, Botucatu) for his contributions to Mycology.

Description. THALLUS corticolous; greenish-gray; mostly applanate (except for the sorediate areas); sublustrose; lobate; pergaminaceous; macules weak and punctiform, irregularly distributed on distal parts; satin clear at 20×; size till 10 cm; epruinose; not auto incompatible. LOBES short, anisotomic to sympodial; axils oval to auriculate; few axillary folds; 3.0–5.0 mm wide at branching base, the major width 5.0–10.0 mm; laterally superposed to contiguous, rarely counterposed; loose adnate to somewhat revolute when sorediate; black line clear-cut, till 0.1 mm broad, commonly complementary; longitudinal axis distended to undulate; transversal cut mostly concave. Proximal surface firm; reticulate to crackled and fissured; smooth to slightly creased. Distal surface firm; continuous to crackled; from smooth to slightly creased and rugose. Lateral margin smooth to irregularly cut and crenate; sinuous to undulated; closed and commonly lacinulate; apical zone ascending, revolute at the sorediate parts; apex rounded to irregularly cut, most of the times from plane to descending. CILIA absent. Secondary Lobes absent. Lobules few; concolored; common as cicatrization process of marginal lacerations in proximal surface and lateral margin, sometimes at the border of laminal commonly oval perforations; 0.5–1.5 mm long × 0.2–0.5 mm wide.; lamina plane to ascending; undulated; apex rounded; black line clear-cut, till 0.1 mm broad, black line complementary; eciliated; underside dark brown to black. Lacinules marginal in the proximal parts, underside ivory; commonly sorediate; dichotomous to irregularly ramified; isolated to contiguous to laterally superposed and straddled; from elevated to revolute; 2.0–4.0 mm long × 0.3–0.7 mm wide PUSTULES common; verruciform; not confluent; marginal to submarginal; till 0.7 mm wide; erumpent; dismantling into soredia; originate on the lacinules apices; caducous, pustular medulla K+ strong yellow. SORALS common; marginal to submarginal; labriform to irregular; 1.0 mm long × 0.5 mm wide; not coalescent; eciliated; cortex surrounding the soral crackled and shedding plates. SOREDIA from persistent to caducous and, in this case, leaving the medulla exposed and exhibiting a light brown pigment K+ yellow; not auto incompatible; farinose; ecorticated; heaped; commonly produced in the lacinules apical zones. ISIDIA absent. MEDULLA bicolored, one upper layer yellow and a lower layer white with irregular relative proportions; in rare points a third yellow very thin layer may occur close the under cortex, in other rare points the medulla may be completely white or yellow; pigment K+ red or purple absent; density normal. UNDERSIDE brown to dark brown at the marginal zone and black at the proximal parts. Marginal zone brown to dark brown; sublustrose; satin clear at 20×; ca. 3.0–

4.0 mm wide; attenuated; smooth to slightly creased; epapillated; erhizinated; not fissured. Proximal part black; sublustrous; satin clear at 20×; from creased to rugose and papillated; crackled; reticulate-fissured, the fissures sometimes perpendicularly ramified, 0.2–1.0 mm long × ca. 0.5–1.0 mm wide, commonly cicatrized and with elevated borders. RHIZINAE absent from marginal zone, monomorphic, simple sometimes with penicillate to arbuscular apices, cylindrical; common and irregularly distributed into small sparse regions; black; not pigmented; sublustrous; not gomose; satin clear at 20×; commonly interlaced and difficult to measure; straight; erect; monometric; 0.20–0.50 mm long × ca. 0.05–0.10 mm wide; just a few sparse groups distributed irregularly on the underside at the fixation regions. APOTHECIA absent. PYCNIDIA absent.

Color tests: upper cortex K+ yellow, UV-; yellow medulla K+ yellow, C-, KC+ faint yellow, P+ orange, UV-; white medulla K+ yellow, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, protocetraric acid and stictic acid. Without norstictic acid. The yellow pigment was not identified.

Comments. *Parmotrema bagaglii* has a pergaminaceous, maculate, sublustrous (satin clear at 20×) applanate grayish-green thallus that is ascending only at the sorediate areas. It develops marginal pustules producing soredia lobules and lacinules. The medulla has two colors, the upper part yellow and lower part white, the opposite of the great majority of the species with bicolored medulla. Some parts of the thallus may occasionally produce a third very thin yellow layer close to the under cortex. Besides, ramified, cicatrized fissures with elevated borders are developed on the under cortex, and the thallus produces protocetraric acid jointly with stictic acid. Additionally, since it is part of the group of protocetraric acid producing *Parmotrema* species, it is worth to state the absence of cilia and norstictic acid.

Parmotrema araucariarum (Zahlbr.) Hale (Hale 1965) is somewhat similar in the loosely adnate thallus, the lobes apices rounded and by producing soredia; however, differently of *P. bagaglii*, their soredia are granular and the upper surface goes from continuous to crackled to reticulately cracked, the thallus is mineral gray, the medulla is entirely pale orange yellow, and the medullary color reactions C+, KC++ yellow and P-, besides producing several unknown substances.

Parmotrema matudae (Kurok.) Hale ex DePriest & B.W. Hale (DePriest & B.W. Hale 1998) also has rounded eciliated lobes 6.0–10.0 mm wide, and bicolored medulla; however, in *P. bagaglii* the disposition of the layers is inverted and the yellow medulla reacts K+ yellow, C-, P+ orange [K+ purple, P- in *P. matudae*, diffractaic and barbatic acids]. Additionally, soredia of *P. matudae* are subgranular but farinose in *P. bagaglii*.

Parmotrema conjunctum Hale (Hale 1974) is also loosely adnate, eciliated and sorediate; however, has a light gray thallus, sorals strictly marginal, the lobes greater, 8–12 mm wide, the medulla wholly yellow and produces gyrophoric acid together lichexanthone with (medulla C+ rose, UV+).

The thallus of *Parmotrema affluens* (Hale) Hale (Hale 1971) is also loose adnate, eciliated, has labriform sorals, and has a bicolored medulla; however, the layers are inverted in disposition, the thallus is submembranaceous, has a narrow inferior marginal zone 0.5–4.0 mm wide, and produces medullary echinocarpic acid [upper cortex K+ brown, white medulla K-, KC+ orange; yellow medulla KC+ orange].

Parmotrema flavomedullosum Hale (Hale 1974) is another corticicolous loosely adnate species with rounded lobes apices sometimes eciliated, and colored medulla. However, its thallus is bigger, till 18.5 cm, and lobes much greater till 20.0 mm wide (Spielmann & Marcelli 2009), commonly develops sparse cilia, has no maculae and the medulla is yellow throughout, the pustules originate from laminal wrinkles, and has gyrophoric acid [medulla C+ orange, KC+ yellow, P-] (Hale 1965).

Parmotrema lavineae Ciecoski & Marcelli (described ahead) is about the same size and has a bicolored medulla similarly disposed, lacinules sorediate, labriform sorals, and a somewhat similar chemistry (protocetraric acid). However, its thallus is more delicate, submembranaceous, develops cilia, has no lobules or pustules, nor any substance of the stictic acid group.

Fig. 2. *Parmotrema bagaglii* (holotype, *F. Ciecoski 475, CNMTf 495). Scale bar = 10 mm.*

Parmotrema castagnae Ciecoski & Marcelli **sp. nov. (**Fig. 3)

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Parmotrema castagnae is a lobate, pergaminaceous, maculated species which has lacinules with sulcate pustules that dismantle into farinose frequently ciliate soredia, underside with not ramified not cicatrized fissures with elevated borders on the proximal part, bifusiform conidia, and produces protocetraric acid.

Type. BRAZIL, Mato Grosso State, municipality of Cotriguaçu, São Nicolau Farm, Site 11: 9°48'59.15"S, 58°16'70.42"W, elevation 244 m, open ombrophilous Forest, on tree trunk, *F. Ciecoski 486*, 26-IX-2020.

Holotype. CNMTf 496

Etymology. The epithet is in honor of the geographer Daniela Castagna, a good old friend that works as researcher on ecosystemic services in Amazon and Brazilian cerradoes.

Description. THALLUS corticolous; greenish-gray; sublustrose; lobated; pergaminaceous; maculae rare, efigurated, submarginal to marginal; satin already at 10×; till 6.0 cm broad; epruinose. LOBES short, anisotomous to sympodial; axils oval to square and torn, commonly involute, axillary folds few; auto incompatibilities at lateral margins; 2.0–7.0 mm wide at branching base, the major width 5.0–18.0 mm; contiguous to laterally superposed; conformed to substrate to slightly elevated; longitudinal axis distended to undulated; transversal cut with alternated plane and deeply concave parts. Proximal surface firm; from continuous to crackled; smooth to rugose and creased. Distal surface firm; continuous to slightly crackled, sometimes creased to escrobiculated. Lateral margin smooth to crenate with rare lacerations; straight to sinuous and revolute; closed; sorediated; black line subtle, till 0.1 mm, attenuated, complementary at the auto incompatible torn parts; apical zone from ascending to involute, revolute at the sorediate parts; apex rounded, plane, to revolute at the sorediated parts. CILIA black; few; only on some sorals; satin clear at 20×; without pigments; curved to sinuous; irregular in width; sharp; 1.00–1.20 mm long × 0.10–0.15 mm wide; descending; simple to rarely 2–4 ramified, 0.5 mm from the basis. Secondary lobes and laciniae absent. Lobules absent. Lacinules common; concolored; absent from distal part and common at the proximal region; growing from the lacinules apical crenae; pustulated and sorediated; sympodial to irregularly ramified; contiguous; from elevated to revolute; 1.0–2.0 mm long × 0.5–1.0 mm wide. PUSTULES common; verruciform; deeply sulcate to capitate; apical on the lacinules but also marginal to submarginal; not confluent but somewhat aggregated and spread on marginal and submarginal regions; till 0.5 mm wide; erumpent; dismantling into soredia on lacinules apices and on the revolute margins; rarely caducous and leaving the lacinules apical extremity completely exposed; with a brown K+ yellow pigment; pustular medulla K+ yellow. SORALS few; marginal to submarginal; labriform to capitate; till 0.4 × 0.6 mm; not coalescent; part of them ciliate; surrounding cortex crackled and shedding plates; not pigmented. SOREDIA both caducous and persistent, not auto incompatible; farinose; ecorticated; heaped; commonly produced at the apical parts of the lacinules; K+ yellow. ISIDIA absent. MEDULLA white, loose. UNDERSIDE brown or black at marginal zone and black at the proximal part. Marginal zone brown or black; lustrous; satin clear already at 10×; ca. 1.5–2.0 mm wide at brown part, no differentiation between marginal and proximal zones when black; slightly undulate at brown part and creased at the black part; epapillated; erhizinated; fissures common, not ramified, not cicatrized, with elevated borders. Proximal part black; sublustrous; satin already clear at 10×; from papillated to creased and rugose; irregularly fissured; fissures not ramified, not cicatrized, margins elevated. RHIZINAE absent form marginal zone; monomorphic, arbuscular; rare and irregularly distributed into small sparse places; black; not pigmented; subopaque; not gomose; satin clear only at 40×; just a few interlaced; sinuous; erect; monometric; 0.7–1.0 mm long × ca. 0.10–0.15 mm wide; just rare groups irregularly distributed on fixation places and difficult to measure. APOTHECIA absent. PYCNIDIA marginal to submarginal, immersed, ostioles black. CONIDIA bifusiform, straight, 10.5–12.0 × 1.5 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C+ weak yellow, KC-, P+ orange, UV-.

Substances of taxonomic importance: atranorin, protocetraric acid.

Comments. *Parmotrema castagnae* has a greenish-gray thallus without usnic acid, is pergaminaceous and rarely maculate, sublustrose but with satin already clear a 10× magnification, whose lobes present auto incompatibility at the lateral margins. It has marginal lacinules which commonly develop brownish pustules that expose a K+ yellow pigment and dismantle into farinose frequently ciliate sorals (the margins are surprisingly eciliated, an exclusive characteristic). The underside develops not cicatrized fissures with elevated borders and arbuscular rhizines, and the conidia are bifusiform. It is part of the species of *Parmotrema* species containing medullary protocetraric acid.

Parmotrema madilynae A. Fletcher (Hale 1986) is somewhat similar in the presence of cilia (although marginal), pustules originating soredia, few maculae, white medulla, and presence of protocetraric acid. However, it has a submembranaceous thallus and the pustules are extensive and laminal. Besides, Benatti & Marcelli (2011) described its conidia as bacilliform and mentioned the presence of malonprotocetraric acid (trace) and fatty acids, absent from *P. castagnae*, that also has brownish sorals and a brown pigment, different to *P. madilynae*

Parmotrema schindleri Hale (Hale 1986) also has rounded lobes, soredia, white medulla, cilia (marginal), white medulla, and protocetraric acid. However, it is strictly saxicolous, develops secondary lobes and produces gyrophoric acid.

Parmotrema ditatatum (Vain.) Hale (Hale 1974) is lobate, produces scarce marginal cilia, soredia on lacinules apices and protocetraric acid. However, its conidia are lageniform to sublageniform and produces additionally medullary echinocarpic acid, subvirensic acid, convirensic acid, and conechinocarpic acid (KC+ orangish-red) (Benatti & Marcelli 2010a; Vainio 1890).

Parmotrema spielmannii (Ciecoski & Marcelli) (described ahead) is chemically alike *P*. *castagnae* with the presence of medullary protocetraric acid (K-, C+ weak yellow, P+ orange, UV-). Differs morphologically by the presence of squizidia, the simple, furcate to irregularly ramified rhizinae, the sublageniform conidia, and chemically by the presence of a not identified fatty acid.

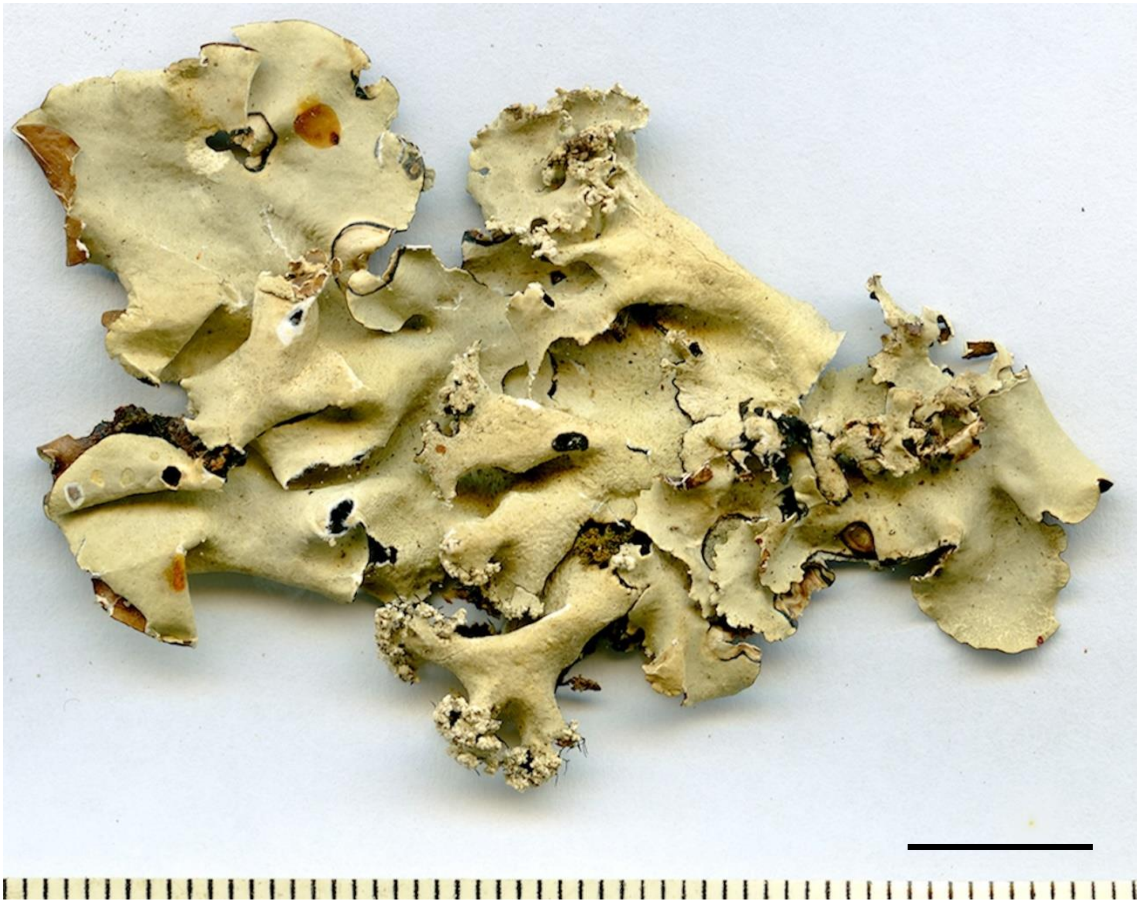

Fig. 3. *Parmotrema castagnae* (holotype, *F. Ciecoski 486, CNMTf 496). Scale bar = 10 mm.*

Parmotrema. subarnoldii (Abb.) Hale (Hale 1965) is described as lobate, with rounded sorediated apices, maculate, lacinulated, ciliate, with a white medulla, and producing protocetraric acid (K-). Differs in the presence of long sorediated lacinules. Furthermore, *P. subarnoldii* has a K+ purple pigment on its dense marginal cilia, the marginal zone may be white to variegate under the sorediate lobes, the rhizinae are concolored with the underside, and the medulla produces one fatty acid (protolichesterinic?) and traces of succinprotocetraric and fumarprotocetraric acids, which are absent in *P. castagnae* (Benatti & Marcelli 2011).

Parmotrema robustum (Degel.) Hale (Hale 1974) is somewhat similar in the presence of soredia, white medulla and, according to Eliasaro & Donha (2003), the presence of protocetraric acid. Differs from *P. castagnae* by the presence of marginal cilia (few), the presence of lobules, and the negative medullary color reactions.

Parmotrema latericulosum Marcelli & Ciecoski ***sp. nov.*** (Fig. 4)

MycoBank MB842957

Parmotrema latericulosum is a lobed subcoriaceous to subpergaminaceous eciliate thallus, slightly maculate since the submargin, densely crackled and cracked proximal surface, that develop lobules and schizidia, has a white medulla, apothecia sub-bullate, conidia bifusiform straight 9.0–10.5 × ca. 1.5 µm, and produces atranorin, protocetraric acid, praesorediosic acid, protopraesorediosic acid, and one unidentified fatty acid.

Type. BRAZIL, Mato Grosso State, municipality of Cotriguaçu, São Nicolau Farm, Site 12: 9°48'52.09" S, 58°17'39.10" W, elevation 246 m, open and dense ombrophilous Forest, on tree trunk, *F. Ciecoski 497*, 09-III-2021.

Holotype. CNMTf 497

Etymology. The epithet (from Latin *latericulu* = tile) makes reference to the intense crackling and cracking of the upper surface.

Description. THALLUS corticolous; gray; opaque; lobed; subcoriaceous (*F. Ciecoski 935)* or subpergaminaceous; macules weak and efigurated since the submargin, irregularly distributed; not satin even at 45×; till 15.0 cm broad (*F. Ciecoski 935*); epruinose; not auto incompatible. LOBES short, anisotomous to sympodial; axils acute to oval and auriculated; axillary folds common, low but long, till the central axis on the proximal parts; not self-autoincompatible; 5.0–7.0 mm wide at branching base, the major width 7.0–15.0 mm (*F. Ciecoski 935)*; laterally superposed to contiguous, rare counterposed; loose adnate to conformed to the substrate; black line absent to clear, till 0.1 mm wide, sometimes complementary; longitudinal axis distended to undulated (at the axillary folds); transversal cut plane/concave, except at axillary folds. Proximal surface firm to brittle; strongly crackled and sometimes cracked and shedding plates (medulla exposed in several parts), rare regions scrobiculated; cracks from subparallel to reticulated; smooth to slightly crumpled. Distal surface firm; continuous only at the submargin, soon crackled and cracked; smooth to slightly crumpled and rugose. Lateral margin smooth to irregularly cut and crenate; sinuous to undulated; closed; apical zone little ascending or descending; apex rounded to irregularly cut and crenate. CILIA absent. Secondary lobes absent. Lobules common; concolored; common as cicatrizing process of the lateral margins' lacerations, sometimes growing from the margins of laminal and commonly irregular perforations; 0.5–0.7 mm long × 0.2–0.5 mm wide; plane to ascending; undulated, crackled; rounded apices, black line attenuated, width till 0.5 mm, complementary; eciliated; underside light brown to ivory, rare plenty of marginal pycnidia (*F. Ciecoski 935)*. Lacinules absent. PUSTULES absent. SORALS absent. ISIDIA absent. SCHIZIDIA frequent; concolored; most plane; irregularly distributed on proximal surface; 0.5–1.2 mm diam.; opaque; relatively firm; occasionally studded with pycnidia (*F. Ciecoski 935*); originating from flaking of the upper cortex because of the intense crackling (*F. Ciecoski 935*).

MEDULLA white, somewhat lax. UNDERSIDE brown to dark brown at the marginal zone and black at the proximal part. Marginal zone lustrous on the brown part and sublustrous on the dark brown; satin clear already at 10× on the brown part and at 20× on the dark brown; ca. 3.0–7.0 mm wide; attenuated; smooth to crumpled; papillated on the transition zone; rarely rhizinated on the transition zone; not cracked Proximal part black; sublustrous; satin clear at 20×; from crumpled to rugose and crackled; the fissures sometimes perpendicularly ramified, 0.2–3.0 mm long × ca. 0.5–1.0 mm wide, sometimes cicatrized and with elevated borders. RHIZINES rarely present on marginal zone; dimorphic, simple and bifid, commonly with the apices penicillate (commonly whitish apices) to arbusculiform, cylindrical; common and irregularly distributed in small sparse regions; black; not pigmented; sublustrous; not gomose; satin clear at 20×; forked and 3–4 ramified since 0.6 mm height; commonly interlaced; straight; erect; monometric; 0.40–1.20 mm long × ca. 0.05–0.20 mm thick; just a few sparse groups irregularly distributed on fixation regions. APOTHECIA sub-bullate (very young); sulcate (very young); till 10.0 mm diam. (young); subadnate; laminal to submarginal; basis's medulla K+ yellow; disc brown, epruinose, entire (young), imperforated; margin till 1.5 mm thick, smooth, not ornamented; amphithecia smooth, emaculated, not ornamented, amphithecial medulla K+ yellow; stipe central (young), 0.7–1.0 mm wide × 0.2–0.5 mm high, smooth to crumpled, crackled, emaculated, not ornamented, stipe K+ yellow; hymenium till 75 µm alt. ASCOSPORES absent, asci absent. PYCNIDIA laminal to marginal, submarginais and subapical, immersed, ostioles black. CONIDIA bifusiform, straight 9.0–10.5 × ca. 1.5 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C-, KC+ weak yellow, P+ orange, UV-.

Substances of taxonomic importance: atranorin, protocetraric acid, praesorediosic acid, protopraesorediosic acid.

Comments. *Parmotrema latericulosum* is characterized by the gray, opaque, subcoriaceous, eciliated, maculated and strongly cracked thallus, the presence of lobules with studded of marginal pycnidia, the schizidia originated by cortical crackling, the white medulla containing protocetraric acid, praesorediosic acid, protopraesorediosic acid, and an unidentified fatty acid, the rhizines both simple and bifid, the underside fissures perpendicularly ramified, cicatrized, with elevated borders, and the conidia bifusiform straight 9.0–10.5 × ca. 1.5 µm.

Parmotrema sublatericulosum Ciecoski & Marcelli (described ahead) is somewhat similar in morphology and in the production of protocetraric acid. Differs in the subpergaminaceous, greenish-gray thallus, the young apothecia cupuliform till 8.0 mm diam., the sublageniform conidia 9.0–10.5 × ca. 1.50 µm and in the presence of not identified chemical substances.

Parmotrema pseudolatericulosum Ciecoski & Marcelli (described ahead) is also similar morphologically and chemically. Differs in the production of sulcate pustules that dismantle into soredia, and by the additional presence of an unidentified fatty acid.

Parmotrema disparile (Nyl.) Hale (Hale 1974) is similar in the loose adnate thallus, commonly eciliated rounded lobes, maculated and the white medulla containing protocetraric acid. Differs in the presence of long marginal lacinules and the presence of fatty acids and other not identified substances (medulla KC+ red and P+ brick red) (Flakus *et al*. 2014). The apothecia found in *P*. *latericulosum* were very young, but with purpose of register, *P*. *disparile* has apothecia subpedicellate with rugose maculated amphithecia, discs imperforated, hymenia 90–100 µm high, ascospores 16.0–21.0 × 8.0–10.0 µm, epispore 1.5–2.0 µm, and pycnidia common on the lacinules (conidia unknown) (Hale 1965).

Parmotrema cornigerum Kurok. (Kurokawa 2001) also has a gray loose adnate eciliate thallus that produces medullary protocetraric acid. Differs by the membranaceous, emaculated and laciniate thallus, the underside rarely rhizinated and with light yellow patches. The apothecia are 10.0–16.0 mm diam., the amphithecia rugose and emaculated, the discs brown and perforated, the hymenia 90.0–100.0 µm high, the ascospores ellipsoid to ovoid 20.0–21.0 × 9.0–10.0 µm, and the pycnidia unknown. (Kurokawa 2001).

Fig. 4. *Parmotrema latericulosum* (holotype, *F. Ciecoski 935, CNMTf 497). Scale bar = 10 mm.*

Parmotrema zollingeri (Hepp) Hale (Hale 1974) is similar in the loose adnate thallus with rounded lobules, the conidia 8.0–10.0 µm, and the presence of protocetraric acid. Differs in the olivaceous gray, lacinulated, and ciliated thallus, in the fumarprotocetraric acid and succinprotocetraric acid containing medulla, and the medullary color reactions KC+ red and P+ brick red. *Parmotrema zollingeri* has apothecia 3.0–10.0 mm diam., hymenia 70.0–80.0 µm alt., and ascospores 18.0–22.0 × 7.0–10.0 µm. (Hale 1965)

Parmotrema machupicchuense Kurok. (Kurokawa & Moon 1998) is similar only in the loose adnate thallus with white medulla containing protocetraric acid. Differs in the saxicolous habit, the yellowish-gray thallus, the presence of cortical usnic acid. The apothecia are concave

2.0–5.0 mm diam., the hymenia 90 µm high and the ascospores 16.0–18.0 × ca. 10.0 µm. (Kurokawa & Moon 1998)

Parmotrema lavineae Ciecoski & Marcelli ***sp. nov.*** (Fig. 5)

MycoBank MB842958

Parmotrema lavineae is a lobate submembranaceous very weakly maculate, eciliate to very scarcely ciliate species whose proximal surface is notably reticulate rugulose, develops apical labriform sorals on densely juxtaposed lacinules, has a bicolored medulla, apothecia concave imperforated, ascospores elliptical 15.0–27.5 × 12.5–17.5 µm, conidia sublageniform 4.8–6.4 × 1.6 µm, and medullary protocetraric acid and stictic acid.

Type. BRAZIL, Mato Grosso State, municipality of Cotriguaçu, São Nicolau Farm, Site 11: 9°48'59.15"S, 58°16'70.42"W, elevation 244 m, open ombrophilous Forest, on tree trunk, *F. Ciecoski 467*, 26-IX-2020.

Holotype. CNMTf 498

Etymology. The epithet *lavineae* is given after F. Ciecoski daughter's Lavínea Sofientini Ciecoski.

Description. THALLUS corticolous; greenish-gray, subopaque, satin clear at 30×; lobate; submembranaceous; till 10 cm broad. LOBES short-ramified, subdichotomous; axils rounded, acute or squared; 2.5–3.0 mm wide at branching base, the major width 6.0–8.0 mm; laterally superposed to heaped; loose adnate; longitudinal axis little undulated; transversal cut initially plane to concave, then concave or folded. Proximal surface firm, reticulated since very young, then crackled. Distal surface creased, with concavities towards the proximal part; epruinose; lateral margin smooth to irregularly cut, commonly slightly ascending and sometimes counterposed, closed; black line very subtle or absent, till 0.05 mm wide; apical zone little elevated to involute; apices rounded, plane to descending. Maculae efigurated, subtle to weak. CILIA absent on most of the specimens, scarce in *F. Ciecoski 684*; black; delicate; subopaque; satin clear only at 45×; without pigments; curved; irregular in width; irregularly 1–2 ramified since 0.3–0.5 mm from the basis; subulate; 0.50–1.00 mm long × 0.05–0.10 mm wide; slightly ascending. Marginal lacinules abundant; concolored, few on the lobes apices on distal parts and abundant at the lacinules apices on the proximal region; not ramified (those closely juxtaposed can seem like ramifications); 0.2–1.3 mm long × ca. 0.5 mm wide; plane; straight; ascending to recurved; under surface white on the ascending part; inferior subapices early sorediated and strongly revolute; those oldest ones (*F. Ciecoski 637*), closely and intricated juxtaposed, can acquire an apparently arbuscular shape whose development and structure are difficult to visualize. Lobules absent. PUSTULES absent. ISIDIA absent. SORALS abundant; labriform; developed under the subapex of strongly revolute marginal lacinules or, in older specimens, also from laminal protuberances that produce soredia since its early formation and that eventually develop into laminal lacinules; till 1.5 mm long × 0.5 mm wide; not coalescent; surrounding cortex integer; without K+ pigment. SOREDIA persistent, not auto incompatible; subgranular; sometimes corticated; heaped. MEDULLA bicolored, upper part a very light stramineous to pale yellow, the inferior part white, sometimes au contraire, proportion 1:1 to 1:3; loose. UNDERSIDE brown to light brown on distal parts and black on the proximal region. Marginal zone brown to light brown; sublustrose; satin clear at 20×; ca. 3.0 mm wide; smooth to subrugose; papillae and rhizinae absent. Proximal part black; sublustrose; satin the same as the distal part; rare linear fissures present; smooth to papillated to rugulose or with reticulated wrinkles. RHIZINES absent form marginal zone; monomorphic; black; not pigmented; subopaque; satin clear only at 40×; simple; straight; cylindrical; grouped at the top of the crests; monometric; few; 0.5–1.0 mm long × 0.1 mm wide APOTHECIA young

(*Carpanedo C, s/n*); submarginal; concave; circular; till 2.3 mm diam.; disc brown, epruinose, entire, imperforated; margin thick, involute, sinuous, perhaps radially cut on the older ones, naked; amphithecia smooth, not ornamented; stipe central, 1.0–1.5 mm wide × 0.5–0.8 mm high, smooth. ASCOSPORES simple, hyaline, elliptical to slightly curved, 15.0–27.5 × 12.5–17.5 µm, epispore 2.5 µm. PYCNIDIA black, laminal, immerse (*F. Ciecoski 637*). CONIDIA sublageniform, straight, 4.8–6.4 × 1.6 µm.

Color tests: upper cortex K+ yellow, UV-; yellow medulla K+ yellow, C+ weak yellow, KC+ yellow, P+ orange, UV-; white medulla K+ yellow, C-, KC-, P+ orange; UV-.

Substances of taxonomic importance: atranorin, protocetraric acid, and stictic acid.

Specimens examined (paratypes). BRAZIL, Mato Grosso State, municipality of Cotriguaçu, Farm São Nicolau, Site 15: 9°48'24.06"S, 58°17'07.60"W, elevation 252 m, open ombrophilous Forest, on tree trunk, *F. Ciecoski 594*, 26-IX-2020; idem, municipality of Santa Cruz do Xingu; Xingu State Park, Site 17: 9°53'47.15"S, 52°30'36.37"W, elevation 283 m, Dense Submontane Ombrophilous Forest with canopy, on tree trunk, *F. Ciecoski 637*, *684*, 13-II-2021; idem, Site 18: 9°48'20.54" S, 52°27'40.89" W, 265 m elevation, Dense Submontane Ombrophilous Forest with canopy, on tree trunk, *F. Ciecoski 711*, 10-II-2021; idem, Site 20: 9°43'46.70"S, 52°17'25.51"W, 276 m elevation, Dense Submontane Ombrophilous Forest with canopy, on tree trunk, *F. Ciecoski 837*, 12-II-2021; idem, Site 23: 9°42'29.62"S, 52°16'90.85"W, 252 m elevation, Dense Submontane Ombrophilous Forest with canopy, on tree trunk, *F. Ciecoski 924*, 12-II-2021; idem, municipality of Alta Floresta; Cristalino I State Park, Site 27: 9°27'41.33"S, 55°49'11.38"W, elevation 254 m, dense submontane ombrophilous forest with canopy, on tree trunk, *F. Ciecoski 955,* 12–III–2021; idem, municipality of Santa Cruz do Xingu; Xingu State Park, Site 30: 9°36'32.56"S, 52°27'43.52"W, elevation 252 m, Dense Submontane Ombrophilous Forest with canopy, on tree trunk, *R. Carpanedo C*, 11-IX-2020.

Comments. *Parmotrema lavineae* is characterized by the submembranaceous greenish-gray, lobate, subopaque thallus, the satin clear only at 30×, the sorediated closely juxtaposed and commonly intricated lacinules, cilia mostly absent, the bicolored medulla (upper part light yellow and the inferior white), the apothecia concave and imperforated with elliptical slightly curved ascospores 15.0–27.5 × 12.5–17.5 µm, the pycnidia laminal with sublageniform straight conidia 4.8–6.4 × 1.6 µm, and by containing medullary protocetraric acid stictic acid. Among the studied specimens, cilia (scarce) were found only in *F. Ciecoski 684*.

Parmotrema permutatum (Stirt.) Hale (Hale 1974) is somewhat similar in the bicolored medulla, but the upper layer is the white one. The thallus has also sorediate lacinules, however shorter. Differs from *P. lavineae* by the presence of gyrophoric acid (C+ rose and KC+ red), conidia from bacilliform to filiform and the pigment of the Eumitrin type. Besides, *P. permutatum* is described (Benatti & Marcelli 2009a) as having a coriaceous thallus and the lower medulla layer pigmented in multiple colors, i.e., salmon, ocher, and yellowish (Hale 1965).

Parmotrema hypomiltoides (Vain.) Kurok. (Kurokawa & Moon 1998) also has a sorediated thallus, the medulla commonly pigmented only in the lower part, and the lobes' size 5.0–10.0 mm wide. According to Benatti & Marcelli (2009a), Kurokawa & Moon (1998), Fleig (1997), and Vainio (1890), *P. hypomiltoides* differs in having a medulla with alectoronic acid and α-collatolic acid, the ocher color of the colored part of medulla K+ dark red or K+ purple, KC+ rosed, UV + bluish (Hale 1965).

In the examined specimens, only *F. Ciecoski 684* presented cilia, rare and sparse. Some ciliate species are somewhat similar in other aspects.

Parmotrema flavomedullosum Hale (Hale 1974) has rounded apices' lobes sparse or scarcely ciliated, but the medulla is completely yellow pigmented and produces medullary gyrophoric acid (Hale 1965).

Parmotrema affluens (Hale 1974) also has a submembranaceous thallus, labriform sorals, a bicolored medulla, and by the presence of protocetraric acid. Differs, however in inverse disposition of the medulla layers (the upper white), and in the medullary chemistry that has additionally echinocarpic acid and the color reactions: cortex K+ brown, and medulla K-, KC+ orange, C- (Hale 1965).

Fig. 5. *Parmotrema lavineae* (holotype*, F. Ciecoski 467, CNMTf 498). Scale bar = 10 mm.*

Parmotrema pseudolatericulosum Marcelli & Ciecoski **sp. nov.** (Fig. 6)

MycoBank MB842959

Parmotrema pseudolatericulosum is a greenish-gray maculated pergaminaceous species whose sublobed, eciliated, and strongly crackled thallus reaches till 23.0 cm, has auto incompatible lobes that develops sorediated lacinules with a canaliculated basis and pustules strongly sulcate that dismantle into labriform to capitate sorals, develops abundant schizidia, and produces protocetraric acid, praesorediosic acid, protopraesorediosic acid, and one unidentified fatty acid.

Type. BRAZIL, Mato Grosso State, municipality of Santa Cruz do Xingu; Xingu State Park, Site 21: 9°40'37.73"S, 52°16'26.51"W, elevation 257 m, Dense Submontane Ombrophilous Forest with canopy, on a fallen tree in one island of the Fontoura river, *F. Ciecoski 882*, 12-III-2021.

Holotype. CNMTf 499

Etymology. The epithet refers to the resemblance to *P. latericulosum* in the extremely crackled upper cortex.

Description. THALLUS corticicolous; greenish-gray; sublustrose; sublobate; pergaminaceous; maculae evident, punctiform to efigurated, irregularly distributed; satin clear at 30×; till 23.0 cm broad; epruinose; common signs of auto incompatibility on the counterposed margins of the lobes; whitish spots sparsely spread on upper cortex. LOBES long, internode 3.0–4.0 mm long, dichotomous to sympodial; axils acute to oval and auriculated; axillary folds abundant and a little elevated; commonly auto incompatible when laterally counterposed; 5.0–9.0 mm wide at branching base, the major width 6.0–15.0 mm; mostly with straddling borders, counterposed when young, laterally superposed to contiguous when very young ; those counterposed and straddled marginally sorediated; loose adnate to conformed to the substrate; black line absent to clear-cut and attenuated, till 0.1 mm wide, rarely complementary; longitudinal axis distended to undulate; transversal cut chiefly plane with ascending margins or, more commonly, descending and straddled. Proximal surface firm to brittle, sometimes torn; strongly crackled and reticulately cracked; smooth to crumpled and rugose to escrobiculated; rare laminal swellings where agglomerations of sorals are produced. Distal surface firm to brittle; from cracked and crackled to reticulated; smooth to crumpled and rugose to escrobiculated. Lateral margin smooth to irregularly cut or crenate; sinuous to undulated; closed and commonly studded of sorals on lacinules; apical zone slightly ascending, sometimes descending and subinvolute; apex rounded to irregularly cut. CILIA absent. Secondary lobes absent. Lobules common; concolored; commonly produced as cicatrization process of torn parts of the lateral margin and at the margins of laminal commonly irregular to oval perforations 0.3–1.0 mm long × 0.3–0.6 mm wide; plane to ascending; undulated, crackled; rounded apices; black line attenuated, till 0.5 mm thick, complementary; eciliated; underside light brown to brown. Lacinules marginal, sorediated; irregularly ramified and commonly with canaliculated base; contiguous; from elevated to revolute; 1.0–2.0 mm long × 0.5–0.8 mm wide PUSTULES common; verruciform; strongly sulcate to capitated; apical and subapical on the lacinules; not confluent, but somewhat aggregated and spread on marginal and submarginal regions; till 0.5 mm wide; erumpent; dismantling into soredia; originated on apices and subapices of the lacinules; commonly caducous, leaving the apical medulla of the lacinules totally exposed; without pigment; pustular medulla K+ yellow. SORALS frequent; marginal to submarginal; labriform to capitate; till 1.0 × 0.4 mm; sometimes coalescent; eciliated; cortex around the sorals from crackled to shedding plates; without pigment. SOREDIA from caducous to persistent, not auto incompatible, common the lacinules apex; mostly farinose, a few granular and corticated;

heaped; K+ yellow. ISIDIA absent. SCHIZIDIA abundant; concolored; mostly plane; all over the proximal surface; 0.3–1.0 mm diam.; cosatin to the thallus; relatively firm; not ornamented; developed from wrinkles, swellings and fissures on the upper cortex. MEDULLA white, normal. UNDERSIDE light brown on marginal zone and black on proximal region. Marginal zone light brown; sublustrous; satin clear at 30×; ca. 3.0–6.0 mm wide; attenuated; smooth to crumpled and slightly venate on the transition zone; not papillated; slightly rhizinated on transition zone; continuous (not cracked). Proximal part black; sublustrous; satin clear at 20×; from crumpled to rugose; reticulate cracked, fissures irregularly ramified, 0.5–3.0 mm long × ca. 0.5–1.0 mm wide, commonly cicatrized and with strongly elevated borders. RHIZINES absent from marginal zone and present on transition zone; monomorphic, simple, the apices commonly penicillate to arbusculiform, cylindrical; common and irregularly distributed in small sparce regions; black; not pigmented; sublustrous; not gomose; satin clear at 20×; commonly interlaced and difficult to access; straight; erect; monometric; 0.3–1.0 mm long × ca. 0.05–0.10 mm wide; common sparse groups distributed irregularly on underside in the substrate fixation points. APOTHECIA absent. PYCNIDIA absent.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C+ weak yellow, KC+ weak yellow, P+ orange, UV-.

Substances of taxonomic importance: atranorin, protocetraric acid, praesorediosic acid, protopraesorediosic acid, and one not identified fatty acid.

Comments. *Parmotrema pseudolatericulosum* is characterized by the greenish-gray sublobed, pergaminaceous, eciliated thallus with whitish points all over the upper cortex, punctiform to efigurated maculae, the internodes 3.0–4.0 mm long, ramification dichotomous to sympodial, the upper surface strongly crackled, lobules frequent as cicatrization process, lacinules sorediated with canaliculated basis, pustules strongly sulcate dismantling into labriform to capitate sorals, abundant schizidia, white medulla containing protocetraric acid, praesorediosic acid, protopraesorediosic acid, and one not identified fatty acid.

Parmotrema latericulosum Marcelli & Ciecoski as well *P*. *sublatericulosum* (described ahead) are similar in the strongly crackled thallus and in the medullary chemistry with protocetraric acid and the same not identified fatty acid. *Parmotrema latericulosum* differs in the subcoriaceous thallus, lobes short and anisotomous, while *P*. *pseudolatericulosum* has sorediated lacinules, and *P*. *sublatericulosum* has an opaque lobed thallus whose schizidia are commonly studded with pycnidia, the medulla contains only protocetraric acid and the unidentified fatty acid, without the praesorediosic acid and protopraesorediosic acid found in *P*. *latericulosum* and *P*. *pseudolatericulosum*.

Parmotrema dominicanum (Vain.) Hale (Hale 1974) is similar in the sorediated, eciliated thallus with capitated sorals, white medulla with protocetraric acid, and differs by the smaller thallus till 15.0 cm, cortex reticulate cracked, the farinose soredia pigmented yellow, the presence of usnic acid in the upper cortex, and the medullary color reactions KC+ red and P+ orangish-red (Hale 1965).

Parmotrema robustum (Degel.) Hale (Hale 1974) is similar in the long sorediated lacinules and the medullary protocetraric acid, the loose adnate thallus, and the white medulla. Differs in the sparse cilia in the thallus, absence of maculae (Eliasaro & Donha 2003) and the lack of protopraesorediosic acid and praesorediosic acid (Degelius 1941).

Parmotrema gardneri (CW Dodge) Sérus. (Swinscow & Krog 1988) also is eciliated, lobulated, has sorediated lacinules white medulla, protocetraric acid and one or more unidentified fatty acids, and differs in the smaller coriaceous olivaceous till 10 cm broad thallus, the wrinkled upper surface, the upper cortex K+ yellowish-brown, the interrupted linear sorals, and the presence of traces of malonprotocetraric acid (Dodge 1959; Swinscow & Krog 1988; Benatti & Marcelli 2011).

Parmotrema subochraceum Hale (Hale 1990), a Brazilian Amazon species, also has a loose adnate eciliated and maculated thallus with sorediated lacinules and protocetraric acid in the medulla. Differs by the membranaceous to submembranaceous whitish-gray thallus with a rugose surface, the subgranular soredia, the lower part of the medulla tinged orangish-red to ocher (K+ reddish), and the presence of succinprotocetraric acid, orangish pigment unknown and by traces of lichesterinic acid and divaricatic acid and in the medullary color reaction KC+ rosed (Benatti & Marcelli 2011).

Figure 6. *Parmotrema pseudolatericulosum* (holotype, *F. Ciecoski 882, CNMTf 499). Scale bar = 10 mm.*

Parmotrema spielmannii Ciecoski & Marcelli **sp. nov.** (Fig. 7)

MycoBank MB842960

Parmotrema spielmannii is a coriaceous species with a very complicated system of folding and rolling of the lobes driven by the enormous growth of the axillary folds that makes a rigid plate and occult most of the lobes margins, has pycnidiated schizidia, three types of rhizines , big ellipsoid ascospores 30.0–32.5 (–37.5) × 12.5–15.0 (–17.5) µm, short sublageniform conidia 3.70–4.50 × ca. 1.50 µm and produces only protocetraric acid and one not identified fatty acid in its white and firm medulla.

Type. BRAZIL, Mato Grosso State, municipality of Novo Mundo, Cristalino II State Park, Site 24: 9°35'11.86"S, 55°28'1.52"W, elevation 320 m, Dense Ombrophilous Forest with canopy, on fallen tree branch, *F. Ciecoski 1005*, 13-III-2021.

Holotype. CNMTf 500

Etymology. The epithet is given after Dr. Adriano Afonso Spielmann because of his great and significant contributions to Brazilian Lichenology, kindness, and constant and relevant friendship.

Description. THALLUS corticolous, greenish-gray, subopaque to velvet; satin clear only at a 30×; lobate; coriaceous; till 12.0 cm broad. LOBES short and wide, little ramified; 4.0–8.0 mm wide at branching base, the major width 7.0–16.0 mm; laterally superposed to heaped and counterposed to straddled; loosely adnate to revolute or involute; when laterally superposed (younger parts), many times occur a great growing and elevation of the axillary folds, which grow up till the point of closing completely, folding and rolling around themselves and parallel to the longitudinal axis of the lobes to form high ascending tubes; in those parts where the lobes lateral margins are counterposed, also occurs a big elevation of the axillary folds that finish by reuniting and juxtaposing several near axils, causing an intense wrinkling (folds) of the thallus transversal central axis of the lobes; these folds united side by side also finish by straddling, folding together again around themselves, and resulting in another type of high ascending tubes; this system of uprising folding, rolling and straddling make the thallus a solid and rigid structure where margins are very difficult to observe, since they are inside such structure; axils acute to straddled to laterally juxtaposed or even auriculated, frequently with involute folds, some torn, rarely oval; auto incompatible on lateral margins, commonly on the counterposed lobes or when they fold on themselves; black to grayish perforations also occur along the longitudinal axis; longitudinal axis distended to strongly undulated (parallel folds); transversal cut with the middle plane to concave and lateral borders revolute to involute; axillary folds abundant, strongly elevated, and responsible for the complicated folded thallus pattern. Proximal surface firm to crackled and reticulated, commonly with delimited regions plenty of pycnidia and/or swellings that will develop into apothecia; in other parts the cortex presents well delimited, corticated, and irregularly distributed white areas. Distal surface crackled to foveolate and rugose; epruinose. Lateral margin smooth to crenate or irregularly cut, from sinuous to undulated and crisped, commonly closed, but not rarely open and studded with marginal pycnidia; black line from absent to very subtle and attenuated, till 0.1 mm wide, complementary and clear cut; apical zone from elevated to involute or revolute; apices rounded to truncate, prostrated to involute or revolute. MACULAE absent. CILIA absent. Secondary lobes marginal; anisotomous; isolated; on the primary ones; prostrated to ascending; different from the primary, these are smooth and present fissures till 2.0 mm long in the under marginal zone; the other aspects are the same as the primary lobes. Lacinules and lobules absent. PUSTULES absent. SORALS absent. ISIDIA absent. SCHIZIDIA concolored; mostly slightly concave; irregularly distributed, occasionally may detach and fix themselves on the proximal part; till 1.0 mm diam.; little firm to caducous; some ornamented with pycnidia; originating from the crackles at the top of the convex thallus folds and some in concave regions. MEDULLA white and firm. UNDERSIDE light brown to ivory on the marginal zone and black on the proximal part; when the marginal zone is irregularly cut its color is black and without transition to the black center. Marginal zone light brown to badius and black at the irregularly cut parts; lustrous to sublustrous; satin already clear at 10×; ca. 10.0 mm wide at the brown smooth attenuated part; crackled and a few times crumpled on the black part; erhizinated; natural fissures absent. Proximal part black with rare whitish spots irregularly distributed; from opaque to sublustrous; subsatin clear at 30×; from crackled to crumpled and rugose; fissures from irregularly distributed to reticulated; ramifications reticulate to perpendicularly-ramified, cicatrized, with elevated borders. RHIZINAE rare and irregularly distributed in sparse groups; black; not pigmented; sublustrous; not gomose; subsatin already at 10× and satin clear at 20×, trimorphic, the simple can be subulate or have a brushed apex, cylindrical straight to sinuous, erect to bent, ca. 1.0–1.2 mm long × 0.1 mm wide; those bifid are planiform (flat), ramify at half length, are sinuous, somewhat bent, ca. 1.0–1.5 mm long × 0.1 mm wide, rarely one branch may turn into an enlarged leaf-like structure; and the irregularly ramified, cylindrical, branching 3–6 times after 1/3 of the length, arbusculiform, erect to bent. APOTHECIA from sub-bullate (young) to subadnate (old); from urceolate (young) to concave (old), the young sulcate and the old petaloid; till 22.0 mm diam.; subpedicellate; laminal and submarginal; base's medulla K+ yellow; disc brown, epruinose, entire in the young and cut till 2/3 of radius in the old, folded to lobed, till 4 folds, imperforated; margin thick till 1.5 mm wide, smooth to irregularly cut and brittle, not ornamented; amphithecia crackled, emaculated, not ornamented, amphithecial medulla K+ yellow; stipe central (young) and eccentrical (old), 1.0–1.5 mm wide × 0.5–1.2 mm high, smooth to crumpled, crackled, emaculated, not ornamented stipe K+ yellow; hymenia till

150 µm high ASCOSPORES ellipsoid, straight to lightly curved, 30.0–32.5 (–37.5) × 12.5–15.0 (–17.5) µm, epispore 2.5 µm, rare biguttulate. PYCNIDIA laminal and marginal, submarginal and subapical immersed, ostiole black. CONIDIA sublageniform, straight 3.70–4.50 × ca. 1.50 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C+ weak yellow, KC+ yellow, P+ orange, UV-.

Substances of taxonomic importance: atranorin, protocetraric acid and one not identified fatty acid.

Comments. *Parmotrema spielmannii* is characterized by the greenish-gray, coriaceous, opaque to velvet thallus, whose lobes have a complicate pattern of folds and overlapping leaded by the enormous growth of the axillary folds that bring together axils and lobes. Sometimes the highly ascending axillary folds weld together their margins and fold the formed structure around themselves to form an ascending tube. Furthermore, on the lobes with counterposed marginal zones, the strong elevation of near axils cause a juxtaposition of transversal folds that fold around themselves as a group, straddling them also to form an ascending multi-layered tube. This process of straddling lobes margins and axillary folds makes the thallus a rigid plate where the margin of the lobes become occulted and difficult to observe since they remain inside the tubes. Additionally, the concave sometimes pycnidiated schizidia, the very firm white medulla, the under marginal zone light brown, the typical trimorphic rhizines, the petaloid imperforated apothecia, the hymenia till 150 µm high, the big ascospores 30.0–32.5 (–37.5) × 12.5–15.0 (–17.5) µm, part of the pycnidia occurring marginally inside opened margins, the sublageniform short conidia 3.70–4.50 × ca. 1.50 µm, and medullary protocetraric acid make this species unique.

Parmotrema cornigerum Kurok. (Kurokawa 2001) is somewhat similar in the eciliate, loose adnate, emaculated thallus with the proximal surface sparsely foveolated, and the presence of protocetraric acid. However, it differs by the membranaceous lacinulated thallus, the yellowish medulla, the perforated apothecia, and the much smaller ascospores 20–21 × 9–10 µm (Kurokawa 2001).

Figure 7. *Parmotrema spielmannii* (holotype, *F. Ciecoski 1005, CNMTf 500). Scale bar = 10 mm.*

Parmotrema zollingeri (Hepp) Hale (Hale 1974) also has a loosely adnate thallus with short wide lobes, apothecia imperforated, and protocetraric acid in the medulla. Differs in the olivaceous-gray thallus, greater lobes 15.0–18.0 mm wide, smaller apothecia 3.0–10.0 mm diam., thinner hymenia 70–80 µm, smaller ascospores 18–22 × 7–10 µm and the medullary color reactions KC + red and P+ red (Hale 1965).

Parmotrema cachimboense Hale (Hale 1990) found in the Serra do Cachimbo (Pará State) is somewhat similar in being eciliate and the ascospores size 30–33 × 15–18 µm and the presence of protocetraric acid. However, it is whitish-gray, the medulla is ocher with orange-reddish parts, the epispore somewhat thinner 2.0 µm wide (Hale 1990).

Parmotrema progenes Hale (Hale 1977), also collected in Brazilian Amazon (Pará State) is corticicolous, coriaceous, has a white medulla, epispore 2.5 µm thick, and medullary protocetraric acid. Differs in the whitish-gray color, adnate apothecia with hymenia 100 µm high, smaller ascospores 20–22 × 8–10 µm, and the additional presence of echinocarpic acid and other unknown substances (Hale 1977).

Parmotrema sublatericulosum Marcelli & Ciecoski **sp. nov.** (Fig. 8)

MycoBank MB842961

Parmotrema sublatericulosum is lobed, eciliate, opaque, and subpergaminaceous, with a white medulla, pycnidiated schizidia, weak maculae and, straddling to counterposed lobes, lobulated, with the underside reticulate cracked with cicatrized fissures, sublageniform conidia 9.00–10.50 × ca. 1.50 µm, and medullary protocetraric acid together with one unidentified fatty acid.

Type. BRAZIL, Mato Grosso State, municipality of Novo Mundo, Cristalino II State Park, Site 28: 9°35'11.86"S, 55°28'10.52"W, elevation 337 m, dense submontane ombrophilous forest with canopy, on tree trunk, *F. Ciecoski 985*, 12-III-2021.

Holotype. CNMTf 501

Etymology. The epithet refers to the extremely crackled thallus, and in being somewhat similar in morphology to *Parmotrema latericulosum*.

Description. THALLUS corticicolous; greenish-gray; opaque; lobed; subpergaminaceous; maculae weak and efigurated, irregularly distributed; not satin even at 40×; till 12.0 cm broad; epruinose; not auto incompatible. LOBES short, anisotomous to sympodial; axils acute to oval and auriculated; axillary folds common, low; not auto incompatible; 4.0–7.0 mm wide at branching base, the major width 6.0–10.0 mm; commonly straddling and counterposed, sometimes laterally superposed to contiguous at the younger parts; loosely adnate to conformed to the substrate; black line absent to clear, till 0.1 mm thick, sometimes complementary; longitudinal axis distended to slightly undulated; transversal cut plane-concave and ascending at the borders with a descending apex (straddling of the lobes). Proximal surface firm to brittle, sometimes torn; strongly crackled and sometimes cracked; smooth to crumpled and rugose to escrobiculated; laminal swellings common where aggregates of pycnidia are developed. Distal surface firm to brittle; continuous only near the margin, almost totally cracked and crackled; smooth to slightly crumpled. Lateral margin smooth to irregularly cut; sinuous to undulated; closed and commonly studded by pycnidia, principally at the crests of the straddled lobes; apical zone ascending most of the times; apices rounded to irregularly cut. CILIA absent. Secondary lobes absent. Lobules common; concolored; common as cicatrization process of tear in the lateral margin, sometimes also in the margins of laminal commonly irregular to oval perforations, 0.5–0.7 mm long × 0.3–0.5 mm wide; plane to ascending; undulated; surface cracked; rounded apices; black line attenuated, till 0.5 mm thick, complementary; eciliated; underside light brown to brown, commonly studded with submarginal pycnidia. Lacinules absent. PUSTULES absent. SORALS absent. ISIDIA absent.

SCHIZIDIA common; concolored; plane to slightly concave; 0.5–1.5 mm diam.; opaque as the thallus; firm; studded with pycnidia; originating from cracks opened by the upper cortex crackling and from wrinkles. MEDULLA white, normal. UNDERSIDE badius to light brown at the marginal zone and black at the proximal part. Marginal zone badius to light brown; lustrous; satin already clear at 10×; ca. 1.0–7.0 mm wide; attenuated; smooth to crumpled and slightly venate at transition zone; epapillated; erhizinated; not cracked. Proximal part black; sublustrous; satin clear at 20×; from crumpled to strongly rugose and corrugated; reticulate cracked, fissures perpendicularly ramified, 0.5–3.0 mm long × ca. 0.5–1.0 mm wide, commonly cicatrized and with elevated borders. RHIZINES absent at marginal zone; monomorphic, simple, commonly with penicillate to arbusculiform apices, cylindrical; common and irregularly distributed on small sparse regions; black; not pigmented; sublustrous; not gomose; satin clear at 20×; commonly interlaced difficult to measure; straight; erect; monometric; 0.50–2.00 mm long × ca. 0.05–0.10 mm thick. APOTHECIA cupuliform (young) to concave (old); sulcate; till 8.0 mm diam.; subadnate; from laminal to submarginal; medulla of the base K+ yellow; disc brown, epruinose, entire (young) and cut (old), imperforated; margin till 1.5 mm wide, smooth to reticulated crackled, not ornamented; amphithecia smooth, emaculated, not ornamented, amphithecial medulla K+ yellow; stipe central (young), 0.7–2.0 mm wide × 0.5–0.7 mm high, smooth to crumpled, emaculated, not ornamented, stipe K+ yellow; hymenia till 75 µm alt. ASCOSPORES absent, asci absent. PYCNIDIA all over the surface, immersed, ostiole black. CONIDIA sublageniform, straight 9.00–10.50 × ca. 1.50 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C+ weak yellow, KC+ weak yellow, P+ orange, UV-

Substances of taxonomic importance: atranorin, protocetraric acid and one not identified fatty acid, and several other unidentified substances.

Comments. *Parmotrema sublatericulosum* is characterized by the loose adnate, greenish-gray, lobate, opaque (not satin), subpergaminaceous, maculated, eciliated thallus with short lobes commonly laterally counterposed and straddled. The proximal surface is crackled, has pycnidiated swellings and develops lobules and schizidia studded with pycnidia; the medulla is white, the underside cracked, with the fissures cicatrized and with elevated borders; the apothecia are concave and subadnate, till 8.0 mm diam., the hymenia till 75 µm alt., with sublageniform conidia 9.00–10.50 × ca. 1.50 µm and medulla with protocetraric acid, one unknown fatty acid and several other unidentified substances.

Parmotrema latericulosum Marcelli & Ciecoski and *P*. *pseudolatericulosum* Marcelli & Ciecoski are similar in the strongly crackled and cracked thallus and in the medullary chemistry with protocetraric acid and the same unidentified fatty acid. *P*. *latericulosum* differs in the bifusiform conidia 9.0–10.5 × ca. 1.5 µm and the medullary chemistry that includes praesorediosic acid and protopraesorediosic acid. *P*. *pseudolatericulosum* differs in the greater thallus till 23.0 cm broad and in developing sulcate pustules that dismantle into soredia.

Parmotrema disparile (Nyl.) Hale (Hale 1965) is similar in containing protocetraric acid and one not identified fatty acid, in the loose adnate thallus with rounded eciliated lobes, the white medulla, and imperforated apothecia. Differs in the apothecia entire with rugose amphithecia, the hymenia 90–100 µm high, and the color reactions KC+ reddish and P+ brick red (Hale 1965, Flakus et al. 2014).

Parmotrema cornigerum Kurok. (Kurokawa 2001) also produces protocetraric acid in the medulla and has a loose adnate eciliated thallus. Differs in the membranaceous, lustrous thallus, the perforated apothecia with rugose amphithecia, the hymenia 90–100 µm high, and the presence of only protocetraric acid in the medulla (Kurokawa 2001).

Parmotrema zollingeri (Hepp) Hale resembles *P. sublatericulosum* in the thallus loosely adnate with rounded lobes, apothecia with smooth amphithecia, imperforate discs and hymenia 70–80 µm high (Hale 1965) and differs by the sublageniform conidia Elix (1994) which are larger (8 to 10 um) (Hale 1965), by the membranous thallus, pedicelled apothecia with entire discs, by the presence of chloroatranorine and by the medullary reactions K+ dirty brown and P+ brick red (Elix 1994).

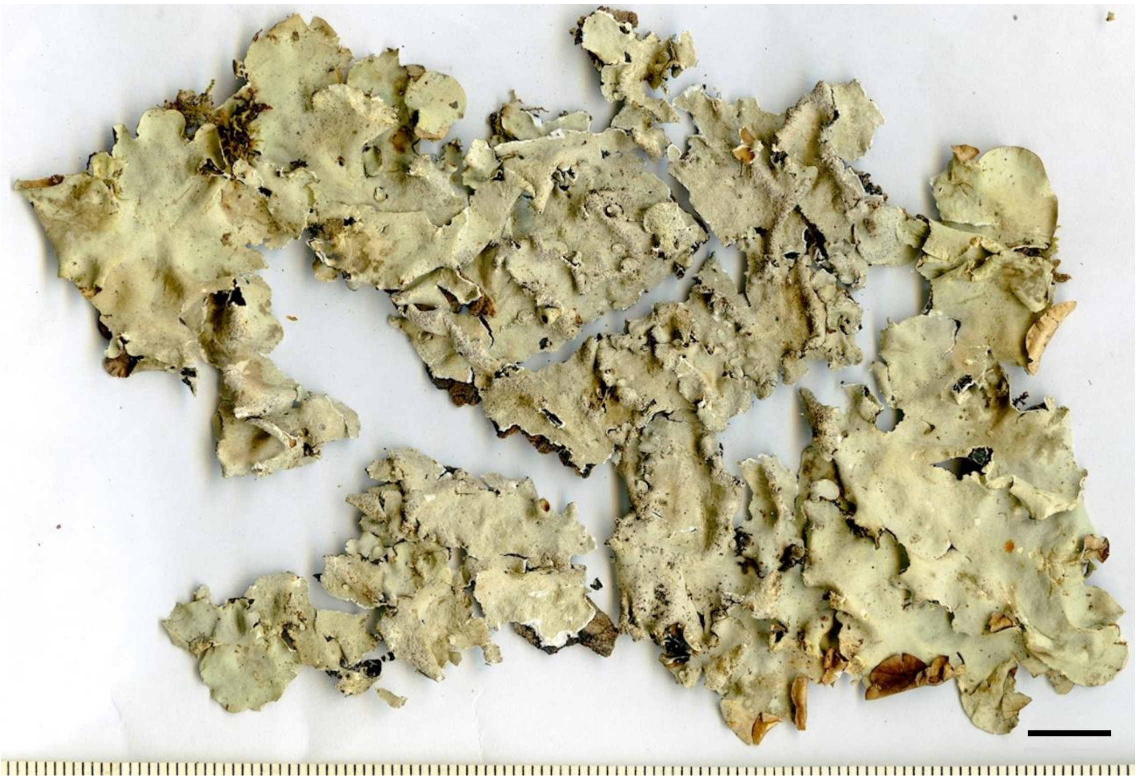

Fig. 8. *Parmotrema sublatericulosum* (holotype, *F. Ciecoski 985, CNMTf 501). Scale bar = 10 mm.*

Parmotrema subochraceum Hale, *Bibliotheca Lichenologica* 38: 117. 1990. **(**Fig. 9)

MycoBank MB126749

Type: BRAZIL, Pará State, 877 km North of Cuiabá on the Cuiabá-Santarém highway (Br-1631 Road, ca. 8º45'S, 54º15'W), Serra do Cachimbo, Cataracts on the Rio Curuá, *Brako & Dibben 6506* (NY, holotype; US, isotype).

Distribution. SOUTH AMERICA: GUIANAS and BRAZIL: Pará, Paraná, and São Paulo States (Benatti & Marcelli 2009). This is the first occurrence for the Mato Grosso State.

Description. THALLUS corticicolous; greenish-gray; opaque on proximal surface to sublustrose on distal; sublobed; pergaminaceous; maculae weak, irregularly distributed, efigurated; satin clear at 20× on sublustrous part and not satin even at 45× on opaque part; till 13.0 cm broad; epruinose; not auto incompatible; rare whitish spots at distal portion. LOBES short, dichotomous to sympodial; axils acute to oval and squared; axillary folds common, erect to bent, initially 1.0–2.0 mm high × 1/4 of the lobe width, then they growth suberect, strongly convex, lie down radially on the lobes and ramify as producing lobules and become densely sorediate; not auto incompatible; 2.0–4.0 mm wide at branching base, the major width 3.0–8.0 mm; laterally superposed to contiguous and counterposed to straddled and, in this case, the soral are abundant and practically juxtaposed; in the contiguous lobes of the proximal part the margins of the elevated axils are strongly laciniated and sorediated, but the lateral margins and apical zones of the lobes are not sorediated; commonly the nearby axillary lacinules get elevated to form a cone in whose top the apices are strongly sorediated; rare whitish spots are irregularly distributed on the proximal surface; loosely adnate; elevated and revolute; black line absent to attenuated, till 0.1 mm wide, sometimes complementary; longitudinal axis distended to undulated; transversal cut normally concave to plane with descending borders at distal zone. Proximal surface firm; continuous to reticulated; smooth to crumpled and strongly rugose at central part. Distal surface firm; continuous to slightly reticulated; smooth to crumpled. Lateral margin smooth to irregularly cut and crenate; sinuous to undulated; closed; apical zone ascending to involute; apices rounded to irregularly cut, ascending and involute. CILIA absent. Secondary Laciniae and Lobes absent. Lobules rare; concolored; irregularly distributed on proximal surface and lateral margin; not ramified; 0.5–1.0 mm long × 0.3–0.5 mm wide; margin sinuous; undulated; ascending; apices rounded; black line subtle, till 0.1 mm thick; eciliated; underside brown; common in the marginal cicatrization process. Lacinules abundant all over the proximal region, less frequent on distal part, strongly sorediated at the lobe's axils; irregularly ramified; 0.5–1.5 mm long × 0.5–1.0 mm wide; canaliculated with sinuous apical part; undulated; ascending to revolute and involute; apices strongly sorediated; eciliated; contiguous to laterally superposed. PUSTULES rare; verruciform; not capitate; apical on lacinules; not confluent, till 0.5 mm wide; erumpent; dismantling into soredia; not caducous; pigment light yellow, K+ yellow; pustular medulla K+ yellow. SORALS dense; marginal and on apices and subapices of the lacinules, rare laminal from cortical swellings and ornamenting apothecia; orbicular to labriform; 1.0 mm long × 0.5 mm wide; commonly coalescent; eciliated; cortex surrounding the sorals from crackling to shedding plates; pigment yellow, K+ yellow. SOREDIA from caducous to persistent, not auto incompatible, contiguous to dense at the apices of the lacinules and marginal; mostly farinose, rare granular; ecorticated the farinose and corticated the granular, rarely forming isidioid structures; normally heaped; commonly produced on lacinules apices; K+ yellow. ISIDIA absent. MEDULLA normal; in great part bicolored white and ocher near the under cortex; the pigment irregularly distributed in sparse regions, K+ red. UNDERSIDE badius to brown at marginal zone and black at the proximal part; a few whitish regions due to discontinuity of the under cortex that expose the medulla as well some pigmented regions. Marginal zone badius to brown; whitish under the sorediated lacinules; sublustrous on badius o brown part and subopaque on whitish parts; satin clear at 20×

on badius to brown part and little visible at 45× on the whitish part; ca. 1.0–9.0 mm wide on badius to brown part and ca. 0.5–2.0 mm wide, attenuated on badius and brown part and clear cut at the whitish part; smooth to crumpled; little papillated and slightly venate and rugose; sometimes rhizinated on transition zone; not cracked (continuous). Proximal part black; sublustrous; satin clear at 20×; crumpled to rugose and verrucose; not cracked. RHIZINES absent from marginal zone but present at transition; monomorphic, simple, commonly with penicillate apices, cylindrical; common and distributed in somewhat sparse regions; black; not pigmented; sublustrous; not gomose; satin clear at 30×; rarely interlaced; straight to sinuous; straight to bent; monometric; 0.30–0.50 mm long × ca. 0.05–0.10 mm thick; isolated or in sparse groups irregularly distributed at the fixation regions. APOTHECIA laminal and marginal, bullate (young) and sub-bullate (old); the young strongly sulcate; till 6.0 mm diam.; adnate (young) and pedicellate (old); laminal to submarginal; medulla of the base K+ yellow; disc light brown, epruinose, entire, imperforated; margin till 0.5 mm thick, smooth in the young to strongly sorediated in the older; those marginal immerse in soredia in such a way that cover all the disc turning them almost invisible since they become very alike the sorediate apices of the lacinules; amphithecia smooth in the young to strongly sorediated in the older, emaculated; amphithecial medulla K+ yellow; stipe central since the youngest 0.2–0.5 mm alt. × 0.1–0.2 mm wide; smooth, emaculated, not ornamented, stipe K+ yellow; hymenia till 50 µm alt (immature?). ASCOSPORES absent; asci absent. PYCNIDIA submarginal, immerse in the laminal cortex and in the sorals; ostiole black. CONIDIA bifusiform, straight, 9.0–10.5 × ca. 1.5 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C+ weak yellow, KC+ weak yellow, P+ orange, UV-; the colored medulla K+ red.

Substances of taxonomic importance: atranorin, protocetraric acid, and orange pigment K+ wine red.

Specimens examined. BRAZIL, Mato Grosso State, municipality of Santa Cruz do Xingu, Xingu State Park, Site 22: 9°42'19.20"S, 52°17'57.90"W, elevation 268 m, Semidecidual Submontane Seasonal Forest, on trunk of tree in the forest, *F. Ciecoski 908,* 09–II–2021 (CNMT 502); idem, municipality of Alta Floresta, Cristalino I State Park, Site 27: 9°27'41.33"S, 55°49'11.38"W, elevation 254 m, Semidecidual Submontane Seasonal Forest, on trunk of tree in the forest, *F. Ciecoski 962*, 12–III–2021. (CGMS)

Comments. *Parmotrema subochraceum* Hale is characterized by the pergaminaceous, sublobed, eciliate, weakly maculate thallus that has common and strongly convex axillary folds which lie down on the lobes and ramify apically becoming densely sorediated, by the abundant sorediated lobules and lacinules, the proximal surface strongly rugose, the bicolored medulla with one upper layer white and one under layer orangish-yellow near the under cortex, the apothecia so strongly ornamented by soredia that practically occult and turn them almost invisible, part of the pycnidia also immersed and occult by the soredia, by the bifusiform conidia 9.0–10.5 × ca. 1.5 µm and the presence of protocetraric acid and one pigment orange K+ wine-red in the medulla.

Fig. 9. *Parmotrema subochraceum* (*F. Ciecoski 962, CNMTf 502). Scale bar = 10 mm.*

In the original description, Hale (1990) mentioned a thallus adnate to loosely adnate 3–10 cm broad, whitish, with rounded lobes 3–6 mm wide, sorediated, continuous at distal parts and a rugulose to cracked proximal part, the lower part of the medulla ocher, an underside densely rhizinated, and the medullary chemistry with protocetraric acid and one anthraquinone as pigment; ascospores and conidia were not mentioned. So, our specimens are bigger, harder, with greater lobes, and much less rhizinated, what could be a consequence of climatic factors.

Donha (2005), studying specimens of the Brazilian southern Paraná state, also cited the thallus as membranaceous, greenish-gray, 5.0–14.5 cm wide maculated and sorediated lobes 3–9 (–12) mm wide; the soredia were said subgranular, the apothecia rare, adnate, the amphithecia sorediated, the ascospores 20–25 × 12,5–15 µm , the medullary color reactions K- or K+ weak yellow or brownish, pigment K+ strong red (anthraquinone Rfc ~53), C-, KC- or KC+ brownish or rose, UV- (protocetraric acid, cf. virensic acid, and other not identified compounds. Pycnidia were not found.

Analyzing specimens from São Paulo State, Benatti & Marcelli (2009) also characterized the thallus of *P. subochraceum* as membranaceous to submembranaceous, frequently lobed to sublobed till 13.5 cm broad, with lobes (1.5–) 2.0–7.0 (–10.5) mm wide, elevated, sorediated on the proximal parts, the apothecia concave with imperforated discs, sorediated amphithecia, ascospores ellipsoid 19.0–30.5 × 11.0–16.5 µm (similar to Donha's findings), epispore 2.0–2.5 µm thick, and the medullary color reactions K-, C-, KC+ rose, P+ orangish, UV- (protocetraric acid, trace of succinprotocetraric acid, trace of lichesterinic acid, trace of divaricatic acid, and the unknown orangish pigment).

Parmotrema gardneri (Dodge) Serus. (Swinscow & Krog 1988) is somewhat similar by the greenish-gray color, the sorediated lobes, and the medullary protocetraric acid. Differs in the coriaceous thallus, the not pigmented medulla and additional not identified fatty acids (Swinscow & Krog 1988).

Parmotrema dominicanum (Vain.) Hale (Hale 1974), even presenting protocetraric acid in the medulla, differs by a great concentration of usnic acid in the upper cortex, the farinose soredia, and the completely white medulla (K-, C-, KC-) (Hale 1965).

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Figure legends:

Figure 1. Location of Cristalino I and II State Park, Xingu State Park and São Nicolau Farm in Mato Grosso. Datum SIRGAS2000. Source: IBGE – Brazilian Institute of Geography and Statistics, BC250, Version 2019. Prepared by F.A.R. Ciecoski.

Figure 2. *Parmotrema bagaglii* (holotype, *F. Ciecoski 475, CNMTf 495). Scale bar = 10 mm.*

Figure 3. *Parmotrema castagnae* (holotype, *F. Ciecoski 486, CNMTf 496). Scale bar = 10 mm.*

Figure 4. *Parmotrema latericulosum* (holotype, *F. Ciecoski 935, CNMTf 497). Scale bar = 10 mm.*

Figure 5. *Parmotrema lavineae* (holotype, *F. Ciecoski 467, CNMTf 498). Scale bar = 10 mm.*

Figure 6. *Parmotrema pseudolatericulosum* (holotype, *F. Ciecoski 882, CNMTf 499). Scale bar = 10 mm.*

Figure 7. *Parmotrema spielmannii* (holotype, *F. Ciecoski 1005, CNMTf 500). Scale bar = 10 mm.*

Figure 8. *Parmotrema sublatericulosum* (holotype, *F. Ciecoski 985, CNMTf 501). Scale bar = 10 mm.*

Figure 9. *Parmotrema subochraceum* (*F. Ciecoski 962, CNMTf 502). Scale bar = 10 mm.*

CAPÍTULO II.

Some species of *Parmotrema* (*Parmeliaceae*) from the Brazilian Amazon with salazinic acid

O presente manuscrito segue a padronização adotada pelo periódico *Acta Amazonica*, ao qual o presente trabalho foi submetido (Anexo B).

Some species of *Parmotrema* (*Parmeliaceae*) from the Brazilian Amazon with salazinic acid

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Some species of *Parmotrema* (*Parmeliaceae*) from the Brazilian Amazon with salazinic acid

ABSTRACT

Six new species of *Parmotrema* (*P. aristidesii*, *P. hypoflavum*, *P. marjorieanum*, *P. marlitonii*, *P. nelihondae*, and *P. subcristiferum*) and *P. cristiferum*, all containing salazinic acid, were collected from the Amazon rainforest in Mato Grosso State, Brazil, (central South America), and are described, illustrated and commented by using the ultimate version of the GEL (Lichenological Studies Group) descriptive protocol.

KEYWORDS: lichen systematics, Xingu, Cristalino, axillary folds, taxonomy

Algumas espécies de *Parmotrema* (*Parmeliaceae*) da Amazônia brasileira com ácido salazínico

RESUMO

Seis novas espécies de Parmotrema (P. aristidesii, P. hypoflavum, P. marjorieanum, P. marlitonii, P. nelihondae e P. subcristiferum) e P. cristiferum, todas contendo ácido salazínico, foram coletadas da floresta amazônica em Mato Grosso Estado, Brasil, (centro da América do Sul), e são descritos, ilustrados e comentados usando a versão final do protocolo descritivo GEL (Lichenological Studies Group).

PALAVRAS-CHAVE: sistemática de liquens, Xingu, Cristalino, dobras axilares, taxonomia

INTRODUCTION

The 4,800,000 km^2 of the Amazon Forest, the largest humid tropical forest on the planet, occupies 5% of the entire dry surface of the world and 40% (nine countries) of South America (Lemos & Silva 2011). In Brazil, the Amazon spans nine states, representing about 61% of the territory (Assad 2016; Menin 2010).

According to Teixeira et al. (2017) the creation of Conservation Units in the Amazon is an effective mechanism to guarantee the "sustainable development and conservation of natural resources". However, the dynamism of activities linked to the exploitation of natural resources that use deforestation and fires as main resources, have promoted a decrease in soil quality, changes in the hydrological regime, emission of greenhouse gases and an irreparable loss of biodiversity (Fearnside 2005) often still hidden from science.

The center and north of the country, which includes the Amazon rainforest, has its foliose lichen mycota practically unknown.

Among the lichenized foliose fungi, the *Parmeliaceae* family stands out for its wide dispersion, with 2,765 species distributed in 80 genera (Thel et al. 2012; Lücking et al. 2017a, b).

The genus *Parmotrema* has the same prominence, which has 350 species (Elix 1993; Brodo et al. 2001; Nash and Elix 2002) and more than 196 species are cited for Brazil (Aptroot, unpublished data). The genus is recognized by the foliose thallus with rounded and broad lobes (generally more than 5 cm) and ciliated margins (commonly), by the upper cortex that may present macules, isidia, soredia or pustules, by the lower surface usually black in the center with margins ranging from brown to brown to white, by ellipsoid ascospores with thick epispores and emerged pycnidia (Elix 1993; Brodo et al. 2001; Nash and Elix 2002).

The *Parmotrema* species in this work were collected in two conservation units (Cristalino State Park I and II and Xingu State Park) and on the trails and plots of the Biodiversity Research Program (PPBio) installed at Sao Nicolau Farm. The three study areas are located in the extreme south of the Amazon.

Among the various secondary substances produced by lichens and of taxonomic character, salazinic acid can be recognized by means of spot tests with reaction K+ yellow → blood red, C– and P+ strong yellow (Hale 1979; Spielmann & Marcelli 2020); the specimens in this work contain salazinic acid and corroborate these results.

MATERIAL AND METHODS

From May/2020 to March/2021, samples of lichenized fungi were collected in three areas of the Amazon Forest located in the north of the Mato Grosso state.

Cristalino State Park I and II (9°28'17.45"S, 55°49'22.20"W) is characterized by a hot and humid climate, with average annual temperatures above 24 °C and average annual precipitation above 2400 mm (Sasaki et al. 2008). The Xingu State Park (9°53'47.15"S, 52°30'36.37"W) has well-defined wet and dry seasons with average rainfall ranging from 2,000 to 2,500 mm and temperature between 32.0°C and 21.0°C (IBGE 2012). São Nicolau Farm (09°49'09.0"S, 58°15'31.1"W) has a climate and average temperature similar to Cristalino State Park. The rainfall reaches an annual average of 2,034 mm (Noronha et al. 2015).

The methodology adopted for collection and herborization was based on Brodo et al. (2016), Fidalgo & Bononi (1967, 1989), Peixoto & Maia (2013), and adjustments were made when necessary.

Specimens were morphologically studied using stereomicroscope and light microscopes. Anatomical sections, including those of apothecia and pycnidia, were hand made with razor blades. The chemical constituents were checked by spot tests with potassium hydroxide (K), sodium hypochlorite (C) para-phenylenediamine (P), and examined under UV light (360 nm). Microscopic measures were taken in water. Chemical constituents were identified by thin-layer chromatography (TLC) using solvents B, C and G (Huneck & Yoshimura 1996, Orange et al. 2010, White & James 1985), and comparison with authentic samples.

The descriptions were made by using the ultimate version of the protocol developed by the Group of Lichenological Studies (GEL) of the Instituto de Botânica, São Paulo, Brazil.

RESULTS AND DISCUSSION

Parmotrema aristidesii Ciecoski & Marcelli, sp. nov. **(**Figure 1)

MycoBank: MB 842962

Type: BRAZIL. Mato Grosso State: municipality of Santa Cruz do Xingu; Xingu State Park, Site 30: 9°36'32.56"S, 52°27'43.52W, elevation 252 m, Seasonal Semidecidual Submontane Forest, on tree trunk in the forest, *R. Carpanedo A*, 11-IX-2020 (Holotype: CNMTf 512).

Diagnosis: *Parmotrema aristidesii* is a species with velvet-opaque (velutinous), greenish gray to bluish, subpergaminaceous till 27 cm broad, mostly eciliated, maculated thallus, with axillary folds common and low, the medulla stramineous and firm, the underside commonly cracked with mostly not cicatrized crevices, apothecia concave and clefted, hymenia till 200 µm alt., ascospores ellipsoid (20.0–) 25.0–27.5 × 12.5–15.0 µm, epispore 2.5 µm thick conidia straight bifusiform 10.5–13.5 × 1.5–3.0 µm, and acid salazinic in the medulla.

Description. THALLUS corticicolous; greenish-gray to slightly bluish; velvet opaque; lobed; subpergaminaceous; satin difficult to observe even at 45×; till 27.0 cm broad; maculae evident, irregularly distributed, efigurated. **LOBES** short, anisotomous to sympodial; axils acute to oval and auriculated; **axillary folds** common, low, sometimes descending; 6.0–10.0 mm wide at branching base, the major width 8.0–15.0 mm; contiguous to laterally superposed to straddled, some counterposed; loosely adnate to elevated; black line absent to subtle and clear-cut, till 0.2 mm thick, sometimes complementary; **longitudinal axis** undulated; **transversal cut** plane-concave at the center and strongly involute on the laterals. **Proximal surface** firm; continuous; smooth, rarely crumpled and rugose; oval to irregular perforations common, commonly cicatrized, and internally ciliated. **Distal surface** firm; continuous; smooth to rugose. **Lateral margin** smooth to irregularly cut, crenate and corroded; strongly involute; sinuous to undulated; closed and commonly studded with pycnidia; not auto incompatible; **apical zone** ascending while, sometimes, involute; apices rounded to irregular, mostly involute. **CILIA** black, few to rare; satin clear at 20×; not pigmented; straight to irregularly curved; cylindrical to pointed; 0.7–1.0 mm long × 0.1 mm thick; de erect to coplanar to the lobe;

simple to forked since 0.2 mm form the base; common at the internal margins of the laminal perforations and at the lacerated lateral margins. **Secondary lobes** absent. **Lobules** rare; marginal at the internal margins of the perforations and lacerations, 0.4–0.6 mm wide at branching base, the major width 0.7–2.0 mm (*F. Ciecoski 1006*). **Lacinules** absent. **PUSTULES** absent. **SORALS** absent. **ISIDIA** absent. **MEDULLA** stramineous, firm. **UNDERSIDE** badius to brown or black in the marginal zone and black in the proximal part; a few whitish spots in the marginal zone. **Marginal zone** badius to brown or black, rarely white in involute part; lustrous; satin clear already at 10×; ca. 3.0–5.0 mm wide; attenuated in the badius and brown part, in the part black there is not differentiation between marginal zone and proximal part; smooth to crumpled and reticular rugose; papillated (*F. Ciecoski 1006*); erhizinated; commonly cracked; crevices accidental, 2.00–5.00 mm long × 0.02–0.05 mm wide, few cicatrized and the borders slightly elevated. **Proximal part** black; sublustrous; satin already clear at 10×; crumpled to rugose; crackled to rugose and crumpled; papillate (*F. Ciecoski 1006*); reticular cracked (*F. Ciecoski 1006*), 0.50–1.00 mm long × 0.03–0.05 mm wide, commonly cicatrized and borders slightly elevated. **RHIZINES** absent in the marginal zone; monomorphic, simple to arbusculiform (*F. Ciecoski 1006*), cylindrical; rare and irregularly distributed in small sparse regions; black; not pigmented; sublustrous; not gomose; satin clear at 20×; sometimes interlaced (*F. Ciecoski 1006*); straight; erect; monometric; 0.20–0.50 mm long × ca. 0.05–0.10 mm thick; sparse groups irregularly distributed at the fixation points. **APOTHECIA** bullate (young) and concave (older); till 13.0 mm diam.; subpedicellate; laminal to submarginal; medulla of the basis K+ red; disc brown to light brown (*F. Ciecoski 1006*), epruinose, the young entire, the older 3-4 clefted till 1/3 of the radius; open to 3-4 folded; imperforated; margin till 3.0 mm thick, smooth to crenate-cut;

amphithecia smooth to crumpled, maculae punctiform to efigurated, not ornamented, amphithecial medulla K+ red; stipe short and central, 1.0–2.0 mm wide × 0.5–1.0 mm high, smooth to crumpled, maculae punctiform to efigurated, not ornamented, stipe K+ red; hymenia till 200 µm high. **ASCOSPORES** ellipsoid, straight to slightly curved, (20.0–) 25.0–27.5 × 12.5–15.0 µm, epispore 2.5 µm thick, gutules absent. **PYCNIDIA** marginal to submarginal, immersed, ostiole black. **CONIDIA** bifusiform, straight, 10.5–13.5 × 1.5–3.0 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K+ yellow → orange, C-, KC+ yellow, P+ orange, UV-.

Substances of taxonomic importance: atranorin, salazinic acid.

Etymology: The epithet is given as homage to Mr. Aristides Adércio Filho, worker in the Santa Fé do Xingu Farm, a simple man full of charisma and with a great empiric knowledge at the field.

Comments: *Parmotrema aristidesii* is characterized by the greenish-gray to bluish, subpergaminaceous, velutinous, maculated, till 27 cm thallus, whose lobes are laterally superposed to straddled, very few ciliated, with perforations of unknown cause, perhaps caused by an insect, medulla stramineous and firm, underside lustrous and sparsely rizinate, reticularly cracked, apothecia concave till 13.0 mm diam., with clefted discs, amphithecia smooth to crumpled and maculated, hymenia till 200 µm high and ascospores ellipsoid (20.0–) 25.0–27.5 × 12.5–15.0 µm, epispore 2.5 µm, conidia bifusiform 10.5–13.5 × 1.5–3.0 µm and acid salazinic in the medulla (K+ yellow → orange).

Parmotrema cristatum (Nyl.) Hale (Hale 1974) is similar to *P. aristidesii* by the ciliated thallus, the medulla pigmented light yellow (K+ red), the imperforated apothecia and ascospores 25–30 × 16–20 µm. Differs by the laciniate thallus, the apothecial margin dented to ciliated, and by the presence of protocetraric acid (Donha 2005, Sipman 2005).

Parmotrema cryptoxanthoides (Kurok.) Hale ex DePriest & BW Hale (De Priest & B.W. Hale 1998) is somewhat similar to *P. aristidesii* by the pigmented pale-yellow medulla, the pedicellate apothecia with discs 13 mm diam. and ascospores 22–27 × 10–12 µm. Differs by the thallus submembranaceous to subcoriaceous (5–) 10–15 (–17) cm broad with cilia till 5-forked, occasionally by the yellow pigment deposition only in part of the medulla, the hymenia 80–95 µm high, conidia sublageniform 7–8 × 1 µm and by the presence of caperatic acid, lichesterinic acid, mennegaziaic acid, other three not identified fatty acids and one unknown pigment (Kurokawa 1974, Donha 2005, Benatti & Marcelli 2009).

Parmotrema cornutum (Lynge) Hale (Hale 1974), a species from the Mato Grosso State, is similar by the yellow pigmented medulla and the ascospores (26–) 22–27(–32) × (13–)10–12(–15) µm, and differs by the smaller thallus till 10–15 cm broad, the apothecia dented with hymenia 100–130 µm high, the presence of vulpinic acid and medullary color reactions K-, C-, KC- and P- (Hale 1965, Lynge 1914) [salazinic acid absent].

Parmotrema lyngeanum (Zahlbr.) Hale (Hale 1974) is another species from theMato Grosso State that differs by the whitish thallus, the apothecia cupuliform, bigger ascospores 19–30 × 11–17 µm, epispore 3 µm thick, the conidia bifusiform 7.0 × 0.7 µm and the presence of rhodophycin (Sipman 2005).

Parmotrema appendiculatum (Fée) Hale (Hale 1974) differs in the bicolored medulla (white to yellow above and orangish below), the apothecia dented and ciliated and by the barbatic acid in the medulla (Benatti & Marcelli 2009).

Parmotrema masonii L.I. Ferraro (Ferraro 1979) is similar in the presence of salazinic acid and differs by the presence of usnic acid and one unknown substance, and the ascospores 10–14 × 5–7 µm.

Parmotrema delicatulum (Vain.) Hale (Hale 1974) also has salazinic acid and differs by the saxicolous habit, the color evidently yellowish green (cortical usnic acid), the white medulla, and the ascospores smaller, 13–10 × 8–5 µm (Hale 1965, Vainio 1890).

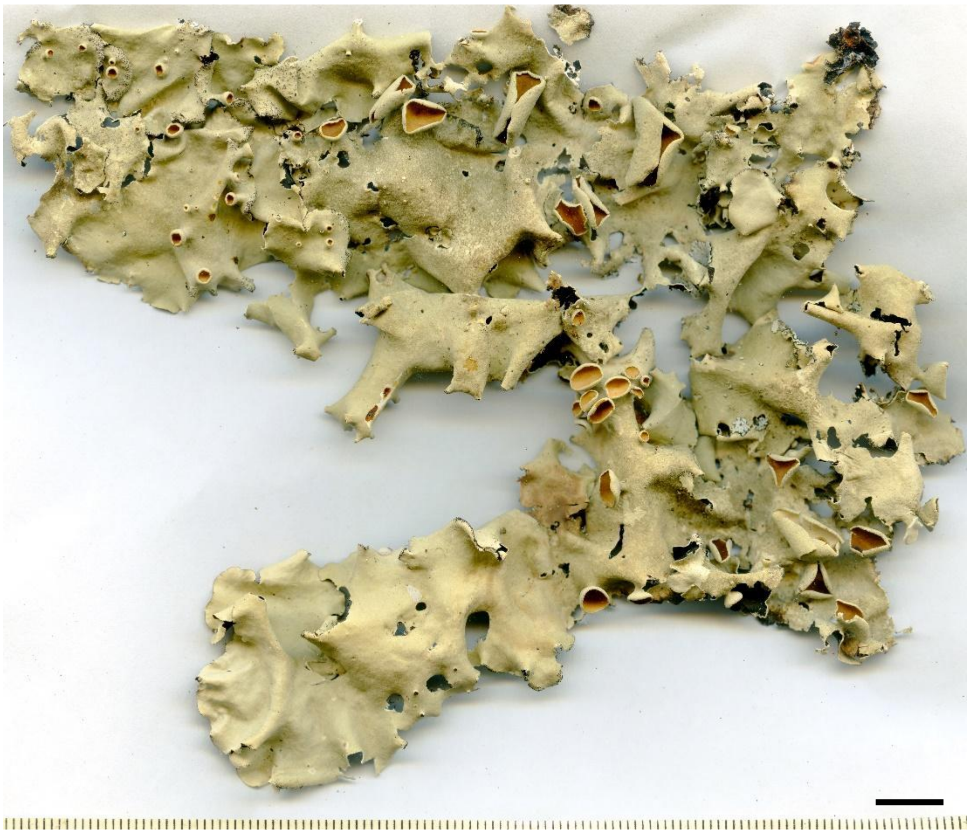

Figure 1. *Parmotrema aristidesii* (holotype, *F. Ciecoski 475*, CNMTf 512). Scale bar = 10 mm.

Parmotrema cristiferum (Taylor) Hale, *Phytologia* 28(4): 335. 1974. (Figure 2)

MycoBank: MB 343031

≡ *Parmelia cristifera* Taylor. *London Journal of Botany* 6: 165. 1847.

Type: INDIA, Calcutta, *Wallich s.n.* (lectotype: fh-tayl).

Distribution: OCEANIA. AFRICA. Indic Ocean Archipelagos. ASIA, Pacific Ocean archipelagos. NORTH AMERICA, CENTRAL AMERICA, Caribe. SOUTH AMERICA. Brazil: Mato Grosso, Minas Gerais, Paraná, and São Paulo State (Spielmann & Marcelli 2020).

Description. **THALLUS** corticicolous; greenish-gray; sublustrous; lobed; subcoriaceous; maculae weak, efigurated, irregularly distributed; satin clear at 20×; till 13.0 cm broad; epruinose; common signs of auto incompatibility in the laterally superposed margins of the lobes. **LOBES** short, anisotomous; axils acute to oval; **axillary folds** common, erect to inclined, 1.0–1.5 mm high × 1/4 of the lobe width long; sometimes auto incompatible when laterally superposed; 4.0–10.0 mm wide at branching base, the major width 5.0–14.0 mm; most of the times laterally superposed to contiguous, and counterposed to straddled; loose adnate to elevated and revolute; black line absent to attenuated, till 0.1 mm thick, not complementary; **longitudinal axis** distended to undulated; **transversal cut** plane-concave, the margins ascending in the older lobes. **Proximal surface** firm; continuous to reticular crackled; smooth to crumpled and sometimes rugose in the lateral margin. **Distal surface** firm; principally continuous to slightly reticular and crackled; smooth to crumpled and subescrobiculated. **Lateral** m**argin** smooth to irregularly cut and crenate; sinuous to undulated, commonly crispate in the older parts; closed and commonly ornate by sorals in lacinules; **apical zone** ascending to slightly descending in the younger parts, strongly ascending to erect in the old sorediated parts; apex rounded to irregularly cut, strongly crispate-sorediate in the proximal parts. **CILIA** very rare, in the apices of the lobes; black; satin clear at 30×;

pigment absent; straight in the base to sinuous the apex; pointed; 0.40–0.70 mm long × 0.05–0.10 mm thick; ascending; simple and biforked since 0.4 mm of the length. **Secondary lobes** absent. **Lobules** few; concolored; common as cicatrization process of the lateral margin; 0.6–1.5 mm long × 0.4–0.6 mm wide; lamina canaliculated; sinuous; ascending; apex rounded; black line attenuated till 0.1 mm wide, complementary; eciliated; underside brown. **Lacinules** marginal in the proximal parts, sorediated; simple to irregularly ramified; contiguous to laterally superposed; elevated to revolute; 1.2–2.0 mm long × 0.5–1.2 mm wide **PUSTULES** few; verruciform; rare capitate; apical and subapical on the lacinules; not confluent but somewhat aggregated and spread on the apex; till 0.5 mm wide; erumpent; dismantling into soredia; originated on the apices of the lacinules; rare caducous, leaving the apices extremities with the medulla completely exposed; pigment rose K+ red; pustular medulla K+ red. **SORALS** common; marginal and on the apices and subapices of the lacinules, rare laminal from swellings of the upper cortex; orbicular to labriform when at the lacinules apices; those on the apices and margins of the very young are linear interrupted, when old become subcanaliculated, ascending and crispate, giving the sorals a strongly sinuous shape; orbicular to labriform till 1.0 mm long × 0.5 mm wide and those linear interrupted till 2.5 mm long × 0.4 mm wide; sometimes coalescent; eciliated; cortex surrounding the sorals crackled to shedding plates; pigment reddish-brown K+ red. **SOREDIA** caducous to persistent; auto incompatibility affecting the coloration and changing it to brown or black, common at the apex of the lacinules and marginal; mostly farinose and rare granular; the farinose ecorticated and those granular corticated (granules), rarely forming isidioid structures; heaped; commonly produced at the apical zones of the lacinules and on the crispate and erect margins of the lobes; K+ red. **ISIDIA** absent. **MEDULLA** white, normal.

UNDERSIDE badius to brown and black in the marginal zone, black in the proximal part. **Marginal zone** badius to brown and black; sublustrous; satin clear at 20× in the badius and brown parts and clear at 30× in the black part ; ca. 4.0–8.0 mm wide; attenuated; smooth to crumpled; commonly papillated; sometimes rhizinated at the transition zone; little reticular fissured, the crevices 0.50–3.00 mm long × ca. 0.05–0.10 mm wide, commonly cicatrized and with elevated borders **Proximal part black**; sublustrous; satin clear at 20×; crumpled to rugose and papillated; reticular fissured, the crevices irregularly ramified, 3.00–10.00 mm long × ca. 0.05–0.10 mm wide, commonly cicatrized and with the borders slightly elevated. **RHIZINES** absent in the marginal zone but present at the transition zone; monomorphic, simple, apices commonly penicillate to arbusculiform, cylindrical; common and irregularly distributed by small sparse regions at the fixation points; black; not pigmented; sublustrous; not gomose; satin clear at 20×; commonly interlaced and difficult to measure; straight; erect; monometric; 0.40–0.70 mm long × ca. 0.05–0.10 mm thick; rare sparse groups irregularly distributed on the underside. **APOTHECIA** absent. **PYCNIDIA** absent.

Color tests: upper cortex K+ yellow, UV-; medulla K+ yellow →orange, C-, KC-, P+ orange, UV-.

Substances of taxonomic importance: atranorin, salazinic acid.

Specimens examined. BRAZIL; Mato Grosso State; municipality of Alta Floresta; Cristalino I State Park, Site 5: 9°28'42.62"S, 55°49'50.82"W, elevation 300 m, Open Ombrophilous Submontane Forest with Canopy, on tree trunk in the forest, *F. Ciecoski 274*, 07–VI–2020 (CNMTf 513).

Comments: *Parmotrema cristiferum* (Taylor) Hale is a lobed, subcoriaceous, rarely ciliate, and weak maculated species that presents signals of auto incompatibility in the margins of the laterally superposed lobes, common axillary folds, the proximal surface continuous to reticular crackled, the margin of the lobes crispate and ornated with sorals on the lacinules and lobes margins, the marginal sorals are linear interrupted and become subcanaliculated, ascending and crispate, has lobules common in the process of cicatrization of the lateral margin, pustules with a rose pigment K+ red that dismantle into soredia; the medulla is white with rare stains resulting from the oxidation of the salazinic acid (K+ yellow → orange); the underside is rhizinated and has reticular cicatrized fissures with slightly elevated borders.

It is considered a cosmopolitan species broadly distributed in the tropical and subtropical regions (Hale 1965, Michlig *et al*. 2015) but complete descriptions are lacking.

Parmotrema cristiferum was described by Taylor (1847) and, among the original studied specimens, there is one collection from Brazil. The species was characterized as having a whitish thallus ca. 15–20 cm broad, with the margins covered by a "fine and pulverulent powder". In 1965, Hale wrote about what could be that powder concluding that it was the soredia, which are originated in linear sorals on the lobes' margins; furthermore, Hale (1965) described the thallus as eciliate and with an opaque, continuous but broken upon ageing surface, the color reactions from the upper cortex K+ yellow, medulla K+ yellow → red, C-, KC-, and P+ orangish-red due to the presence of atranorin and salazinic acid.

Marcelli & Benatti (2010) studied Brazilian specimens identified as *P. cristiferum* collected in São Paulo State and described them as having a sublobed thallus till 30.0 cm broad with lobes irregularly ramified forming pleated and subcanaliculated folds, apices revolute when sorediated, cilia rare and sparse, medulla not pigmented but sometimes tinged by the oxidation of the salazinic acid, and the underside partially papillated and rugose.

Donha (2005), with material from Paraná State, mentioned a coriaceous thallus and rhizines black, ivory, and bicolored. Bawingan *et al*. (2017) mentioned the presence of consalazinic acid in the medulla.

Parmotrema cristiferum (Taylor) Hale is like *P. subcristiferum* Marcelli & Ciecoski (described ahead) by the thallus opaque loose adnate, by the soredia subgranular and farinose, by the white medulla containing acid salazinic and by the color reactions K+ yellow → orange → red, C-, KC+ weak yellow, P+ orange. Differs by the sorals development as marginal (Hale 1965), the coriaceous thallus with a bright and smooth surface (Donha 2005) and by the consalazinic acid in the medulla (Bawingan *et al*. 2017).

Parmotrema bangii (Vain.) Hale (Hale 1974) differs from *P. cristiferum* by the presence of sorediated pustules (Hale 1965), the membranaceous thallus and the stictic acid in the medulla (Sipman 2005).

Benatti & Marcelli (2010) described *P. rubifaciens* (Hale) Hale (Hale 1974) with morphological similarities very near to *P. cristiferum* (Taylor) Hale, differing by producing norstictic acid, connorstictic acid, constictic acid in the medulla, and the sorals even more agglomerated.

Parmotrema margaritatum (Hue) Hale (Hale 1974) differs from *P. cristiferum* by the membranaceous thallus (Hue 1899) with an opaque to bright surface and submarginal sorals (Hale 1965), the habit sublaciniate, in being hypermaculated, and by producing chlroatranorine and consalazinic acid (Spielmann & Marcelli 2020).

Parmotrema stuppeum (Taylor) Hale (Hale 1974) also has a morphology somewhat like *P. cristiferum* in the linear and marginal sorals, and the salazinic acid in the medulla, the distinction between them made by the longer cilia (2.0−3.0 cm) and the smaller conidia (4.0–6.0 µm) in *P. stuppeum* (Marcelli & Benatti 2010) besides the size of the spores (Hale 1965). The specimen of *P. cristiferum* here studied has no apothecia and pycnidia to make comparisons; however, Donha (2005) mentioned the conidia sublageniform 7−9 × 1 µm, confirming the difference pointed by Marcelli & Benatti (2010).

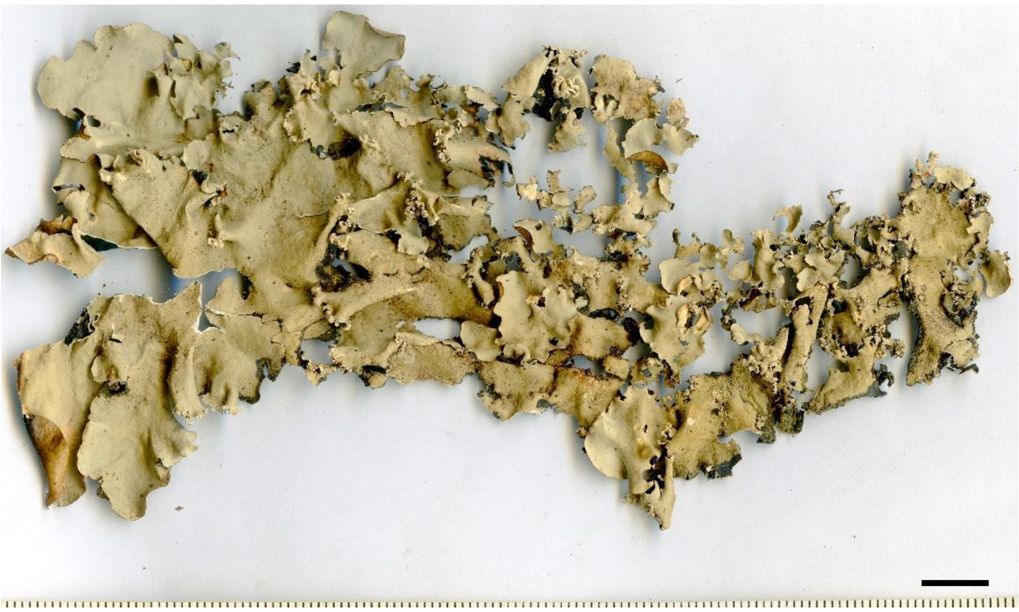

Figure 2. *Parmotrema cristiferum* (*F. Ciecoski 274*, CNMTf 513). Scale bar = 10 mm.

Parmotrema hypoflavum Marcelli & Ciecoski, sp. nov. (Figure 3)

MycoBank: MB 842963

Diagnosis*:* *Parmotrema hypoflavum* is a greenish-gray, velvet opaque, pergaminaceous species that has pustules that dismantle into soredia K+ red, the major part of the medulla bicolored white (above) and yellow close to the under cortex, which can be inverted or totally white in different parts of the thallus, contains salazinic acid and secalonic C acid, with the white medulla K+ yellow, C-, KC-, P+ yellow, UV-, and yellow medulla K+ yellow →orange → red, C-, KC-, P+ yellow, UV-.

Type: BRAZIL. Mato Grosso State: municipality of Novo Mundo, Cristalino I State Park, Site 7: 9°29'60.91"S, 55°51'28.06"W, elevation 311 m, Seasonal Semidecidual Submontane Forest with Emergent Canopy, on tree trunk in the forest, *F. Ciecoski 325*, 08-VI-2020 (Holotype: CNMTf 514).

Description. **THALLUS** corticicolous; greenish-gray; velvet opaque; lobed; pergaminaceous; rare reticular maculae (*F. Ciecoski 705*); satin visible only at 40×; till 10.0 cm broad; the counterposed parts are commonly ciliated and/or sorediated; epruinose; laminal perforations commonly oval, internally ciliated and of unknown origin, some of them not totally perforated and exposing the upper side of the lower cortex. **LOBES** short, anisotomous to sympodial; axils oval to irregular and acute; **axillary folds** frequent; 5.0–10.0 mm wide at branching base, the major width 6.0–18.0 mm; laterally superposed to contiguous and counterposed; loosely adnate to slightly revolute; black line absent to attenuated, till 0.1 mm thick, sometimes complementary; **longitudinal axis** distended to undulated; **transversal cut** initially concave, convex at the older parts, borders coplanar to slightly involute. **Proximal** s**urface** firm; continuous to crackled; smooth to slightly crumpled. **Distal surface** firm; continuous to crackled; smooth to slightly crumpled. **Lateral** m**argin** smooth to irregularly cut; sinuous to undulated; closed and sometimes sorediated; signals of auto incompatibility; **apical zone** slightly ascending, sometimes a little revolute at the sorediated parts; apex rounded to irregular, ascending to little revolute at the sorediated parts. **CILIA** black; satin clear at 20×; without pigments; sinuous; cylindrical and pointed; 0.4–1.5 (–2.0) mm long × 0.05–0.1 mm thick (*F. Ciecoski 361*); erect to ascending; simple to forked and irregularly 3–5 ramified since 0.5 mm of the length; few at the lobes' apical margins, rare on the sorediated lacinules and growing on the sorals, common on the distal margins. **Secondary lobes** and **lobules** absent. **Lacinules** marginal in parts of the proximal and distal surface, commonly sorediated; anisotomous to irregularly ramified; contiguous to laterally superposed, sometimes elevated and counterposed to form a tube with the apex open and sorediated; elevated to revolute; 1.5–2.0 mm long × 0.5–1.0 mm wide. **PUSTULES** few; verruciform and irregular; not confluent; normally subapical on the shorter lacinules, a few marginal to submarginal and laminal on the lobes; till 1.0 mm diam.; erumpent; dismantling into soredia; originated on the apices and revolute and ascending margins or from swellings on the laminal cortex; not caducous; without pigments; medulla pustular K+ red. **SORALS** abundant; subapical on the lacinules, even the shorter ones, rare marginal to submarginal; orbicular; till 1.0 mm long × 0.5 mm wide; not coalescent; a few ciliated; the cortex surrounding the sorals from entire to cracked and shedding plates. **SOREDIA** caducous to persistent, not auto incompatible; common the farinose and abundant the granular; ecorticated; heaped; commonly produced on the apical zones of the lobes; K+ red. **ISIDIA** absent. **MEDULLA** firm, white in some points, the major part bicolored, more commonly one upper layer white and one thin lower layer yellow with irregular relative thickness proportions, in some points inverted, with the yellow layer above the white. **UNDERSIDE** badius to dark brown or black in the marginal zone and black in the proximal part. **Marginal zone** badius to dark brown or black; lustrous in the badius to dark brown part and sublustrous in the black; satin clear already at 10× in the badius to dark brown part and clear only at 40× in the black one; ca. 4.0–6.0 mm wide; slightly attenuated in the badius and dark brown parts, in the black part there is no differentiation between the marginal zone and proximal part; smooth to slightly crumpled; epapillated; erhizinated; commonly cracked in the black part; crevices irregularly ramified, sometimes cicatrized, with elevated borders. **Proximal part** black; sublustrous; satin clear only at 40×; crumpled to rugose; reticular cracked, crevices sometimes ramified, commonly cicatrized and with elevated margins. **RHIZINES** absent in the marginal zone; monomorphic, simple, sometimes with penicillate to arbusculiform apex, cylindrical; rare and irregularly distributed in small sparse regions at the fixation points; black; not pigmented; sublustrous; not gomose; satin clear at 30×; commonly interlaced and difficult to measure; straight; erect; monometric; 0.20–0.70 mm long × ca. 0.08–0.10 mm thick. **APOTHECIA** absent. **PYCNIDIA** absent.

Color tests: upper cortex K+ yellow, UV-; white medulla K+ yellow, C-, KC-, P+ yellow, UV-; yellow medulla K+ yellow → orange → red, C-, KC-, P+ yellow, UV-.

Substances of taxonomic importance: atranorin, salazinic acid, secalonic C acid.

Etymology: The epithet *hypoflavum* is a union of the Greek prefix "*hypo"* (=below) and the Latin word "*flavum"* (=yellow), as a reference to the yellow medullary layer near the under cortex.

Specimens examined (paratypes). BRAZIL, Mato Grosso State, Site 9: 9°30'25.04"S, 55°49'51.83"W, elevation 258 m, Dense Submontane Ombrophilous Forest with canopy, on tree trunk, *F. Ciecoski 361*, *381*, 10-VI-2020 (CNMT); idem, municipality of Santa Cruz do Xingu; Xingu State Park, Site 18: 9°48'20.54"S, 52°27'40.89"W, elevation 265 m, Dense Submontane Ombrophilous Forest with canopy, on tree trunk, *F. Ciecoski 705*, 13-II-2021 (CGMS).

Comments: *Parmotrema hypoflavum* is characterized by the thallus greenish-gray, loosely adnate to revolute, velvet opaque and pergaminaceous, the lobes with simple, forked and irregularly ramified cilia, the pustules dismantling into orbicular sorals with farinose and granular ecorticated soredia, with sorediated lacinules, medulla bicolored yellow (upper layer) and white; the underside lustrous, rhizinated and reticular cracked with cicatrized crevices of elevated borders, producing salazinic acid and secalonic C acid (medulla white K+ yellow, C-, KC-, P+ yellow, UV-; medulla yellow K+ yellow → orange → red, C-, KC-, P+ yellow, UV-).

Parmotrema paramoreliense W.L. Culb. & C.F. Culb. (Culberson & Culberson 1981) is similar in the color reactions (medulla K+ yellow → red, C-, P + orange-red) and, according to the analysis done by Spielmann & Marcelli (2020), differs from *P. hypoflavum* by the white medulla containing chlroatranorine and consalazinic acid. Nash *et al*. (2002) also cited gyrophoric acid and protocetraric acid in *P. paramoreliense*.

Parmotrema cristiferum (Taylor) Hale (Hale 1974) is presented in the original description by Taylor [1847] as a thallus with margins covered with a powder (soredia), and Hale (1974) states that its thallus is coriaceous till 24 cm broad and the medulla only white colored containing salazinic acid. Bawingan *et al*. (2017) cited the presence of consalazinic acid in the medulla, and Benatti & Marcelli (2010) mentioned not pustular sorals.

Parmotrema margaritatum (Hue) Hale (Hale 1974) differs from *P. hypoflavum* by the membranaceous thallus (Hue 1899), the capitate sorals on the lacinules apices (Benatti & Marcelli 2010) and in the chemistry, by the presence of chlroatranorine and consalazinic acid (Spielmann & Marcelli 2020).

Parmotrema stuppeum (Taylor) Hale is similar in the presence of ciliated sorals and salazinic acid in the medulla (Hale 1965), and differs by the thallus coriaceous 10–20 cm broad (Hale 1965), the sorals linear and marginal (Benatti & Marcelli 2010), the medulla white and production of chlroatranorine and consalazinic acid.

Parmotrema permutatum (Stirt.) Hale (Hale 1974) is a ciliated species that also has a white and yellow bicolored medulla (Hale 1965), and has the same thallus dimensions (10 cm) and lobes width 5–18 mm (Eliasaro & Donha 2003), the greenish-gray color and the granular soredia (Benatti & Marcelli 2009). Differs in the shorter lacinules 0.2–1.1 (−1.8) × 0.2–0.9 (−1.1) mm, and the subcoriaceous thallus. Curiously, the results of the color reactions vary from author to author. In the original description, Hale (1965) mentions the medulla K + yellow, C-, KC-, P + light orangish yellow (stictic acid); Eliasaro & Donha (2003) described the medulla K-, C + rose, KC + rose (gyrophoric acid and other not identified compounds); and Benatti & Marcelli (2009) found the white upper part as K+ yellow, C+ rosed→orangish, KC+ rosed → orangish, P-, UV-, and in the lower colored part K+ strong yellow, C+ rosed → orangish, KC+ red → orangish, P-, UV-, but the sorals UV+ light bluish (gyrophoric acid and Eumitrin type pigments).

Even considering the possibility that those authors have analyzed different species identified as *P*. *permutatum*, all results differ from *P*. *hypoflavum* that produces salazinic acid in the medulla (K+ yellow →red).

Parmotrema hypomiltoides (Vain.) Kurok. (Kurokawa & Moon 1998) differs from *P*. *hypoflavum* chiefly by the medullary color and chemistry. In the original description, Vainio (1890) describes the medulla as chiefly white but having spots of an ocher pigment K+ red near the under cortex. Hale (1965) mentioned the medulla as orangish-red containing alectoronic acid and one anthraquinone, and Kurokawa & Moon (1998) described the medulla as rusty-orange containing α-collatolic acid.

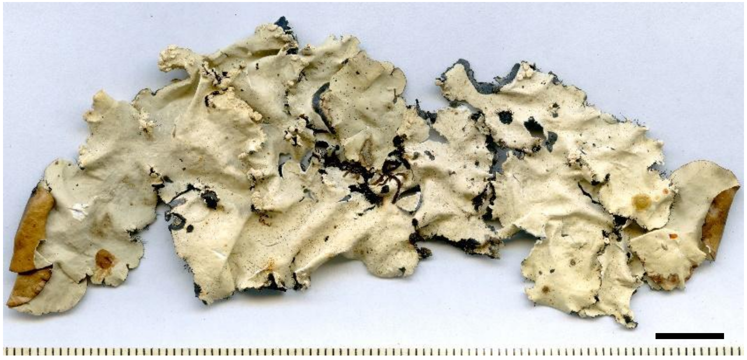

Figure 3. *Parmotrema hypoflavum* (holotype, *F. Ciecoski 486*, CNMTf 514). Scale bar = 10 mm.

Parmotrema marjorieanum Ciecoski & Marcelli, sp. nov. (Figure 4)

MycoBank: MB 842964

Diagnosis: *Parmotrema marjorieanum is a subpergaminaceous, not maculate, lobed, lacinulated, few ciliated species with a cracked surface, orange-reddish pigmented pustules (K+ yellow) that dismantle into farinose soredia, has confluent sorals which form aggregates spreading on the submarginal region, and the white medulla contains salazinic acid.*

Type: BRAZIL, Mato Grosso State, municipality of Novo Mundo, Cristalino I State Park, Site 8: 9°26'45.27"S, 55°50'40.08"W, elevation 242 m, Open Dense Ombrophilous Submontane Forest with Canopy, on to fallen tree branch in the forest, *F. Ciecoski 355*, 10-VI-2020 (Holotype: CNMTf 515).

Description. **THALLUS** corticicolous; greenish-gray; opaque; lobed; subpergaminaceous; not maculated; epruinose; satin little perceptible even at 40× at the distal parts, where the surface is continuous; the opacity of the proximal surface is due the cracking of the upper cortex; till 6.0 cm broad. **LOBES** short, anisotomous; axils oval to acute; **axillary folds** common; auto incompatible on the lateral margins; 0.5–3.0 mm wide at branching base, the major width 1.0–6.0 mm; contiguous to laterally superposed; conformed to the substrate to slightly elevated; **longitudinal axis** distended to slightly undulate; **transversal cut** plane to concave in the center, the laterals ascending to revolute. **Proximal** s**urface** firm; continuous to crackled; smooth, with sparce foveolas. **Distal surface** firm; continuous to reticulated; sometimes crumpled. **Lateral margin** smooth to irregularly cut and crenate; straight to sinuous and revolute; closed and sorediated; epruinose; black line subtle, till 0.1 mm thick, attenuated, complementary at many parts. A**pical zone** ascending to involute, revolute in the sorediated parts; apex rounded, plane to involute, revolute in the sorediated parts. **CILIA** black; satin clear at 30×; without pigments; straight to slightly sinuous; cylindrical and pointed; 1.00–2.00 × 0.10–0.15 mm; erect to coplanar to the lobe; simple to rarely forked since 0.4 mm from the base; few, in the apical margins dos lobes to absent principally at the sorediated apices. **Secondary lobes** absent. **Lobules** absent. **Lacinules** marginal in the young parts; sympodial to irregularly ramified; contiguous; elevated to revolute; 0.5–1.5 × 0.5–1.0 mm. **PUSTULES** common; oval-verruciform to capitate; commonly confluent forming aggregates that spread on submarginal region; marginal to submarginal; till 0.7 mm wide; erumpent; dismantling into sorals; originated in the lacinules apices and in the revolute and ascending margins of the lobes; caducous, making the medulla exposed at the apices of the lacinules; with an orange-reddish K+ yellow pigment; medulla pustular K+ yellow.

SORALS frequent; marginal to submarginal; labriform to orbicular; till 0.7 mm long × 0.5 mm wide; not coalescent; eciliate; the cortex surrounding sorals from entire to crackled and shedding plates; with orange-reddish K+ yellow pigment. **SOREDIA** caducous to persistent, not auto incompatible; farinose; ecorticated; heaped; commonly produced at the apical zones of the lobes; K+ yellow. **ISIDIA** absent. **MEDULLA** white, loose. **UNDERSIDE** brown or black in the marginal zone and black in the proximal part. **Marginal zone** brown or black; lustrous; satin clear already at 10×; ca. 2 mm wide in the brown part, in the black part there is no differentiation between the marginal zone and part proximal; smooth in the brown part and crackled to crumpled in the black part; epapillate; erhizinate; rare not ramified, not cicatrized crevices without elevated borders. **Proximal part** black; sublustrous; satin clear at 30×; smooth to papillated and crumpled to rugose; few times irregularly fissured; crevices not ramified, part of them cicatrized, margins elevated; rare roundish decorticated regions with elevated borders sometimes cicatrized, looking like pseudocyphellae, till 0.5 mm diam. and exposing the medulla (consequence of rhizines fall). **RHIZINES** absent in the marginal zone; monomorphic, cylindrical; rare and irregularly distributed in small sparse regions; black; not pigmented; lustrous; not gomose; satin clear already at 10×; simple; not interlaced; straight; erect; monometric; 0.30–0.40 mm long × ca. 0.10–0.15 mm thick; rare groups irregularly distributed in the fixation regions, difficult to measure. **APOTHECIA** absent. **PYCNIDIA** absent.

Color tests: upper cortex K+ yellow, UV-; white medulla K+ yellow → orange → red, C-, KC-, P+ yellow, UV-.

Substances of taxonomic importance: atranorin, salazinic acid.

Etymology: The epithet is given after F. Ciecoski's daughter Marjorie Sofientini Ciecoski.

Comments. *Parmotrema marjorieanum* is characterized by the greenish-gray, lobed, and pergaminaceous thallus till 6.0 cm broad and lobes 1.0–6.0 mm wide with only a few cilia restricted to the apices, by the laciniae with pigmented orange-reddish (K+ yellow) pustules that dismantle into farinose soredia (K+ yellow), the medulla white, and the presence of salazinic acid in the medulla (K+ yellow → orange → red, C-, KC-, P+ yellow, UV-).

Parmotrema paramoreliense W.L. Culb. & CF Culb. (Culberson & Culberson 1981) is similar in the thallus size (7 cm), the medullary color reactions K + yellow → red, C-, P+ orange-red (Culberson & Culberson 1981) indicating the salazinic acid (Spielmann & Marcelli 2020). Differs by the thallus lacinulated, maculate, the granular soredia (Culberson & Culberson 1981) and in the presence of chlroatranorine in the upper cortex and consalazinic acid in the medulla (Spielmann & Marcelli 2020).

Parmotrema cristiferum (Taylor) Hale (Hale 1974) differs in the coriaceous till 24 cm thalli (Donha 2005), not pustular sorals with granular soredia (Benatti & Marcelli 2010), and the presence of consalazinic acid in the medulla (Bawingan *et al*. 2017).

Parmotrema margaritatum (Hue) Hale (Hale 1974) differs in the thallus sublaciniated, membranaceous, and granular soredia (Hue 1899), by the size of the thallus (6–17 cm), the presence chlroatranorine in the upper cortex and consalazinic acid in the medulla (Spielmann & Marcelli 2020).

Taylor (1847) described *P. stuppeum* (Taylor) Hale (Hale 1974) as having a coriaceous thallus 6 cm large and Hale (1965) mentioned thalli 10–20 cm broad with grayish color and ciliated sorals. Marcelli & Benatti (2010) cited the lobes width as 1.0–1.5 cm. Spielmann & Marcelli (2020), studying the holotype, described it as not lacinulate, with farinose soredia, the underside densely venate, and with chlroatranorine and consalazinic, in which it differs from *P. marjorieanum*, that has an underside smooth to crumpled, and produces lacinules.

Figure 4. *Parmotrema marjorieanum* (holotype, *F. Ciecoski 935*, CNMTf 515). Scale bar = 10 mm.

Parmotrema marlitonii Ciecoski & Marcelli, sp. nov. (Figure 5)

MycoBank: MB 842965

Diagnosis*: Parmotrema marlitonii* is a submembranaceous, lobed, whitish-gray, ciliated, velvet-opaque (velutinous), small 3 cm broad species whose pustules dismantle into both farinose and granular soredia, has most of the medulla bicolored white above and lemon-yellow below, the proximal part of the underside papillate and with deep not cicatrized fissures, rhizines both planiform and cylindrical, and contains salazinic acid in the medulla (K+ orange → red).

Type: BRAZIL. Mato Grosso State: municipality of Novo Mundo, Cristalino I State Park, Site 8: 9°26'45.27"S, 55°50'40.08"W, elevation 242 m, Open Dense Ombrophilous Submontane Forest with Canopy, on at fallen branch in the forest, *F. Ciecoski 351*. 10-VI-2020 (Holotype: CNMTf 516).

Description. THALLUS corticicolous; whitish-gray; not maculated; velvet-opaque, satin not visible even at 40×; lobed; submembranaceous; small, till 3.0 cm broad. **LOBES** short, subdichotomous; axils oval to squared; 4.0–8.0 mm wide at branching base, the major width 4.0–12.0 mm; laterally superposed to counterposed; loose adnate at elevated parts; **longitudinal axis** slightly undulated; **transversal cut** plane to concave, at the center, the border coplanar to revolute; **axillary folds** common, low; **proximal surface** firm to brittle, reticular cracked tot crackled; **distal surface** smooth to foveolate and with folds becoming elevated when near the center of the thallus; epruinose; **lateral margin** smooth to irregularly cracked and involute, closed; sorediated; black line very subtle, till 0.1 mm thick, attenuated, complementary at many parts; apical zone elevated or involute, revolute at the sorediated parts; apices rounded, plane to involute, revolute in the sorediated parts . **CILIA** black; satin evident at 30×; without pigments; straight to irregularly curved; cylindrical to pointed; 2.0–4.0 mm long × 0.1 mm thick; erect; simple to forked to irregularly 2–3 ramified since 0.5 mm of the length; common at the axillary folds, frequent in parts of the lateral margin, absent principally from the esorediate apices. **Secondary lobes** absent. **Lacinules** and **lobules** absent. **PUSTULES** rare; oval-verruciform to capitate; not confluent; marginal and submarginal; till 1.0 mm wide;

erumpent; dismantling into soredia; originated on the apices of the involute and ascending margins; not caducous; without pigments; K+ yellow. **SORALS** frequent; marginal to submarginal, rarely laminal from eruptions near the lateral margins; labriform to orbicular and efigurated when laminal; till 2.0 mm long × 1.0 mm wide; not coalescent; eciliate; cortex surrounding the sorals entire or cracked and shedding plates; without pigments. **SOREDIA** persistent, not auto incompatible; farinose to granular; commonly corticated (granules); heaped; rarely produced directly in the lateral margin; K+ yellow. **ISIDIA** absent. **MEDULLA** loose, irregularly bicolored, the upper part white and the lower lemon-yellow, in the proportion of 1:2 to 2:3; or completely white at some points, without K+ pigment. **UNDERSIDE** brown in the marginal zone and black in the proximal part; continuously black since below the sorals in the marginal zone till the proximal region. **Marginal zone** brown to black; sublustrous; subsatin at 20×; ca. 7 mm width in the brown part; in the black part there is not differentiation between marginal zone and proximal part; smooth in the brown part to papillated and crumpled in the black part; black papillae common in the black part of the margin; erhizinated; fissures absent. **Proximal part** black; sublustrous; subsatin clear at 30×; smooth to papillated and crumpled at rugulose; commonly fissured in the region where the lower medulla is yellow, rare sympodial to perpendicular ramifications, 1.0 × 0.2 mm, not cicatrized and with margins elevated, on more accentuated may rarely occur deep fissures the can exposed even the white medulla above the yellow one; decorticated rounded regions with elevated borders are common, sometimes cicatrized and similar to pseudocyphellae, till 1.5 mm diam. which expose the yellow medulla (consequence of rhizines fall). **RHIZINES** absent in the marginal zone; dimorphic (planiform to cylindrical); few and irregularly distributed in small sparse regions of fixation; black; not pigmented; sublustrous; not gomose; satin clear at 20×;

simple to irregularly 2–4 branched; coplanar to the lobes; the first branch since 2.0 mm of the length; not interlaced; sinuous to curved; bent to erect and prostrated without orientation; dimetric; the planiform near the marginal zone 1.0–1.2 mm long. × ca. 0.1 mm thick, and the cylindrical present at the proximal region 0.2–0.4 mm long × ca. 0.1 mm thick; few; small groups distributed irregularly on the underside. **APOTHECIA** absent. **PYCNIDIA** absent.

Color tests: upper cortex K+ yellow, UV-; white medulla K+ orange → red, C-, KC+ yellow, P+ yellow, UV-; yellow medulla K+ orange → red, C-, P+ yellow, UV-.

Substances of taxonomic importance: atranorin, salazinic acid.

Etymology: The epithet is a homage to the entomologist Dr. Marliton Rocha Barreto from Federal University of Mato Grosso, for his contributions to Amazonian research and the incomparable friendship.

Comments. *Parmotrema marlitonii* is characterized by the thallus whitish-gray, velvet-opaque, submembranaceous and lobed, by the cilia simple to forked or ramified, the pustules dismantling into farinose and granular soredia, the bicolored medulla with the upper part white and the lower lemon-yellow or completely white in some points, by the underside with a papillated marginal zone and the proximal part with deep not cicatrized fissures, the rhizines dimorphic (planiform and cylindrical) and by the presence of salazinic acid in the medulla (K+ orange → red).

Parmotrema permutatum (Stirt.) Hale (Hale 1974) is somewhat similar in the whitish-gray to yellowish-gray thallus (Stirton 1877-1878), loosely adnate (Hale 1965), the soredia granular and medulla bicolored, white in the upper part and yellow in the lower one (Eliasaro & Donha 2003). Differs in the presence of stictic acid in the medulla

(Hale 1965), the medullary KC+ rose reaction (acid gyrophoric) (Eliasaro & Donha 2003), and in the subcoriaceous lacinulated thallus (Benatti & Marcelli 2009).

Parmotrema hypomiltoides (Vain.) Kurok. (Kurokawa & Moon 1998) also has a bicolored medulla white above and yellow below. Differs in the presence of alectoronic acid, α-collatolic acid, and one anthraquinone in the medulla (Hale 1965). and by the color reactions of the medulla KC+ rosed and UV+ greenish-blue (Benatti & Marcelli 2009).

Parmotrema paramoreliense W.L. Culb. & CF Culb. (Culberson & Culberson 1981), despite producing salazinic acid in the medulla (Spielmann & Marcelli 2020), differs in the laciniated 7 cm broad thallus (Culberson & Culberson 1981), maculated, the presence of chlroatranorine and consalazinic acid (K+ yellow → blood red) (Spielmann & Marcelli 2020), and gyrophoric acid and protocetraric acid in the medulla (Nash *et al*. 2002).

Parmotrema cristiferum (Taylor) Hale (Hale 1974) is similar in the whitish thallus (Taylor 1847), loose-adnate with marginal sorals, soredia farinose to subgranular (Donha 2005), and the presence salazinic acid in the medulla (Bawingan *et al*. 2017). Differs in the thallus size 15–20 cm (Taylor 1847), coriaceous, white medulla (Donha 2005), the sorals not pustulated (Marcelli & Benatti 2010), and by the presence of consalazinic acid in the medulla (Bawingan *et al*. 2017).

Parmotrema margaritatum (Hue) Hale (Hale 1974) also has salazinic acid in the medulla but differs by the presence of maculae (Hale 1965), the presence of sorediated marginal lacinules (Marcelli & Benatti 2010), the sublaciniated 6–17 cm broad thallus, the medulla white, and the presence of chlroatranorine and consalazinic acid (Spielmann & Marcelli 2020).

Parmotrema stuppeum (Taylor) Hale (Hale 1974) also has a lobed loose-adnate thallus containing salazinic acid in the medulla (Hale 1965) and differs by the coriaceous thallus (Taylor 1847), the thallus size 10–20 cm broad, ciliated sorals (Hale 1965), the medulla white and the presence of chlroatranorine and consalazinic acid in the medulla (Spielmann & Marcelli 2020).

Figure 5. *Parmotrema marlitonii* (holotype, *F. Ciecoski 467*, CNMTf 516). Scale bar = 10 mm.

Parmotrema nelihondae Marcelli & Ciecoski, sp. nov. (Figure 6)

MycoBank: MB 842966

Diagnosis: *Parmotrema nelihondae* is an opaque to sublustrous, ciliated, cracked, and coriaceous species with many strongly counterposed sorediate-isidiated lobes whose fused margins turns the thallus a rigid plate, has sorediated and isidiated lacinules, white medulla, the pustules dismantle into sorals, the underside is papillated and rhizinated, and contains salazinic acid (medulla K+ yellow → red).

Type: BRAZIL. Mato Grosso State: municipality of Cotriguaçu, São Nicolau Farm, Site 11: 9°48'59.15"S, 58°16'70.42"W, elevation 244 m, Dense Open Ombrophilous Forest, on tree trunk in the forest, *F. Ciecoski 459*, 10-VI-2020 (Holotype: CNMTf 517).

Description. THALLUS corticicolous; greenish-gray; mostly opaque (to sublustrous); lobed; coriaceous; not maculate; satin clear only at 40×; till 9.0 cm broad, rare reddish stains irregularly spread; epruinose. **LOBES** short, dichotomous to sympodial; axils oval to acute and squared; axillary folds common, elevated; not auto incompatible; 1.0–6.0 mm wide at branching base, the major width 3.0–7.5 mm; laterally superposed to heaped, sometimes forming layers, commonly strongly counterposed and with the margins so fused that the "sewing" is practically invisible, few of those straddled; conformed to the substrate to loose adnate; black line clear-cut to rarely attenuated, till 0.1 mm thick, complementary in many parts; **longitudinal axis** distended to strongly undulate; **transversal cut** convex to concave, the borders undulated to descending. **Proximal surface** firm; continuous to crackled and reticular cracked; crumpled to escrobiculated and rugose. **Distal surface** firm to brittle and shedding plates of the upper cortex; continuous to reticular cracked; smooth to crumpled and escrobiculated to rugose. **Lateral** m**argin** smooth to irregularly cut and crenate to bicrenate; straight to sinuous, revolute when sorediated and isidiated, ascending when without reproductive structures; closed; sorediated-isidiated; **apical zone** ascending, revolute in the sorediated-isidiated parts; apex roundish, plane, revolute in the sorediated parts. **CILIA** bright black; satin already clear at 10×; without pigments; straight to slightly sinuous; cylindrical and pointed; 0.90–2.00 mm long × 0.10–0.15 mm thick; erect to ascending; simple to rarely squarrose since the base or forked since 0.5 mm of the length; few at the apical margins of the lobes, common on the sorediated lacinules growing on the sorals and on the isidia, a few laminal to submarginal growing on cortical swellings or on small and sparse isidia agglomeration, some growing on folds at the longitudinal axis, rare on the distal younger margins. **Secondary lobes** rare; marginal; anisotomous, rare dichotomous; isolated and sparse to heaped and contiguous; on the primary lobes; elevated; 0.5–1.5 mm long × 0.5–1.0 mm wide. **Lobules** absent. **Lacinules** marginal all over the thallus, intensely sorediated-isidiated; sympodial to irregularly ramified; heaped and counterposed, sometimes the counterposed margins are circumvented by grouping sorals and isidia growing on the apical zone; after the margins becomes counter positioned they turns involute, straddled and also fused by marginal and submarginal soredia and isidia; elevated to revolute; 0.5–1.7 × 0.2–0.3 mm; when revolute, the fusion promoted by the sorals result in a cauliflower-like structure. **PUSTULES** few; verruciform and irregular; not confluent; marginal to submarginal; till 1.0 mm wide; erumpent; dismantling into sorals; originated on revolute and ascending apices and margins; not caducous; without pigment. **SORALS** abundant; marginal to submarginal, very frequently along the fused margins; labriform to capitate; till 1.0 mm long × 0.5 mm wide; coalescent, forming irregular agglomerations difficult to measure; eciliated; cortex surrounding the sorals integer to cracked and shedding plates. **SOREDIA** caducous to persistent, not auto incompatible; common the farinose, abundant the granular that commonly originating the isidia; ecorticated; heaped; commonly produced in the apical zones of the lobes; K+ yellow. **ISIDIA** concolored but with darkened apices, common the decapitated, sublustrous; dense; erect; principally marginal to submarginal and on the lacinules apices, a few laminal; grouped to cespitose; firm, fragile, a few caducous with the lost parts adhered to the submarginal cortex and becoming cespitose; conical to irregular and barreled; surface integer, smooth to slightly crackled and undulated; straight to principally irregular; commonly both pointed and roundish, sometimes truncate (decapitate); apex brown, integer to fallen; base not constricted; few of those irregularly 2–3 ramified since half height, rare the antleriform; 1.0–4.0 mm high × ca. 1.0–1.5 mm thick; a few with one apical commonly simple cilium 0.30–0.70 mm high × ca. 0.10–0.15 mm thick, rare the forked cilia 10.0–12.0(–17.0) mm high × ca. 0.2–1.0 mm thick, and rare the squarrose 0.30–0.80 mm high × ca. 0.05–0.10 mm thick; rarely developing lobules; not auto incompatible. **MEDULLA** white, firm. **UNDERSIDE** dark brown or black on the marginal zone and black on the proximal part. **Marginal** z**one** brown or black; sublustrous; satin clear at 30×; ca. 1.0–2.0 mm wide on the dark brown part, on the black part there is no differentiation between the marginal zone and proximal part; smooth to crumpled on the dark brown part and rugose to crumpled on the black part; a few concolored papillae sparsely distributed on the convex apices of the folds; erhizinated; fissures rare not ramified, not cicatrized, with not elevated borders. **Proximal part** black; sublustrous; satin clear at 30×; smooth to papillated and crumpled to rugose; reticular fissured, the crevices with irregular ramifications, commonly cicatrized and with elevated margins. **RHIZINES** absent from the marginal zone; simple and forked, cylindrical; commonly irregularly distributed in small sparse at the thallus fixation point; black; not pigmented; sublustrous; not gomose; satin clear at 20×; erect; monometric length; those simple with pointed apices 0.20–0.70 mm long × ca. 0.10–0.12 mm thick, the simple with straight penicillate apex 0.50–0.70 mm long × ca. 0.09–0.10 mm thick, the forked ramified 0.5 mm from the base, apices pointed, 0.20–0.70 mm long × ca. 0.10–0.15 mm thick. **APOTHECIA** absent. **PYCNIDIA** absent.

Color tests: upper cortex K+ yellow, UV-; medulla K + yellow → red, C+ weak yellow, KC+ yellow, P+ yellow, UV-.

Substances of taxonomic importance: atranorin, salazinic acid.

Comments. *Parmotrema nelihondae* is characterized by the opaque to sublustrous, coriaceous, emaculate thallus with rare reddish stains, by the sorediate-isidiated lacinules, the presence of dichotomous to sympodial lobes, many of them strongly counterposed with fused margins that turns the thallus a rigid plate, by the proximal surface crackled and reticulate cracked, cilia in the margins of lobes, sorals, and isidia, by the pustules dismantling into sorals, the medulla white, underside with concolored papillae, by the rhizines both simple and forked, and by the presence salazinic acid (medulla K+ yellow → red).

Among the species with salazinic acid, *P. coralliforme* (Hale) Hale (Hale 1974) is somewhat like *P. nelihondae* in relation to the size of the thallus (10 cm) loose adnate and rigid and the medulla white (Hale 1965). Differs by the lustrous thallus, the coralliform ciliate and concolor isidia till 5 mm high, the KC- medullary color reaction (Hale 1965), the fissured underside (Spielmann & Marcelli 2020). Furthermore, *P. nelihondae* presents pustules that dismantle into sorals and the lobes, besides strongly counterposed, have the densely sorediated and isidiated margins fused.

Parmotrema flavotinctum (Hale) Hale (Hale 1974) is similar in the white medulla and differs by the membranaceous thallus, the coralliform isidia and by having only atranorin as chemical component (Hale 1965).

P. gibberosum Kurok. (Kurokawa & Moon 1998) also has an opaque thallus and develops pustules; however, differently of *P. nelihondae*, its pustules do not dismantle into sorals; also, its bicolored medulla has a lower yellow (K+ purple) layer, and contains protocetraric acid, obtusatic acid and norobtusatic acid.

Parmotrema ramusculum (Hale) Hale (Hale 1974) is somewhat similar in the thallus opaque and ciliate, the medulla white with salazinic acid (Hale 1965) and the medullary color reactions K+ yellow → blood red, C–, KC–, P+ strong yellow, UV–, and differs by developing sorediated eciliate ivory arbuscules and on the chemistry by the presence of chlroatranorine and consalazinic acid (Spielmann & Marcelli 2020).

The epithet is to homage to our dear Dra. Neli Kika Honda, for her very significant studies on the Brazilian lichen chemistry and several other contributions to Brazilian lichenology, besides her great sweetness, affability, and friendship.

Figure 6. *Parmotrema nelihondae* (holotype, *F. Ciecoski 882*, CNMTf 517). Scale bar = 10 mm.

Parmotrema subcristiferum Marcelli & Ciecoski, sp. nov. (Figure 7)

MycoBank: MB 842967

Diagnosis: *Parmotrema subcristiferum* is a lobed, subpergaminaceous, eciliate, and opaque species whose proximal surface is corrugated and escrobiculated, develops pustulated and sorediated lacinules, the pustules dismantle into granular and farinose soredia (K+ red), the white medulla contains salazinic acid (K+ yellow → orange → red). **Type**: BRAZIL. Mato Grosso State: municipality of Novo Mundo, Cristalino I State Park, Site 5: 9°28'42.62"S, 55°49'50.82"W, elevation 300 m, Seasonal Semidecidual Submontane Forest with Emergent Canopy, on tree trunk in the forest, *F. Ciecoski 273*, 07-VI-2020 (Holotype: CNMTf 518).

Description. **THALLUS** corticicolous; greenish-gray; opaque; lobed; subpergaminaceous; not maculated; satin visible only at 45×; till 10.0 cm broad; epruinose; not auto incompatible. **LOBES** short, anisotomous to sympodial; axils oval to irregular and squared; **axillary folds** common; not auto incompatible; 3.0–10.0 mm wide at branching base, the major width 5.0–20.0 mm; laterally superposed to contiguous and rare counterposed; loose adnate to adnate to slightly revolute when sorediated; black line absent to very thin and attenuated, till 0.1 mm wide, not complementary; **longitudinal axis** distended to undulated; **transversal cut** plane to strongly convex-canaliculated with the borders plane to descending or involute. **Proximal surface** firm; continuous to crackled; smooth to slightly crumpled to strongly corrugated and escrobiculated. **Distal surface** firm; continuous to crackled; smooth to slightly crumpled and rugose. **Lateral margin** smooth to irregularly cut; sinuous to undulated; closed and sometimes sorediate; **apical zone** slightly ascending, revolute in the sorediated parts; apex rounded to irregularly cut, plane to ascending to revolute in the sorediated parts. **CILIA** absent. **Secondary lobes** absent. **Lobules** rare; marginal in the young parts and absent in the proximal part. **Lacinules** marginal in places of the proximal part, commonly sorediated; dichotomous to irregularly ramified; contiguous to laterally superposed; elevated to revolute; 2.0–4.0 mm long × 0.5–1.0 mm wide. **PUSTULES** frequent; verruciform; not confluent; apical and subapical on the lacinules, some marginal to submarginal and rarely laminal; till 1.5 mm wide; erumpent; dismantling into soredia; originated at the revolute and ascending apices and margins or from swellings of the laminal cortex; few caducous, leaving the medulla exposed; pigment red; medulla pustular K+ yellow. **SORALS** abundant; originated from the pustules; orbicular; 1.5 mm long × 0.7 mm wide; not coalescent; not ciliated; cortex surrounding the soral integer to crackled and shedding plates. **SOREDIA** caducous to persistent, not auto incompatible; common the farinose and abundant the granular; ecorticated; heaped; K+ red. **ISIDIA** absent. **MEDULLA** white, firm. **UNDERSIDE** brown to dark brown or black in the marginal zone and black in the proximal part. **Marginal** z**one** brown to dark brown; lustrous to sublustrous; satin clear already at 10×; ca. 1.0–5.0 mm wide; slightly attenuated; smooth to slightly crumpled; epapillated; erhizinated; rarely fissured, fissures not ramified, sometimes cicatrized and with not elevated borders. **Part proximal** black; sublustrous to opaque; satin clear at 30×; crumpled to rugose and papillated; cracked; reticular fissured; the crevices very narrow and commonly parallel, sometimes perpendicular ramified, commonly cicatrized and with elevated borders, 1.00–4.00 mm long × 0.05–0.10 mm wide **RHIZINES** absent in the marginal zone; monomorphic, simple, sometimes with penicillate to arbusculiform apices, cylindrical; common and irregularly distributed into small sparse regions in the fixation points; black; not pigmented; sublustrous; not gomose; satin clear at 20×; commonly interlaced and difficult to measure; straight; erect; monometric; 0.2–1.0 mm long × ca. 0.1–0.2 mm wide. **APOTHECIA** absent. **PYCNIDIA** absent.

Color tests: upper cortex K+ yellow, UV-; white medulla K+ yellow → orange → red, C-, KC+ weak yellow, P+ orange, UV-.

Substances of taxonomic importance: atranorin, salazinic acid.

Etymology: The epithet is a reference to *Parmotrema cristiferum* because of the morphological and chemical similarity, differing by the soredia development and by the presence of consalazinic acid in the medulla.

Comments. *Parmotrema subcristiferum* is characterized by the greenish-gray, opaque, lobed, subpergaminaceous thallus, the proximal surface typically corrugated and escrobiculated, the lobes loose adnate to slightly revolute when sorediate, the red pigmented (K+ yellow) pustules that dismantle into soredia (K+ red) both granular and farinose, by the medulla white salazinic acid and the consequent color reactions K+ yellow → orange → red, C-, KC+ weak yellow, P+ orange, UV-).

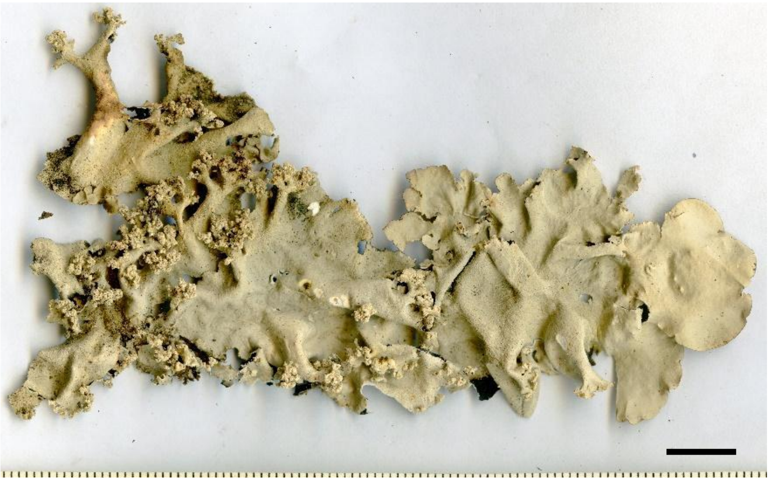

Figure 7. *Parmotrema subcristiferum* (holotype, *F. Ciecoski 1005*, CNMTf 518). Scale bar = 10 mm.

Parmotrema cristiferum (Taylor) Hale (1974) is similar in the big loosely adnate thallus, the subgranular and farinose soredia, the white medulla containing salazinic acid and by the medullary color reactions. Differs by the marginal sorals (Hale 1965), the coriaceous thallus with a lustrous smooth surface, and by the consalazinic acid in the medulla (Bawingan *et al*. 2017).

Parmotrema bangii (Vain.) Hale (Hale 1974) also has soredia developing from pustules (Hale 1965). Differs by the eciliated thallus with a bright proximal surface, the medullary color reactions (K + yellow, C-, KC-, P + light orangish red) and the presence of stictic acid (Hale 1965).

Parmotrema rubifaciens (Hale) Hale (Hale 1974) the similarities are in the farinose and subgranular soredia, differing by the thallus membranaceous (Sipman 2005) or subcoriaceous, eciliate and with sorediated margins, by the white medulla containing stains of an orangish piment (Marcelli & Benatti 2010), and by the presence of norstictic acid (Hale 1965).

Parmotrema margaritatum (Hue) Hale and *P. stuppeum* (Taylor) Hale (Hale 1974) are commonly compared to *P. cristiferum* because of the similarity of the soredia development. So, they are also like *P. subcristiferum*. *Parmotrema margaritatum* differs *in* the membranaceous thallus, the presence chlroatranorine and consalazinic acid in the medulla, and *P. stuppeum* differs by the coriaceous thallus and by the same chemistry observed in *P. margaritatum* (Spielmann & Marcelli 2020, Hale 1965). Furthermore, these species do not have the typical corrugated-escrobiculated surface of *P. subcristiferum*.

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Figure legends:

Figure 1. *Parmotrema aristidesii* (holotype, *F. Ciecoski 475*, CNMTf 512). Scale bar = 10 mm.

Figure 2. *Parmotrema cristiferum* (*F. Ciecoski 274*, CNMTf 513). Scale bar = 10 mm.

Figure 3. *Parmotrema hypoflavum* (holotype, *F. Ciecoski 486*, CNMTf 514). Scale bar = 10 mm.

Figure 4. *Parmotrema marjorieanum* (holotype, *F. Ciecoski 935*, CNMTf 515). Scale bar = 10 mm.

Figure 5. *Parmotrema marlitonii* (holotype, *F. Ciecoski 467*, CNMTf 516). Scale bar = 10 mm.

Figure 6. *Parmotrema nelihondae* (holotype, *F. Ciecoski 882*, CNMTf 517). Scale bar = 10 mm.

Figure 7. *Parmotrema subcristiferum* (holotype, *F. Ciecoski 1005*, CNMTf 518). Scale bar = 10 mm.

CAPÍTULO III.

Nine new species of *Parmotrema* (*Parmeliaceae*) containing medullary fatty acids from Amazon rainforest, Mato Grosso State, Brazil

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O presente manuscrito seguirá as padronizações adotadas pelo periódico *Mycotaxon*, ao qual o presente trabalho será submetido (Anexo B).

Nine new species of *Parmotrema* (*Parmeliaceae*) containing medullary fatty acids from Amazon rainforest, Mato Grosso State, Brazil

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ABSTRACT— *Parmotrema barbosae*, *P. carpanedoae*, *P. cotriguassuanum*, *P. cristalinense*, *P. danielii*, *P. excentricum*, *P. myrianae*, *P. sanctinicolaense*, and *P. sofientinii,* new species characterized by containing fatty acids as principal medullary substances, were discovered in the Amazon tropical rainforest and are described here. The descriptions were based in the ultimate version of the GEL descriptive protocol. These results are part of an inventory project on Amazonian *Parmeliaceae* that found 39 species from which 34 (87%) are new to science despite of *Parmeliaceae* apparently do not be an important component of the lichenized mycota in the equatorial Amazon rainforest.
Key words— lichen systematics, axillary folds, auto incompatibility, satin, black line

Introduction

The Amazon stands out for being the largest humid tropical forest in the world, covering 5% of the planet's land surface and 40% of South America, totaling an area of approximately 4.8 million square kilometers (Lemos; Silva 2011). Its phytophysiognomy, climate and topography provide diverse habitats for the greatest biodiversity on the planet (Menin 2010).

In Brazil, the family Parmeliaceae is favored by climatic conditions, microclimate, abundance of substrates and other factors that make its diversity and study complex to the point that we are far from representing all the species richness still hidden (Marcelli, personal communication). The family has 2,765 species distributed in 77 genera (Lücking & al. 2017a). In Brazil, there are 509 species distributed in 26 genera (Aptroot, unpublished data).

The genus *Parmotrema* A. Massal. is the most numerous in the family with about 350 species. Its morphology encompasses aspects such as lobes with wide and rounded apices (generally more than 0.5 cm), absence of pseudocyphellae, marginal cilia (generally present), macules (generally present with different shapes) underside with bare marginal zone and commonly different color from the proximal part, simple rhizines (generally), and thick-walled ascospores (Brodo & al. 2001; Nash; Elix 2002) and in Brazil, more than 196 species are cited (Aptroot, unpublished data).

Parmotrema is by far the most studied foliose genus in Brazil (Canêz 2005; Donha 2005; Eliasaro 2001; Fleig 1997; Hale 1965, 1974; Jungbluth 2006; Ribeiro 1998; Spielmann 2009; Benatti; Marcelli 2008, 2009; Spielmann; Marcelli 2009, 2020) and embraces chiefly great foliose thalli and can be considered one of the best known in the Neotropics (Bungartz; Spielmann 2019).

This work aimed to expand the knowledge of the genus *Parmotrema* in three areas of the Amazon, Mato Grosso State, Brazil.

Materials & methods

Samples of lichenized fungi were collected from May/2020 to March/2021 in three areas of the Amazon rainforest located in northern of Mato Grosso state.

The Cristalino State Park is a state-level conservation unit created by Decree No. 1,471/2000 and Law No. 7,518/2001, covering a total of 184,900 ha. It is located between the municipalities of Novo Mundo and Alta Floresta, between the coordinates 9°28'17.45"S, 55°49'22.20"W.

The region's climate is considered hot and humid, with average annual temperatures above 24 °C and average annual rainfall above 2,400 mm (Sasaki et al. 2008). Its hydrography comprises the sub-basins of the Cristalino, Rochedo and Nhandu rivers (Rodrigues et al. 2016). The vegetation typology is exclusively Amazonian (SEMA 2009) with a predominance of Submontane Dense Ombrophilous Forest (Borges et al. 2014). The relief can vary from undulating to mountainous, with flat to heavily undulating areas (Fundação Ecológica Cristalino 2008).

The Xingu State Park is also a conservation unit located in the municipality of Santa Cruz do Xingu (9°53'47.15"S, 52°30'36.37"W) (Lima et al. 2018) and was created by Decree No. 3,585 of December 7, 2001, currently having an area of 95,024.84 hectares.

The characteristic vegetation formation is Submontane Seasonal Semideciduous Forest and Wooded Savanna (Borges et al. 2014). It has well-defined seasons such as rainy and dry (IBGE 2012) with an average rainfall ranging from 2,000 to 2,500 mm and a temperature between 32.0°C and 21.0°C. The relief varies from flat to heavily undulating (Lima et al. 2018).

The São Nicolau Farm (09°49'09.0"S, 58°15'31.1"W) is located in the municipality of Cotriguaçu on the left bank of the Juruena River. The area has 10,000 ha, of which 7,000 ha are of slightly degraded Amazon Forest (Rodrigues et al. 2011; Sonoda & Rebellato 2016). The flora is of the Open and Dense Ombrophilous Forest type (Veloso et al. 1991) and the climate and average temperature are similar to those of the Cristalino State Park. Rainfall reaches an annual average of 2,034 mm and the data come from a meteorological tower installed on the farm between 2000 and 2009 (Noronha et al. 2015).

The methodology adopted for collection and herborization was based on Brodo & al. (2016), Fidalgo; Bononi (1967, 1989), Peixoto; Maia (2013), and adjustments were made when necessary.

The specimens were morphologically examined using stereomicroscope and light microscope. Anatomical sections, including those of apothecia and pycnidia, were hand made with razor blades. The chemical constituents were verified by spot tests with potassium hydroxide (K), sodium hypochlorite (C) para-phenylenediamine (P), and examined under UV light (360 nm). Microscopic measures were taken in water. Chemical constituents were identified by thin-layer chromatography (TLC) using solvents B, C and G (Huneck & Yoshimura 1996, Orange & al. 2010, White & James 1985), and compared with authentic samples.

The descriptions were made by using the last version of the protocol developed by the Group of Lichenological Studies (GEL) of the Instituto de Botânica, São Paulo, Brazil.

The illustrations were made from the digitization of the holotype.

The holotypes were deposited in the Herbario Centro-Norte Mato-Grossense, Sinop, Mato Grosso State, Brazil (CNMT) and the isotypes in the Herbarium of the Fundação Universidade Federal de Mato Grosso do Sul (CGMT).

Taxonomy

All nine species described and commented below produce protopraesorediosic acid in the medulla. Other fatty acids, such as praesorediosic acid, protolichesterinic acid, lichesterinic acid, and some other not identified occurred variedly in the species.

Parmotrema barbosae Ciecoski & Marcelli, **sp. nov**. FIG. 1

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Parmotrema barbosae is similar to *Parmotrema mesotropum* (Müll. Arg.) Hale but differs by the coriaceous, rugose, and corrugate thallus, and by the medulla containing protolichesterinic acid and protopraesorediosic acid.

HOLOTYPE: BRAZIL, Mato Grosso State, municipality of Cotriguaçu, São Nicolau Farm, Site 11: 9°48'59.15"S, 58°16'7.42"W, elevation 244 m, Open and Dense Ombrophilous Forest, on tree trunk in the forest, *leg. F. Ciecoski 465*, 26-IX-2020 (CNMTf 486).

ETYMOLOGY: the epithet is in honror to the biologist Dr. Flávia Rodrigues Barbosa, from the Universidade Federal de Mato Grosso, who studies taxonomy of asexual *Ascomycetes* of the Amazon.

THALLUS corticicolous, greenish-gray, opaque to sublustrous; satin evident at 30×; lobed; integer to broken, (apparently resulting from an irregular development), with some parts distended and others heaped; subcoriaceous; till 4.0 cm broad. LOBES short, anisotomous to irregular; axils rounded to acute; 1.0–3.0 mm wide at branching base, the major width 1.0–4.0 mm; laterally superposed to heaped and contiguous; loose adnate; longitudinal axis little undulated to distended with apex ascending to involute; transversal cut undulated to concave; axillary folds common; surface firm, continuous to cracked, smooth to escrobiculated along the lateral margin. Proximal surface intensely rugose to corrugate; epruinose. Lateral margin smooth to irregularly cut or corroded and broken, undulated to sinuous, ascending and sometimes counterposed, both closed and open, sometimes studded by pycnidia; black line very subtle or absent, till 0.1 mm thick; apical zone little elevated to involute; apex rounded to irregular, plane to involute. MACULES weak, efigurated, rare, all over the proximal surface. CILIA absent. Secondary lobes absent. Lobules absent. PUSTULES absent. ISIDIA absent. SORALS absent. MEDULLA white; firm. UNDERSIDE brown in the marginal zone with whitish parts due to discontinuities on the under cortex; black in the proximal part. Marginal zone brown; lustrous to sublustrous; satin somewhat visible at 10× and clear at 20×; ca. 4 mm wide; attenuated; smooth to subrugose and sometimes papillate; papillae concolored; rhizines absent. Proximal part black; opaque to velvet; not satin; rare linear fissured at convex points, not cicatrized, borders not elevated; smooth to papillate and slightly undulated; rare not cicatrized fissures. RHIZINES absent from the marginal zone and rare in the proximal part; monomorphic; black; not pigmented; subopaque; not gomose; satin visible at 30×; simple; not interlaced; cylindrical; straight; erect to slightly curved; isolated; cylindrical; ca. 0.2–0.5 mm long × ca. 0.1 mm thick; rare; in sparse points near the proximal part. APOTHECIA bullate and sulcate when young, the older concave; till 9.0 mm diam.; adnate to subadnate; K-; disc dark brown to badius, epruinose, rare 1–2 clefts the radius sized in the older; 2–3 folded to involute; imperforate, the oldest's discs linear sulcate and irregular, like corrosion made by insects; margin 0.3–1.5 mm thick, smooth to undulated to irregularly crenate-sublobed since very young; naked; amphithecia smooth to foveolate, macules efigurated and punctiform, not ornamented, K-; stipe eccentric, 1.0–2.0 mm high × 1.0–1.5 mm wide, smooth to undulated, macules efigurated, not ornamented; K-; hymenia till 80 µm high. ASCOSPORES and asci absent. PYCNIDIA submarginal, immerse, ostioles black. CONIDIA bifusiform, straight, 10.5–13.8 × 1.5 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K+ yellow, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, protolichesterinic acid, and protopraesorediosic acid.

COMMENTS—*Parmotrema barbosae* is characterized by the opaque to sublustrous, lobed, eciliated, subcoriaceous, loose adnate, intensely rugose and corrugate thallus with concave apothecia till 9.0 mm diam., discs cleft and imperforated, the amphithecia smooth and maculated (K-), with eccentric stipes and hymenia till 80 µm high, conidia bifusiform 10.5–13.8 × 1.5 µm, white medulla containing protolichesterinic acid and protopraesorediosic acid, and the medullary color reactions negative, except for the K+ yellow reaction.

Among those species containing medullary fatty acids, *P. danielii* Ciecoski & Marcelli (described ahead) is the only that shares the same acids. However, *P. danielii* also contains praesorediosic acid, lichesterinic acid, and another fatty acid Rf. 28. Morphologically, *P. danielii* differs by the sublaciniated, subpergaminaceous, pustulate, and sorediate thallus.

Parmotrema mesotropum (Müll. Arg.) Hale (Hale 1974) is similar in the opaque thallus 5–10 cm broad, the apothecia with maculated amphithecia, discs imperforated and hymenia 60–90 µm high, and differs by the reticulate cracked thallus, the all-negative medullary color reactions, the presence of caperatic acid (Hale 1965), chlroatranorin, hydroconstipatic acid, protodehydroconstipatic acid, and constipatic acid (Boom *et al.* 2021).

The apothecia of *P. mesogenes* (Nyl.) Hale (Hale 1974) have approximately the same size of those of *P. barbosae* (6–8 mm diam.), and imperforate discs, but the hymenium is higher (115–130 µm), the medulla presents a reddish-orange layer near the under cortex, an unknown anthraquinone (Hale 1965), diffractaic acid, and barbatic acid (Sipman 2005).

Parmotrema disparile (Nyl.) Hale (Hale 1974) differs by a greater thallus (15 cm) cracked upon ageing with evident white stains, by the presence of long canaliculated lobules (lacinules?), the apothecia till 15 mm diam., amphithecia rugose, hymenia 90–100 µm high, the medullary reaction KC+ reddish, and by the presence of protocetraric acid (Hale 1965).

Parmotrema cornigerum Kurok. (Kurokawa 2001) differs by the membranaceous, eciliate, shiny, emaculate, and rugose thallus with the underside distinctively rugose, by the rugose amphithecia, perforated discs, the hymenia 90–100 µm high, the medulla with protocetraric acid, salazinic acid, and consalazinic acid (Kurokawa 2001).

FIG. 1. *Parmotrema barbosae* (holotype, *F. Ciecoski 465*, CNMTf 486). Scale bar = 10 mm.

Parmotrema carpanedoae Ciecoski & Marcelli, **sp. nov.** FIG. 2

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Parmotrema carpanedoae is similar to *Parmotrema mesotropum* (Müll. Arg.) Hale but differs by the 100 µm high hymenia, by the presence of hapterons as a fixation mechanism and by containing protopraesoredioic acid and an Rf 28 fatty acid.

HOLOTYPE: BRAZIL, Mato Grosso State, municipality of Santa Cruz do Xingu; Xingu State Park, Site 30: 9°36'32.56"S, 52°27'43.52"W, elevation 252 m, Seasonal Semidecidual Submontane Forest, margin of Xingu River, on tree trunk in the riparian forest, *leg. Carpanedo B (s/n)*, 11-IX-2020 (CNMTf 487).

ETYMOLOGY: In honror to Rainiellen de Sá Carpanedo, forestal engineer, a great friend and partner of expeditions with an enormous faith in science.

THALLUS corticicolous; greenish-gray, opaque, satin clear only at 40×; sublobed; pergaminaceous; till 6.0 cm broad; macules evident, common on the proximal part and few on the distal zone, reticulate and punctiform. LOBES irregularly short-ramified; axils variously shaped, frequently oval to irregular; 2.0–6.0 mm wide at branching base, the major width 4.0–6.0 mm; with varied dispositions, laterally superposed to contiguous; loose adnate to elevated;

longitudinal axis undulated and apically descending; transversal cut concave to convex; proximal surface little firm at the lamina and brittle at the margins, continuous at the lamina and reticulate cracked at the margins, smooth to slightly undulated; epruinose; lateral margin crenate to crenulate, commonly with a corroded or “chewed” aspect but cicatrized; sinuous to crispate; closed; black line absent to clear-cut and attenuated, till 0.1 mm thick; apical zone ascending to involute, apex crenulated, prostrate to involute; macules sparse and effigurate. Secondary lobes absent. Lobules and lacinules absent. CILIA and PUSTULES absent. ISIDIA absent. SORALS absent. MEDULLA white; texture normal, cottony. UNDERSIDE brown to light brown at the distal part, with whitish stains devoid of cortex on the marginal zone; gradually turning black at the proximal part. Marginal zone opaque at the whitish parts and sublustrose at the brown part; satin clear at 30×, till 5.0 mm wide; attenuated; smooth to slightly crumpled; epapillate; erhizinated. Proximal part sublustrous; satin clear at 30×; continuous; a few irregulars and not ramified fissures with no apparent cicatrization and with preserved not elevated margins; rugose, commonly reticulate-rugose to venate. RHIZINES absent; the thallus attached directly to the substrate by haptera. APOTHECIA imperforated, submarginal, sub-bullate, stipe tubular subcylindrical that frequently, in the older, have the basis partially detached from the thallus and laterally split till expose the discs basis and perforating them; the young are bullate, sulcate, 2.0 × 3.0 mm diam.; the older are cleft to petaloid, involuted, 8.0–9.0 mm diam.; discs dark brown in the young and badius in the older, epruinose, entire the young and the older 5–7 cleft till half radius, the young involute to almost closed by till 4 folds. Margin till 2 mm thick, smooth to slightly undulated, naked. Amphithecia smooth, the older torn at the involuted folds, maculated, not ornamented; K + yellow; stipe central to eccentric, 3.0–5.0 mm alt. × 2.0–4.0 mm wide, smooth to longitudinally pleated, macules efigurated, not ornamented, K + yellow; hymenia till 100 µm high. ASCOSPORES simple, hyaline, ellipsoid, curved, 15.0–20.0 × 7.5–10.0 µm, epispore till 2.5 µm thick. PYCNIDIA principally studding submargins and margins with a very clear dark stripe of “dots”, the quantity increasing in direction to the margin, black, immerse. CONIDIA lageniform, straight, 5–7.5 × 2.5 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, protopraesorediosic acid, and one fatty acid Rf 28.

COMMENTS—*Parmotrema carpanedoae* is characterized by the opaque, sublobed, pergaminaceous, loose-adnate, brittle, maculated, and eciliate thallus till 6.0 cm broad, whose crenate to crenulate lateral submargin and margin are studded with pycnidia, the sinuous to crispate margins commonly with a corroded or chewed but cicatrized appearance, the laterally superposed to contiguous lobes, the white medulla, the underside erhizinate and fastened by haptera, the old half-detached apothecia sub-bullate and imperforate with tubular laterally opened subcylindrical stipes exposing the inferior side of the discs and perforating them, the discs cleft to petaloid, the amphithecia torn and maculated, the hymenia till 100 µm alt. and ascospores 15.0–20.0 × 7.5–10.0 µm, conidia lageniform com 5–7.5 × 2.5 µm, the medullary color reactions all-negative, and by producing protopraesorediosic acid and another unidentified fatty acid Rf. 28.

Parmotrema mesotropum (Müll. Arg.) Hale (Hale 1974) is somewhat similar to *P*. *carpanedoae* in it is somewhat similar in the opaque thallus with crenate lobes' margins, the imperforated apothecia and ascospores size (15–21 × 7–11 µm). Differs in the lower hymenia 60–90 µm high and by the presence of medullary caperatic acid (Hale 1965).

Parmotrema mesogenes (Nyl.) Hale (Hale 1974) differs from *P*. *carpanedoae* by the greater ascospores 21–30 × 12–14 µm, and the medulla becoming reddish-orange near the under cortex due an unknown anthraquinone (Hale 1965).

Parmotrema disparile (Nyl.) Hale (1974) is similar to *P*. *carpanedoae* in the imperforated apothecia with hymenia 90–100 µm high and the ascospores size 16–21 × 8–10 µm. Differs in the medullary color reaction KC+ reddish and the presence of protocetraric acid (Hale 1965).

Parmotrema carpanedoae has several chemical and morphological distinctions from the other fatty acid containing species described here.

Parmotrema barbosae Ciecoski & Marcelli differs by the coriaceous thallus, the lobes laterally superposed to heaped with the transversal cut undulated to concave, the margins smooth to irregularly cut, the proximal surface intensely rugose to corrugate, the firm medulla, the underside rhizinated and with concolored papillae, and by presenting protolichesterinic acid in the medulla.

Parmotrema sanctinicolaense Marcelli & Ciecoski (described ahead) differs by the thallus membranaceous with lobes laterally superposed to contiguous and counterposed, the counterposed margins commonly sorediate, the transversal cut with ascending laterals and strongly concave center, the proximal surface strongly rugose with deep furrows and escrobiculate, the presence of pustulate-sorediate lobules and lacinules, and by containing only protopraesorediosic acid in the medulla.

Parmotrema cotriguassuanum Marcelli & Ciecoski (described ahead) differs by the pattern of lobes disposition laterally superposed to contiguous and counterposed to straddled, by the transversal cut plane at the middle and with ascending laterals, the underside rhizinated, the presence of medullary praesorediosic acid, the ascospores greater (22.5–) 25.0–30.0 × 12.5–15.0 µm, and the conidia bifusiform 10.5–12.0 × ca. 1.50 µm.

Parmotrema cristalinense Marcelli & Ciecoski (described ahead) differs by the proximal surface continuous and smooth, the presence of pustules that dismantle into labriform soredia, the whitish to ivory underside with simple to ramified and dendroid rhizines, and by containing only protopraesorediosic acid.

Parmotrema danielii Ciecoski & Marcelli (described ahead) differs by the irregularly sublaciniated thallus, the transversal cut concave and with undulated to ascending borders, the proximal surface strongly crackled, lateral margins strongly revolute when sorediate, the presence of simple and bifurcate cilia, lobules and lacinules pustulate-sorediate, the underside with a white to ivory marginal zone, and by the presence of medullary lichesterinic acid and protolichesterinic acid.

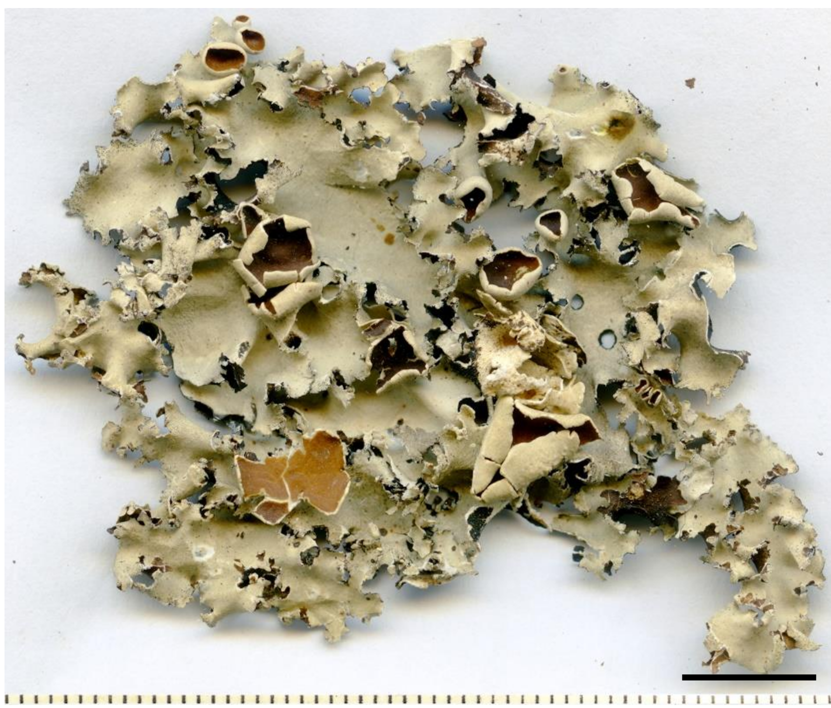

FIG. 2. *Parmotrema carpanedoae* (holotype, *Carpanedo B*, CNMTf 487). Scale bar = 10 mm.

Parmotrema cotriguassuanum Marcelli & Ciecoski, **sp. nov** FIG. 3

MB 842830

Parmotrema cotriguassuanum is similar to *Parmotrema mesotropum* (Müll. Arg.) Hale but differs by the brittle, emaculate thallus, the ascospores bigger (22.5–) 25.0–30.0 × 12.5–15.0 µm, and by containing medullary praesorediosic acid and protopraesorediosic acid.

HOLOTYPE: BRAZIL, Mato Grosso State, municipality of Cotriguaçu, São Nicolau Farm, Site 14: 9°48'47.07"S, 58°18'12.70"W, elevation 250 m, Seasonal Semidecidual Submontane Forest with Emergent Canopy, on tree trunk in the forest, *leg. F. Ciecoski 537*, 29-IX-2020 (CNMTf 488).

ETYMOLOGY: the epithet is a reference to the municipality of Cotriguaçu, where the São Nicolau Farm, the type locality, is located.

THALLUS corticicolous; greenish-gray; velvet-opaque; sublobed; pergaminaceous; emaculate; satin visible only at 40×; till 9.0 cm broad; epruinose; not auto incompatible. LOBES short, anisotomous to sympodial; axils oval to acute and squared; axillary folds common, low; 2.0–4.0 mm wide at branching base, the major width 3.0–8.0 mm; laterally superposed to contiguous and counterposed to straddled; loose adnate to conformed to the substrate; black line absent to subtle and attenuated, till 0.1 mm thick, not complementary; longitudinal axis distended to slightly undulated; transversal cut plane in the middle, the laterals ascending. Proximal surface firm to slightly brittle; continuous to reticulate cracked; smooth to crumpled and rugose. Distal surface firm to slightly brittle; continuous to cracked and with corroded parts; smooth to slightly crumpled and rugose to escrobiculated. Lateral margin smooth to irregularly cut and crenate; sinuous to undulated; closed, sometimes torn, without signals of association with vegetative structures and rarely pycnidiated; apical zone slightly ascending; apex rounded, irregularly cut to crenate, plane to ascending. CILIA absent. Secondary lobes absent. Lobules and Lacinules absent. PUSTULES absent. SORALS absent. ISIDIA absent. MEDULLA stramineous, loose. UNDERSIDE brown or black in the marginal zone and black in the proximal part. Marginal zone brown to black, whitish stains common, commonly irregular to reticulate, representing discontinuities of the under cortex at the wrinkles apices (insects); sublustrous to opaque; satin clear at 20× in the brown sublustrous part and only at 40× in the black opaque part; ca. 4.0–9.0 mm wide; slightly attenuated, in the black part there is no differentiation between marginal zone and proximal part; smooth to strongly rugose; epapillate; erhizinate; not fissured (continuous). Proximal part black, whitish stains like those of the marginal zone; sublustrous to opaque; satin clear at 20× in the sublustrous part; crumpled to strongly rugose and escrobiculated; reticulate cracked; reticulate fissured; crevices very narrow, commonly parallel, sometimes perpendicularly ramified, rarely cicatrized and with elevated borders, 1.00–3.00 mm long × 0.05–0.15 mm wide. RHIZINES absent in the marginal zone; monomorphic, simple, frequently with apices penicillate to arbusculiform, cylindrical; common and irregularly distributed into small sparse regions in the fixation points of the thallus; black; not pigmented; sublustrous; not gomose; satin clear at 20×; not interlaced; straight; erect; monometric; 0.3–0.7 mm long × ca. 0.1–0.2 mm thick. APOTHECIA sub-bullate (young) to concave and plane (old); sometimes sulcate; till 4,5 mm diam.; subadnate; submarginal; the basis medulla K-; disc brown, epruinose, open to involute, imperforate; margin till 1.5 mm thick, irregularly cut and brittle, not ornamented; amphithecia crackled, emaculate, not ornamented, amphithecial medulla K-; stipe central (young) to eccentric (old), 0.4–0.7 mm wide × 0.3–0.5 mm high, smooth to crumpled, crackled, emaculated, not ornamented, stipe K-; hymenia till 100 µm high ASCOSPORES ellipsoid, straight to slightly curved, (22,5–) 25.0–30.0 × 12,5–15.0 µm, epispore 2,5 µm, rare uniguttulated, 6/ascus (reconfirmed). PYCNIDIA laminal to marginal, submarginal, and subapical, immerse, ostiole black. CONIDIA bifusiform, straight, 10.5–12.0 × ca. 1.50 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, praesorediosic acid, protopraesorediosic acid.

COMMENTS—*Parmotrema cotriguassuanum* is characterized by the opaque to velvet, sublobed, eciliate, pergaminaceous, and brittle thallus, by the lobes with axillary folds common, by the stramineous medulla, the rugose and escrobiculated underside with whitish stains, the apothecia concave and imperforated with amphithecia crackled, hymenia 100 µm high, the 6/ascus ellipsoid ascospores (22.5–) 25.0–30.0 × 12.5–15.0 µm, epispore 2.5 µm, bifusiform conidia 10.5–12.0 × ca. 1.50 µm, the all-negative medullary color reactions, and by containing praesorediosic acid and protopraesorediosic acid.

Parmotrema mesotropum (Müll. Arg.) Hale (Hale 1974) differs by the thallus reticulate cracked with time, the maculate amphithecia, by the smaller ascospores 15–21 × 7–11 µm and by the presence of caperatic acid possibly together with protolichesterinic acid (Hale 1965).

Parmotrema mesogenes (Nyl.) Hale (Hale 1974) is somewhat similar in the imperforate apothecia and the size of the ascospores (21–30 × 12–14 µm). Differs by the medulla orange K+ purple nearby the under cortex, and in the presence of diffractaic acid and barbatic acid (Hale 1965).

Parmotrema disparile (Nyl.) Hale (Hale 1974) shares the imperforated apothecia and the hymenia 90–100 µm high. However, *P. disparile* has the thallus cracked with time, the amphithecia rugose and white stained, a medullary reaction KC+ reddish, and protocetraric acid in the medulla (Hale 1965).

Parmotrema cornigerum Kurok. (Kurokawa 2001) differs by the thallus membranaceous and laciniate, shiny, rugose to somewhat foveolate, the apothecia perforated with amphithecia rugose, ascospores smaller 20–21 × 9–

10 µm, the medullary color reaction P+ orangish-red, and by the presence of protocetraric acid (Kurokawa 2001).

Parmotrema cotriguassuanum presents some morphological and chemical similarities with new fatty acids containing species here described.

Parmotrema danielii Ciecoski & Marcelli (described ahead) differs in the transversal cut of the lobes with the middle concave and the borders undulated to ascending, the presence of adventitious lobes and pustulated-sorediated lacinules, the underside rhizinated and not fissured and by containing medullary lichesterinic acid, protolichesterinic acid and one fatty acid Rf. 28.

Parmotrema excentricum Ciecoski & Marcelli (described ahead) differs by the firm, continuous to cracked thallus, the white and loose medulla, the underside rhizinated and fissured, the apothecia cupuliform with strongly eccentric stipes, the discs till 2-folded, the amphithecia strongly rugose, the hymenia lower till 87,5 µm high, and by the conidia greater (12.0–)15.0–16.5(–18.0) × 1.5–3.0 µm.

Fig. 3. *Parmotrema cotriguassuanum* (holotype, *F. Ciecoski 537*, CNMTf 488). Scale bar = 10 mm.

Parmotrema cristalinense Marcelli & Ciecoski, **sp. nov.** FIG. 4

MB 842831

Parmotrema cristalinense differs from *P. exquisitum* (Kurok.) DePriest & B.W. Hale by the pergaminaceous thallus with medullary color reactions KC- and UV-, and by containing protopraesorediosic acid in the medulla.

HOLOTYPE: BRAZIL, Mato Grosso State, municipality of Alta Floresta; Cristalino I State Park, Site 5: 9°28'42.62"S, 55°49'50.82"W, elevation 300 m, Dense Submontane Ombrophilous Forest with Canopy, on tree trunk, leg. F. Ciecoski 945, 09–VI–2020 (CNMTf 489).
ETYMOLOGY: the epithet refers to the Cristalino River of the Cristalino State Park.
STUDIED MATERIAL: BRAZIL, Mato Grosso State, municipality of Alta Floresta; Cristalino I State Park, Site 3: 9°28'17.45"S, 55°49'22.20"W, elevation 337 m, Dense Submontane Ombrophilous Forest with Canopy, on tree trunk, *leg. F. Ciecoski 92*, 09–VI–2020 (CGMS).

THALLUS corticicolous; greenish-gray; sublustrous on the proximal part and opaque on the distal, satin clear at 40×, lobed; pergaminaceous; till 7.0 cm broad (*F. Ciecoski 92*). LOBES irregularly short-ramified; axils variate, frequently oval to irregular; few axillary folds; 1.0–4.0 mm wide at branching base, the major width 3.0–6.0 mm; disposition variate, common those laterally superposed to contiguous; loose adnate to little elevated and slightly revolute; longitudinal axis distended to undulate; transversal cut plane to concave in the middle, the borders ascending to revolute; proximal surface firm, continuous, smooth to slightly escrobiculate; epruinose; lateral margin smooth, slightly sinuous; closed, sometimes sorediate; black line subtle to absent, till 0.1 mm thick, present in a few parts of the distal region, attenuated, complementary; apical zone ascending to involute; macules absent. CILIA absent. Secondary lobes absent. Lacinules and lobules absent. PUSTULES few, small, verruciform, ca. 0.5–1.0 mm long × 0.3–0.5 mm wide, few, marginal to submarginal and involute, frequent on the proximal part, detaching and leaving the medulla exposed, erumpent and becoming sorediose, originated on the apical region but develop on the subapex, K+ yellow. ISIDIA absent. SORALS frequent, laminal (*F. Ciecoski 92*), marginal to submarginal on the underside, labriform to orbicular, till 0.5 mm wide, eciliate, the surrounding cortex integer to cracked and shedding plates; K+ yellow. SOREDIA caducous, not auto incompatible, farinose to granular, cortex absent, piled to heaped, distributed parallel to lobes' axes on the underside of the involuted parts, K+ yellow. MEDULLA white; texture normal, cottony. UNDERSIDE whitish to ivory and light brown (*F. Ciecoski 92*) on the marginal zone attenuating to black on the proximal part; points of cortical discontinuities on the under cortex, irregular to reticulate and exposing the medulla on the marginal zone (*F. Ciecoski 92*). Marginal zone sublustrous; satin clear at 30×; till 3.0 mm wide; attenuate to clear-cut; smooth to crumpled; epapillated; rhizinate; not fissured. Proximal part opaque to sublustrous; satin clear at 30×; continuous to fissured, the crevices few and irregularly distributed, not ramified, not cicatrized, at an apparently initial process of cicatrization, the borders slightly elevated; crumpled to rugose. RHIZINES absent from the marginal zone, few but common at some regionalized parts along the longitudinal axes of the lobes;

monomorphic; concolored at the proximal part and brown on the marginal zone; pigments absent; opaque to sublustrous; satin visible at 30×; mostly simple to irregularly 3–5 ramified and dendroid, these intensely interlaced and very difficult to measure, 2.0–3.0 mm long × 0.1 mm thick, ramified at the distal third, some plume-like, sinuous to contorted, little inclined to bent without orientation; isolated to agglutinated and tangled; those not ramified range from cylindrical to conical 0.5–1.0 mm long × 0.1 mm thick. APOTHECIA and PYCNIDIA absent.

Color Tests: upper cortex K+ yellow, UV-; medulla K-, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, protopraesorediosic acid.

COMMENTS—*Parmotrema cristalinense* is characterized by the pergaminaceous, lobed thallus, sublustrous on the proximal part and opaque on the distal (contrary to the common), by the marginal to submarginal pustules, the laminal, marginal and submarginal sorals, the farinose to granular soredia , the white medulla, the underside whitish to ivory and light brown at the marginal zone, the proximal part with not ramified and not cicatrized fissures, the rhizines intensely interlaced, most of them with plumed apices, and the medullary reactions K-, C-, KC-, P-, UV- due to the exclusive presence of protopraesorediosic acid.

Parmotrema sofientinii Ciecoski & Marcelli (described ahead) and *P. sanctinicolaense* Marcelli & Ciecoski (described ahead) are the chemical and morphologically nearer species among those described here. These three species have only protopraesorediosic acid in the medulla, and only morphological aspects can distinguish them.

Parmotrema sofientinii differs by the sublobed thallus with the margins of the lobes counterposed and straddled, what results in elevated folds and pleating that give the thallus a rigid structure, by the erect and strongly sorediate axillary folds, the transversal cut strongly ascending on the laterals and applanated in the center, the lateral margin smooth and irregularly cut, crenate and bicrenate and by the sorediate-pustulate lacinules.

Parmotrema sanctinicolaense differs by the sublobed membranaceous thallus, the axillary folds frequent and low, by the longitudinal axis strongly rugose, the proximal surface firm to cracked, by the lateral margin smooth to irregularly cut and crenate, the lacinules pustulate and sorediate, the rhizines simple with penicillate apices and by the color reaction of the upper cortex K+ strong yellow.

Parmotrema exquisitum (Kurok.) De Priest & B.W. Hale (DePriest & B.W. Hale 1998) is similar in the laminal and submarginal sorals with farinose soredia, in the white medulla, the upper surface smooth and under surface wrinkled. Differs by the medullary reaction KC+ rose (DePriest & B.W. Hale 1998), the thallus coriaceous, the medullary reaction UV+ white, and by the presence of alectoronic acid (Sipman 2005).

Parmotrema soredioaliphaticum Estrabou & Adler (Estrabou & Adler 1998) is somewhat similar in the pustules that become sorediose (Spielmann & Marcelli 2009) and differs by the saxicolous habit, the presence of unknown fatty acids, and the development of the sorals on dactyls (Estrabou & Adler 1998) developed on the lamina (Marcelli & Benatti 2010).

Parmotrema praesorediosum (Nyl.) Hale (Hale 1974) is somewhat similar in the lobed to sublobed, eciliate thallus with irregular ramification, the lobes contiguous to laterally superposed, and the marginal labriform or orbicular sorals with farinose soredia. Differs by the membranaceous to submembranaceous thallus (Marcelli & Benatti 2010) and by the presence of caperatic acid (Hale 1965); furthermore, Marcelli & Benatti (2010) mentioned the presence of protolichesterinic acid and praesorediosic acid, and Spielmann & Marcelli (2009) cited an unidentified substance Rf 54 in the solvent C.

Fig. 4. *Parmotrema cristalinense* (holotype, *F. Ciecoski 954*, CNMTf 489). Scale bar = 10 mm.

Parmotrema danielii Ciecoski & Marcelli, **sp. nov.** FIG. 5

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Parmotrema danielii is similar to *Parmotrema louisianae* (Hale) Hale but differs by the all-negative medullary color reactions and by containing protopraesorediosic acid, praesorediosic acid, lichesterinic acid, protolichesterinic acid, and one fatty acid Rf 28 in the solvent C in the medulla.

HOLOTYPE: BRAZIL, Mato Grosso State, municipality of Santa Cruz do Xingu; Xingu State Park, Site 17: 9°53'47.15"S, 52°30'36.37"W, elevation 283 m, Seasonal Semidecidual Submontane Forest, margin of Xingu River, on tree trunk in the forest, *leg. F. Ciecoski 670*. 13-II-2021 (CNMTf 490).

ETYMOLOGY: the epithet is in honor to Ciekcoski's nephew Daniel.

THALLUS corticicolous; greenish-gray; velvet-opaque (velutinous); irregularly sublaciniate; subpergaminaceous; emaculate; not satin even at 45×; till 12.0 cm broad; epruinose; rare laminal whitish stains and signals of corrosion (chewing?) on the cortex probably caused by insects, sometimes resulting in laminal commonly irregular to oval lobulated and cicatrized perforations. LOBES short, anisotomous; axils oval to irregular; a few axillary folds; not auto incompatible; 0.5–1.5 mm wide at branching base, the major width 1.0–4.0 mm; laterally superposed to heaped; loose adnate to strongly revolute; black line absent to attenuated till 0.1 mm thick, sometimes complementary; axis longitudinal distended to undulate; transversal cut concave at the middle, with undulate to ascending borders. Proximal surface firm; continuous to crackled and reticulate; crumpled to escrobiculated and rugose Distal surface firm; strongly crackled; smooth to crumpled and rugose to corrugate. Lateral Margin strongly irregularly cut to crenate; sinuous, ascending or strongly revolute when sorediate; closed; apical zone ascending, strongly revolute on the sorediate parts; rounded to irregular apices, ascending to revolute on the sorediate parts. CILIA black; sublustrous, satin clear at 20×; without pigments; sinuous; cylindrical and pointed; 1.00–2.00 mm long × 0.08–0.10 mm thick; erect to ascending; simple to bifurcate to irregularly 3-5 ramified since 0.4 mm of the length; few on the apical margins of the lobes, common on the sorals of the sorediate lacinules, rare on the distal margins. Secondary lobes absent. Lobules adventitious rounded, very small, on the margins of cicatrized regions. Lacinules marginal all over the thallus, commonly sorediate; dichotomous to sympodial and irregularly plane-ramified (subarbuscular); commonly contiguous; ascending to strongly revolute, forming crevices and lacerations at the basis of the ramifications; 1.5–2.0 mm long × 0.5–1.0 mm wide; underside initially ivory, however commonly becomes lichenized all-around (the algal layer spreads to form a continuous tube below the cortex) and by this way transforming the lacinules into arbuscular structures. PUSTULES few; small; verruciform and irregular; not confluent; apical to subapical on the revolute and ascending lacinules and margins; till 1.0 mm wide; erumpent; dismantling into sorals; not caducous; without pigment. SORALS abundant; apical to subapical; labriform to orbicular; till 1.5 mm long × 0.5 mm wide; few coalescent forming irregular agglomerations; few ciliated; the cortex around the sorals integer to cracked and shedding plates. SOREDIA caducous to persistent, not auto incompatible; common the farinose and abundant the granular; ecorticated; heaped; commonly produced on the apical zones of the lobes; K+ yellow. ISIDIA absent. MEDULLA white, firm. UNDERSIDE white to ivory on the marginal zone and black on the proximal part. Marginal zone white to ivory; opaque on the white part and sublustrous on the ivory part; satin clear at 30× on the ivory part and not satin at the white; ca. 4.0–6.0 mm wide; slightly attenuated; smooth to slightly crumpled; epapillate; erhizinated; not fissured. Proximal part black; sublustrous; satin clear at 30×; crumpled to strongly rugose; cracks common; fissures parallel common, sometimes perpendicularly ramified, commonly cicatrized and with elevated margins. RHIZINES absent on the marginal zone; monomorphic, simple, cylindrical; rare and irregularly distributed in small sparse regions; black; not pigmented; sublustrous; not gomose; satin clear at 30×; not interlaced; straight; erect; monometric; 0.40–0.50 mm long × ca. 0.07–0.10 mm thick; sparse groups distributed irregularly on the underside at the substrate fixation points. APOTHECIA absent. PYCNIDIA absent.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, protopraesorediosic acid, praesorediosic acid, lichesterinic acid, protolichesterinic acid, and one fatty acid Rf 28 on the solvent C.

COMMENTS—*Parmotrema danielii* is characterized by the greenish-gray velutinous, ciliate, irregularly sublaciniate, subpergaminaceous, strongly crackled thallus with the lobes laterally superposed to heaped, strongly revolute, with the transversal cut concave at the middle and with undulate to ascending borders, by the marginal lacinules subarbuscular, plane-ramified, pustulate-sorediate, by the sorals labriform to orbicular with soredia farinose and granular, the medulla white, by the underside with a marginal zone white to ivory, the proximal part cracked, fissured and rhizinate, the all-negative medullary reactions, and by producing protopraesorediosic acid, praesorediosic acid, lichesterinic acid, protolichesterinic acid, and one unidentified fatty acid Rf 28 on the solvent C.

From the new *Parmotrema* species containing fatty acids here described, *P. danielii*, *P. excentricum* Marcelli & Ciecoski (described ahead), *P. cotriguassuanum*, and *P. carpanedoae* share two medullary fatty acids: protopraesorediosic acid and praesorediosic acid. However, *P. danielii* contains additionally lichesterinic acid, protolichesterinic acid, and one unidentified fatty acid with Rf 28 on the solvent C.

Morphologically, *P. excentricum* Marcelli & Ciecoski is like *P. danielii* in the anisotomous lobes with longitudinal axis distended and undulate, the lateral margins irregularly cut, and in the medullary color reactions all-negative. Nevertheless, *P*. *danielii* has a thallus with the proximal surface firm and continuous to reticulate cracked, the distal surface continuous to cracked, the underside brown or black on the marginal zone and black on the proximal part.

Parmotrema cotriguassuanum Marcelli & Ciecoski differs by the brittle eciliate thallus, and the stramineous medulla.

Parmotrema carpanedoae Ciecoski & Marcelli is a little similar in the greenish-gray thallus, the oval to irregular axils and the white medulla. Differs from *P*. *danielii* by the opaque, sublobate, pergaminaceous, and brittle thallus, the maculate and eciliate lobes, the crenate and crenulate studded of pycnidia lateral margin, and the presence of haptera instead rhizines as fixation mechanism.

Parmotrema louisianae (Hale) Hale (1974) differs by the medullary reactions UV+ white and KC+ rose (alectoronic acid) (Sipman 2005).

Parmotrema hababianum (Gyeln.) Hale (Hale 1974) differs in the maculate thallus and by the submarginal sorals and the medullary color reaction KC+ reddish because it contains cryptochlorophaeic acid, protolichesterinic acid (Hale 1965), and norlobaridone (Sipman 2005).

Parmotrema ciliiferum Hale (1990) is somewhat similar to *P*. *danielii* by the loose-adnate, lacinulate, sorediate thallus 6–13 cm broad and differs by the presence of constipatic acid and one unknown fatty acid (Hale 1990), by the thallus submembranaceous, the surface continuous to cracked, the lacinules more frequent at the proximal parts and the presence of four other not identified fatty acids, apparently related to constipatic acid (Marcelli & Benatti 2010).

Fig. 5. *Parmotrema danielii* (holotype, *F. Ciecoski 670*, CNMTf 490). Scale bar = 10 mm.

Parmotrema excentricum Marcelli & Ciecoski, **sp. nov.** FIG. 6

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Parmotrema excentricum is similar to *Parmotrema mesotropum* (Müll. Arg.) Hale but differs by the sublustrous, reticulate cracked to continuous thallus, the bigger ascospores 25,0–30,0 × 12,5–15,0 µm, and by containing praesorediosic acid and protopraesorediosic acid in the medulla.

HOLOTYPE: BRAZIL, Mato Grosso State, municipality of Cotriguaçu, Are Nicolau Farm, Site 16: 9°48'53.09"S, 58°17'06.40"W, elevation 256 m, Open Dense Ombrophilous Forest, on tree trunk in the forest, *leg. F. Ciecoski 593*, 01-X-2020 (CNMTf 491).

ETYMOLOGY: the epithet is a reference to the typical eccentric positioning of the apothecial stipes.

THALLUS corticicolous; greenish-gray; sublustrous; lobed; subpergaminaceous; emaculate; satin clear at 20×; till 8.0 cm broad; epruinose. LOBES short, anisotomous to sympodial; axils oval to acute, axillary folds common; auto incompatibility at the margins; 4.0–5.0 mm wide at branching base, the major width 5,5–9.0 mm; contiguous to laterally superposed and counterposed; conformed to the substrate to slightly elevate; longitudinal axis distended to undulated; transversal cut concave to slightly convex, border ascending to revolute. Proximal surface firm; continuous to reticulate cracked; smooth to escrobiculated and crumpled to rugose. Distal surface firm; continuous to cracked; sometimes escrobiculated. Lateral margin smooth to irregularly cut and crenate, sometimes torn; straight to sinuous; ascending to revolute; closed; black line subtle to absent, till 0.1 mm thick, attenuated, sometimes complementary; apical zone ascending to involute; apex rounded, plane to involute. CILIA absent. Secondary lobes absent. Lacinules and lobules absent. PUSTULES absent. SORALS absent. ISIDIA absent. MEDULLA white, slightly loose. UNDERSIDE brown or black on the marginal zone and black on the proximal part. Marginal zone brown or black; lustrous on the brown part and sublustrous on the black; the brown part satin clear at 10×, ca. 2 mm wide, on the black there is no differentiation between marginal zone and proximal part; crumpled on the brown part and rugose to crumpled on the black part; epapillate; erhizinate; fissures common, not ramified, not cicatrized, sometimes with elevated borders. Proximal part black; sublustrous to opaque; satin clear only at 30×; rugose to rugulose and crumpled to rarely papillate; a few times irregularly fissured, the crevices not ramified, not cicatrized, with elevated margins; a few irregular to reticulate decorticate regions, sometimes without elevated borders, some in cicatrization process, till 4.0 mm wide RHIZINES absent on the marginal zone; monomorphic, cylindrical; rare and irregularly distributed in small sparce regions; black; not pigmented; sublustrous; not gomose; satin clear at 30×; simple to irregularly ramified; not interlaced; straight to sinuous; erect to inclined; monometric; 0.20–0.50 mm long × ca. 0.10–0.12 mm wide; rare groups distributed irregularly on the underside at the fixation regions and difficult to measure. APOTHECIA cupuliform, the discs strongly inclined in relation to the thallus surface with the inclined part involute and ladle-like; concave (young) to ladled and rare convex (old); till 6.0 mm diam.; evidently pedicellate; laminal to submarginal; medulla of the base K-; discs light brown, epruinose, not cleft, till 2-folded to involute, imperforate; margin till 2.0 mm thick, smooth to cut and brittle, not ornamented; amphithecia crumpled to strongly rugose and pleated, with effigurate and reticulate macules, not ornamented, amphithecial medulla K-; stipes strongly eccentric since very young, 1.0–1.5 mm wide × 0.5–1.0 mm high, crumpled to rugose, emaculate, not ornamented, stipe K-; hymenia till 87,5 µm high ASCOSPORES simple, hyaline, elliptical to slightly curved, 25.0–30.0 × 12,5–15.0 µm, epispore 2,5 µm thick, 8/ascus. PYCNIDIA marginal to submarginal, immerse, ostioles black. CONIDIA bifusiform, straight, (12.0–)15.0–16,5(–18.0) × 1.5–3.0 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, praesorediosic acid, and protopraesorediosic acid.

COMMENTS—*Parmotrema excentricum* is characterized by the lobed, subpergaminaceous, sublustrous thallus with anisotomous and sympodial lobes, the transversal cut concave to slightly convex and the borders ascending to revolute with the margins showing signals of auto incompatibility, by the proximal surface reticulate cracked and the distal part cracked, the lateral margin irregularly cut and crenate, the white medulla, the underside fissured, rugose to rugulose and rhizinate, by the cupuliform apothecia whose discs are strongly eccentric and inclined, becoming involute and ladled, with discs imperforate and till 2-folded, the amphithecia rugose and pleated, the ascospores elliptic to curved, 25.0–30.0 × 12,5–15.0 µm, epispore 2,5 µm thick, by the hymenia till 87,5 µm high, the marginal to submarginal pycnidia and bifusiform straight conidia (12.0–)15.0–16,5(–18.0) × 1.5–3.0 µm, the all-negative medullary reactions, and by the medulla containing praesorediosic acid and protopraesorediosic acid.

Parmotrema mesotropum (Müll. Arg.) Hale (Hale 1974) is similar in the lobes with crenate margins, apothecia with maculate amphithecia, discs imperforate, the hymenia 60–90 µm high, and in the medullary reactions negative (K-, C-, KC-, P-). Differs by the thallus opaque and reticulate cracked, the ascospores smaller 15–21 × 7–11 µm, and by the presence of caperatic acid in the medulla (Hale 1965).

Parmotrema mesogenes (Nyl.) Hale (Hale 1974) differs by the presence of diffractaic acid and barbatic acid in the medulla, which is orange pigmented nearby the under cortex (Sipman 2005), by the habit saxicolous very adnate, the opaque thallus, and by the hymenia 115–130 µm high (Hale 1965).

Parmotrema danielii and *Parmotrema cotriguassuanum*, described here, are similar in chemistry by the presence of praesorediosic acid and protopraesorediosic acid in the medulla.

Parmotrema danielii differs in the thallus opaque to velvet and irregularly sublaciniate, the proximal surface crackled, the plane-ramified marginal subarbuscular lacinules, the underside with marginal zone white to ivory and the proximal part cracked and fissured, and the additional presence of lichesterinic acid, protolichesterinic acid, and another fatty acid Rf 28 in the solvent C.

Parmotrema cotriguassuanum differs by the sublobed thallus with a brittle surface, the medulla stramineous, the underside with whitish stains, the apothecia concave with amphithecia crackled, and by the conidia bifusiform and smaller 10.5–12.0 × ca. 1.50 µm.

Fig. 6. *Parmotrema excentricum* (holotype, *F. Ciecoski 593*, CNMTf 491). Scale bar = 10 mm.

Parmotrema myrianae Ciecoski & Marcelli, **sp. nov.** FIG. 7

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Parmotrema myrianae is similar to *Parmotrema endosulphureum* (Hillmann) Hale but differs by the by the cylindrical to barrel-shaped decapitate isidia, the medullary color reactions K+ orangish-red, C-, KC+ yellow, P-, and UV-, and

by containing a not identified yellow pigment, three not identified fatty acids and other not identified substances.
HOLOTYPE: BRAZIL, Mato Grosso State, municipality of Cotriguaçu, São Nicolau Farm, Site 14: 9°48'47.07"S, 58°18'12.70"W, elevation 250 m, Open and Dense Ombrophilous Forest, on tree trunk in the forest, *leg. F. Ciecoski 545*, 29-IX-2020 (CNMTf 492).
ETYMOLOGY: the epithet is in honror to Myrian Pinto Marcelli, mother of Dr. Marcelo Pinto Marcelli, an intelligent woman, a magnificent soul.

THALLUS corticicolous; gray; velvet-opaque on the proximal surface and sublustrous on the distal part; lobed; subpergaminaceous; satin clear at 20× on the distal parts and only at 40× on the proximal surface; till 8.0 cm broad; emaculate. LOBES short, dichotomous to sympodial; axils acute to oval; axillary folds common, low; 3.0–9.0 mm wide at branching base, the major width 4.0–11.0 mm; laterally superposed to contiguous; loose adnate to conformed to the substrate; black line absent to subtle and clear-cut, till 0.1 mm thick, not complementary; longitudinal axis distended to slightly undulate; transversal cut slightly involute at the laterals and plane in the middle; proximal surface firm; continuous to reticulate-rugose; mostly densely rugose; wrinkles longitudinal or effigurate; distal surface firm; continuous; smooth to crumpled, sparsely rugose; lateral margin smooth to irregularly cut and lacerate; sinuous to undulate; closed and sometimes studdled with pycnidia; not auto incompatible; apical zone descending; apex rounded to irregular, descending to slightly involute. CILIA absent. Secondary lobes absent. Lobules absent. Lacinules absent. PUSTULES absent. SORALS absent. ISIDIA small, concolored, sometimes decapitate, sublustrous; dense; erect; principally laminal on the apex of folds and on the rugules, few marginal; not grouped; firm but commonly caducous, fragile; cylindrical to barreled; surface entire; straight to principally irregular; commonly pointed, sometimes truncate (decapitate); base constricted; not ramified; eciliate; 0.2–0.3 mm high × 0.1–0.2 mm thick MEDULLA yellow; firm; pigment K+ orangish red. UNDERSIDE badius to brown on the marginal zone and black on the proximal part. Marginal zone badius to brown; lustrous; satin clear already at 10×; ca. 2.0–5.0 mm wide; attenuated on the badius and brown part; smooth to crumpled and reticulate and sparsely rugose; papillated only on the transition zone; erhizinate; not fissured. Proximal part black; sublustrous; satin clear at 20×; crumpled to rugose; papillate; irregularly fissured, crevices 0.50–0.70 mm long × 0.02–0.04 mm wide, not cicatrized and with slightly elevated borders. RHIZINES absent on the marginal zone; monomorphic, simple, cylindrical; rare and irregularly distributed in small sparse regions; black; not pigmented; sublustrous; not gomose; satin clear at 20×; not interlaced; straight; erect; monometric; 0.30–0.70 mm long × ca. 0.05–0.10 mm thick; sparce groupings irregularly distributed on the attachment points. APOTHECIA absent. PYCNIDIA marginal to submarginal, immerse, ostioles black. CONIDIA bifusiform, straight, 9.0–12.0 × ca. 1.5 µm.

Color tests: cortex upper K+ yellow, UV-; medulla K+ orangish red, C-, KC+ yellow, P-, UV-.

Substances of taxonomic importance: atranorin, one not identified yellow pigment, three not identified fatty acids, and several other not identified substances.

COMMENTS—*Parmotrema myrianae* is characterized by the gray, lobed, velutinous on the proximal surface and sublustrous on the distal part subpergaminaceous, densely isidiate thallus, the firm yellow medulla, the isidia small, concolored, decapitate and with constricted base, the underside papillate and irregularly fissured and rhizinate, the pycnidia marginal to submarginal with bifusiform straight conidia 9.0–12.0 × ca. 1.5 µm, by the medullary reactions K+ red orangish, C-, KC+ yellow, P-, UV-, and by containing one yellow not identified pigment, three not identified fatty acids, beside other not identified substances.

Fig. 7. *Parmotrema myrianae* (holotype, *F. Ciecoski 545*, CNMTf 492). Scale bar = 10 mm.

Parmotrema myrianae is the only isidiate fatty acids containing species found and has a unique chemistry with several unidentified substances.

Parmotrema endosulphureum (Hillmann) Hale is somewhat like *P*. *myrianae* in the gray, eciliate, densely isidiate thallus with yellow medulla (Hale 1974). *Parmotrema endosulphureum* has occasionally thin isidia, and *P*. *myrianae* has cylindrical to barrel-shaped and decapitate isidia. Furthermore, *P*. *endosulphureum* presents gyrophoric acid in the medulla and consequently diverse color reactions K +, C +, KC +, all strong yellow (Hale 1965).

Parmotrema enteroxanthum Hale differs by the thallus saxicolous, fragile, sparsely ciliate, the medulla white or yellow, and by the presence of salazinic acid (Hale 1977).

Parmotrema sanctinicolaense Marcelli & Ciecoski**, sp. nov.** FIG. 8

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Parmotrema sanctinicolaense is similar to *Parmotrema exquisitum* (Kurok.) DePriest & B.W. Hale but differs by the membranaceous sublobed thallus, the pustulate and sorediate laciniae with farinose and granular soredia, the medullary color reactions KC- and UV-, and by containing protopraesorediosic in the medulla.

Holotype: BRAZIL, Mato Grosso State, municipality of Cotriguaçu, São Nicolau Farm, Site 10: 9°48'60.00"S, 58°15'60.00"W, elevation 234 m, Open and Dense Ombrophilous Forest, on tree trunk in the forest, *leg. F. Ciecoski 431*. 25-IX-2020 (CNMTf 493).

Etymology: the epithet refers to the São Nicolau Farm where the species was collected.

THALLUS corticicolous; greenish-gray; sublustrous; sublobed; membranaceous; satin clear at 20×; till 7.0 cm broad; epruinose; emaculate. LOBES short, anisotomous to sympodial; axils oval to irregular and acute; axillary folds frequent, low; 3.0–6.0 mm wide at branching base, the major width 4.0–13.0 mm; laterally superposed to contiguous and counterposed; the counterposed margins commonly sorediate; loose adnate to revolute when sorediate; black line absent to subtle and attenuated, till 0.1 mm thick, sometimes complementary; longitudinal axis distended to undulate, frequently strongly rugose; transversal cut strongly concave on the middle and with ascending laterals; proximal surface firm; continuous to cracked; smooth to crumpled, mostly strongly parallel-rugose; distal surface little firm to brittle; continuous to cracked and torn; smooth but crumpled near the apical zone, more commonly strongly rugose with deep furrows to escrobiculated; lateral margin smooth to irregularly cut and crenate; sinuous to undulate; closed, sometimes sorediate; not auto incompatible; apical zone slightly ascending, sometimes somewhat revolute on the sorediate part; apex rounded to irregular, ascending to revolute on the sorediate part. CILIA absent. Secondary lobes absent. Lobules marginal adventitious; concolored; few; not ramified; 0.2–0.4

mm wide at branching base, the major width 0.5–2.0 mm; lamina plane and apex slightly ascending; slightly sinuous; ascending; apex rounded; black line subtle, till 0.05 mm thick; eciliate; underside brown; apparently developed on the cicatrized margins after becoming torn; without vegetative or reproductive structures. Lacinules marginal all over the thallus, commonly sorediate; anisotomous to irregularly ramified; superposed laterally to counterposed and sorediate; elevate to revolute; 1.0–1.5 mm long × 0.4–0.7 mm wide. PUSTULES common; verruciform and irregular; sometimes confluent; normally subapical on the shorter lacinules, a few marginal to submarginal and laminal; till 1.0 mm diam.; erumpent; dismantling into soredia; originated on the apices, on the revolute and ascending margins, or from swellings on the laminal cortex; caducous, leaving the extremities of the apices with the medulla totally exposed; pigment orangish-brown; pustular medulla K+ yellow. SORALS abundant; apical to subapical on the lacinules, a few marginal to submarginal; orbicular to labriform and capitate; till 0.7 × 0.5 mm.; not coalescent; eciliate; cortex surrounding the sorals integer to cracked and shedding plates. SOREDIA caducous to persistent, not auto incompatible; common the farinose and abundant the granular; ecorticated; heaped; commonly produced on the apical zones of the lacinules; K+ yellow. ISIDIA absent. MEDULLA white; firm. UNDERSIDE badius to brown on the marginal zone and black on the proximal part. Marginal zone badius to brown; lustrous on the badius part to sublustrous on the brown; satin clear already at 10×; ca. 1.0–4.0 mm wide; attenuated; smooth to slightly crumpled; sparsely papillate, papillae concolored; erhizinate; commonly fissured; crevices irregularly ramified, 1.5–3.0 mm long × 0.3–0.5 mm wide, sometimes cicatrized and with elevated borders. Proximal part black; sublustrous; satin clear at 20×; crumpled to rugose; cracked; not fissured. RHIZINES rare on the marginal zone; monomorphic, simple, sometimes with penicillate to arbusculiform apices, cylindrical; few and irregularly distributed in small sparse regions; whitish to concolored on the marginal zone and black on the proximal part; not pigmented; sublustrous; not gomose; satin clear at 30×; commonly interlaced and difficult to measure; straight; erect; monometric; 0.20–0.50 mm long × ca. 0.05–0.10 mm thick; sparse groupings irregularly distributed at the fastening points. APOTHECIA absent. PYCNIDIA absent.

Color tests: upper cortex K+ strong yellow, UV-; medulla K-, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, protopraesorediosic acid.

COMMENTS—*Parmotrema sanctinicolaense* is characterized by the sublobed, membranaceous, sorediate thallus with lobes laterally superposed to contiguous and counterposed, the axils oval and acute, folds axillary frequent, the longitudinal axis rugose and the transversal cut concave on the center, the surface proximal continuous and cracked, the margins irregularly cut and crenate, the adventitious lobules marginal and concolored, the lacinules pustulate-sorediate, the pustules with orangish-brown pigment (K+ yellow), by the farinose and granular soredia, the white medulla, the underside smooth and papillate, rhizinate and fissured, by the all-negative medullary reactions, and by containing only protopraesorediosic acid in the medulla.

Among the new species described here, *Parmotrema sofientinii* Ciecoski & Marcelli (described ahead) and *P. cristalinense* are the nearer species, distinguished only on morphological basis, since the three species produce only protopraesorediosic acid in the medulla.

P. sofientinii Ciecoski & Marcelli differs in the sublobed and pergaminaceous thallus with the margins of the lobes counterposed and straddled, which promote elevations and pleating that makes the thallus stiff, in the continuous and smooth proximal surface, the granular soredia are corticate (granules) and heaped into moniliform isidioid structures or yet forming effigurate lacinules.

P. cristalinense differs by the lobed and pergaminaceous thallus, by the transversal cut of the lobes plane to concave with ascending to revolute borders, the proximal surface continuous, smooth to escrobiculate, the marginal not pigmented pustules, the underside whitish to ivory and light brown on the marginal zone, by the intensely interlaced rhizines with plumed apices.

Fig. 8. *Parmotrema sanctinicolaense* (holotype, *F. Ciecoski 431*, CNMTf 493). Scale bar = 10 mm.

Parmotrema exquisitum (Kurok.) DePriest & B.W. Hale presents both chemical and morphological differences, in the coriaceous, lobed thallus with laminal sorals and exclusively farinose soredia, the medullary color reactions KC+ rose and UV+ white because of the presence of alectoronic acid (DePriest & B.W. Hale 1998).

Parmotrema sorediοaliphaticum Estrabou & Adler) is similar in the membranaceous thallus with white medulla and differs by the saxicolous habit, the sorals originated on the apices of dactyls (Estrabou & Adler 1998) and in the presence de unknown fatty acids (Marcelli & Benatti 2010).

Parmotrema praesorediosum (Nyl.) Hale has also a greenish-gray lobed to sublobed thallus, the sorals are labriform, the soredia farinose to subgranular, and the medulla is white (Hale 1974). Differs by the habit both corticicolous and saxicolous, the greater thallus till 20 cm broad (Marcelli & Benatti 2010), and the medullary chemistry by the presence of praesorediosic acid, caperatic acid, protolichesterinic acid, and one not identified substance Rf 54 on the solvent C (Spielmann & Marcelli 2009).

Parmotrema sofientinii Ciecoski & Marcelli, **sp. nov.** FIG. 9

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Parmotrema sofientinii is similar to *Parmotrema austrosinense* (Zahlbr.) Hale but differs by the bigger thallus (20 cm), the pustulate/sorediate laciniae, by the medullary color reactions C- and KC-, and by containing protopraesorediosic in the medulla.

HOLOTYPE: BRAZIL, Mato Grosso State, municipality of Cotriguaçu, Are Nicolau Farm, Site 16: 9°48'53.09"S, 58°17'06.40"W, elevation 256 m, Open and Dense Ombrophilous Forest, on fallen tree branch in the forest, *leg. F. Ciecoski 588*, 01-X-2020 (CNMTf 494, isotype-CGMS).

ETYMOLOGY: the epithet is in honor to Ciecoski’s husband Altair Sofientini Ciecoski.

THALLUS corticicolous; greenish-gray; sublustrous sublobed; pergaminaceous; satin at 20×; till 20 cm broad; the margins along the longitudinal axes of the longer lobes frequently become counterpose and straddled, with the mortised points elevated and sinuous and pleated, what turns the thallus into a rigid plate; arbuscular lacinules abundantly pustulate-sorediate grow up at the top of the pleats; epruinose; macules weak with irregular distribution, effigurate to reticulate; conical prominences common on the distal surface originate pustules and sorals. LOBES short, subdichotomous to sympodial; axils acute, a few oval at the lateral margins; axillary folds erect, common and strongly sorediate; 3.0–6.0 mm wide at branching base, the major width 4.0–10.0 mm; more commonly counterposed and straddle, few contiguous; loose adnate to revolute when sorediate; black line absent to subtle and clear-cut, till 0.1 mm thick, sometimes complementary; longitudinal axis distended to slightly undulate; transversal cut applanate in the center and strongly ascending in the laterals. Proximal surface firm; continuous; smooth, rarely crumpled. Distal surface firm; continuous to rarely cracked; smooth to rugose. Lateral margin smooth to irregularly cut, crenate to bicrenate; sinuous to undulate, ascending but involute at the apices (straddling of the lobes); closed and strongly sorediated; not auto incompatible; apical zone plane-concave to strongly ascending and revolute at the sorediate parts; apices rounded to irregular, ascending to revolute in the sorediate parts. CILIA absent. Secondary lobes absent. Lobules absent. Lacinules marginal all over the thallus, absent only from the youngest parts; abundantly sorediated; dichotomous to irregularly ramified; laterally superposed to counterposed; elevated to revolute; 1.00–2.00 mm long × 0.04–0.10 mm wide; underside ivory. PUSTULES common; verruciform and irregular; sometimes confluent; normally subapical on the shorter lacinules, few apical to subapical and laminal; till 1.0 mm diam.; erumpent; dismantling into sorals; originated on the revolute and ascending apices and margins or, sometimes, from conical laminal and submarginal prominences; caducous, leaving the apices with the medulla totally exposed; without pigments; pustular medulla K+ yellow. SORALS abundant; apical to subapical on the lacinules, a few marginal to submarginal and on the conical laminal and submarginal prominences; labriform and capitate; till 1.0 mm long × 0.5 mm wide; not coalescent; eciliate; cortex below the sorals integer. SOREDIA caducous to persistent, not auto incompatible; rare the farinose and abundant those granular; commonly integrally corticate (granules); heaped to piled up into corticate isidioid moniliform structures; sometimes the piles form effigurate lacinules; commonly produced at the apical zones of the lacinules; K+ yellow. ISIDIA absent. MEDULLA white; firm. UNDERSIDE badius to brown or black in the marginal zone and black in the proximal part. Marginal zone badius to brown or black; lustrous; satin clear already at 10×; ca. 3.0–5.0 mm wide; attenuated in the badius and brown part, in the part black there is no differentiation between the marginal zone and proximal part; smooth to strongly crumpled and reticulately rugose; sparsely papillate, concolored; erhizinated; sparsely fissured in the black regions; fissures irregularly ramified, 1.0–4.0 mm long × 0.3–0.5 mm wide, commonly cicatrized and with borders slightly elevate. Proximal part black; lustrous; satin already clear at 10×; strongly crumpled to rugose and papillate; crackled to escrobiculated; fissures 0.50–1.50 mm long × 0.1–0.2 mm wide, fissures commonly cicatrized and with borders slightly elevated. RHIZINES rare in the marginal zone, few in the proximal region; monomorphic, simple, sometimes with arbusculiform apices, cylindrical; few and irregularly distributed in small sparse regions; black; not pigmented; sublustrous; not gomose; satin clear at 20×; strongly interlaced and difficult to measure; straight; erect; monometric; 0.20–0.70 mm long × ca. 0.05–0.10 mm thick; very sparse groups irregularly distributed on the underside at the substrate fixation regions. APOTHECIA only young present; bullate; sulcate; till 0.2 mm diam.; laminal to submarginal; medulla of the base K-; discs brown, epruinose, entire in the young; imperforated; margin thick, till 3.0 mm thick, smooth to cut, strongly ornate by sorals since the very begin of the amphithecia development; amphithecia smooth, emaculated, ornamented by sorals, amphithecial medulla K-; stipe central, 0.7–1.0 mm wide × 0.4–0.6 mm high, smooth to crumpled, emaculated, not ornamented, stipe K-; hymenia till 50 µm high (young apothecia). ASCOSPORES absent; asci absent. PYCNIDIA absent.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, protopraesorediosic acid.

COMMENTS—*Parmotrema sofientinii* is characterized by the greenish-gray, sublobed, sublustrous, pergaminaceous, weakly maculate thallus with the margins along the longitudinal axis of the lobes elevated, counterposed, straddled, pleated, and sinuous, making the thallus a rigid plate; the transversal cut of the lobes is applanated in the center and have strongly ascending laterals; the abundant lacinules are pustulate-sorediate with labriform and capitate sorals, the medulla white and firm; the underside rhizinate, strongly crumpled to rugose-papillate and irregularly fissured, the crevices cicatrized; the apothecia imperforate with sorediate amphithecia, the all-negative medullary reactions, and by containing only protopraesorediosic acid.

Parmotrema austrosinense (Zahlbr.) Hale (Hale 1974) differs in the smaller thallus (6–10 cm), in the lobes marginally sorediate, the medullary reactions C+ blood-red, KC+ blood-red, and by the presence of lecanoric acid (Hale 1965, Donha 2005).

Parmotrema exquisitum (Kurok.) DePriest & BW Hale (DePriest & B.W. Hale 1998) is similar in having the thallus with an upper surface smooth. by the coriaceous thallus and the medullary color reactions KC + rose and UV + white, indicating the presence of alectoronic acid (Kurokawa 1987), absent in *P*. *sofientinii*.

Parmotrema sorediolaliphaticum Estrabou & Adler (Estrabou & Adler 1998) differs in the saxicolous membranaceous thallus, in the sorals developed at the apices of laminal dactyls, and the presence of non-identified fatty acids (Estrabou & Adler 1998).

Parmotrema praesorediosum (Nyl.) Hale (Hale 1974) presents somewhat distant similarities with *Parmotrema sofientinii* as for the eciliated sorediated margins, the imperforated apothecia with sorediate amphithecia and the all-negative medullary reactions. Differs in the presence of caperatic acid (Hale 1965), the membranaceous thallus with a smooth surface that turns rugose and cracked upon ageing, and a not identified substance Rf 54 in solvent C (Spielmann & Marcelli 2009).

Fig. 9. *Parmotrema sofientinii* (holotype, CNMTf 494 (left) and isotype, CGMS (right), *F. Ciecoski 588*). Scale bar = 10 mm.

Parmotrema sofientinii presents certain chemical and morphological similarities with the other fatty acids containing species described here.

Parmotrema cristalinense Marcelli & Ciecoski differs by the lobes with oval and irregular axils, the pustules shaped like a bunch of grapes originated in the margins and submargins of the proximal part, the underside with points of discontinuous under cortex, while in *P. sofientinii* the axils are acute and little oval, the pustules are verruciform, irregular and originate in the subapical regions of the shorter lacinules, the underside does not present discontinuities of the under cortex, and has irregularly ramified fissures. Both these species have only protopraesorediosic acid in the medulla.

Parmotrema cotriguassuanum Marcelli & Ciecoski differs in the presence of praesorediosic acid additional to the protopraesorediosic acid. *P. cotriguassuanum* has low axillary folds, while they are erect and strongly sorediate in *P. sofientinii*. Furthermore, *P. cotriguassuanum* has a stramineous medulla, the margin of the lobes pycnidiate, and the underside with perpendicularly ramified and rarely cicatrized fissures, while in *P. sofientinii* the medulla is white, the margins of the lobes have sorediate lacinules, and the underside develops cicatrized and irregularly ramified fissures.

Parmotrema carpanedoae Ciecoski & Marcelli and *P. sofientinii* are similar in the presence of protopraesorediosic acid; however, *P. carpanedoae* produces one fatty acid Rf 28 not found in *P. sofientinii*. Furthermore, *P. carpanedoae* has a smaller thallus (6.0 cm) and typical morphological characteristics as the lobes with transversal cut concave to convex, proximal surface little firm at the proximal parts and brittle at the margins, the lateral margin is crenate to crenulate with corroded but cicatrized appearance and the fastening to substrate is by haptera, not rhizines.

Parmotrema excentricum Marcelli & Ciecoski differs by the presence of praesorediosic acid, by the thallus lobed and smaller (8,0 cm), the lobes with the transversal cut concave to slightly convex with ascending and revolute borders, the underside rarely rhizinated and irregularly fissured with not ramified and not cicatrized crevices.

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Figure legends:

FIG. 1. *Parmotrema barbosae* (holotype, *F. Ciecoski 465*, CNMTf 486). Scale bar = 10 mm.

FIG. 2. *Parmotrema carpanedoae* (holotype, *Carpanedo B*, CNMTf 487). Scale bar = 10 mm.

FIG. 3. *Parmotrema cotriguassuanum* (holotype, *F. Ciecoski 537*, CNMTf 488). Scale bar = 10 mm.

FIG. 4. *Parmotrema cristalinense* (holotype, *F. Ciecoski 954*, CNMTf 489). Scale bar = 10 mm.

FIG. 5. *Parmotrema danielii* (holotype, *F. Ciecoski 670*, CNMTf 490). Scale bar = 10 mm.

FIG. 6. *Parmotrema excentricum* (holotype, *F. Ciecoski 593*, CNMTf 491). Scale bar = 10 mm.

FIG. 7. *Parmotrema myrianae* (holotype, *F. Ciecoski 545*, CNMTf 492). Scale bar = 10 mm.

FIG. 8. *Parmotrema sanctinicolaense* (holotype, *F. Ciecoski 431*, CNMTf 493). Scale bar = 10 mm.

FIG. 9. *Parmotrema sofientinii* (holotype (left) and isotype (right), *F. Ciecoski 588*, CNMTf 494). Scale bar = 10 mm.

CAPÍTULO IV.

Some new species of *Parmotrema* (*Parmeliaceae*) from Brazilian Amazon rainforest with diverse medullary chemistry

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O presente manuscrito seguirá as padronizações adotadas pelo periódico *Mycobiota*, ao qual o presente trabalho será submetido (Anexo D).

Some new species of *Parmotrema* (*Parmeliaceae*) from Brazilian Amazon rainforest with diverse medullary chemistry

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Abstract: Eight new species of *Parmotrema* (*P. modestum*, *P. helicoideum*, *P. erectum*, *P. xinguense*, *P. halei*, *P. josei*, *P. meguroae*, *P. sinapisium*) and a new record for the Mato Grosso state (*P. sulphuratum*) which produces medullary alectoronic acid, norstictic acid, gyrophoric acid, α-cholatolic acid and vulpinic acid are illustrated, described and commented using the latest version of the gel descriptive protocol.

Key words: axillary folds, biodiversity, Cristalino, Juruena, lichen systematics, satin, taxonomy, Xingu

Introduction

The Amazon holds 20% of the planet's existing biodiversity (Magalhães et al. 2012) and there is certainly an immense amount of species still unknown to science (Menin, 2010). The strong threats to the biome due to the dynamism of activities linked to the exploitation of its natural resources - the increasing deforestation of forests, for example - means that information on important biological groups is neglected (Garrido-Filha, 2002; Irigaray et al. 2013) or lost.

The study of the diversity of lichenized fungi in the Amazon or of a specific taxon guarantees the registration of many species and genera not yet referred to the biome or to science, as is the case in this work.

The family *Parmeliaceae* is composed of lichenized fungi with foliose thalli and is currently known as the largest lichen family with 2,765 species distributed in 77 genera (Lücking et al. 2017a, b) of which 26 genera and 509 species occur in Brazil (Aptroot, pers. com. 2021).

Among the genera of this family, *Parmotrema* stands out as one of the most studied foliose groups in Brazil (Benatti & Marcelli 2008, 2009a, b, 2010, 2011; Benatti et al. 2008, 2010, 2013; Hale 1965, 1974; Honda et al. 2016; Santos et al. 2021; Spielmann & Marcelli 2009, 2020) and is one of the best known in the Neotropics (Bungartz & Spielmann 2019).

Honda & Vilegas (1998) highlighted the importance of chemical compounds in the taxonomy of lichens since some of the secondary metabolites produced are largely exclusive for a particular group. Benatti (2013) highlighted that in Brazil, the genus *Parmotrema* has presented relevant and peculiar taxonomic aspects, ranging from varied morphology to diversified medullary chemistry.

The *Parmotrema* species in this work were collected in the extreme south of the Amazon and are distinguished by the diversity of chemical compounds (allectoronic acid, norstictic acid, gyrophoric acid, α-collatolic acid, vulpinic acid, among others) identified from staining tests, chromatography and microcrystallization. The secondary substances produced by lichens suggest that a taxonomic investigation will produce significant results for bioprospecting and the survey of lichenized mycota can contribute to the determination of new and specific public policies aimed at the preservation and conservation of the Amazon.

Materials and methods

Field expeditions were carried out from May/2020 to March/2021 where samples of lichenized fungi were collected in three areas of the Amazon Forest located in the north of the Mato Grosso state.

The Cristalino State Park is, conservation unit located between the municipalities of Novo Mundo and Alta Floresta (9°28'17.45"S, 55°49'22.20"W) and characterized by a hot and humid climate, with mean annual temperatures above 24°C and mean annual rainfall above 2400 mm (Sasaki et al. 2008). The Xingu State Park is also a conservation unit located in the municipality of Santa Cruz do Xingu (9°53'47.15"S, 52°30'36.37"W) and has well-defined rainy and dry seasons (IBGE 2012) with average precipitation ranging from 2,000 to 2,500 mm and temperature between 32.0°C and 21.0°C. The São Nicolau Farm is located in the municipality of Cotriguaçu (09°49'09.0"S, 58°15'31.1"W) on the left bank of the Juruena River. The climate and average temperature are similar to those of the Cristalino State Park. The rainfall reaches an annual average of 2,034 mm (Noronha et al. 2015).

The methodology adopted for collection and herborization was based on Brodo & al. (2016), Fidalgo; Bononi (1967, 1989) & Peixoto; Maia (2013), and adjustments were made when necessary.

Specimens were morphologically studied using standard stereoscopic and light microscopes. Anatomical sections, including those of apothecia and pycnidia, were hand made with razor blades. The chemical constituents were checked by spot tests with potassium hydroxide (K), sodium hypochlorite (C) para-phenylenediamine (P), and examined under UV light (360 nm). Microscopic measures were taken in water. Chemical constituents were identified by thin-layer chromatography (TLC) using solvents B, C and G (Huneck & Yoshimura 1996, Orange et al. 2010, White & James 1985), and comparison with authentic samples.

Descriptions were made using the latest version of the protocol for the study of *Parmeliaceae* developed by the Lichenological Studies Group (GEL) of the Instituto de Botânica, São Paulo State, Brazil.

Taxonomy

Parmotrema erectum Ciecoski & Marcelli, **sp. nov.** Fig. 1

MycoBank, MB 842840

Diagnosis: *Parmotrema erectum* is a ciliate, coriaceous, subopaque, emaculate species whose lobes grow forming stratified layers separated by the ascending margins, whose elevated apices fuse to the underside of the superposing ones, forming a high multilayered rigid structure. The lateral margins of the lobes are strongly erect, the proximal surface is firm and mostly continuous (rarely cracked), smooth to slightly undulate, with short-lacinulate margins, apothecia sub-bullate and petaloid occasionally perforated upon ageing, amphithecia hypermaculated, hymenia till 100–125 µm high, ascospores elliptical, 15.0–20.0 × 7.5–10.0 µm with epispore till 2.5 µm thick, conidia sublageniform 9.0–12.0 × ca. 1.5 µm, medullary reactions K-, C-, KC+ orange, P-, UV+ ice-blue, and contain medullary alectoronic acid and α-collatolic acid.

THALLUS corticicolous; gray, loose adnate to ascending, subopaque, satin clear at 30×; lobed; integer; coriaceous; till 14 cm broad; epruinose; not maculate. **LOBES** short, irregular ramified; axils varied, frequently acute and auricular, irregular to torn; few erect to inclined axillary folds 1.0–1.5 mm high × 1/4 of the lobe width long; 5.0–10.0 mm wide at branching base, the major width 5.0–15.0 mm; variedly disposed; several growth to form stratified heaped-superposed layers, that many times are separated by the ascending margins, whose elevated apices of the subjacent lobes touch and fuse anatomically to the underside of the superposing ones, forming a high multilayered rigid structure, the borders along the central axis commonly become elevate e remain erect; this lobes organization makes the thallus a rigid structure several centimeters high; **longitudinal axis** undulate to ascending; **transversal cut** concave in the center with erect margins; **proximal surface** firm, rarely cracked, smooth to slightly undulate; **distal surface** firm, continuous and from smooth to crumpled; **lateral margin** smooth, crenate to crenulate; sinuous and intensely undulate, occasionally the undulations may become strongly involute, folding in direction to the underside till the two lateral margins meet one another and fuse to form a tube; closed, frequently the apical margin (truly apical) is studdled with linearly disposed pycnidia; **black line** absent or subtle, clear-cut to attenuate, till 0.1 mm thick; **apical zone** ascending and slightly involute; apex rounded to irregularly cut, ascending to revolute. **CILIA** few, black, subopaque, satin clear at 30×; pigment absent; straight in the base and curved in the apex or curved to sinuous; pointed; 0.60–2.00 mm long × 0.07–0.10 mm thick; ascending; not ramified; common in the axils and apices of the lobes. **Laciniae** and

secondary lobes absent. **Lobules** absent. **Lacinules** common in the older parts of the lobes, marginal, small, concolored; not ramified; 0.7–1.0 mm long × 0.3–0.5 mm wide, lamina plane to sinuous; straight to undulate; coplanar to the lobe to little revolute; apex rounded; black line subtle to absent, 0.05 mm thick; underside concolored to the lobe; commonly pycnidiate in the apical margins. **PUSTULES** absent. **ISIDIA** absent. **SORALS** absent. **SCHIZIDIA** concolored; irregularly distributed, occasionally can detach and adhere to the proximal surface; till 0.5 mm diam.; from little firm to fallen; not ornamented; originated from the submarginal cracks of some revolute lobes. **MEDULLA** white; texture normal (cottony). **UNDERSIDE** light brown to ivory and frequently black in the marginal zone, proximal part black. **Marginal zone** subopaque in the light brown and ivory parts and opaque in the black part; satin clear at 40× in the opaque part; till 4.0 mm wide; from attenuated in the light brown part to clear-cut in the ivory part; in the part black there is not differentiation in relation to the proximal part; smooth to slightly crumpled; epapillate; erhizinate to rhizinate in one small portion in the transition zone; not fissured. **Proximal part** opaque to subopaque; satin clear at 30× in the subopaque part; continuous; fissures rare, reticulate to irregular, cicatrized and with elevated borders; crumpled to strongly rugose and venate; presence of whitish to pale yellow corticate stains that are depressed in relation to the under cortex. **RHIZINES** absent in the marginal zone, otherwise rare and in regionalized parts; trimorphic, commonly **simple**, extremely rare those **ramified** (only one found) with 2-3-branched from 0.7 mm of the length, and **forked** (few exemplars) dichotomous since 0.5 mm of the length; black; pigment absent; opaque to sublustrous; satin clear at 20×; not interlaced; straight; erect to inclined; isolated; the simple are cylindrical and the ramified and forked are planiform; monometric, 0.40–1.50(–2.00) mm long × 0.10 mm wide; few and regionalized; a few growing on the apices of the folds and acting more directly in the thallus fixation. **APOTHECIA** young and old present; the young are bullate, sulcate, 3.0 × 3.3 mm diam.; the old are sub-bullate, petaloid, discs irregular in shape 18.0–20.0 × 8.0–10.0 mm diam.; submarginal; discs brown, the older irregularly fissured, epruinose, entire in the young and cleft in the old, 3–6 clefts till 1/3 of the radius; the young open, involute with till 5 folds, the old lobed to folded; imperforated in the young to occasionally perforated in the old; perforation slit-shaped to oval, smooth to irregular; margin thin, till 0.2 mm thick, smooth to irregularly cut, naked; amphithecia smooth to crumpled in the younger to strongly venate and rugose in the older, hypermaculated, not ornamented; K+ yellow; stipe eccentrical, sub-bullate, 3.0–5.0 mm high × 2.0–4.0 mm wide, smooth to longitudinally pleated, effigurate macules, not ornamented, K+ yellow; hymenia till 100–125 µm high **ASCOSPORES** simple, hyaline, elliptical, 15.0–20.0 × 7.5–10.0 µm, epispore till 2.5 µm thick; 8/ascus. **PYCNIDIA** black, laminal, immerse. **CONIDIA** sublageniform, straight, 9.0–12.0 × ca. 1.5 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C-, KC+ orange, P-, UV+ ice-blue.

Substances of taxonomic importance: atranorin, alectoronic acid, and α-collatolic acid.

Holotype: BRAZIL, Mato Grosso State, municipality of Novo Mundo, Cristalino II State Park, Site 24: 9°35'11.86"S, 55°28'1.52"W, elevation 320 m, Dense Ombrophilous Forest with canopy, on fallen tree branch, *leg. F. Ciecoski 927*, 09–III–2021. (CNMTf 503)

Etymology*:* the epithet *erectum* (from the Latin *erectus* = standing up) makes reference to the strongly elevated (erect) borders of the lobes.

Comments: *Parmotrema erectum* is discern by the lobed, ciliate, coriaceous, subopaque, and several centimeters thick thallus with superposed lobes whose margins are strongly erect and growth forming stratified heaped-superposed layers, that many times are separated by the ascending margins, whose elevated apices of the subjacent lobes touch and fuse anatomically to the underside of the superposing ones, forming a high multilayered rigid structure, the axils more frequently oval, the proximal surface firm and rarely cracked, smooth to slightly undulate, with lacinulated margins, by the underside with rare rhizines, light brown to ivory and black in the marginal zone and black in the proximal part, the presence of whitish to pale yellow depressed stains, by the sub-bullate and petaloid apothecia occasionally perforated upon ageing with hypermaculated amphithecia, by the hymenia till 100–125 µm high, the ascospores elliptical 17.5–20.0 × 12.5–10.0 µm with the epispore till 2.5 µm thick, the sublageniform conidia 12.0–9.0 × ca. 1.5 µm, the medullary reactions K-, C-, KC+ orange, P-, UV+ ice-blue, and by containing alectoronic acid and α-collatolic acid in the medulla.

Among those species with eciliate apothecia, *P*. *erectum* is chemical and morphologically near to *P*. *argentinum* (Kremp.) Hale, *P*. *maclayanum* (Müll. Arg.) Hale, *P*. *pseudobreviciliatum* Adler, Elix & Hale, *P*. *vainioi* (A.L. Sm.) Haleand, *P*. *helicoideum* Marcelli & Ciecoski (described here), *Parmotrema subrugatum* (Kremp.) Hale, *Parmotrema melanothrix* (Mont.) Hale, *Parmotrema catarinae* Hale.

Parmotrema argentinum (Kremp.) Hale differs from *P*. *erectum* by the thallus stained with simple to dichotomous branching lacinia, by the eciliate apothecia, by the hymenia 50 to 70 µm tall, by the smaller size of the ascospores of 11–22 × 6–12 µm and bacilliform conidia 5–7 µm long (Hale 1965, 1974; Donha 2005; Sipman 2005).

However, *P*. *maclayanum* (Müll. Arg.) differs from *P*. *erectum* by the thallus cracked into the center, the underside with an exclusively dark brown marginal zone, by the rhizines sometimes present near the margins, by the well-lit and dry altitude habitat with 900 to 2200 m of elevation below the Capricorn tropical line [subtropical climate] (Hale 1974; Krog & Swinscow 1981), smaller lobes 10–15 mm wide, entire margins becoming short-digitate lobulate into the center, perforated apothecia with hymenia 60–70 µm high, ascospores 12–15 × 6–10 µm, and epispore 1.0–1.5 µm, and the medullary reaction KC+ orange. Furthermore, based on the isotype (g) photography of *P*. *maclayanum* (Hale 1965: Plate 7, figure 23) it is possible to verify that *P*. *maclayanum* has abundant rhizines and open denticulate discs.

Parmotrema pseudobreviciliatum differs from *P*. *erectum* by the saxicolous habit, the conidia filiform 20–23 µm, ascospores 10–14 × 13–18 µm, the apothecia cupuliform with imperforate discs that have isidioid lobules in the margins and by having two additional substances beyond the alectoronic acid and acid α-collatolic (Adler 1989).

Parmotrema vainioi differs of *P*. *erectum* by the thallus maculate, the scarcity or absence of lacinules, the medulla with aleatory stains of a K+ dark red pigment, the apothecia sometimes ciliate, the bigger ascospores 16.0–25.0 × 10–15 with epispore 1.0–1.5 µm thick, and by the filiform conidia 5.0–7.5 (rarely –9.0) × ca. 1.0 µm (Hale 1974; Marcelli & Benatti 2011).

Parmotrema helicoideum differs from *P*. *erectum* by the spiral developed and disposed lobes, by the rhizines placed in the internal part of the lobes' folds, by the lower hymenia 75–100 µm that produces slightly bigger ascospores 20.0–17.5 × 12.5–10.0 µm, the much smoother amphithecia, the medullary reaction KC+ rose, and by containing only alectoronic acid in the medulla.

Parmotrema subrugatum (Kremp.) Hale differs of *P*. *erectum* by the thallus maculate, the apothecia dentate-laciniate and ciliate with higher hymenia 100–140 µm, ascospores bigger 26–34 × 12–18 µm, medulla KC+ red (Hale 1965), the smaller thallus till 8.0 cm, submembranaceous to subcoriaceous, maculate and sometimes presenting an orangish K+ red pigment in the medulla (Marcelli & Benatti 2011).

Parmotrema melanothrix (Mont.) Hale differs from *P*. *erectum* by the abundant very long cilia, the medulla KC- containing acid protolichesterinic, the apothecia dentate-laciniate and ciliate, the higher hymenia 100–140 µm, the bigger ascospores 20–26 × 10–16 µm, and by the all-negative medullary reactions (Hale 1965).

Parmotrema catarinae Hale differs by the C+ red medulla containing gyrophoric acid, and the apothecia ciliate with bigger ascospores 24–28 × 14–16 µm with epispore till 2 µm thick (Hale 1986).

Fig. 1. *Parmotrema erectum* (holotype, *F*. *Ciecoski 927*, CNMTf 503). Scale bar = 10 mm.

Parmotrema halei Marcelli & Ciecoski, **sp. nov.** Fig. 2

MycoBank, MB 842841

Diagnosis: *Parmotrema halei* is a velvet-opaque plane subcoriaceous eciliate lobed species with mostly involuted apices and lateral margins, abundant axillary folds, upper cortex reticulate cracked with rare schizidia, simple eciliate concolored isidia sometimes with orangish apices, pigment red layer in the medulla just above the under cortex, hemi-sulcate to petaloid imperforate and isidiate young apothecia, and norstictic acid in the medulla.

THALLUS corticicolous; greenish-gray, plane-adnate, with disperse reddish stains; velvet-opaque; satin visible only at 40×; lobate; entire; subcoriaceous; 6.0 cm broad, epruinose, emaculate. **LOBES** short, irregular; axils principally acute to torn, sometimes oval, difficult to visualize; **axillary folds** abundant, making the thallus a rigid plate, low, mostly inclined, a few erect 1.5–3.0 mm high × 1/2 of the lobe width long; 3.0–9.0 mm wide at branching base, the major width 5.0–10.0 mm; contiguous to laterally superposed, commonly straddled and rare counterposed; mostly loose adnate; **longitudinal axis** plane to undulate; **transversal cut** plane-concave to slightly undulate, rarely convex; laterals margins descending to very involute; **proximal surface** firm, continuous to reticulate cracked at to convex to portion of the lobes, smooth to subfoveolate and scrobiculate, **lateral margins** smooth to irregularly cracked, sinuous to undulate, closed, with few schizidia irregularly distributed; black line absent to subtle and attenuated, till 0.1 mm thick, not complementary; **apical zone** prostrate to strongly involute; **apex** rounded to rarely truncate, prostrate to involute. **Secondary lobes** and **laciniae** absent. **Lobules** and **lacinules** absent. **CILIA** absent. **PUSTULES** and **SORALS** absent. **ISIDIA** frequent, true, concolored, apex concolored to slightly orangish, sublustrous, erect to slightly inclined, some decapitate; laminal to submarginal; isolated to grouped by the basis; firm to caducous; rigid; those cylindric straight to undulate, and barrel-shaped; entire; curved to sinuous; apices pointed to rounded; basis constricted; not ramified; eciliate; 0.20–0.30 mm high × 0.05–0.10 mm wide. **MEDULLA** white; firm; red pigment irregularly distributed but also forming a layer just above the under cortex; K+ yellow → red. **UNDERSIDE** dark brown in the marginal zone attenuated to black in the proximal part, orangish pigment in several points but more concentrate in the proximal part. **Marginal zone** subopaque, satin clear at 30×; till 4.0 mm wide; limit attenuated; crumpled to rugose, epapillate; erhizinate: not fissured. **Proximal part** black, subopaque; satin visible at 30×; few fissures, some reticulate, in the convex regions, not ramified, not cicatrized and without elevated borders. **RHIZINES** black in the proximal part to brown in the distal part, few, distribution irregular, pigment absent; opaque; satin visible at 40×, simple to forked, not interlaced; sinuous to curly; inclined to recurved to prostrated without orientation; isolated to aggregated; cylindrical; till 2.00 mm long × 0.05 mm thick **APOTHECIA** young, some with stains of orangish pigment in the margin; bullate; hemi-sulcate to slightly petaloid; adnate to subadnate; till 2.0 mm diam.; laminal to submarginal; discs light brown, epruinose, entire, folded to involute; imperforate; margin till 1.5 mm thick, smooth, entire to cleft and cicatrized, naked to isidiate, the isidia irregularly distributed; amphithecia smooth in the young to foveolate in the bigger, emaculate, the bigger isidiate, K+ yellow; stipe central, 0.6–1.0 mm high × 0.1–0.2 mm wide, smooth to crumpled, emaculate, the more developed isidiate or with papillae that become simple concolored isidia, K+ yellow; hymenia till 80 µm high **ASCOSPORES** absent. **PYCNIDIA** absent.

Color tests: upper cortex K+ yellow, UV-; medulla K+ yellow, C-, KC-, P+ yellow, UV-; the pigment in parts of the medulla, upper cortex and above the under cortex K+ yellow → red.

Substances of taxonomic importance: atranorin and norstictic acid.

Holotype: BRAZIL, Mato Grosso State, municipality of Alta Floresta; Cristalino I State Park, Site 28: 9°28'17.45"S, 55°49'22.20"W, elevation 337 m, Dense Submontane Ombrophilous Forest with Emergent Canopy, on tree trunk in the forest, *leg. F. Ciecoski 976*, 29-IX-2020 (CNMTf 504).

Etymology: The epithet is in honor to the great Mason Ellsworth Hale Jr that understood *Parmeliaceae* as almost nobody else, contributed a lot with lichenology and lichenologists, and to whom Marcelli is eternally indebted.

Comments: *Parmotrema halei* is distinguish by the velvet-opaque, plane, subcoriaceous thallus, whose lobes apices and lateral margins are mostly involuted, the axils acute to torn, folds axillary abundant, the upper cortex reticulate-cracked with rare schizidia, the isidia concolored sometimes with orange apices, the medulla white with a red pigment red forming a layer just above the under cortex, the underside dark brown in the marginal zone attenuating to black in the proximal part, sparsely papillate and rhizinate, the young apothecia hemi-sulcate to slightly petaloid, imperforate and isidiate, and by the white medulla containing norstictic acid.

Parmotrema josei Marcelli & Ciecoski (see ahead), also from Brazilian Amazon, is close to *P. halei* in the plane adnate thallus with apices and lateral margins of the lobes mostly involute and by the laminal isidia. Differs in the subpergaminaceous hypermaculated thallus, the absence of pustules, the ramified higher isidia 0.50–0.80(–1.20) mm high, the proximal surface continuous, the distal surface crackled into the center, the medullary reactions K-, C+ red, KC+ red, and P-, because the presence of gyrophoric acid.

Parmotrema conformatum (Vain.) Hale is like *P. halei* in the densely isidiate thallus, isidiate amphithecia, and imperforate discs. Differs by the thallus ciliate with continuous upper cortex the reticulate cracks appearing only upon ageing, by the isidia simple to ramified, the medullary reactions P+ red and K+ brown, by the medulla containing protocetraric acid and fumarprotocetraric acid, and the upper cortex with usnic acid ((Hale 1974; Hale 1965).

Parmotrema peralbidum (Hale) Hale presents some morphological similarities com *P. halei* as the thallus with irregularly ramified lobes, not maculate, eciliated, the laminal to submarginal, simple, and slender isidia, and by the rhizines simple and rarely forked (Benatti 2014), by the white medulla, the imperforate discs and isidiate amphithecia (Hale 1965). Differs from *P. halei* in the thallus whitish and slightly cracked upon ageing (Hale 1965), the lobes with smooth the subcrenate margins and without black line, the axils oval, the surface continuous, smooth to sub-rugose, the underside lustrous, smooth and sub-rugose, by the medullary reactions K- or + weak yellowish, KC+ rosed-reddish, and P+ orangish, and by containing protocetraric acid in the medulla. (Benatti 2014).

Parmotrema praeisidiosum Fleig also has the thallus isidiate and white medulla but differs of *P. halei* by the membranaceous, light gray saxicolous thallus, by the medullary reactions all negative and by containing fatty acids (Fleig 1999).

Parmotrema tinctorum (Despr. Ex Nyl.) Hale is somewhat like *P. halei* by the thallus eciliated, densely isidiate, the isidiate amphithecia and imperforate discs. Differs by the thallus whitish gray, the medullary reactions K-, C+ blood red, KC + red, and P-, and by containing lecanoric acid (Hale 1965, 1974).

Fig. 2. *Parmotrema halei* (holotype, *F. Ciecoski 976*, CNMTf 504). Scale bar = 10 mm.

Parmotrema helicoideum Marcelli & Ciecoski, **sp. nov.** Fig. 3

MycoBank, MB 842842

Diagnosis: *Parmotrema helicoideum* is a lobed, ciliate, coriaceous, subopaque, emaculate species with mostly smooth to little crumpled upper surface, laterally superposed lobes that enroll together into spirals that make the thallus tight and some centimeters high, the proximal surface firm and mostly continuous (rarely cracked), smooth to slightly undulate, with short-lacinulate margins, apothecia sub-bullate and petaloid occasionally perforated upon ageing, amphithecia hypermaculated, hymenia till 75–100 µm high, ascospores elliptical, 17.5–20.0 × 10.0–12.5 µm with epispore till 2.5 µm thick, conidia sublageniform 12.0–10.5 × ca. 1.5 µm, medullary reactions K weak yellow, C+ weak yellow, KC+ rose, P**-**, UV+ ice-blue, and contain medullary alectoronic acid and α-collatolic acid.

THALLUS corticicolous; greenish-gray, loose adnate to ascending, subopaque, satin clear at 30×; lobed; integer; coriaceous; till 17 cm broad; epruinose; not maculate. **LOBES** short, irregular ramified; axils varied, frequently oval, irregular to torn; few erect to inclined axillary folds 1.0–1.5 mm high × 1/4 of the lobe width long; 2.0–5.0 mm wide at branching base, the major width 4.0–15.0 mm; variedly disposed, those not distal and with counterposed and/or laterally superposed margins grow erect/suberect together and become till 4-turns longitudinal-spirally enrolled into approximately conical arrangements; part of the most distal lobes (and in some parts of the proximal surface) turns up, becoming strongly revolute till 2 cm high, sometimes even upside-down and exposing the underside around in about 1/3 of the thallus circumference; this lobes organization makes the thallus to rigid structure several centimeters high; **longitudinal axis** undulate to ascending; **transversal cut** concave to convex; **proximal surface** firm, rarely cracked, smooth to slightly undulate; **distal surface** firm, continuous and from smooth to crumpled; **lateral margin** smooth, crenate to crenulate; sinuous and intensely undulate, occasionally the undulations may become strongly involute, folding in direction to the underside till the two lateral margins meet one another and fuse to form a tube; closed, frequently the apical margin (truly apical) is studdled with linearly disposed pycnidia; black line absent or subtle, clear-cut to attenuate, till 0.1 mm thick; **apical zone** ascending and slightly involute; apex rounded to irregularly cut, ascending to revolute. **CILIA** few, black, subopaque, satin clear at 30×; pigment absent; straight in the base and curved in the apex or curved to sinuous; pointed; 0.60–2.00 mm long × 0.07–0.10 mm thick; ascending; not ramified; common in the axils and apices of the lobes. **Laciniae** and **secondary lobes** absent. **Lobules** absent. **Lacinules** common, marginal, small, concolored and irregularly distributed all over the thallus; not ramified; 0.7–1.0 mm long × 0.3–0.5 mm wide, lamina plane to sinuous; straight to undulate; coplanar to the lobe to little revolute; apex rounded; black line subtle to absent, 0.05 mm thick; underside concolored to the lobe; commonly pycnidiate in the apical margins. **PUSTULES** absent. **ISIDIA** absent. **SORALS** absent. **SCHIZIDIA** concolored; irregularly distributed, occasionally can detach and adhere to the proximal surface; till 0.5 mm diam.; from little firm to fallen; not ornamented; originated from the submarginal cracks of some revolute lobes. **MEDULLA** white; texture normal (cottony). **UNDERSIDE** light brown to ivory and frequently black in the marginal zone, proximal part black. **Marginal zone** subopaque in the light brown and ivory parts and opaque in the black part; satin clear at 40× in the opaque part; till 4.0 mm wide; from attenuated in the light brown part to clear-cut in the ivory part; in the part black there is not differentiation in relation to the proximal part; smooth to slightly crumpled; epapillate; erhizinate to rhizinate in one small portion in the transition zone; not fissured. **Proximal part** opaque to subopaque; satin clear at 30× in the subopaque part; continuous; fissures rare, reticulate to irregular, cicatrized and with elevated borders; crumpled to strongly rugose and venate; presence of whitish to pale yellow corticate stains that are depressed in relation to the under cortex. **RHIZINES** absent in the marginal zone, otherwise rare and in regionalized parts; trimorphic, commonly **simple**, extremely rare the **ramified** (only one found) 2-3-branched from 0.7 mm of the length, and **forked** (just a few) dichotomous since 0.5 mm of the length; black; pigment absent; opaque to sublustrous; satin clear at 20×; not interlaced; straight; erect to inclined; isolated; the simple are cylindrical and the ramified and forked are planiform; monometric, 0.40–1.50(–2.00) mm long × 0.10 mm wide; few and regionalized; part rare and irregularly distributed in the vertical walls of the convex folds of manner that the rhizines do not touch the substrate, a few growing on the apices of the folds and acting more directly in the thallus fixation. **APOTHECIA** young and old present; the young are bullate, sulcate, 3.0 × 3.3 mm diam.; the old are sub-bullate, petaloid, discs irregular in shape 7.0–13.0 × 4.0–10.0 mm diam.; submarginal; discs brown, the older irregularly fissured, epruinose, entire in the young and cleft in the old, 3–6 clefts till 1/3 of the radius; the young open, involute with till 5 folds, the old lobed to folded; imperforate in the young to occasionally perforate in the old; perforation slit-shaped to oval, smooth to irregular; margin thin, till 0.2 mm thick, smooth to irregularly cut, naked; amphithecia smooth in the young and scrobiculate to crumpled in the old, hypermaculated, not ornamented; K+ yellow; stipe eccentrical, sub-bullate, 3.0–5.0 mm high × 2.0–4.0 mm wide, smooth to longitudinally pleated, effigurate macules, not ornamented, K+ yellow; hymenia till 75–100 µm high **ASCOSPORES** simple, hyaline, elliptical, 17.5–20.0 × 10.0–12.5 µm, epispore till 2.5 µm thick; 8/ascus. **PYCNIDIA** black, laminal, immerse. **CONIDIA** sublageniform, straight, 10.5–12.0 × ca. 1.5 µm.

Color tests: upper cortex K+ yellow, UV**-**; medulla K**+** weak yellow, C+ weak yellow, KC+ rose, P**-**, UV+ ice-blue.

Substances of taxonomic importance: atranorin, alectoronic acid.

Holotype: BRAZIL, Mato Grosso State, municipality of Novo Mundo, Cristalino II State Park, Site 24: 9°35'11.86"S, 55°28'1.52"W, elevation 320 m, Dense Ombrophilous Forest with canopy, on fallen tree branch, *leg. F. Ciecoski 926*, 09–III–2021. (CNMTf 505).
Etymology*:* The epithet *helicoideum* (of the grego *helix*= spiral) makes reference to the typical spiral disposition of the enrolled lobes.

Comments: *Parmotrema helicoideum* is identified by the lobed, ciliate, coriaceous, subopaque, and several centimeters high thallus, the laterally superposed and counterposed lobes disposed in spiral, part of the peripherical lobes strongly revolute and turning upside-down, the axils more frequently oval, the proximal surface firm and rarely cracked, smooth to slightly undulate, with lacinulated margins, by the underside with rare rhizines, light brown to ivory and black in the marginal zone and black in the proximal part, the presence of whitish to pale yellow depressed stains, by the sub-bullate and petaloid apothecia occasionally perforated upon ageing with hypermaculated amphithecia, by the hymenia till 75–100 µm high, the ascospores elliptical 17.5–20.0 × 10.0–12.5 µm with the epispore till 2.5 µm thick, the sublageniform conidia 12.0–10.5 × ca. 1.5 µm, the medullary reactions K+ weak yellow, C+ weak yellow, KC+ rose, P-, UV+ ice-blue, and by containing alectoronic acid in the medulla.

Among those species with eciliate apothecia, *P. helicoideum* is chemical and morphologically near to *P. maclayanum* (Müll. Arg.) Hale (Hale 1974), *P. pseudobreviciliatum* Adler, Elix & Hale (Adler 1989), *P. vainioi* (A.L. Sm.) Hale (Hale 1974) and *P. erectum* Ciecoski & Marcelli (described here).

Parmotrema maclayanum (Müll. Arg.) Hale differs from *P. helicoideum* by the thallus cracked into the center, the underside with an exclusively dark brown marginal zone, by the rhizines sometimes present near the margins, by the well-lit and dry altitude habitat with 900 to 2200 m of elevation below the Capricorn tropical line [subtropical climate] (Hale 1974; Krog & Swinscow 1981), smaller lobes 10–15 mm wide, entire margins becoming short-digitate lobulate in to the center, perforated apothecia with hymenia 60–70 µm high, ascospores 12–15 × 6–10 µm, and epispore 1.0–1.5 µm, and the medullary reaction KC+ orange. Furthermore, based on the isotype (g) photography of *P.*

maclayanum (Hale 1965: Plate 7, figure 23) it is possible to verify that *P*. *maclayanum* has abundant rhizines and open denticulate discs.

Parmotrema pseudobreviciliatum Adler, Elix & Hale differs of *P*. *helicoideum* by the saxicolous habit, the conidia filiform 20–23 µm, ascospores 10–14 × 13–18 µm, the apothecia cupuliform with imperforate discs with isidioid lobules in the margins and by having two additional substances beyond the alectoronic acid and acid α-collatolic (Adler 1989).

Parmotrema subrugatum (Kremp.) Hale differs of *P*. *helicoideum* by the thallus maculate, the apothecia dentate-laciniate and ciliate with higher hymenia 100–140 µm, ascospores bigger 26–34 × 12–18 µm, medulla KC+ red (Hale 1965), the smaller thallus till 8.0 cm, submembranaceous to subcoriaceous, maculate and sometimes presenting an orangish K+ red pigment in the medulla (Marcelli & Benatti 2011).

Parmotrema melanothrix (Mont.) Hale differs from *P*. *helicoideum* by the abundant very long cilia, the medulla KC- containing acid protolichesterinic, the apothecia dentate-laciniate and ciliate, the higher hymenia 100–140 µm, the bigger ascospores 20–26 × 10–16 µm, and by the all-negative medullary reactions (Hale 1965).

Parmotrema catarinae Hale differs by the C+ red medulla containing gyrophoric acid, and the apothecia ciliate with bigger ascospores 24–28 × 14–16 µm with epispore till 2 µm thick (Hale 1986).

P. *vainioi* differs from *P*. *helicoideum* by the thallus maculate, the scarcity or absence of lacinules, the medulla with aleatory stains of a K+ dark red pigment, the apothecia sometimes ciliate, the bigger ascospores 16.0–25.0 × 10–15 with epispore 1.0–1.5 µm thick, and by the filiform conidia 5.0–7.5 (rarely –9.0) × ca. 1.0 µm (Marcelli & Benatti 2011).

Parmotrema erectum Ciecoski & Marcelli differs from *P*. *helicoideum* in several morphological aspects as well in the medullary chemistry (see Comments under *P*. *erectum*).

Fig. 3. *Parmotrema helicoideum* (holotype, *F. Ciecoski 926*, CNMTf 505). Scale bar = 10 mm.

Parmotrema josei Marcelli & Ciecoski, **sp. nov.** Fig. 4

MycoBank, MB 842843

Diagnosis: *Parmotrema josei* is a lobed, adnate, subpergaminaceous, eciliate and hypermaculated species whose lobes are subdichotomous, laterally superposed and straddled, with involute apices and lateral margins, the proximal surface is crackled into the center, the lateral margins corroded, has concolored antleriform laminal isidia with constricted basis, underside fissured and becoming crackled, rhizinated, white medulla containing gyrophoric acid, and conidia filiform, straight, 12.50–17.50 × 1.25 µm.

THALLUS corticicolous; greenish-gray; adnate, velutinous; satin visible only at 50×; lobate; subpergaminaceous; 13 cm broad; hypermaculated. **LOBES** not auto incompatible; short-ramified, subdichotomous; axils irregular, oval to torn, difficult to observe; **axillary folds** abundant and making the thallus a rigid plate, the distal narrow, elevated and erect, the proximal elevated, and apically folded or densely covered by isidia, 1.0–2.0 mm high × 1/4 of the lobes width long; 2.0–4.0 mm wide at branching base, the major width 6.0–10.0

mm; laterally superposed to counterposed, commonly straddled; adnate; **longitudinal axis** distended in the distal part to strongly undulate/pleated into proximal region; **transversal cut** from plane in some distal parts to undulate or pleated in the proximal parts, the margins ascending to sometimes involute and then straddled on the ascending margin of the alongside lobes (straddled); **proximal surface** firm, continuous in the distal part and crackled into to center, smooth to slightly crumpled in the distal parts to rugulose in the proximal region; epruinose; **lateral margin** commonly irregular with a corroded appearance as chewed by por animals and not cicatrized, undulate, commonly incurved and straddled; closed; black line subtle and attenuate, till 0.1 mm thick; **apical zone** normally involute, sometimes plane or ascending; **apex** normally involute or descending, sometimes prostrate or ascending. **Lobes** and **laciniae secondary** absent. **Lobules** and **lacinules** absent. **CILIA** absent. **PUSTULES** frequent, very small, not confluent, irregularly distributed; laminal and submarginal in the proximal part, developing on the decapitate apices of isidioid structures 0.1 mm diam.; laminal in the distal zone and originated from oval apices of swellings that open into irregular shapes, 0,1–0,3 mm diam., pustular medulla K-. **SOREDIA** absent. **ISIDIA** concolored, rare with darkened brown to blackish apices; sublustrose; dense; erect; principally laminal on the apex of folds, axillary folds, and on the rugules, sometimes also marginal; not grouped; firm; brittle; cylindrical to irregular to submoniliform; surface integer; straight to principally irregular; commonly pointed, sometimes truncate (decapitate); base constricted; irregularly 3–4(–5) ramified, antleriform, some dichotomous; eciliate; 0.50–0.80(–1.20) mm high × 0.05–0.10 mm thick. M**EDULLA** white; pigment K+ absent; density normal (spongy cottony). **UNDERSIDE** brown in the distal part with an attenuated transition to black in the proximal part. **Marginal zone** sublustrose, satin badly visible at 10× and very evident at 20×, till 8 mm wide; limit attenuated; smooth to radial or arachnoid rugulose; not fissured. **Proximal part** black, subopaque; satin visible only at 30×; fissures frequent to abundant, subtle, mostly transversal to irregular or crackled, principally cicatrized; smooth to irregularly rugulose. **RHIZINES** black, rare in the distal part, abundant in the crests of folds in the proximal part; pigment absent; satin like the upper cortex; simple, straight, not grouped, cylindrical, monometric, till 1.00 mm long × 0.04 mm thick **APOTHECIA** absent. **PYCNIDIA** submarginal, black, immersed, ostioles black. **Conidia** filiform, straight, 12.50–17.50 × 1.25 µm.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C+ red, KC+ red, P-, UV-.

Substances of taxonomic importance: atranorin and gyrophoric acid.

Holotype: BRAZIL, Mato Grosso State, municipality of Cotriguaçu, São Nicolau Farm, Site, Site 14: 9°48'47.07"S, 58°18'12.7"W, elevation 256 m, Open and Dense Ombrophilous Forest, on tree trunk in the forest, *leg. F. Ciecoski 532*, 29-IX-2020. (CNMTf 506).

Etymology: To epithet is a homage to Ciecosk's father José de Souza Rego, her big encourager into the scientific way, a very simple man who had badly to first letters but too much knowledge on life and nature.

Comments: *Parmotrema josei* is characterized by the adnate, lobate, opaque, subpergamináceo, eciliated and hypermaculated thallus, subdichotomous laterally superposed straddled lobes, by the proximal surface crackled into the center, by the corroded margin, by to isidia concolored and laminal, with constricted basis and antleriform, by the underside fissured becoming crackled, rhizinate, medulla white containing acid gyrophoric and conidia filiform com 12.50–17.50 × 1.25 µm.

Parmotrema halei Marcelli & Ciecoski, also from Brazilian Amazon, is similar in the general appearance of the thallus but differs in several aspects (see comments under *P. halei*).

Parmotrema tinctorum (Despr. Ex Nyl.) Hale is similar in the opaque, eciliated and densely isidiate thallus, the white medulla and the chemical medullary reactions K-, C + blood red, KC+ red and P- (Hale 1965, 1974). Differs in the coriaceous, emaculate or with tenuous maculate thallus, the underside smooth to little rugose and by the smaller filiform conidia 8.0–12.0 × 1.0 µm (Gerlach & Eliasaro 2012) and in the presence of lecanoric acid in the medulla (Hale 1965).

Parmotrema conformatum (Vain.) Hale (Hale 1974) is somewhat similar only by the thallus densely isidiate. Differs of *P. josei* by the yellowish green (usnic acid) and eciliated thallus, the surface continuous or reticulate cracked upon the ageing, the medullary reactions P + red, K + brown, and C -, and by containing usnic acid, protocetraric acid and fumarprotocetraric acid in the medulla (Hale 1965).

Fig. 4. *Parmotrema josei* (holotype, *F. Ciecoski 532*, CNMTf 506). Scale bar = 10 mm.

Parmotrema meguroae Ciecoski & Marcelli, **sp. nov.** Fig. 5

MycoBank, MB 842844

Diagnosis: *Parmotrema meguroae* is a species with an opaque, lobed, subpergaminaceous, emaculate, UV+ ice blue thallus with dichotomous to anisotomous lobes, principally acute axils, few axillary folds, proximal surface smooth with few cracks, distal surface mostly smooth and sparsely lacinulate and revolute, with cilia in the axils; it is pustulate/sorediate with farinose soredia, fixed by rhizines simple, forked, and rhizinoid structures cylindrical, thickened, and gomose, with dilatate tips in an elephant paw shape, conidia bifusiform 13.5–15.0 × ca. 1.5 µm, medullary reactions K-, C+ yellow, KC+ orangish yellow, P-, UV+ ice-blue, and alectoronic acid in the medulla.

THALLUS corticicolous; greenish-gray; velvet-opaque (velutinous); lobed; subpergaminaceous; emaculate; satin badly visible at 45× in the distal margin and not visible at all in the proximal surface; till 4.0 cm broad; epruinose. **LOBES** short, dichotomous to anisotomous; axils acute to oval or auriculate; few axillary folds, erect to slightly inclined, 1.0–1.5 mm high × 1/4 of the lobe width long; not auto incompatible; 3.0–8.0 mm wide at branching base, the major width 8.0–15.0 mm; laterally superposed to contiguous and counterposed; loose adnate; black line absent to subtle, till 0.1 mm thick, not complementary; **longitudinal axis** distended to undulate, marginal zone ascending with commonly involute apices; **transversal cut** plane-concave with ascending borders, descending in the younger parts. **Proximal surface** firm; continuous to slightly reticulate; smooth and with few cracks in the convex parts of the lobes' folds. **Distal surface** firm; continuous; smooth to slightly crumpled. **Lateral margins** smooth to sparsely lacinulate; sinuous to ascending and revolute; closed and, when open, associated to pustules and sorals; **apical zone** ascending but with descending apices; apices principally rounded to lacinulate, ascending, prostrate in the younger parts. **CILIA** long, black; sublustrous, satin clear at 20×; without K+ pigment; sinuous; pointed; (0.50–)1.50–2.50(–3,80) mm long × 0.10–0.12 mm thick; erect to ascending and prostrate; mostly simple, few forked from (0.5–)1.5–2.0 mm of the basis; not interlaced; common in the axils of the lobes and rare in the apical margins, rare conical marginal "ciliary buds" in the lobes 0.05–0.10 mm long × ca. 0.05 mm wide, spaced 0.10–0.50 mm. **Laciniae** and **Secondary lobes** absent. **Lobules** absent. **Lacinules** few; concolored; in some lobes of the distal part; 0.70–2.00 mm long × 0.50–0.70 mm wide; not ramified; plane to sinuous; coplanar to involute; irregular apices, black line subtle to clear-cut 0.5 mm thick, frequently with cilia like those of the lobes; concolored to the underside; frequently pustulate and sorediate. **PUSTULES** few; very small, irregular; not confluent; in the apices of the lacinules; till 0.05 mm wide; erumpent; dismantling into in soredia; not caducous; without pigment, pustular medulla K+ greenish-yellow. **SORALS** few; originated from the pustules at the lacinules apices; labriform and verruciform; till 0.4 × 0.5 mm diam.; not coalescent; eciliate; surrounding cortex rarely cracked. **SOREDIA** common, caducous to persistent, not auto incompatible; farinose; ecorticated; heaped; K+ yellow. **ISIDIA** absent. **MEDULLA** white; firm. **UNDERSIDE** brown and black in the marginal zone and black in the proximal part. **Marginal zone** brown and black; subopaque; satin clear at 30×; ca. 3.0–7.0 mm wide in the brown part, in the part black there is not differentiation in relation to the proximal part; attenuated in the part brown; smooth to crumpled and slightly rugose; epapillate; sometimes rhizinate in the transition zone, rhizines concolored; not fissured. **Proximal part** black; sublustrous; satin clear at 20×; crumpled to rugose and strongly venate; not fissured. **RHIZINES** absent in the marginal zone and occasionally present in the transition zone; dimorphic, **simple**, rare with penicillate apices, common those cylindrical, thickened, with accentuated apical elephant paw-shaped dilatations at the tips; a few **forked** at 1.0 mm from the basis; straight to sinuous and curved; erect to recurved and prostrate in direction to the distal margin, some with a "licked aspect" and gomose, glued to the under cortex; common and distributed in sparse regions; concolored in the marginal zone and black in the proximal part; not pigmented; sublustrous; satin clear at 20×; not interlaced; cylindrical; dimetric; the thickened 0.80–1.00 mm long × ca. 0.15–0.20 mm thick, those simple and forked 0.60–2.50(–3.50) mm long × ca. 0.05–0.10 mm thick; few the isolated, more frequent in sparse groups distributed in the crests of folds in the underside; K+ strong yellow. **APOTHECIA** absent. **PYCNIDIA** marginal, immerse, ostiole black. **CONIDIA** bifusiform, straight, 13.5–15.0 × ca. 1.5 µm.

Color tests: upper cortex K-, UV+ ice-blue; medulla K-, C+ yellow, KC+ orangish yellow, P-, UV+ ice-blue.

Substances of taxonomic importance: atranorin, alectoronic acid.

Holotype: BRAZIL, Mato Grosso State, municipality of Alta Floresta; Cristalino I State Park, Site 28: 9°28'17.45"S, 55°49'22.20"W, elevation 337 m, Dense Submontane Ombrophilous Forest with Canopy, on tree trunk in the forest, *leg. F. Ciecoski 984 (1)*, 12–III–2021. (CNMTf 507).

Etymology: The epithet is a homage to Dr. Marico Meguro, a great missed plant ecologist and courageous woman that accepted advice Marcelli in a, to her, distant subject in an epoch when lichenology was an "occult" science in Brazil. Her strength, dedication, kindness, and humanity sense will not be forgotten.

Comments: *Parmotrema meguroae* is characterized by the thallus UV+ ice blue, subpergaminaceous, opaque, lobed, and emaculate, the lobes dichotomous to anisotomous with acute to oval or auriculate axils and few axillary folds, by the proximal surface smooth to little cracked in the convex folds of the lobes, the smooth to sparsely lacinulate and revolute margins with cilia restricted to the axils, very small apical pustules that originate farinose soredia, the underside with a brown and black in the marginal zone and black in the proximal part with rhizines that are simple, forked, and a rhizinoid fixation thickened and gomose structure that have a dilatated tip in an elephant paw shape, by the bifusiform conidia 13.5–15.0 × ca. 1.5 µm, the upper cortex the medullary reactions K-, C+ yellow, KC+ orangish yellow, P-, UV+ ice-blue, and by containing alectoronic acid alone in the medulla.

Parmotrema rampoddense (Nyl.) Hale differs from *P*. *meguroae* by stained, membranaceous to subcoriaceous thallus, rough surface, pigmented pith with reactions (C-, KC+ red, K+ purple) (Hale 1965, 1974). In addition, *P*. *rampoddense* has subgranular to granular soredia and bacilliform to filiform conidia 9–12 µm (Fleig 1997).

Parmotrema sorediiferum Hale differs from *P*. *meguroae* by the thallus saxicolous, bright and by containing acid α-collatolic in the medulla (Hale 1986).

Parmotrema arnoldii (Du Rietz) Hale differs by the bright and maculate broader thallus 8–20 cm, the dentate lobes, the submarginal sorals and smaller conidia 10.5–11.5 µm (Hale 1965, 1974).

Parmotrema mellissii (CW Dodge) Hale .is easily differentiated from *P*. *meguroae* by the presence of coralloid ramified and ciliate isidia (Hale 1965, 1986).

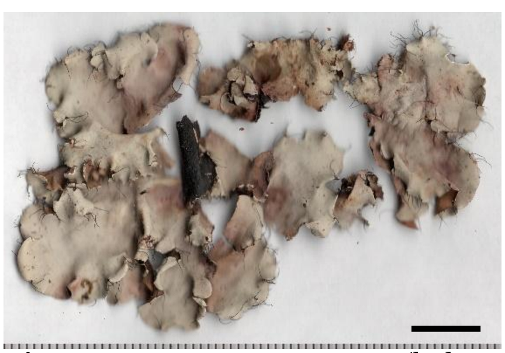

Fig. 5. *Parmotrema meguroae* (holotype, *F*. *Ciecoski 984*, CNMTf 507). Scale bar = 10 mm.

Parmotrema modestum Marcelli & Ciecoski, **sp. nov.** Fig. 6

MycoBank, MB 842845

Diagnosis: *Parmotrema modestum* é a small ca. 3 cm broad, ochraceous-green, opaque to subopaque, membranaceous species with anisotomous laterally superposed to contiguous and counterposed lobes, acute to oval and quadratics axils, axillary folds common, margins irregularly cut and crenate, the proximal surface very brittle, small digitiform, isidioid pustules sometimes ciliate, medulla intensely ocher, medullary reactions K+ magenta → purple, C+ orange, KC-, P+ orange, UV+ greenish-yellow, with a not identified pigment, and a series of unidentified substances above of the acid norstictic (TLC) in the medulla.

THALLUS corticicolous; small; ochraceous-green; opaque in the proximal surface and subopaque in the distal margin; lobed; membranaceous; very delicate; emaculate; not satin even at 45× in the opaque part and satin clear at 40× in the subopaque part; till 3.0 cm broad; epruinose; not auto incompatible. **LOBES** short, anisotomous; axils acute to oval and squared; **axillary folds** common, erect to inclined, 1.0–2.0 mm high × half of the lobe width long; not auto incompatible; 1.0–2.0 mm wide at branching base, the major width 3.0–3.5 mm; laterally superposed to contiguous, counterposed, and straddled; loose adnate; black line absent to attenuated, till 0.1 mm thick; **longitudinal axis** distended to undulate; **transversal cut** concave and convex, margins ascending. **Proximal surface** strongly brittle; reticulate to crackled and cracked; crumpled to rugose and scrobiculate. **Distal surface** brittle; slightly reticulate cracked; smooth to crumpled. **Lateral margin** smooth to irregularly cut and crenate; sinuous to undulated; closed and commonly pustulate; **apical zone** ascending to involute and revolute; apices irregularly cut, ascending and revolute. **CILIA** black; satin clear at 20×; without pigments; irregularly sinuous; cylindrical and pointed; 0.90–1.40 × 0.10–0.15 mm; erect to prostrate; simple; common; in the apical margins of the lobes and in the apices of the pustules. **Secondary laciniae** and **lobes** absent. **Lobules** rare; marginal; concolored; irregularly distributed in the distal margin; not ramified; 0.8–1.0 mm long × 0.3–0.5 mm wide; lamina sinuous; undulated; ascending; apex rounded; black line subtle, till 0.1 mm thick; ciliate; underside dark brown. **Lacinules** absent. **PUSTULES** very small**,** frequent, appearing as digitiform/isidioid projections that become apically erumpent; also, from laminal and submarginal swellings that open apically; commonly capitate; marginal to submarginal in the lobes. A few laminal from rugose wrinkles on the upper cortex; sometimes confluent and irregularly ramified; till 0.5 mm wide; frequently caducous; some ciliate; without pigment; pustular medulla K+ magenta → purple. **SORALS** absent. **ISIDIA** absent. **MEDULLA** strong ocher; loose. **UNDERSIDE** brown to black in the marginal zone and black in the proximal part. **Marginal zone** brown to black; sublustrous; satin clear at 20×; ca. 0.5–2.0 mm wide in the brown part, in the black part there is no differentiation in relation to the proximal part; attenuate in the brown part; crumpled; rarely papillate and slightly rugose; sometimes rhizinated in the transition zone; not fissured. **Proximal part** black; sublustrous; satin clear at 20×; crumpled to rugose; rarely fissured; crevices irregular, not ramified, 2.00–3.00 mm long × ca. 0.05–0.10 mm wide, cicatrized and with elevated borders. **RHIZINES** absent in the marginal zone and present in the transition zone; dimorphic, those **simple** sometimes with penicillate apices and **forked** at 0.5 mm high, cylindrical; common and distributed in sparse regions; black; not pigmented; subopaque; not gomose; satin clear at 30×; rarely interlaced; straight to sinuous; erect to inclined; monometric; 0.70–0.10 mm long × ca. 0.05–0.10 mm wide; isolated to grouped, irregularly sparsely distributed on the underside in the fixation points. **APOTHECIA** absent. **PYCNIDIA** absent.

Color tests: upper cortex K+ yellow, UV+ yellow; medulla K+ magenta → purple, C+ orange, KC-, P+ orange, UV+ greenish-yellow.

Substances of taxonomic importance: atranorin, pigment and a series of unknown substances above the norstictic acid.

Holotype: BRAZIL, Mato Grosso State, municipality of Santa Cruz do Xingu; Xingu State Park, Site 22: 9°42'19.20"S, 52°17'57.90"W, elevation 268 m, Seasonal Semidecidual Submontane Forest, on tree trunk in the forest, *leg. F. Ciecoski 564*, 09–II–2021. (CNMTf 508)

Etymology: O epithet is a reference to the modest size of the thallus.

Comments: *Parmotrema modestum* é characterized by the ochraceous-green, lobed, ciliate, membranaceous and fragile, opaque to subopaque small (till 3.0 cm) thallus, by the lobes anisotomous laterally superposed to contiguous and counterposed with acute to oval and quadratics axils, axillary folds common, irregularly cut and crenate margins, by the brittle proximal surface, the presence de concolored lobules, the very small digitiform, isidioid, and sometimes ciliate pustules, by the intensely ocher medulla, the underside fissured, the rhizines both simple and forked, the medullary reactions K+ magenta → purple, C+ orange, KC-, P+ orange, UV+ greenish-yellow and by containing a non-identified pigment together a series of unidentified substances above the norstictic acid in the medulla.

Initially, *P. modestum* was identified as *P. aurantiacoparvum* Sipman (Sipman & van Aubel 1992) because thallus size, color of the medulla, and other morphological and chemical similarities. However, comparing our specimen with the original description of *P. aurantiacoparvum* as well descriptions from posterior registers (Benatti & Marcelli 2009; Donha 2005), became clear that the presence of pustules and the medullary color reactions (upper cortex K+ yellow, UV+ greenish-yellow; medulla K+ magenta → purple, C+ orange, KC-, P+ orange, UV+ greenish-yellow) readily distinguishes *P. modestum* from *P. aurantiacoparvum*.

Parmotrema aurantiacoparvum is also like *P. modestum* in the lobes with irregular ramification and the surface continuous to irregularly cracked (Benatti & Marcelli 2009), the thallus with upper surface opaque and emaculate, the lobes with crenulate, undulated, and ciliate margins, and in the orangish medulla (Sipman & van Aubel 1992).

According to Sipman & van Aubel (1992) the pigment of *P. aurantiacoparvum* is unknown but, considering the K+ dark purple reaction, may be an anthraquinone; and Benatti & Marcelli (2009) mentioned skyrin and a complex of 4 to 6 substances present in the medulla; furthermore, in some thalli it was possible observe areas with white medulla. In *P. modestum* we observed the presence of a pigment reacting K+ magenta → purple and a series of unidentified substances above the norstictic acid in the solvents B and C.

Parmotrema aurantiacoparvum differs morphologically from *P. modestum* by the presence of coralloid isidia, the abundance of longer cilia till 3.0 mm, the shorter commonly simple rhizines 0.5 mm long, the upper surface smooth and continuous in the distal part and rugulose with irregular fissures in the proximal part, by the medullary reactions K+ dark purple, C + weak purple, P-, UV-, and upper cortex reactions K + yellow and UV- (Sipman & van Aubel 1992).

Parmotrema hypomiltoides (Vain.) Kurok. (Kurokawa & Moon 1998) differs of *P. modestum* by the maculate, sorediate thallus, the cilia longer 1.5–2.5 mm, the medullary reactions K-, C-, KC + reddish orange, P-, and by the presence of alectoronic acid (Hale 1965).

Parmotrema enteroxanthum Hale (Hale 1977) differs from *P. modestum* by the thallus saxicolous and bigger (15 cm broad), the presence of isidia and by containing salazinic acid in the medulla (K+ yellow → red) (Hale 1977).

Fig. 6. *Parmotrema modestum* (holotype, *F. Ciecoski 564,* CNMTf 508). Scale bar = 10 mm.

Parmotrema sinapisium Marcelli & Ciecoski, **sp. nov.** Fig. 7

MycoBank, MB 842846

Diagnosis: *Parmotrema sinapisium* is a lustrous lobed/sublobed pergaminaceous ciliate emaculate species with sulphury yellow medulla, dichotomous to anisotomous lobes and acute to oval axils, few axillary folds, continuous to reticulate-crackled surface, smooth to irregularly crenate becoming pustulate and isidiate lateral margins, cilia simple and furcate, digitiform pustules that dismantle into farinose soredia, cylindrical to irregular and antleriform isidia principally laminal to submarginal and marginal, underside mustard-colored in the marginal zone and black in the proximal part, rhizinate (simple and forked), all-negative medullary reactions and with vulpinic acid in the medulla.

THALLUS ramulicolous; yellowish-gray; lustrous; lobed to sublobed; pergaminaceous; emaculate; satin already clear at 10×; epruinose; 6.0 cm broad. **LOBES** short, dichotomous to anisotomous; acute to oval axils; few axillary folds, initially low, erect, 0.8–1.0 mm high × 1/3 of the lobe width long, then strongly canaliculate and causing turning of the lobes; not auto incompatible; 1.5–2.0 mm wide at branching base, the major width 2.0–5.0 mm; laterally superposed to contiguous and counterposed to straddled; loose adnate to elevated; black line absent to subtle, till 0.1 mm wide, not complementary; **longitudinal axis** distended to strongly undulate; **transversal cut** initially concave, then from convex to irregular because the canaliculate axillary folds. **Proximal surface** firm; from continuous to reticulate crackled, smooth to crumpled, sometimes scrobiculate; rare yellowish stains of unknown origin; strongly pustulate-isidiate. **Distal surface** firm; continuous to reticulate cracked; smooth to slightly crumpled; little pustulate-isidiate. **Lateral margins** smooth to irregularly crenate becoming pustulate and isidiate; sinuous to undulate; closed and, when open, associated to the pustules and isidia; **apical zone** ascending and apically involute; **apex** irregularly crenate, pustulate and isidiate, ascending and involute. **CILIA** black; satin clear at 20×; without pigments; sinuous; pointed; (0.60–)1.00–1.50(–2.00) mm long × 0.08–0.10 mm thick; from erect to ascending and prostrate; mostly simple and few furcate from 0.6–1.0 mm of the basis; not interlaced; common in the lobes axils and rare in the apical margins of the lobes. **Secondary laciniae and lobes** absent. **Lobules** absent. **Lacinules** rare and in initial development from the densely isidiate margins where the isidia become flattened and then plane; straight; apex irregular to rounded, occasionally ciliate, cilia alike those of the lobes; black line absent; concolored to the thallus, 0.30–0.50 mm long × 0.10–0.30 mm wide **PUSTULES** frequent; very small, digitiform to irregular; not confluent; commonly laminal in the crests of the convex folds, few marginal and submarginal; till 0.5 mm wide; erumpent; dismantling into isidioid and sorediate structures; caducous; without pigment; originating from the not constricted basis of fallen isidia that eventually originate sorals; pustular medulla K+ greenish-yellow. **SORALS** frequent;

laminal and submarginal originated from eruptions in the upper cortex and marginal originated from digitiform pustules; orbicular; till 0.5 diam. × 0.3 mm diam.; not coalescent; eciliate; surrounding cortex integer to reticulate; without pigment. **SOREDIA** from caducous to persistent, not auto incompatible; commonly farinose; heaped; commonly produced from erumpent pustules in the apical zones; K+ greenish-yellow. **ISIDIA** abundant, concolored, sublustrous; dense; erect to procumbent; principally laminal and marginal, few submarginal; grouped to strongly cespitose; firm to detaching when touched, little rigid; frequently caducous, some of the fallen parts adhered to the distal cortex; cylindrical to irregular and barrel-shaped, from smooth to slightly undulate, integer surface, from straight to principally irregular, apex commonly pointed and rounded, frequently truncate, concolored, integer to decapitate; basis sometimes constricted; abundant those irregularly 2–4 ramified since half height, abundant the antleriform 0.3–0.5 mm high × ca. 0.1–0.2 mm thick; eciliate; not auto incompatible; some of them become erumpent and originate sorals after decapitation, frequent the small exposing-medulla orifices left by the isidia fall, many of them cicatrized and filled with newly made cortices. **MEDULLA** sulphury yellow; loose. **UNDERSIDE** mustard (greenish-badius) in the marginal zone and black in the proximal part. **Marginal zone** mustard; subopaque; satin clear only at 40×; ca. (0.1–)1.0–3.0 mm wide, sometimes the marginal zone is very narrow; attenuate; smooth to crumpled; epapillate; sometimes with sparse groups of black rhizines in the transition zone; not fissured. **Proximal part** black; sublustrous; satin clear at 20×; from crumpled to rugose; not fissured, rarely reticulate cracked. **RHIZINES** dimorphic, mostly **simple**, rare with apex penicillate, and few **forked** since 1.0 mm from the basis; sinuous to contorted; common and distributed in sparse regions; not pigmented; sublustrous; not gomose; satin clear at 20×; not interlaced; cylindrical; monometric; simple and forked 1.00–2.50 mm long × ca. 0.05–0.10 mm thick; frequently irregularly distributed all over the proximal part and small groups in transition and marginal zones of a few lobes. **APOTHECIA** absent.

PYCNIDIA absent.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, vulpinic acid.

Holotype: BRAZIL, Mato Grosso State, municipality of Alta Floresta; Cristalino I State Park, Site 3: 9°28'17.45"S, 55°49'22.20"W, elevation 337 m, Dense Submontane Ombrophilous Forest with Canopy, on roots of epiphyte in the forest, *leg. F. Ciecoski 107*, 09–VI–2020 (CNMTf 509).

Etymology: The epithet comes from the Latin *sinapi* (mustard) as reference to the underside marginal zone typical color.

Comments: *Parmotrema sinapisium* is characterized by the thallus lobed to sublobed, pergaminaceous and emaculate, lustrous, with dichotomous to anisotomous lobes and axils acute to oval with few axillary folds, continuous to reticulate crackled surface, lateral margins smooth to irregularly crenate and becoming pustulate-isidiate, simple and furcate cilia, digitiform very small pustules that dismantle into farinose soredia, isidia that are cylindrical to irregular, antleriform and ramified, principally laminal to submarginal and marginal, sulphury yellow medulla, underside greenish-badius (mustard) in the marginal zone and black in the proximal part, rhizinate (simple and forked), medullary reactions K-, C-, KC-, P-, UV-, and with vulpinic acid in the medulla.

Parmotrema sulphuratum (Nees & Flot.) Hale differs from *P*. *sinapisium* by the thallus cracked in the oldest parts, by the cylindrical laminar isidia, simple to branched (Hale 1965, 1974), by the membranaceous to submembranaceous thallus or rarely subcoriaceous with larger size (25 cm) (Benatti & Marcelli 2009), the presence of skyrin (purple K+) (Krog & Swinscow 1981), the ciliated sorals and the presence of fatty acids (Donha 2005).

Parmotrema endosulphureum (Hillmann) Hale (Hale 1974) differs from *P*. *sinapisium* by the thallus opaque and eciliate, by the underside black, brown marginal zone, and the medullary reactions K+, C+, KC+ intensely yellow (Hale 1965).

Parmotrema peralbidum (Hale) Hale (Hale 1974) differs from *P*. *sinapisium* by the thallus eciliate, grayish-white, the isidia thin and not ramified, by the reactions medullary KC+ rose and P+ orange, and by the presence from protocetraric acid in the medulla (Hale 1965).

Fig. 7. *Parmotrema sinapisium* (holotype, *F. Ciecoski 107*, CNMTf 509). Scale bar = 10 mm.

Parmotrema sulphuratum (Nees & Flot.) Hale, *Phytologia* 28(4): 339. 1974. Illustration in Benatti & Marcelli (2009), p. 602, fig. 6

MycoBank, MB 343139

Basonym: *Parmelia sulphurata* Nees & Flot. *Linnaea* 9:501. 1835. *Parmelia persulphurata* Nyl. in *Cromb. Journ. Linn. Soc. Lond.* 16:219. 1877. Type collection: BRAZIL, Bahia State, *leg. Crombie* (bm, holotype). *P. brisbanensis* Stilton, *Trans. Proc. Roy. Soc. Victoria* 17:69. 1881. Type collection: AUSTRALIA, Brisbane, Queensland, *leg. Bailey 228* (bm, holotype; glam, isotype.)

THALLUS corticicolous; yellowish-gray; lustrous; lobed; submembranaceous; emaculate; satin already at 10×; epruinose; 7.0 cm broad; thallus corroded with few preserved lobes. **LOBES** short, anisotomous; acute to irregular axils; axillary folds few, low, erect, ca. 1.0 mm high × 1/3 of the lobe width long; not auto incompatible; 1.5–3.0 mm wide at branching base, the major width 2.0–7.0 mm; contiguous to laterally counterposed; adnate to loose-adnate; black line subtle, till 0.05 mm thick, not complementary; **longitudinal axis** distended to little undulate; **transversal cut** initially descending to concave and descending. **Proximal surface** little firm; continuous to reticulate cracked, smooth to undulate according the substrate. **Distal surface** little firm; from continuous to reticulate cracked, smooth to undulate; little isidiate; **lateral margin** smooth to irregularly cut becoming isidiate; sinuous to undulate; closed; **apical zone** descending to depressed; **apex** irregularly cut, descending. **CILIA** long, black; lustrous, satin clear at 10×; without pigments; sinuous; pointed; 0.50–1.50 mm long × 0.05–0.10 mm thick; from ascending to prostrate; mostly simple and rare furcate (only one found), from 1.2 mm of the base; not interlaced; common in the apical margins of the lobes and rare in the axils. **Secondary laciniae and lobes** absent. **Lobules** absent. **Lacinules** absent. **PUSTULES** absent. **SORALS** absent. **ISIDIA** few, concolored, subopaque; erect to procumbent; principally marginal and few submarginal; in sparse groups; firm to detaching when touched, little rigid; frequently caducous, some of the fallen parts adhered to the upper cortex; cylindrical to irregular, smooth to slightly undulate, integer surface, from straight to principally irregular, commonly rounded apices, concolored, integer; not constricted basis; not ramified to occasionally irregularly 1-ramified from the half height 0.05–0.20 mm high × ca. 0.10 mm thick; eciliate; not auto incompatible. **MEDULLA** sulphury yellow; loose. **UNDERSIDE** brown in the marginal zone and black in the proximal part. **Marginal zone** brown; opaque; satin not visible even at 45×; ca. 1.0 mm wide; attenuate; smooth to crumpled; epapillate; sometimes rhizinate in the transition zone; not fissured. **Proximal part** black; lustrous; satin already clear at 10×; from crumpled to rugose; not fissured. **RHIZINES** monomorphic, simple, some with penicillate apices; sinuous to contorted; few and distributed in sparse regions; not pigmented; lustrous; not gomose; satin clear at 10×; not interlaced; cylindrical; monometric; 0.30–0.50 mm long × ca. 0.05 mm thick; distributed irregularly all over the proximal part; occasionally present in the transition zone. **APOTHECIA** absent. **PYCNIDIA** absent.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C-, KC-, P-, UV-.

Substances of taxonomic importance: atranorin, vulpinic acid.

Type: CUBA, *leg. Wright 72* (ups, neotype; bm, fh, k, m, us, isoneotypes).

Known distribution: AUSTRALIA. ASIA: Sumatra. AFRICA: Congo, Ivory Coast, Zaire, Quenia. NORTH AMERICA: USA, México. CENTRAL AMERICA and CARIBE: Honduras, Panamá, Cuba, Dominican Republic. SOUTH AMERICA: French Guyana, Suriname, Venezuela, Argentina, and Brazil – São Paulo State (Benatti & Marcelli 2009) This is the first record for Mato Grosso State.

Examines material: BRAZIL, Mato Grosso State, municipality of Alta Floresta; Cristalino I State Park, Site 6: 9°28'52.91"S, 55°50'35.26"W, elevation 290 m, Dense Submontane Ombrophilous Forest with Canopy, on to fallen tree branch in the forest, *leg. F. Ciecoski*

310. 08–VI–2020; idem, Site 9: 9°30'25.04"S, 55°49'51.83"W, elevation 258 m, Dense Submontane Ombrophilous Forest with Canopy, on to fallen tree branch in the forest, *leg. F. Ciecoski 400.* 10–VI–2020. (CNMTf 510).

Comments: *Parmotrema sulphuratum* is characterized by the sulphury yellow medulla, the lobed submembranaceous ciliate emaculate thallus com anisotomous lobes and the axils acute with few axillary folds, the continuous to reticulate cracked surface, smooth to irregularly cut and little isidiate lateral margins, the isidia cylindrical to irregular, the underside brown in the marginal zone and black in the proximal part, the medullary reactions all-negative, and by containing vulpinic acid in the medulla.

Hale (1965) described to *P*. *sulphuratum* an opaque, reticulate-cracked in the older parts thallus, isidia cylindrical, simple to ramified 3 mm high × 0.03–0.05 mm thick, with underside black in the proximal part and brown in the marginal zone. Benatti & Marcelli (2009) mentioned a membranaceous to submembranaceous or rarely subcoriaceous till 25 cm thallus with macules that are absent to weak present only in the distal parts of younger lobes, marginal and axillary cilia black and simple, sorals and pustules absent, isidia marginal and on crests of folds. Our specimen fits both descriptions but differs from that described by Donha (2005), that mentioned a thallus occasionally sorediate and the soredia becoming granular with brown apices and the presence of one pigment and two unknown fatty acids.

Parmotrema endosulphureum (Hillmann) Hale (Hale 1974) differs from *P*. *sulphuratum* by the thallus eciliate and medullary color reactions (K +, C +, KC + intensely yellow) (Hale 1965).

Parmotrema peralbidum (Hale) Hale (Hale 1974) differs from *P*. *sulphuratum* by the thallus eciliate, the medullary color reactions (KC+ rose and P+ orange) and by the presence of protocetraric acid in the medulla (Hale 1965).

Parmotrema xinguense Ciecoski & Marcelli, **sp. nov.** Fig. 9

MycoBank, MB 842847

Diagnosis: *Parmotrema xinguense* is a lobed, maculate, ciliate, and subcoriaceous species with anisotomous to sympodial lobes, axils mostly acute to oval and common axillary folds, the upper surface is continuous, the lateral margin smooth to irregularly cut and crenate, the underside has simple and furcate rhizines, the apothecia are subpedicellate and the old occasionally petaloid with imperforate discs and hymenia 100 µm high, the ascospores ellipsoid 25.0–32.5 × 12.5–17.5 µm, the medullary color reactions K-, C+ red, KC+ red, P+ yellow, and UV-, consequence of the presence of lecanoric acid, gyrophoric acid, protopraesorediosic acid, praesorediosic acid and at least one substance of the protocetraric acid complex occult in the trail (TLC) of the gyrophoric acid and lecanoric acid in the medulla.

THALLUS corticicolous; gray, velvet-opaque (velutinous) in the proximal surface and sublustrous in the distal portion; lobed; subcoriaceous; weak effigurate macules sparse in the distal margin; not satin even at 45× in the opaque part and satin clear at 20× in the sublustrous part; till 12.0 cm broad; epruinose. **LOBES** short, anisotomous to sympodial; axils acute to oval and squared to auriculate; axillary folds common, erect, 2.0–4.0 mm high × 1/3 of the lobe width long; auto incompatible in the margins of the superposed laterally lobes near the distal margin; 2.0–8.0 mm wide at branching base, the major width 3.0–12.0 mm; laterally superposed to contiguous, counterposed and straddled; loose adnate; black line absent to subtle, till 0.1 mm thick; some longitudinally torn lobes showing cicatrization process of the margins, re-making the black line and cilia; **longitudinal axis** distended to undulate and ascending; **transversal cut** initially convex with descending borders to concave with ascending laterals. **Proximal surface** very firm; continuous to reticulate; crumpled to rugose and scrobiculate; few oval laminal perforations of unknow origin apparently with cicatrization and formation of cilia and/or lobules. **Distal surface** firm; continuous to slightly reticulate; smooth to crumpled; whitish and yellowish stains indicating corrosion of the upper cortex but apparently in cicatrization process with the newly-made cortex slightly scrobiculate. **Lateral margin** smooth to irregularly cut and crenate; sinuous to undulate and conformed to the substrate; closed and, when open, not associated with other structures; **apical zone** ascending to involute and descending; apices irregularly cut to rounded, ascending and prostrate. **CILIA** black; satin clear at 20×; without pigment; straight to sinuous; pointed; monometric, 0.20–1.50 mm long × 0.05–0.10 mm thick; erect to ascending and prostrated; dimorphic, mostly simple, rare forked from 0.3 mm of the basis; not interlaced; common in the axils of the lobes, rare in the apical margins of the lobes and few in the cicatrized perforations of the proximal surface. **Laciniae** and **Secondary lobes** absent. **Lobules** common; mostly concolored, some a little bit lighter than the thallus; frequent in the distal margin and few in the proximal surface; not ramified; 0.5–1.5 mm long × 0.2–0.7 mm wide; lamina plane-concave; straight to undulate; ascending; apex rounded; black line subtle, till 0.1 mm thick; frequently ciliate in the axils and rarely in the apical margin, cilia black, simple, straight; erect; underside brown to dark brown; common in cicatrized parts of the distal margin and in the perforations of the proximal surface. **Lacinules** absent. **PUSTULES** absent. **SORALS** absent. **ISIDIA** absent. **MEDULLA** white; firm. **UNDERSIDE** chestnut and black in the distal part and black in the proximal part. **Marginal zone** ivory to light brown and black; sublustrous; satin clear at 20×; ca. 0.4–8.0 mm wide in the ivory and light brown part, in the part black there is no differentiation in relation to the proximal part; attenuated in the ivory and light brown part; smooth, crumpled, sometimes papillate in the transition zone; sometimes rhizinate in the transition zone, rhizines concolored, sometimes with whitish and penicillate apices; few fissures in the black part, irregularly ramified, 0.50–2.00 mm long × ca. 0.05–0.10 mm wide, cicatrized and with slightly elevated borders. **Proximal part** black; sublustrous; satin clear at 20×; crumpled to rugose and papillate; commonly fissured with a crackled pattern; fissures irregular to reticulate, commonly ramified, 1.00–3.00 mm long × ca. 0.05–0.10 mm wide, cicatrized and some borders strongly elevated. **RHIZINES** absent from the marginal zone and occasionally present in the transition zone; dimorphic: **simple**, with penicillate apices are common in the transition zone, some rhizines develop a accentuate thickening at the top in an elephant paw-shape, and rare other are **forked** at 0.3 mm from the basis; straight to sinuous; common and distributed in sparse regions; concolored in the marginal zone and black in the proximal part; not pigmented; sublustrous; not gomose; satin clear at 20×; rarely interlaced; cylindrical; dimetric; the simple and forked 0.40–0.70 mm long × ca. 0.05–0.10 mm thick and those thickened 0.70–0.80 mm long × ca. 0.20–0.30(–0.40) mm thick; few isolated, more frequently in sparse groups distributed on the top of the folds. **APOTHECIA** subadnate to short-stipitate; sulcate, rare subpetaloid (old); till 4.0 mm diam.; laminal to submarginal; medulla of the base K-; discs brown, epruinose, entire in the young and rarely cleft in the old, 1–2 clefts till 1/3 of the radius; imperforate; margin thick, till 0.2 mm thick, smooth to crenulate; amphithecia smooth to slightly crumpled, emaculate, not ornamented, medulla of the amphithecia K-; stipes central, short and narrow 0.3–0.5 mm wide × 0.2–0.3 mm high, smooth to crumpled, emaculate, not ornamented, stipe K-; hymenia till 100 µm high **ASCOSPORES** ellipsoid, hyaline, straight to slightly curved, 25.0–32.5 × 12.5–17.5 µm, epispore 2.5 µm, not guttulate, 8/ascus. **PYCNIDIA** absent.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C+ red, KC+ red, P+ yellow, UV-.

Substances of taxonomical importance: atranorin, lecanoric acid, gyrophoric acid, protopraesorediosic acid, praesorediosic acid and possibly at least one substance of the protocetraric complex hidden in the gyrophoric trail, responsible by the P+ reaction.

Holotype: BRAZIL, Mato Grosso State, municipality of Santa Cruz do Xingu; Xingu State Park, Site 21: 9°40'37.73"S, 52°16'26.51"W, elevation 257 m, Seasonal Semidecidual Submontane Forest, on tree trunk in the forest, *leg. F. Ciecoski 880(1)*, 12–II–2021. (CNMTf 511).

Etymology: the epithet refers to the collection place, the Xingu River, that bathes the Xingu State Park.

Comments: *Parmotrema xinguense* is characterized by the lobed and lobulate, maculate, ciliate and subcoriaceous thallus with anisotomous to sympodial lobes, by the axils acute to oval and squared to auriculate, axillary folds common, the auto incompatibility in the margins of the laterally superposed lobes near the distal margin, the proximal surface very firm continuous to reticulate, by the lateral margin smooth to irregularly cut and crenate, by the “chestnut” and black underside in the distal part and black in the proximal part, rhizines simple and forked, the apothecia sub-bullate and concave and with the older occasionally petaloid, imperforate and with hymenia till 100 µm high, the ascospores ellipsoid 25.0–32.5 × 12.5–17.5 µm, epispore 2.5 µm thick, the medullary reactions K-, C+ red, KC+ red, P+

yellow, UV- and by containing lecanoric acid, gyrophoric acid, protopraesorediosic acid, praesorediosic acid and one substance of the protocetraric complex (?) occult in the strong colored trail of both the gyrophoric acid and lecanoric acid in the medulla.

Fig. 8. *Parmotrema xinguense* (holotype, *F. Ciecoski 880(1)*, CNMTf 511). Scale bar = 10 mm.

Parmotrema gradsteinii Aubel (Sipman & Aubel 1992) differs from *P. xinguense* by the emaculate thallus, the simple rhizines till 1 mm long, the hymenia till 150 µm high, the medulla without fatty acids and P+ substances, and by the P- medullary color reaction (Sipman & Aubel 1992).

Parmotrema abnuens (Nyl.) Hale (Hale 1974) differs by the thallus with upper surface bright and rugose, the margins with dense longer cilia 3–5 mm, apothecia with wider discs 5–10 mm, and by the presence of olivetoric acid in the medulla (Hale 1965).

Parmotrema eunetum (Stirt.) Hale (Hale 1974) differs in the thallus with longer cilia 2–4 mm, the apothecia perforated with amphithecia strongly maculate, and by containing only gyrophoric acid in the medulla (Hale 1965).

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Figure legends:

Figure 1. *Parmotrema erectum* (holotype, *F. Ciecoski 927*, CNMTf 503). Scale bar = 10 mm.

Figure 2. *Parmotrema halei* (holotype, *F. Ciecoski 976*, CNMTf 504). Scale bar = 10 mm.

Figure 3. *Parmotrema helicoideum* (holotype, *F. Ciecoski 926*, CNMTf 505). Scale bar = 10 mm.

Figure 4. *Parmotrema josei* (holotype, *F. Ciecoski 532*, CNMTf 506). Scale bar = 10 mm.

Figure 5. *Parmotrema meguroae* (holotype, *F. Ciecoski 984*, CNMTf 507). Scale bar = 10 mm.

Figure 6. *Parmotrema modestum* (holotype, *F. Ciecoski 564*, CNMTf 508). Scale bar = 10 mm.

Figure 7. *Parmotrema sinapisium* (holotype, *F. Ciecoski 107*, CNMTf 509). Scale bar = 10 mm.

Figure 8. *Parmotrema xinguense* (holotype, *F. Ciecoski 880(1)*, CNMTf 511). Scale bar = 10 mm.

CAPÍTULO V.

Species of *Bulbothrix*, *Pseudoparmelia*, *Parmelinella*, and *Canoparmelia* (*Parmeliaceae*) from the Brazilian Amazon rainforest

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O presente manuscrito seguirá as padronizações adotadas pelo periódico *Rodriguésia*, ao qual o presente trabalho será submetido (Anexo E).

Original article

Species of *Bulbothrix*, *Pseudoparmelia*, *Parmelinella*, and *Canoparmelia* (*Parmeliaceae*) from the Brazilian Amazon rainforest

Espécies de *Bulbothrix*, *Pseudoparmelia*, *Parmelinella* e *Canoparmelia* (*Parmeliaceae*) da floresta amazônica brasileira

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***Parmeliaceae* species from the Amazon**

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Abstract

Three areas in the Amazon rainforest in the North of Mato Grosso State, Brazil, were investigated for *Parmeliaceae* species. Four new species (*Bulbothrix benattii*, *B. marcellii*, *Canoparmelia matogrossensis*, and *Pseudoparmelia straminea*) and two new records (*Parmelinella amazonica* and *B. tabacina*) are described, illustrated and commented according the ultimate version of the GEL descriptive protocol. The number of new species found is a clear demonstration of how unknown this Biome is yet, chiefly if taking in account that *Parmeliaceae* is a minor component of its lichenized mycota.

Key words: taxonomy, biodiversity, satin, lichenized fungi

Resumo

Três áreas da floresta amazônica no norte do estado de Mato Grosso, Brasil, foram investigadas para espécies de *Parmeliaceae*. Quatro novas espécies (*Bulbothrix benattii*, *B. marcellii*, *Canoparmelia matogrossensis* e *Pseudoparmelia straminea*) e dois novos registros (*Parmelinella amazonica* e *B. tabacina*) são descritos, ilustrados e comentados de acordo com a versão final do protocolo descritivo GEL (Lichenological Studies Group). O número de novas espécies encontradas é uma clara demonstração do quão desconhecido este Bioma ainda é, principalmente se levarmos em conta que *Parmeliaceae* é um componente menor de sua micota liquenizada.

Palavras-chave: taxonomia, biodiversidade, cetim, fungos liquenizados

Introduction

The Amazon stands out for having the greatest biodiversity on the planet, and this natural heritage is of immense economic and environmental value (IBGE 2011). According to Magalhães et al. (2012) of all the planet's diversity, 20% is located in the Amazon. Still, it is believed that there is another immense number of species also unknown to science (Menin 2010).

The study of lichens in the Amazon occurs in a fragmented way or with a focus on a specific genus. Thus, the data are poorly known, which makes it difficult to obtain data on all known species. Among other factors, access to habitats amidst the forest canopy provides enough obstacles to limit study, research and material collection (Seaward 2000).

However, making known the diversity of lichenized fungi in the Amazon or of a specific taxon guarantees the registration of many species and genera not yet referred to the biome or to science, as is the case in this work.

Unlike foliose lichens, which are virtually unknown in the Brazilian Amazon, microlichens have been studied more intensively (Aptroot & Cáceres 2013, 2014a, 2014b, 2014c; Aptroot & Souza 2021; Aptroot et al. 2017, 2021; Brako et al. 1985; Cáceres & Aptroot 2016, 2017; Cáceres et al. 2014; Feuerstein et al. 2013; Monteiro et al. 2018).

Parmeliaceae is one of the most widespread lichenized families in the world (Benatti, 2005), with 2,765 species distributed in 77 genera (Lücking & al. 2017a, b). In Brazil, it has 509 species in 26 genera (A. Aptroot 2021, personal communication).

This work aimed to expand the knowledge of the family *Parmeliaceae* through the description and illustration of the genera *Bulbothrix*, *Canoparmelia*, *Parmelinella* and *Pseudoparmelia* in three areas of the Amazon rainforest located in the north of the Mato Grosso state.

Materials & Methods

Field expeditions were carried out from May/2020 to March/2021 where samples of lichenized fungi were collected in three areas of the Amazon rainforest located in the north of the Mato Grosso state.

The Cristalino State Park (9°28'17.45"S, 55°49'22.20"W) which is characterized by a hot and humid climate, with average annual temperatures above 24°C and average annual precipitation above 2400 mm (Sasaki et al. 2008). The Xingu State Park (9°53'47.15"S, 52°30'36.37"W) has well-defined wet and dry seasons with average rainfall ranging from 2,000 to 2,500 mm and temperature between 32.0° C and 21.0°C (IBGE 2012) and São Nicolau farm (09°49'09.0"S, 58°15'31.1"W) has a climate and average temperature similar to Cristalino State Park. The rainfall reaches an annual average of 2,034 mm (Noronha et al. 2015).

The methodology adopted for collection and herborization was based on Brodo et al. (2016), Fidalgo & Bononi (1967, 1989), Peixoto & Maia (2013), and adjustments were made when necessary.

Species were morphologically studied using stereomicroscope and light microscopes. Anatomical sections, including those of apothecia and pycnidia, were hand made with razor blades. The chemical constituents were checked by spot tests with potassium hydroxide (K), sodium hypochlorite (C) para-phenylenediamine (P), and examined under UV light (360 nm). Microscopic measures were taken in water. Chemical constituents were identified by thin-layer chromatography (TLC) using solvents B, C and G (Huneck & Yoshimura 1996, Orange et al. 2010, White & James 1985), and comparison with authentic samples.

The descriptions were made by using the ultimate version of the protocol developed by the Group of Lichenological Studies (GEL) of the Instituto de Botânica, São Paulo, Brazil.

The illustrations were made from the high resolution digitization of the type species.

The type species were deposited in the Centro-Norte-Mato-grossense Herbarium (CNMT) of Federal University of Mato Grosso (UFMT) and the isotypes will be deposited in the Herbarium of the Federal University of Mato Grosso do Sul Foundation (CGMS).

Taxonomy

Bulbothrix benattii Marcelli & Ciecoski, *sp. nov.* Holotype: BRAZIL, Mato Grosso State, municipality of Santa Cruz do Xingu; Xingu State Park, Site 23: 9°42'29.62"S, 52°16'90.85"W, elevation 252 m, Seasonal Semidecidual Submontane Forest, on branch of an orange tree in the orchard's headquarters of Santa Fé do Xingu Farm, leg. F. Ciecoski 925, 13-II-2021 (CNMTf 519). MycoBank: MB 842848. Fig. 1

Bulbothrix benattii differs of B. pustulata (Hale) Hale by the greenish-gray subopaque thallus with the proximal surface strongly reticulate to crackled and the digitiform pustules that dismantle into soredioid structures.

THALLUS corticicolous (ramulicolous); greenish-gray; velutinous (velvety-opaque); laciniate; submembranaceous; satin visible only at 45×; till 10.0 cm broad; integer; epruinose; hypermaculated. LACINIAE short-ramified, internodes 0.3–0.5 mm long, dichotomous to sympodial; axils frequently acute and oval; axillary folds rare, little erect, 0.3–0.6 mm high × 1/2 width of the lacinium long; 0.5–1.0 mm wide at branching base, the major width 0.5–1.5 mm; commonly contiguous, few laterally superposed; adnate to a little loose; black line absent to very subtle, till 0.05 mm thick; longitudinal axis distended; transversal cut plane. Proximal surface little firm; strongly reticulate crackled and cracked; crumpled and escrobiculate. Distal surface little firm; reticulate to cracked; escrobiculate to crumpled. Lateral margin irregularly cut; conformed to the substrate; closed; not auto incompatible; apical zone slightly depressed; apex irregular, descending. CILIA bulbate, black; sublustrous, satin clear at 20×; without pigments; the longer sinuous; 0.10–0.40 (–1.00) mm long × 0.05–0.10 mm wide; common in the axils of the lobes and rare in the laciniae apices, occasionally laminal biconcave devoid-apex bulbs develop on the proximal part; bulbate base biconcave (like a red blood cell) to spherical 0.10–0.50 mm diam.; apices absent in the biconcave laminal bulbs and one/bulb in the spherical; apices pointed, descending, acting as rhizines in the distal zone; not interlaced; interciliary distance equivalent to 3–4 bulbs at the apex of the laciniae and lateral margins, contiguous in the axils. Lobules absent. Secondary laciniae abundant but with different origins; in the distal part they are marginal and growth horizontally filling that substrate spaces not occupied by the thallus and stop growing when there is no space left; in the proximal part they are irregularly distributed, conforming on the primary laciniae and develop from digitiform eruptions of them, arisen in the borders of laminal and submarginal cracks normally hidden by the dense covering of secondary laciniae, till 0.50–2.50 mm long × 0.30–1.00 mm wide; anisotomous; ciliate, the cilia with bulbate basis and apices frequently absent or much shorter than those of the primary laciniae, commonly restricted to the axils; underside with a marginal zone white and clear-cut, proximal part black. Lacinules absent. PUSTULES frequent; very small, till 0.5 mm diam.; digitiform to irregular; not confluent; commonly laminal; erumpent; dismantling into isidioid structures; caducous, leaving the medulla exposed; without pigment; open by the apical break of the isidioid structures and, posteriorly, some of them originate isidia; pustular medulla K+ yellow. SORALS absent. ISIDIA abundant, concolored and concolored with light brown apices, sublustrous; dense; erect to bend; chiefly laminal; grouped to frequently cespitose; firm to detaching when touched, little rigid; frequently caducous, some of the detached parts adhered to the proximal cortex; cylindrical to irregular and barrel-shaped, smooth, surface integer, straight to sinuous, apex commonly rounded and frequently light brown, a few entirely concolored, normally integer, a few decapitate; basis frequently constricted; commonly ramified from the apices, 3–7-ramified, abundant those antleriform; (0.05–) 0.10–0.30 (–1.00) mm high × ca. 0.05–0.10 mm thick; eciliate; not auto incompatible. MEDULLA white; normal (cottony). UNDERSIDE brown in the marginal zone and black in the proximal part. Marginal zone brown; sublustrous; satin clear at 20×; ca. 0.5–1.0 mm wide; attenuate; smooth; little papillate, papillae concolored; rhizinated till near the margin; not fissured. Proximal part black; lustrous; satin clear already at 10×; smooth to slightly crumpled and rarely rugose; not fissured. RHIZINES both bulbate and not bulbate; frequent till the marginal zone; monomorphic, simple, sometimes with penicillate apices, cylindrical; concolored; not pigmented; opaque; not gomose; satin little visible even at 45×; not interlaced; sinuous; inclined; monometric; 0.50–0.70 mm long × ca. 0.05–0.10 mm thick; not grouped and regularly distributed. Rhizines of the secondary laciniae bulbate, till 0.30–0.40 mm long × 0.05–0.10 mm thick, bulb 0.10–0.50 mm diam., black, few and spread irregularly by the underside. APOTHECIA absent. PYCNIDIA absent.

Color tests: upper cortex K+ yellow, UV-; medulla K+ yellow → orange, C+ weak yellow, KC+ weak yellow, P+ orange, UV-.

Substances of taxonomic importance: atranorin, salazinic acid.

Etymology: the epithet is a homage to Dr. Michel Navarro Benatti, admired and good friend who unveiled and knows deeply the genus *Bulbothrix*.

Comments

Bulbothrix benattii is characterized by the submembranaceous thallus with laciniae dichotomous to sympodial, the margins irregularly cut and irregular apices, the hypermaculated upper cortex strongly reticulate to crackled and cracked, the secondary marginal laciniae in the distal part growing horizontally to fill the not occupied inter-laciniae substrate and, in the proximal part from eruptions in the borders of laminal and submarginal digitiform cracks and conforming on the primary laciniae, by the very small digitiform pustules that dismantle into isidioid structures, the ramified and antleriform isidia, the laminal cilia with biconcave basis and no apices and the marginal inflate and with one apex and acting as rhizines, by the proximal part black, lustrous and smooth, the rhizines bulbate and not bulbate, and by the salazinic acid in the medulla.

Bulbothrix benattii has some similarities with other two known pustulated species in the genus. *B*ulbothrix *pustulata* (Hale) Hale is somewhat near in general shape and has salazinic acid too. However, *B. pustulata* has an olive green to whitish thallus with a proximal surface rugose and shiny, becoming moderately isidiate-pustulate with inflated pustules (Hale 1974; Hale & Kurokawa 1964) described also as irregular wrinkles or dactyloid contorted and villous structures that dismantle into granules (Benatti 2013), while in *B. benattii* the thallus is greenish-gray with a proximal surface strongly reticulate to crackled and subopaque, and the pustules are digitiform and dismantling into isidioid structures.

Benatti (2013) reported, in *B. pustulata*, laciniae with smooth to crenate margins, absence of macules and laminal cilia that sometimes have doubled apices and are absent from the laciniae apices. In *B. benattii* the margins are irregularly cut, the thallus is hypermaculated, there are laminal without apices cilia with biconcave basis, the marginal cilia have always one apex and occur, however not commonly, at the laciniae apices as well. Furthermore, in *B. benattii* the pustules are caducous and leave exposed the medulla, and in *B. pustulata* there is not medullary exposition (Benatti 2013).

Bulbothrix oliveirae A. Fletcher was the second pustulated species known in the world, firstly found by Brako & Dibben (1983) in the Serra do Cachimbo, Pará State (Amazon biome) and later in the littoral of the Brazilian Southeast (Benatti 2012). It is close to *B. benattii* only in general aspects such as the presence of caducous pustules that commonly expose the medulla (Hale 1986), oval axils and the submembranaceous thallus (Benatti 2012). *Bulbothrix oliveirae* differs by the cilia densely ramified, the abundance of dichotomous ramified rhizines, and the presence of gyrophoric acid in the medulla (Hale 1986). *Bulbothrix benattii* has salazinic acid, the cortex inferior emaculate, continuous, smooth and rarely cracked, the laciniae with smooth or irregular and commonly sublacinulate margins, presents lacinules, cilia with forked and dichotomous apices, presence of sorals, rounded blister-like swelled pustules that originate coarse corticated granules, and the medulla reacts K-, C+, and KC+ rosed, P- (Benatti 2012).

Bulbothrix marcellii Ciecoski (described ahead) reminds *B. benattii* principally by the presence of pustules, and macules. However, differs in the thallus subpergaminaceous velvet-opaque, pruinose, the margins crenate and bicrenate, the proximal surface reticulate cracked, the cilia with 2–3 apices per bulb, and the medulla containing gyrophoric acid.

Other somewhat similar species containing salazinic acid and producing isidia are not pustulate but commented below.

Bulbothrix subtabacina (Elix) Elix is similar in the maculate isidiate thallus with dichotomous laciniae (Elix 1993). Differs of *B. benattii* by the upper cortex smooth and irregularly cracked, the ciliate isidia, the furcate to irregularly ramified and without bulbate basis rhizines, and by the presence of chlroatranorin in the upper cortex (Benatti 2013; Elix 1993).

Bulbothrix tabacina (Mont. & Bosch) Hale is somewhat like *B. benattii* in the submembranaceous and maculated thallus, and the concolored isidia with brown apices (Benatti 2013; Hale 1974). However, *B. tabacina* differs of *B. benattii* by the laciniae irregularly ramified, imbricate and heaped, the upper cortex smooth and sometimes subrugose, the cilia (rare) with double apices, and by the rhizines simple to irregularly ramified with not bulbate basis (Benatti 2013).

Bulbothrix decurtata (Kurok.) Hale is similar to *B. benattii* by the isidiated thallusand the dichotomic laciniae with oval axils (Benatti 2013; Hale 1974). Differs of *B. benattii* by the coriaceous saxicolous thallus (Kurokawa 1964), the isidia with blackish apices and by the upper cortex smooth and irregularly cracked (Benatti 2013).

Bulbothrix australiensis Hale is readily distinguished from *B. benattii* by the coriaceous thallus (Benatti 2013) whitish and emaculated (Hale 1986), the upper cortex smooth to rugose and cracked and by the presence of marginal lacinules (Benatti 2013).

Bulbothrix subglandulifera (Hue) Hale differs from *B. benattii* by the thallus subcoriaceous and by the laciniae with crenate margins, the presence of lacinules and by the brown color of the rhizines with not bulbate basis (Benatti 2013; Hale 1974).

Fig. 1. *Bulbothrix benattii* (holotype, *F. Ciecoski 925*, CNMTf 519). Scale bar = 10 mm.

Bulbothrix marcellii Ciecoski, *sp. nov.* Holotype: BRAZIL, Mato Grosso State, municipality of Alta Floresta; Cristalino I State Park, Site 4: 9°28'45.37"S, 55°49'20.56"W, elevation 307 m, Dense Submontane Ombrophilous Forest with Canopy, on shrub in the forest, *leg. F. Ciecoski 204*, 09-VI-2020 (CNMTf 520). MycoBank: MB 842849. Fig. 2

Bulbothrix marcellii differs from B. subdissecta (Nyl.) Hale by the laciniae with irregular and crenate apices, lateral margins irregularly cut to crenate and bicrenate, the upper cortex reticulate cracked, rare black cilia, the marginal cilia with whitish apices and acting as rhizines, and by the underside badius to light brown in the marginal zone and black to dark brown in the proximal part.

THALLUS corticicolous; greenish-gray; velutinous (velvet-opaque); laciniate; subpergaminaceous; satin not visible even at 45×; till 6.0 cm broad; integer; pruinose, pruine irregularly distributed all over the thallus; macules evident and irregularly distributed all over the thallus, effigurate. LACINIAE short-ramified, internodes 0.2–0.4 mm long, dichotomous and trichotomous; axils frequently acute the oval and squared; axillary folds common, erect, 0.5–0.7 mm high × 1/2 of the lacinium width long; 0.5–0.7 mm wide at branching base, the major width

1.0–1.5 mm; commonly contiguous in the distal part, frequently laterally superposed and straddled in the proximal part; adnate; black line absent; longitudinal axis distended, little undulate; transversal cut plane-concave. Proximal surface firm; strongly reticulate cracked; smooth to crumpled; abundant very small crateriform wounds left by the fallen isidia in sparse regions all over the thallus, part of them exposing the medulla and part already cicatrized scars. Distal surface firm; continuous to reticulate cracked; smooth to crumpled. Lateral margin irregularly cut to crenate and bicrenate; conformed to the substrate to undulate; closed, here and there opened; not auto incompatible; apical zone slightly descending to ascending; apex irregular to crenate, ascending to descending in the distal portion, descending to involute in the proximal. CILIA bulbate, black; sublustrous, satin clear at 20×; without pigments; 0.10–0.20 mm long × 0.05–0.10 mm wide; abundant in the axils and frequent in the apical margins, rare spherical laminal bulbs devoid of apices on the distal part; bulbate base inflate, bulbs 0.05–0.10 mm diam.; apices absent only of the cilia laminal, frequent very short apices in the proximal part and abundant with 2–3 apices (cespitose) per bulb in the distal parts; rare whitish apices in the proximal part and few (the longest) light brown at distal parts; pointed, descending, acting as rhizines all around the thallus; commonly interlaced in the distal part; interciliary distance null along all the lateral margins of the distal part with the cilia compactly juxtaposed, rarely with space of 1–2 bulbs in some of the distal and proximal apices. Secondary lobes and lobules absent. Secondary laciniae marginal, abundant in the distal part growing horizontally to fill those not yet occupied inter laciniae substrate spaces, commonly laterally superposed, a few straddled; in the proximal part they stablish a second thallus layer by growing and conform on the primary laciniae; because the lack of exposed substrate space in this region the second layer is formed from marginal initially upgrowing marginal branching that soon bend to growth horizontally on the primary laciniae; the ramification points that produce these strongly isidiate secondary laciniae are normally hidden by the dense covering of secondary laciniae; frequently the secondary lacinules disconnect of the primary laciniae apparently by constriction of connection (origin) point; till 0.50–0.70 mm long × 0.20–0.50 mm wide; ramifications anisotomous to rare dichotomous; ciliate, cilia with bulbate basis and apices much shorter that those of the primary laciniae, apices ramified, a few without apices, cilia and/or bulbs regularly present all over the margins of the laciniae; underside with marginal zone and proximal part varying between black and dark brown, not attenuate. Lacinules absent. PUSTULES few; very small, mostly digitiform (pustuloid isidia) 0.10–0.20 mm high × ca. 0.05−0.10 mm thick, surface irregular and crumpled, basis not constricted, not confluent, commonly laminal, a few marginal, entire to apically erumpent, some caducous and leaving the medulla exposed; rarely appear as laminal hemispherical swellings ca. 0.1 mm diam. that burst apically; without K+ pigment; pustular medulla K+ yellow. SORALS absent. ISIDIA abundant, concolored, opaque; basis mostly constricted, erect to inclined and procumbent; from principally laminal to submarginal; from isolate to forming rows or cespitose; caducous to detaching when touched, the loose parts commonly adhered to the proximal cortex; cylindrical to barrel-shaped to pyriform, surface integer and smooth, from straight to sinuous, apices commonly rounded and concolored, from integer to frequently decapitate and cicatrized; those cicatrized or cicatrizing simple to commonly 1–3 digitate ramified from half-height and their branches again decapitate, cicatrized and now proliferating (not ramifying) new simple isidia from their sides and/or the border of the cicatrized plates, resulting in groups of till 8 grouped apices on a same basis; 0.05–0.20 (–0.30) mm high × ca. 0.03–0.05 (–0.10) mm thick; eciliate; not auto incompatible. MEDULLA white; normal. UNDERSIDE badius to light brown in the marginal zone and black to dark brown in the proximal part. Marginal zone badius to light brown; subopaque, satin clear at 30×; ca. 0.5–1.0 mm wide;

attenuated; smooth; very papillate, papillae concolored to black; rhizinated till very near the margin; not fissured. Proximal part black to dark brown; subopaque; satin clear at 30×; smooth the slightly crumpled; rhizinated; not fissured. RHIZINES little bulbate; frequent till the marginal zone; black; dimorphic, the simple commonly with penicillate apices, those irregularly ramified with the ramifications from nearly 0.05 mm height; sinuous to contorted; not pigmented; opaque; satin clear only at 40×; commonly interlaced; monometric; 0.10–0.20 mm long × ca. 0.02–0.05 mm thick; common and regularly distributed all over the proximal part. Rhizines of the secondary laciniae conical, till 0.20–0.30 mm long × 0.05–0.10 mm thick, brown, sometimes with penicillate apices, few and regularly spread on the underside. APOTHECIA absent. PYCNIDIA absent.

Color tests: upper cortex K+ yellow, UV-; medulla K-, C+ rose, KC-, P+ yellow, UV-.

Substances of taxonomic importance: atranorin, gyrophoric acid.

Etymology: The epithet is a homage to Dr. Marcelo Pinto Marcelli that, besides being one of the precursors of Brazilian lichenology, with fundamental contributions to this science in Brazil, brings with himself a fascination with nature and the life that inspires everyone.

Comments

Bulbothrix marcellii is characterized by the velvet-opaque subpergaminaceous, pruinose, and maculated thallus with dichotomous and trichotomous laciniae with irregularly cut to crenate and bicrenate margins, by the proximal surface reticulate plenty of scars of the fallen isidia; the isidia simple cylindrical, pyriform or barrel-shaped, and ramified, concolored frequently decapitate but eventually cicatrized; by the presence of cilia de with 1–3 apices per bulb, the longest of the distal zone with light brown apices; by the pustuloid isidia that burst apically to produce true isidia, secondary laciniae that form a second thallus layer on the primary ones, by the underside badius the light brown in the marginal zone and black the dark brown in the proximal part, by the rhizines little bulbate and dimorphic (simple and irregularly ramified) and by the medulla white with gyrophoric acid and, possibly, atranorin (P+ yellow).

Of the three other pustulate species in the genus, *B. pustulata* (Hale) Hale and *B. oliveirae* A. Fletcher were already known before this work. The third, *B. benattii* Marcelli & Ciecoski, is described here.

Bulbothrix pustulata differs by the laciniae irregularly ramified, sometimes almost anisotomic dichotomous, by the oval to irregular axils, the presence de sorals, the medulla containing salazinic acid and the medullar color reactions K+ yellow → dark red, C-, KC- (Benatti 2013, Hale 1974).

Bulbothrix oliveirae is like *B. marcellii* in the presence of pustules, the dichotomous laciniae (Hale 1986), the oval axils, and by the white medulla containing gyrophoric acid (Benatti 2012). Differs from*B. marcellii* by the anisotomic ramified laciniae, by the presence de lacinules, the upper cortex continuous and smooth with rare transversal cracks, by the presence de sorals, the shape of the pustules that appear as roundish swellings, and by the medullary color reactions KC+ rose and P- (Benatti 2012).

Bulbothrix benattii differs by the thallus submembranaceous and hypermaculated, the dichotomous to sympodial laciniae, the proximal surface reticulate crackled, the irregularly cut margin, by the simple or absent apices of the cilia, the presence de concave and biconcave bulbs, and by the digitiform pustules that dismantle into isidioid structures, presence of isidia, and the salazinic acid in the medulla.

Bulbothrix scortella (Nyl.) Hale is like *B. marcellii* in the dichotomous or trichotomous laciniae, the upper cortex continuous, smooth and maculated, and in the white medulla containing gyrophoric acid (Benatti 2014; Hale 1974). Besides being not pustulate, *B. scortella* differs from *B. marcellii* by the presence of lacinules, the varied coloration of the cilia from black to brown and whitish, by the isidia firm and apically light brown, the underside brown to dark brown throughout without a color distinction of the marginal zone, and by the presence of lecanoric acid, lobaric acid and oxolobaric acid in the medulla (Benatti 2014).

Bulbothrix apophysata (Hale & Kurok.) Hale is like *B. marcellii* by the maculated thallus (Hale 1974, Hale & Kurokawa 1964), by the dichotomous laciniae, oval axils, the cilia with till three apices per bulb. Differs by the presence of also anisotomic laciniae and margins little sublacinulate, the presence of lacinules, the upper cortex smooth and little to very transversally cracked, by the medullar color reactions KC+ lilac rose, P-, and UV+ bluish white to light blue, and by containing lobaric acid (Benatti 2014).

Bulbothrix papyrina (Fée) Hale (Hale 1974) somewhat like *B. marcellii* in the maculated thallus with dichotomous, by the white medulla reacting K- and C+ rose with gyrophoric acid. Differs by the continuous upper cortex and the presence of just occasional few cracks, the concolored pycnidiate isidia with brown apices, and by the medullary color reactions KC+ rose, P-, UV- or UV+ weak light bluish (Benatti 2014).

Fig. 2. *Bulbothrix marcellii* (holotype, *F. Ciecoski 204*, CNMTf 520). Scale bar = 10 mm.

Bulbothrix tabacina (Mont. & Bosch) Hale, *Phytologia* 28(5): 481. 1974. MycoBank: MB 341619 Fig. 3

Basonym: *Parmelia tabacina* Montagne & Bosch. *Sylloge generum specierumque cryptogamarum*: 327. 1856. *Parmelia meizospora* var. isidiosa Müller Argoviensis. *Flora* 67: 620. 1884 (*nomem nudum*). *Parmelia meizosporoides* Dodge. *Annals of the Missouri Botanical Garden* 46: 83. 1959. *Parmelia ochrovestita* Zahlbruckner. *Annales de Cryptogamie Exotique* 1: 200. 1928. *Parmelia sublaevigatoides* Dodge. *Annals of the Missouri Botanical Garden* 46: 88. 1959.

Lectotype: Indonesia, Java, in cortice arborum, *leg. Junghuhn s.n.* (l, duplicate in pc).

Known Distribution: OCEANIA: Australia (Hale 1976, Elix 1994), Polynesia (Louwhoff & Elix 2000), Rarotonga Islands (Louwhoff & Elix 2002). ASIA: Ceylon (Awasthi 1976), Philippines (Hale 1976), India (Hale 1976, Divakar & Upreti 2005), Indonesia (Zahlbruckner 1928, as *P. ochrovestita*, Junghuhn 1855, Montagne 1856, Hale 1976), Malaysia (Hale 1976), Nepal, (Hale 1976, Kurokawa 1993), Taiwan (Hale 1976, Kurokawa & Lai 2001). AFRICA: Madagascar (Dodge 1959, as *P. meizosporoides*, Hale 1976, Aptroot 1990), South Africa, Angola (Hale 1976), Ethiopia (Swinscow & Krog 1988), Congo, (Dodge 1959, as *P. sublaevigatoides*), Guinea (Hale 1976), Malawi, Mozambique (Dodge 1959, as *P. sublaevigatoides*), Quenia (Swinscow & Krog 1988), Uganda (Dodge 1959, as *P. sublaevigatoides*, Swinscow & Krog 1988), Tanzania (Dodge 1959, as *P. sublaevigatoides*, Hale 1976, Swinscow & Krog 1988). NORTH AMERICA: Mexico (Hale 1976, Sipman & Wolf 1998). CARIBE: Cuba, Haiti, Dominican Republic, Trinidad and Tobago (Hale 1976), SOUTH AMERICA: Chile (Galloway & Quilhot 1998), Guyana (Feuerer 2008), Uruguay (Osório 1992), Venezuela (Hale 1976, López-Figueiras 1986, Marcano et al. 1996), and Brazil – Rio Grande of the Sul State (Canêz 2005), and São Paulo State (Hale 1976, Osório 1989, Marcelli 1990. 1991. 1993, Jungbluth 2006). This is the first register to Mato Grosso State.

THALLUS corticicolous (ramulicolous); greenish gray; sublustrous; laciniate; submembranaceous; satin visible at 20×; till 8.0 cm broad; integer; epruinose; macules weak, irregularly distributed all over the proximal part, effigurate. LACINIAE short-ramified, internode 0.3–0.5 mm long, dichotomous to trichotomous; axils frequently acute to oval and quadratic; axillary folds rare, little erect, 0.7–1.0 mm high × 1/2 of the laciniae width long; 0.8–3.0 mm wide at branching base, the major width 2.5–4.0 mm; commonly contiguous, a few laterally superposed and rarely straddled; adnate in the proximal part to loose adnate in the distal zone; black line absent to very subtle, till 0.05 mm thick; longitudinal axis distended, little undulate as result of the conformation to the substrate; transversal cut plane. Proximal surface little firm (not brittle); strongly reticulate crackled and cracked; crumpled and scrobiculate; abundant marks left by fallen isidia on sparse regions of the surface, mostly as micro crateriform scars (visible at 30×) mixed to circular plane marks exposing the medulla. Distal surface little firm (not brittle); continuous to sparsely cracked; smooth to crumpled. Lateral margin irregularly cut to crenate; conformed to the substrate; closed; not auto incompatible; apical zone slightly depressed to descending; apex rounded to irregular, descending. CILIA bulbate, black; satin clear at 20×; without pigments; 0.10–0.30 mm long × 0.05–0.10 mm wide; common in the axils of the lobes and rare at the apical margins of the laciniae, rare spherical laminal bulbs devoid of apices developed on the distal part; bulbate basis inflate, spherical, rarely with concave bulbs, bulbs 0.05–0.10 mm diam., apices absent or only one per bulb; apices pointed, descending, acting as rhizines in the distal zone; simple; not interlaced; interciliary distance 4-6 bulbs in the apex and lateral margin to contiguous or 1-bulb spaced in the axils. Secondary lobes and lobules absent. Secondary laciniae abundant all over the thallus but with different origins: in the distal part they are marginal and grow horizontally to fill the spaces (substrate) not occupied by the thallus and rarely superposing laterally, in the proximal part they sprout from submarginal cracks in the same way as occurs in normal cicatrization process, grow up in between the laciniae above and then bend to grow horizontally and conform on the primary laciniae or on older secondary ones to form a dense covering of superposed secondary laciniae, several layers thick, that normally occult the primary ones; isidiate, till (2.00–) 0.50–1.00 (–2.50) mm long × 0.20–0.80 (–1.00) mm wide; anisotomous; ciliate, cilia with bulbate basis and with apices much shorter than those of the primary laciniae or, frequently, without apices at all and frequently present only at the axils of the laciniae; underside totally black. Lacinules absent. PUSTULES absent. SORALS absent. ISIDIA abundant, both concolored and, most frequently, concolored with darkened apices, sublustrous; erect to procumbent; principally laminal to submarginal; grouped to frequently cespitose; firm to detaching when touched, little rigid (not brittle); frequently caducous, with some of the lose parts adhered to the proximal cortex; cylindrical to barrel-shaped, smooth, surface integer, straight to little sinuous, apex commonly pointed to rounded, entire to frequently decapitate; basis frequently not constricted; 2–3 antleriform ramified (0.05–) 0.10–0.30 mm high × ca. 0.05–0.10 mm thick; eciliate; not auto incompatible. MEDULLA white; firm. UNDERSIDE brown in the marginal zone and black in the proximal part. Marginal zone brown; sublustrous; satin clear at 20×; ca. 0.5–1.0 mm wide; attenuate; smooth; little papillate, papillae concolored; rhizinated almost till the margin; not fissured. Proximal part black; sublustrous; satin clear at 20×; smooth to slightly crumpled and rugose; not fissured. RHIZINES not bulbate; frequent till the marginal zone; monomorphic, simple, rarely with penicillate apices, cylindrical to conical; concolored; not pigmented; subopaque; not gomose; satin clear at 45×; not interlaced; sinuous; inclined; monometric; 0.10–0.30 mm long × ca. 0.05–0.10 mm wide. Rhizines of the secondary laciniae not bulbate to conical, till 0.30–0.40 mm long × 0.05–0.10 mm thick, black, few and regularly spread by the underside. APOTHECIA absent. PYCNIDIA absent.

Color tests: upper cortex K+ yellow, UV-; medulla K+ yellow → orange, C-, KC-, P+ orange, UV-.

Substances of taxonomic importance: atranorin, salazinic acid.

Examined material: BRAZIL, Mato Grosso State, municipality of Alta Floresta; Cristalino I State Park, Site 28: 9°28'17.45"S, 55°49'22.20"W, elevation 337 m, Dense Submontane Ombrophilous Forest with Emergent Canopy, on shrub in the forest, *leg. F. Ciecoski 954*, 12-III-2021 (CNMTf 521).

Comments

Bulbothrix tabacina is characterized by the laciniate submembranaceous thallus with dichotomous to trichotomous laciniae, commonly contiguous and maculated with a proximal surface reticulate crackled and cracked, by the simple bulbate cilia, the presence of secondary laciniae growing on the primary, the cylindrical to barrel-shaped isidia with darkened apices, the underside brown in the marginal zone and black in the proximal part, the rhizines not bulbate, and by containing salazinic acid in the medulla.

Benatti (2013) mentioned in *B. tabacina* the presence de apothecia ecoronate containing ellipsoid or oval ascospores 9.0−15.5 (−16.5) × 5.5−8.0 (−10.0) µm and subtlety bifusiform conidia 4.0–6.0 × ca. 1.0 µm. Our specimen has neither apothecia nor pycnidia.

Bulbothrix decurtata (Kurok.) Hale is like *B. tabacina* in the chemistry by containing salazinic acid in the medulla and by the medullary reactions K+ yellow → red, C-, KC-, P+ light orangish-red (Hale 1974; Hale & Kurokawa 1964) and, in the morphology, by the cilia with simple or absent apices and the laciniae with crenate margins (Benatti 2013). *B. decurtata* differs from *B. tabacina* by the thallus saxicolous and the isidia frequently more or less granular and rarely ramified (Hale & Kurokawa 1964), by the coriaceous thallus with anisotomic dichotomous to irregular ramification and by the bulbate rhizines (Benatti 2013).

Bulbothrix subtabacina (Elix) Elix is like *B. tabacina* in the submembranaceous maculate thallus (Benatti 2013; Elix 1993) densely isidiate, the medullary reactions K+ yellow → red, C-, KC-, P+ orange, and by containing salazinic acid in the medulla (Elix & Stevens 1979). *B. subtabacina* differs by the upper cortex smooth almost totally cracked except in some distal parts, the oval or irregular axils, the cilia with simple and forked apices, the rhizines simple becoming forked and then dichotomous, and by the presence of chlroatranorine in the upper cortex (Benatti 2013).

Bulbothrix isidiza (Nyl.) Hale is like *B. tabacina* in the submembranaceous maculate thallus, the cilia with simple to absent apices, the isidia laminal straight to ramified, concolored or with brownish apices, and by the medullary reactions K+ yellow → dark red, C-, KC-, P+ yellow, UV- (Benatti 2013). *B. isidiza* differs by the laciniae with irregular sometimes dichotomous and anisotomic ramification with oval axils, the upper cortex continuous and subrugose with some occasional irregular cracks, the underside light brown with some portions a little bit darker, by the rhizines light brown and brown, and by containing chlroatranorine in the cortex and consalazinic acid in the medulla (Benatti 2013; Hale 1974).

Fig. 3. *Bulbothrix tabacina* (*F. Ciecoski 954*, CNMTf 521). Scale bar = 10 mm.

Canoparmelia matogrossensis Ciecoski & Marcelli, *sp. nov.* Holotype: BRAZIL, Mato Grosso State, municipality of Santa Cruz do Xingu; Xingu State Park, Site 17: 9°53'47.15''S, 52°30'36.37''W, elevation 283 m, Seasonal Semidecidual Submontane Forest, on tree trunk in the forest, *leg. F. Ciecoski 623(1)*, 13–II–2021 (CNMTf 522). MycoBank: MB 842850. Fig. 4

Canoparmelia matogrossensis differs from C. caroliniana (Nyl.) Elix & Hale by the bicolored medulla containing protocetraric acid and by the isidioid pustules, and the concolored to darkened laminal and submarginal isidia.

THALLUS corticicolous; gray; lustrous in the distal part and opaque in the proximal; sublaciniate; subpergaminaceous; irregularly distributed punctiform effigurate macules; satin clear at 10× in the distal margin and not satin in the proximal surface even at 45×, possibly due the densely isidiate surface; epruinose; till 8 cm broad. SUBLACINIAE long, internode till 1.0 mm long, dichotomous to sympodial; axils frequently acute to oval; axillary folds frequent, erect, 1.5–2.0 mm high × 1/2 of the lobe width long; not auto incompatible; 1.5–3.0 mm wide at branching base, the major width 2.0–6.0 mm; laterally superposed to contiguous and counterposed to straddled; loose adnate to conformed to the substrate; black line absent to very subtle, till 0.05 mm thick, not complementary; longitudinal axis distended to strongly undulate; transversal cut with lateral borders strongly elevated and the center plane-concave. Proximal surface firm; from continuous to reticulate, strongly crumpled and scrobiculate; rare whitish stains of unknown origin and marks by corrosion (insects?); densely isidiate. Distal surface firm; continuous; smooth to slightly crumpled; little isidiate. Lateral margin irregularly crenate and cut; sinuous to undulate; closed, sometimes isidiate; apical zone descending and involute; apex irregularly cut to crenate, descending and involute. CILIA absent. Secondary lobes and laciniae absent. Lacinules absent. PUSTULES few, very small, not confluent, irregularly distributed; frequent in the proximal part, principally laminal and submarginal, developing on the decapitate apex of isidioid structures, 0.1–0.2 mm diam., pustular medulla K-. SORALS absent. ISIDIA dense in the proximal surface and frequent in the distal margin; some concolored but the majority badius darkened with brown apices, sublustrous; erect; principally on laminal and marginal folds, few submarginal; grouped, sometimes strongly cespitose; firm to detaching when touched, little rigid; frequently caducous, some of the lost parts adhered to the distal cortex; cylindrical to barrel-shaped, smooth, surface integer, from straight to slightly sinuous, apices commonly pointed and rounded, frequently integer to few decapitate, some of those decapitate originating pustules; basis sometimes constricted; abundant the irregularly 2–4-ramified from the half-height, abundant too the antleriform; (0.1–)0.2–0.3 mm high × ca. 0.05–0.10 mm thick; eciliate; not auto incompatible; after decapitate some become pustuloid ornamenting the amphithecia. MEDULLA normal (cottony); irregularly bicolored, an upper layer white and thick and one inferior very thin yellow orangish layer in the proportion 4:1; in distal parts the medulla is entirely white, in the proximal part it is irregularly bicolored; pigment yellow irregularly distributed, K-. UNDERSIDE greenish-gray to brown and brown in the marginal zone, black in the proximal part. Marginal zone greenish-gray to brown and brown; lustrous; satin already clear at 10×; ca. (0.1–)1.0–3.0 mm wide; attenuate; smooth; papillate; sparse groups of rhizines in the transition zone, rhizines black with whitish penicillate apices; not fissured. Proximal part black; sublustrous; satin clear at 20×; from crumpled to strongly rugose; not fissured, sometimes reticulate cracked. RHIZINES occasionally present in the transition and marginal zones; dimorphic, mostly simple, rare with apices penicillate to arbusculiform, and few forked from 0.2 mm of the basis; sinuous; common and distributed irregularly all over the proximal part; not pigmented; sublustrous; sometimes gomose; satin clear at 20×; not interlaced; cylindrical; monometric; simple and forked 0.20–0.50 mm long × ca. 0.05–0.10 mm thick; irregularly frequently distributed all over the proximal part. APOTHECIA adnate (young) to subpedicellate (old); sulcate (young) to petaloid (old); till 5.0 mm diam.; from laminal to submarginal; medulla of the basis K-; discs brown, epruinose, entire in the young and cleft in the old, till 2/3 of the radius, from folded to lobed and strongly involute, till 4 folds, imperforated; margin till 0.5 mm thick, from smooth to cut and crenate, frequently isidiate; amphithecia crumpled, effigurate and irregularly distributed macules (old) to emaculate (young), frequently the older ornamented by antleriform isidia and digitiform pustules, in the younger only isidia; medulla of the amphithecia K+ yellow; stipe central (young and old), 0.5–1.0 mm wide × 0.1–0.3 mm high, smooth (young) to crumpled (old), weak and effigurate macules, sometimes isidiate, stipe K+ yellow; hymenia till 100 µm high ASCOSPORES absent; asci absent. PYCNIDIA black, laminal, immerse. CONIDIA filiform, straight, 9.0–12.0 × ca. 1.5 µm.

Color tests: upper cortex K+ yellow, UV-; white medulla of the distal region of the thallus K-, C-, KC-, P+ orange, UV-; white medulla of the central region of the thallus K+ yellow, C-, KC+ yellow, P+ orange, UV-; yellow medulla K-, C-, KC+ reddish-orange, P+ red, UV-.

Substances of taxonomic importance: atranorin, protocetraric acid.

Etymology: The epithet refers to the Brazilian Mato Grosso State, where the holotype was collected.

Comments

Canoparmelia matogrossensis is characterized by the medulla bicolored (white and orangish), the sublaciniate subpergaminaceous isidiate/pustulate and maculate thallus with the sublaciniae laterally superposed to contiguous, proximal surface strongly crumpled and scrobiculate, pustules isidioid, laminal and submarginal isidia concolored to darkened, the underside greenish-gray to brown and brown in the marginal zone and black in the papillate and rhizinate proximal part, the subpedicellate laminal to submarginal apothecia cleft and isidiate with hymenia 100 µm high and protocetraric acid in the medulla.

At first sight, *C. matogrossensis* showed morphological and chemical similarities to *Parmelinella amazonica* (Nyl.) A.S. Rodrigues, A.P. Lorenz & Canêz (Rodrigues et al. 2021).

Parmelinella amazonica presents an entirely white medulla K-, KC+ weak yellow, and C+ weak yellow and sublageniform conidia 5–8 µm, while *C. matogrossensis* has a bicolored medulla with a part yellow K-, C-, KC+ reddish-orange, P+ red and distinct reactions in the white proximal (K+ yellow, C-, KC+ yellow, P+ orange) and distal (K-, C-, KC-, P+ orange) medulla and filiform conidia, straight, 9.0–12.0 × ca. 1.5 µm.

Parmelinella wallichiana (Taylor) Elix & Hale differs in the coriaceous and ciliate thallus, the presence of cortical chlroatranorin and trace of secalonic acid in the medulla (Elix & Hale 1987).

Canoparmelia caroliniana (Nyl.) Elix & Hale differs from *C. matogrossensis* by the white medulla containing divaricatic acid and traces of not identified substances, by the presence of chlroatranorin in the upper cortex, the medullary color reactions KC+ violaceus, P- UV+ bluish white, and by the laminal simple to little ramified or rarely coralloid isidia (Elix et al. 1986).

Canoparmelia sanguinea Marcelli, Benatti & Elix differs from *C. matogrossensis* by the granular to cylindrical isidia simple to partially ramified, generally very agglomerated, laminal, the medulla white containing olivetol-carboxylic acid and by the reactions medullary K-, C+ red, KC+ red, P- (Benatti et al. 2008).

Canoparmelia texana (Tuck.) Elix & Hale differs in the sorediate thallus, the medulla white containing divaricatic acid and by the medullary reactions K-, C-, KC- or + weak violaceous, P-, UV+ light bluish (Elix et al. 1986).

Fig. 4. *Canoparmelia matogrossensis* (holotype, *F. Ciecoski 623(1)*, CNMTf 522). Scale bar = 10 mm.

Parmelinella amazonica (Nyl.) A.S. Rodrigues, A.P. Lorenz & Canêz, *The Bryologist* 124(3): 352–361. MycoBank: MB 839860 Fig. 5

Basonym: *Parmelia amazonica* Nyl., *Flora* 68: 611. 1885. *Pseudoparmelia amazonica* (Nyl.) Hale, *Phytologia* 29(3): 189. 1974. *Canoparmelia amazonica* (Nyl.) Elix & Hale, *Mycotaxon* 27: 278. 1986.

Lectotype: BRAZIL. Pará State: Santarém, *leg. R. Spruce* 111 (h-nyl 35111); (bm, g, ny, w, pc, isolectotypes, fide Hale 1976). Designated by Hale (1959).

Known Distribution: AFRICA: Angola and Madagascar (Aptroot 1991; Hale 1976). NORTH AMERICA: Mexico and United States (Lendemer et al. 2016; Sipman & Wolf 1998). CENTRAL AMERICA: Cuba, Honduras and Puerto Rico (Hale 1976). SOUTH AMERICA: Bolivia, Brazil − Bahia (Lynge 1914), Minas Gerais (Hale 1976, Ribeiro 1998), Mato Grosso do Sul (Fleig & Riquelme 1991), Mato Grosso (Lynge 1914, Hale 1976), Pará (Hale 1976), Paraná (Eliasaro 2001), Rio de Janeiro (Hale 1976), and São Paulo (Kalb 1981. Marcelli 1998a); Colombia, Guyana, Trinidad and Venezuela (Hale 1976, Flakus et al. 2016; Sipman & Aptroot 1992). ASIA: China, Sri Lanka, Thailand, and Taiwan (Ahti et al. 1999; Breuss & Brunnbauer 1997; Hale 1976; Mongkolsuk et al. 2011).

THALLUS corticicolous/ramulicolous; whitish-gray; lustrous; sublaciniate; subpergaminaceous; reticulate to effigurate irregularly distributed macules; satin clear at 10×; epruinose; till 6.0 cm broad. SUBLACINIAE short, dichotomous to sympodial; axils oval to irregular; axillary folds absent; not auto incompatible; 1.0–1.5 mm wide at branching base, the major width 2.0–5.0 mm; laterally superposed to contiguous; loose adnate to strongly conformed to the substrate; black line absent to very subtle, till 0.05 mm thick, not complementary; longitudinal axis distended; transversal cut plane. Proximal surface firm; continuous and smooth becoming rugose and rugulose into the center. Distal surface firm; continuous; smooth. Lateral margin smooth to irregularly cut; sinuous; closed; apical zone depressed; apex irregularly cut to rounded, prostrate. CILIA absent. Secondary laciniae and lobes absent. Lobules and lacinules absent. PUSTULES absent. SORALS absent. ISIDIA common in the proximal surface and absent in the distal zone; concolored, opaque; erect; laminal and few submarginal; isolated; firm to detaching when touched, little rigid; frequently caducous, some of the lost parts adhered to the distal cortex; barrel-shaped to irregular, smooth, surface integer, from straight to slightly sinuous, apices commonly rounded, from integer to capitate, not ramified; very small and difficult to measure ca. 0.05–0.15 mm high × ca. 0.05–0.07 mm thick; eciliate; not auto incompatible. MEDULLA white; firm. UNDERSIDE light brown to brown in the marginal zone and black in the proximal part. Marginal zone light brown to brown; lustrous; satin already clear at 10×; 1.0–2.0 mm wide; attenuate; smooth; papillate; rhizinate till near the margin, rhizines concolored; not fissured. Proximal part black; sublustrous; satin clear at 20×; crumpled to rugose; not fissured. RHIZINES till very near the margin; monomorphic, simple; sinuous; not pigmented; subopaque; not gomose; satin clear at 30×; interlaced and difficult to measure; cylindrical; monometric; ca. 0.10–0.20 mm long × ca. 0.05 mm thick; frequently irregularly distributed all over the proximal part. APOTHECIA absent. PYCNIDIA absent.

Color tests: upper cortex K+ yellow, UV-; medulla K-, KC+ weak yellow, C+ weak yellow, P+ orange, UV-.

Substances of taxonomic importance: atranorin, protocetraric acid.

Examined material: BRAZIL, MATO GROSSO STATE, municipality of Santa Cruz do Xingu; Xingu State Park, Site 20: 9°43'46.70"S, 52°17'25.51"W, elevation 276 m, Seasonal Semidecidual Submontane Forest, on tree trunk in the forest, *leg. F. Ciecoski 844, 866, 868, 872, 873*, 12–II–2021 (CNMTf 523); idem; municipality of Alta Floresta; Cristalino I State Park, Site

27: 9°27'41.33"S, 55°49'11.38"W, elevation 254 m, Dense Submontane Ombrophilous Forest with Canopy, on tree trunk in the forest, *leg. F. Ciecoski 964*, 12–III–2021 (CGMS); idem, Site 29: 9°28'43.24"S, 55°48'52.81"W, elevation 440 m, Dense Submontane Ombrophilous Forest with Canopy, on tree trunk in the forest, *leg. F. Ciecoski 1008*, 13–III–2021 (CGMS).

Comments

Parmelinella amazonica is characterized by the sublaciniate eciliate subpergaminaceous maculate thallus with short sublaciniae laterally superposed to contiguous, proximal surface smooth to rugose and rugulose into the center, laminal and submarginal concolored isidia, underside light brown to brown in the marginal zone and black in the proximal part, papillate and rhizinate, by the medullary reactions K-, KC+ weak yellow, C+ weak yellow, P+ orange, UV-, and by the white medulla containing protocetraric acid.

Elix et al. (1986) treated *P. amazonica* as *Canoparmelia* based on exclusively morphological characters like the absence of cilia, white medulla and presence of papillae in the inferior margin of the lobes. Rodrigues et al. (2021), based exclusively in molecular data, placed *C. amazonica* in *Parmelinella* and highlighted that those characters suggesting that *C. amazonica* pertains to *Parmelinella* are the white medulla and the absence or the presence of only vestiges of triterpenes, characters, commonly found in several genera of *Parmeliaceae* (*e.g.*, *Canoparmelia*, *Parmotrema*, *Hypotrachyna*).

See the distinction from *Canoparmelia matogrossensis* under the Comments of that.

Parmelinella inexplicabilis Marcelli & C.H. Ribeiro differs from *P. amazonica* by the all-negative medullary reactions and by the absence of medullary acids (Marcelli & Ribeiro 2002). Nevertheless, the authors stressed that *P. inexplicabilis* was only provisionally placed in

Parmelinella based in the lobe morphology and the cilia restricted to the axils, knowing that the circumscription of *Parmelinella* includes only species containing acid salazinic and with simple rhizines. In fact, Sipman et al. (2009) transferred the species to *Hypotrachyna* based on chemistry and the presence of rare furcate rhizines, considering also the possibility of *Hypotrachyna* to produce cilia.

Parmelinella wallichiana (Taylor) Elix & Hale differs from *P. amazonica* by the thallus coriaceous, the medullary reactions K+ and P+ and by containing chlroatranorine in the cortex and trace of secalonic acid in the medulla (Elix & Hale 1987).

Parmelinella versiformis (Kremp.) Marcelli differs from *P. amazonica* by the underside dark brown to light brown, the medullary reactions K+ yellow → red with K- parts, KC-, C- and P+ yellow, and by containing salazinic acid in the medulla (Marcelli 1993).

Parmelinella simplicior (Hale) Elix & Hale differs from *P. amazonica* by the thallus subcoriaceous, not isidiate, the medullary reactions K + yellow → red, P + orange, and by the medullary salazinic acid (Elix & Hale 1987).

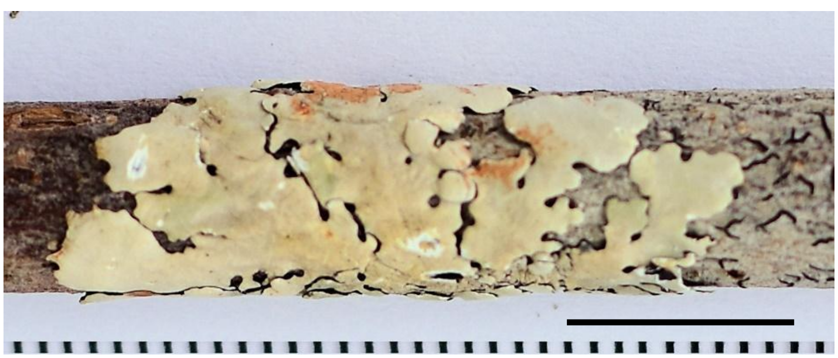

Fig. 5. *Parmelinella amazonica* (*F. Ciecoski 872*, CNMTf 523). Scale bar = 10 mm.

Pseudoparmelia straminea Marcelli & Ciecoski, *sp. nov.* Holotype: BRAZIL, Mato Grosso State, municipality of Santa Cruz of do Xingu; Xingu State Park, Site 20: 9°43'46.70"S, 52°17'25.51"W, elevation 276 m, Seasonal Semidecidual Submontane Forest, on tree trunk in the forest border near to access road to Santa Fé do Xingu Farm, leg. F. Ciecoski 852, 12-II-2021 (CNMTf 524). MycoBank: MB 842851. Fig. 6

Pseudoparmelia straminea differs from P. uleana (Müll. Arg.) Elix & TH Nash by the pergaminaceous, maculate, sublobed thallus with dichotomic to sympodial ramification, the bicolored medulla, and by the subspherical ascospores 5.0–7.5 × 5.0–7.5 µm.

THALLUS corticicolous; greenish; velvet-opaque (velutinous); sublobed; pergaminaceous; not satin even at 45×; till 4.5 cm broad; entire; epruinose; reticulate macules uniformly distributed all over the thallus. SUBLOBES long and narrow, internodes 0.1–0.5 mm long, dichotomous to sympodial; axils frequently oval and acute, few squared; axillary folds rare, erect, 0.5–0.8 mm high × 1/4 of the branch width long; 0.5–2.0 mm wide at branching base, the major width 1.0–4.0 mm; more commonly contiguous, few laterally superposed, and rare straddled; adnate to loose adnate; black line absent; longitudinal axis distended to slightly undulate; transversal cut plane-concave. Proximal surface little firm (but not brittle); continuous; scrobiculate to crumpled. Distal surface little firm (but not brittle); reticulate to continuous and sometimes cracked; scrobiculate to crumpled. Lateral margin irregularly cut, crenate to bicrenate; sinuous to undulate; closed; not auto incompatible; apical zone slightly ascending; apex rounded to irregular, little ascending. CILIA absent. Secondary lobes and lobules absent. Lacinules absent. PUSTULES absent. SORALS absent. ISIDIA absent. MEDULLA normal (cottony); bicolored, a very thin stramineous upper layer and a thicker white layer below, regularly distributed by all to thallus in the proportion 1:4; K+ yellow. UNDERSIDE light olive-green, and yellowish olive-green in a small portion in the center of the thallus. Marginal zone light olive-green; lustrous; satin clear already at 10×; there is no color differentiation between marginal zone and proximal part; crumpled to little cracked; sparsely papillate, papillae concolored; rhizinated almost till the margin; not fissured. Proximal part mostly light olive-green and with a yellowish olive-green small central portion; lustrous in the part light olive-green and sublustrous in the central yellowish olive-green part; satin clear at 20× in the yellowish olive-green part and at 10× (shiny) in the light olive-green part; crumpled to rugose, not fissured. RHIZINES frequent till the marginal zone; monomorphic, simple, sometimes with penicillate apices, cylindrical; few and regularly distributed all over to underside; concolored; not pigmented; sublustrous; not gomose; opaque, satin badly clear at 45×; not interlaced; sinuous; inclined; monometric; 0.50–0.70 mm long × ca. 0.05–0.10 mm wide; isolated and regularly distributed on the underside. APOTHECIA plane; hemi-sulcate; till 1.2 mm diam.; adnate; laminal and submarginal; medulla of the basis K+ yellow; light brown discs, epruinose, open, imperforated, lustrous, satin already visible at 10×; margin till 0.1 mm thick, smooth, not ornamented; amphithecia smooth, emaculated, not ornamented, amphithecial medulla K+ yellow; hymenia till 75 µm high. ASCOSPORES subspherical, hyaline, 5.0–7.5 × 5.0–7.5 µm, 8/ascus. PYCNIDIA absent.

Color tests: upper cortex K+ yellow, UV-; the yellow medulla K+ yellow, C+ yellow, KC+ yellow, P-, UV-; the white medulla K+ yellow, C+ weak yellow, KC+ yellow, P-, UV-.

Substances of taxonomic importance: atranorin, secalonic C acid.

Etymology: the epithet *straminea* comes from the Latin *stramineus* (straw colored) and makes reference to the partially yellowish-straw colored medulla.

Comments

Pseudoparmelia straminea is characterized by the velvet-opaque, sublobed, pergaminaceous and maculated thallus with long and narrow dichotomic to sympodial contiguous ramifications, axils oval and acute, the proximal surface continuous and escrobiculate, the medulla bicolored with a layer upper very thin layer stramineous above and a white layer below, the underside light olive-green, the hemi-sulcate laminal and submarginal apothecia with imperforate lustrous discs, hymenia till 75 µm high, ascospores subspherical 5.0–7.5 × 5.0–7.5 µm, and the medulla containing secalonic C acid.

Fig. 6. *Pseudoparmelia straminea* (holotype, *F. Ciecoski 852*, CNMTf 524). Scale bar = 10 mm.

Pseudoparmelia uleana (Müll. Arg.) Elix & TH Nash is similar in the maculated thallus with rugose under surface, the epruinose apothecia, and in the production of secalonic C acid in the medulla (Elix & Nash 1997). Differs by the thallus coriaceous, lustrous becoming opaque, and rugulose, with superposed lobes, by the light yellow or yellow medulla and by a difference in the sphericity of the ascospores 5–9 × 4–7 µm (Elix & Nash 1997).

Pseudoparmelia sphaerospora (Nyl.) Hale also has a maculated, lustrous, becoming opaque thallus, sparse rhizines apically penicillate, and apothecia with lustrous discs (Elix & Nash 1997). Differs by to brittle thallus with agglomerate, superposed and irregular lobes, by the upper cortex rugulose, the medulla pale yellow, the under surface rugose, light brown to dark olive-green, the bigger ascospores 8–10 × 7–8 µm, medullary reactions K+ orange-yellow and KC+ orange-yellow, and by the presence of butlerins (A, B, C, D, and E) and secalonic acid A (Elix & Nash 1997).

Pseudoparmelia kalbiana Elix & T.H. Nash differs of *P. straminea* by the coriaceous bigger thallus 5–10 cm broad, the light yellow or yellow medulla, the under surface rugose, brown to ivory, by the ellipsoid to subspherical ascospores 9–12 × 7–8 µm, the medullary reactions C+ orange-yellow and KC+ pale orange-red, and by the presence of secalonic acid A, hypostatic acid and hyposalazinic acid in the medulla and chlroatranorine in the upper cortex (Elix & Nash 1997).

Conclusion

These results show that, although the lichenized mycota of *Parmeliaceae* is not abundant, the Amazon rainforest is an important reservoir of new lichen species, and research on *Parmeliaceae* and other families is urgent, including to support conservation activities and government planning.

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CONCLUSÃO

A partir da análise dos resultados, concluiu-se que:

▪ 39 espécies de fungos liquenizados foram registrados nas áreas de estudo.

▪ 34 espécies são novas para a ciência.

▪ 3 espécies são novas ocorrências para Mato Grosso: *Parmotrema subochraceum* Hale, *Parmotrema sulphuratum* (Nees & Flot.) Hale e *Bulbothrix tabacina* (Mont. & Bosch) Hale.

▪ Os liquens são mais abundantes em locais mais iluminados, de dossel aberto e menos abundantes em locais escuros de dossel mais denso.

▪ A ausência de liquens no solo da floresta também foi observada, muito provavelmente devido à densa cobertura de folhas secas e mortas ou em decomposição cobrindo praticamente toda a área.

▪ Pelo grande número de espécies novas encontradas, o local de estudo se caracteriza como um reservatório de biodiversidade e demonstra a falta de recursos humanos qualificados no estudo de fungos liquenizados, desta e de outras famílias.

▪ O Parque Estadual do Cristalino foi mais representativo no número de espécies encontradas, provavelmente por apresentar dossel mais aberto permitindo a entrada de luz, fator preponderante para o desenvolvimento dos liquens.

▪ *Parmeliaceae*, objeto de estudo desta pesquisa, foi representada por 71 exemplares pertencentes a 39 espécies distribuídas em cinco gêneros. (Tabela 1).

Tabela 1: Distribuição das espécies por gênero.

Gênero	**Total de espécies**	**Novas para o Mato Grosso**	**Novas para a Ciência**
Parmotrema	33	2	**30 (90%)**
Bulbothrix	3	1	**2**
Pseudoparmelia	1	-	**1**
Parmelinella	1	-	**-**
Canoparmelia	1	-	**1**
Total	**39**	**3**	**34**

▪ *Parmotrema* foi o gênero mais representativo em número total de espécies (33), espécies novas (30) e número de novos registros para o Mato Grosso (2 espécies, *P. subochraceum* e *P. sulphuratum*).

▪ Por área de estudo (Tabela 2), o Parque Estadual do Cristalino foi o mais representativo com um total de 18 espécies.

Tabela 2: Distribuição das espécies por área de estudo.

Área de estudo	Total de espécies	Espécies conhecidas	Espécies novas
Fazenda São Nicolau	12	1	**11**
Parque Estadual do Cristalino	18	3	**15**
Parque Estadual do Xingu	9	1	**8**
Total	**39**	**5 (13%)**	**34 (87%)**

As espécies apresentaram uma química significativamente diversa, sendo o ácido protocetrárico, ácidos graxos e ácido salazínico os mais comuns, mas, também com a presença de ácido alectorônico, ácido norstictico, ácido girofórico, ácido α-colatólico e ácido vulpínico. Quanto à coloração da medula, o número de espécies com a medula total ou parcialmente colorida por diferentes pigmentos, e várias vezes bicolor (Tabela 3), equivale a cerca de 36% do total, proporção muito diferente, por exemplo, da região Sudeste do Brasil, onde a medula branca é muito mais dominante.

Tabela 3. Variabilidade química das espécies de *Parmeliaceae* deste trabalho.

Gênero	**Química**	**Total de espécies**	**Medula pigmentada**
Parmotrema	Protocetrárico	8	3
	Salazínico	7	3
	Ácidos graxos	9	2
	Alectorônico, norstíctico, girofórico, α-colatólico, vulpínico	9	4
Bulbothrix	Salazínico	2	
	Girofórico	1	
Canoparmelia	Protocetrárico	1	1
Parmelinella	Protocetrárico	1	
Pseudoparmelia	Secalônico-C	1	1
Total		**39**	**14**

Sugere-se que, futuramente seja feito um estudo ecológico das áreas de coleta para responder com maior precisão o porquê da diferença da abundância e riqueza de liquens e que sejam estabelecidas parcerias com liquenólogos especialistas nas demais famílias e/ou hábito dos liquens para que seja ampliado o conhecimento geral dos fungos liquenizados da Amazônia mato-grossense. Além disso, esses resultados poderão ser usados para alicerçar políticas públicas que visem a conservação destes ambientes visto que se tratam de hábitats de grupos biológicos ainda desconhecidos para a ciência.

APÊNDICE

Apêndice A: Vegetação de dossel das áreas de estudo.

Figura 1-6: 1. Dossel da mata no PEC I. **2.** Estrada de acesso às trilhas no PEC I. **3.** Vegetação arbustiva às margens da estrada no PEX. **4.** Vegetação de borda no PEX. **5.** Dossel da mata na Fazenda São Nicolau. **6.** Mata ciliar do córrego na mata da Fazenda São Nicolau.

Apêndice B: Metodologia de coleta e análise das amostras.

Figura 8-15: 8. Coleta no Parque Estadual Cristalino. **9.** Amostras sendo secas ao ar no Laboratório. **10.** Espécimes após triagem e testes químicos. **11.** Análise das estruturas reprodutivas ao microscópio. **12.** Análise Ultravioleta dos espécimes. **13.** Extração de estrato para cromatografia. **14.** Secagem da placa cromatográfica na capela. **15.** Análise Ultravioleta das placas cromatográficas.

Apêndice C: Protocolo do Grupo de Estudos Liquenológicos do Instituto de Botânica utilizado nas descrições das espécies.

PROTOCOLO DESCRITIVO PARA PARMELIACEAE
GRUPO DE ESTUDOS LIQUENOLÓGICOS

Versão novembro/2021

TALO

- substrato: corticícola / saxícola / muscícola / foliícola / outro,
- cor: da parte distal (margem do talo) e da parte proximal (o restante do talo anterior à margem),
- brilho: lustroso / sublustroso / subopaco / opaco / aveludado / outro (parte distal e proximal);
- acetinado: a 10×, a 20×, a 30× (caso ainda não seja acetinado a 30, verificar a 40 e 50×);
- hábito: laciniado / lobado (sub);
- integridade: íntegro / demidiado (com o centro morto) / autoincompatível;
- textura: membranáceo / pergamináceo / coriáceo;
- xx cm de tamanho (c x l, mais usual apenas o comprimento).

LOBOS / LACÍNIOS / SUBLACÍNIOS Todas as características abaixo devem ser descritas para cada aspecto morfológico presente.

- ramificação (comprimento): curta / longa (se longa, medir entrenós);
- ramificação (padrão): dicotômica / anisotômica / isotômica / simpodial / irregular / outra;
- axilas: redondas / ovaladas / auriculadas / agudas / quadráticas / irregulares / rasgadas / outro;
- dobras axilares: abundância / eretas / inclinadas / xx mm altura × xx mm larg. do lobo comp., tornam o talo rígido / permanece flexível;
- autoincompatibilidade: não / sim / cor das partes mortas / descrição das partes mortas;
- integridade: íntegros / segmentados (comprimento dos segmentos); – Mais usual para *Xantoparmelia*.
- comprimento: ca. xx mm (no caso de talos demidiados) / cor das partes mortas; - Mais usual para *Xantoparmelia*.
- xx mm larg. da base,
- xx mm na maior largura,
- máculas (presença): ausentes / fracas / distintas / hipermaculado;
- máculas (distribuição): (onde ocorrem e graus de abundância);
- máculas (forma): puntiformes / lineares / reticulares / efiguradas / outro;
- máculas: verificar se originam quebras / pseudocifelas / sorédios / pústulas / etc.
- pruína: pruinoso / epruinoso / distribuição;
- disposição: espalhados / contíguos / sobrepostos lateralmente / amontoados / contrapostos / encavalados / outro;
- adnação: adnatos / frouxo adnatos / conformados ao substrato / elevados/ revolutos;

eixo longitudinal

- eixo longitudinal: distendido / ascendente / ondulado / outro;

corte transversal

- corte transversal: côncavo / plano / convexo / parte um, parte outro (descreva) / outro
- corte transversal (ascendência da borda): coplanar / ascendente / descendente / involuta / revoluta / outra;

Superfície proximal

- superfície (resistência): firme/ pouco firme / quebradiça (usar lâmina e/ou estilete para verificar);
- superfície (observar todo o eixo longitudinal) (continuidade): contínua / reticulada / quebrada / gretado / craquelado / outro,
- superfície (relevo): lisa / amarrotada / escrobiculada (com depressões) / foveolada / rugosa / ruguloso / corrugada (+) / verrucosa / outra;

Superfície distal

- Superfície (resistência): firme, quebradiça, (usar lâmina e/ou estilete para verificar);
- superfície (observar toda a margem) (continuidade): contínua / reticulada / quebrada / gretado / craquelado / outro,
- superfície (relevo): lisa / amarrotada / escrobiculada (com depressões) / foveolada / rugosa / ruguloso / corrugada (+) / verrucosa / outra;

Margem lateral

- margem lateral (recorte): lisa / crenada / bicrenada / crenulada / irregularmente recortada / outro,
- margem lateral (conformação vertical e horizontal): reta (apenas acompanha a ramificação) / plana / conformada ao substrato / sinuosa / ondulada / crispada (franzida) / outro,
- margem lateral (integridade): fechada / aberta (descrever processo e possível associação com estruturas vegetativas ou reprodutivas) - verificar também margem apical;
- linha negra: variação no talo (indicar onde é presente ou ausente),
- linha negra: espessura em xx mm larg.
- linha negra: nítida / atenuada,
- linha negra: não complementar / complementar;

zona apical

- zona apical (ascendência): prostrada / ascendente / descendente / depressa / convexa / revoluta / involuta / outro;
- ápice (forma): truncado / agudo / redondo / outro
- ápice (ascendência): prostrado / ascendente / descendente / revoluto / involuto / outro.

Cílios (Caixa alta e negrito)

- cor,
- acetinado acima de xx ×;
- pigmento: se presente deverá existir uma espécie de purpurina colorida sobre o cílio, na maioria das vezes dourada (descreva (verifique se a medula ao pé do cílio é pigmentada também),
- reação K+: púrpura / azul-royal / vermelho / maravilha / outro,
- local da reação: apenas na base / na metade basal / em todo o cílio / outro,

- forma: retos / sinuosos / helicoidais / contorcidos / curvados / outro
- afilamento: subulados / pontiagudos e curtos / cilíndricos de ápice truncado / irregulares em diâmetro /outro;
- xx–xx mm comp. × xx–xx mm larg.;
- ascendência: praticamente eretos / ascendentes / coplanares ao lobo (lacínio, etc) / descendentes / funcionando como rizinas / outro;
- ramificação simples / furcados / trifurcados / irregularmente ramificados / cespitosos / dicotômicos (tipo) / esquarrosos / fibrilosos / ápice penicilado / outro;
- entrelaçamento: não entrelaçados / entrelaçados / ápices entrelaçados / outro;
- altura do primeiro ramo: desde a base / desde próximo à base / após ⅓ / após metade da altura / após ⅔ / etc;
- ramificação (número, quando mais que furcadas): de .. a .. / mais que... / pelo menos...
- abundância: raros / poucos / frequentes / abundantes / densos / contíguos;
- distribuição: em toda a margem / axilas das crenas / axilas dos lobos / etc.
- Exclusivo para *Bulbothrix*:
    - cílios: bulbados / não bulbados
    - base esférica: inflada / ovalada / alongada;
    - base: côncava / bicôncava (hemácia);
    - ápices: ausentes / nº de ápices por bulbo
    - ápice: simples, ramificado,
    - distância interciliar: nula / um bulbo / dois bulbos / indicar distribuição (margem, axila).

Lacínios / Sublacínios / Lobos secundários

- origem: marginais nos... (descreva locais e idades) / outro;
- ramificação: dicotômica (anisotômica/isotômica) / simpodial / irregular / outra;
- disposição: contíguos / sobrepostos lateralmente / amontoados / outro;
- localização: ocupando os espaços vazios entre os primários / sobre os primários / outro;
- elevação: prostrados / conformados aos primários / elevados/ revolutos, etc etc;
- descrever os mesmos demais atributos dos primários, mencionando as diferenças entre os primários e secundários: se for o caso diga: idênticos aos primários, exceto pelo tamanho ....;
- tamanho: xx – xx × xx – xx mm; chegam a atingir o tamanho dos primários e se confundir com eles?
- cor no lado de baixo.

Lacínulos / Lóbulos

- cor: concoloridos / outro;
- modo de desenvolvimento;
- distribuição;
- ramificação;
- xx–xx × xx–xx mm,
- conformação (lâmina e ápice): lâmina plana / canaliculada / de ápice reto / curvo / sinuoso / outro;
- forma: retos / sinuosos / contorcidos / ondulados / outro;

- ascendência: coplanares / ascendentes / curvados (base coplanar, mas parte restante curvada ou recurvada);
- ápice: redondo / truncado / agudo;
- linha negra;
- cílios: presença, distribuição, ramificação, forma, tamanho (mesmos atributos dos cílios marginais; verifique);
- cor do lado de baixo;
- outra característica relevante (veja lista das características de lacínulos e lobos, acima);

Pústulas

- abundância;
- forma: verruciforme / arredondada / irregular / outro;
- confluência: mencionar se elas se fundem ao crescerem, como e quanto;
- distribuição;
- tamanho xx mm;
- erupção: erumpentes / não erumpentes;
- integridade: íntegras / rebentam em (erumpentes)... / se desmancham em;
- origem e desenvolvimento;
- caducas: não / sim (descrever processo e consequências);
- pigmento K+ ou K- (verifique a medula dentro (medula da pústula) e abaixo procurando pigmentos);

Sorais

- abundância;
- disposição: laminais / marginais/ marginais e dobras / ápice de lacínulos / lacínulos / lóbulos / outro;
- forma: lineares contínuos / lineares interrompidos / capitados / labriformes / orbiculares / outro;
- medidas dos sorais (xx–xx × xx–xx mm diâm.);
- coalescência: mencionar se eles se fundem ao crescerem, como e quanto;
- presença de cílios (só mencionar se forem presentes, então descrever BEM a quantidade, disposição, tamanho e outros atributos dos cílios);
- origem e desenvolvimento (detalhado); (quando no ápice não é necessário detalhar)
- estado do córtex ao redor do soral: íntegro / em desagregação / soltando placas / etc.;
- pigmento K+ ou K- (verifique a medula dentro, abaixo e nas proximidades procurando pigmentos).

Sorédios

- caducidade: caducos / persistentes;
- autoincompatibilidade: se presente, afeta produção ou coloração dos sorédios? Como?
- tamanho do grão: farinhosos / granulares / isidioides / outro;
- presença de córtex (grânulos): ausente / presente apenas nos mais velhos / presente em parte (mistura de sorédios e grânulos - quantificar);

- se córtex presente: em todo o grânulo / em parte do grânulo (descrever) / restos do córtex original do talo que cobria o soral / restos do córtex ao redor do soral em crescimento / outro;
- organização: amontoados / empilhados (descrever) / isidioides / outro;
- distribuição específica (sorédios, não sorais): laminais / submarginais / marginais / na borda de placas corticais;
- ontogenia;
- pigmento K+ ou K-

Isídios

- cor: da base / do ápice;
- brilho: lustrosos / opacos / outro;
- abundância: graus de abundância / densos;
- posição: curvados / eretos / procumbentes / outro;
- disposição: laminais / marginais/ marginais e dobras / ápice lacínios/ lacínulos / outro,
- agrupamento (não confundir com disposição): não agrupados / cespitosos / em grupos... (descreva) / outro
- caducidade: firmes / caducos / destacam ao toque / outro
- fragilidade: rígidos / quebradiços / frágeis / desmancham ao toque / etc.
- forma geral: cilíndricos / achatados / granulares / barriliformes (dolioliformes) / de diâmetro irregular / outro,
- forma – contorno (silhueta e superfície): descrever os detalhes do contorno da forma geral (liso / tuberculado / ondulado / moniliforme / irregular (descrever) / pustuloides (parecem pústulas, mas são sólidos) / inflados (pustulados, colocar como pústulas isidioides e não como isídios) /etc.;
- superfície: íntegra / erodida (não tem córtex) /;
- forma – curvatura: retos / curvos (descrever) / sinuosos / outro (descrever em detalhe),
- forma do ápice: pontiagudo / truncado / arredondado / outro,
- cor do ápice: marrom / negro / escurecido / hemisférico... (parece palito de fósforo) / outro,
- integridade do ápice: íntegro / ecorticado / decapitado / pseudocifelado / erodido / etc.;
- base: constrita / não constrita (dica: normalmente os de base constrita deixam uma cicatriz ao cair, os de base não constrita deixam a sua base no talo ao caírem;
- ramificação: simples / ramificados (descrever e quantificar as ramificações) / antleriformes (ramificação espalhada, tipo chifre de veado) / coraloides / coplanar (no mesmo plano) / outro (preste atenção na proliferação das bases dos isídios caídos e como ela influencia na ramificação);
- ramificação (altura): desde a base / apenas na base / a partir de... / apenas .... / outro;
- disposição da ramificação: irregular / coplanar / outra;
- xx–xx × xx–xx mm;
- presença de cílios (se presentes, descrever a quantidade, disposição, tamanho e outros atributos dos cílios);
- descrever se forem sorediados, pustulados, se desenvolverem lóbulos, etc.;
- origem e desenvolvimento (detalhado): indicar se há presença de cicatrizes de isídios caídos.
- autoincompatibilidade: se presente, afeta produção, coloração ou ramificação dos isídios? Como?

Outra ornamentação (só mencionar se presente): lóbulos, filídios, dáctilos, esquizídios, etc (verificar os mesmos atributos de sorais e isídios);

ESQUIZÍDIOS

- cor: da base / do ápice; concolorido;
- concavidade: a grande maioria plano (alguns/ raros/...)
- distribuição: proximal, distal, exceto alguma parte, por todo o talo, em parte do talo, restrito a qual parte.
- xxx mm diâm.:
- brilho: coacetinado como o talo;
- caducidade: firmes/ relativamente firmes / caducos / destacam ao toque / caídos sobre o talo/
- presença de estruturas ornamentais: não ornamentado/ (cílios, desmanchando em sorédios, isídios, picnídios, ...);
- origem e desenvolvimento (detalhado).

MEDULA

- cor: branca / amarelo claro ou forte / salmão / ocre/ marrom / estramíneo / outro;
- bicolorida: citar proporção (em espessura) e distribuição das cores (observar as partes jovens e velhas do talo) / observar se há alternância na posição das camadas;
- pigmento: ausente/ presente (se presente descrever detalhadamente a disposição; verificar no lado de baixo),
- cor do pigmento,
- reação do pigmento: negativa / amarelo / púrpura (roxo) / azul-royal / vermelho / maravilha / ferrugem / verde / inicia avermelhando, mas passa a arroxear até ficar... (preste atenção, isso pode indicar mistura de pigmentos de mesma cor) / outro;
- densidade: firme / normal / frouxa.

LADO DE BAIXO

- cor: na **zona marginal** e na **parte proximal**;
- Acrescentar peculiaridades.

Zona marginal

- cor: marrom / negra / branca / marfim / variegada (tem manchas distintas?) / outra;
- brilho: lustroso / sublustroso / opaco / aveludado / outro;
- acetinado acima de xx ×;
- largura (mm) (quando atenuado, medir na metade da transição);
- limite: atenuado / nítido;
- relevo: lisa / papilada / amarrotada / rugosa / rugulosa / verrucosa / verruculosa / venada / aracnoide / radial / epapilado /etc.;
- presença de papilas: papilado / epapilado
- papilas: abundância, cor - anote a diferença de cor entre base e ápice, se houver;
- presença de rizinas: rizinado / errizinada;
- fissuras (presença): ausentes, abundância (graus de abundância),

- fissuras (ramificação): não ramificadas, ramificadas, padrão de ramificação, comprimento x largura,
- fissuras (cicatrização): cicatrizadas, não cicatrizadas, algumas cicatrizadas, maior parte cicatrizada,
- Fissuras (bordas): sem elevação de borda / com bordas elevadas / outro.

Parte proximal

- cor: marrom / negra / branca / marfim / variegada (dizer como) / outra;
- brilho: lustroso / sublustroso / opaco / aveludado / outro;
- acetinado acima de xx ×;
- relevo da superfície: lisa / papilada / amarrotada / rugosa / corrugada / rugulosa / verrucosa / verruculosa / venada / (quando com veias, caracterizar a ocorrência, sinuosa, perpendicular) etc.;
- fissuras (presença): não fendida / fendida (descrição: abundância, disposição, ramificação, cicatrização, elevação das margens, etc.);
- fissuras (disposição):
- fissuras (ramificação): não ramificadas, ramificadas, padrão de ramificação, comprimento x largura,
- fissuras (cicatrização): cicatrizadas, não cicatrizadas, algumas cicatrizadas, maior parte cicatrizada,
- Fissuras (bordas): com elevação de bordas / sem bordas elevadas / outro.

RIZINAS

- presença: ausentes / ausentes da zona marginal / presentes inclusive na zona marginal / outro;
- dimorfismo: monomórficas / dimórficas / trimórficas (descrever cada tipo em detalhe e a distribuição relativa deles: se misturados, se regionalizados - como?);
- cor: negras / concoloridas / base isso ápice aquilo / etc;
- pigmento: se presente deverá existir uma espécie de purpurina colorida sobre o cílio, na maioria das vezes dourada: descreva (verifique se a medula ao pé da rizina é pigmentada também),
- reação: pigmento (cor) K+ presente (púrpura, azul, vermelho, etc.);
- brilho: lustroso / sublustroso / opaco / aveludado / outro;
- gomosas: gomosas / não gomosas (se tem goma, grudenta);
- acetinado acima de xx ×;
- ramificação: simples / furcadas/ trifurcadas / irregularmente ramificadas/ dicotômicas / dendroides / esquarrosas / arbusculares / fibrilosas / palmadas / fasciculadas / etc ,
- altura do primeiro ramo: desde a base / desde próximo à base / após ⅓ / após metade da altura / após ⅔ / etc,
- ramificação (número, quando mais que furcadas): de .. a .. / mais que ... / pelo menos…;
- entrelaçamento: não entrelaçadas / entrelaçadas / ápices entrelaçados / outro (descreva);
- forma: retas / sinuosas / curvadas / crespas / contorcidas / cilíndricas/ outro;
- orientação: eretas / inclinadas / recurvadas / tombadas sem orientação / tombadas em direção ao centro / prostradas sem orientação / prostradas orientadas ... / gomosa (parecem coladas, ou quase, ao lado de baixo) / outro;
- agregação: isoladas / aglutinadas / fasciculadas / emaranhadas / ápice emaranhado;

- afilamento: subuladas / cilíndricas / planiformes;
- tamanho: monométricas (todas do mesmo tamanho) / dimétricas (tamanhos diferentes juntas na região do talo com a mesma idade) / outro;
- xx–xx × xx–xx mm (quando dimétricas, apresentar as duas medidas);
- abundância: raras / poucas / frequentes/ abundantes/ formando tomento;
- distribuição: homogeneamente distribuídas / agrupadas (onde? grupo de quantas?).

REPRODUÇÃO INDIRETA

APOTÉCIOS (Caixa alta e negrito)

- adnação (estipe) (descrever de jovem até velho): planos/ côncavos/ bulados / sub-bulados / cupuliformes (taça de conhaque) / infundibuliforme (taça de martini, funil) / convexos / outro;
- contorno (estipe) (descrever de jovem até velho): sulcado (verticalmente vincados, em forma de moranga, como tendo gomos) / hemi-sulcados / petaloide / outro (deixar para descrever as fendas abaixo, em "disco");
- xx-xx mm diâm.;
- disposição: laminais / submarginais/ sub terminais / no ápice de lacínios / outro,
- base K+ ou K-;

- disco (cor): esverdeado / marrom claro / badio / marrom escuro / enegrecido / branco / outro,
- disco (pruína): presente / ausente (citar cor),
- disco (recorte): inteiro / fendido (descrever número de fendas e a profundidade delas - e.g. até 1/3 do raio),
- disco (conformação): aberto / dobrado (fechado como boca) / involuto (com dobras para dentro; citar número de dobras) / ondulado / sinuoso / lobado / lacerado / etc. (pode ser mais de um),
- disco (perfuração): imperfurado / perfurado,
- disco (perfuração - origem): desde a formação / aparece nos jovens / aparece nos velhos / aparece nos muito velhos / apenas ocasional naqueles ... (mencione a abundância),
- disco (perfuração - forma): circular / em fenda / irregular / etc.,
- disco (perfuração - margem): sem margem talina / com margem talina (mencionar caso se feche com o tempo),
- disco (perfuração - margem): lisa / crenulada / irregular / etc.;

- margem (espessura): fina / espessa / xx mm larg.
- margem (recorte): lisa / crenada / denteada / fendida
- margem (recorte interno; se houver) [explicação: a margem pode ser, por exemplo, lisa por fora e crenulada em direção ao disco];
- margem (ornamentação): nua / coronada / ciliada / pustulada / isidiada / lobulada / sorediada (descrever);

- anfitécio (relevo): liso / vincado / rugoso / amarrotado / escrobiculado / etc (descrever do alto para a base, onde se inicia e termina o relevo; associe também com a idade do apotécio),
- anfitécio (máculas): emaculado / maculado (descrever, distribuição),

- anfitécio (ornamentação): não ornamentado / isidiado / sorediado / ciliado / rizinado / escábrido (pelos curtos e grossos) / pustulado (descrever em detalhe, inclusive distribuição),
- anfitécio K+ ou K-;

- estipe (posição): central / excêntrico,
- estipe: xx–xx mm alt. × xx–xx mm larg. (se bulado, citar a relação de tamanho entre o diâmetro do estipe de do disco - ex.: "metade do diâmetro do disco"),
- estipe (relevo): liso / longitudinalmente pregueado / rugoso / amarrotado / escrobiculado / etc
- estipe (maculação): emaculado / maculado (descrever, inclusive distribuição),
- estipe (ornamentação): não ornamentado / isidiado / sorediado / ciliado / pustulado (descrever em detalhe, inclusive distribuição),
- estipe K+ ou K-;

- epitécio xx µm.

- himênio xx µm alt. [Sempre efetuar a medida].

- subhimênio tipo de tecido, xx µm alt., cor, formado por hifas (usar "células," se vistas em corte transversal) de orientação .... e paredes ...

- hipotécio tipo de tecido, xx µm alt., cor, formado por hifas (usar "células," se vistas em corte transversal) de orientação .... e paredes ...

Ascósporos

- forma: elipsoides / longo elipsoides / ovais / esféricos/ oblongos (verificar se são retos ou curvos),
- (xx–) xx–xx × xx–xx (–xx) µm,
- **[**obs. importante: os mais longos são os mais estreitos? / os mais longos são os mais largos?]
- episporo: xx µm (parede do esporo),
- cor: hialino / incolor / marrom
- anotar presença de gútulas: (gotas de gordura; confirmar com álcool): unigutulado / bigutulado / gútulas ausentes / etc.
- quantidade por asco: 8/asco; 16/asco,

Picnídios

- disposição: laminais / submarginais / subapicais / restritos aos lacínulos / restritos ao anfitécio / etc. etc. etc., (pode ser mais de um; explique, principalmente se ocorrerem nos apotécios ou nos propágulos),
- imersão: imersos, semi-emersos / em depressões / em criptas / outro,
- cor do ostíolo: negro / marrom.

Conídios

- forma: filiformes / sublageniformes / bifusiformes / unciformes / bacilares / sigmoides / fusiformes / outros,

- <u>forma (curvatura):</u> retos / ligeiramente curvados / curvados / outros,
- <u>xx–xx × ca. xx µm ou xx–xx × xx µm.</u>

TESTES DE COLORAÇÃO

- se a medula for bicolorida, fazer as reações em ambas e mencionar.
- use esta seta se necessário: → (para indicar variação de cor: laranja→vermelho)
- não esqueça de anotar reações do tipo: branco leitoso, amarelo leitoso, buraco, compactação, bolhas, gelificação, limpeza (some o conteúdo e fica apenas a esponja do micélio), descora o pigmento, etc...

➢ Córtex superior K, UV

➢ Medula K, C, KC, P, UV

➢ Substâncias de importância taxonômica: após TLC, microcristalização.

Exemplo:
Testes de coloração: córtex superior K+ amarelo, UV-**;** medula K-, C+ amarelo, KC+ rosa, P-, UV+ azul-gelo.
Substâncias de importância taxonômica: atranorina, ácido alectorônico.

<u>Graus de abundância (válido para todos os aspectos):</u>

Raros: quase ausentes; precisa procurar muito
Poucos: fáceis de ver, mas um aqui e outro ali
Comuns: não tem tantos, mas eu não chamaria de "poucos"
Frequentes: tem bastante, mas eu não chamaria de "muitos"
Abundantes: Ah! Isso eu chamo de "muito", mas eles ainda estão separados por espaço maior que 2 ou 3 cílios
Densos: a distância entre eles é de aproximadamente 1 cílio
Contíguos: extremamente densos; se desenvolvem um ao lado do outro ou praticamente isso

ANEXOS

Anexo A. Normas do Periódico *Acta Botânica Brasilica*. no qual o Capítulo 1 será submetido.

Acesso livre

Acta Botânica Brasilica

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Sobre o jornal

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Acta Botanica Brasilica (**Acta bot. bras.**) é a revista oficial da Sociedade Botânica do Brasil e foi fundada em 1987. Desde 1998, a revista publica quatro números por ano. Artigos experimentais, teóricos e aplicados em todos os aspectos da biologia de plantas (incluindo algas) e fungos são bem-vindos. O manuscrito submetido ou seu conteúdo essencial não deve ter sido publicado anteriormente ou estar sendo considerado para publicação em outro lugar. As contribuições devem ser substanciais, escritas em inglês de alta qualidade e mostrar interesse geral. Manuscritos que relatam aspectos de interesse local são desencorajados, a menos que as implicações das descobertas sejam de grande alcance. Espera-se que manuscritos com assuntos agronômicos contenham uma quantidade substancial de biologia vegetal básica.

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Escopo da revista

Artigos experimentais, teóricos e aplicados em todos os aspectos da biologia de plantas (incluindo algas) e fungos são bem-vindos. O manuscrito submetido ou seu conteúdo essencial não deve ter sido
publicado anteriormente ou estar sendo considerado para publicação em outro lugar. As contribuições
devem ser substanciais, escritas em inglês e mostrar interesse geral. Manuscritos que relatam
aspectos de interesse local são desencorajados, a menos que as implicações das descobertas sejam de
grande alcance. Espera-se que manuscritos com assuntos agronômicos contenham uma quantidade substancial
de biologia vegetal básica. Clique aqui (http://acta.botanica.org.br/for-authors-journal-scope-and-instructi- ons/) para ver detalhes adicionais.

Por que publicar na Acta Botanica Brasilica?

- *Acta bot. sutiãs.* é uma revista indexada, de acesso aberto e revisada por pares, dedicada à publicação de pesquisas de alta qualidade em Biologia Vegetal.
- Todos os manuscritos publicados pela *Acta bot. sutiãs.* são de acesso aberto, maximizando o impacto de sua pesquisa.
- As submissões são revisadas por pelo menos dois especialistas que avaliam a qualidade científica e a novidade.
- Nosso processo de revisão é muito eficiente. Levará apenas cerca de dois meses para a primeira decisão sobre seu manuscrito.
- Os manuscritos são divulgados para todos os membros da SBB, disponíveis no site da revista, na base de dados SciELO e nas redes sociais.
- *Acta bot. sutiãs.* está indexado em Scopus e Web of Science, entre outros.
- Aumentando o fator de impacto: *Acta bot. sutiãs.* O FI vem aumentando nas últimas avaliações (de 0,374 em 2012 para 1,048 em 2019).

Edição de idioma

Se o inglês não for sua primeira língua, é altamente recomendável que seu manuscrito seja editado para o idioma antes do envio. Este não é um passo obrigatório, mas pode ajudar a garantir que o conteúdo acadêmico do seu artigo seja totalmente compreendido pelos editores e revisores do periódico. A edição de idioma não garante que seu manuscrito seja aceito para publicação. Os autores são responsáveis por todos os custos associados a tais serviços.

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Artigos Originais Avaliações

Métodos de Sites de vista Comunicações curtas

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O gerenciamento de submissão e avaliação de manuscritos submetidos envolverá o sistema de submissão de manuscritos online da Revista. O texto do manuscrito deve ser preparado em inglês (veja **PREPARANDO O ARQUIVO DE ARTIGO** abaixo para detalhes) e submetido online (http://mc04.manuscriptcentral.com/abb-scielo). Figuras, tabelas e outros tipos de conteúdo devem ser organizados em arquivos separados para submissão (veja **Preparando Tabelas, Figuras e Material Suplementar** abaixo para detalhes). Se você estiver usando o sistema de submissão online pela primeira vez, vá para a página de login e gere um nome de login e senha depois de clicar em “ **Novo usuário - cadastre-se aqui**" link. Se você já é cadastrado, mas precisa ser lembrado do seu login ou senha, por favor, vá até a página de login e informe seu e-mail em “ **ajuda de senha** ”. Por favor, nunca crie uma nova conta se você já estiver registrado.

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Todos os manuscritos devem ser enviados com uma carta de apresentação, que deve incluir um resumo de aproximadamente 80 palavras dos Sites fortes científicos do trabalho que os autores acreditam qualificá-lo para consideração pela *Acta Botanica Brasilica.* A carta de apresentação também deve incluir uma declaração declarando que o manuscrito relata trabalho não publicado que não está sob consideração ativa para publicação em outro lugar, nem foi aceito para publicação, nem publicado na íntegra ou em parte (exceto na forma de resumo).

Preparando o arquivo do artigo

(Consulte a última edição da **Acta Botanica Brasilica** para layout e estilo)

Todos os manuscritos devem seguir estas orientações: o texto deve ser em fonte Times New Roman, tamanho 12, espaço duplo e margens de 25 mm; o tamanho do papel deve ser definido como A4 (210 x 297 mm). Todas as páginas devem ser numeradas sequencialmente. Cada linha do texto também deve ser numerada, com a linha superior de cada página sendo a linha 1. Para arquivos de texto .doc, .docx e .rtf são os únicos formatos aceitáveis. Arquivos no formato Adobe ®PDF (arquivos .pdf) não serão aceitos. Quando apropriado, o arquivo do artigo deve incluir uma lista de legendas de figuras e cabeçalhos de tabela no final. Este arquivo de artigo não deve incluir nenhuma ilustração ou tabela, todas as quais devem ser enviadas em arquivos separados. Também não inclua código de campo.

A **primeira página** deve indicar o tipo de artigo (Artigo Original, Revisão, Site de Vista, Método, Comunicação curta ou MDD) e fornecer um título completo conciso e informativo seguido dos nomes de todos os autores. Cada nome deve ser seguido do número Orcid e um número sobrescrito de identificação ([1, 2, 3] etc.) associado ao endereço institucional apropriado a ser inserido mais abaixo na página. Apenas um autor correspondente deve ser indicado com um asterisco e deve ser sempre o autor da submissão. O(s) endereço(s) institucional(is) de cada autor deve(m) ser listado(s) a seguir, sendo cada endereço precedido pelo número sobrescrito quando apropriado. O endereço deve ser sintético e em inglês com instituição, CEP, cidade, estado e país. Não traduza laboratório, departamento e universidade. Títulos e cargos não devem ser mencionados. Esta informação é seguida do endereço de e-mail do autor correspondente.

A **segunda página** deve conter um **Resumo** estruturado não superior a 200 palavras em um único parágrafo sem referências. O Resumo deve delinear o conteúdo essencial do manuscrito, especialmente os resultados e a discussão, destacando a relevância dos principais achados.

O Resumo deve ser seguido de cinco a dez **palavras-chave** . Observe que as palavras essenciais do título devem ser repetidas nas palavras-chave.

Os artigos originais devem ser divididos em seções apresentadas na seguinte ordem:

Folha de rosto Resumo Introdução
Materiais e métodos Resultados

Discussão
Agradecimentos Referências

Tabelas e legendas de figuras
Dados complementares (se aplicável)

Material e métodos e **Resultados** devem ser claros e concisos. A seção **Discussão** deve evitar a repetição extensa dos resultados e deve terminar com algumas conclusões. Esta seção pode ser combinada com resultados (**Resultados e discussão**), no entanto, recomendamos que os autores consultem o Conselho Editorial para uma avaliação prévia.

Os nomes das plantas devem ser escritos por extenso no resumo e novamente no texto principal para cada organismo na primeira menção, mas o gênero só é necessário para a primeira espécie em uma lista dentro do mesmo gênero (por exemplo,
Hymenaea stigonocarpa e *H. stilbocarpa*). A autoridade (por exemplo, L., Mill., Benth.) é necessária apenas na seção Material e Métodos. Use o Índice Internacional de Nomes de Plantas (www.ipni.org) para os nomes corretos das plantas. Cultivares ou variedades devem ser adicionados ao nome científico (por exemplo , *Solanum lycopersicum* 'Jumbo'). Os autores devem incluir em Material e Métodos uma referência ao(s) espécime(s) e número(s) do comprovante das plantas ou outro material examinado.

As abreviaturas devem ser evitadas, exceto em casos usuais (ver edições recentes) e todos os termos devem ser escritos por extenso quando usados para iniciar uma frase. As abreviaturas não convencionais devem ser explicitadas na primeira menção.

Unidades de medida. *Acta bot. sutiãs.* adota o *Systéme International d'Unités* (SI). Para volume, use o metro cúbico (por

exemplo, 1×10^{-5} m^3) ou o litro (por exemplo, 5 µL, 5 mL, 5 L).

Para concentrações, use µM, µmol L^{-1} ou mg L^{-1} . Para tamanho e distância use metros (cm, mm, um, etc) e seja consistente no manuscrito.

Números até nove devem ser escritos, a menos que sejam medidas. Todos os números acima de dez devem estar em algarismos, a menos que estejam iniciando frases.

As citações no texto devem tomar a forma de Silva (2012) ou Ribeiro & Furr (1975) ou (Mayer & Wu 1987a; b; Gonzalez 2014; Sirano 2014) e ser ordenadas cronologicamente. Artigos de três ou mais autores, mesmo na primeira menção, devem ser abreviados com o nome do primeiro autor seguido de *et al* . (por exemplo, Simmons *et al* . 2014). Se dois autores diferentes tiverem o mesmo sobrenome e o artigo tiver o mesmo ano de publicação, indicar suas iniciais (ex. JS Santos 2003). Apenas se refira a artigos como 'no prelo' se eles tiverem sido aceitos para publicação em um periódico nomeado, caso contrário, use os termos 'unpubl. res.», indicando as iniciais e o apelido do interessado (por exemplo, RA Santos unpubl. res.).

As referências devem ser organizadas em ordem alfabética com base no sobrenome do(s) autor(es). Quando o(s) mesmo(s) autor(es) tem dois ou mais artigos listados, esses artigos devem ser agrupados em ordem de ano. As letras 'a', 'b', 'c', etc., devem ser adicionadas à data dos trabalhos com a mesma citação no texto. Por favor, forneça DOI de documentos 'in press' sempre que possível.

Para artigos com **seis** autores ou menos, por favor, forneça os nomes de *todos* os autores. Para artigos com **sete** autores ou mais, por favor, forneça apenas os nomes dos *três primeiros* autores, seguidos de *et al* .

Por favor, siga os estilos:

Livros

Smith GM. 1938. Botânica criptogâmica. Vol. II Briófitas e Pteridófitas. 2º. ed. Nova York, McGraw-Hill Book Company.

Capítulos em livros

Schupp EW, Feener DH. 1991. Filogenia, forma de vida e dependência de habitat de plantas defendidas por formigas em uma floresta panamenha. In: Huxley CR, Cutler DC. (eds.) Interações formiga-planta. Oxford, Oxford University Press. pág. 175-197.

Artigos de pesquisa

Alves MF, Duarte MO, Oliveira PEAM, Sampaio DS. 2013. Autoesterilidade no hexaplóide *Handroanthus serratifolius* (Bignoniaceae), a flor nacional do Brasil. Acta Botânica Brasilica 27: 714-722.

Artigos no prelo (antes da impressão)

Alves JJ, Sampaio MTY. 2015. Estrutura e evolução das flores. Acta Botânica Brasilica (no prelo). doi: 10.1590/0102- 33062015abb3339

Diários somente online

Wolkovich EM, Cleland EE. 2014. Nichos fenológicos e o futuro dos ecossistemas invadidos com as mudanças climáticas.
Plantas AoB 6: plu013 doi:10.1093/aobpla/plu013

Tese (a citação deve ser evitada)

Souza D. 2014. Reguladores de crescimento vegetal. Tese de Doutorado ou Mestrado, Universidade do Brasil, Brasil.

Sites e outras fontes (a citação deve ser evitada)

Anônimo. 2011. Título da cartilha, folheto, relatório, etc. Cidade, Editora ou outra fonte, País.

As referências a sites devem ser estruturadas como: nome do(s) autor(es) inicial(is) do(s) autor(es). ano. Título completo do artigo. URL completo. 21 de outubro de 2014 (Data do último acesso bem-sucedido).

Os agradecimentos devem ser preferencialmente em menos de 80 palavras. Seja conciso: “agradecemos…” é preferível a “Os presentes autores gostariam de expressar seus agradecimentos a…”. As informações de financiamento devem ser incluídas nesta seção.

Deve-se seguir o seguinte exemplo:

Agradecemos ao Centro de Microscopia (UFMG) pelo fornecimento de equipamentos e suporte técnico para experimentos envolvendo microscopia eletrônica. Agradecemos também a JS Santos pelo auxílio nas análises estatísticas. Este trabalho foi financiado através de uma bolsa de pesquisa do Conselho Nacional de Desenvolvimento Científico e Tecnológico - CNPq (ID number).

Para **COMUNICAÇÕES CURTAS** , observe que as diretrizes editoriais aplicáveis aos artigos originais também devem ser aplicadas aqui. Em geral, a diferença entre artigos originais e comunicações curtas é a **falta de subseções no texto** e espaço limitado para ilustrações neste último. Figuras e tabelas podem estar presentes, desde que o tamanho total do manuscrito não ultrapasse o limite de cinco páginas impressas (material suplementar pode ser adicionado). O resumo (como descrito para artigos originais) deve ser seguido de um "texto corrido" (uma única seção, sem subtítulos), seguido dos agradecimentos e referências.

Elaboração de Figuras, Tabelas e Material Suplementar

Todas as figuras (fotografias, mapas, desenhos, gráficos, diagramas, etc.) e tabelas devem ser citadas no texto, em ordem crescente. As citações de figuras no texto devem aparecer de forma abreviada e em maiúsculas (por exemplo, Fig. 1, Fig. 2A- D, Fig. 3A, Figs. 3A, 4C, Tab.1).

As dimensões máximas das figuras individuais devem ser de 170 × 240 mm. A largura de um componente individual pode ser 170 mm ou 85 mm, sem exceção, enquanto a altura pode ser ≤ 240 mm. Para imagens de tons contínuos (por exemplo, fotografias), forneça arquivos TIFF em 300 dpi. Desenhos mais complexos, como ilustrações botânicas detalhadas, não serão redesenhados e deverão ser fornecidos como arquivos TIFF de 600 dpi.
O agrupamento de gráficos ou imagens relacionadas em uma **única figura** (uma placa) é fortemente encorajado. Quando um bloco de material ilustrativo for composto por várias partes, cada parte deve ser rotulada com letras maiúsculas sequenciais, na ordem de sua citação no texto (A, B, C, etc.). As letras que identificam imagens individuais devem ser inseridas dentro de círculos brancos no canto inferior direito. Para separar as imagens agrupadas, os autores devem inserir barras brancas (1mm de espessura).

As imagens individuais (não agrupadas como placa) devem ser identificadas com algarismos arábicos sequenciais, na ordem de sua citação no texto (Fig. 1, Fig. 2, Fig. 3, etc.), apresentadas da mesma forma que as letras identificando imagens individuais (descritas acima).

O número que identifica uma figura agrupada (por exemplo, Fig. 2) não deve ser inserido na placa, mas deve ser referenciado apenas na legenda da figura e no texto (por exemplo, Fig. 2A-C).

As barras de escala, quando necessárias, devem ser posicionadas no canto inferior direito da figura. As unidades da barra de escala devem ser fornecidas no final da legenda da figura ou, quando uma figura contém várias barras de escala com unidades diferentes, acima de cada barra.
Os detalhes dentro de uma figura podem ser indicados com setas, letras ou símbolos, conforme apropriado.

As tabelas devem ser precedidas de títulos, indicados com algarismos arábicos sequenciais (Tabela 1, 2, 3, etc.; não abreviar). As tabelas devem ser criadas usando a função Tabela do Microsoft Word™. Colunas e linhas devem estar visíveis, embora nenhuma linha escura deva ser usada para separá-las. As regras horizontais devem ser usadas apenas na parte superior (abaixo do título) e na parte inferior (abaixo da linha final) da tabela. Não use preenchimentos, sombreamentos ou cores nas tabelas.

Quando apropriado, dados em excesso (mas importantes) podem ser enviados como Arquivos Suplementares, que serão publicados online e disponibilizados como links. Isso pode incluir figuras adicionais, tabelas ou outros materiais necessários para documentar completamente a pesquisa contida no artigo ou para facilitar a capacidade dos leitores de entender o trabalho.

Os Materiais Suplementares estão vinculados à página principal do artigo. Eles podem ser citados usando o mesmo DOI do artigo.

Os Materiais Suplementares devem ser apresentados em arquivo .doc apropriado para texto e tabelas e arquivo .tiff em 300dpi para figuras e gráficos. O título completo do trabalho e os nomes dos autores devem ser incluídos no cabeçalho. Todas as figuras e tabelas suplementares devem ser referenciadas no corpo do manuscrito como “Tabela S1” e/ou “Figura S1”.

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O Processo de Revisão

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Como enviar um artigo revisado

Após a revisão por pares, acesse “clique aqui para enviar uma revisão” e faça o upload da nova versão do manuscrito. Lembre- se de excluir os documentos em duplicata.

Processo de publicação e impressão

Após a aceitação, uma prova em PDF será enviada aos autores correspondentes como anexo de e-mail. As provas corrigidas devem ser devolvidas em até 72 h. É de responsabilidade exclusiva do autor correspondente a verificação de erros na prova.

Cada artigo é identificado por um DOI (Digital Object Identifier) único, um código utilizado na consulta e referência bibliográfica.

As datas de submissão e aceitação serão impressas em cada artigo.

O autor correspondente receberá gratuitamente um PDF ou URL que dá acesso ao artigo online e a um PDF para download.

O autor correspondente é responsável por distribuir este PDF ou URL para qualquer coautor.

Má conduta

A má conduta nos manuscritos submetidos levará à rejeição imediata. Publicação duplicada, plágio, manipulação de figuras, submissão dupla e qualquer outro método fraudulento não serão tolerados.

Caso seja detectada má conduta após a publicação do manuscrito, o artigo será retratado e uma nota de retratação será publicada.

Os manuscritos enviados podem ser digitalizados para detectar plágio e verificar a originalidade dos artigos.

Sociedade Botânica do Brasil
SCLN 307 - Bloco B - Sala 218 - Ed. Centro de Controle Asa Norte CEP: 70746-520 Brasília/DF - Alta Floresta - MT - Brasil
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SciELO - Scientific Electronic Library Online

Rua Dr. Diogo de Faria, 1087 – 9º andar – Vila Clementino 04037-003 São Paulo/SP - Brasil E-mail: scielo@scielo.org

Anexo B. Normas do Periódico *Acta Amazonica*, no qual o Capítulo 2 será submetido.

ACTA BOTANICA BRASILICA

Published on behalf of Sociedade Botânica do Brasil

Instruções

Início » Instruções

Edição de idioma

Se o inglês não for sua primeira língua, é altamente recomendável que seu manuscrito seja editado para o idioma antes do envio. Este não é um passo obrigatório, mas pode ajudar a garantir que o conteúdo acadêmico do seu artigo seja totalmente compreendido pelos editores e revisores do periódico. A edição de idioma não garante que seu manuscrito seja aceito para publicação. Os autores são responsáveis por todos os custos associados a tais serviços.

Tipos de artigos

Artigos Originais

Avaliações

Sites de vista

Métodos

Comunicações curtas

Resumo dos processos de submissão

O gerenciamento de submissão e avaliação de manuscritos submetidos envolverá o sistema de submissão de manuscritos online da Revista. O texto do manuscrito deve ser preparado em inglês (consulte Preparando o arquivo do artigo abaixo para obter detalhes) e submetido online (http://mc04.manuscriptcentral.com/abb-scielo). Figuras, tabelas e outros tipos de conteúdo devem ser organizados em arquivos separados para submissão (veja Preparando Tabelas, Figuras e Material Suplementar abaixo para detalhes). Se você estiver usando o sistema de submissão on-line pela primeira vez, vá para a página de login e gere um nome de login e senha depois de clicar no link "Novo usuário – cadastre-se aqui". Se você já é cadastrado, mas precisa ser lembrado do seu login ou senha, acesse a página de login e informe seu e-mail em "ajuda de senha". Por favor, nunca crie uma nova conta se você já estiver registrado.

Caso não consiga acessar nosso sistema de submissão online, entre em contato com a Editoria (acta@botanica.org.br)

Carta de apresentação

Todos os manuscritos devem ser submetidos com uma carta de apresentação, que deve resumir os Sites fortes científicos do trabalho que os autores acreditam qualificá-lo para consideração pela Acta Botanica Brasilica. A carta de apresentação também deve incluir uma declaração declarando que o manuscrito relata trabalho não publicado que não está sob consideração ativa para publicação em outro lugar, nem foi aceito para publicação, nem publicado na íntegra ou em parte (exceto na forma de resumo). Por favor, forneça também uma declaração de que os autores têm o direito de publicar todas as imagens incluídas no manuscrito.

Preparando o arquivo do artigo

(Consulte a última edição da Acta Botanica Brasilica para layout e estilo)

Todos os manuscritos devem seguir estas orientações: o texto deve ser em fonte Times New Roman, tamanho 12, espaço duplo e margens de 25 mm; o tamanho do papel deve ser definido como A4 (210 x 297 mm). Todas as páginas devem ser numeradas sequencialmente. Cada linha do texto também deve ser numerada, com a linha superior de cada página sendo a linha 1. Para arquivos de texto .doc, .docx e .rtf são os únicos formatos aceitáveis. Arquivos no formato Adobe® PDF (arquivos .pdf) não serão aceitos. Quando apropriado, o arquivo do artigo deve incluir uma lista de legendas de figuras e cabeçalhos de tabela no final. Este arquivo de artigo não deve incluir nenhuma ilustração ou tabela, todas as quais devem ser enviadas em arquivos separados. Também não inclua o código de campo.

A primeira página deve indicar o tipo de artigo (Artigo Original, Revisão, Site de Vista, Método ou Comunicação curta) e fornecer um título completo conciso e informativo seguido dos nomes de todos os autores. Cada nome deve ser seguido pelo número Orcid e um número identificador sobrescrito (1, 2, 3 etc.) associado ao endereço institucional apropriado a ser inserido mais abaixo na página. Apenas um autor correspondente deve ser indicado com um asterisco e deve ser sempre o autor da submissão. O(s) endereço(s) institucional(is) de cada autor deve(m) ser listado(s) a seguir, sendo cada endereço precedido pelo número sobrescrito quando apropriado. O endereço deve ser sintético e em inglês com instituição, CEP, cidade, estado e país. Não traduza laboratório, departamento e universidade. Títulos e cargos não devem ser mencionados. Esta informação é seguida do endereço de e-mail do autor correspondente.

A segunda página deve conter um Resumo estruturado não superior a 200 palavras em um único parágrafo sem referências. O Resumo deve delinear o conteúdo essencial do manuscrito, especialmente os resultados e a discussão, destacando a relevância dos principais achados.

O Resumo deve ser seguido de cinco a dez palavras-chave. Observe que as palavras essenciais do título devem ser repetidas nas palavras-chave.

Os artigos originais devem ser divididos em seções apresentadas na seguinte ordem:

Folha de rosto

Resumo

Introdução

Materiais e métodos

Resultados

Discussão

Reconhecimentos

Referências

Legendas de tabelas e figuras

Dados Suplementares (se aplicável)

Materiais e métodos e Resultados devem ser claros e concisos. A seção Discussão deve evitar repetições extensas

dos resultados e deve terminar com algumas conclusões. Esta seção pode ser combinada com resultados (Resultados e Discussão), entretanto, recomendamos que os autores consultem o Conselho Editorial para uma avaliação prévia.

Os nomes das plantas devem ser escritos por extenso no resumo e novamente no texto principal para cada organismo na primeira menção, mas o gênero só é necessário para a primeira espécie em uma lista dentro do mesmo gênero (por exemplo, Hymenaea stigonocarpa e H. stilbocarpa). A autoridade (por exemplo, L., Mill., Benth.) é necessária apenas na seção Materiais e métodos. Use o Índice Internacional de Nomes de Plantas (www.ipni.org) para os nomes corretos das plantas. Cultivares ou variedades devem ser adicionados ao nome científico (por exemplo, Solanum lycopersicum ‘Jumbo’). Os autores devem incluir em Materiais e métodos uma referência ao(s) espécime(s) e número(s) do comprovante das plantas ou outro material examinado.

As abreviaturas devem ser evitadas, exceto em casos usuais (ver edições recentes) e todos os termos devem ser escritos por extenso quando usados para iniciar uma frase. As abreviaturas não convencionais devem ser explicitadas na primeira menção.

Unidades de medida. Acta bot. sutiãs. adota o Systéme International d'Unités (SI). Para volume, use o metro cúbico (por exemplo, 1 × 10–5 m3) ou o litro (por exemplo, 5 µL, 5 mL, 5 L). Para concentrações, use µM, µmol L–1 ou mg L–1. Para tamanho e distância use metros (cm, mm, um, etc) e seja consistente no manuscrito.

Números até nove devem ser escritos, a menos que sejam medidas. Todos os números acima de dez devem estar em algarismos, a menos que estejam iniciando frases.

As citações no texto devem tomar a forma de Silva (2012) ou Ribeiro & Furr (1975) ou (Mayer & Wu 1987a; b; Gonzalez 2014; Sirano 2014) e ser ordenadas cronologicamente. Artigos de três ou mais autores, mesmo na primeira menção, devem ser abreviados para o nome do primeiro autor seguido de et al. (por exemplo, Simmons et al. 2014). Se dois autores diferentes tiverem o mesmo sobrenome e o artigo tiver o mesmo ano de publicação, indicar suas iniciais (por exemplo, JS Santos 2003). Apenas se refira a artigos como 'no prelo' se eles tiverem sido aceitos para publicação em um periódico nomeado, caso contrário, use os termos 'unpubl. res.', indicando as iniciais e o sobrenome do interessado (por exemplo, RA Santos unpubl. res.).

As referências devem ser organizadas em ordem alfabética com base no sobrenome do(s) autor(es). Quando o(s) mesmo(s) autor(es) tem dois ou mais artigos listados, esses artigos devem ser agrupados em ordem de ano. As letras ‘a’, ‘b’, ‘c’, etc., devem ser adicionadas à data dos trabalhos com a mesma citação no texto. Por favor, forneça DOI de documentos 'in press' sempre que possível.

Para artigos com seis autores ou menos, por favor, forneça os nomes de todos os autores. Para artigos com sete autores ou mais, por favor, forneça apenas os nomes dos três primeiros autores, seguidos de et al.

Por favor, siga os estilos:

Livros

Smith GM. 1938. Botânica criptogâmica. Vol. II Briófitas e Pteridófitas. 2º. ed. Nova York, McGraw-Hill Book Company.

Capítulos em livros

Schupp EW, Feener DH. 1991. Filogenia, forma de vida e dependência de habitat de plantas defendidas por formigas em uma floresta panamenha. In: Huxley CR, Cutler DC. (eds.) Interações formiga-planta. Oxford, Oxford University Press. pág. 175-197.

Artigos de pesquisa

Alves MF, Duarte MO, Oliveira PEAM, Sampaio DS. 2013. Autoesterilidade no hexaplóide Handroanthus serratifolius (Bignoniaceae), a flor nacional do Brasil. Acta Botânica Brasilica 27: 714-722.

Artigos no prelo (antes da impressão)

Alves JJ, Sampaio MTY. 2015. Estrutura e evolução das flores. Acta Botânica Brasilica (no prelo). doi: 10.1590/0102-33062015abb3339.

Diários somente online

Wolkovich EM, Cleland EE. 2014. Nichos fenológicos e o futuro dos ecossistemas invadidos com as mudanças climáticas. Plantas AoB 6: plu013 doi:10.1093/aobpla/plu013

Tese (a citação deve ser evitada)

Souza D. 2014. Reguladores de crescimento vegetal. Tese de Doutorado ou Mestrado, Universidade, Cidade.

Sites e outras fontes (a citação deve ser evitada)

Anônimo. 2011. Título da cartilha, folheto, relatório, etc. Cidade, Editora ou outra fonte, País.

As referências a sites devem ser estruturadas como: nome do(s) autor(es) inicial(is) do(s) autor(es). ano. Título completo do artigo. URL completo. 21 de outubro de 2014 (Data do último acesso bem-sucedido).

Os agradecimentos devem ter menos de 80 palavras. Seja conciso: “agradecemos…” é preferível a “Os presentes autores gostariam de expressar seus agradecimentos a…”. As informações de financiamento devem ser incluídas nesta seção.

Deve-se seguir o seguinte exemplo:

Agradecemos ao Centro de Microscopia (UFMG) pelo fornecimento de equipamentos e suporte técnico para experimentos envolvendo microscopia eletrônica. Agradecemos também a J. S. Santos pelo auxílio nas análises estatísticas. Este trabalho foi apoiado por uma bolsa de pesquisa do Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq (número de identificação).

Para COMUNICAÇÕES CURTAS, observe que as diretrizes editoriais aplicáveis aos artigos originais também devem ser aplicadas aqui. Em geral, a diferença entre artigos originais e comunicações curtas é a falta de subseções no texto e espaço limitado para ilustrações neste último. Figuras e tabelas podem estar presentes, desde que o tamanho total do manuscrito não ultrapasse o limite de cinco páginas impressas (material suplementar pode ser adicionado). O resumo (como descrito para artigos originais) deve ser seguido de um “texto corrido” (uma única seção, sem subtítulos), seguido dos agradecimentos e referências.

Elaboração de Figuras, Tabelas e Material Suplementar

Todas as figuras (fotografias, mapas, desenhos, gráficos, diagramas, etc.) e tabelas devem ser citadas no texto, em ordem crescente. As citações de figuras no texto devem aparecer de forma abreviada e em maiúsculas (por exemplo, Fig. 1, Fig. 2A-D, Fig. 3A, Figs. 3A, 4C, Tab.1).

As dimensões máximas das figuras individuais devem ser de 170 × 240 mm. A largura de um componente individual pode ser 170 mm ou 85 mm, sem exceção, enquanto a altura pode ser ≤ 240 mm. Para imagens de tons contínuos (por exemplo, fotografias), forneça arquivos TIFF em 300 dpi. Desenhos mais complexos, como ilustrações botânicas detalhadas, não serão redesenhados e deverão ser fornecidos como arquivos TIFF de 600 dpi.

O agrupamento de gráficos ou imagens relacionadas em uma única figura (uma placa) é fortemente encorajado. Quando um bloco de material ilustrativo for composto por várias partes, cada parte deve ser rotulada com letras maiúsculas sequenciais, na ordem de sua citação no texto (A, B, C, etc.). As letras que identificam imagens individuais devem ser inseridas dentro de círculos brancos no canto inferior direito. Para separar as imagens agrupadas, os autores devem inserir barras brancas (1mm de espessura).

As imagens individuais (não agrupadas como placa) devem ser identificadas com algarismos arábicos sequenciais, na ordem de sua citação no texto (Fig. 1, Fig. 2, Fig. 3, etc.), apresentadas da mesma forma que as letras identificando imagens individuais (descritas acima).

O número que identifica uma figura agrupada (por exemplo, Fig. 2) não deve ser inserido na placa, mas deve ser referenciado apenas na legenda da figura e no texto (por exemplo, Fig. 2A-C).

As barras de escala, quando necessárias, devem ser posicionadas no canto inferior direito da figura. As unidades da barra de escala devem ser fornecidas no final da legenda da figura ou, quando uma figura contém várias barras de escala com unidades diferentes, acima de cada barra.

Os detalhes dentro de uma figura podem ser indicados com setas, letras ou símbolos, conforme apropriado.

As tabelas devem ser precedidas de títulos, indicados com algarismos arábicos sequenciais (Tabela 1, 2, 3, etc.; não abreviar). As tabelas devem ser criadas usando a função Tabela do Microsoft Word™. Colunas e linhas devem estar visíveis, embora nenhuma linha escura deva ser usada para separá-las. As regras horizontais devem ser usadas apenas na parte superior (abaixo do título) e na parte inferior (abaixo da linha final) da tabela. Não use preenchimentos, sombreamentos ou cores nas tabelas.

Quando apropriado, dados em excesso (mas importantes) podem ser enviados como Arquivos Suplementares, que serão publicados online e disponibilizados como links. Isso pode incluir figuras adicionais, tabelas ou outros materiais necessários para documentar completamente a pesquisa contida no artigo ou para facilitar a capacidade dos leitores de entender o trabalho.

Os Materiais Suplementares estão vinculados à página principal do artigo. Eles podem ser citados usando o mesmo DOI do artigo.

Os Materiais Suplementares devem ser apresentados em arquivo .doc apropriado para texto e tabelas e arquivo .tiff em 300dpi para figuras e gráficos. O título completo do trabalho e os nomes dos autores devem ser incluídos no cabeçalho. Todas as figuras e tabelas suplementares devem ser referenciadas no corpo do manuscrito como “Tabela S1” e/ou “Figura S1”.

Acta bot. sutiãs. pretende manter arquivos de Materiais Suplementares, mas não garante sua disponibilidade permanente. Acta bot. sutiãs. reserva-se o direito de remover os Materiais Suplementares de um artigo publicado no futuro.

O Processo de Revisão

Todos os autores receberão um e-mail confirmando a submissão do manuscrito, com o respectivo número de referência. O Editor-Chefe avaliará a aderência do manuscrito às instruções, qualidade e novidade e decidirá sobre a adequação para revisão por pares. Os manuscritos que não seguirem o formato serão devolvidos aos autores. Os manuscritos são enviados a pelo menos dois pareceristas anônimos que têm 21 dias para devolver seus relatórios.

Como enviar um artigo revisado

Após a revisão por pares, acesse “clique aqui para enviar uma revisão” e faça o upload da nova versão do manuscrito. Lembre-se de excluir os documentos em duplicata.

Processo de publicação e impressão

Após a aceitação, uma prova em PDF será enviada aos autores correspondentes como anexo de e-mail. As provas corrigidas devem ser devolvidas em até 72 h. É de responsabilidade exclusiva do autor correspondente a verificação de erros na prova.

Cada artigo é identificado por um DOI (Digital Object Identifier) único, um código utilizado na consulta e referência bibliográfica.

As datas de submissão e aceitação tance será impresso em cada papel.

O autor correspondente receberá gratuitamente um PDF ou URL que dá acesso ao artigo online e a um PDF para download.

O autor correspondente é responsável por distribuir este PDF ou URL para qualquer coautor.

Má conduta

A má conduta nos manuscritos submetidos levará à rejeição imediata. Publicação duplicada, plágio, manipulação de figuras, submissão dupla e qualquer outro método fraudulento não serão tolerados.

Caso seja detectada má conduta após a publicação do manuscrito, o artigo será retratado e uma nota de retratação será publicada.

Os manuscritos enviados podem ser digitalizados para detectar plágio e verificar a originalidade dos artigos.

Anexo C. Normas do Periódico *Mycotaxon*, no qual o Capítulo 3 será submetido.

1. Mycotaxon 2021 journal submission guidelines

Our 2021 style guide outlines formatting styles for taxonomic and nomenclatural papers intended for journal publication. Mycotaxon prefers separate files presenting basic text ('author'_body.*doc*), illustration captions ('author'_legend.*doc*), and tables ('author'_table.*doc*). However, authors may submit one text file divided into three sections: (1) manuscript text, (2) illustration captions (without artwork), and (3) tables. Submit illustrations only as plates in jpg format. After receiving the required presubmission reviews from expert reviewers, authors are expected to revise all files before submitting final perfect copy (no colored fonts, tracking, or comments permitted) with a completed submission form to the Nomenclature Editor.

After nomenclatural review, authors again thoroughly revised text file/s, jpgs, and submission form before Emailing the attachments to the Editor-in-Chief. Those proposing new taxonomic names must also include copies of their IndexFungorum/ Fungal Names/ MycoBank notifications to prove nomenclatural deposit.

Before preparing a manuscript for the journal, authors should consult the sample Mycotaxon manuscript or an open-access paper on the Mycotaxon journal website. Please use the pre-formatted '2021 blank template' and follow **MycoT** styles following the Format> Styles> User Defined Styles menu. **(**Format your document in US Letter (*not* A4) with margins set to 5.25 cm (top/bottom) and 5.3 cm (left/right). Please contact the Editor-in-Chief immediately when a style does not deliver the proper formatting. Times, Arial (titles & subheadings only), and Symbol are the only fonts permitted for submission. **SimSun** fonts are **NOT** permitted.

2. Requirements for range extension papers

Mycotaxon's core topics are the **taxonomy** and **nomenclature** of fungi. To be published in the journal, manuscripts describing new records for an area must make a significant taxonomic contribution and cover more than one species. For each taxon treated, an acceptable taxonomic contribution must include an **original** description based on the studied material and **illustration**(**s**) of the newly collected specimens. Range extension manuscripts must present for each taxon:

1. a **taxonomic heading** including the authorship, bibliographic reference, and the figure references;
2. an **original** technical description based **entirely** on the new collections (do not include information from previously published descriptions here);
3. a standard **Specimens examined** section citing at least **two** collections per taxon (from different locations) and vouchering data for the newly collected material;
4. **illustrations** (preferably photographs, but drawings accepted) of each collection; and
5. a **brief** discussion of similarities/differences between the newly collected specimens and previously published descriptions and data from the same species.

We particularly stress comparing a new record with the type description of the species, as often these new records may represent a new species.

3. Mycotaxon 2021 styles (Times/Times New Roman unless otherwise specified)

Manuscript title (Arial, 11-pt, no text boxes!)

Authors[1*] [10-pt]

[1] *Address information* [8-pt]— SHORT: *institution on top line;*
address, city & country on second line
[*] Correspondence to: *Email address*

Abstract —8-pt

Key words—8-pt

Subtitles (all **Arial** except for **Times/Times New Roman** taxonomic heading)**:**

9-pt Arial: Introduction, Materials & methods, Taxonomy, Discussion

8-pt Arial: "Acknowledgments" "Literature cited" and other secondary subtitles

***Taxonomic: Latin name* (10-pt):** 9-pt: authors & sp. nov. Fig ref

FN # IF # MB # (8-pt) Nomenclatural identifiers required for all new taxa or typifications

Diagnosis paragraph compares new taxon with its most closely related taxon

Type paragraph— (8-pt)

Etymology—(8-pt)

Specimen(s)/Additional specimen(s) examined—place after technical description (do not repeat type information in new species papers)

Key formatting (all except title in Times/Times New Roman 9-pt font)

1. Key Lead [set right hand margin with tab keys; do ***NOT*** type full stops] 2

Paragraph styles (all Times/Times New Roman; Symbol when needed):

10-pt

"Introduction" "Taxonomy" "Results" "Discussion": first lines indented by 0.5 cm, paragraphs justified; NO spacing between.

9-pt

"Materials & methods" "Acknowledgments": first line indented by 0.5 cm, paragraphs justified; NO spacing between.

Table titles: hanging indent, left aligned (not justified)

8-pt

Diagnosis (no heading), Type, Etymology, Specimens examined sections: indented 1 cm from each margin.
Illustration captions ("Figure" or "Plate" in small caps) in 8-pt font.

Literature cited [for alphabetized list of references] justified; hanging indent; all Latin *taxonomic names* (up through kingdom) in italics

4. Literature cited & Digital Object Identifiers

Literature cited

Format all entries using 'hanging indents' and without empty lines between entries. Arrange entries alphabetically first by author(s), then by publication date; exception: Author & al. references should be cited by date as no second names appear in text references. List author surnames before given name initials; do not separate name and initials with commas or place full stops after initials. Separate each author by a comma; omit 'and' or '&' before the last author name. Italicize only *Latin taxonomic names* and use regular ('roman') typeface everywhere else [including book titles]. Place all titles in sentence case.

Digital Object Identifiers (DOI)

Authors must retrieve DOIs for all references that have them after registering for a free account at CrossRef. Paste formatted references into the box on the CrossRef website to generate a 'https://doi.org/' DOI code for every paper that has one. After obtaining each DOI, paste it into your browser bar to view the first page or abstract of the cited article; check your spelling in your own references before adding the DOI to your 'Literature cited' section. For example,

Paste cited references on the https://doi.crossref.org/simpleTextQuery webpage

Ewald OM. 2009. Using Latin in diagnoses: a guide for the perplexed. North Aeerican Fungi 4: 1–-9.
Hodge KT, Gams W, Samson RA, Korf RP, Seifert KA. 2005. Lectotypification and status of *Isaria* Pers. : Fr. Taxon 54: 485–489.
Korf RP. 2007. On the genus *Solenopezia* (*Fungi: Lachnaceae*) and ICBN Art. 58—a sleeping dog bites back. Bol. Soc. Argent. Bot. 43: 29–-32.
Strongman DB, Wang J, Xu S. 2010. New trichomycetes from western China. Mycologia 101: 174–184.

CrossRef returns:

Ewald OM. 2009. Using Latin in diagnoses: a guide for the perplexed. North Aeerican Fungi 4: 1–9.
https://dx.doi.org/10.2509/naf2009.004.002
Hodge KT, Gams W, Samson RA, Korf RP, Seifert KA. 2005. Lectotypification and status of Isaria Pers. : Fr. Taxon 54: 485–489.
https://doi.org/10.2307/25065379
Korf RP. 2007. On the genus Solenopezia (Fungi: Lachnaceae) and ICBN Art. 58—a sleeping dog bites back. Bol. Soc. Argent. Bot. 43: 29–32.
Strongman DB, Wang J, Xu S. 2010. New trichomycetes from western China. Mycologia 101: 174–184.
https://doi.org/10.3852/09-029

Clicking on the site listed by CrossRef will route you to the original first pages; there you should notice and correct the misspelling of "American" in the first reference. The third reference has no DOI.

As italics are ignored by CrossRef, correct **only** the mistakes in your original copy and retain your original italics. When looking over the pages, make certain that the DOI represents the publication you are citing and NOT a review of the publication.

Your revised citations

Ewald OM. 2009. Using Latin in diagnoses: a guide for the perplexed. North American Fungi 4: 1–9. https://doi.org/10.2509/naf2009.004.002

Hodge KT, Gams W, Samson RA, Korf RP, Seifert KA. 2005. Lectotypification and status of *Isaria* Pers. : Fr. Taxon 54: 485–489. https://doi.org/10.2307/25065379

Korf RP. 2007. On the genus *Solenopezia* (*Fungi: Lachnaceae*) and ICBN Art. 58—a sleeping dog bites back. Bol. Soc. Argent. Bot. 43: 29–32.

Strongman DB, Wang J, Xu S. 2010. New trichomycetes from western China. Mycologia 101: 174–184. https://doi.org/10.3852/09-029

Do not introduce any hyphens, full stops, or spaces when entering the DOI number into your file, which must be copied as one unbroken text string. The Editor-in-Chief will redistribute the Literature cited lines to remove any large or awkward spaces after she has exported your text and changed fonts prior to PDF conversion.

5. Footnotes & illustration captions

Place the text of all illustration captions & footnotes below. (NEVER use text frames!) We encourage you to submit these in a separate 'legend' file after nomenclatural review labeled with only accession number (e.g., 21-018legend).

Table titles and footnotes belong with your tables in the next section or in a separate table text file (e.g., first labeled 'Malik-table' but as '21-018table' for final submission).

Send illustrations (e.g., graphs, phylotrees, photographs, line drawings) as individual jpg formatted plates, each set to an 11-cm (4.33-in.) width and 300-dpi resolution. Phylotrees submitted as PDFs are acceptable; those submitted in MSWord are not. Send files intended for color in RBG color mode but format all others in gray-scale mode to reduce file size. Label each file with author name_accession number_plate/fig number (e.g., malik21-018pl1.*jpg*).

Enter figure captions and footnotes below. (Give approximate location for each figure/plate. Add additional lines as needed.)

Special guidelines for footnotes:

1. Use footnotes rarely. Integrate the information into the main text whenever possible. Mycotaxon footnotes equal participation by two authors at the bottom of the first page.
2. In the main text, highlight the superscript after the word you are footnoting.
3. List footnote number, manuscript page, and the four words preceding each footnote number in the placement directions (highlighted in yellow) to the editor.
4. Place footnote text after the placement direction in Times 8-pt.

Please remove all text on this page above this line before adding captions and footnote text!

Insert footnote 1 at the bottom of p. __. (Words preceding footnote number in corresponding text are __)

[1] Write your footnote here. (Remember to add superscript with highlight in the manuscript text.)

Insert Fig. 1 + legend near text on manuscript p. __

Fig. 1. Place your caption here.

Insert Fig. 2 + legend near text on manuscript p.

Fig. 2. Place your caption here.

5. Tables

NEVER use text frames for tables!

Place all tables (including titles at the top and abbreviations or other reference information at the bottom) together in one section at the end of a document or in a separate table text file (e.g., labeled as 'Malik-table' before accession and '21-018table' for final submission).

Submit separate table text files when tables have different orientations: portrait (vertical on the page) vs. landscape (table text to be turned 90° for tables more than 11 cm wide.) Orient tables vertically whenever possible.

Graphs and charts are considered artwork and must be sent as separate jpg (or tif using lzw compression) digital files and accompanying text presented in the legend text file.

Mycotaxon requires Times 7-pt in tables. Column & row headers may be distinguished by small caps.

Please remove all text on this page above this line before adding table with title

---

Insert Table 1 near manuscript p. __

Table 1. Replace this text with your table title (9-pt font).

Replace this text with your table (remember to use 7-pt Times New Roman/Times)
* Replace this text with your table footnote (7-pt) here.

Insert Table 2 on near manuscript p. __

Table 2. Replace this text with your table title (9-pt font).

Replace this text with your table (remember to use 7-pt Times New Roman/Times)
* Replace this text with your table footnote (7-pt) here.

6. Twelve important requirements:

Remove tracking, highlights, comments before nomenclatural and final submission. Clean copy only accepted.

Permitted fonts: Times (Times New Roman), Arial, Symbol (no others!)

Use *italics* for names of taxa at all levels, including in the Literature cited. Do NOT use italics for reference titles or other Latin terms and abbreviations (use '& al.' 'i.e.' 'in situ', 'sensu', 'textura prismatica' 'etc.').

Footnotes belong with the illustration captions (see part 4 for details).

Deactivate all internet hyperlinks: type your text yourself; do NOT copy and paste text from a website (active hyperlinks usually import).

Key words (five terms only, separated by commas, no unnecessary capitals, no full stop at end) must not repeat terms in the title or abstract.

Never use the tab key or space bar to indent the first line of a paragraph; use the tab key only to force text (figure references, key leads) to the right margin.

Limit diagnoses for proposed new taxa to 5 or fewer lines. Diagnoses are NOT descriptions and should only cite the characters that distinguish your new taxon from the most closely related described taxon. English diagnoses (permitted by the International Code of Nomenclature) are preferred; Latin is still permitted.

Use boldface only for countries in Specimens examined, and for type designations (e.g., **holotype**, **isotype**). Elsewhere use small caps (not *italics*) for emphasis. (Boldface is permitted elsewhere only for stand-alone headings.)

DOIs are required for Literature cited references that have them. Refer to part 3 for details on how to retrieve DOI numbers and format the Literature cited section.

Never place legends, titles, or tables into text frames, as they do not process within the PDF conversion program used by Mycotaxon.

All work must be original. However, remember no scientist works in a vacuum! Take care to attribute paraphrases from other works with text references. Words that exactly match those of the original publication must be enclosed within quotation marks, or your paper will be rejected as plagiaristic. Authors must acknowledge their expert reviewers (cite institution and country) in the Acknowledgments.

Anexo D. Normas do Periódico Mycobiota, no qual o Capítulo 4 será submetido.

Mycobiota - Instructions to Authors

Instructions to Authors

Submission

Submission to this journal is only through e-mail. All manuscripts should be submitted to the Editor-in-Chief (e-mail: cmdenchev@yahoo.co.uk).

Editorial Policy

Manuscripts, submitted for consideration by ***MYCOBIOTA,*** will be checked for styles, language, and presentation of methods results, and discussion/analyses.

Scientists who use English as a foreign language are urged to have their manuscript read by a native English-speaker. Either British or American spelling may be used as long as usage is consistent throughout.

The submitted papers must be original and of high scientific standards, as applied methods and presented results and discussion or analyses.

Submission of a manuscript for consideration by ***MYCOBIOTA*** indicates (i) that the authors have neither previously published (except in the form of an abstract) nor are simultaneously submitting substantially the same material in another research journal or book; (ii) that in case of multiple authorship, it is read and approved by all authors; and (iii) that, if accepted, it will not be published elsewhere including electronically in the same form, in English or in any other language, without the written consent of the copyright-holder. Manuscripts which are substandard in these requirements will be not considered.

Peer-review Process

When a manuscript is submitted to the Editor-in-Chief, it is given a manuscript number (always refer to this number in communications with the Editor). Papers which conform to journal scope and styles will be reviewed.

MYCOBIOTA is **a peer-reviewed journal.**

- Articles submitted by authors are evaluated by at least two peer experts in the field, selected by the editors.
- The reviewers recommend whether the submitted article should be published, revised, or rejected.
- The authors do not know who is reviewing their work.

The reviewers' identities are not released to authors or to other reviewers. The reviewers should remain anonymous throughout the review process and beyond. They should not identify themselves to authors without the editor's knowledge. If, however, the reviewer has revealed his or her identity to the author, the authors have to inform the editor, as soon as possible.

Conversely, the Editorial Board does not accept attempts by authors to reveal the reviewers and/or to confront them.

Based on the reviewers' recommendations, the editors

- make a decision from among several possibilities:
  - publication as it stands;
  - publication with minor corrections;
  - publication with major amendments;
  - rejection.

After this process, the corresponding author will be informed about acceptance of the manuscript. If the manuscript is acceptable, the corresponding author possibly will be asked to answer some questions of the referees. The revised manuscript, figures, and/or tables, returned to the corresponding author if modifications are necessary, should be revised and sent back to the Editor-in-Chief **within two months;** otherwise, the manuscript will be considered to have been withdrawn.

The Editors reserve the right to edit manuscripts for clarity of expression and to conform to the journal style.

Proofs, PDF-file, Reprints, Publication

The corresponding author will receive **proofs** once. Please read the proofs and send them back **within 10 days** after receipt. Changes in proofs, other than typographical errors, will be at the author's cost.

On the publication date, the corresponding author will receive **a free of charge PDF-file** (**for personal use only**). **Reprints** can be ordered when the corrected proof is returned; they will be billed at cost.

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MYCOBIOTA is committed to rapid editorial decisions and publication.

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Small text quotations borrowed from another paper are placed in quotes and cited.

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Manuscript Preparation

1. Manuscripts for MONOGRAPHS and FULL LENGTH ARTICLES should include the following items in this order: Title of the paper;
    - Name(s) of the author(s);
    - Address(es) of the author(s) (when more than one, indicate authors' addresses with superscript numbers);
    - Corresponding author's name, address, e-mail address;
    - Abstract not exceeding 250 words; Key words;
    - Main text; References; Figures;
    - Figure legends;
    - Table(s), including title(s); Notes to the Editor-in-Chief.
2. Manuscripts for NOTES and BRIEF ARTICLES should include items for full length articles, but primary headings such as 'Introduction', 'Results', 'Discussion', etc. should be omitted, and the abstract should not exceed 150 words.
3. Submit your manuscript, incl. tables and figures, as **electronic files** and sent them as attachment files through e-mail. The electronic file of the text should be created with ***Microsoft Word.***
4. All parts of the manuscript should be prepared using **1.5 lines line spacing** (30 lines per page) with **margins of 2.5 cm.** All text must be in **Times New Roman** or **Arial 12p size fonts** and left aligned (not justified) so that the right margin is uneven. Primary headings should be flush left. Number all pages in the top right margin. Line numbers should be inserted.
5. **Title.** – The title should be as short and informative as possible. Write the title in **bold**, and capitalize only the first word and the proper nouns. Use *italics* for all names of fungi, plants, and animals. Omit names of authors of taxa except when necessary to avoid uncertainty. Only the affiliation to families or orders should be mentioned in the title. When the article is part of a series, a number should be added to the title, and reference to the series or to a previous article should be made.
6. **Abstract.** – The abstract should be written as a single paragraph starting with the word '**Abstract.**' (in bold). Do not use any abbreviations, and do not include authorities for taxa (unless they are necessary to distinguish homonyms). All new taxa, new combinations and new synonyms must be recorded in the abstract.
7. **Key words.** – List in alphabetical order no more than 8 words or phrases. Identify by the phrase '**Key words:**' (note: in **bold**) beginning at the left margin.
8. **Main text.** – The material must generally be divided into the following sections, although exceptions and additions might be necessary as some papers are not best presented in this form: **Introduction**, **Materials and methods**, **Results**, **Discussion** (or **Results and discussion**), **Acknowledgements.** Other headings, such as **Taxonomy, Taxonomic treatment, Enumeration of the species,** etc., as well as secondary headings may be used if necessary for clarity of text organization. Write all main headings in **bold.** The secondary headings must be ***in italic.*** Vernacular names, e.g., a basidiomycete, several ascomycetes, the agarics, both gasteromycetes, etc., should not start with a capital letter. All tables and illustrations must be referred to in the text in the order presented.
9. **Materials and methods.** – All methods and materials should be described in detail, or references to published materials and/or methods should be provided. Modifications of published methods should be described. Add the list of used non-standard abbreviations in an alphabetical manner.

10. **Acknowledgements.** – They should be brief and should precede the references. The source of any financial support received for the work being published must be included in this section.

11. References.

- All references in the text, except the cases mentioned below, must also be listed under 'References' and vice versa.
- Only published papers or those being accepted for publication should be included. Accepted but not yet published ones are listed with the mention 'In press' after the author(s) name(s), when the year is not yet known, or after the journal title, when the date is known. Manuscripts which were submitted but not yet accepted have to be mentioned only in the text with the addition of '(subm.)' or '(unpubl.)'. Personal information provided by anybody should be avoided except in some critical cases where this information may be cited **only in the text** as 'A.B. Johnson (pers. comm.)' or '(A.B. Johnson, pers. comm.)' regardless whether provided orally or in a letter. Citation of abstracts of meetings should be avoided except only in critical cases and only if they are published in an abstract book with Publisher and City indicated. This kind of information may be cited in the text as 'Johnson (2011, abstr.)' or '(Johnson 2011, abstr.)', and added to the reference list.
- References in the text should be cited in chronological not in alphabetical order (e.g., AuthorD 1999; AuthorB 2006, 2010; AuthorA & AuthorB 2007; AuthorC et al. 2009). Single author: Johnson (2009) or (Johnson 2009), two authors: Johnson & Ricker (2010) or (Johnson & Ricker 2010), more than two authors: Johnson et al. (2008) or (Johnson et al. 2008). Several references by the same author/s published in the same year: Johnson (2010a, b) or (Johnson 2010a, b).
- Where it is desirable to refer to a particular page, a colon is used: Johnson (2011: 44) or (Johnson 2011: 44). The titles of the periodicals **must not be abbreviated,** provide the full titles.
- Titles of papers in languages other than English, French, German, Spanish, and Italian should be translated into English and surrounded by square brackets […]. In addition, the original language should be indicated at the end of the reference, such as (In Chinese).
- Place DOI numbers at the end of every cited reference already listed in CrossRef. Not all references have numbers.
- Examples of citations used in ***MYCOBIOTA*** are given below. The references included in the list should match in all respects the examples below.

References

(i) Articles in journals and monograph series:

Author, A. 2011. Title of article. – Journal 16: 112–121.
Author, A. & Author, L. 2010. Title of article. – Journal 15: 222–234.
Author, A. & Author, M. 2009. [Title of article]. – Journal 14: 155–168. (In Russian)
Author, A., Author, D. & Author, E. 2010. Title of article. – Journal 15: 14–16.
Author, A., Author, C. & Author, D. 2011. Title of article. – Journal 16: 16–18.
Author, A., Author, B. & Author,

C. 2012a. Title of article. – Journal 17:
10–24. Author, A., Author, B. &
Author, C. 2012b. Title of article. –
Journal 17: 104–116.
Author, D.E. 1959. Title of a monograph. –
Beiträge zur Kryptogamenflora der Schweiz 12:
1–1407. Author, F. 1897. Title of article. – Journal
21(3): 33–44 + Pls II–IV.
Author, G. 2013.
Title of article. –
Journal 18. In press.
Author, H. In press.
Title of article. –
Mycobiota.

(ii) Article in a journal with a DOI (Digital Object Identifier) reference:

Author, A., Author, Z. & Author, C. 2012. Title of article. – Journal 24: 44–52. doi: 10.xxxx/...............

(iii) Article online, with a DOI reference:

Author, A. & Author, C. 2012. Title of article. – Journal 17: e24. doi: 10.xxxx/..............

(iv) Books – full citations:

Author, A.A. & Author, B. 2011. Title of book. Publisher, City.

Author, B.D. 2010.
Title of book. Vol. 1.
Publisher, City.
Author, D. 2011. Title
of book. 2nd edn.
Publisher, City.
Editor, B.F. & Editor, A. (eds) 1991–2002. Title of book. Vols 1–5. Publisher, City.

(v) Books – part citations:

Author, A.A. & Author, B.E. 2011.
Title of book, pp. 311–422.
Publisher, City. Editor, B.D. (ed.)
2010. Title of book. Vol. 2. Pp. 101–
132. Publisher, City.

(vi) Books – chapters:

Author, A. & Author, D. 2012. Title of chapter. – In: A. Editor & B. Editor (eds). Title of book. Vol. 2. Pp. 22–44. Publisher, City. Author, D. & Author, A. 2011. Title of chapter. – In: B. Editor & A. Editor (eds). Title of book. 2nd edn. Pp. 444–555. Publisher, City. Author, E.G. 2011. Title of chapter. – In: L.M. Editor (ed.). Title of book, pp. 122–188. Publisher, City.

(vii) Proceedings of an international congress or symposium:

Author, A. & Author, B. 2011. Title of article. – In: A.B. Editor (ed.). Title of congress or symposium, city/town, date. Pp. 45–50. Publisher, City. Author, B. 2010. [Title of article]. – In: A.B. Editor (ed.). [Title of congress or symposium], city/town, date. Pp. 55–64. Publisher, City. (In Chinese) or Author, B. 2010. [Title of article]. – In: A.B. Editor (ed.). Title of congress or symposium, city/town, date. Pp. 55–64. Publisher, City. (In Chinese)

(viii) Abstracts of an international congress or symposium (as exception, see the remark in Art. 11):

Author, A.D. & Author, B. 2011. Title of abstract. – In: A.B. Editor & F.G. Editor (eds). Title of Abstracts of congress or symposium, city/town, date. P. 44. Publisher, City.

(ix) Thesis:

Author, A. 2011. Title of thesis. PhD thesis. University/Institute, City.

12. **Tables.** – Tables should be prepared in a separate file and numbered with Arabic numerals (e.g. **Table 1.** …) in the order in which they are cited in the text as '(Table 1)'. They must have brief, concise titles and legends that will make the general meaning of the table comprehensible. The titles should be placed at the top of the tables. Explanatory footnotes may be placed below the table, written with superscript lowercase letters (not Arabic numerals). Omit vertical separation lines. The maximum size of a full page table is 13.5 x 19.5 cm. All abbreviations must be explained in the legends. Distinguish between a nil result (0 or –, in contrast to +) and missing result (NA or blank space) (NA = not available).

13. Illustrations.

- Prepare as many figures as necessary for the best demonstration of the results or descriptions.
- Figures are acceptable in one of the following formats: **psd** [Photoshop + layers] 300 dpi, **tiff** 300 dpi, **jpeg** 300 dpi, maximum quality; for drawings 600– 1200 dpi.
- Designate all illustrations (photographs, graphs, diagrams, line drawings) as figures (abbreviations: Fig., Figs) and numbered with Arabic numerals. Cite in the text as 'Fig. 1', 'Figs 2, 3' or 'Figs 1–4'. A plate of drawings or photographs may be treated as one figure (separate parts of this figure may be identified by lower case letters for each element which must be cited in the text as 'Fig. 1a') or as several figures with each figure numbered consecutively.
- All figures should have a legend. The legends of all figures in the article should be written consecutively **on a separate file.**
- Figures must be submitted as electronic files. Submit all figures in their final size. **The maximum size of a full page figure is 13.5 x 19.5 cm,** including space for the legend (in filling a page to the full depth, space should be left for the legend).
- Actual sizes in line drawings should be indicated by bars drawn on the figures. Photographs should include a scale line. For all figures the bar scale is given in the legend, not on the figure. Do not write magnifications such as ´4, or ´1250, in the figure caption. The publisher reserves the right to reduce or enlarge some figures.

- Any signs and letters in the illustration must be large enough to be read without any problems. Hand-written signs and letters are not accepted. Figures for reproduction in colour are acceptable.

14. Scientific names.

- The names of all taxa must be written in *italics.*
- Authority names of all fungal taxa must be cited when used the first time. Abbreviations of the authority names should follow Kirk & Ansell (1992) or http://www.indexfungorum.org/Names/AuthorsOfFungalNames.asp. A generic name followed by a specific epithet should be written in full at first mention; subsequently it may be abbreviated to its capitalised initial letter, provided that no ambiguity results.
- In the lists of synonyms, abbreviations of the names of journals should follow *Botanico-Periodicum-Huntianum* or http://kiki.huh.harvard.edu/databases/publication_index.html.
- When citing author names of plants, they should be properly abbreviated according to The International Plant Names Index (http://www.ipni.org/ipni/authorsearchpage.do).

15. Symbols, abbreviations, values, measurements.

- Insert diacritical marks and symbols (e.g., ä, á, μ, ×, ≡, ≥) via the 'symbols' menu.
- Use regular font for abbreviations derived from the Latin or Greek (for example: ca, et al., i.e., e.g., op. cit., s. str.).
- In general, the measurements should be given in units recommended by the International Unit System (SI) metric system, except for 'liter' (and its abbreviation) and 'ml'. When non-SI units are used, they must be adequately explained to avoid ambiguity. Italicize only absorbency (*A*) and gravitational acceleration (*g*). The plural forms of abbreviated units should not be formed by adding '-s'. Use always a space to separate figures given from the units measured (e.g. '5 µm' not '5µm', '24 ºC', not '24ºC'), except some abbreviations for numbers, i.e. 'K' and 'M' (e.g., 2K = 2000).
- The most important unit abbreviations are the following: length – nm, µm, mm, cm, m
  - mass – pg, ng, µg, mg, g, kg
  - amount of substance – nmol, µmol, mmol, mol molar concentration – µM, mM, M
  - area – mm^2, cm^2, m^2 volume – µl, ml, l, cm^3, m^3
  - time – s, min, h (the time of day should be given in terms of the 24 h clock (e.g. 14.00 h not 2.0 p.m.)
  - temperature – ºC, K light – J, lx, lm, W
  - molecular weight – Da, kDa
- Other commonly used abbreviations and contractions which may be used in manuscripts without definition are the following: about – ca (*circa*)
  - altitude, elevation above sea level – alt. approximately – approx.
  - at the place cited – l.c. (*loco citato*) average – av.
  - boiling point – b.p. calculated – calc. coefficient – coeff.
  - combination, new – *comb. nov.* (*combinatio nova*) compare – cf. (*confer*)
  - concentrated – conc. concentracion – concn. constant – const.
  - Correlation coefficient – *r* cultivar(s) – cv. (cvs) cultivated – cult. (*cultis*) degrees of freedom – D.F.
  - deoxyribonucleic acid – DNA diameter – diam

- district – distr. dry weight – DW edition – edn
- editor(s) – ed. (eds)
- *et alia* – et al. Figure(s) – Fig. (Figs)
- for example – e.g. (*exempli gratia*) forma (as taxonomic category) – f. fresh weight – FW
- (of) gardens – hort. (*hortorum*) genus, new – *gen. nov.*
- Greenwich Mean Time – GMT herbarium – herb.
- height – ht
- hydrogen ion, minus log concentration – pH (plural pH values) in a broad sense – s. lat. (*sensu lato*)
- in correspondence – in litt. (*in litteris*) in a narrow sense – s. str. (*sensu stricto*) in the work cited – op. cit. (*opere citato*)
- Internal transcribed spacer – ITS light microscope – LM
- log to base 10 – log
- log to base e (natural log) – ln maximum – max.
- maximum velocity – V_{max} messenger ribonucleic acid – mRNA Michaelis constant – K_m
- million – M
- million years – Myr minimum – min. minute – min
- molecular weight – mol. wt name, new – *nom. nov.*
- nicotinamide adenosine dinucleotide – NAD not seen – n.v. (*non visus*)
- number – no. (*numero*) observed – obs.
- page, pages – p., pp. per cent – % preparation – prep. radius – r
- ribonucleic acid – RNA
- ribosomal ribonucleic acid – rRNA scanning electron microscopy – SEM special form – f. sp.
- species – sp., spp. (plural) species, new – *sp. nov.* standard deviation – SD standard error of mean – SEM
- subspecies – subsp., subspp. (plural) that is – i.e. (*id est*)
- thousand – K temperature – temp.
- transmission electron microscopy – TEM variety – var.
- volume(s) – vol. (vols) weight – wt

- Enzyme nomenclature has to refer to international standards.

16. **Dates.** – Names of months are given in full in the main text in the form: 1 January 2010. The names of months in dates included either in lists of specimens examined or in Tables should be abbreviated to the first three letters (e.g., Jan, Feb, Mar, Jun).

17. Numbers and measurements.

- For decimal values a point and not a comma is used, e.g. '3.5' not '3,5'.
- Numbers of up to four digits should be spelt like 758 or 4579, but those of five or more like 57 894 or 256 000. Never use commas within numbers. Measurements of structures should be recorded as length by width (or diameter). Authors are encouraged to give the measurement in this form: '(8–)12–18(– 23) x 6–8(–10) µm (n = 50)' where the figures within parentheses are the extreme ranges, and n = 50 is the number of measured objects. Indicate mean values, standard deviation, etc. separately.
- Decimal values for percentages in the case of large structure are mostly valueless and should be rounded up or down to the appropriate, significant figures: 56.84 % to 56.8 %.

18. **Keys.** – Dichotomous keys are preferred. Complex of features should be segregated by a semicolon, e.g. characteristics of ascomata; of ascospores; of hyphae; etc.

19. Description of new taxa.

- Before describing a new taxon **consult the *International Code of Nomenclature for algae, fungi, and plants*** (*Melbourne Code*).
- Publication of all new fungal names (incl. names of organisms treated as fungi) requires the citation of a unique identifier issued by a recognized repository (e.g. MycoBank, http://www.mycobank.org/).
- The type specimens of new taxa must be deposited in public herbaria where they are permanently preserved and accessible to other researchers. The herbaria must be cited by their official acronyms, as given in *Index Herbariorum* (http:// http://sweetgum.nybg.org/ih/).
- The symbol ≡ should be used to indicate a homotypic (also called a nomenclatural) synonym, which is a synonym based on the same type. The symbol = should be used to indicate a heterotypic (also called a taxonomic) synonym, which is a synonym based on a different type.
- For publication of a new combination, the basionym must be cited with a clear and direct reference to its place of valid publication (journal title and volume or book title, page where protologue begins, and date).

  ≡ *Genus epithet* Author, Journal 24: 121, 2004 (basionym).
- All new taxa, new combinations and new synonyms must be recorded in the abstract.

20. **Citing collections.** – Lists of studied collections must be arranged geographically or alphabetically with respect to countries. Where available, map coordinates, elevation, and collection number should be included. Standard recommended abbreviations for herbaria must be used. The following are examples of a complete citation:

Specimen examined — On **Substratum: COUNTRY,** STATE/PROVINCE, city/town, locality, map coordinates, elevation, date (e.g., 23 Jul 2011), collector, collector number (herbarium acronym and specimen number).

or

Specimen examined: **COUNTRY,** STATE/PROVINCE: city/town, locality, map coordinates, elevation, **Substratum,** date (e.g., 23 Jul 2011), collector, collector number (herbarium acronym and specimen number).

21. **Molecular sequence data.** – Molecular sequence data must be deposited in a molecular sequence repository (EMBL, http://www.ebi.ac.uk; GenBank, http://www.ncbi.nlm.nih.gov/Genbank/, etc.) and the accession numbers must be cited in the paper. Authors are also expected to deposit sequence alignments in TreeBASE (http://www.treebase.org/) or other public databases.

22. Punctuation.

- Use regular font for abbreviations derived from the Latin or Greek (for example: ca, et al., i.e., e.g., op. cit., s. str.).
- Do not end any heading with a full stop.
- A punctuation mark (e.g., comma, full stop) takes the same face as the word immediately before it (exceptions are the cases of parentheses, square brackets, quotation marks, em–dashes), i.e., if a word before a comma, colon, or full stop is in italic, the respective punctuation mark must be also in italic.
- With the exception of the sanctioning colon (e.g., Fr. : Fr.), no space stands between a ‘single’ punctuation mark and the preceding text.
- No space stands between a paired mark (e.g., parentheses) and the enclosed text.

The hyphen, en-dash, and em-dash have different uses. Do not hyphenate long words in text files to break at line end, as the hyphen may appear in midline after pdf conversion. Hyphens are used to join words (e.g., ‘yellow-green’) but never between adjectives (not ‘yellowish-green’). They are not used where a prefix is involved (e.g.

- ‘coevolution’ not ‘co-evolution’). The longer en-dash (–) is used (with spaces) for ‘minus’ in mathematical notations and (without spaces) in range expressions. The longest em-dash (—) replaces colons in lists or is used for emphatic terms or phrases that would be — otherwise — enclosed in parentheses or brackets or separated by commas.
- Single quotes (‘…’) should be used throughout for quotations or to indicate colloquialism or doubt; double quotes (“…”) should only be used for a quotation within a quotation.
- Brackets should be used in the following order: {level 3 [level 2 (level 1)]}.

23. **Hyperlinks.** – Text files containing active hyperlinks are unacceptable and will be returned to the authors for repair.

When in doubt about manuscript editing matters, the authors are urged to consult the Editor-in-Chief or the latest issue of the journal.

A **TEMPLATE** for preparation

of a manuscript can be

downloaded here. These

Instructions for authors can be

downloaded

Anexo E. Normas do Periódico *Rodriguésia*, no qual o Capítulo 5 será submetido.

O que devo saber antes de submeter o manuscrito?

Como enviar meu manuscrito?

Quem fornece o certificado de idioma em inglês?

As imagens devem ser enviadas em que formato?

Como devo enviar as tabelas?

Como devo organizar o material examinado?

Qual o formato que devo usar nas referências?

Onde devo colocar as legendas?

Foco e Escopo

A Rodriguésia publica, sem custos, artigos científicos originais, de revisão, opinião e notas científicas em diversas áreas da Biologia Vegetal (taxonomia, sistemática e evolução, fisiologia, fitoquímica, ultraestrutura, citologia, anatomia, morfologia, palinologia, desenvolvimento, genética, biologia reprodutiva, ecologia, etnobotânica, biogeografia e filogeografia), bem como em história da botânica e atividades ligadas a jardins botânicos. A submissão dos manuscritos e posterior publicação é gratuita, não acarretando ônus financeiros aos autores.

Preconiza-se que os manuscritos submetidos à Rodriguésia excedam o enfoque essencialmente descritivo, evidenciando sua relevância interpretativa relacionada à morfologia, ecologia, evolução ou conservação. Artigos de revisão ou de opinião poderão ser aceitos após avaliação pelo Corpo Editorial.

A Rodriguésia aceita a submissão de manuscritos nas seguintes condições:

todos os autores do manuscrito tenham aprovado a submissão; os resultados ou ideias apresentados no manuscrito sejam originais;

o manuscrito enviado não tenha sido submetido também para outra revista;

o manuscrito tenha sido preparado de acordo com a última versão das Normas para Publicação da Rodriguésia.

Se publicado, o artigo (ou partes do mesmo) não deverá ser publicado em outro lugar, exceto:

com consentimento do Editor-chefe;

caso sua reprodução e o uso apropriado não tenham fins lucrativos, apresentando apenas propósito educacional.

Qualquer outro caso deverá ser analisado pelo Editor-chefe.

O conteúdo científico, gramatical e ortográfico de um artigo é de total responsabilidade de seus autores.

O autor para correspondência pode solicitar a qualquer momento a retirada do seu manuscrito do processo de avaliação desde que envie um e-mail ao Editor-chefe.

Desde novembro de 2018, a Rodriguésia solicita sejam submetidos apenas artigos em língua inglesa. O Tradutor ou revisor do texto final em inglês deverá apresentar um certificado de proficiência da língua inglesa (nível C2) caso não seja nativo desse idioma. Também aceitamos comprovantes de tradução/revisão realizados por um tradutor cientifico especializado (pessoa física ou jurídica) ou de um nativo do idioma. Os certificados devem ser encaminhados no momento da submissão do manuscrito.

Desde janeiro de 2019, a Rodriguésia adotou a modalidade de publicação anual contínua, que está disponível online na biblioteca SciELO.

Preprints: A Rodriguésia está de acordo com a iniciativa internacional de um processo editorial mais transparente, conhecido como Ciência Aberta (Open Access). Assim, serão considerados para publicação na Rodriguésia manuscritos depositados em servidor preprint (SciELO Preprints ou bioRxiv). O processo de revisão pelos pares para artigos depositados em servidores preprint seguirá as normas descritas no Processo de Avaliação por Pares.

https://preprints.scielo.org/index.php/scielo

Processo de Avaliação por Pares

Os manuscritos submetidos à Rodriguésia, serão inicialmente avaliados pelo Editor-chefe e Editor(es) Assistente(s), que definirão sua área específica. Em seguida, o manuscrito será enviado para o respectivo Editor de área que o avaliará e optará por sua rejeição ou pelo seu envio para pelo menos dois consultores ad hoc. Os comentários e sugestões dos revisores e a decisão do Editor de área serão enviados para os respectivos autores, a fim de, quando necessário, realizarem modificações de forma e conteúdo. Os autores terão oportunidade para expor considerações ou contestar as críticas dos revisores e do Editor de área. Após o encaminhamento da versão revisada, o manuscrito é avaliado pelo Editor de área que pode encaminhar para nova rodada de avaliação pelos revisores ou devolver aos autores solicitando nova revisão ou indicar ao Editor-chefe a aceitação ou rejeição. Em caso de aprovação do manuscrito, o texto completo com os comentários dos revisores ad hoc será encaminhado para o Editor-chefe para ajustes finais (análise de tradução, análise das normas e qualidade das imagens).

Uma prova eletrônica do manuscrito já editorado será enviada ao autor para correspondência. A publicação do artigo estará condicionada à devolução desta prova ao Corpo Editorial da Revista com as correções solicitadas e o aceite do autor dentro do prazo estipulado.

Os manuscritos devem obedecer às normas atualizadas de publicação e formatação da Rodriguésia. Aqueles que apresentarem falhas nesses quesitos, a qualquer tempo, não terão seu mérito avaliado no sistema até que uma nova versão seja encaminhada pelos autores.

Um arquivo digital do trabalho ficará disponível em formato PDF no site da revista após sua publicação.

Política de Acesso Livre

Diretrizes para Autores

1. Envio dos manuscritos:

Os manuscritos devem ser submetidos eletronicamente através do site https://mc04.manuscriptcentral.com/rod-scielo

Desde novembro de 2018, a Rodriguésia solicita sejam submetidos apenas artigos em língua inglesa. O tradutor ou revisor do texto final em inglês deverá apresentar um certificado de proficiência da língua inglesa (nível C2) caso não seja nativo desse idioma. Também aceitamos comprovantes de tradução/revisão realizados por um tradutor cientifico especializado (pessoa física ou jurídica) ou de um nativo do idioma. Os certificados devem ser encaminhados no momento da submissão do manuscrito.

2. Forma de Publicação:

Os artigos devem ter no máximo 30 laudas. Aqueles que ultrapassarem este limite somente poderão ser avaliados no sistema após decisão do Corpo Editorial.

Artigos Originais: somente poderão ser aceitos artigos originais nas áreas anteriormente citadas para Biologia Vegetal, História da Botânica e Jardins Botânicos.

Artigos de Revisão: serão aceitos preferencialmente aqueles convidados pelo Corpo Editorial ou após a consulta ao Editor-chefe.

Artigos de Opinião: cartas ao editor, comentários a respeito de outras publicações e ideias, avaliações e outros textos desde que caracterizados como de opinião, serão aceitos.

Notas Científicas: este formato de publicação compõe-se por informações sucintas e conclusivas (não sendo aceitos resultados preliminares), as quais não se mostram apropriadas para serem inclusas em um artigo cientifico típico. Técnicas novas ou modificadas podem ser apresentadas.

2.1. Artigos originais

Formatação dos manuscritos

Os manuscritos submetidos deverão ser formatados em A4, com margens de 2,5 cm e alinhamento justificado, fonte Times New Roman, corpo 12, espaço duplo, com no máximo 20 MB de tamanho. Todas as páginas, exceto a do título, devem ser numeradas, consecutivamente, no canto superior direito. Letras maiúsculas devem ser utilizadas apenas se as palavras exigem iniciais maiúsculas, de acordo com a língua do manuscrito. Não serão considerados manuscritos escritos inteira ou parcialmente em maiúsculas. Palavras em latim devem estar em itálico (ex.: “ex” | “e.g.,” | “apud” | “i.e.,” | “In:” | “et al.” | “vs.”), bem como nomes científicos genéricos e infragenéricos. Não usar itálico em nomes de softwares, empresas, títulos de periódicos ou livros (exceto a Flora brasiliensis).

Utilizar nomes científicos completos (gênero, espécie e autor) na primeira menção, abreviando o nome genérico subsequentemente, exceto onde o nome abreviado possa causar dúvidas em relação a outros gêneros citados no texto (veja também o item “Citação de autores de táxons” abaixo). Também deverá ser usado o nome científico completo quando citado no início de cada parágrafo. Os nomes dos autores de táxons devem ser citados segundo a base de dados do International Plant Name Index - IPNI (http://www.ipni.org), ou de acordo com Brummitt & Powell (1992), na obra “Authors of Plant Names”. As siglas dos herbários deverão seguir o Index Herbariorum (http://sweetgum.nybg.org/science/ih/).

- Primeira página - deve incluir o título (em dois idiomas), autores, filiação completa (instituições e endereços), título resumido e endereço de email do autor para correspondência. O título deverá ser conciso e objetivo, expressando a ideia geral do conteúdo do trabalho e não deve conter nomes de autores de espécies. O título resumido deve vir logo abaixo do nome dos autores e ter no máximo 40 caracteres.

- Segunda página - deve conter Abstract com Key words e Resumo e Palavras-chave (até cinco Key words). As Key words do Abstract devem estar em ordem alfabética. As Palavras-chave traduzidas devem seguir a ordem das originais.

Exemplo:

Key words: coastal vegetation, Atlantic Forest domain, flora, similarity.

Palavras-chave: vegetação costeira, Domínio Mata Atlântica, flora, similaridade.

Abstracts e Resumos devem conter até 250 palavras cada. Caso haja nomes de espécies, não incluir suas autorias. No Abstract e Resumo, as espécies citadas não apresentam os nomes de seus autores.

2.1.1. Texto – Iniciar em nova página na sequência: Introduction, Material and Methods, Results, Discussion, Acknowledgements e References. O item Results pode estar associado a Discussion quando mais adequado.

Os títulos (Introduction, Material and Methods etc.) e subtítulos deverão ser apresentados em negrito.

As figuras e tabelas deverão ser numeradas em arábico de acordo com a sequência em que as mesmas aparecem no texto. Veja o item Ilustrações para mais detalhes.

Sugere-se que conjuntos de dados morfológicos discretos sejam depositados no MorphoBank (http://www.morphobank.org).

Nos tratamentos taxonômicos os protólogos devem ser citados conforme o modelo abaixo:

Exemplo:

Phyllanthus glaziovii Müll. Arg., Fl. bras. 11(2): 41, pl.8. 1873. Tipo: BRASIL. RIO DE JANEIRO: A.F.M. Glaziou 2892 (holótipo BR n.v., fotografia do holótipo em BR!; isótipo P n.v., fotografia do isótipo em P!).

O nome de autores de espécies deve ser indicado apenas na primeira vez que aparece no texto. Para os casos em que o manuscrito contenha descrição, diagnose ou lista de espécies, os táxons citados nesses itens deverão estar acompanhados dos respectivos autores, fazendo desnecessária a sua citação posteriormente ao longo do texto (ex: Swartzia pilulifera Benth.).

Citações de autores de táxons

Nomes de autores de famílias e gêneros devem ser suprimidos em todos os manuscritos.

Isto é tratado como uma citação normal, e assim, o artigo completo em que a espécie foi publicada deve ser incluído nas referências seguindo as normas da revista (veja o item Referências). Para artigos com vários números de táxons, como listagens florísticas, a autoria deve ser abreviada conforme as regras do IPNI.

Em caso de dúvida entre em contato com o Corpo Editorial da Rodriguésia. Abreviações dos nomes dos autores também serão usadas para sinônimos quando os autores dos basiônimos já tiverem sido citados. Também em caso de descrição de novos táxons os autores devem ser abreviados.

A citação de autores dos táxons deve seguir a regra com os exemplos hipotéticos abaixo:

Exemplo:

Jardinia botanica Mart. ex Bentham (1937: 128).

- Martius é abreviado porque a espécie foi publicada por Bentham, que é o autor do artigo que será citado.

Arboretum botanicum (Mart. ex Benth.) Hepaminondes (1967: 56).

- Bentham é abreviado porque a autoria já foi devidamente citada anteriormente no basiônimo.

Plantoria bonita (Lobravonitz 1904: 120) Calic (1970: 98).

- Deve-se citar o sobrenome completo dos autores, tanto do basiônimo como da nova combinação, quando o basiônimo não for citado anteriormente.

Citações de autores de trabalhos

Artigos do mesmo autor ou sequência de citações devem estar em ordem cronológica. Quando o mesmo autor publicou várias obras no mesmo ano, as diferentes citações devem ser indicadas por letras (ex: Smtih 2009a, 2009b, 2009c) respeitando a ordem alfabética em que é citado no texto. A citação de Teses e Dissertações deve ser utilizada apenas quando estritamente necessária. Não citar trabalhos apresentados em Congressos, Encontros e Simpósios.

Comunicação pessoal devera ser citada no texto seguindo o exemplo: “... os estudos ainda são escassos no grupo (M.F. Silva 2015, comunicação pessoal).”

As citações de referências no texto devem seguir os seguintes exemplos:

- Para um ou dois autores:

Segundo Miller (1993)...

De acordo com Miller & Maier (1994) ...

- Para três ou mais autores:

Proposto por Baker et al. (1996)...

- É importante lembrar que o Site e vírgula é usado para separar mais de uma citação entre parênteses:

(Miller 1993; Miller & Maier 1994).

- Citações de citações devem ser indicadas por apud como no exemplo:

(Souza apud Siqueira 2004).

2.1.2. Descrições

Em trabalhos de flora não deve constar descrição para gêneros com apenas uma espécie na área em estudo. Apenas a espécie deve ser descrita.

Para números decimais, use Site, obedecendo a norma da língua inglesa (ex.: 10.5 m). Separe as unidades dos valores por um espaço (exceto em porcentagens, graus, minutos e segundos). Não utilizar o número “zero” após a vírgula ou Site (ex.: 1.2 mm; 1 mm; 4.7 cm).

Use abreviações para unidades métricas do Système International d’Unités (SI) e símbolos químicos amplamente aceitos. Demais abreviações devem ser evitadas, mas podem ser utilizadas, devendo ser precedidas de seu significado por extenso na primeira menção. Observe o uso de maiúsculas e minúsculas (ex.: km, m, cm, MB, ºC).

A cada início de parágrafo o nome da espécie deve vir sem abreviação.

2.1.3. Material examinado

O material examinado deve ser citado obedecendo a seguinte ordem: local, coordenadas (separadas por vírgula), data de coleta (dia, mês e ano separados por Site (.) e o mês em algarismos romanos - maiúsculo), bot., fl., fr., fl. e fr. (para as fases fenológicas), nome do coletor (sem espaço entre as iniciais dos primeiros nomes seguido do sobrenome por extenso em itálico e utilizando et al. quando houver mais de dois coletores (ex.: R.L. Borges)) e número do coletor e siglas dos herbários entre parênteses, segundo Index Herbariorum (Thiers, continuously updated - http://sweetgum.nybg.org/ih/).

Quando não houver número de coletor não utilize s.n., neste caso o número de registro do espécime deverá ser citado após a sigla do respectivo herbário (ex.: A. Pereira (RB 9754)).

Os nomes dos países e dos estados/províncias deverão ser citados por extenso, em letras maiúsculas e em ordem alfabética, seguidos dos respectivos materiais estudados. Dentro de cada estado/província, os municípios (com todos os dados da coleta) deverão ser citados em ordem alfabética separados por Site (.). Diversas coletas dentro de um mesmo município serão separadas por Site e vírgula (;), sem repetir o nome do município e nem usar as palavras “idem” e “ibidem”. Caso haja repetição dos locais de coletas dentro dos municípios, suprimir também os nomes desses locais. Não usar “s.loc.”, “s.d.” nem “s.n.”.

No exemplo abaixo o nome dos municípios e o local repetidos foram riscados:

BRASIL. PARANÁ: Guaratuba, Rio Itararé, 17.VIII.1994, fl. e fr., J.M. Silva 1372 (RB, MBM). Morretes, Ninho do Gavião, Porto de Cima, 3.X.1948, fl., G. Hatschbach et al. 1011 (MBM); Morretes, Ninho do Gavião, Serra Marumbi, 9.V.1996, fr., J.M. Silva 1372 (MBM). Paranaguá, trilha para Torre da Prata, 1.VII.2003, bot., J.M. Silva 3753 (RB, MBM). Piraquara, Rio Taquari, 29.IX.1951, fl., G. Hatschbach 2519 (MBM). Quatro Barras, Morro Sete, 23.XI.1988, fr., J.M. Silva 600 (ESA, HUEFS, MBM, SPF, UB); Quatro Barras, 10.IX.1982, fl., G. Hatschbach 45288 (MBM). SANTA CATARINA: Garuva, Monte Cristo, 6.X.1960, fr., R. Reitz & S. Pereira 10037 (RB, FLOR, HBR). Joinville, Castelo dos Bugres, 25.XI.2004, fr., F.C.S. Silveira 637 (FURB). SÃO PAULO: Cajati, Estação Repetidora da Serra do Aleixo, torre da Embratel, 30.IX.2002, fl., J.M. Silva 3649 (CESJ, HUEFS, MBM).

Veja alguns exemplos para uso de letra maiúscula e minúscula nos nomes dos locais de coleta:

- trilha para Pedra do Sino / trilha ao longo do Rio Maianarte / Trilha da Jararaca

- Estrada da Vista Chinesa / Estrada Diamantina / estrada para a Lagoa Pires / estrada Rio-Petrópolis / estrada entre Guinda e Sopa

- lagoa próxima a Serra do Espinhaço / Lagoa de Jurubatiba

- fazenda no caminho da Trilha do Lobo / Fazenda dos Portugueses

Quando o material examinado for muito extenso, a citação de material selecionado deve ser priorizada sempre que pertinente, buscando abranger a diversidade morfológica tratada, assim como a distribuição geográfica.

Para trabalhos de flora estadual ou local, no material examinado que abrange Sites de coleta inseridos na área em estudo, não deve ser repetido o nome da localidade na qual foi desenvolvido o estudo de flora. No caso de floras estaduais devem ser citados os municípios e para floras locais os Sites de coleta inseridos na área em estudo.

Em trabalhos sobre a descrição de novos táxons, os espécimes adicionais examinados (parátipos) devem ser citados em material examinado. É recomendável que os autores apresentem o status de conservação seguindo os critérios e categorias da Lista Vermelha da IUCN (2001).

Comentários sobre a espécie

Comentários referentes a Distribution, Habitat, Phenology, Conservation status etc. de uma espécie deve ser escrito em parágrafo próprio, após o "Examined material".

Seguir o exemplo abaixo:

Distribution, ecology, and conservation status: It is known only in one site, in the municipality of Santa Teresa, in the Reserva Biológica Augusto Ruschi. The species grows in the Ombrophilous Montane Forest, at altitudes between 800–900 m. The new species is evaluated as data deficient (DD) of IUCN (2016) criteria, due to few collections.

Phenology: The material with flowers and young fruits was collected in April.

Etymology: The name of the new species refers to the trichomes in the apex of corolla lobes.

2.1.4. Tabelas

Cada tabela deve ser enviada separadamente em arquivo formato Word (.doc, .docx). Todas devem ser apresentadas em preto e branco, sem linhas nem preenchimentos ou sombreados.

*** Todas as tabelas devem ser citadas no texto. ***

No texto, as tabelas devem ser sempre citadas de acordo com os exemplos abaixo:

"There are studies about the species (Tabs. 2 e 3)..."

ou:

"These species are described at the Tables 2 e 3..."

2.1.5. Ilustrações

Mapas, desenhos, gráficos e fotografias devem ser denominados como Figuras. Fotografias e ilustrações que pertencem à mesma figura devem ser organizadas em pranchas (ex.: Fig. 1a-d – significando que a figura 1 possui quatro fotografias ou desenhos). Quando o número de figuras ultrapassar as letras do alfabeto, usar: a’, b’, c’. No texto, as figuras devem ser sempre citadas de acordo com os exemplos abaixo:

“The hilium is oblong-ovate (Figs. 1g; 3a’-c’)...”

“Some characteristics are presented at Figures 2 e 3...”

“These seeds (Fig. 1) and the fruits (Figs. 2; 3; 6) ...”

“Observe the inflorescences of Coryanthes dasilvae (Figs. 2a,b; 5e-g)...”

As pranchas devem possuir 15 cm larg. × 19 cm comp. (altura máxima permitida). Também serão aceitas figuras que caibam em uma coluna, ou seja, 7 cm larg. × 19 cm comp.

*** Importante: Todas as ilustrações devem ser citadas no texto e na sequência em que aparecem, sendo inseridas em arquivos independentes, nunca inseridas no arquivo de texto. ***

Envio das imagens para a revista:

FASE INICIAL – submissão eletrônica

O autor deve submeter o manuscrito no site: <https://mc04.manuscriptcentral.com/rod-scielo>

As imagens devem ser submetidas em formato PDF, JPEG, PNG ou TIF com tamanho máximo de 10 MB.

Os gráficos devem ser enviados em formato Excel.

Ilustrações que não possuam todos os dados legíveis resultarão na devolução do manuscrito.

SEGUNDA FASE – para artigo aceito para publicação

Nessa fase, caso haja necessidade, solicitaremos ao autor que nos envie imagens com maior qualidade. Neste caso, a imagem deve ser enviada para a revista Rodriguésia do seguinte modo: através de sites de uploads, de preferência o WeTransfer, disponibilizado no link: <https://wetransfer.com/>

O autor deve enviar um email para a revista avisando sobre a disponibilidade das imagens no site e informando o link para acesso aos arquivos.

ATENÇÃO: Todas as pranchas nesta fase devem ser enviadas sem os dísticos (i.e., elementos externos à imagem: setas, bolinhas, asteriscos, letras etc.).

Nas pranchas, as barras de escala devem ser colocadas sempre na vertical. Não serão aceitas barras horizontais nem diagonais em ilustrações botânicas.

As imagens solicitadas nesta segunda fase devem ter no mínimo 300 dpi de resolução, nas medidas citadas acima, em formato TIF ou PDF. No caso dos gráficos, o formato final será em Excel.

IMPORTANTE: Lembramos que as IMAGENS (pranchas digitalizadas, fotos originais, desenhos, bitmaps em geral) não podem ser enviadas dentro de qualquer outro programa (Word, Power Point etc), e devem ter boa qualidade. Observe que, caso a imagem original tenha baixa resolução, ela não deve ser redimensionada para uma resolução maior, no Photoshop ou qualquer outro programa de tratamento de imagens. Caso ela possua pouca nitidez, visibilidade, fontes pequenas etc., deve ser digitalizada novamente. Não aceitaremos fotografias alteradas de forma desproporcional.

Sugerimos o depósito das figuras também no site Figshare: <https://figshare.com>

Imagens coloridas serão publicadas em cores apenas na versão eletrônica, saindo em escala de cinza na versão impressa. Em casos especiais algumas imagens poderão ser impressas em 4 cores.

*** Use sempre o último número publicado como exemplo ao montar suas figuras. ***

2.1.6. Legendas

Devem vir ao final do arquivo do texto do manuscrito.

Exemplo:

Figure 2 – a. Cyperus aggregatus – spikelet. b-d. C. entrerianus – b. habit; c. glomerule; d. spikelet. e-g. C. hermaphroditus – e. habit; f. spike; g. spikelet. h. C. luzulae – spike. i-j. C. odoratus – i. spikelet; j. diaspore: glume above, rachilla segment involving achene below. (a. Ribeiro et al. 175; b-d. Ribeiro et al. 151; e-g. Araújo Junior (MOSS 5569); h. Ribeiro et al. 49; i-j. Ribeiro 82).

Nos trabalhos de taxonomia e flora, a amostra com a qual a ilustração foi elaborada deverá ser obrigatoriamente indicada na legenda, ou seja, as legendas das ilustrações deverão conter o coletor e o número de coleta do material que serviu de modelo para a mesma.

Nas legendas das figuras, não inserir os nomes dos autores das espécies.

2.1.8. Agradecimentos

Caso o artigo seja resultado de projeto de pesquisa financiado por entidades de fomento à pesquisa (CAPES, CNPq etc.), citar o órgão de fomento e o número do processo.

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Artigos de revistas:

BFG - The Brazil Flora Group (2015) Growing knowledge: an overview of seed plant diversity in Brazil. Rodriguésia 66: 1085-1113.

Tolbert RJ & Johnson MA (1966) A survey of the vegetative shoot apices in the family Malvaceae. American Journal of Botany 53: 961-970.

Livros e teses:

Costa CG (1989) Morfologia e anatomia dos órgãos vegetativos em desenvolvimento de Marcgravia polyantha Delp. (Marcgraviaceae). Tese de Doutorado. Universidade de São Paulo, São Paulo. 325p.

Kersten RA & Galvão F (2013) Suficiência amostral em inventários florísticos e fitossociológicos. In: Felfili JM, Eisenlohr PV, Melo MMRF & Meira Neto JAA (eds.) Fitossociologia no Brasil. Vol. 1. Ed. UFV, Viçosa. Pp. 156-173.

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Sasamori MH & Droste A (2016) Baixas concentrações de macronutrientes beneficiam a propagação in vitro de Vriesea incurvata (Bromeliaceae). Available at <http://rodriguesia.jbrj.gov.br/FASCICULOS/rodrig67-4/17-0155.pdf>. Access on 10 January 2017. DOI: 10.1590/2175-7860201667417.

Thiers B [continuously updated] Index herbariorum: a global directory of public herbaria and associated staff. New York Botanical Garden’s Virtual Herbarium. Available at <http://sweetgum.nybg.org/science/ih/>. Access on 9 June 2016.

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Caspary JXR (1878) Nymphaeaceae. In: Martius CFP & Urban I (eds.) Flora brasiliensis. Fleicher, Liepizig. Vol. 4, pars 2, pp. 129-184, t.37-38.

Flora fanerogâmica do estado de São Paulo:

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Baitello JB & Marcovino JR (2003) Ocotea (Aubl.). In: Wanderley MGL (ed.) Flora fanerogâmica do estado de São Paulo. Instituto de Botânica, São Paulo. Vol. 3, pp. 179-208.

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