

UNESP - UNIVERSIDADE ESTADUAL PAULISTA

CÂMPUS DE BOTUCATU

INSTITUTO DE BIOCÊNCIAS

**Estudos taxonômicos em espécies de *Hypotrachyna* (fungos
liquenizados, *Parmeliaceae*) saxícolas do sudeste brasileiro**

Bianca Regina da Hora

**Tese apresentada ao Instituto de
Biociências, Câmpus de Botucatu,
UNESP, para obtenção do título de
Doutor em Ciências Biológicas
(Botânica), AC: Morfologia e
Diversidade Vegetal.**

BOTUCATU - SP

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ORIENTADOR

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“Eles querem saber como faz pra chegar
Como foi, como é, se tem boi, quem que tá”
Eu digo é nóiz, eu digo é nóiz
Eu digo é nóiz, eu digo é nóiz”

Emicida

“Lichens should cause happiness and fun and no stress at all.”

Klaus Kalb

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RESUMO

Hypotrachyna foi descrito por Vainio em 1890 como *Parmelia* subgênero *Parmelia* seção *Hypotrachyna*, que dividiu nos subgrupos *Irregularis*, *Cychlocheila* e *Sublinearis*. Hale e Kurokawa, em 1964, entenderam que o subgrupo *Sublinearis* representava muito bem a seção e elegeram *Parmelia brasiliana* como tipo do subgênero *Hypotrachyna*, que dez anos depois Hale elevou a gênero. Hoje estima-se que o gênero seja um dos maiores dentro da família *Parmeliaceae* com cerca de 270 espécies. Estudos filogenéticos recentes comprovaram que esse gênero é polifilético e necessita de uma melhor compreensão. *Hypotrachyna* é um gênero com centro de dispersão nas américas, onde está o maior número de espécies endêmicas. Em toda a história da liquenologia brasileira não se deu especial atenção às espécies saxícolas de fungos liquenizados pela dificuldade de coleta e transporte. O objetivo do trabalho foi estudar a taxonomia do gênero *Hypotrachyna* no Brasil, com ênfase nas espécies saxícolas do sudeste brasileiro. Para tanto foram realizadas expedições a localidades da Serra da Mantiqueira, Serra do Caraça e arredores para obtenção de material, que foi estudado de acordo com o protocolo desenvolvido pelo GEL, que sofreu várias atualizações e aprimoramentos decorrentes do desenvolvimento desta tese. Como resultado foram criados os gêneros *Hypotrachynella*, *Lyngenella*, *Martiana* e *Vainia*, todos segregados de *Hypotrachyna* s.l., e descobertas 27 espécies novas, sendo que dez pertencem a *Hypotrachyna* s.l. (*H. corrugata*, *H. etii*, *H. fracta*, *H. iarae*, *H. martiana*, *H. nashii*, *H. palui*, *H. protentoides*, *H. serrana*, e *H. vexillina*); cinco estão em *Hypotrachynella*, que compreende espécies com ácidos girofórico e lecanórico (*H. caapora*, *H. marcellii*, *H. mogiana*, *H. oreadica*, e *H. puiggarii*); duas em *Lyngenella*, com espécies produzindo ácido livídico (*L. damazioi* e *L. subsipmanii*); cinco em *Martiana*, de espécies com ácidos evérnico e lecanórico (*M. caparoensis*, *M. elixii*, *M. itatiaiaensis*, *M. nuda* e *M. sipmanii*); e três em *Vainia*, cujas espécies produzem liquexantona e ácido equinocárpico como metabolitos principais (*V. marcellii*, *V. extraterrestris* e *V. pernambucana*).

Palavras-chave: *Hypotrachynella*, *Lyngenella*, *Martiana*, *Vainia*, Serra da Mantiqueira.

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Introdução

A Família *Parmeliaceae*

A família *Parmeliaceae* Zenker [1827] é composta por espécies que podem apresentar talo folioso ou fruticoso, usualmente com rizinas, com córtex nas duas superfícies; apresentam apotécio séssil, ocasionalmente imerso, algumas vezes com margens bem desenvolvidas, ascos alongados e clavados, ascósporos variados, usualmente pequenos, hialinos e sem septos; os conidiomas são do tipo picnídio; desenvolvem ou não pseudocifelas; são liquenizados por algas verdes. Essas características englobam as famílias *Usneaceae* Eschw. e *Hypogymniaceae* Poelt ex Elix, que são consideradas parte de *Parmeliaceae* por alguns autores (Kirk et al. 2001).

Ainda há muita discussão sobre a melhor circunscrição para a família, no entanto autores como Poelt (1973), Hale (1983), e Rogers & Hafellner (1987) adotaram *Parmeliaceae* no senso de Eschweiler, que exclui as famílias *Usneaceae* e *Hypogymniaceae*, no que têm sido seguidos por autores mais recentes (Elix 1979, Adler 1990, 1992, Fleig 1997, Eliasaro 2001, Benatti 2005, Canêz 2005, Spielmann 2005, Jungbluth 2006). Stevens (1999) alegou que a presença do tecido mecânico central é característica taxonômica suficiente para separar *Usneaceae* de *Parmeliaceae*.

Nesta tese foi seguida a circunscrição de Eschweiler, adotada pela maioria dos pesquisadores.

Em 1803, Acharius criou o gênero *Parmelia* para abrigar todas as espécies de líquens foliosos e com apotécios lecanorinos, que posteriormente originou uma grande quantidade de gêneros (Hale 1987).

Trabalhando com os líquens coletados no Brasil por Martius e Spix, Eschweiler em 1833 utilizou esse conceito amplo de Acharius, que só mudou depois da metade do século 19, quando Nylander e Massalongo descreveram outros gêneros a partir de *Parmelia* (Benatti 2005).

Em seu trabalho clássico sobre os líquens brasileiros, Vainio (1890a/b), separou as 38 espécies de parmélias brasileiras por ele encontradas em Minas Gerais em três seções (*Amphigymnia*, *Hypotrachyna* e *Xanthoparmelia*) e cinco subseções (*Subglaucescens* e *Subflavescentes*, pertencentes à seção *Amphigymnia*; *Irregulares*, *Cyclocheila* e *Sublineares* dentro da seção *Hypotrachyna*).

Posteriormente, Lynge (1914) publicou um estudo das *Parmelia* s.l. coletadas no Brasil por Malme, empregando a classificação de Vainio e criando mais duas seções

(*Bicornutae* Lyngé e *Everniiformes* Hue) e propondo o gênero *Pseudoparmelia*, que depois foi colocado como sinônimo de *Parmelia* por Santesson (1942).

Mais tarde, Hale & Kurokawa (1964) reconheceram três subgêneros para o gênero *Parmelia*: *Parmelia* Ach., *Amphigymnia* (Vainio) Dodge e *Xanthoparmelia* (Vainio) Hale. O subgênero *Parmelia* foi dividido em cinco seções: *Parmelia* (com as subseções *Parmelia* e *Simplices*), *Irregulares*, *Imbricaria* (com as subseções *Imbricaria* e *Bicornutae*, essa última dividida nas séries *Bicornutae* e *Relicinae*), *Cyclocheila* e *Hypotrachyna*.

Em 1976, Hale aceitou a definição de Lyngé, transferindo as espécies de *Parmelia* seção *Cyclocheila* Hale & Kurokawa [1964] para *Pseudoparmelia* (Lyngé) Hale (Hale 1976), que seria depois segregado em outros gêneros como *Canoparmelia* Elix & Hale, *Paraparmelia* Elix & Johnston e *Flavoparmelia* Hale (Hale 1986). Com base nos grupos criados por Vainio outros gêneros foram separados por Hale (1974a,b): *Bulbothrix* Hale, *Parmelina* Hale, *Relicina* (Hale & Kurokawa) Hale e *Xanthoparmelia* (Vainio) Hale.

Parmelina Hale, por sua vez, originou *Canomaculina* Elix & Hale, *Myelochroa* (Asahina) Elix & Hale, *Parmelinella* Elix & Hale, *Parmelinopsis* Elix & Hale e *Parmotremopsis* Elix & Hale (Elix & Hale 1987).

Krog (1982) criou o gênero *Punctelia* a partir de *Parmelia* seção *Parmelia* subseção *Simplices* Hale & Kurokawa, que posteriormente foi dividido nos subgêneros *Punctelia* e *Flavopunctelia*, elevados respectivamente a gênero por Hale (1984) e Elix & Hale (1987).

Estudando um grupo de espécies de *Parmotrema*, re combinadas do subgênero *Parmelia* seção *Irregulares*, Hale & Fletcher (1990) propuseram o gênero *Rimelia*.

Parmelia subgênero *Amphigymnia* seção *Subflavescentes* subseção *Ornaticolae*, série *Subpallidae* Hale (1965) foi elevada ao gênero *Rimeliella* por Kurokawa (1991), sendo depois sinonimizado por Elix (1997) sob *Canomaculina*.

Em 2001, o *Dictionary of Fungi* reconheceu a presença de 83 gêneros e 2.138 espécies na família *Parmeliaceae* (Kirk et al. 2001).

Mais recentemente, estudos filogenéticos (Crespo et al. 2010) forneceram evidências para que os gêneros *Canomaculina*, *Concamerella* e *Rimelia* fossem sinonimizados em *Parmotrema*.

Já Divakar et al. (2010) descreveram o gênero *Remototrachyna* com 15 espécies asiáticas extraídas de *Hypotrachyna*.

Outro gênero descrito a partir de dados filogenéticos foi *Crespoa*, segregado de *Canoparmelia* (Lendemer & Hodkinson 2012).

O Gênero *Hypotrachyna* s.l.

Histórico

Entre fevereiro e junho de 1885, o líquenólogo finlandês Edvard August Vainio esteve no Brasil para desenvolvimento de sua tese de doutorado. Embora tenha coletado também no Estado do Rio de Janeiro, seu foco de atividades foi o Estado de Minas Gerais, onde amostrou líquens principalmente na cidade Antônio Carlos (antigamente Sítio) e na Serra do Caraça, hoje a RPPN Santuário do Caraça. Como resultado dessa visita Vainio elaborou sua Monografia sobre os líquens brasileiros, que se tornou de extrema importância não só para a líquenologia brasileira, como também para a líquenologia mundial, tendo sido o primeiro líquenólogo a propor subdivisões no antigo gênero *Parmelia*, as quais, em sua maioria, correspondem atualmente a gêneros amplamente aceitos (Marcelli & Seaward 1998).

Vainio (1890b) dividiu o gênero *Parmelia* em três seções *Amphigymnia*, *Xanthoparmelia* e *Hypotrachyna*, como exposto acima.

Especificamente, a seção *Hypotrachyna* foi dividida por Vainio em três subgrupos: *Irregularis*, *Cyclocheila* e *Sublinearis*. *Irregularis* compreendia espécies de talo lobado a sublobado, os lobos em parte ascendentes, largos e irregularmente ramificados e com apotécios estipitados. *Cyclocheila* embarcava também as espécies sublobadas a lobadas, porém adnatas e cujos os lobos são irregularmente divididos e sinuoso-incisos, e os apotécios subestipitados. Por sua vez, em *Sublinearis* estavam as espécies laciniadas a sublaciniadas, adnatas, de ramificação dicotômica e ocasionalmente tricotômica, com ápices subtruncados, e apotécios de subestipitados a sesséis.

Estudando o gênero *Parmelia* subgênero *Parmelia* seção *Hypotrachyna* (Vainio) Hale e Kurokawa (1964) entenderam que para Vainio o subgrupo *Sublinearis* era o que melhor representaria uma seção *Hypotrachyna*, já que em 1923 em seu trabalho com líquens das Filipinas Vainio criara a seção *Irregularis*, e tipificaram a seção *Hypotrachyna* com *Parmelia brasiliana*. A seção *Hypotrachyna* passou então a ser descrita como tendo talos de adnatos a frouxo adnatos e subbifurcados, lobos de sublineares a lineares alongados, com lado de baixo negro e rizinas mais ou menos ricamente ramificadas.

Os autores ainda comentam que *Hypotrachyna* é surpreendentemente o mais homogêneo grupo dentro do subgênero *Parmelia* e complementam a descrição da seção dizendo que todas as espécies têm rizinas mais ou menos distintamente dicotômicas, as vezes densas na margem podendo se projetar dando a impressão de serem cílios e, portanto a seção seria eciliada, com uma maior concentração de espécies na América Tropical Ásia e África, compreendendo, então, 83 espécies, sendo 48 endêmicas da América Tropical, 14 na Ásia e 6 na África.

Dez anos depois, Hale (1974b) elevou o grupo ao gênero *Hypotrachyna* (Vainio) Hale. No entanto, ele agora baseou formalmente o gênero não em seu próprio conceito da seção *Hypotrachyna*, que abrangia apenas a seção *Irregularis* de Vainio, porém toda a seção *Hypotrachyna* de Vainio, mantendo *Parmelia brasiliana* como tipo de gênero. Esse procedimento permitiu que ele (Hale 1975) incluísse *Parmelia pluriformis* Nyl. em *Hypotrachyna*, que Vainio colocara no grupo *Irregularis*. Também, ao aumentar a circunscrição para incluir explicitamente as espécies com rizinas dicotômicas, Hale incluiu também *Parmelia flavida* Zahlbr. e *P. velloziae* Vain. em *Hypotrachyna*, ambas colocadas por Vainio na seção *Xanthoparmelia* com base no talo amarelado (ácido úsnico cortical). Nesse trabalho (Hale 1975) ele delimita, então, *Hypotrachyna* como sendo caracterizado por lobos sublineares, frequentemente alongados e apicalmente truncados, apotécios adnatos a raramente subestipitados e imperfurados, rizinas ramificadas dicotomicamente e uniformemente distribuídas por um lado de baixo negro, o córtex superior consistindo de tecido paliçádico plectenquimático com epicórtex porado.

O gênero continha na época 110 espécies, 77 delas ocorrendo principalmente em regiões elevadas da América tropical (Hale 1974b, 1975).

Contudo, o novo gênero não foi imediatamente aceito por todos os liquenólogos e Krog & Swinscow (1979) propuseram que *Parmelia* subgênero *Hypotrachyna* sensu Hale & Kurokawa acomodasse espécies ciliadas, que Hale (1976) havia colocado no gênero *Parmelina*. Anos depois, em seus estudos com os líquens africanos Krog & Swinscow (1987) reconheceram o gênero como proposto por Hale em 1974.

Ao longo dos anos seguintes novas espécies de *Hypotrachyna* foram descritas no mundo (Krog 2000, Kurokawa & Monn 2002, Wang et al. 2000, Marcelli & Ribeiro 2002, Nash et al. 2002, Divakar et al. 2006, Yáñez-Ayabaca & Eliasaro 2009, Lumbsch et al. 2011), até que Sipman et al. (2009) publicaram uma revisão para as espécies neotropicais, que contém 140 espécies das cerca de 230 até então aceitas, sendo essa a mais atual revisão.

Divakar et al. (2010), através de estudos filogenéticos, segregaram *Remototrachyna* de *Hypotrachyna*, um gênero que ocorre em altitudes elevadas das regiões tropicais e principalmente em áreas abertas e úmidas da Ásia, com apenas uma espécie pantropical, *Remototrachyna costaricensis*.

Morfologia

A morfologia de *Hypotrachyna* já foi bem discutida ao longo das últimas décadas (Hale & Kurokawa 1964, Hale 1975, Louwhoff & Elix 2002, Sipman et al. 2009). No entanto, o protocolo detalhado utilizado pelo Grupo de Estudo Liquenólogos (GEL) mostrou que características que não recebiam grande peso ou não eram utilizadas, na verdade são de grande valor taxonômico.

O protocolo descrito por Canêz & Marcelli (2006) contém mais de 150 características, e.g. largura, adnação e textura do córtex superior; a presença, tipo e distribuição de maculas; a presença, ramificação, localização e abundância de cílios; presença de estruturas vegetativas, bem como sua forma, dimensão, distribuição, ornamentação e cor (Anexo 1).

Durante o desenvolvimento desta tese novas características foram encontradas e novos detalhes foram acrescentados às já utilizadas pelo GEL explicadas a seguir.

Acetinado

Utilizando estereomicroscópio sempre é possível perceber um brilho na superfície do talo; na realidade é possível observar que o brilho é composto por pequenos pontos que correspondem ao relevo do córtex. As nossas medições e contagem do número de pontos por milímetro quadrado indicaram que eles correspondem exatamente ao número de células corticais e devem estar relacionados às convexidades do epicórtex no topo de cada uma das células no córtex paliçádico típico de *Parmeliaceae*. Portanto, o acetinado da superfície se relaciona diretamente à estrutura cortical, a sua cobertura, organização e tamanho das células. A fim de padronizar esta observação nós relatamos o acetinado em pelo menos três ampliações (10×, 20× e 30×), chamando de "aveludada" aquelas em que o brilho sob a lâmpada não permite distinguir os pontos corticais, e "acetinada" quando os pontos são facilmente distinguidos. Os termos, subaveludado e subacetinado referem-se, respectivamente, a superfícies onde os pontos são muito densos, mas não se juntaram,

ou os pontos são distintos, mas não são completamente individualizados. O acetinado pode ser observado no córtex superior, nos cílios, no lado de baixo e nas rizinas.

Ramos primários, ramos secundários, lóbulos e lacínulos

Na literatura, os termos lacínio, lobo, lóbulo e lacínulo são utilizados de maneira indistinta e intercambiável entre os autores e até mesmo dentro de um mesmo texto, o que tem levado a constantes enganos de interpretação de estruturas e identificação de espécies, incluindo muitos casos de sinonimização de espécies flagrantemente diferentes, por induzir ao entendimento de que as espécies são muito mais plásticas do que o são na realidade.

Nossos estudos em campo e laboratório mostraram que é essencial a diferenciação dessas estruturas e um absoluto rigor em sua descrição. Dessa maneira, chamamos de lobos apenas aqueles ramos de forma arredondada, em que a largura é maior que o comprimento, e de lacínios aqueles ramos em forma de fita, de lados paralelos, cujo comprimento é normalmente maior que a largura.

Determinadas espécies produzem, além dos ramos primários, que normalmente crescem em forma radial sobre o substrato, outros ramos, que se formam posteriormente, a partir das partes mais velhas dos primários, em geral nas zonas mais centrais do talo. Esses ramos, que chamamos de secundários, podem ser exatamente iguais aos primários ou, dependendo da espécie, terem tamanho, forma e/ou disposição diferente dos primários, a ponto de numa coleta pouco cuidadosa, em que se amostra apenas partes centrais do talo, se supor tratar de outra espécie. Podem crescer sobrepostos aos primários, com maior ou menor grau de adesão a eles, ou crescem entre os primários, preenchendo espaços vazios no substrato. Quando existem, os ramos secundários devem ser minuciosamente descritos e comparados aos primários.

Os ramos primários e secundários são de crescimento indeterminado, ou seja, não limitado, ao contrário dos lóbulos e lacínulos.

Lóbulos e lacínulos têm respectivamente as formas arredondadas ou de lados paralelos, como os nomes sugerem. Surgem a partir dos ramos primários e/ou secundários. De acordo com a espécie têm um padrão definido de distribuição, forma, ramificação, tamanho e ornamentação, e normalmente são muito menores que os ramos.

Crescimento primário e secundário

Ocorre num mesmo ramo, quando a forma de crescimento se altera com a idade do talo quando, por exemplo, um lacínio inicia seu desenvolvimento prostrado, plano e aderido ao substrato e depois se curva para cima e cresce ereto ou subereto e com tendência canaliculada, como acontece, por exemplo, comumente em espécies de *Hypotrachynella*.

Cílios

Trata-se de outra estrutura cuja definição é muito debatida na literatura e utilizada de maneira extremamente diversa pelos autores. Por vezes são casos de difícil interpretação, principalmente quando são morfologicamente semelhantes às rizinas que crescem muito próximas da margem. Como no estudo de *Hypotrachyna*, um gênero que durante muito tempo foi tido como eciliado, sua distinção se tornou fundamental, estabelecemos uma rígida distinção para eles: são produzidos a partir da linha negra marginal.

Cílios que podem ser confundidos com rizinas quando são descendentes na zona marginal/apical, muitas vezes atuando como rizinas, na fixação do talo. Neste caso, um olhar cuidadoso sob ampliação de 20× ou acima resolve facilmente o problema ao mostrar claramente a sua relação com a linha negra, mesmo quando ela é sutil ou um pouco oculta pela margem ser incurvada. Obviamente, espécies sem linha negra são eciliadas.

Rizinas

São de importância taxonômica muito maior que a normalmente atribuída a elas, e os gêneros segregados de *Hypotrachyna* normalmente as têm bastante características.

Características novas encontradas e utilizadas aqui são (1) o fato de sua ramificação ser coplanar (ramos num mesmo plano) ou arbuscular, (2) de elas serem retas curvas, ou recurvadas, (3) de eles se entrelaçarem ou não, (4) de elas serem gomosas (cobertas de uma substância com aspecto de cola) ou não, (5) se são ou não anastomosadas e (6) o ponto onde ocorre a primeira ramificação.

Autoincompatibilidade

Nos talos de algumas espécies ocorre um enegrecimento, às vezes morte, às vezes transformação em córtex inferior, de partes em contato de um mesmo talo. Normalmente a parte afetada é aquela posicionada abaixo de outra, como por exemplo, as laterais superpostas de lacínios. Por vezes é observável nos ápices de lacínios que tocam outro durante seu crescimento, paralisando-o. Nomeamos de autoincompatibilidade esse processo natural que, entre outras coisas, evita a superposição de partes de um mesmo talo e explica parcialmente o hábito característico das muitas espécies. As partes enegrecidas às vezes se desintegram, deixando a margem irregularmente recortada. Pode acontecer também que partes específicas de um talo como, por exemplo, a base apotécio, se tornem escurecidas quando em contato o córtex superior, por vezes, até mesmo produzindo rizinas. Esse fenômeno, ao qual nunca se deu qualquer importância, é responsável pela grande quantidade de talos de Parmeliaceae encontrados na natureza enegrecidos, com partes "danificadas" e "doentes", muitas vezes não coletados por causa do "estado" em que se encontram e que, entretanto, é o normal da espécie.

Linha negra complementar

Ocorre em determinadas espécies em que a margem é de minutamente irregular ou quebrada irregularmente, e a linha negra, ao invés de fazer o contorno dessa margem, preenche as "imperfeições", deixando a margem com aparência de lisa e não recortada. Essa linha negra é, portanto, externamente retilínea e internamente irregular em seu contato com a parte liquenizada do lacínio/lobo.

Metabólitos secundários

Hale (1966) afirmou que Nylander pode receber todos os créditos por ter dado início à sistemática bioquímica em líquens mesmo sem qualquer conhecimento básico da química das reações de spot. O autor ainda explica que essas reações ocorrem devido a presença de uma ou mais das 80 a 100 metabólitos secundários únicos dos líquens, hoje estimados em 854 substâncias (Elix 2014).

Os estudos de Hale & Kurokawa (1964) e Hale (1965) levaram em consideração as substâncias líquênicas na separação de espécies.

Em seu trabalho sobre química e evolução de líquens Hale (1966) discutiu a relação entre a morfologia e a química nos líquens iniciando assim um interesse maior nessa

associação. Culberson & Culberson (1970) e Culberson (1970) começaram os estudos mais efetivos sobre o assunto.

Especificamente em *Hypotrachyna*, Culberson & Hale (1973) discutiram a provável evolução morfológica/química das espécies com ácido barbático e ácido evérnico utilizando essas espécies como modelo de um possível processo de hibridização no grupo.

Hale (1975) encontrou 39 substâncias nas espécies de *Hypotrachyna*, uma mesma espécie podendo ter mais de uma, e relacionou alguns compostos com a morfologia, sugerindo que o gênero poderia ser dividido em subgrupos químicos. Os subgrupos principais eram: ácido alectorônico, ácido evérnico-lecanórico, ácido girofórico, ácido livídico, ácido colensoico, ácido equinocárpico, ácido α -colatólico, ácido protocetrário, ácido úsnico e liquexantona.

Na revisão do gênero para o Neotrópico, Sipman et al. (2009), afirmam que são encontrados 109 produtos naturais em *Hypotrachyna*, que podem estar combinados ou não em uma só espécie. Mais informações em Sipman et al. (2009).

Filogenia

Os estudos filogenéticos realizados com espécies de *Hypotrachyna* começaram com Crespo & Cubero (1998), que observaram que *H. revoluta* é próxima de *Parmelinopsis horrescens*. Posteriormente, Divakar et al. (2006) publicaram um trabalho com o gênero e dividiram as espécies em dois grupos utilizando compostos químicos como principal critério para explicá-los. Como espécies de *Everniastrum* e *Parmelinella* aparecem entre as espécies de *Hypotrachyna*, os autores concluíram que a circunscrição do gênero necessitaria de revisão, tendo em vista que o gênero é polifilético. O fato foi corroborado por Thell et al. (2012) em seu estudo de revisão da família *Parmeliaceae*.

Divakar et al. (2010), numa nova análise com espécies de *Hypotrachyna* descreveu o gênero *Remototrachyna*. Uma nova análise foi depois publicada (Divakar et al. 2013), mais ampla e utilizando gêneros próximos para melhor entendimento desse gênero polifilético. Os autores, então, dividiram o gênero nos grupos, *H.* subgênero *Parmelinopsis*, *H.* sensu stricto, *H.* subgênero *Everniastrum*, *H.* subgênero *sinuosae* e *H.* subgênero *longilobae*, além de um clado não suportado. Com essa nova classificação o gênero continuou polifilético e com a urgente necessidade de uma revisão em sua circunscrição para que se possa compreender adequadamente o grupo, tendo em vista que

com essa análise, três gêneros tradicionalmente aceitos foram inseridos em *Hypotrachyna*: *Parmelinopsis*, *Everniastrum* e *Cetrariastrum*.

Com as recombinações feitas por Divakar et al. (2013) o gênero hoje tem cerca de 270 espécies.

Área de estudo

As Florestas Montanas do sudeste do Brasil localizam-se em altitudes elevadas no complexo montanhoso das Serras da Mantiqueira e do Mar (Pereira 2006), bem como os campos de altitude ou rochosos.

Nas altitudes superiores a 800 m como, por exemplo, Campos do Jordão (SP), Itatiaia (RJ/SP/MG), e nas Serras do Caraça e do Ibitipoca (MG), a abundância e diversidade de fungos liquenizados é maior (Ribeiro 1998).

A Serra da Mantiqueira é composta pelos planaltos do Amparo, de Andrelândia e pela parte sul da Serra do Espinhaço; estende-se pelo leste do Estado de São Paulo, sul de Minas Gerais e sudoeste do Rio de Janeiro, sendo um divisor de águas entre as bacias do rio Grande, em Minas Gerais, e a do rio Paraíba do Sul, em São Paulo e Rio de Janeiro. A região está localizada aproximadamente entre 20°–22° S de latitude e 41°–47° W de longitude (Ribeiro 1998).

De acordo com Brasil (1983), a Serra da Mantiqueira está dividida em duas porções: Mantiqueira Meridional e Setentrional. A primeira apresenta uma área total de 13.176 km², limitada ao norte pelo Planalto do Alto Rio Grande (próximo a São João Del Rei, Pouso Alegre, Caxambu, Lambari e São Lourenço), a leste pelo Planalto Central Sul de Minas (próximo a Nepomuceno, Ponte Nova, Pedra do Indaiá, Itaúna e Cassiteria), ao Sul pelo Vale do Paraíba do Sul (próximo a BR116) e a oeste pelo Planalto do Amparo (próximo a Jaraguá, Atibaia e Camanducaia). Neste ponto, a Serra é um divisor dos rios Itaim e Sapucaí, no extremo da divisa com a depressão Paulista. A Mantiqueira Meridional apresenta duas unidades distintas: Unidade Planalto Campos do Jordão, com 8.828 km² nos estados de Minas Gerais e São Paulo; e Unidade de Itatiaia. A Unidade Planalto Campos do Jordão tem início nas serras ao norte da cidade de São Paulo, passando pelos relevos elevados presentes na margem esquerda do Rio Paraíba do Sul, incluindo as escarpas que dão acesso ao Vale do Paraíba do Sul, terminando as instruções alcalinas de Passa Quatro e Atibaia. A Unidade Planalto de Itatiaia apresenta uma área de 4.348 km² nos Estados de Minas Gerais e Rio de Janeiro, começando ao sul com a região de Passa Quatro e Itatiaia, sendo o limite norte a região do Planalto de Andrelândia.

Nestas unidades está localizada a Serra do Ibitipoca, no município de Lima Duarte. A vegetação predominante nesta região é a de Floresta Alta Montana e Floresta Montana.

A Mantiqueira Setentrional possui uma área total de 35.879 km² nos estados de Minas Gerais, Espírito Santo e uma pequena porção do Rio de Janeiro. Apresenta como limite leste as colinas e os maciços costeiros, ao sul o vale do Paraíba do Sul e a oeste os Compartimentos Planálticos do Leste de Minas (BR262, Planalto de Andrelândia). A altimetria média é de 1.100 m, ocorrendo regiões com altitudes médias de 700 m. Nesta porção da Mantiqueira está o Pico da Bandeira com 2.897 m. A vegetação consta de Florestas Ombrófilas, densas e abertas, e Florestas Submontana (Brasil 1983).

A Mantiqueira Setentrional está dividida em três unidades básicas: Unidade Escalonados do sul Capixaba, Unidade Maciços do Caparaó e Unidade Serranias da Zona da Mata Mineira. Essas, com uma área total de 10.173 km², possuem como limite leste os maciços do Caparaó e patamares escalonados do sul capixaba, sul com a depressão escalonada dos Rios Pomba e Muriaé, a oeste com o planalto campos das vertentes e depressão interplanáltica do médio Rio Doce. Em alguns pontos esta unidade extrapola seus limites como exemplo a região de Juiz de Fora que penetra a depressão escalonada dos Rios Pomba e Muriaé. A vegetação original é formada por Floresta Estacional Semidecidual. A unidade Maciço do Caparaó com uma área de 7.308 km² está localizada quase que totalmente nas folhas SE.24 Rio Doce e SF.24-V-A do Projeto Radam-Brasil. A vegetação original é de Floresta Montana. Por fim, a unidade Patamares Escalonados do Sul Capixaba apresenta como limite leste as colinas e os maciços costeiros e a sul com a depressão escalonada dos Rios Pomba e Muriaé (Brasil 1983).

O mosaico de Unidades de Conservação (UC) da Região da Serra da Mantiqueira abrange uma área com 445.615 ha, composta por 19 Unidades de Conservação, tais como: Parque Nacional do Itatiaia (RJ) e Parque Estadual de Campos de Jordão (SP). Em seu entorno são encontradas outras Unidades de Conservação, como a Reserva Particular do Patrimônio Público Santuário do Caraça e a Parque Estadual do Ibitipoca (Serrano 2010).

Parque Nacional do Itatiaia

O Parque Nacional do Itatiaia (PARNA Itatiaia), primeiro Parque Nacional brasileiro, abrange uma região montanhosa que abriga os pontos culminantes da Serra da Mantiqueira na divisa entre os Estados do Rio de Janeiro, Minas Gerais e São Paulo. Com 28.155,97 ha, localiza-se a 22°15'22"30"S e 44°30'44"45"W, possui área total de 30 mil hectares (Jorge Pádua & Coimbra Filho 1989) e altitudes variando entre 700 e 2.787 m.

O Maciço do Itatiaia, com um importante remanescente de Floresta Atlântica da Serra da Mantiqueira, desde as primeiras visitas dos naturalistas M. H. Wawra von Fernsee e Saint-Hilaire foi destacado como uma região de extremo potencial à investigação científica (Carvalho et al. 2005).

O PARNA Itatiaia é dividido em dois ambientes distintos: a parte baixa, que apresenta o ecossistema de Mata Atlântica, e a parte alta, onde há presença de penhascos e encostas (relevo montanhoso).

A fitofisionomia do PARNA Itatiaia varia de acordo com a altitude, apresentando as formações de Floresta Pluvial Montana, Floresta Pluvial Baixo - Montana e Campo Altimontano (Almeida 2001, Pereira 2006).

Reserva do Patrimônio Natural Santuário do Caraça

Nos arredores da Serra da Mantiqueira outras Unidades de Conservação são encontradas, sendo uma delas a RPPN Santuário do Caraça, na Serra do Caraça (Catas Altas, MG).

Considerado Patrimônio Nacional desde 1955, tornou-se uma Reserva Biológica em 1980 e em 1994 uma Reserva Particular do Patrimônio Natural através da Portaria 32, de 30 de março de 1994. Hoje a área da reserva é de 11.233 hectares e desde o século 19 sempre foi muito visitada por estudiosos em decorrência da riqueza de sua diversidade biológica, bem como pela sua composição geológica (Palú 2006).

Zimmermann (1996) afirmou que a região da RPPN Santuário do Caraça encontra-se inserida no domínio geomorfológico do Quadrilátero Ferrífero. A Serra do Caraça constitui o prolongamento sul da Serra do Espinhaço, e é o divisor de águas mais elevado entre as bacias dos rios São Francisco e Doce. Geologicamente, as rochas presentes no Caraça são metamórficas de origem ígnea, constituído de quartzitos bem estratificados com coloração creme da Formação Moeda e pelos filitos crenulados de coloração cinza prateada pertencentes à Formação Batatal, havendo predominância de clorita-xistos com intercalações de quartzito ferruginoso e rocha vulcânica (Bigarella et al. 1985, Lima 2001, Franco & Endo 2004, Almeida et al. 2005, Morato et al. 2006).

O aspecto geral da morfologia do relevo pode ser descrito como sendo um vale, de fundo relativamente plano e pouco ondulado, cortado pela bacia do ribeirão Caraça, de característica predominantemente sedimentar, cercado por elevações que lhe conferem o aspecto de um anfiteatro, cuja única abertura se volta para norte. Disponíveis abruptos separam o fundo do vale das cristas circundantes, cuja altimetria atinge os 2.070 metros

no Pico do Sol. Observa-se que a altimetria do relevo determina a amenização da tropicalidade do clima regional por atuar como uma barreira natural influenciando na atuação de sistemas atmosféricos (Moreira & Pereira 2004).

Moreira & Pereira (2004) referiram que a área constitui uma região de elevada diversidade biológica, pois é um ecótono entre os domínios da Mata Atlântica e do Cerrado. Os autores ainda afirmaram que a topografia e a presença de afloramentos rochosos determinam a presença de campos rupestres nos pontos mais elevados, registra-se ainda a presença de campos sujo e limpo nas menores altitudes e matas ciliares às margens dos cursos d'água. Palú (2006) relatou que há 200 espécies de orquídeas e mais de 200 de pteridófitas, e afirmou que Vainio encontrou 465 espécies de líquens em sua visita ao Santuário, em 1885.

Outras regiões da Serra da Mantiqueira

Além dos parques acima citados, outras regiões da Serra da Mantiqueira e arredores foram estudadas, entre elas a Serra da Piedade, o PARNA do Caparaó (RJ/ES), as cidades mineiras de São Thomé das Letras e Carrancas. Algumas dessas regiões são marcadas pela presença de gnaisses, migmatitos, granitos, xistos, quartzitos, calcários, calcissilicáticas e anfibolitos (Hausi et al. 1978, Morais et al. 1998), com altitudes que variam de 1.030 a 2.007 metros (Seibert 1975). Nas outras dominam, segundo Andrade (1984), eossolos originados de rochas quartzíticas; no entanto Rocha (1997) observou diferenças no que diz respeito ao material de origem e às características texturais dos solos, que mostraram elevada acidez, baixa capacidade de troca de cátions e pobreza em nutrientes.

O conhecimento Liquenológico da Serra da Mantiqueira

Muitos pesquisadores visitaram as regiões alvo deste projeto, sendo que Martius & Spix [1817–1820] visitaram desde o sul da cidade Rio de Janeiro até a cidade de São Paulo e o norte de Minas Gerais, Gardner [1836-1841] coletou no norte e nordeste do Estado do Rio de Janeiro; Glaziou [1861-1895] coletou na cidade do Rio de Janeiro e na Serra dos Órgãos, no Estado do Rio de Janeiro, e nos Estados de Minas Gerais e São Paulo; Warming [1863–1866] visitou Lagoa Santa, Serra da Piedade, Barbacena, Serra da Mantiqueira e outros lugares do Estado de Minas Gerais e Rio de Janeiro, enquanto Ule [1883–1912] coletou no sudeste e na região central do Brasil. Vainio [1885] desenvolveu sua tese de doutorado com líquens coletados por ele no Estado de Minas

Gerais, particularmente no município de Antônio Carlos e na Serra do Caraça. Malme [1892-1894] participou de uma expedição que em seu início incluiu o sudoeste do Estado do Rio de Janeiro, Minas Gerais (São João Del Rei e montanhas do Itacolomi) e São Paulo (Santos). Já Schiffer & Wettstein (1901), em sua viagem ao sudeste brasileiro, coletaram também na Serra do Itatiaia (RJ). Damázio (1870–1905), o último a visitar a região durante um longo período, coletou em Minas Gerais principalmente nas regiões montanhosas ao redor do pico do Itacolomi (Marcelli 1998). Entretanto, a grande maioria das coletas de líquens é de material crescendo sobre troncos e ramos de árvores, possivelmente devido à dificuldade inerente à coleta e transporte de material saxícola.

Após esse período, as coletas registradas em bibliografia para essas regiões só voltaram a acontecer no final do século 20, com Ahti & Marcelli (1995), Marcelli & Ribeiro (2002) e Ribeiro (1998) que, ao estudar a região sem objetivo de coletar líquens saxícolas, amostrou 42 espécies de *Parmeliaceae*, incluindo algumas poucas amostras saxícolas eventuais.

Mesmo com os estudos realizados nos últimos anos, principalmente pelo Grupo de Estudos Liquenológicos, a micota liquenizada ainda é pouco conhecida no Brasil, e quando se trata de fungos liquenizados saxícolas esse conhecimento é quase nulo.

Espécies esperadas para a região

De acordo com a literatura seria esperado encontrar na Serra da Mantiqueira, com ênfase em líquens saxícolas, cerca de 150 espécies de *Parmeliaceae*, dentre as quais 62 de *Hypotrachyna* sendo elas *H. alectorialiorum* Elix, T.H. Nash & Sipman, *H. angustissima* Marcelli & C.H. Ribeiro, *H. aspera* C.H. Ribeiro & Marcelli, *H. bahiana* (Nyl.) Hale, *H. bogotensis* (Vain.) Hale, *H. brasiliiana* (Nyl.) Hale, *H. breviphiza* (Kurok.) Hale, *H. brueggeri* C.H. Ribeiro & Marcelli, *H. chicitae* (Hale) Hale, *H. chlorina* (Müll. Arg.) Hale, *H. contradicta* (Hale) Hale, *H. croceopustulata* (Kurok.) Hale, *H. dactylifera* (Vain.) Hale, *H. degelii* (Hale) Hale, *H. densirhizinata* (Kurok.) Hale, *H. divaricatica* Elix & T.H. Nash, *H. eitenii* (Hale) Hale, *H. enderythraea* (Zahlbr.) Hale, *H. endochlora* (Leighton) Hale, *H. erythrodes* (Hale & Kurok.) Hale, *H. everniastroides* Sipman, *H. explendens* (Hale) Hale, *H. flavida* (Zahlbr.) Hale, *H. fletcheri* Elix, T.H. Nash & Sipman, *H. goiasii* Elix & T.H. Nash, *H. gondylophora* (Hale) Hale, *H. gracilescens* (Vain.) Hale, *H. hypoalectorialica* Elix & T.H. Nash, *H. imbricatula* (Zahlbr.) Hale, *H. immaculata* (Kurok.) Hale, *H. intercalanda* (Vain.) Hale, *H. isidiocera* (Nyl.) Hale, *H. kalbii* Elix,

T.H. Nash & Sipman, *H. kriegeri* Marcelli & C.H. Ribeiro, *H. laevigata* (Smith) Hale, *H. livida* (Taylor) Hale, *H. lividescens* (Kurok.) Hale, *H. malmei* (Lynge) Hale, *H. mattickiana* Sipman, Elix & T.H. Nash, *H. meridensis* Hale & López-Figueiras, *H. microblasta* (Vain.) Hale, *H. minima* (Lynge) Hale, *H. neodissecta* (Hale) Hale, *H. novela* (Vain.) Hale, *H. obscurella* (Vain.) Hale, *H. osorioi* (Hale) Hale, *H. osteoleuca* (Nyl.) Hale, *H. palmarum* (Lynge) Hale, *H. partita* Hale, *H. physcioides* (Nyl.) Hale, *H. pluriformis* (Nyl.) Hale, *H. polydactyla* (Krog & Swinscow) T. H. Nash, *H. protenta* Hale, *H. pseudosinuosa* (Asahina) Hale, *H. revoluta* (Flörke) Hale, *H. rockii* (Zahlbr) Hale, *H. singularis* (Hale) Hale, *H. subpustulifera* Elix, *H. subsaxatilis* (Bouly de Lesdain) Hale, *H. vainio* Sipman, Elix & T.H. Nash e *H. velloziae* (Vain.) Hale.

Esta tese teve como objetivo o estudo taxonômico de espécies do gênero *Hypotrachyna*, com ênfase em espécies saxícolas da Serra da Mantiqueira e arredores, para elucidar essa lacuna no conhecimento da liquenologia brasileira.

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CAPITULO 1

Hypotrachynella, a new genus segregated from *Hypotrachyna* (Parmeliaceae)

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1 *Hypotrachynella*, a new genus segregated from *Hypotrachyna*
 2 (*Parmeliaceae*)

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10
 11 Running title: *Hypotrachynella* gen. nov.

12
 13 Key words: cilia; autoincompatibility; satin; gummed rhizines; cerrado; Brazil

14
 15 **Abstract**

16 *Hypotrachyna* is a polyphyletic genus with chemical groups from which we describe here the genus
 17 *Hypotrachynella*, corresponding to the gyrophoric acid containing *Hypotrachyna pluriformis* group, where
 18 we include the new combinations *Hypotrachynella chlorocarpa* stat. nov., *H. everniaeformis*, *H. multifida*
 19 stat. nov., *H. neodissecta*, *H. osorioi*, *H. pluriformis*, *H. revoluta*, and *H. subpluriformis*. In addition, we
 20 describe the five new species *H. caapora*, *H. marcellii*, *H. mogiana*, *H. oreadica*, and *H. puiggarii*.

21
 22 **Introduction**

23
 24 *Hypotrachyna* was proposed by Vainio (1890) as a section of *Parmelia* subgenus
 25 *Parmelia* to accommodate those species with whitish or greenish thalli, lower surface
 26 totally rhizinate or at least papillate at the distal parts or naked only in a very narrow
 27 marginal zone. The section included three informal component groups: *Irregularis* (lobed
 28 to sublobed, lobes at least partially ascending, large, and irregularly ramified, the
 29 apothecia stipitate), *Cyclocheila* (sublobed to lobed, adnate, lobes irregularly divided and
 30 irregularly sinuous-incised and apothecia subpedicellate), and *Sublinearis* (adnate,
 31 sublinear, dichotomous to occasionally trichotomous laciniae with subtruncate apices and
 32 the apothecia substipitate to sessile).

33 Hale & Kurokawa (1964) elevated the section *Hypotrachyna* group *Sublinearis* to
 34 subgenus and choose *Parmelia brasiliiana* Nyl. as type species.

35 During the year 1974, Mason E. Hale began the splitting of the big genus *Parmelia*
 36 by recognizing *Pseudoparmelia* and *Parmotrema* (Hale, 1974a;b), two existing but not
 37 used names, and proposing several new genera (Hale, 1974c), among them *Hypotrachyna*
 38 (Vainio) Hale (Hale, 1974d), which included 110 species with sublinear, often elongate,
 39 apically subtruncate lobes, adnate to rarely substipitate imperforate apothecia, and

40 dichotomously branched rhizines uniformly distributed on the black lower surface, the
41 upper cortex consisting of palisade plectenchyma with a pored epicortex.

42 Hale (1974d) based formally his genus *Hypotrachyna* in all Vainio's section
43 *Hypotrachyna*, not in his own concept of the section *Hypotrachyna* (based only in the
44 *Sublinearis* group) and kept *H. brasiliana* [*Parmelia brasiliana*] as the type species of the
45 genus. This enlargement of the genus sense allowed Hale (1975) to include *Parmelia*
46 *pluriformis* Nyl. in *Hypotrachyna*, which has been placed by Vainio in the group
47 *Irregularis*. At the same time, by including the dichotomous rhizines in the
48 circumscription, Hale included *Parmelia flavida* Zahlbr. [as *P. flava* Kremp., nom. illeg.]
49 and *P. velloziae* Vain. in *Hypotrachyna*, both placed by Vainio in the Section
50 *Xanthoparmelia* that was based on the yellowish thalli (with cortical usnic acid).

51 The other *Irregularis* species were combined into *Rimelia* (Hale & Fletcher, 1990)
52 and later in *Parmotrema* (Crespo *et al.*, 2010). By other hand, *Cyclocheila* species were
53 included in *Pseudoparmelia* (Hale 1976) and later distributed in several genera.

54 Nowadays *Hypotrachyna* is estimate to embrace about 230 accepted species
55 (Sipman *et al.*, 2009), one of the largest genera in the family *Parmeliaceae* and,
56 additionally to the characters cited by Vainio and Hale, the included species are stated to
57 share bifusiform conidia, ascospores of medium size, are chiefly eciliate (Krog &
58 Swinscow, 1979; Elix, 1993; Elix, 1994; Eliasaro *et al.*, 1998; Louwhoff & Elix, 2002;
59 Divakar & Upreti, 2003; Sipman *et al.*, 2009; Thell *et al.*, 2012).

60 According to Hale (1975) and Elix (1993), *Hypotrachyna* is a mostly tropical
61 montane genus (subtropical climate), with center of speciation in South America, and
62 occurs in the American Continent, Asia, Africa, Papua New Guinea, Australia, Pacific
63 islands and Europe. In tropical Americas, the altitude ranges between 500 m (Hale, 1975)
64 and 3700 m (Sipman *et al.*, 2009), with species occurring at sea level only on south and
65 north limits of distribution (Hale, 1975), and in Australia occurs above 730 m (Elix,
66 1994).

67 The use of chemistry is classic in lichen taxonomy since the 19th Century but in
68 the *Parmeliaceae* it was put forward definitively in the sixties during the 20th Century
69 (e.g Hale & Kurokawa, 1964; Hale, 1965) when the relationship between morphology
70 and chemistry became apparent (Hale, 1966). Nevertheless, implications on evolution and
71 taxonomy were effectively taken in account by Culberson (1970) and Culberson &
72 Culberson (1970). Specifically in *Hypotrachyna*, Culberson & Hale (1973) discussed the

73 probable morphological/chemical evolution of the species and the possible paper of
74 hybridization process in the group.

75 In his classical monograph on *Hypotrachyna* in Tropical America, Hale (1975)
76 clearly considered the genus as composed by chemical subgroups, and *H. pluriformis*
77 (Nyl.) Hale, with its morphology somewhat deviating from the "typical" *Hypotrachyna*,
78 as already recognized by Vainio, was included in a group characterized by the gyrophoric
79 acid as principal secondary substance together with *H. neodissecta* (Hale) Hale, *H.*
80 *oostingii* (Dey) Hale, *H. osorioi* (Hale) Hale, *H. revoluta* (Flörke) Hale, and *H. thysanota*
81 (Kurok.) Hale.

82 Later phylogenetic approaches supported this view, with Crespo & Cubero (1998)
83 attributing the revealed proximity between *H. revoluta* and *Parmelinopsis horrescens* to
84 the chemical similarity.

85 Beginning the 21st Century, Louwhoff & Elix (2002) commented that
86 phylogenetic studies showed that *Hypotrachyna* was not satisfactorily resolved, and
87 Divakar *et al.* (2006; 2010) found *Hypotrachyna* be polyphyletic.

88 Thell *et al.* (2012) showed that *Hypotrachyna* and *Parmelinopsis* were making
89 together a sister-clade of *Cetrariastrum* and *Everniastrum*.

90 This relationship between *Parmelinopsis* and the group *Hypotrachyna pluriformis*
91 came again to the light recently when Divakar *et al.* (2013) reduced *Parmelinopsis* to a
92 subgenus in *Hypotrachyna* because *Parmelinopsis* share a same clade with the *H.*
93 *pluriformis* group.

94 Our own studies with the Brazilian species of *Hypotrachyna*, based on a very
95 detailed protocol of morphological analysis, revealed also that the group is composed of
96 a number of well-defined morphological/chemical entities that we were already
97 considering as good genera and that automatically fitted very well to the phylogenetic
98 tree published, independently of my morphological analysis, by Divakar *et al.* (2013).

99 Therefore, we are presenting here the small group *H. pluriformis* as a new genus,
100 revising and recombining those species we had access to the type material, and describing
101 some new Brazilian species. As logical consequence, we do not accept *Parmelinopsis* as
102 a subgenus under *Hypotrachyna*.

103 The other subgroups of *Hypotrachyna* are being prepared for publication as
104 several new genera elsewhere.

105

Material and methods

106
107

108 The descriptive protocol developed by GEL (Canêz & Marcelli, 2006) for access
109 the morphological characters of the *Parmeliaceae* has been widely extended to verify
110 more than 150 characters and improved in the qualification and description of these along
111 the years and was used here to standardize the descriptions. Most of the modifications
112 were directed to describe with minutiae those details that have been demonstrated
113 effective and/or important to distinguish Brazilian species, much of them historically
114 overlooked or erroneously considered be too much variable because the small amount of
115 specimens the researchers deal with and/or because they had limited field knowledge with
116 these taxa. In a resumed way, they refer chiefly to: (1) thalli and lobes/laciniae
117 development, ascending, conformation, disposition, and surface relief, including detailed
118 description of apical and marginal zones; (2) detailed evaluation of the underside,
119 including relief, texture and shine, and several aspects of the rhizines conformation,
120 aggregation, and ramifying; (3) rigid definition and distinction among soredia, granules,
121 isidia, dactyls, pustules, including description of their ontogeny (not significant in this
122 text in particular); (4) detailed description of the apothecia both young and old, including
123 disc opening and integrity, rim conformation, and amphithecia relief.

124 Of special interest is the new characteristic introduced here that we named "satin".
125 It has been already evaluated by us for about two years for species of several
126 *Parmeliaceae* genera and proved very efficient to compare upper and lower surfaces, as
127 well as cilia and rhizines on same and among species. Under the stereomicroscope is
128 always possible to perceive the shine of the surfaces. In reality, it is possible to observe
129 that the shining is composed by very small dots corresponding to the surface's micro
130 relief. Our measurements and counting of the number of dots per square millimeters
131 indicated that they correspond exactly to the number of cortical cells and might be relative
132 to the epicortex-covered convexity of the top of each cell in the typical palisade cortex of
133 the *Parmeliaceae*. Therefore, by observing the surface satin we are referring the cortical
134 structure, its covering, and cell size. In order to standardize this observation we report the
135 satin in at least three magnifications (10×, 20×, and 30×) and named "velvety" that shine
136 where is not or only barely possible to distinguish the dots, and "satin" when the dots are
137 readily distinguished. The terms subvelvety and subsatin refers respectively to those
138 surfaces where the dots are very much dense but not joined, or the dots are easily
139 distinguished but not completely individualized. However we recognize that some basic

140 training may be necessary to use this characteristic, we stating that it is not so different
141 from some other characteristics, as, for example, to distinguish correctly soredia from
142 granules, or pustules from dactyls and from big thick isidia. Furthermore, we advise that
143 one must be careful and not mistake the satin (the size and proximity of the shining dots)
144 by the total shining itself, i.e., a surface can be characterized as lustrous and velvety, or
145 dull and velvety, or satin and lustrous, or satin and velvety, and so on. For this, we
146 recommend that the total shining being evaluated at the lowest stereomicroscope
147 magnification, and after the satin evaluated by paying attention to the dots compounding
148 the shine.

149 Depending upon the genus and species, the satin can be the same all over the
150 thallus or the upper surface be different from the lower, sometimes the cells of the upper
151 surface being smaller or vice-versa. The most common situation is the rhizines having the
152 same satin condition that the lower cortex, the cilia the same satin that the black line, but
153 this is not always so. In the reality, this very variable character presents a clear tendency
154 at genus level but is variable from species to species, apparently linked to the taxa cortical
155 development and organization.

156 Another very relevant and commonly not considered aspect in *Hypotrachyna* and
157 other *Parmeliaceae* is the distinction among primary and secondary laciniae/lobes and
158 the lacinules/lobules. In many texts, laciniae and lacinules are interchangeably used or
159 mistaken one for another based only on size. By studying much material at field and lab
160 we consider essential to distinguish them carefully, and consider lacinules/lobules only
161 those branches originated from the laciniae/lobes, which have definite and limited growth
162 and are produced naturally by some species, where they develop characteristics patterns
163 of size, ramifying, disposition, conformation, and other aspects. Differently, the
164 laciniae/lobes are the original branches of the thallus, have their own ramifying and
165 disposition patterns, and are of undetermined growth, i.e., they are the basic basal part of
166 the thallus from where everything originates. The primary ones are those formed from the
167 original propagule and, in *Hypotrachyna*, normally spread radially on the substrate and
168 they are not commonly overlapped. The secondary laciniae, if present, normally originate
169 from the older parts of the primary ones, growth on it, and readily reach the size and
170 characteristics of the primary ones (in some species they are narrower), except for a
171 commonly different manner of spreading, e.g., by irregular overlapping. Because this, a
172 serious care must be taken when collecting, in order to sample entire thalli or, at least,
173 both proximal and distal portions of the individuals, taking notes to avoid

174 misinterpretations on the material as being a mixture. Since it is common that the
175 proximal parts are fairly less adhered than the distal ones, samples composed just by
176 proximal secondary laciniae are not rare, including in type material.

177 Hale & Kurokawa (1964) considered *Hypotrachyna* an eciliate genus (not in the
178 formal circumscription but in the comments and key) and Hale (1975) do not even make
179 mention to cilia, considering all the structures visible beyond the margins as projecting
180 rhizines. Nevertheless, cilia have been mentioned in the literature over the years and their
181 presence is always recognized on isidia in a number of *Hypotrachyna* species, an
182 indication that the genus is capable of producing them. Sipman et al. (2009) used cilia as
183 a normal character in *Hypotrachyna*, stating that they occur chiefly on the axils of a
184 number of species.

185 Really, it is not easy to distinguish cilia from rhizines in *Parmeliaceae*, chiefly
186 when a naked marginal zone is absent and because they are commonly very similar
187 (sometimes undistinguishable) in shape and size. Furthermore, cilia and rhizines can take
188 the function one from another when one of them is absent. It is not rare to observe (in
189 species that clearly have both) cilia turned down and acting in fixation as rhizines, and
190 rhizines projecting away as cilia do, in a clear indication that both functions are somehow
191 important and might be accomplished. Both cilia and rhizines have the same anatomy and
192 are produced in a similar ontogenetic way; so, should not be strange that they have similar
193 shapes. In fact, the morphological analysis of both is very similar.

194 Be the distinction among cilia and rhizines functional, morphological, or both, the
195 fact is that by comparing a great number of individuals e confronting type material we
196 found important distinguish them efficiently for taxonomical purposes and finally decided
197 call cilia those structures produced from the marginal black line, and rhizines those
198 produced on the underside. By doing so, a greater number of *Hypotrachyna* species might
199 be considered ciliate. Cilia can be confused with rhizines when they are descendent and
200 the marginal/apical zone has long well developed rhizines. In this case, a careful look at
201 magnification 20× or above solve easily the problem by showing clearly their relationship
202 to the black line, even when it is subtle or somewhat occult by a turned down margin.
203 Obviously, species without black line are eciliate.

204 Rhizines have also characters whose importance has been widely underestimated.
205 However Sipman *et al.* (2009) have considerably improved their description, we have
206 found important paying attention to several additional aspects or to detail aspects that
207 commonly are only mentioned. The most striking character is about the ramifying pattern,

208 for what we are introducing the differentiation among the "coplanar" and "arbuscular" to
209 distinguish those in which the branching occurs in a same plane from those with
210 irregularly radiate branching. Moreover, the status of bent, curved, curled, sinuous,
211 anastomosed, interlaced, fasciculate, gummed (as covered with glue) are examples of
212 important characteristics, as well where the ramification and/or the curling occurs along
213 the rhizines, since there is certainly a correlation between the curling and the chemical
214 constitution of the species, whose degree of effectiveness needs yet confirmation.

215 Autoincompatibility is how we are naming the phenomenon in which parts of a
216 same thallus become blackened and can even die when in contact. It is a natural process
217 that avoids superimposing of thallus and explain partially the spread habitus and most of
218 the black parts found commonly on *Parmeliaceae* thalli, most of the times considered a
219 symptom of disease or stress. We are considering it species specific. It is principally
220 common at the border of touching or superposing lacinae, when the lacinia below shows,
221 in its dead parts, the outline of the superposed one. The blackened parts sometimes
222 disintegrate, sometimes assume function of lower cortex. It can happen also with specific
223 parts of a thallus as, for example, the apothecial basis that can become darkened when
224 contacting the upper cortex, sometimes even producing rhizines (not in *Hypotrachyna*
225 species). One must be careful when looking for signs of autoincompatibility because
226 blackening and dead can also occur simply upon ageing or when touching certain
227 substrates, bryophytes, dungs, or other lichen species (sometimes hidden under the
228 thallus).

229

230

Results and discussion

231

232 When confronted with Divakar *et al.* (2013) results, we immediately identified
233 their results as corresponding to those that we were obtaining from our own
234 morphological analysis of *Hypotrachyna* species. Nevertheless, considering all this
235 information together the secondary metabolites, we do not agree in considering
236 *Parmelinopsis* and *Hypotrachyna* congeneric, and more, we consider that the
237 *Hypotrachyna pluriformis* group might be removed from *Hypotrachyna* as a new genus
238 near *Parmelinopsis*. These genera have in common the size of the spores, which are larger
239 than in *Hypotrachyna* s.l., and the presence of gyrophoric acid, absent from the remaining
240 *Hypotrachyna*.

241

242 *Hypotrachynella* Marcelli & B.R. Hora, gen. nov. (*Parmeliaceae*). MycoBank 811276

243 Type species: *Hypotrachynella oreadica* B.R. Hora & Marcelli MycoBank 811277.

244

245 Thallus foliose, mostly sublaciniate to short laciniate, the branches in part ascending,
246 convex to subcanaliculate and/or producing marginal convex to subcanaliculate lacinules;
247 upper cortex grayish (atranorin), satin above 20× magnification; lower surface ivory to
248 black with ivory margins; rhizines curly with coplanar branching. Apothecia laminal or
249 subapical, substipitate; discs open and plane when mature, incised, imperforate.
250 Ascospores ellipsoid 12.5–27 × 6–12.5 μm. Pycnidia laminal to subapical, conidia
251 sublageniform and bifusiform 5–35 × 1.25(–5) μm. Gyrophoric acid as principal
252 secondary metabolite.

253

254 *Hypotrachynella* differs from *Hypotrachyna* by the not typically laciniate thallus,
255 light-colored ivory white underside at least at the apical areas, the curly (enrolled and
256 recurved) coplanar branched rhizines, somewhat similar to those found in species of
257 *Rimeliella* [*Parmotrema* p.p.], and the commonly gummed appearance of the rhizines.
258 The subcanaliculate commonly ascending lacinules and the flat split apothecia are also
259 peculiar, as well the presence of gyrophoric acid as the main secondary metabolite.
260 Therefore, no *Hypotrachyna* with gyrophoric acid as main secondary metabolite is left.

261 Additionally, the apothecial disc of *Hypotrachynella* is lighter than those typically
262 dark brown in *Hypotrachyna*. The presence of two conidia types (sublageniform and
263 bifusiform) in a same individual is typical in several species of *Hypotrachynella* and do
264 not occur in *Hypotrachyna*, where they are filiform or bifusiform, but never in a same
265 specimen.

266 The ascospores are generally ellipsoid (10–) 12 – 16 (–17) × 5 – 10 μm and the
267 conidia ca. 4–9 × 1–2.5 μm, except for *H. subpluriformis*, where they are exceptionally
268 bigger, respectively 20–27 × 10–12.5 μm and 22–25 × 2.5–5 μm.

269 Another striking aspect of *Hypotrachynella* is the sublaciniate habit of several
270 species, whose outline (when not subcanaliculate at all) resembles somewhat small
271 specimens of *Rimelia* [*Parmotrema* p.p.]. Furthermore, the commonly ascendant distal
272 portion of the laciniae gives the thallus an appearance irregularly overlapped at first
273 glance; however, a careful inspection reveals the condition of having just laterally
274 superposed laciniae.

275 A very light yellowish cream pigment is found in most species, sometimes almost
 276 restricted to the algal layer, sometimes concentrated in the amphithecial medulla. Most
 277 often is necessary attention and a good white light to perceive such light color. In general
 278 even the white medullas react K+ pinkish (some are K+ light cream yellow), what is
 279 compatible with the TLC results that demonstrated the presence of vioxanthin and
 280 pigmentosin A in all but three species: *H. everniaeformis* (medulla K+ aqueous purple,
 281 that could indicate pigmentosin A), *H. chlorocarpa*, and *H. multifida*, whose medulla
 282 reacts K+ light dirty brown.

283 *Hypotrachynella* species are cited under *Hypotrachyna* from Guinea, in Africa
 284 (Hale, 1971) and in the Brazilian States of São Paulo and Rio de Janeiro (Hale, 1975) and
 285 include up to now the 13 species (five new), 10 of them detailed described below.

286

287

288 *Hypotrachynella oreadica* B.R. Hora & Marcelli, sp. nov.

289 Holotype: Brazil, São Paulo State, Mogi Guaçu Municipality, Martinho Prado Jr.,
 290 Reserva Biológica de Mogi-Guaçu, Bosque das Goiabeiras near cerrado forest, on twig,
 291 592 m alt., 19-VIII-2014, leg. M.P. Marcelli 42849 (SP). MycoBank 811276.

292

293 **Thallus** corticolous, whitish gray, sublustrous, velvety at 10×, satin above 20×,
 294 subcoriaceous, 8.0 cm wide, short laciniate to sublaciniate. **Sublacinae** irregularly
 295 dichotomous when young becoming paracladial and subsympodial, 1.0–2.5 (–3.4) mm
 296 wide, mostly laterally overlapped on proximal part to little laterally overlapping or spread
 297 in the distal part, with signs of autoincompatibility, adnate to commonly ascendant,
 298 longitudinal axis distended to undulate, transversal cut varied, commonly subcanaliculate
 299 to canaliculate here and there, border coplanar; upper surface firm, with ramified
 300 transversal cracks on proximal parts, some cicatrized, little crumpled on distal part and
 301 crumpled to little corrugate on proximal part, epruinose, maculae subtle effigurate all over
 302 the cortex; lateral margin smooth, slightly repand and little blackish and dead here and
 303 there by autoincompatibility, closed; black line absent on distal part and little evident on
 304 proximal part; cilia absent; apical zone convex, descendent when apothecia present; apex
 305 truncate, coplanar to apical zone; axils oval to elliptic, a few quadratic; secondary
 306 branches and lacinules absent. Lacking pustule, soredia and isidia. **Medulla** mostly white,
 307 however slightly cream near the algae layer, cream on amphithecia, firm, pigment K+
 308 pink. **Lower surface:** apical zone ivory to light brown, sublustrous, velvety at 20×,

309 subsatin at 30, satin at 40×, smooth to slight veined, with rhizines, limit attenuated;
 310 proximal part brown, lustrous, velvety at 10×, subsatin at 20×, satin above 30×,
 311 continuous, crumpled, rugulose here and there. **Rhizines** black, pigment absent,
 312 sublustrous, subsatin at 20×, satin above 30×, dichotomous, coplanar, first branching after
 313 1/3 length, 2–4 branched, subulate, sinuous, curly, contorted, gummed, 0.2–0.6 × 0.03 mm,
 314 frequent, homogeneously distributed, commonly anastomosed. **Apothecia** subterminal
 315 on ascendant laciniae, cupuliform when young, plane and lobate when old, to 6.0 mm
 316 diameter, substipitate to stipitate, subapical; disc light brown to brown, epruinose, cleft
 317 since young, 3 to 4 clefts to half diameter, open, imperforate; margin thin, crenate to
 318 minutely crenulated, naked; amphithecium little rugose when young and strong rugose
 319 when old, emaculate and naked, veined into the stipe, mostly lustrous and scabrid when
 320 old; stipe eccentric, 0.5–0.6 × 1.0–1.4 mm, complete (not fissured) rugose, emaculate,
 321 rugulose to veined, smoother towards the thallus, tubular, formed by elevation of laciniae
 322 subapices that gives its interior the same color of the lower surface, naked; ascospores
 323 narrow ellipsoid, 12.5–15.0 × 6.25–7.5 μm, epispore 1.25 μm. **Pycnidia** mostly
 324 subapical, semi-immersed, ostiole black; conidia mostly sublageniform and a few
 325 bifusiform, 5–7.5 × ca. 1.25 μm.

326

327 **Chemistry:** cortex K+ yellow, UV-; medulla K+ pink, C+ pink-orange evanescent, KC+
 328 pink evanescent, P-, UV-. Atranorin, gyrophoric acid, vioxanthin, pigmentosin A (trace).

329

330 *Commentary:* *Hypotrachyna oreadica* is characterized by the sublaciniate habit
 331 commonly ascendant, here and there subcanaliculate to canaliculate, the medulla cream
 332 colored at the algal layer and inside the amphithecium, the complete eccentric tubular stipe
 333 and the narrow ellipsoid ascospores.

334 The tubular stipe formed by elevation of the laciniae subapices whose interior has
 335 the same color of the underside also occur in *H. marcellii* (see below), which presents
 336 faint and effigurate maculae only in distal part, the satin characterized only at
 337 magnification 40×, large petaloid apothecia till 1.5 cm wide, a fissured tubular stipe, the
 338 longer conidia (7.5–8.75 μm), and ascospores wider (7.5–10 μm).

339 *Hypotrachyna oreadica* is common on branches and twigs inside the cerrado
 340 forest in São Paulo State, particularly in not so dry conditions as those found near small

341 water streams or in the transition to gallery forests, mostly till three meters above the
342 ground.

343 The epithet is a reference to the Oreades [the nymph of the trees and mountains]
344 plant formation, the name given by Martius to one of the major divisions of the Brazilian
345 flora, the woods and fields constituents of the cerrado plant formation where the species
346 occur.

347

348 *Hypotrachynella caapora* Marcelli & B.R. Hora, sp. nov.

349 Holotype: Brazil, São Paulo State, Mogi Guaçu Municipality, Martinho Prado Jr.,
350 Reserva Biológica de Mogi-Guaçu, Bosque das Goiabeiras near cerrado forest, on twig,
351 592 m alt., 19-VIII-2014, leg. M.P. Marcelli 42877 (SP). MycoBank 811278.

352

353 **Thallus** corticolous, greenish gray, sublustrous on distal part and subopaque on proximal
354 part, velvety at 10×, subsatin at 20×, slightly satin at 30×, satin at 40×, membranaceous,
355 5.5 cm wide, sublaciniate. **Sublaciniae** subsympodial to anisotomic dichotomous, 0.9-
356 1.7 mm wide, laterally overlapping, loosely adnate but commonly ascendant on old parts,
357 without signs of autoincompatibility, longitudinal axis undulating, transversal cut varied
358 but principally subcanaliculate to canaliculate in the ascendant laciniae, border
359 descendent; upper surface firm, with transversal not ramified cracks on proximal part,
360 smooth on distal part and minutely crumpled on proximal part, epruinose; maculae
361 effigurate, laminal, subtle and hardly visible because the abundant isidia on lamina; lateral
362 margin smooth, slight repand, closed; black line subtle or absent; cilia absent; apical zone
363 convex, apex roundish to little truncate, descendent; axils elliptic, a few oval and rare
364 torn; secondary branches and lacinules absent. Lacking pustules and soredia. **Isidia**
365 concolored to the lamina and with brownish apices, lustrous, laminal, abundant, firm,
366 rigid; initially granular, turn dolioliform and, after branched, become irregularly
367 cylindrical and torulose; apices roundish, corticate, base mostly not constrict, simple to
368 irregularly branched, 0.1–0.25 × 0.03 mm, cilia absent. **Medulla** white (cream inside the
369 isidia?), pigment K+ present (?), texture normal. **Lower surface:** apical zone ivory or
370 variegate ivory/brown, sublustrous, velvety at 20×, subvelvety at 30×, slight satin above
371 40×, limit attenuate, smooth to crumpled to slightly veined, with rhizines short and
372 delicate; proximal part brown, subopaque, velvety at 20×, satin above 30×, continuous,
373 crumpled to veined. **Rhizines** black, pigment absent, sublustrous, velvety at 20×, satin
374 above 30×, mostly simple at apical zone, furcate to dichotomous on proximal part,

375 coplanar ramifying, first branched up to $\frac{1}{3}$, 0-2 branched, erect, recurved to curly,
 376 subulate, gummed, $0.15-0.45 \times 0.02-0.03$ mm, abundant but not dense, concentrated
 377 principally on distal part, the older commonly anastomosed, not grouped. **Apothecia**
 378 cupuliform when young, to 1.5 mm diameter, adnate to substipitate, laminal to subapical;
 379 disc brown, epruinose, entire, open when old, smooth, imperforate; margin thick,
 380 crenulate-lobate when young to pumpkin-like when older, naked; amphithecia rugose,
 381 emaculate, with primordium of isidia; stipe central, very short, rugose, emaculate, naked.
 382 **Ascospores** absent. **Pycnidia** laminal to marginal, immerse, ostiole black; conidia
 383 bifusiform and sublageniform, $5.0-7.5 \times$ ca. $1.25 \mu\text{m}$.

384

385 **Chemistry:** cortex K+ yellow, UV-; medulla K+ faint pink, C+ pink evanescent, KC+
 386 strong pink evanescent, P-, UV-. Atranorin, gyrophoric acid, vioxanthin, pigmentosin A
 387 (trace).

388

389 Additional material: Brazil. São Paulo State, Mogi Guaçu Municipality, Martinho Prado
 390 Jr., Reserva Biológica de Mogi-Guaçu, Bosque das Goiabeiras near cerrado forest, on
 391 twig, 592 m alt., 19-VIII-2014, leg. M.P. Marcelli, leg. M.P. 42898, 42908 (SP).

392

393 Commentary: *Hypotrachynella caapora* is characterized by the laminal isidia, the
 394 subcanaliculate ascendant sublaciniae with an ivory underside, and the white medulla K+
 395 faint pink.

396 *Hypotrachynella caapora* is close to *H. puiggarii* that differs by its emaculate
 397 thallus, the bicolored medulla, plane to convex laciniae, and fragile and dolioliform isidia.

398 *Hypotrachynella neodissecta*, also isidiate, has both margin and isidia ciliate and
 399 the medulla reacts K+ light yellow (vioxanthin and pigmentosin A absent).

400 *Hypotrachynella caapora* has rhizines projecting beyond the margins, which can
 401 be mistaken by cilia. Despite the white medulla, vioxanthin and pigmentosin A were
 402 demonstrated in TLC and, apparently, the medulla of isidia is cream; however, this is a
 403 very hard observation because the isidia are very small and because the presence of the
 404 green algal spots. Furthermore, the typical K+ faint pink medullar reaction indicates at
 405 least the diluted presence of these pigments. The oldest apothecium found is not open and
 406 lobate as in the other species of the group, but pumpkin-like despite being somewhat
 407 opened; however, it did not contain ascospores and we believe that truly mature apothecia
 408 might be open and lobate. Nevertheless, other *Hypotrachynella* species do not develop

409 the "pumpkin stage", except for *H. everniaeformis* (see below), which has this shape in
 410 the upper half of the amphithecium

411 The lower apical zone is most commonly ivory; only the paratype 42898 has it
 412 variegate with brown.

413 The name of specie is given after the Brazilian indigenous folkloric entity
 414 protector of the forests, the Caapora (Caipora in Portuguese), that means habitant of the
 415 forest.

416

417

418 *Hypotrachynella chlorocarpa* (Mull. Arg.) Marcelli & B.R. Hora, comb. nov.

419 *Parmelia pluriformis* Nyl. var. *chlorocarpa* Mull. Arg. Flora 65: 85. 1881. Brazil, [São
 420 Paulo State], Apiahy [nowadays Apiaí Municipality], on tree trunk, leg. [J.I.] Puiggari
 421 s.n., 1878 (G, holotype!). MycoBank 811635.

422

423 **Thallus** corticolous, brownish (herbarium), lustrous, velvety at 10×, subsatin at 20×, satin
 424 above 30×, submembranaceous, 4.4 cm wide, sublaciniate. **Sublaciniae** dichotomous to
 425 subsympodial, 0.7-1.5 (-2.0) mm wide, laterally overlapping, without signs of
 426 autoincompatibility (?), longitudinal axis distended, transversal cut flat to slightly convex,
 427 upper surface firm, continuous, densely minute scrobiculate, epruinose, faintly maculate
 428 (perhaps with effigurate maculae or hypermaculate in fresh material); lateral margin
 429 smooth, little repand, closed; black line present; cilia absent; apical zone descendent; apex
 430 truncate to a few rotund, descendent; axils elliptical; secondary branches and lacinules
 431 absent. Lacking pustules, soredia, and isidia. **Medulla** white, pigment absent. **Lower**
 432 **surface:** apical zone yellow (probably ivory in fresh material), opaque, satin above 30×,
 433 limit attenuate, rugose, with rhizines; proximal part black, opaque, satin at 40×,
 434 continuous and very rugose. **Rhizines** black, pigment absent, sublustrous, satin at 30×,
 435 dichotomous to simple, coplanar ramifying, first branching sometimes basal, commonly
 436 after 1/3, 0-3 branched, erect, curly and recurved, subulate, little gummed, the upper half
 437 interlaced, in part anastomosing, 0.25-0.5 × 0.03 mm, abundant, uncommon in central
 438 part, not grouped. **Apothecia** cupuliform, to 6.5 mm diameter, substipitate, submarginal;
 439 disc light brown, epruinose, sometimes cleft up to half diameter, open, imperforate;
 440 margin subcrenulate, cleft, naked; amphithecia emaculate, the top scrobiculate, became
 441 strongly rugose into the stipe, sometimes rhizines develop at base; stipe central, very
 442 short, rugose, emaculate, the interior of stipe is white near the disc (light yellow in

443 herbarium); ascospores ellipsoid, 12.5–15.0 (–17.5) × 5.0–7.5 μm, episporium 2.5 μm.

444 **Pycnidia** submarginal, immersed, ostiole black; conidia not found.

445

446 **Chemistry:** cortex K⁺ yellow, UV⁻; medulla K⁺ light dirty brown, C⁺ pink evanescent,

447 KC⁺ pink-orange to yellow, P⁻, UV⁻. Atranorin and gyrophoric acid.

448

449 *Commentary:* *Hypotrachynella chlorocarpa* is characterized by the somewhat flat
450 sublaciniae and densely minute scrobiculate, the white medulla reacting K⁺ light dirty
451 brown (vioxanthin and pigmentosin A absent), the presence of some retrorse rhizines in
452 the amphithecia, the tubular stipe that is white inside near the disc, and the thickest
453 episporium in the genus (2.5 μm).

454 *Hypotrachynella chlorocarpa* has been traditionally placed in the synonymy of *H.*
455 *pluriformis* together *H. subpluriformis*, whose undersurface has the proximal part jet
456 black, the rhizines just simple to furcate, abundant, at least in part procumbent in the
457 proximal portion, the amphithecia smooth in the upper part and strongly ridged into the
458 stipe, much bigger ascospores 20.0–27.5 × 10.0–12.5 μm, and the longest conidia of the
459 genus (22.5–) 27.5–35.0 × 2.50–5.0 μm.

460 *Hypotrachynella multifida* differs from *H. chlorocarpa*, also traditionally
461 considered a synonym of *H. pluriformis*, by the very ramified laciniae, emaculate thallus,
462 much less rugose lower side, rhizines only 0-2 branched, somewhat narrower ascospores
463 (7.5–8.75 μm wide), the episporium only to 1.25 μm thick, and the satin well characterized
464 only at magnification 40×.

465

466

467 *Hypotrachynella everniaeformis* (A. Zahlbr.) Marcelli & B.R. Hora comb. nov.

468 *Parmelia everniaeformis* A. Zahlbr., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturw.
469 Cl. Abt. 1, 111: 416. 1902. Brazil, [Rio de Janeiro State], Petrópolis [Municipality], inside
470 the forest [without substrate], leg. Höhnelt (Lichenes Brasilienses 163), s.d. (W,
471 holotype!). MycoBank 811636.

472

473 **Thallus** corticolous, gray, very opaque, velvety at 20×, subvelvety at 30×, minutely satin
474 at 40×, satin only about 50×, coriaceous, 7.5 cm wide, lacinate. **Laciniae**
475 subdichotomous to irregularly branched, 0.8–2.1 mm wide, slight laterally overlapping,

476 very loosely adnate, without signs of autoincompatibility, longitudinal axis distended,
 477 transversal cut mostly convex, border coplanar; upper surface very friable, easily broken
 478 with the steel blade touch, irregularly subreticular cracked, plane to rugose, epruinose,
 479 emaculate; lateral margin smooth, incurved (mostly not visible from above) and
 480 thickened, closed; black line absent; cilia absent; apical zone ascendant; apices rounded
 481 to truncate, some revolute but the majority plane; axils oval to a few elliptic; secondary
 482 branches and lacinules absent. Lacking pustules, soredia, and isidia. **Medulla** very light
 483 cream, pigment K⁺ absent, loose. **Lower surface:** apical zone ivory (probably white in
 484 fresh material), opaque, co-satin to the upper side, limit very variegate, densely minute
 485 scrobiculate to veined, with rhizines; proximal part black, opaque, continuous,
 486 scrobiculate to veined. **Rhizines** black, pigment absent, opaque, co-satin to lower surface,
 487 simple to furcate, recurved when old, delicate, 0.25–0.75 × 0.05 mm, not gummed, not
 488 anastomosed, more concentrated in the light colored distal part, in dark parts rare or
 489 absent. **Apothecia** cupuliform, plane when old, to 6 mm diameter, sessile to substipitate,
 490 laminal, abundant; disc brownish, epruinose, continuous to radially deep cleft and lobate,
 491 till 5 lobes with 5 clefts; imperforate; margin plane, cleft since young, irregularly
 492 crenulate, evidently involute, naked; amphithecia smooth, superior half eroded with radial
 493 clefts, little rugose at basis; stipe absent or very short, central, concolored; ascospores
 494 ellipsoid 14.0–16.0 × 6.0–8.0 μm, epispore 2.0 μm. **Pycnidia** submarginal, immerse,
 495 ostiole black; conidia not found.

496

497 **Chemistry:** cortex K⁻, UV⁻; medulla K⁺ aqueous purple, C⁺ aqueous red evanescent to
 498 light brownish, KC⁺ pink to yellow, P⁻, UV⁻. Atranorin and gyrophoric acid.

499

500 *Commentary:* *Hypotrachynella everniaeformis* is a strongly coriaceous lacinate very
 501 loose adnate species whose cortex is delicate and friable, and the light cream yellowish
 502 medulla reacts K⁺ aqueous purple. Furthermore, the rhizines are neither gummed nor
 503 anastomosed, uncommon in the genus.

504 The K⁺ aqueous purple is intriguing but not strange for a lichen with yellowish
 505 colored medulla. In the other *Hypotrachynella* species with yellow pigments we
 506 confirmed the presence of vioxanthin and traces of pigmentosin A. However, these
 507 substances were not found in our TLC for *H. everniaeformis* nor cited by Sipman et al.
 508 (2009).

509 *Hypotrachynella everniaeformis* is close to *H. multifida*, a membranaceous
 510 species that has a white medulla, firm upper surface, smooth to very little rugose lower
 511 surface, rhizines slightly gummed and interlaced, satin well characterized at
 512 magnification 40×, the apothecia plane since young and not lobate, the epispore thinner
 513 (about 1 µm), and a K+ light brown medullar spot reaction.

514 The rhizines of *H. everniaeformis* grow from the crests of rugs or scrobicules and
 515 are black even on the light surfaces.

516 Hale (1975) called lectotype the material Höhnelt 163, and was followed in this by
 517 Sipman *et al.* (2009); however, this is the only material mentioned by Zahlbruckner
 518 (1902) in the protologue, what qualify it as holotype.

519

520

521 *Hypotrachynella marcellii* B.R. Hora, sp. nov.

522 Holotype: Brazil, São Paulo State, Mogi Guaçu Municipality, Martinho Prado Jr.,
 523 Reserva Biológica de Mogi-Guaçu, Bosque das Goiabeiras near cerrado forest, on twig,
 524 592 m alt., 19-VIII-2014, leg. M.P. Marcelli 42845 (SP). MycoBank 811276.

525

526 **Thallus** corticolous, greenish gray, subopaque, velvety at 20×, subsatin at 30×, satin
 527 above 40×, coriaceous, 9.3 cm wide, short laciniate. **Laciniae** anisotomic dichotomous to
 528 subsympodial, 0.9–1.7 (–3.5) mm wide, laterally overlapping, without signs of
 529 autoincompatibility, the sterile proximal laciniae adnate and the fertile laciniae strongly
 530 ascendant, longitudinal axis distended, transversal cut varied, border coplanar; upper
 531 surface firm, with deep transversal not branched and not cicatrized cracks principally on
 532 proximal part, smooth to minutely crumpled, epruinose, maculae weak and effigurate on
 533 distal part; lateral margin smooth, repand, closed; black line absent; cilia absent; apical
 534 zone coplanar to longitudinal axis, apex truncate, descendent; axils round to a few elliptic;
 535 secondary laciniae and lacinules absent. Lacking pustules, soredia, and isidia. **Medulla**
 536 white to light cream around the algae layer, strongly cream in amphithecia, texture
 537 normal, K+ pigment absent. **Lower surface:** apical zone brown on prostrate laciniae and
 538 white to ivory on the ascendant ones, subopaque, velvety at 10×, subsatin at 20×, minutely
 539 satin at 30×, satin above 40×, veined to little scrobiculate, with rhizines, limit attenuate;
 540 proximal part variegate of back and brown, subopaque to opaque, velvety at 20×, satin
 541 above 30×, continuous, scrobiculate. **Rhizines** black, pigment absent, more lustrous on
 542 distal part, velvety at 20×, satin above 30×, furcate to irregularly branched, coplanar

543 branching, the first branch above $\frac{2}{3}$ length, 1–3 branched, subulate, little sinuous, curly,
 544 slight gummed, slight contorted, anastomosed on proximal part of the thallus, 0.25–0.50×
 545 0.03 mm, abundant, homogeneously distributed all lower the surface. **Apothecia** concave
 546 when young, plane to undulate petaloid-lobed when old, till 1.5 cm diameter, adnate,
 547 subapical; disc brown, epruinose, cleft when old, about 5 clefts from $\frac{1}{3}$ to half disc
 548 diameter, open, imperforate; margin thin, minutely crenulate, naked; amphithecia
 549 crumpled when young and rugose when old, maculae effigurate, naked; stipe central, very
 550 short, rugose, tubular incomplete (with a lateral fissure). **Ascospores** ellipsoid, 12.5–15.0
 551 × 7.5–10.0 μm , epispore 1.25 μm . **Pycnidia** laminal, more abundant on distal part where
 552 they become concentrate on marginal and subapical zones, semi-immersed, ostiole black;
 553 conidia sublageniform, 7.5–8.75 × ca. 1.25 μm .

554

555 **Chemistry:** cortex K+ yellow, UV-; medulla K+ pink, C+ pink evanescent, KC+ pink-
 556 red evanescent, P-, UV-. Atranorin, gyrophoric acid, vioxanthin, pigmentosin A.

557

558 *Commentary:* *Hypotrachynella marcellii* is characterized by the coriaceous short lacinate
 559 (not sublacinate) thallus whose sterile branches are prostrate and the fertile highly
 560 ascendant. The medulla is light cream yellowish around the algal layer and strongly cream
 561 in the amphithecia. The typically lobate petaloid big apothecia that hide the narrow
 562 laciniae and the fissured incomplete tubular stipe are also peculiar.

563 The ascendant growing of the distal parts of the primary laciniae gives, at first
 564 glance, the impression that they are irregularly overlapped, but a careful observation
 565 reveals that the laciniae are in reality just laterally overlapping. Another remarkable
 566 aspect of this species is that the apothecia diameter is much larger than the laciniae
 567 breadth, making the most part of the thallus hidden under the numerous aggregated
 568 apothecia.

569 As in *Hypotrachynella chlorocarpa*, *H. marcellii* has the stipe formed by the
 570 apical elevation of the laciniae and its interior has the same color of the lower surface.
 571 However, the stipes of *H. chlorocarpa* are complete as in all other species in the genus,
 572 and those of *H. marcellii* are incomplete, with a long longitudinal fissure corresponding
 573 to the joint of the folded lateral edges of the laciniae. This happens because the apothecia
 574 develop on very narrow laciniae, which does not allow the complete formation of the
 575 stipe tube. Additionally, *H. chlorocarpa* is sublacinate, submembranaceous, has yellow
 576 to black lower surface, the interior of the stipe white near the apothecia that can develop

577 rhizines on the amphithecia, the underside rhizines scarce to absent on the proximal parts,
 578 the ascospores somewhat narrower (5.0–7.5 μm), and the medullar K reaction light dirty
 579 brown instead K+ pink.

580 The epithet is a tribute to my advisor and friend Dr. Marcelo Pinto Marcelli, who
 581 introduced me into the lichen taxonomy, in particular to the wonderful and intriguing
 582 world of the *Parmeliaceae*, specially the genus *Hypotrachyna*.

583

584

585 *Hypotrachynella mogiana* B.R. Hora & Marcelli, sp. nov.

586 Holotype: Brazil, São Paulo State, Mogi Guaçu Municipality, Martinho Prado Jr.,
 587 Reserva Biológica de Mogi-Guaçu, Bosque das Goiabeiras near cerrado forest, on twig,
 588 592 m alt., 19-VIII-2014, leg. M.P. Marcelli 42899 (SP). MycoBank 811280.

589

590 **Thallus** corticolous, greenish gray, subopaque, velvety at 10 \times , subsatin at 20 \times , minute
 591 satin at 30 \times , satin above 40 \times , membranaceous, 6.5 cm wide, short lacinate. **Laciniae**
 592 anisotomic dichotomous, a few sympodial, 0.5–1.0 mm wide, laterally overlapping and
 593 without signs of autoincompatibility, adnate, longitudinal axis distended, transversal cut
 594 canaliculate, border coplanar; upper surface firm, transversally subtle to deeply and not
 595 cicatrized cracked, slight crumpled on distal part and strong crumpled on proximal part,
 596 epruinose; maculae laminal weak, effigurate; lateral margin smooth, plane, mostly slight
 597 repand, sinuous here and there, closed; black line little evident, but thicker at axils; cilia
 598 black, velvety at 20 \times , satin at 30 \times , pigment absent, coplanar, a few descendent, straight
 599 to sinuous, subulate, simple to furcate, 0.25–0.4 \times 0.03 mm, frequent, all over the margin;
 600 apical zone ascendant, apex truncate, descendent; axils elliptic, a few acute; secondary
 601 laciniae growing from the lateral margin of primary laciniae, morphologically similar the
 602 primary laciniae, 1.0–1.5 mm wide, transversal cut canaliculate; lacinules absent. Lacking
 603 pustules, soredia and isidia. **Medulla** white, texture normal, pigment absent. **Lower**
 604 **surface**: distal part ivory, sublustrous, velvety at 20 \times , subsatin at 30 \times , satin above 40 \times ,
 605 crumpled, with rhizines, limit attenuate; proximal part brown, lustrous, satin above 20 \times ,
 606 continuous, crumpled. **Rhizines** black, pigment absent, velvety at 10 \times , satin above 20 \times ,
 607 irregularly branched, coplanar ramifying, first branch after $\frac{1}{3}$, 2–5 branched, subulate,
 608 curly and delicate, slightly gummed, the apices interlaced and anastomosed, 0.15–0.5 \times
 609 0.03 mm, abundant, all over the lower surface. **Apothecia** cupuliform, to 6.5 mm
 610 diameter, substipitate, laminal; disc brown, epruinose, cleft when old, lobate and involute,

611 almost completely closed, about 4 clefts till 1/4 of the disc diameter, imperforate,
612 emaculate, naked; amphithecia slight crumpled, emaculate, naked; stipe central, 0.3–0.7
613 x 1.0–2.5 mm, rugose, maculae effigurate, naked; ascospores ellipsoid, (12.5–) 13.5–
614 15.0 × 7.5–10.0 μm, episporium 1.25 μm. **Pycnidia** laminal, semi-immersed, ostiole black;
615 conidia sublageniform, 3.75–5.0 × ca. 1.6 μm.

616

617 **Chemistry:** cortex K⁺ yellow, UV⁻; medulla K⁺ cream, C⁺ pink aqueous evanescent,
618 KC⁺ pink evanescent, P⁻, UV⁻. Atranorin, gyrophoric acid, vioxanthin, pigmentosin A
619 (trace).

620

621 *Commentary:* *Hypotrachyna mogiana* is characterized by the membranaceous short
622 lacinate (not sublacinate) mostly canaliculate thallus. The conidia are very short, the
623 laciniae ciliate and the white medulla reacts just K⁺ cream however vioxanthin and
624 pigmentosin A (trace) were demonstrated by TLC.

625 *Hypotrachyna mogiana* is close to *H. marcellii* that has a coriaceous thallus not
626 canaliculate, the underside rugose to scrobiculate, eciliated, the rhizines only 1–3
627 ramified, the apothecia petaloid not involute and much wider than the laciniae, and much
628 bigger conidia (7.5–8.75 μm long).

629 At first glance, *H. mogiana* seems a small specimen of *H. oreadica*, a
630 subcoriaceous species that has a typical paracladial branching, the satin characterized
631 only at magnification 40×, apothecia subterminal, and longer conidia 5–7.5 μm long.

632 The epithet refers to the Mogiana Region, an important agricultural part of São
633 Paulo State where the Mogi-Guaçu Municipality and the cerrado forest biological reserve,
634 the type locality, is located

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Figures 1-9. Holotypes. 1. *Hypotrachynella oreadica*. 2. *H. oreadica*, detail of amphithecia and stipe. 3. *H. caapora*. 4. *H. caapora*, detail of the isidia. 5. *H. chlorocarpa*. 6. *H. everniaeformis*. 7. *H. everniaeformis* underside detail. 8. *H. marcellii*. 9. *H. mogiana*. (scales: 1-3-5-6-8-9= 10 mm; 2-4-7= 5 mm).

641

642 *Hypotrachynella multifida* (Mull. Arg.) B.R. Hora & Marcelli, comb. nov.

643 *Parmelia pluriformis* Nyl. var. *multifida* Mull. Arg., Flora 64: 85. 1881. Brazil, [São
644 Paulo State] Apiahy [nowadays Apiaí Municipality, without substrate], leg. [J.I.] Puiggari
645 1283, VIII-1880 (the label has also the date XI-1880 in the same ink and handprint), (G,
646 holotype!). MycoBank 811654.

647

648 **Thallus** corticolous, brownish (herbarium), lustrous, velvety at 20×, subsatin at 30×, satin
649 above 40×, submembranaceous, 4.8 cm wide, sublaciniate. **Sublaciniae** at least 4–6 times
650 anisotomic dichotomous ramified, 0.5–1.0 mm wide, laterally overlapping, without signs
651 of autoincompatibility, longitudinal axis distended, transversal cut slight convex, border
652 descendent; upper surface firm, continuous, epruinose, emaculate; lateral margin slightly
653 repand, closed; eciliated; apical zone ascendant; apex truncate, descendent; axils elliptic
654 to a few oval; secondary braches and lacinules absent. Lacking pustules, soredia, and
655 isidia. **Medulla** white, loose, pigment absent. **Lower surface:** apical zone yellowish
656 (probably white or ivory in fresh material), opaque, satin above 30×, limit attenuate,
657 rugose, with rhizines; proximal part black, sublustrous, satin above 20×, continuous,
658 smooth to mostly slightly longitudinally rugose, here and there slightly scrobiculate.
659 **Rhizines** sparse, black, pigment absent, sublustrous, satin above 20×, simple to
660 dichotomous, coplanar ramifying, 0–2 branched since the basis, recurved, subulate, erect,
661 (0.015–) 0.25–0.5 × 0.05 mm, slightly gummed, interlaced, frequent, not grouped.
662 **Apothecia** plane, till 6.5 mm wide, substipitate, laminal; disc light brown, epruinose,
663 entire, open, imperforate; margin plane, slightly crenulate, naked, with grooves that can
664 develop into crevices, involute; amphithecia rugose, emaculate, naked, more yellowish
665 than the thallus; stipe central, 1×2 mm, longitudinally rugose, emaculate, naked;
666 ascospores elliptic, (10.0–) 12.5–15.0 (–16.25) × 7.5–8.75 μm, epispore 1.0–1.25 μm.
667 **Pycnidia** apical, immersed, ostiole black; conidia not found.

668

669 **Chemistry:** cortex K⁺ yellow, UV⁻; medulla K⁺⁺ light brown, C⁺ strong pink
670 evanescent, KC⁺ pink-orange to yellow, P⁻, UV⁻. Atranorin and gyrophoric acid.

671

672 *Commentary:* *Hypotrachynella multifida* is characterized by the thallus membranaceous
673 whose the short laciniate (not sublaciniate) are very ramified but not canaliculate (only
674 little convex). The medulla is white and very loose, the rhizines sparse, the apothecial

675 discs mostly entire (not cleft), and the yellowish stipes contrast somewhat with the greyer
676 thallus.

677 *Hypotrachynella multifida* is close to *H. chlorocarpa*, that has much less ramified
678 laciniae, the interior of the stipe is white near the disc and the amphithecia develops
679 rhizines, the ascospores are somewhat wider (5.0–7.0 μm large), the epispore much
680 thicker (2.5 μm), and the satin easily visible at magnification 30 \times .

681 *Hypotrachynella everniaeformis*, a species with very ramified laciniae, differs
682 from *H. multifida* in several ways, particularly in the very coriaceous extremely opaque
683 thallus whose satin is characterized only at magnification 50 \times , the lower surface densely
684 rugose to scrobiculate, rhizines not gummed and not interlaced, the apothecia lobed-cleft,
685 and the epispore thicker (2.0 μm).

686

687

688 *Hypotrachynella neodissecta* (Hale) B.R. Hora & Marcelli, comb. nov.

689 *Parmelia neodissecta* Hale. Phytologia 22(2): 94. 1971. Guinea, Cercle de N'Zérékoré,
690 Nimba Mountains, ca. 6 km SE of Zouépo (Zigueta), just below the camp, 1.5 km SSW
691 of the top "1611", 1550 m alt., on tree in the outskirts of a mountain forest, 10-VIII-1954,
692 leg. Rolf Santesson 10597d (UPS, holotype, n.v.; US, isotype!). MycoBank 811637.

693

694 **Thallus** corticolous, yellowish gray, sublustrous, velvety at 10 \times , subvelvety at 20 \times ,
695 subsatin at 30 \times , minute satin at 40 \times , membranaceous, 6.6 cm wide, short lacinate.

696 **Laciniae** anisotomic dichotomous, 1.3–2.0 mm wide, mostly laterally overlapping, with
697 evident signs of autoincompatibility, loose adnate, longitudinal axis distended to slightly
698 undulate, transversal cut convex, border coplanar; upper surface firm, continuous and
699 distinctly minute crumpled, epruinose, emaculate; lateral margin smooth, closed, slightly
700 repand, many parts blackened by autoincompatibility; black line evident but thin
701 nevertheless, thicker at axils, with an inflated appearance; cilia black, satin above 30 \times ,
702 pigment absent, straight to little sinuous, subulate, coplanar, simple to furcate, frequent
703 all over the margin, 0.20–0.35 \times 0.03–0.05 mm; apical zone descendent, apices truncate,
704 descendant; axils round to oval; laciniae secondary alike the primary, growth from the
705 margins of old parts and occupy the space in between the primary laciniae or grow up
706 those, lacinules absent. Lacking pustules and soredia. **Isidia** abundant and dense in
707 proximal part, laminal, concolored to the lamina to slightly brownish, simple to little
708 branched, sometimes ciliate, base constrict, 0.1–0.25 \times 0.06–0.1 (–0.13) μm , the majority

709 erect, irregular in diameter and branching, some torulose, apices roundish, corticate,
 710 fragile, part of them with lateral cilia, the older cilia similar to the marginal ones; they
 711 born as small papillae, grown first in highness and after in diameter into granular and
 712 subspherical, with constrict base, before branching irregularly and proliferate to a torulose
 713 shape. **Medulla** white, firm, pigment absent. **Lower surface:** apical zone brown,
 714 sublustrous, subvelvety at 10×, satin above 20×, smooth to crumpled, with rhizines;
 715 proximal part black, subopaque, subvelvety at 10×, subsatin at 20×, satin above 30×,
 716 continuous, smooth to crumpled. **Rhizines** black, pigment absent, opaque, cosatin to
 717 proximal zone, irregular to dichotomous, trichotomies frequent, coplanar branching, first
 718 branch after $\frac{1}{3}$, 0–3 branched, the apices interlaced and in part anastomosing, sinuous to
 719 recurved, not curly, not gummed, in part dendroid (principally the young), 0.15–0.4 ×
 720 0.1–0.3 mm, abundant, homogeneously distributed. **Apothecia** cupuliform, short
 721 stipitate, laminal to submarginal, till 4.0 mm diameter, cleft since young, very involute
 722 when old; disc brown, epruinose, continuous, imperforated; margin plane, crenulate,
 723 involute, irregularly isidiate, isidia alike the laminal; amphithecia smooth, sometimes
 724 irregularly isidiate, yellowing into the stipe, medulla white, emaculate; stipe central, very
 725 short, 0.3 mm wide, emaculate, naked; ascospores ellipsoid, 13.75–16.25 × (5.0–) 6.25–
 726 8.7 μm , episporium 2.5 μm . **Pycnidia** laminal to submarginal, immersed, ostiole black,
 727 frequent, sometimes on amphithecia; conidia not found.

728

729 **Chemistry:** cortex K+ yellow, UV-; medulla K+ light yellow, C+ pink very fast
 730 evanescent, KC+ pink evanescent, P-, UV-. Atranorin and gyrophoric acid.

731

732 **Commentary:** *Hypotrachynella neodissecta*, currently the only African species of the
 733 genus to now, is characterized by the laminal partially ciliate isidia, its unique inflat
 734 black line, presence of cilia, not curled rhizines and the episporium 2.5 μm thick.

735 In the Brazilian isidiate species, *H. caapora* and *H. puiggarii*, the isidia lacks cilia
 736 and the medulla reacts K+ pinkish (vioxanthin and pigmentosin A present) instead the
 737 characteristically K+ light yellow of *H. neodissecta*.

738 In habit, including the laciniae branching pattern, thallus size, color, and presence
 739 of cilia and isidia, *H. neodissecta* is very similar to Brazilian specimens of *Parmelinopsis*
 740 *minarum* (Vainio) Elix & Hale, from which is readily distinguished by the typical rhizines

741 of *Hypotrachynella* and the presence of some substances of the chemical complex
742 horrescens in *P. minarum*.

743

744 *Hypotrachynella puiggarii* Marcelli & B.R. Hora, sp. nov.

745 Holotype: Brazil, São Paulo State, Mogi Guaçu Municipality, Martinho Prado Jr.,
746 Reserva Biológica de Mogi-Guaçu, Bosque das Goiabeiras near cerrado forest, on twig,
747 592 m alt., 19-VIII-2014, leg. M.P. Marcelli 42855 (SP 466022). MycoBank 811638.

748

749 **Thallus** corticolous, greenish gray, sublustrous on distal part and opaque on proximal
750 part, velvety at 20×, minute satin at 30×, satin above 40×, membranaceous, 4.5 cm wide,
751 short lacinate. **Laciniae** anisotomic dichotomous to subsympodial, in part paracladial,
752 0.6-1.4 mm wide, contiguous to little laterally overlapping, with few signs of
753 autoincompatibility, longitudinal axis distended to undulate, transversal cut plane to
754 convex, border coplanar; upper surface firm, continuous, smooth to slight crumpled,
755 epruinose, emaculate; lateral margin smooth, repand, closed; black line little evident,
756 thicker at axils; cilia absent; apical zone prostrate, apices truncate, coplanar to slightly
757 descendent; axils rotund to elliptic; secondary laciniae and lacinules absent. Lacking
758 pustule and soredia. **Isidia** liminal, base concolored to thallus and apices brownish,
759 lustrous, abundant, caducous, fragile, torulose, smooth, straight to slightly sinuous, apices
760 roundish, corticated, base constrict only in older, little simple to furcate to little irregularly
761 branched, 0.15–0.30 × 0.03–0.05 mm, eciliate, erect. **Medulla** light cream on upper 1/3
762 and white below, pigment K+ reddish, compact. **Lower surface:** apical zone light brown,
763 sublustrous, satin above 30×, limit attenuate, slight crumpled, with rhizines; proximal part
764 black, sublustrous, subsatin at 20×, satin above 30×, slightly crumpled. **Rhizines** black,
765 in part with whitish apices, pigment absent, lustrous, velvety at 20×, satin above 30×,
766 furcate to irregularly branched, coplanar branching, first branch next the base or only after
767 2/3s, 2–3 branched, little sinuous and curly, not gummed, interlaced, not anastomosed,
768 subulate, not contorted, 0.2–0.4 × 0.03 mm, abundant, distribute all lower the surface.
769 **Apothecia** and **pycnidia** absent.

770

771 **Chemistry:** cortex K+ yellow, UV-; medulla K+ pink, C+ pink evanescent, KC+ light
772 pink evanescent, P-, UV-. Atranorin, gyrophoric acid, vioxanthin, pigmentosin A (trace).

773

774 Commentary: *Hypotrachynella puiggarii* is characterized by the thallus membranaceous
775 short lacinate, not canaliculate, with laminal eciliate isidia, and not gummed rhizines.
776 The medulla is compact, reacts K⁺ pink, and has the upper portion light yellowish.

777 *Hypotrachynella puiggarii* is close to *H. caapora* that differ by an entirely white
778 medulla, the laciniae principally subcanaliculate, effigurate maculae, and the rhizines
779 projecting outward the margins resembling cilia.

780 See *H. neodissecta* (above) for more comparisons with other isidiate species.

781 The epithet is a tribute to Juan Ignacio Puiggari [1823-1900], an important
782 collector that lived in the southeastern part of São Paulo State, in the region of Apiaí
783 Municipality (Marcelli, 1998).

784

785 *Hypotrachynella subpluriformis* (Zahlbr.) B.R. Hora & Marcelli, comb. nov.

786 *Parmelia subpluriformis* Zahlbr., Denkschr. Kaiserl. Akad. Wiss., math-Naturwiss. Kl.
787 83: 172. 1909. Brazil, São Paulo State, [São Paulo City], "in monte Jaraguá prope Taipas",
788 800 m alt., VI-1901, leg. Wettstein & Schiffner s.n. (W, holotype!; W, isotype!).
789 MycoBank 811639.

790

791 **Thallus** corticolous, gray little yellowish, lustrous, subvelvety at 10×, subsatin at 20×,
792 minutely satin at 30×, satin at 40×, membranaceous, 5.7 cm wide, sublaciniate.
793 **Sublaciniae** anisotomic dichotomous, (0.5–) 1.0–2.0 mm wide, laterally superposed to
794 somewhat overlapped, with signs of autoincompatibility; longitudinal axis distended,
795 transversal cut flat, upper surface firm, crumpled, occasionally cracked, epruinose,
796 emaculate; lateral margin smooth, slightly repand to subirregular, closed, border coplanar
797 to slightly descendent; black line barely visible; cilia absent; apices truncate; axils
798 elliptical, a few oval; secondary branches and lacinules absent. Lacking pustules, soredia,
799 and isidia. **Medulla** white, texture normal, pigment absent. **Lower surface:** apical zone
800 yellowish brown, papillate and rhizinate, limit attenuate; proximal part black, lustrous,
801 satin at 20×, rugose to slightly longitudinally veined, some parts strongly longitudinally
802 veined. **Rhizines** black, pigment absent, opaque, velvety till 30×, slightly satin at 40×,
803 mostly furcated to simple, but commonly till 2-ramified dichotomous, the longest not rare
804 fasciculate and sinuous, 0.25–0.50× 0.03 mm, mostly recurved, tapered, frequent, sparser
805 on old parts. **Apothecia** cupuliform since young, till 5.0 mm diameter, stipitate,
806 subapical; disc brown, the older wavy, commonly 1–2 (–3) clefts up to 1/3 of the radius;
807 margin densely crenulate; amphithecia lighter and smooth on upper part and deeply

808 plicate towards the stipe, felty when old; stipe smooth, concolored, emaculate, tubular
 809 incomplete, brown inside; ascospores ellipsoid, 20.0–27.5 x 10.0–12.5 µm; epispore 2
 810 µm. **Pycnidia** subapical to apical, ostiole black, frequent; conidia sublageniform, (22.5–
 811) 27.5–35.0 × 2.50–5.0 µm.

812

813 **Chemistry:** cortex K+ yellow, UV-; medulla K+ cream yellow, C+ pink very weak near
 814 the upper cortex, KC+ pink evanescent, P-, UV -. Atranorin, gyrophoric acid, vioxanthin,
 815 and pigmentosin A (trace).

816

817 *Commentary:* *Hypotrachynella subpluriformis* has the biggest ascospores and conidia in
 818 the genus. The transversal mostly plane cut laciniae, the almost entire discs with only
 819 short clefts, and the very noticeable color graduation of the amphithecia from grey to
 820 almost white towards the margin are typical. Additionally, the smooth lighter upper part
 821 of the amphithecia become eroded, what turn the apothecia felty when old, while in other
 822 species the amphithecium is no more than slightly scabrid.

823 *Hypotrachynella subpluriformis* is traditionally placed in the synonymy of
 824 *Hypotrachyna pluriformis*, whose ascospores are 11–16 × 8–10 µm (Nylander 1860).

825

826 **Other new combinations**

827

828 We made below new combinations for three species that fit in the genus but whose type
 829 material we still did not have access.

830

831 *Hypotrachynella pluriformis* (Nylander) B.R. Hora & Marcelli, comb. nov.

832 *Parmelia pluriformis* Nylander. Syn. Meth. Lich.: 381. 1860. Type: Brazil, Minas Gerais
 833 State, s.d., Weddell s.n. (H-NYL, lectotype,lost; PC, isolectotype, n.v.). MycoBank
 834 811640.

835 Hale (1975) selected the specimen from H-NYL as lectotype, and was followed
 836 in this by Sipman *et al.* (2009). However, in the protologue, Nylander (1860) wrote
 837 explicitly "*Parmelia pluriformis* Nyl. in Mus. Paris", what attribute clearly the status of
 838 holotype to the material housed in PC.

839 Along the time, one species by Zahlbruckner (*Parmelia subpluriformis*) and two
 840 varieties by Müller Argoviensis (*Parmelia pluriformis* var. *chlorocarpa* and *P.*

841 *pluriformis* var. *multifida*) were placed in its synonymy but are here considered good
 842 species (see comments under those species).

843

844 *Hypotrachynella osorioi* (Hale) Marcelli & B.R. Hora, comb. nov.

845 *Parmelia osorioi* Hale, Phytologia 28: 266. 1974. Type: Uruguay, Lavalleja: Abrade
 846 Cotto, 12-X-1969, leg. Osorio 6507 (MVM, holotype, n.v.; US, isotype, n.v.). MycoBank
 847 811641.

848 According Sipman *et al.* (2009) this is a saxicolous species that develops isidioid
 849 club-shaped dactyls with erumpent but not sorediate apices and occurs in South America,
 850 in Uruguay and surroundings regions in Brazil and Argentina.

851

852

853 *Hypotrachynella revoluta* (Flörke) Marcelli & B.R. Hora, comb. nov.

854 *Parmelia revoluta* Flörke, Deutsch. Lich. 1: 11. 1815. Type: Germany, leg. Flörke (PH-
 855 Tuck, neotype selected by Krog & Swinscow 1979: 36, n.v.). MycoBank 811642.

856 According Sipman *et al.* (2009) this is an almost cosmopolite species and the only
 857 sorediate species in the genus. The soralia are initially subcapitate and subterminal,
 858 becoming confluent upon ageing.

859



860

861 Figures 10-13. Holotypes. 10. *Hypotrachynella multifida*. 11. *H. neodissecta*. 12. *H.*
 862 *puiggarii*. 13. *H. subpluriformis*. (scales: 10 mm).

Key to the *Hypotrachyna* species

863		
864		
865	1.a. Thallus with isidia, soredia, or dactyls	2
866	1.b. Thallus without those	6
867	2.a. Thallus with subapical soredia	<i>H. revoluta</i>
868	2.b. Thallus without soredia	3
869	3.a. Isidia present	4
870	3.b. Pustuloid dactyls present	<i>H. osorioi</i>
871	4.a. With cilia on an inflat black line	<i>H. neodissecta</i>
872	4.b. Eciliate; black line not inflated	5
873	5.a. Lower surface light brown; upper part of medulla light cream yellow ..	<i>H. puiggarii</i>
874	5.b. Lower surface ivory or variegated ivory/brown; medulla white	<i>H. caapora</i>
875	6.a. With cilia on black line	<i>H. mogiana</i>
876	6.b. Black line eciliate	7
877	7a. Medulla K+ light brown [white]	8
878	7b. Medulla K+ pinkish or purplish	9
879	8a. Lacinae very ramified satin above 40×; apothecia laminal involute; ascospores 7.5–	
880	9.0 µm wide, epispore 1.25 µm thick	<i>H. multifida</i>
881	8b. Lacinae satin above 30×; apothecia submarginal open; ascospores 5.0–7.5 µm wide,	
882	epispore 2.5 µm thick	<i>H. chlorocarpa</i>
883	9a. Medulla K+ aqueous purple, cortex very fragile	<i>H. everniaeformis</i>
884	9b. Medulla K+ pinkish, cortex firm	10
885	10a. Medulla white; thallus submembranaceous	11
886	10b. Medulla light cream yellow near the algal layer; thallus subcoriaceous to coriaceous	
887	12
888	11a. Ascospores 20–27 × 10–12.5 µm	<i>H. subpluriformis</i>
889	11b. Ascospores 11–16 × 8–10 µm	<i>H. pluriformis</i>
890	12a. Apothecia to 15 mm wide, stipe fissured, ascospores 7.5–10.0 µm wide, conidia	
891	7.5–9.0 µm long	<i>H. marcellii</i>
892	12b. Apothecia to 6 mm wide, stipe complete, ascospores 6.25–7.5 µm wide, conidia 5–	
893	7.5 µm long	<i>H. oreadica</i>

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901

902

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CAPITULO 2

Two new species of *Hypotrachyna* (*Parmeliaceae*) with alectoronic acid from Brazil

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Two new species of *Hypotrachyna* (*Parmeliaceae*) with alectoronic acid from Brazil

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Running title: *Hypotrachyna* species with alectoronic acid

Abstract

We describe the two new saxicolous species from southeast Brazil, *Hypotrachyna protentoides* and *H. serrana*; moreover we describe in detail the type specimens of *H. protenta*, *H. densirhizinata*, and *H. explendens*, also alectoronic acid containing species.

Key word: alectoronic; Serra da Mantiqueira; rocky fields; complementary black line; satin

Introduction

Hypotrachyna was proposed by Vainio (1890) in his monograph on Brazilian lichens as *Parmelia* subgenus *Parmelia* section *Hypotrachyna*, which he divided on the subgroups *Irregularis*, *Cyclocheila* and *Sublinearis*. Hale & Kurokawa (1964) understood that *Sublinearis* represented very well the section and raised it to subgenus. Years later, Hale (1974) recognized *Hypotrachyna* as genus. Explanations on the creation and history of *Hypotrachyna* are provided by Hale (1975), Sipman *et al.* (2009) and Hora *et al.* (2015).

The genus includes *Parmeliaceae* species mostly lacking cilia that share branched rhizines, bifusiform conidia, and have spores of medium size (Hale, 1974; Elix, 1994; Sipman *et al.*, 2009; Thell *et al.*, 2012).

Nowadays the genus is estimate to embrace about 230 accepted species (Sipman *et al.*, 2009), one of the largest genera in the *Parmeliaceae* family. The genera occurs in the America, Asia, Africa, Papua New Guinea, Australia, Pacific islands and Europe at altitudes between 730 (Elix, 1994) and 3700 (Sipman *et al.*, 2009).

In his studies about the genus in Tropical America, Hale (1975) opined that *Hypotrachyna* is divided on chemical subgroups, e.g., the gyrophoric acid containing

39 group, the evernic-lecanoric acids group, the lividic acid group, and alectoronic acid
40 group, among other (Hale, 1975).

41 When working on the inventory of the *Hypotrachyna* species of the high parts of
42 the southeastern Brazilian mountains, we found specimens that initially we named *H.*
43 *protenta* Hale. However, the detailed study of the material under our descriptive protocol,
44 which include a number of commonly not studied or not satisfactorily described
45 characteristics, revealed that we had not found that species in the region but two new ones
46 that differ from it in several ways.

47 We describe here the two saxicolous southeastern Brazilian new species that were
48 previously under the name the type material of *H. protenta*. Additionally, we include the
49 types of *H. densirhizinata* (Kurok.) Hale and *H. explendens* (Hale) Hale, two species of
50 the same group but sorediate, as a continuation of our effort to increase the knowledge on
51 the genus.

52

53

Material and Methods

54

55 The descriptive protocol developed by GEL (Canêz & Marcelli, 2006) for access
56 the morphological characters of the *Parmeliaceae*, which is now widely extended to
57 verify more than 150 characters (Hora et al., 2015), was used to standardize the
58 descriptions. Most of the modifications were directed to describe with minutiae details
59 that have demonstrated effective and/or important to distinguish Brazilian species, much
60 of them historically overlooked or erroneously considered be too much variable because
61 the small amount of specimens the researchers dealt with and/or because the limited field
62 knowledge with these taxa they had.

63 More information about the used characteristics and his adopted definitions, as
64 satin, velvety, primary and secondary laciniae/lobes, lacinules, lobules, rhizines, and cilia
65 can be found in Hora et al. (2015).

66 We introduce here “complementary black line” as an important characteristic. It
67 occurs when the lateral margin is minutely regular to irregularly fringed, and the black
68 line, instead simply making the contour of the margin, fills and occupies the space in
69 between the irregular "teeth", turning the margin outline straight. It is an easy character
70 to visualize because this black line is smooth outside and very irregular in its contact with
71 the lichenized part of the thallus.

72

Results

73

74

75 ***Hypotrachyna protentoides* B.R. Hora & Marcelli, sp. nov.**

76 Holotype: Brazil, Espírito Santo State, Alto Caparaó Municipality, Parque Nacional do
77 Caparaó, 20°27.3 'S 41°48.3' W, 2317 m alt., saxicolous, próximo a placa indicativa da
78 Trilha para o Pico da Bandeira, B.R. Hora 1204, 18-XI-2011 (SP).

79

80 **Thallus** aluminum gray on distal part and dark gray on proximal part, opaque, velvety at
81 20×, subsatin at 30×, satin above 40× on distal part, velvety at 30×, subsatin at 40× on
82 proximal part, 5.3 cm wide, laciniate. **Laciniae** anisotomic dichotomous to subsympodial,
83 0.6–1.4 mm wide, overlapped, adnate, longitudinal axis distended, transversal cut plane
84 to concave, slightly convex on proximal part, border coplanar to little ascendant; upper
85 surface firm; transversal cracks ramified or not, subtle to deep, not cicatrized, more dense
86 on proximal part; crumpled to slightly rugulose; pruina absent; emaculate; lateral margin
87 irregularly cut, however with a complementary black line, repand, closed; black line
88 evident, complementary, thicker on axils; cilia black, satin above 30×, 0.2–0.75 × 0.03–
89 0.05 mm, pigment absent, acting as rhizines, straight to little curved, cylindrical with
90 truncate apices; simple, some with furcate apex; frequent, all over the margin; apical zone
91 convex or concave, apex truncate, coplanar to descendant; axils acute to a few quadratics,
92 irregular in appearance and complemented by the black line; secondary laciniae and
93 lacinules absent. Lacking pustules, soredia, and isidia. **Medulla** white, on proximal part
94 here and there with spots of K⁺ red orange pigment, compact. **Lower surface:** apical
95 zone dark brown, sublustrous, velvety at 20×, subsatin at 30×, satin above 40×, attenuated
96 limit, papillate to slight rugulose, with rhizines; proximal part black, sublustrous, velvety
97 at 20×, subsatin at 30×, satin above 40×, continuous, crumpled to veined. **Rhizines** black,
98 sublustrous, cosatin to lower surface, simple to slight irregularly branched, 0–2×
99 branched, slight curved, subulate, erect, the longer sinuous, not gummed, not interlaced,
100 not anastomosed, with coplanar ramifying tendency, 0.5–1.25 × 0.05–0.075 mm,
101 abundant, all over the lower surface. **Apothecia** cupuliform when young tending to plane-
102 petaloid when old, adnate, laminal; disc dark brown, pruina absent, cleft since young till
103 half diameter, 3–4 clefts, bent when young, plane-petaloid when old; margin thick, 0.1
104 mm, crenulate since young, naked; amphithecia rugulose, emaculate, naked; stipe central,
105 very sort to inexistent; ascospores subspherical to ellipsoid, 10–12.5 × 8.75–10 μm,

106 epispore 1.0–1.25 μm . **Pyrenidia** laminal, immerse, ostiole black; conidia sublageniform
107 to bifusiform, (6.25–) 7.5–8.75 \times ca. 1.0 μm .

108

109 Chemistry: cortex K⁺ yellow, UV⁻; medulla K⁺ dirty yellow, C⁺ yellow near of upper
110 cortex, milky, KC⁺ pink to orange (almost red), P⁺ slight yellow, UV⁺ pool green.
111 Atranorin and alectoronic acid.

112

113 Distribution: Southeast of Brazil (Espírito Santo and Minas Gerais States).

114

115 Comments: *Hypotrachyna protentoides* is characterized by the black line complementary,
116 cilia present and acting as rhizines, little curved, not ramified (some with furcate apices)
117 axils irregularly acute to few quadratics and corrected by a complementary black line,
118 medulla white with spots of orange pigment reacting K⁺ red.

119 Most of the material is blackened by the presence of an epiphyte alga that covers
120 parts of the cortex and fills crevices, being also responsible by a reticular design that is
121 so continuous with the cortical cracks that can mislead morphological interpretation. This
122 occurs in the holotype and the paratypes 1301 and 1304.

123 *Hypotrachyna protentoides* is somewhat similar to *H. protenta* that produces α -
124 collatolic acid together with alectoronic acid, is satin already at magnification 30 \times , has
125 bigger cilia (0.7–0.9 \times 0.075–0.1 mm), axils quadratic to oval, secondary laciniae, the
126 medullar pigment reacts K⁺ purple, has ascospores and conidia smaller, respectively
127 (8.75–) 10.0–12.5 \times 5–6.25 (–7.5) and 6.25–7.5 \times ca. 1.25 μm ,

128 The other close specie is *H. serrana* (see below), whose laciniae are anisotomic
129 dichotomous to paracladial, has a minutely crumpled upper surface, the rhizines more
130 branched [1–3 (–4)] with interlaced apices, and smaller conidia 5–6.25 \times ca. 1.25 μm .

131 The epithet is a reference to the habit similarity to *H. protenta*.

132

133 Additional examined material. Brazil, Minas Gerais State, Itamonte Municipality, Parque
134 Nacional do Itatiaia, Abrigo Rebouças, 20°23'08.2"S 44°43'46"W, 2380 m alt., on rock,
135 leg. B.R. Hora & M.P. Marcelli 1300 (B), 1301 (BM), 1304 (US), 27-III-2012.

136

137 ***Hypotrachyna serrana* Marcelli & B.R. Hora, sp. nov.**

138 Holotype: Brazil, Minas Gerais State, Carrancas Municipality, 21°28'18.5"S
139 44°40'54.0"W, 1017 m alt., saxicolous, Cachoeira da Fumaça, leg. B.R. Hora & M.P.
140 Marcelli 1878, 22-X-2012 (SP).

141

142 **Thallus** saxicolous, aluminum gray, sublustrous, velvety at 20×, minute satin at 30×, satin
143 above 40×, submembranaceous, 6.3 cm wide, short laciniate. **Laciniae** anisotomic
144 dichotomous to paracladial, 1.0–2.5 mm wide, little laterally overlapped, without signs
145 of autoincompatibility, adnate; longitudinal axis slight undulate, transversal cut plane to
146 slight concave or convex, border coplanar to descendant; upper surface firm; transversal
147 cracks ramified, subtle to a few deep, mostly cicatrized; minutely crumpled, pruina
148 absent, emaculate; lateral margin smooth, repand, closed, black line very subtle, evident
149 on axils; cilia black, strong satin above 30×, pigment absent, 0.2–0.6 × 0.03–0.05 mm,
150 acting as rhizines, sinuous, subulate, furcate to simple, frequent, distribute all over the
151 margin; apical zone descendant, apex truncate, coplanar; axils oval to quadratics.
152 Secondary laciniae absent. Lacinules adventitious concolored to the thallus, distributed
153 all over the damaged margins, dichotomous, plane; apex round and brownish, black line
154 evident, lower surface black; grow from eventually damaged margins of the laciniae,
155 beginning as small protuberances that extends and widen to become spatulate, prostrate
156 and overlapped on the proximal part of the thallus. Lacking pustules, soredia, and isidia.
157 **Medulla** white, pigment absent, compact. **Lower surface:** apical zone brown, lustrous,
158 subvelvety at 20×, subsatin at 30×, satin above 40×, continuous, slight crumpled here and
159 there, slightly venulate. **Rhizines** black, sublustrous on distal part and more opaque on
160 proximal part, cosatin, furcate to 1–3 (4) dichotomous branched, arbuscular, sinuous,
161 subulate, erect, generally with interlaced apices, not gummed, however rarely
162 anastomosed, 0.45–0.75 × 0.03–0.05 mm, abundant, distributed all over the lower
163 surface. **Apothecia** absent. **Pycnidia** laminal, immerse, ostiole black; conidia bifusiform
164 to sublageniform, 5–6.25 × ca. 1.25 μm.

165

166 Chemistry: cortex K⁺ yellow, UV⁻; medulla K⁺ dirty yellow, C⁻, KC⁺ pink evanescent,
167 P⁻. UV + pool green.

168

169 Distribution: Southeast Brazil (Espírito Santo and Minas Gerais States).

170

171 Comments: *Hypotrachyna serrana* is characterized by the anisotomic dichotomous to
 172 paracladial laciniae, longitudinal axes slightly undulate, medulla without pigments,
 173 rhizines furcated to dichotomous with interlaced apices but rarely anastomosed.

174 *Hypotrachyna serrana* is close to *H. protentoides* that have a complementary
 175 black line, laciniae anisotomic dichotomous to subsympodial, upper surface crumpled to
 176 slight rugulose, pigment on medulla, rhizines less branched (0–2 times) and not
 177 interlaced, and bigger conidia $7.5\text{--}8.75 \times \text{ca. } 1.0 \mu\text{m}$.

178 Other near species is *H. protenta*, which has a complementary black line, pigment
 179 on medulla, and develop secondary laciniae, has the satin characterized above $30\times$, bigger
 180 cilia $0.7\text{--}0.9 \times 0.075\text{--}0.1 \text{ mm}$, and the rhizines are dichotomous to subpalmate and
 181 spinulate.

182 The epithet is a reference to the Mantiqueira Range (Serra in Portuguese), the
 183 greatest mountainous formation in southeast Brazil from where the species is described.

184

185 Additional material examined. Brazil, Minas Gerais State, Carrancas Municipality,
 186 Cachoeira da Fumaça, $21^{\circ}28'18.5''\text{S } 44^{\circ}40'54.0''\text{W}$, 1017 m alt., leg. B.R. Hora & M.P.
 187 Marcelli 1866, 22-X-2012 (B); idem, Espírito Santo State, Alto Caparaó Municipality,
 188 Parque Nacional do Caparaó, $20^{\circ}25.1'\text{S } 41^{\circ}50.5'\text{W}$, 1371m alt., leg. B.R. Hora 946, 14-
 189 XI-2011 (US).

190

191

192 ***Hypotrachyna protenta* Hale**

193 Smithsonian Contributions to Botany 25: 58. 1975. Venezuela, Mérida, El Valle, leg.
 194 Hale 43365 (holotype, US!; isotypes in DUKE, TNS, and UPS).

195

196 **Thallus** saxicolous, aluminum gray, lustrous, velvety at $10\times$, subsatin at $20\times$, satin above
 197 $30\times$, subcoriaceous, laciniate. **Laciniae** subsympodial to irregularly branched, 0.5–1.2
 198 mm wide, little laterally overlapping, loose adnate, longitudinal axis distended to
 199 irregularly undulate; transversal cut plane to concave, border coplanar; upper surface
 200 firm, continuous, slight crumpled, pruina absent, emaculate; lateral margin irregularly cut
 201 but with a complementary black line, closed; black line complementary, less evident on
 202 distal part; cilia black, velvety at $10\times$, subsatin at $20\times$, satin above $30\times$, pigment absent,
 203 straight to slightly sinuous, subulate, $0.7\text{--}0.9 \times 0.075\text{--}0.1 \text{ mm}$, the smaller with coplanar
 204 tendency some downturned and acting as rhizines, generally branched to simple, even the

205 simple are spinulate,, the first branching at half length, frequent; apical zone ascendant,
 206 apices truncate, descendant; axils quadratics to oval to irregular. Secondary laciniae
 207 dichotomous to irregular, laterally overlapping, prostrate, slight crumpled, 0.4–0.9 mm
 208 wide, axils quadratics to few oval; lacinules absent. Lacking pustules, soredia, and isidia.

209 **Medulla** white, pigment orange close the under cortex reacting K⁺ purple, compact.

210 **Lower surface:** apical zone brown, sublustrous, velvety at 30×, subsatin above 40×,
 211 attenuated limit, smooth to slight crumpled, with rhizines; proximal part black,
 212 sublustrous, velvety at 30×, subsatin at 40×, continuous, smooth to crumpled. **Rhizines**
 213 black, pigment absent, lustrous, cosatin, dichotomous to subpalmate, coplanar, the first
 214 branched after half length, 1–3 branched, sinuous, erect, not gummed, apex interlaced on
 215 distal part, spinulate, not anastomosed, 0.47–1.0 × 0.05 mm, more abundant on distal part.

216 **Apothecia** cupuliform when young and petaloid when old, sessile to substipitate, laminal;
 217 disc brown, pruina absent, cleft to half diameter, 1–4 (–5) clefts, involute when young
 218 and open when old, imperforate; margin thin, crenulate since young, naked; amphithecia
 219 smooth near to margin and rugulose toward to stipe, concolored on apex becoming
 220 yellowish toward the stipe, emaculate, naked; stipe central, very short, rugulose,
 221 emaculate, naked; ascospores narrow ellipsoid to suboval, (8.75–) 10–12.5 × 5–6.25 (–
 222 7.5) μm, epispore 1–1.25 μm. **Pycnidia** principally marginal, not rare laminal, immerse,
 223 ostiole black, abundant; conidia filiform to sublageniform, 6.25–7.5 × 1.25 μm.

224

225 Chemistry: cortex K⁺ yellow, UV⁻; medulla K⁺ dirty yellow, C⁻, KC⁺ light pink
 226 evanescent, P⁻, UV⁺ pool green. Atranorin, α-collatolic, alectoronic and
 227 dehidroxycollatolic (?) acids.

228

229 Distribution: Brazil, Colombia, Costa Rica, Panama and Venezuela (Hale, 1975). Costa
 230 Rica, Panama, Colombia, Venezuela, Guyana, Ecuador, Peru, Brazil and Bolivia (Sipman
 231 *et al.*, 2009).

232

233 Comments: *Hypotrachyna protenta* is characterized by the thallus satin being
 234 characterized above 30×, laciniae subsympodial to irregularly branched, upper surface
 235 continuous to slight crumpled, cilia simple and spinulate, secondary laciniae present,
 236 medulla with orange pigment reacting K⁺ purple, and dichotomous to subpalmate
 237 rhizines.

238 *H. protenta* is close *H. chicitae* that also does not have pustules, soredia, and isidia.
 239 However, *H. protenta* has alectoronic and α -collatolic acids and *H. chicitae* has evernic
 240 and lecanoric acids. Moreover, *H. chicitae* has the old apothecia plane with margin
 241 smooth to crenulated, thallus submembranaceous, laciniae slight overlapped, and the
 242 medulla without pigment.

243 For comparison with *H. serrana* and *H. protentoides*, see the comments under
 244 those species.

245

246

247 ***Hypotrachyna densirhizinata* (Kurok.) Hale**

248 *Parmelia densirhizinata* Kurok., in Hale & Kurokawa, Contr. U.S. Natl. Herb. 36: 171.
 249 1964. Panamá: Volcán, Chiriquí, 1500–3000 ft., 5-12 Dec 1948, leg. Scholander s.n.
 250 (holotype, US!).

251

252 **Thallus** muscicolous, yellowish, sublustrous on distal part and opaque on proximal part,
 253 velvety at 30 \times , subsatin above 40 \times , membranaceous, 20 cm wide, long laciniate.
 254 **Laciniae** anisotomic dichotomous to irregularly branched, 1.2–2.5 (–3.0) mm wide,
 255 laterally overlapping, loose adnate; longitudinal axis distended, transversal cut plane,
 256 border coplanar; upper surface firm, continuous, slight crumpled, pruinose in some
 257 laciniae, white; emaculate; lateral margin smooth, straight to repand, closed; black line
 258 subtle, thicker on axils; cilia black, subsatin at 20 \times , satin above 30 \times , 0.5–0.75 \times 0.05–0.1
 259 mm, pigment absent, coplanar to laciniae or working as rhizines, slightly sinuous,
 260 subulate, arbuscular, 2–4 (–6) branched, dichotomous, first branching near to base to half-
 261 length, frequent, distribute all over the margin; apical zone prostrate, apex acute, involute;
 262 axils oval to quadratics, a few elliptic. Secondary laciniae and lacinules absent. Lacking
 263 pustules and isidia. **Soralia** frequent, mostly subterminal, some laminal, capitate,
 264 subspherical, till 1.5 mm \times 0.5 mm, not coalescent upon growing, eciliate; the stipitate
 265 soralia develops on the top of a very high apical convexity on the laciniae; initially
 266 circular, they become hemispherical with the soredia production; the stipes are short,
 267 wide, hollow, slightly yellowish 0.8–1.5 \times (0.2–) 0.3 – 0.5 mm, K-; soredia persistent,
 268 farinose, from white to slightly yellowish; granules absent. **Medulla** white, pigment
 269 absent, texture normal. **Lower surface:** black, lustrous to subopaque, velvety at 10 \times ,
 270 subsatin at 20 \times , satin above 30 \times , continuous, smooth to slight crumpled. **Rhizines** black,
 271 till the margin, pigment absent, lustrous, cosatin, dendroid, arbuscular, first branched after

272 $\frac{1}{3}$ of length, till 7 times branched, erect, slightly sinuous; extremities much branched,
273 almost fibrillose; 0.25–0.75 (–1.0) \times 0.03–0.07 mm, abundant, distributed all over the
274 lower surface, more dense on distal part. **Apothecia** cupuliform, rare, up to 1.5 mm
275 diameter, subbullate laminal; disc light brown, pruina absent, entire, open, imperforated;
276 margin thin, smooth, naked; amphithecia darker than thallus, maculae evident, smooth,
277 naked; stipe central, 0.5 \times 0.75 mm, smooth, emaculate, densely pruinose on base, darker
278 than thallus; ascospores immature. **Pycnidia** laminal to subterminal, ostiole black,
279 frequent; conidia not found.

280

281 Chemistry: cortex K⁺ yellow, UV⁻; medulla K⁺ dirty yellow gelatinous, C⁻, KC⁺
282 gelatinous evanescent purple, P⁻, UV⁺ whitish blue. Atranorin, alectoronic and α -
283 collatolic acid.

284

285 Distribution: Argentina, Chile, Colombia, Costa Rica, Guatemala, Mexico and Venezuela
286 (Hale, 1975). Bolivia, Dominican Republic, Ecuador, Haiti, Panama and Peru (Hale &
287 Kurokawa, 1964; Sipman *et al.*, 2009).

288

289 Comments: *Hypotrachyna densirhizata* is characterized by the yellowish thallus, pruina
290 present on some laciniae, soralia on short and wide hollow slight yellowish stipes,
291 dendroid rhizines, and the apothecial stipe pruinose.

292 *H. densirhizata* share with *H. explendens* (see below) the same chemistry and
293 presence of soredia. However, *H. explendens* is short laciniate, has a subopaque thallus
294 whose satin is characterized above magnification 40 \times , maculae effigurate, medulla with
295 pigment that reacts K⁺ purple, rhizines little branched (0–4 \times). The soralia of *H. explendes*
296 are subspherical, subterminal, up to 2.5 mm diameter, short stipitate up to 3.5 mm \times 0.5
297 mm, and the soredia are persistent.

298

299

300 ***Hypotrachyna explendens* (Hale) Hale**

301 *Parmelia exsplendens* Hale, in Hale & Kurokawa, Contr. U.S. Natl. Herb. 36: 174. 1964.
302 Jamaica, Blue Mountains, Murdock's Gap, 19-III-1953, leg. Imshaug 15306 (holotype,
303 MSC!; isotype, US).

304

305 **Thallus** corticolous, brownish (herbarium), subopaque velvety at 10×, subsatin at 20×,
306 satin above 30×, subcoriaceous, 6.6 cm wide, short laciniate. **Laciniae** anisotomic
307 dichotomous to irregularly branched, 0.8–2.0 mm wide, laterally overlapping, adnate,
308 longitudinal axis distended to undulate, transversal cut convex to plane, border coplanar,
309 upper surface firm, with transversal cracks on proximal part mostly not cicatrized smooth
310 to slightly crumpled; pruina absent; macule effigurate, abundant; lateral margin smooth,
311 plane with ascendant tendency of some axils, closed; black line evident, thicker on axils;
312 cilia black, lustrous, subsatin at 20×, satin above 30×, pigment absent, slightly sinuous,
313 subulate, $0.25\text{--}0.75 \times 0.05\text{--}0.075$ mm, a few practically erect, the majority acting as
314 rhizines, anisotomic dichotomous, 2–5 branched, rare, all over the margin, arbuscular;
315 apical zone prostrate, ascendant when sorediate, apex truncate to acute, ascendant in
316 sorediate laciniae; axils oval, rare elliptic and quadratic. Secondary laciniae and lacinules
317 absent. Lacking pustules and isidia. **Soralia** subspherical, subterminal, abundant, up to
318 2.5 mm diameter, not confluent upon growing, eciliate; appear a cortical swellings and
319 may expose the upper side of the inferior cortex when old and shed the soredia, short
320 stipitate up to 3.5×0.5 mm, K-; soredia persistent, farinose, granules absent. **Medulla**
321 white, pigment orange near the lower cortex reacting K+ purple, firm, loose near the upper
322 cortex. **Lower surface** black, lustrous, velvety at 10×, satin above 20×, venulate to
323 smooth, continuous. **Rhizines** black, till the margin, pigment absent, sublustrous, cosatin,
324 dichotomous to irregularly ramified, a few simple, abundant, dense on distal part, slender,
325 straight, some curved, not gummed, not interlaced, not anastomosed, coplanar ramifying,
326 first branched after $\frac{1}{3}$ of length, 0–4 branched, subulate, $0.5\text{--}1.5 \times 0.03$ mm, distributed
327 all over the lower surface. **Apothecia** absent. **Pycnidia** absent.

328

329 Chemistry: cortex K+ yellow, UV-; medulla K+ light yellow, C+ very light yellow, KC+
330 light pink evanescent, P-, UV+ strong pool green. Atranorin, alectoronic and α -collatolic
331 acids.

332

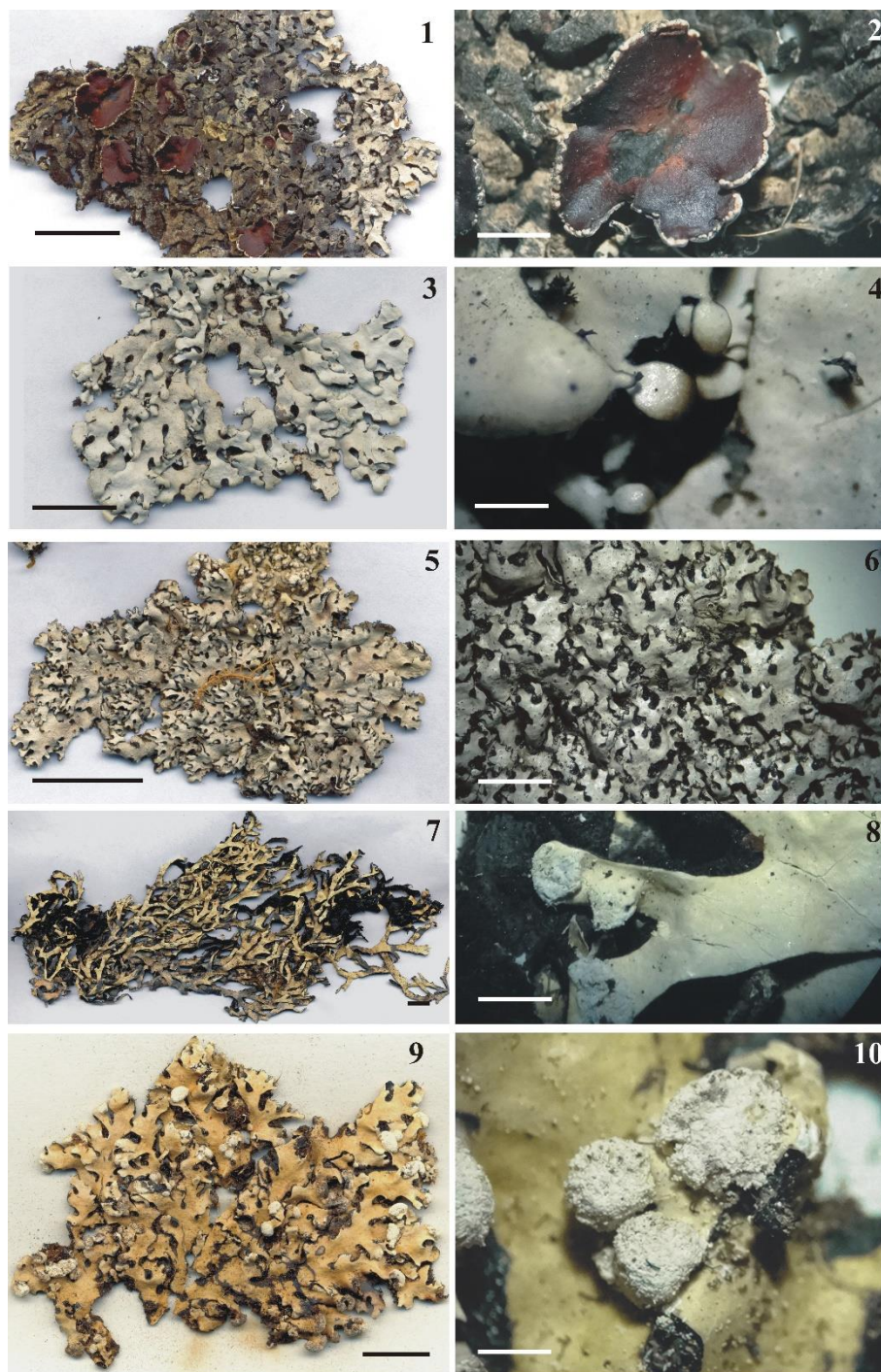
333 Distribution: Costa Rica and Jamaica (Hale, 1975). Guatemala, Jamaica, and Mexico
334 (Hale & Kurokawa, 1964). Colombia, Dominican Republic, Ecuador, Puerto Rico,
335 Venezuela and Windward island (Sipman *et al.*, 2009).

336

337 Comments: *Hypotrachyna explendens* is characterized by the short laciniae, upper surface
 338 transversally cracked on proximal part, maculae effigurate, medulla with pigment orange
 339 reacting K+ purple, and the lower surface venulate to smooth.

340 See *H. densirhizinata* for comparison with that species.

341



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Figures 1-11. Holotypes. 1. *Hypotrachyna protentoides*. 2. *H. protentoides*, detail of apothecia. 3. *H. serrana*. 4. *H. serrana*, detail of the lacinule. 5. *H. protenta*. 6. *H. protenta*, detail of the secondary laciniae. 7. *H. densirhizinata*. 8. *H. densirhizinata*, detail of the soralia. 9. *H. explendens*. 10. *H. explendens*, detail of the soralia. (scales: 1-3-5-7-9= 10 mm; 2-4-6-8-10= 1 mm).

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CAPITULO 3

***Lyngenella*, a new genus segregated from *Hypotrachyna* (Parmeliaceae)**

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***Lyngenella*, a new genus segregated from *Hypotrachyna* (*Parmeliaceae*)**

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Abstract

Hypotrachyna is a polyphyletic genus with chemical groups from which we describe here the genus *Lyngenella* corresponding to the lividic acid containing *Hypotrachyna livida* group, in which we describe the new species *L. damazioi* and *L. subsipmanii*, and include the new combinations *Lyngenella dactylifera*, *L. immaculata*, *L. klauskalbii*, *L. livida*, *L. novella*, *L. osseoalba*, *L. osseoalbida*, *L. palmarum*, *L. perexigua*, *L. polydactyla*, *L. pustulifera*, *L. regis*, and *L. virensica*. Furthermore, we describe according our protocol, which includes a number of commonly not studied or not satisfactorily described characteristics, all species from what we had access to the type material.

Key words – cilia, hypermaculate, lividic acid, satin,

Introduction

Hypotrachyna was described by Vainio (1890) in his monograph on Brazilian lichens, as *Parmelia* subgenus *Parmelia* section *Hypotrachyna*. In the same monograph the section *Hypotrachyna* is divided in the subgroups *Irregularis*, *Cyclocheila* and *Sublinearis*. About 70 years later, Hale & Kurokawa (1964) understood that the *Sublinearis* subgroup represented very well the section and raised the subgroup *Sublinearis* to subgenus *Hypotrachyna* inside of *Parmelia*, and finally Hale (1974) placed *Hypotrachyna* at genus level. A detailed explanation about the history and creation of *Hypotrachyna* genus can be found in Hale (1975), Sipman et al. (2009) and Hora et al. (2015a).

The genus is cosmopolite, occurring principally at altitudes between 730 (Elix 1994) and 3700 m (Sipman et al. 2009), and Elix (1993) commented that *Hypotrachyna* have its center of speciation in South America.

Hypotrachyna s.l. includes species that share sublinear, often elongate, apically subtruncate adnate to rarely substipitate branches mostly lacking cilia, imperforate apothecia, dichotomously branched rhizines uniformly distributed on a black lower surface, the upper cortex consisting of a palisade plectenchyma with pored epicortex, bifusiform conidia and having ascospores of medium size (Hale 1974, Elix 1994, Sipman et al. 2009, Thell et al. 2012). Nowadays the genus is estimated to embrace about 230 accepted species (Sipman et al. 2009), one of the largest genera in the *Parmeliaceae*.

The use of chemistry in lichen taxonomy comes from the 19th Century. In *Parmeliaceae* it is intensively used since the sixties during the 20th Century (e.g. Hale 1966, Hale & Kurokawa 1964) when the correlation between morphology and chemistry became apparent (Hale 1966). Culberson (1970) and Culberson & Culberson (1970) discussed the significance of the chemical evolution in lichens and Culberson & Hale (1973) made considerations about the probable morphological and chemical evolution of the *Hypotrachyna* species.

In his monograph on *Hypotrachyna* in Tropical America, Hale (1975) clearly considered the genus as composed by chemical groups, the lividic acid group (*Hypotrachyna livida* group) in the higher evolutionary level.

Hale (1975) included in this group *H. dactylifera* (Vain.) Hale, *H. erythrodes* (Zahlbr.) Hale, *H. formosana* (Zahlbr.) Hale, *H. immaculata* (Kurok.) Hale, *H. livida* (Taylor) Hale, and *H. novella* (Vain.) Hale. The author reported that lividic acid could be associated with atranorin, colensoic acid, 4-O-methylphysodic acid, lichexanthone, norcolensoic acid, physodic acid and rhodophyscin (skyrin). Sipman et al. (2009) included in the group *H. cunhaensis* Elix, T.H. Nash & Sipman (2009), *H. klauskalbii* Fletcher ex Sipman, Elix & T.H. Nash, *H. nana* Marcelli & Ribeiro, *H. osseoalba* (Vainio) Park & Hale, *H. polydactyla* (Krog & Swinscow) T.H. Nash, *H. protoformosana* Elix, T.H. Nash & Sipman, *H. pustulifera* (Hale) Skorepa, *H. subformosana* Hale ex Elix, T.H. Nash & Sipman, and *H. virensica* Elix, T.H. Nash & Sipman, and excluded *H. dactylifera* (only colensoic acid, norcolensoic acid, and 4-O-methylphysodic acid present), *H. erythrodes* (only lichexanthone, 4-O-methylphysodic acid, and physodic acid present) and *H. formosana* [= *Hypotrachyna osseoalba*].

The clade presented by Divakar et al. (2010) showed that *H. livida* and *H. osseoalba* made one supported clade near then *H. brasiliiana* (Nyl.) Hale. The same clade appears on the

new phylogenetic analysis by Divakar et al. (2013) that the authors named “*Hypotrachyna sensu stricto*” for containing *H. brasiliana*, the type of the genus. However, this clade has two subclades corresponding to chemical groups, one with *H. brasiliana* (lichexanthone, protocetraric acid, and virensic acid), and other with *H. livida* (stranorine and lividic acid).

When reviewing the type material of *Hypotrachyna* species under our descriptive protocol that includes a number of commonly not studied or not satisfactorily described characteristics, it became clear that the *H. livida* group is a good morphological and chemical unity at genus level that corresponded exactly to the phylogenetic results of Divakar et al. (2010, 2013). Therefore, we describe here the new genus *Lyngnella* (*H. livida* group).

Another chemical group containing species with gyrophoric acid as main secondary metabolite and a very typical morphology was recently segregated from *Hypotrachyna* as the genus *Hypotrachynella* Marcelli & B.R. Hora (Hora et al. 2015a).

Material and methods

The analytical descriptive protocol for studying specimens of *Parmeliaceae* developed by GEL (Canêz & Marcelli 2006) modified by Hora et al. (2015a,b,c) was used. The modifications to the protocol made possible the observation of characteristic that have been showed important and have not yet been properly observed, compared, and used in the taxonomy of *Parmeliaceae*.

Maculae are commonly interpreted as white (or with the color of the medulla) spots on the thallus, of varied distribution and morphology, reflecting the lack of photobiont cells caused by a discontinuous distribution of those. The most common situation is the presence of white dots, lines or nets on lamina, amphithecia and other parts. Nevertheless, there is an inverse condition when most of the thallus (or a part of it) is whitish and the spots are darker, reflecting the presence of dispersed photobiont glomerules. This condition of photobiont-free extensive areas we call "hypermaculate" in the sense of Spielmann (2009).

Some species that produce lichexanthone and protocetraric acid together with the lividic acid could perhaps fit here but we are in need of more complete studies. They constitute the *Hypotrachyna protoformosana* Elix, T.H. Nash & Sipman group, which will be presented elsewhere.

Results and discussion

Hale (1975) had already stated that the *Hypotrachyna livida* group is clearly a chemical group inside genus *Hypotrachyna*. Divakar et al. (2006) commented that the *Hypotrachyna* clade required a revision in the generic concept.

When compared with Divakar et al. (2013) results, we immediately identified their results as corresponding to those that we were obtaining from our own morphological analysis of *Hypotrachyna* species.

Considering all this information together, we state that the *Hypotrachyna livida* group makes a sound morphological, chemical and molecular entity that we segregate here in a new genus.

***Lyngenella* B.R. Hora & Marcelli gen. nov. (Parmeliaceae)**

MycoBank 811338.

Type species: *Parmelia livida* Taylor. Hooker Journal of Botany 6:171. 1847. Type: U.S.A., Louisiana, New Orleans, s.d., leg. Hooker s.n. (holotype, FH!).

Lyngenella is characterized by laciniae subopaque or lustrous, irregularly dichotomous, whose satein is very minute, most of the species being just subsatein at least till about magnification 30×; the medulla is white or bicolor, the lower surface black with a brown apical zone and cosatein to the upper surface; the rhizines cosatein to lower surface, coplanar ramified, slender, 1–6× branched, simple to irregular and little curved, and abundant all over the lower surface; the apothecia are laminal, concave when young, cleft since young, with crenulated margin, the disc imperforate, ascospores ellipsoid 7.0–13.7 μm × 5.0–7.5 μm; the pycnidia are subapical, the conidia straight filiform to sublageniform 3.75–6.25 μm × 1.0 μm. The main secondary metabolites are substances of the lividic acid and of the "palmarum" complexes.

Since *Hypotrachyna* is a wide polyphyletic group with a wide range of morphological and chemical characteristics, it is very difficult to distinguish it from *Lyngenella*. However, reducing *Hypotrachyna* s.l. into smaller groups brings to the light some definite patterns of chemical and morphologically relatively homogeneous units, and *Lyngenella* is one of them.

Hypotrachyna s.s. is in the reality a not numerous group of species close to *H. brasiliiana* that produces lichexanthone associated with protocetraric acid, and whose typically lacinate thallus is very regularly dichotomous ramified, eciliate, the lower side totally black

without an apical zone; the rhizines are sparse, little ramified, erect, and not curved; the laminal to subapical apothecia are adnate to rarely substipitate, involute when old, 1–4 cleft since young, the ascospores ellipsoid about $8\text{--}12 \times 4\text{--}8 \mu\text{m}$, and the conidia probably exclusively bifusiform (needs confirmation by type review).

Ours TCL analyses did not demonstrate lividic acid in *H. cunhaensis* and *H. nana*. Therefore, they were not included as *Lyngenella* species for now.

There are not isidiate species of *Lyngenella* known until now.

Lyngenella species are cited as *Hypotrachyna* from Brazil, Thailand, USA and Venezuela (Sipman et al. 2009).

The genus is named in honor of Bernt Arne Lyngge [1884-1942], the Norwegian lichenologist who worked on the *Parmeliaceae* collected by G.O. Malme during the Regnellian Expeditions to South America and understood very well what are the Brazilian *Parmeliaceae* species as well their real variability, producing texts and descriptions of high accuracy and enormous value to the Brazilian lichenology. His species, commonly placed into synonymies by former researchers, are constantly being resurrected by our studies.

Lyngenella livida (Taylor) Marcelli & B.R. Hora, **comb. nov.**

Fig. 1

MycoBank 811351.

Parmelia livida Taylor. Hooker Journal of Botany 6:171. 1847. Type: U.S.A., Louisiana, New Orleans, s.d., leg. Hooker s.n. (holotype, FH!).

Thallus corticolous, brownish (herbaria), lustrous, velvety at $10\times$, subvelvety at $20\times$, subsatin above $30\times$, 4.0 cm wide, membranaceous, laciniate. **Laciniae** subdichotomous, 1.0–1.4 mm wide, laterally and/or apically overlapping, adnate; longitudinal axis distended, transversal cut convex, border coplanar, upper surface firm; little transversally cracked; cicatrized, cracks not branched; slight rugulose to smooth, pruina absent, macule absent; lateral margin smooth, repand, closed; black line subtle to inexistent; cilia absent; apical zone prostrate, apex truncated, descendant; axils oval to quadratic; secondary laciniae absent; lacinules mostly spathulate, a few laciniate, the older lengthened into sublaciniae, abundant, 0.1–0.5 mm wide. **Lacking** pustules, soredia, and isidia. **Medulla** white, pigment absent, compact. **Lower surface**: black, slight rugulose, lustrous, velvety at $10\times$, subsatin at $30\times$, satin above $40\times$, continuous. **Rhizines** black, 1–3 branched, furcate to dichotomous, cosatin, little curved, subulate, not gummed, not anastomosed, interlaced, fragile, first branching at half-length, 0.2–

0.3 × 0,03–0,05 mm, distribution subsparse. **Apothecia** concave, up to 8.5 mm diameter, sessile, cleft since young, clefts to 1/4 diameter, 2–5 clefts, the older become plane, petaloid, and prostrate on the thallus; disc dark brown, imperforate; margin crenate, naked; amphithecia smooth, naked; stipe absent; ascospores absent. **Pycnidia** immerse, abundant, ostiole black; conidia not found.

Chemistry: cortex K+ yellow, UV-; medulla K+ yellow to brown, C+ dirt yellow evanescent, KC+ intensifies the K, P+ brown collapses the medulla, UV-.

Distribution: Occurring throughout tropical South America, mostly common in southeastern Brazil and Uruguay and United States (Hate 1975, Sipman et al. 2009).

Comments: *Lyngenella livida* is characterized by emaculate membranaceous thallus, slightly rugulose to smooth, subsatin above magnification 30×; laciniae subdichotomous; cilia absent; medulla white; lower surface black and slightly rugulose; rhizines furcate to dichotomous, little curved, subulate, fragile; apothecia concave when young and plane-petaloid when old, sessile, 2–5 cleft.

Lyngenella livida is somewhat similar in habit to *L. osseoalbida*, which is saxicolous, subsatin above 20×, the transversal cracked surface becomes schizidiate, is short laciniate and irregularly branched, the medulla is ochre near to lower cortex reacting K+ wine, the rhizines are simple to a few dichotomous, 1–2 (–5)× branched, has concave apothecia when young and tend to be plane when old.

Other somewhat similar species is *L. perexigua* that has the thallus subopaque, satin above 40×, submembranaceous to subpergamineous, has the medulla cream on upper half and white on lower half, the apothecia concave when young and plane and prostrate when old, with continuous discs, underside of the amphithecia blackened and producing rhizines, and ellipsoid ascospores 11–12.5 × 7.5 μm.

***Lyngenella dactylifera* (Vain.) B.R. Hora & Marcelli, comb. nov.** MycoBank 811352 Fig. 2 Mycobank 811352.

Parmelia dactylifera Vain. Act. Soc. Fauna et Flora Fennica 7: 57. 1890. Type: Brazil, Minas Gerais [State], leg. Vainio, Lich. Bras. Exs. 363, 18-26-III-1885 (lectotype, TUR–V!; isolectotypes in BM, FH, M, PC, and UPS).

= *Parmelia tiliacea* var. *leucina* Müll. Arg. Flora 63: 267. 1880. Type: Brazil, [Rio de Janeiro State], Petrópolis [Municipality], leg. Deventer (lectotype, G!).

Thallus corticolous, brown (herbaria), sublustrous, velvety at 10×, subsatin at 20×, satin above 30×, 5.9 cm wide, subcoriaceous, sublaciniate. **Laciniae** anisotomic dichotomous, (0.5–) 0.8–1.5 mm wide, little laterally overlapping, overlapped on proximal part, loose adnate; longitudinal axis distended, transversal cut plane to convex, border coplanar; upper surface firm, occasionally little cracked, mostly slight crumpled, pruina absent, emaculate; lateral margin smooth, repand, closed; black line little evident; cilia absent; apical zone coplanar to ascendant, apex truncate to rounded, descendant; axils elliptic to oval; secondary laciniae and lacinules absent. **Lacking** pustules, soralia and isidia. **Dactyls** isidioid laminal, get spatulate upon growing, furcate, concolored to lamina, mostly dolioliform, a few slender, 0.27–0.3 mm × 0.10–0.25 mm. **Medulla** white, pigment absent, compact. **Lower surface:** apical zone light brown, lustrous, velvety at 10×, subvelvety at 20×, subsatin above 30×, attenuated limit, smooth, with rhizines; proximal part black, sublustrous, continuous, slight veined, velvety at 10×, subvelvety at 20×, subsatin at 30×, satin above 40×. **Rhizines** black, abundant, few on proximal part, dense, subulate, erect, a few curved, not gummed, not anastomosed, slender, dichotomous to irregularly branched, some trichotomous, first branched after $\frac{1}{3}$ of length, 1–3 branched, very interlaced, 0.5–1.25 × 0.03–0.05 mm. **Apothecia** laminal, substipitate, concave, up to 4.6 mm, when old prostrated on cortex; disc brown, continuous when young and discontinuous 2–3 cleft when old, the clefts up to $\frac{1}{8}$ diameter; margin crenate, naked; amphithecia continuous, pumpkin-like in the upper part, rugulose, concolored, naked; stipe very short; ascospores ellipsoid, 8.75–10 × 3.75–5 μm , episore 1.25 μm . **Pycnidia** absent.

Chemistry: cortex K+ yellow, UV–; medulla K+ yellow to red (brown when dry), C+ light yellow, KC+ orange at lower part, the upper part remains brown (after K), P+ orange, UV–.

Distribution: Widespread in the Neotropical mountains from Mexico to Bolivia and southeastern Brazil, and further south in Paraguay and Argentina (Sipman et al. 2009).

Comments: *Lyngenella dactylifera* is characterized by the sublustrous thallus with satin above 30×, subcoriaceous, loose adnate, sublaciniate, elliptic to oval axils, dactyls present; the medulla is white, the lower surface has an apical zone light brown; the rhizines mostly erect

are dichotomous to irregularly branched, some trichotomous, very interlaced; the apothecia are concave when young to prostrated when old, disc with 2 to 3 clefts, ellipsoid ascospores $8.75\text{--}10 \times 3.75\text{--}5 \mu\text{m}$.

Lyngenella dactylifera is somewhat similar in habit and chemistry to *Hypotrachyna brueggeri* Marcelli & Ribeiro, which does not produce lividic acid. However *H. brueggeri* has true solid isidia (however thick and pustular in appearance), the medulla is white with a pigment yellow-orange reacting K⁺ reddish inside of isidia, the thallus membranaceous, smooth to crumpled, satin above 30 \times , rhizines simple to dichotomous, 0–4 branched, slender, straight to slight sinuous.

Lyngenella klauskalbii has lichexanthone on cortex, isidia, short laciniae anisotomic dichotomous to sympodial, the lower half is light brown and reacting K⁺ faint red in the older parts of the thallus, and the rhizines are dichotomous to irregular, 2 to 4 branched, little curved and with the apex little interlaced.

Lyngenella damazioi Marcelli & B.R. Hora, **sp. nov.**

Fig. 3

MycoBank 811339.

Holotype: Brazil, Espírito Santo State, Santa Marta Municipality, Parque Nacional do Caparaó, forest near the Guard Post, 20°29.88'S 41°43.99'W, 965 m alt., on rock, leg. B.R. Hora 1029, 17–XI–2011 (SP 466025).

Thallus saxicolous, ivory, opaque, velvety at 10 \times , subvelvety at 20 \times , subsatin at 30 \times , satin at 50 \times , 7.5 cm broad, lacinate. **Laciniae** anisotomic dichotomous, laterally overlapping and contraposed, adnate, longitudinal axis undulate, transversal cut irregular; upper surface firm; transversally parallel cracked, the cracks begin at margin and extends inward the lamina till $\frac{1}{3}$ of the breadth; pruina absent, maculae absent; lateral margin smooth, repand, closed; black line little evident, thicker on axils; cilia absent; apical zone descendant, apex roundish; axils oval to a few elliptic; secondary laciniae and lacinules absent. Lacking soredia and isidia. **Pustules** mostly subapical and on the crests of the laciniae, may be aggregate, only the older confluent; begin as spherical to capitated blackened swellings, many times with a verruculose surface, each verrucule originating one granule when the pustules break down or open apically; the margins of the open pustules produces more soredia and grow up irregularly to for a somewhat elevate structure cauliflower-like; all the inner parts of the pustules become blackened; old empty pustules are commonly deeply excavate; granules and soredia granular mixed, many partially blackened. **Medulla** white, light brown below the pustules, pigment K-

, texture normal. **Lower surface:** apical zone light brown, lustrous, subvelvety at 10×, subsatin at 20×, satin above 30×, smooth, attenuated limit, papillate; proximal zone black, opaque, subvelvety at 10×, subsatin at 20×, satin above 30×, slight crumpled. **Rhizines** black, cosatin, dichotomous, few trichotomous, cylindrical, sinuous, curved, not gummed, not interlaced, few anastomosed, first branched after 1/3 of length, 1–3 branched, coplanar, 0.4–0.6 × 0.03–0.05 μm, in sparse groups. **Apothecia** absent. **Pycnidia** absent.

Chemistry: cortex K+ yellow, UV-; medulla K+ yellow to light brown, C+ light yellow, KC+ pink evanescent, P+ light cream, UV-.

Distribution: southeastern Brazil.

Comments: *Lyngenella damazioi* is characterized by thallus saxicolous, satin only at 50×, anisotomic dichotomous laciniae with cilia, undulate longitudinal axis, presence of pustules, the medulla white but light brown below the pustules, lower surface with a light brown apical zone and a black proximal zone; the rhizines are black, dichotomous, curly, 1 to 3 branched.

It is relatively easy to distinguish *L. damazioi* from other similar pustulate species of *Martiana* and *Lyngenella* because its typically curved rhizines in sparse groups. Sometimes it is easier to look for them on the substrate, detached from the thallus.

Martiana sipmanii is also pustulate, but the medulla is white in the upper 2/3 and light brown below (Hora et al. 2015c).

Lyngenella subsipmanii, by its time, has the pustules brownish inside instead the typical black of *L. damazioi*.

Additional examined material. Brazil, Espírito Santo State, Santa Marta Municipality, Parque Nacional do Caparaó, forest near the Guard Post, 20°29.889'S 41°43.992'W, 965 m alt., on rock, leg. B.R. Hora 1006 (B), 1007 (US), 1008(BM), 17–XI-2011.

Lyngenella immaculata (Kurok.) B.R. Hora & Marcelli, **comb. nov.**

Fig. 4

MycoBank 811353.

Parmelia immaculata Kurok., in Hale & Kurokawa, Contr. U.S. Natl. Herb. 36: 178. 1964. South Africa, Distr. Zoutpansberg, Punch Bowl Inn, N of Louis Trichardt, alt. 4500', on bark, leg. Ove Almborn 6551, 11-X-1953 (holotype, LD!; isotype, US).

Thallus corticolous, subopaque, velvety at 10×, subsatin up to 30×, satin above 40×, 6.0 cm wide, membranaceous, sublaciniate. **Laciniae** anisotomic dichotomous, (1.2–) 1.5–2.0 (–2.3) mm wide, contiguous, little laterally overlapping, loose adnate; longitudinal axis distended, transversal cut convex to plane, border coplanar; upper surface firm, transversal cracks mostly branched and cicatrized, smooth to crumpled, pruina absent, maculae absent; lateral margin smooth, repand to straight, closed; black line evident and thicker on axils; cilia black, lustrous, subsatin at 20×, satin above 30×, pigment absent, straight, subulate, 0.15–0.35 × 0.03–0.05 mm, coplanar, mostly downturned and acting as rhizines, furcate to dichotomous, 1–3x branched, few, all over the lateral margin; apical zone ascendant, apex truncated, descendant; axils oval; secondary laciniae and lacinules absent. **Lacking** pustule and isidia. **Soralia** frequent, laminal, on crest of laciniae, up to 1.3 mm × 1.5 mm, cilia absent, developed from small cortical non pustular swellings of brownish apices, at first orbicular, then growing to become capitate and confluent, cortex integer near the soralia, pigment absent; soredia farinose, caducous, granules absent. **Medulla** white, pigment absent, texture normal. **Lower surface:** apical zone brown, lustrous, velvety at 10×, subsatin above 20×, attenuate limit, little crumpled, with rhizines; proximal zone black, sublustrous, velvety at 10×, subsatin at 20×, satin above 30×, continuous, slight crumpled. **Rhizines** black, pigment absent, lustrous, cosatin, dichotomous, coplanar, first branching mostly after 1/3 of length, a few since the base, 1–4× branched, curved, a few straight, subulate, not gummed, interlaced, little anastomosed, 0.5–0.75 × 0.03 mm, abundant, all over the lower surface. **Apothecia** absent. **Pycnidia** absent.

Chemistry: cortex K+ yellow, UV-; medulla K+ yellow to brown, C+ yellow gelatinous, KC- but gelatinous, P+ light orange, UV+ white.

Distribution: United States, Mexico and Puerto Rico to Bolivia and Peru, Argentina, southern Africa, India, Taiwan, Philippines, Thailand, Papua New Guinea and Australia (Divakar & Upreti 2003, Elix 1994, Elix et al. 2002, Hale 1975, Kurokawa & Lai 2001, Sipman et al. 2009, Wolseley et al. 2002).

Comments: *Lyngenella immaculata* is characterized by the thallus corticolous membranaceous, with satin above 40×, smooth to crumpled, anisotomic dichotomous sublaciniae, cilia present, with soredia, white medulla, and black rhizines, dichotomous, 1–4 branched, interlaced and little anastomosed.

As *L. immaculata*, *L. virensica* has soredia, however its thallus is subsatin at 30×, submembranaceous, slight crumpled to crumpled, the laciniae are dichotomous, develops

secondary laciniae, and the rhizines are simple to irregularly 1–4× branched and sometimes with interlaced apices. The soredia of *L. virensica* are mostly subapical, some on crest of laciniae where arise from swellings of pustular appearance whose cortex break irregularly to produce soredia.

Lyngenella klauskalbii (Sipman, Elix & T. Nash) Marcelli & B.R. Hora, **comb. nov.** Fig. 5
MycoBank 811354.

Hypotrachyna klauskalbii Sipman, Elix & T. Nash. Flora Neotropica Monograph 104: 86. Brazil, São Paulo [State], Paranapiacaba, Serra do Mar, 60 km sudeste de São Paulo [City], oberhalb von Juquitiba, in einem hellen, fuchten Urwald na einem stausee, 550m alt, leg. K. Kalb & G. Plöbst 31843, 14-V-1978 (Klaus Kalb! holotype).

Thallus corticolous, grayish on distal part and ivory on proximal part, subopaque, velvety at 20×, subsatin above 30×, 8.3 cm wide, subcartilaginous, short laciniate. **Laciniae** anisotomic dichotomous to sympodial, (0.4–) 0.7–1.0 (–1.5) mm wide, juxtaposed to laterally overlapping, adnate; longitudinal axis distended, transversal cut straight to little convex, border coplanar; upper surface firm, continuous, transversal cracks not branched, not cicatrized, smooth, on some parts slightly crumpled, pruina absent, maculae effigurate, more evident on young parts, frequent; lateral margin smooth, repand, closed; black line little evident; cilia absent; apical zone distended, apex truncate, descendant; axils oval to a few elliptic; secondary laciniae and lacinules absent. **Lacking** pustules and soredia. **Isidia** laminal, irregularly short branched since the base, base constrict, slight satin at 40×, sometimes subdichotomous, torulose, mostly dolioliform, apex not dark, concolored to thallus, 0.25–0.35 × (0.10–) 0.20 mm. **Medulla** white, on older part of thallus the lower half is light brown, the pigment reacting K+ faint reddish, compact. **Lower surface:** black, smooth to slight crumpled, not very deep transversally cracked and cicatrized, lustrous, velvety at 10×, subvelvety at 20×, subsatin above 30×. **Rhizines** black, pigment absent, lustrous, cosatin, dichotomous to irregular, coplanar, first branched after 1/3 of length, 2–4 branched, subulate, little curved, mostly straight, not gummed, apex little interlaced, not anastomosed, 0.25–0.6 × 0.25–0.05 mm, abundant, all over the lower surface. **Apothecia** absent. **Pycnidia** absent. Chemistry: cortex K–, UV+ yellow; medulla K+ yellow to brown gelatinous, C+ gelatinous, yellow after dry, KC+ intensifies the K reaction, P+ yellow, UV–.

Distribution: Brazil (Sipman et al. 2009).

Comments: *Lyngenella klauskalbii* is characterized by are corticolous subcartilaginous thallus, subopaque, subsatin above 30×, mostly smooth, anisotomic dichotomous to sympodial short laciniate, juxtaposed to laterally overlapped, the maculae effigurate, isidia present, white medulla but on the older parts the lower half light brown and reacting K⁺ faint reddish, black and smooth to slight crumpled lower surface, and rhizines, dichotomous to irregular 2 to 4 branched and apex little interlaced.

L. klauskalbii and *L. virensica* have lichexanthone in the cortex, however *L. virensica* has soredia, develops secondary laciniae, has a submembranaceous thallus slight crumpled to crumpled, dichotomous laciniae, smooth to slight crumpled lower surface, and rhizines simple to irregularly 1 to 4 branched and sometimes with interlaced apex.

Lyngenella novella (Vain.) B.R. Hora & Marcelli, **comb. nov.**

Fig. 6

Myacobank 811355.

Parmelia novella Vain. Acta Soc. Fauna Fl. Fenn. 7(7): 56. 1890. Type: Brazil: Minas Gerais [State], Sítio [nowadays Antonio Carlos], 3–5 III 1885, leg. Vainio, Lich. Bras. Exs. 1028 (lectotype, TUR–V!; isolectotypes in BM, FH, and M).

≡ *Parmelia brasiliiana* var. *novella* (Vain.) Lyngé, Ark. Bot. 13(13): 115. 1914.

Thallus corticolous, brownish (herbaria), subopaque, velvety at 10×, subvelvety at 20×, subsatin above 30×, 5.5 cm wide, subcoriaceous, laciniate. **Laciniae** anisotomic dichotomous to subsympodial, 0.5–1.0 cm wide, overlapped, loose adnate; longitudinal axis distended, transversal cut plane to convex, border coplanar; upper surface firm, continuous, crumpled to rugulose, pruina absent, hypermaculate principally on proximal part; lateral margin smooth, repand, closed; black line subtle; cilia absent; apical zone coplanar; apex rounded to subtruncate, coplanar to descendant; axils oval to elliptic; secondary laciniae and lacinules absent. **Lacking** pustules, soredia, and isidia. **Medulla** white, pigment absent, texture normal in upper half and compact in lower half. **Lower surface:** apical zone black sometimes brown, lustrous, subvelvety up to 20×, subsatin above 30×, smooth, with rhizines; proximal part black, lustrous, velvety at 10×, subsatin at 20×, satin above 30×, continuous, slight veined to smooth. **Rhizines** black, some with brown apex, cosatin, dichotomous to subdichotomous, few trichotomous, mostly cylindrical, a few subulate, not gummed, little interlaced, not

anastomosed, curved to erect, first branching after $\frac{1}{3}$ of length, 1–3 (–4) branched, (0.25–) 0.5–0.75 \times 0.02–0.05 mm, abundant, forming big tufts. **Apothecia** laminal, up to 6.3 mm diameter, concave when young, involute and cleft when old, 2–4 clefts, cleft up to half diameter, folded, 3 folds; margin thin, crenulate, naked; amphithecia become more yellowish toward the stipe, continuous, emaculate, naked, smooth when young and veined on old; stipe almost inexistent, emaculate, strong yellowish, naked, smooth; ascospores ellipsoid to oval, (10–) 11.25–13.7 (–14.4) \times (5.0–) 6.25–7.5 μm , episore 1 μm . **Pycnidia** subapical, frequent, ostiole black; conidia not found.

Chemistry: cortex K–; UV+ yellow; medulla K+ light yellow gelatinous, C+ very light yellow, KC+ reddish yellow, P+ terracotta red, UV–.

Distribution: Australia, southeastern of Brazil, and Venezuela (Elix 1994, Sipman et al. 2009).

Comments: *Lyngenella novella* is characterized by corticolous subcoriaceous thallus, subopaque, subsatin above 30 \times , anisotomic dichotomous to sympodial laciniae, loose adnate, crumpled to rugulose upper surface, hypermaculate, white medulla; the rhizines are black with brown apex, dichotomous to subdichotomous, a few trichotomous, mostly cylindrical, the apothecia concave when young and involute and 2 to 4 cleft when old, ellipsoid to oval ascospores, (10–) 11.25–13.7 (–14.4) \times (5.0–) 6.25–7.5 μm .

Lyngenella novella is similar to *L. regis* that has anisotomic dichotomous laciniae, with autoincompatibility between primary and secondary laciniae, the longitudinal axis distended to very undulate, the upper surface evidently transversally rugose since the third internode, macule absent, rhizines totally black, mostly curved, slender, just a few erect; the apothecia are concave with discs 2 to 4 cleft, continuous, some involute, ascospores ellipsoid, 10–12.5 \times 6.25 μm .

Other alike species is *L. livida*, whose thallus is membranaceous, slight rugulose to smooth, the laciniae subdichotomous, without maculae; the lower surface is black and slightly rugulose, the rhizines are 1 to 3 branched, little curved; the apothecia 2–5 cleft, plane–petaloid and prostrated when old, with discs dark brown.

Lyngenella osseoalbida (Lyng.) B.R. Hora & Marcelli, **comb. nov.**

Fig. 7

MycoBank 811356.

Parmelia osseoalbida Lynge. Ark. Bot. 13 (13): 133. 1914. Type: Brazil, Rio Grande do Sul [State], Porto Alegre [Municipality], leg. Malme 595, 15-X-1892 (holotype, S!; isotypes in UC and UPS).

Thallus saxicolous, ivory on distal part and grayish on proximal part (presence of epiphytic cyanobacteria on the holotype), lustrous, velvety at 10×, subsatin above 20×, 6.0 cm wide, membranaceous, short laciniae. **Laciniae** irregularly branched, 1–2 mm wide, laterally overlapping, loose adnate; longitudinal axis undulate, transversal cut diverse, border coplanar; upper surface firm, transversal cracks branched or not, cicatrized, becoming schizidiate, smooth to little crumpled, pruina absent, emaculate; lateral margin smooth, repand, closed; black line evident, thicker at axils; cilia absent; apical zone coplanar, apex rounded, ascendant, a few descendant; axils oval to a few elliptic; secondary laciniae and lacinules absent. **Lacking** pustules, soredia, and isidia. **Medulla** mostly white but ocher K+ wine near to the under cortex and in older parts of the thallus, texture normal. **Lower surface**: apical zone brown, lustrous, subvelvety at 10×, subsatin above 20×, attenuated limited, smooth to little veined, with rhizines; proximal part black, lustrous, velvety at 10×, subvelvety at 20×, subsatin above 30×, transversal cracks branched and mostly cicatrized, smooth to slightly crumpled. **Rhizines** black, simple to a few dichotomous, first branching after $\frac{2}{3}$ of length, $0.87\text{--}1.2 \times 0.07\text{--}0.2$ mm, 1–2 (–5)× branched, subulate, erect, very slightly curved, not gummed, not anastomosed, not interlaced, slender, delicate, mostly sparse to grouped in some parts. **Apothecia** laminal, adnate, concave tending to plane when old, up to 3 mm diameter; disc brown, continuous, imperforated, the older 1–2cleft till $\frac{1}{3}$ of diameter; margin continuous, naked, undulate to subcrenulate; amphithecia smooth, continuous, naked, emaculate; stipe very short; ascospores ellipsoid, $11.2\text{--}13.7 \times 6.25\text{--}7.5$ μm , epispore 1 μm . Pycnidia laminal to subapical, immerse, frequent, ostiole black; conidia bifusiform to sublageniform, $5\text{--}6.25 \times 1$ μm .

Chemistry: cortex K+ yellow, UV–; medulla K+ yellow to light brown collapsing the medulla, C+ very light yellow, KC+ red on lower part of medulla, light brown and gelatinous on upper part, P+ light orange, UV–.

Distribution: South Brazil (Lynge 1914).

Comments: *Lyngenella osseoalbida* is characterized by saxicolous thallus membranaceous, ivory, subsatin above 20×, short laciniae and irregularly branched, upper surface is smooth to

little crumpled and the transversal cracks becoming schizidia; the medulla is white but ocher near the lower cortex and reacts K⁺ wine; the rhizines are simple to a few dichotomous, delicate, the apothecia concave when young and plane when old, with margin undulate to subcrenulate, the ascospores ellipsoid, 11.2–13.7 × 6.25–7.5 μm, the conidia bifusiform to sublageniform, 5–6.25 × 1 μm.

Lyngenella ossealbida is somewhat similar to *L. livida*, whose thallus is corticolous, subsatin above 30×, with subdichotomous laciniae, slight rugulose to smooth upper surface, white medulla, rhizines are furcate to dichotomous, apothecia are concave when young and plane–petaloid and prostrated when old.

Lyngenella perexigua has a subopaque submembranaceous to subpergaminaceous thallus, satin above 40×, medulla is cream on upper half and white on lower half, apothecia are concave when young and plane and prostrated when old, continuous discs, and the lower part of the amphithecia become as blackened as the lower surface and produce rhizines.

Lyngenella palmarum (Lyng.) Marcelli & B.R. Hora, **comb. nov.**

Fig. 8

MycoBank 811357.

Parmelia palmarum Lyng. Ark. Bot. 13(13): 136. 1914. Type: Brazil, Mato Grosso [State], Serra da Chapada, Buriti, leg. Malme 2243c*, 20-I-1894 (holotype, S!).

= *Parmelia zahlbruckneri* Lyng. Ark. Bot. 13(13): 136. 1914. Type: Brazil, Serra da Chapada, pr. Boca da Serra, in rupibus, leg. Malme 90, 15-V-1894 (Syntype, C!).

Thallus corticolous, brown (herbaria), 6.4 cm wide, sublustrous on distal part and opaque on proximal part, subvelvety at 10×, satin above 20×, subcoriaceous, laciniate. **Laciniae** subdichotomous to irregularly branched, (0.5–) 0.9–1.3 (–2.0) mm wide, laterally overlapping, adnate; longitudinal axis distended to slightly undulate, transversal cut plane to convex, border coplanar; upper surface fragile, continuous, slight crumpled to crumpled, pruina absent, maculae absent; lateral margin smooth, repand, closed; black line subtle; cilia absent; apical zone tending to ascendant, apices mostly truncate, coplanar to descendant; axils principally oval to a few elliptic; secondary laciniae originating of regrowth from those blackened laminal or marginal parts resulting of the detachment of surface pieces of the coriaceous but brittle thallus; similar to the primary ones but fragile; lacinules absent. **Lacking** pustules, soredia, and isidia. **Medulla** white, pigment absent, compact near the upper cortex, loose for the most part. **Lower surface:** apical zone brown, lustrous, velvety at 10×,

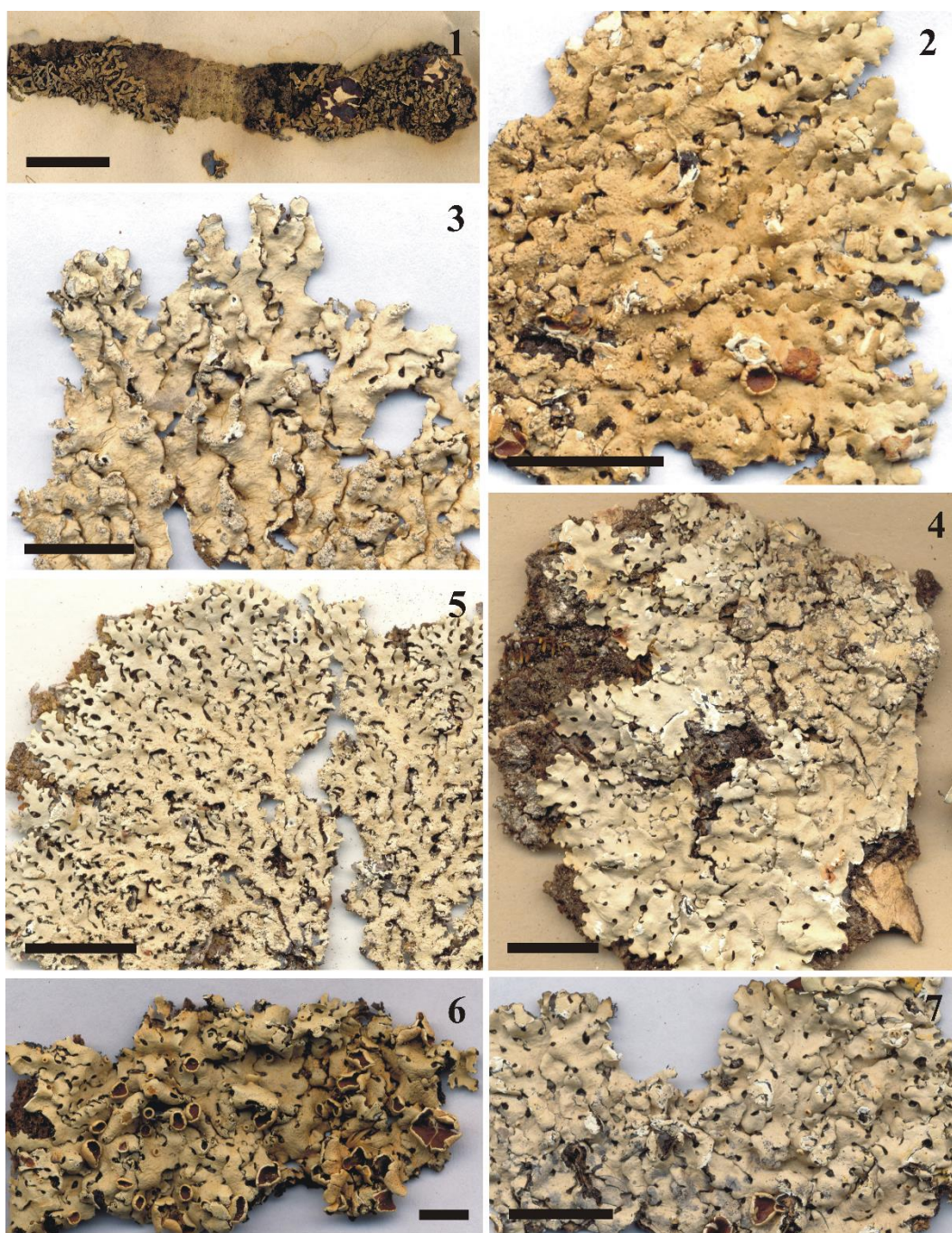
subsatin at 20×, satin above 30×, attenuated limited, smooth to papillate, with rhizines; proximal zone black, sublustrous to opaque, velvety at 10×, subsatin at 20×, satin above 30×, transversal cracks frequent, rugulose to smooth. **Rhizines** black, pigment absent, sublustrous, subsatin up to 20×, satin above 30 x, simple to dichotomous, coplanar, first branching after 1/3 of length, 1–2 (–3) branched, slender, curved, some erect, subulate, non gummed, non interlaced, non anastomosed, 0.25–0.5 × 0.03–0.05 mm, frequent, sparse. **Apothecia** concave when young, become subplane when old, a few remaining concave, up to 4.5 mm diameter, adnate, laminal, abundant; disc brown, pruina absent, 1–4 (–6) cleft at less than 1/5 of diameter, open, imperforate; margin thin, irregularly crenate since young, naked; amphithecia smooth, concolored, continuous, emaculate, naked; stipe almost inexistent; ascospores ellipsoid to suboval, 8.75–11.5 × 6.25–7.5 μm, episporium 1.25 μm. **Pycnidia** laminal, frequent, immerse to sessile, ostiole black; conidia not found.

Chemistry: cortex K+ yellow, UV–; medulla K+ yellow gelatinous and producing a hole, C–, KC+ gelatinous very light aqueous pink to very light brown, P–, UV+ very faint blue whitish.

Distribution: Guyana, Venezuela, in Andes of Ecuador and Bolivia, in cerrado vegetation at southern Brazil (Sipman et al. 2009).

Comments: *Lyngenella palmarum* is characterized by corticolous subcoriaceous but friable thallus, satin above 20×, subdichotomous to irregularly branched laciniae, slight crumpled to crumpled upper surface, secondary laciniae present, medulla white, simple to dichotomous rhizines, curved, 1 to 2 (3) branched; the apothecia are concave when young and become subplane when old, 1–4(–6) cleft, and the ascospores are ellipsoid to suboval, 8.75–11.5 × 6.25–7.5 μm.

Lyngenella palmarum is somewhat similar in habit to *H. chicitae* that also does not have pustules, soredia, and isidia. However, *H. chicitae* has medullary evernic and lecanoric acids, the old apothecia plane with smooth to crenulated margin, the thallus submembranaceous, cilia present, subsatin above 20×, apothecia are plane when old, ellipsoid ascospores 10–11 × 5–5.5 μm with a very thin episporium 0.7–0.8 μm.



Figures 1-7. Holotypes. 1. *Lyngenella livida*. 2. *L. dactylifera*. 3. *L. damazioi*. 4. *L. immaculata*. 5. *L. klauskalbii*. 6. *L. novella*. 7. *L. ossealbida*. (scales: 1-7= 10 mm).

Lyngenella perexigua (Marcelli & Ribeiro) *Lyngenella*, **comb. nov.**

Fig. 9

Mycobank 811396.

Hypotrachyna perexigua Marcelli & Ribeiro. Mitt. Inst. Allg. Bot. Hamburg 30–32: 141. 2002. Type: Brazil, Minas Gerais State, Catas Altas Municipality, Serra do Caraça, Parque Natural do Caraça, cerrado de candeia, 1220 m. alt., 13-XI-1997, leg. Marcelli & Ribeiro 32187 (holotype, SP!; isotype, B).

Thallus corticolous, dirty gray, subopaque, velvety up to 20×, subsatin at 30×, satin above 40×, 5.0 cm wide, submembranaceous to subpergamineous, lacinate. **Laciniae** dichotomous to irregularly branched, with signs of autoincompatibility, (0.3–) 0.5–0.8 (–1.0) mm wide, overlapped, strongly adnate; longitudinal axis distended, transversal cut convex, border coplanar; upper surface firm, smooth on distal part and slight rugulose on proximal part, pruina absent, macule absent; lateral margin smooth, repand, closed; black line evident principally on distal part, on proximal part the laciniae are very short and have the black line hidden by the strong convexity; cilia absent; apical zone descendant, apex truncated to acute, coplanar; axils round to oval; secondary laciniae and lacinules absent. **Lacking** pustules, soredia, and isidia. **Medulla** white on lower half and cream on upper half, pigment K–, texture normal on upper half and loose on lower half. **Lower surface** totally black, velvety at 10×, subsatin at 20×, satin above 30×, sublustrous, continuous, smooth. **Rhizines** black, pigment absent, lustrous, satin above 10×, furcate to irregularly branched, coplanar branched, first branching after $\frac{2}{3}$ of length, 1–2 branched, straight to a few curved, subulate, not gummed, not interlaced, not anastomosed, $0.25\text{--}0.35 \times 0.03\text{--}0.05$ mm, frequent, all over the lower surface. **Apothecia** concave when young, plane and prostrate when old, up to 2.5 mm diameter, adnate, laminal; disc brown, pruina absent, continuous, open, imperforated; margin thin, crenulate when old, naked; amphithecia smooth, continuous, emaculate, naked, the base of amphithecia become blackened as the lower surface and produce rhizines; stipe very short; ascospores ellipsoid, $11\text{--}12.5 \times 7.5$ μm , epispore 1.0 μm . **Pycnidia** laminal, immerse, ostiole black; conidia not found.

Chemistry: cortex K+ yellow, UV–; medulla K+ yellow (stronger on cream part) to light brown, C+ faint yellow, KC+ yellow gelatinous, P+ pale yellow to pale orange, UV+ swimming pool green.

Distribution: higher mountains on southeast Brazil.

Comments: *Lyngenella perexigua* is characterized by the corticolous thallus, submembranaceous to subpergamineous, subopaque, satin above 40×, the very narrow laciniae, overlapped, cream on upper half and white on lower half medulla, black rhizines, furcate to irregularly 1 to 2 branched; the apothecia are concave when young and plane and

prostrated when old, the continuous discs, the amphithecia become blackened as the lower surface and produce rhizines, and the ascospores are ellipsoid $11\text{--}12.5 \times 7.5 \mu\text{m}$.

Lyngenella perexigua is similar to *L. regis* that has the subsatin above $30\times$ thallus, anisotomic dichotomous laciniae, secondary laciniae present, autoincompatibility between primary and secondary laciniae, totally white medulla, furcate to dichotomous to a few trifurcate rhizines, 1–3 branched with apex interlaced, apothecia are concave 2 to 4 cleft, and ellipsoid somewhat narrower ascospores $10\text{--}12.5 \times 6.25 \mu\text{m}$.

For comparison with *L. livida* and *L. osseoalbida* see the comments under those species.

Lyngenella regis (Lyngé) B.R. Hora & Marcelli, **comb. nov.**

Fig. 10

MycoBank 811358.

Parmelia regis Lyngé. Ark. Bot. 13(13): 126. 1914. Type: Brazil, Minas Gerais [State], São João Del Rey [Municipality], 30-VIII-1892, leg. Malme 178 (holotype, S!; isotype, UPS!).

Thallus corticolous, dirty white, subopaque, velvety up to $20\times$, subsatin above $30\times$, 4.5 cm wide, membranaceous, lacinate. **Laciniae** anisotomic dichotomous, 0.6–1.1 mm wide, adnate; autoincompatibility between primary and secondary laciniae; longitudinal axis distended to very undulate, transversal cut plane to concave, border coplanar; upper surface firm, contiguous to little laterally overlapping on apex; transversally rugose since the third internode, sometimes before; pruina absent, maculae absent; lateral margin smooth, plane, straight, closed; black line evident on distal part, almost inexistent on proximal part; cilia absent; apical zone conformed to substrate, apex acute to truncate, coplanar; axils oval, few irregular; the secondary laciniae grow scattered between the primary ones, short, (0.1–) 0.5–1.5 \times 0.4 mm, simple to 1–2 dichotomous, upper surface as the primary; lacinules absent. **Lacking** pustules, soredia, and isidia. **Medulla** white, pigment absent, texture normal. **Lower surface** totally dark brown, sublustrous, subsatin at $20\times$, satin above $30\times$, continuous, crumpled. **Rhizines** black, pigment absent, lustrous, subvelvety up to $20\times$, subsatin at $30\times$, satin above $40\times$, furcate to dichotomous, a few trifurcated, coplanar ramified, first branching after half length, 1–3 branched, mostly little curved, slender, few erect, not gummed, with interlaced apices, not anastomosed, subulate, $0.15\text{--}0.25 \times 0.02\text{--}0.03 \text{ mm}$, abundant, all over the lower surface. **Apothecia** concave, up to 1.3 mm diameter, adnate, laminal; disc brown,

pruina absent, 2–4 cleft till $\frac{1}{3}$ diameter, continuous, some involute, imperforate; margin crenulate when young, smooth to slight incise when old, continuous, naked; amphithecia smooth, continuous, emaculate, concolored; stipe absent or very short; ascospores ellipsoid, $10\text{--}12.5 \times 6.25 \mu\text{m}$, epispore 1μ . **Pycnidia** subapical, immerse, ostiole black, conidia straight filiform to sublageniform $(2.5\text{--}) 3.75\text{--}5.0 \times \text{ca. } 1.0 \mu\text{m}$.

Chemistry: cortex K⁻, UV⁺ yellow; medulla K⁺ yellow to light brown, C⁺ faint yellow, KC⁻, P⁺ yellow collapses the medulla, UV⁻.

Distribution: Brazil (type locality).

Comments: *Lyngenella regis* is characterized by the corticolous membranaceous thallus, subopaque, subsatin above $30\times$, anisotomic dichotomous laciniae, autoincompatibility between primary and secondary laciniae, upper surface is transversally rugose since at least the third internode, emaculate, white medulla; the rhizines are slender, mostly curved, few erect, furcate to dichotomous to a few trichotomous with interlaced apices; the apothecia are concave with 2 to 4 clefts, some involute, the ellipsoid ascospores, $10\text{--}12.5 \times 6.25 \mu\text{m}$, and the straight filiform to sublageniform conidia, $(2.5\text{--}) 3.75\text{--}5.0 \times \text{ca. } 1.0 \mu\text{m}$.

Lyngenella regis has been traditionally placed in the synonymy of *L. novella* that has a subcoriaceous thallus, the anisotomic dichotomous to subsympodial laciniae, extensive maculae, no signs of autoincompatibility; rhizines are black some with brownish at apices, dichotomous to subdichotomous, few trichotomous, mostly cylindrical, and the somewhat bigger ellipsoid to oval ascospores, $(10\text{--}) 11.25\text{--}13.7 (-14.4) \times (5.0\text{--}) 6.25\text{--}7.5 \mu\text{m}$.

For comparison with *L. perexigua* see the comments under that species.

Lyngenella subsipmanii B.R. Hora & Marcelli, **sp. nov.**

Fig. 11

MycoBank 811340.

Holotype: Brazil, Espírito Santo State, Alto Caparaó Municipality, Parque Nacional do Caparaó, Casa Queimada camping area, 20°27.48'S 41°48.55'W, 2181 m alt., on rock, leg. B.R. Hora 1154 (SP 466026).

Thallus saxicolous, ivory, opaque, velvety up to 20×, subvelvety up to 40×, subsatin at 50×, 6.3 cm broad, lacinate. **Laciniae** anisotomic dichotomous, 0.5–1.0 mm wide, laterally overlapping, loose adnate; longitudinal axis distended, transversal cut slight canaliculate, border coplanar; upper surface firm; transversal cracks branched or not, mostly deep and not cicatrized; slight crumpled, pruina absent; maculae distinct, all over the upper surface; lateral margin smooth, sinuous, close; black line evident, thicker on axils; cilia black, opaque, subvelvety up to 20×, subsatin at 30×, satin above 40×, mostly acting as rhizines, a few coplanar, slender, subulate, simple to furcate, frequent, all over the margin; apical zone ascendant, apex roundish, descendant; axils oval to elliptic; secondary laciniae and lacinules absent. Lacking soredia and isidia. **Pustules** dense, sinuous mostly not confluent, on the crests and subapices of the laciniae, 0.4–1.0 mm wide, erumpent, not sorediate, not caducous, entire, brownish inside, pigment K-. **Medulla** white, pigment absent, compact. **Lower surface:** apical zone brown, lustrous, velvety up to 40×; minute satin at 50×, attenuated limit, papillate, with rhizines; proximal zone black, sublustrous, velvety up to 40×, satin at 50×, transversal cracked and cicatrized, smooth. **Rhizines** black, opaque, satin up to 30×, simple to dichotomous, a few irregularly branched, first branched after 1/3 of length, 0–3 branched, sinuous, a few curved, not gummed, not anastomosed, not interlaced, 0.25–0.75 × 0.05–0.075 mm, abundant, all over the lower surface. **Apothecia** absent. **Pycnidia** absent.

Chemistry: cortex K+ yellow, UV-; medulla K+ straw, C+ pink, KC+ pink to orange, P+ light cream, UV-.

Distribution: southeastern Brazil.

Comments: *Lyngenella subsipmanii* is characterized by the saxicolous thallus, opaque, subsatin at 50×, with ciliate, anisotomic dichotomous laciniae whose upper surface is slightly crumpled, distinct all over the upper surface maculae, the pustules on crests and subapices of the laciniae are neither sorediate nor caducous, the medulla is totally white except inside the

pustules, where it is brown; the rhizines are black, opaque, satin at 30×, simple to dichotomous, a few irregularly branched, mostly sinuous, 0 to 3 times branched.

Lyngenella subsipmanii is similar in habit and pustules disposition to *Martiana sipmanii* B.R. Hora & Marcelli, whose pustules are caducous and bursting, has the medulla brown below and the rhizines are anastomosed (Hora et al 2015c).

Other pustulate species somewhat similar in habit is *Martiana rockii* (Zahlbr.) B.R. Hora & Marcelli whose pustules are laminal and the rhizines dendroid (Hora et al 2015c).

Lyngenella virensica (Elix, T. Nash & Sipman) B.R. Hora & Marcelli, **comb. nov.** Fig.12
Hypotrachyna virensica Elix, T. Nash & Sipman. Flora Neotropica Monograph 104: 163.
 Type: Brazil, Minas Gerais, Catas Altas Municipality, Serra do Caraça, near Caraça Monastery, along trail to Capela do Sagrado Coração, Varginha, 20°06'S 43°29'W, c. 1300 m alt., leg. Sipman 40742, 17-IX-1997 (holotype, B!; isotype, SP!).

Thallus corticolous, whitish, sublustrous on distal part and opaque on proximal part, velvety up to 20×, subsatin above 30×, 5.0 cm wide, submembranaceous, laciniate. **Laciniae** dichotomous, 0.5–1.5 mm wide, contiguous, a few laterally overlapping, loose adnate; longitudinal axis distended, transversal cut plane to slight convex, border coplanar to descendant; upper surface fragile; transversal cracks not branched, not cicatrized, on proximal part; slight crumpled to crumpled, pruina absent, macule absent; lateral margin smooth, straight to repand, closed; black line subtle; cilia absent; apical zone distended, apices truncate to acute, coplanar; axils round to oval; secondary laciniae like the primary, scattered between the primary, not overlapped, the apex of some stop growing when touching the primary ones; lacinules absent. **Lacking** pustules and isidia. **Soralia** frequent, up to 1.5 mm × 1.0 mm, eciliate, not pustulate, pigment absent, basically capitate however commonly confluent, mostly subapical, some on crest of laciniae where arise from swellings of pustuloid appearance, whose cortex cleft irregularly to produce soredia; the first soredia produced are granular, mature soralia produce farinose soredia. **Medulla** white, pigment absent, compact. **Lower surface:** apical zone brown, lustrous, subsatin up to 20×, satin above 30×, attenuate limit, smooth; proximal zone black, lustrous, velvety at 10×, subsatin at 20×, satin above 30×, continuous, smooth to slight crumpled. **Rhizines** black, abundant, pigment absent, lustrous, cosatin, simple to irregularly branched, coplanar branched, first branching after half length, 0–4 branched, slender, mostly erect, few curved, subulate, not gummed, sometimes with

interlaced apex, not anastomosed, $0.3\text{--}0.5 \times 0.03\text{--}0.05$ mm, all over the lower surface.

Apothecia absent. **Pycnidia** absent.

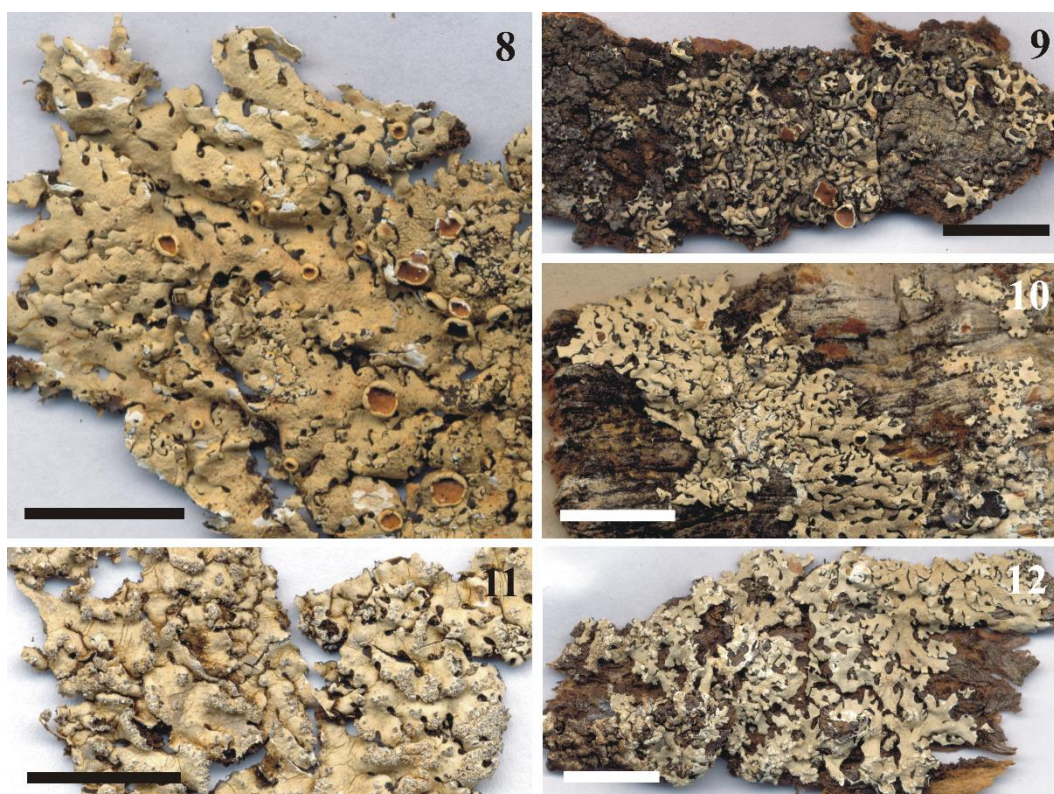
Chemistry: cortex K⁻, UV⁺ yellow; medulla K⁺ yellow to pale brown, C⁺ milky, KC⁺ turns back to yellow and brown again upon drying, P⁺ yellow, UV⁻.

Distribution: Brazil (Sipman et al. 2009).

Comments: *Lyngenella virensica* is characterized by the corticolous and submembranaceous thallus, sublustrous, subsatin above $30\times$, slight crumpled to crumpled, fragile, dichotomous laciniae, the secondary laciniae present and growing between the primary, subapical soralia, white medulla, the rhizines are abundant, simple to irregularly branched, 0 to 4 branched, sometimes with interlaced apex.

L. virensica and *L. immaculata* produce soredia; however, *L. immaculata* has the membranaceous thallus, satin at $40\times$, smooth to crumpled, the anisotomic dichotomous sublaciniae, cilia present, the dichotomous rhizines, 1 to 4 branched, little anastomosed, and interlaced, and the cortex UV negative. The soralia of *L. immaculata* are laminal and not pustular in origin.

L. virensica and *L. klausbalbii* have lichexanthone in the cortex; however, *L. klauskalbii* produces isidia instead soredia, does not develop secondary laciniae, its thallus is subopaque, subcartilaginous, slightly crumpled, the short laciniae are anisotomic dichotomous to sympodial, and it has effigurate maculae.



Figures 8-12. Holotypes. 8. *Lyngenella palmarum*. 9. *L. perexigua*. 10. *L. regis*. 11. *L. subsipmanii*. 12. *L. virensica*. (scales: 8-12= 100 mm).

Other new combinations

We make below new combinations for three species that fit in the genus but whose type material we did not have access until now:

Lyngenella osseoalba* (Vainio) B.R. Hora & Marcelli, **comb. nov.*

Parmelia osseoalba Vainio, Ann. Soc. Zool. Bot. Fenn. "Vanamo" 1: 39. 1921. Type: Thailand, Chiang Mai, Summit of Mt. Doi Sutep, 1675 m, on tree trunk, 1904, leg. Hosseus s.n. (holotype, TUR-V). MycoBank 811643.

This is a corticolous cosmopolite species with cortical lichexanthone that develops pustules eventually erupting to produce granular soredia and has the medulla mostly white but with patches of yellow-orange pigment in lower part (Sipman et al. 2009).

Lyngenella polydactyla* (Krog & Swinscow) Marcelli & B.R. Hora, **comb. nov.*

Parmelia polydactyla Krog & Swinscow, Norw. J. Bot., 26: 34. 1979. Type: Kenya, Central: Mt. Kenya, 1900 m, s.d., leg. Krog & Swinscow K 49-135 (holotype, O; isotypes in BM and UPS). MycoBank 811644.

According to Sipman et al. (2009) this is a corticolous or saxicolous species that develops dactyls never sorediate and occurs in southeastern Brazil and northern Argentina.

Lyngenella pustulifera* (Hale) Marcelli & B.R. Hora, **comb. nov.*

Parmelia pustulifera Hale, Brittonia 24: 23. 1972. Type: USA, Georgia: Rockdale Co., Mt. Arabia, IV-1964, leg. Hale 30865 (holotype, US; isotypes in TNS and UPS). MycoBank 811645.

According to Sipman et al. (2009) this species produce soredia in slightly excavated soralia or pustules that initially may appear as dactylate, and occurs in the Neotropics and United States.

Lyngenella subformosana* (Elix, T.N. Nash & Sipman) B.R. Hora & Marcelli, **comb. nov.*

Hypotrachyna subformosana Hale ex Elix, T.H. Nash & Sipman, Flora Neotropica Monograph 104: 153. Type: Brazil, Pará [State], ca. 20 km N of the border with Mato Grosso [State], on Cuiabá-Santarém highway (Br-163), on a tree in broad, sandy, level plain along Rio Braço de Norte, leg. Brako & Dibben 5951, 430-480, 25-IV-1983 (holotype, NY). MycoBank 811652.

Key to the species included in *Lyngenella*

- | | |
|--|------------------------|
| 1a. Soralia, dactyls or pustule present | 2 |
| 1b. Lacking soralia, dactyls or pustules | 11 |
| 2a. Pustules present | 3 |
| 2b. Pustules absent | 6 |
| 3a. Pustules not sorediate | <i>L. subsipmanii</i> |
| 3b. Pustules sorediate | 4 |
| 4a. Medulla totally white..... | <i>L. pustulifera</i> |
| 4b. Medulla partially pigmented | 5 |
| 5a. Medulla with patches of yellow-orange pigment in lower part | <i>L. osseoalba</i> |
| 5b. Medulla mostly white, light brown below the pustules | <i>L. damazioi</i> |
| 6a. Soredia present | 7 |
| 6b. Soredia absent | 10 |
| 7a. Medulla totally white | 8 |
| 7b. Medulla with patches of yellow-orange pigment in lower part | <i>L. subformosana</i> |
| 8a. Dactyls absent | <i>L. immaculata</i> |
| 8b. Dactyls present | 9 |
| 9a. Medulla C+ red; KC+ red | <i>L. pustulifera</i> |
| 9b. Medulla C+ milky; KC+ yellow to brown | <i>L. virensica</i> |
| 10a. Corticolous; dactyls isidioid | <i>L. dactylifera</i> |
| 10b. Corticolous or saxicolous; dactyls club or crescent-shaped (fide Sipman et al. 2009)
..... | <i>L. polydactyla</i> |
| 11a. Medulla totally white | 10 |

11b. Medulla bicolored	14
11a. Medulla K+ yellow to brown, C+ yellow	12
11b. Medulla K+ yellow, C-	<i>L. palmarum</i>
12a. Maculae present; satin above 30×	<i>L. novella</i>
12b. Maculae absent, subsatin till 50×	13
13a. Autoincompatibility present; ascospores 10-15.5 × 6.25 μm	<i>L. regis</i>
13b. Autoincompatibility absent; ascospores 7-9 (-10) × 5-6 μm	<i>L. livida</i>
14a. Medulla part white (upper half), part brown or cream (lower half)	15
14b. Medulla part white, part ocher near to lower cortex	<i>L. osseoalbida</i>
15a. Thallus green; subsatin till 50×; maculae present; medulla lower half brown	<i>L. klauskalbii</i>
15b. Thallus gray; satin above 40×; maculae absent; medulla upper half cream	<i>L. perexigua</i>

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CAPITULO 4

Two new saxicolous species of Hypotrachyna (Parmeliaceae) from Brazil

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Two new saxicolous species of *Hypotrachyna* (Parmeliaceae) from Brazil.

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Running title: New *Hypotrachyna* species of the gracilescens complex

Abstract

We describe two new saxicolous species from southeast Brazil, *Hypotrachyna corrugata* and *H. nashii*; moreover we describe in detail the type specimen of *H. gracilescens*.

Key word: rocky fields; Serra da Mantiqueira;

Introduction

Hypotrachyna was proposed by Vainio (1890) in his monograph on Brazilian lichens as *Parmelia* subgenus *Parmelia* section *Hypotrachyna*, that he divided into the subgroups *Irregularis*, *Cyclocheila* and *Sublinearis*. Hale (1974) recognized *Parmelia* section *Hypotrachyna* as genus *Hypotrachyna*. Explanations on the creation and history of *Hypotrachyna* are provided by Hale (1975), Sipman *et al.* (2009) and Hora *et al.* (2015a, In press).

Nowadays the genus is estimate to embrace about 230 accepted species (Sipman *et al.*, 2009), one of the largest genera in the *Parmeliaceae* family, and occurs in the America, Asia, Africa, Papua New Guinea, Australia, Pacific islands and Europe at altitudes between 730 and 3700 (Hale 1975, Elix 1994, Sipman *et al.* 2009).

Hypotrachyna s.l. includes species mostly lacking cilia that share branched rhizines, bifusiform conidia, and have spores of medium size (Hale 1974, Elix 1994, Sipman *et al.* 2009, Thell *et al.* 2012). However, Hora *et al.* (2015b, In press) understood that *Hypotrachyna* s.s. is composed by a relatively small group of species close to *H. brasiliiana* (Nyl.) Hale (1974: 25) that produce lichexanthone associated with protocetraric acid and whose typically lacinate thallus is very regularly dichotomous ramified, eciliate, the lower side totally black without an apical zone, with sparse little ramified erect and not curved rhizines, laminal to subapical adnate to rarely substipitate apothecia that are involute when old and 1–4 cleft since

young, the ascospores ellipsoid about $8\text{--}12 \times 4\text{--}8 \mu\text{m}$ and the conidia probably exclusively bifusiform.

Hale (1975) comment that *H. gracilescens* (Vain.) Hale (1975: 40) is the only species that produces the “gracilescens complex” as secondary metabolites, and Sipman *et al.* (2009) states that this specie has medullary decarboxyalectronic acid and condecarboxyalectronic acid, respectively in major and minor concentration.

When working on the inventory of the saxicolous *Hypotrachyna* species of the high parts of the southeast Brazil mountains, we found specimens that initially we named *H. gracilescens*. However, the detailed study of the material under our descriptive protocol, which includes a number of commonly not studied or not satisfactorily described characteristics, revealed that we had two new species that differ from it in several ways, which we describe here together with the type material of *H. gracilescens*.

Material and Methods

The descriptive protocol developed by GEL (Canêz & Marcelli 2006) for accessing the morphological characters of the *Parmeliaceae*, which is now widely extended to verify more than 150 characters, was used to standardize the descriptions. Several used characteristics are new (e.g. satin and velvety surfaces, primary and secondary laciniae/lobes, complementary black line) and many of the classically ones used whose concepts are variable according the authors became strictly defined, as lobes, laciniae, lacinules, lobules, rhizines, and cilia (Hora *et al.* 2015a, b, c, d). Most of the modifications were directed to describe with minutiae details that have demonstrated effective and/or important to distinguish Brazilian species, much of them historically overlooked or erroneously considered be too much variable because the small amount of specimens the researchers deal with and/or because the limited field knowledge with these taxa they had.

Results

Hypotrachyna corrugata B.R. Hora & Marcelli, *sp. nov.*

Holotype: BRAZIL. Minas Gerais State, Catas Altas Municipality: Reserva Particular do Patrimônio Natural Santuário do Caraça, $20^{\circ}06'58.5''\text{S } 43^{\circ}31'01.3''\text{W}$, saxicolous, Campo de Fora, cerrado rupestre de candeia, 19 June 2012, *B.R. Hora & Marcelli 1594* (SP 466027). MycoBank 811283.

Thallus saxicolous, gray on distal part and dirty gray on proximal part, subopaque, velvety at 10×, subvelvety at 20×, subsatin above 30×, membranaceous, 5 cm broad, laciniate. **Laciniae** anisotomic dichotomous, 0.9–1.5 mm wide, laterally overlapping, loose adnate, longitudinal axis undulate; transversal cut varied, border coplanar; upper surface firm, transversal cracks frequent, mostly not ramified, deep, mostly cicatrized on proximal part, subtle on distal part; slight crumpled on distal part and dense transversally rugulose on proximal part; pruina absent; maculae distinct, effigurate, laminal; lateral margin smooth, repand, closed; black line very evident; cilia absent; apical zone plane to descendant, apex truncate, coplanar; axils elliptic to oval; secondary laciniae absent. **Lacinules** concolored, begin as small marginal expansions on the laciniae that become spatulate, get longer and then ramify, 0.3–0.6 × 0.3–1.8 mm, dichotomous, straight, coplanar to the laciniae, apex truncate, black line little evident, cilia absent, lower surface black. Lacking pustules, soredia, and isidia. **Medulla** white, pigment absent, compact. **Lower surface:** apical zone dark brown, sublustrous, velvety at 20×, small satin above 30×, attenuated limit, papillate, without rhizines; proximal part black, sublustrous, subvelvety until 20×, subsatin at 30×, satin above 40×, continuous, slight transversally rugulose. **Rhizines** black, pigment absent, sublustrous, velvety at 10×, subvelvety at 20×, subsatin above 30×, simple to dichotomous, straight, a few curved, cylindrical, not gummed, not interlaced, not anastomosed, first branched after half-length, 0–2 branched, 0.5–0.75 × 0.05–0.1 mm, frequent, all over the lower surface. **Apothecia** absent. **Pycnidia** laminal to submarginal, immerse, ostiole black, conidia sublageniform, 2.5–3.75 (–5) × 1.25 μm.

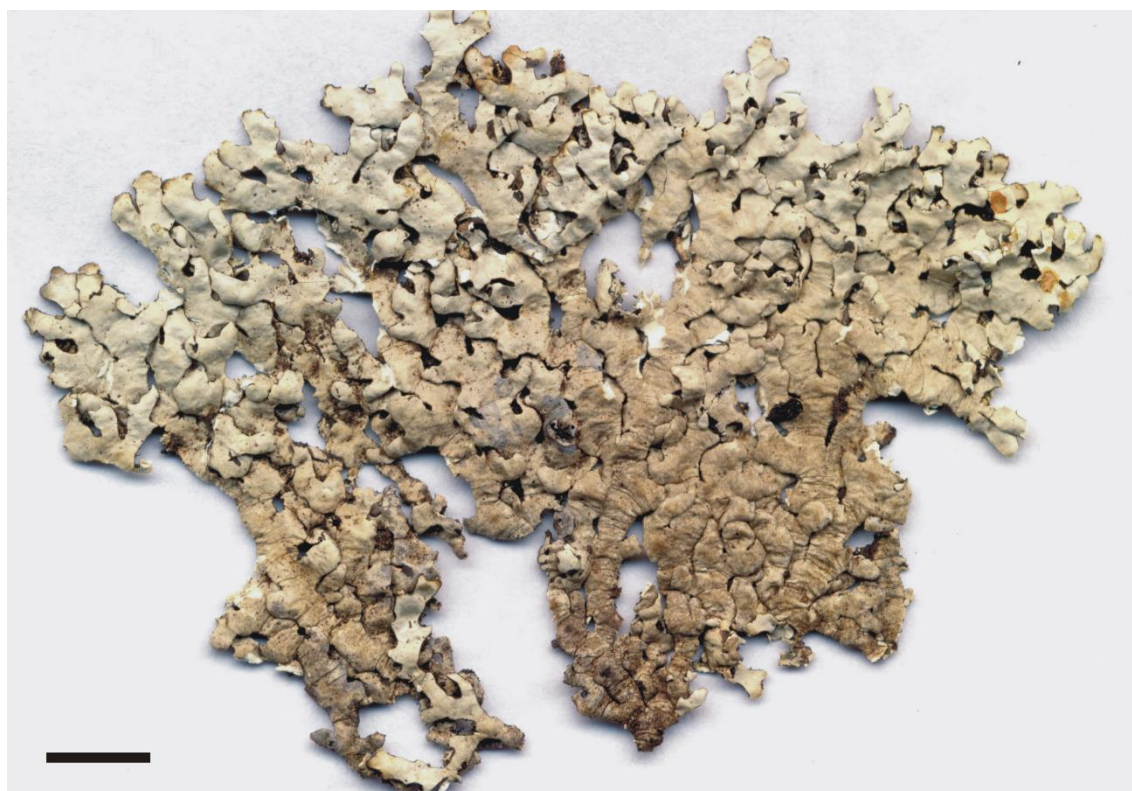
Chemistry: cortex K+ yellow, UV-; medulla K+ yellow, C-, KC+ pink evanescent, P+ yellow, UV+ bluish white.

Distribution: saxicolous on Southeastern Brazil.

Comments: *Hypotrachyna corrugata* is characterized by the saxicolous thallus subsatin even at magnification 50×, with anisotomic dichotomous laciniae, laterally overlapped, slight crumpled on distal part and shallowly corrugate (low parallel but dense roughs) on proximal part, with effigurate maculae. It lacks pustules, soredia, and isidia, and has a white medulla, a lower surface with an brown apical zone and a black proximal part; the rhizines are black, simple to dichotomous, 0 to 2 times branched, and the conidia are sublageniform 2.5–3.75 (–5) × 1.25 μm.

Hypotrachyna corrugata is similar to *H. nashii* that develops soreciate pustules, is emaculate, ciliate, the rhizines furcate to dichotomous, few trichotomous, 1 to 3 times branched, and the conidia are straight filiform $5\text{--}6.25 \times 1.25 \mu\text{m}$.

Hypotrachyna grascilescens also has no isidia, soredia and pustules, but has a thallus whose laciniae are anisotomic dichotomous to subsympodial, overlapped, pruinose, and ciliated; moreover, the lower surface is totally black (without apical zone), the rhizines are dichotomous 2 to 5 times branched, and the conidia subbifusiform to filiform, $5\text{--}6.25 \times 0.62\text{--}1.25 \mu\text{m}$.



Figures 1. Holotype. *Hypotrachyna corrugata*. (scale: 10 mm).

Hypotrachyna nashii Marcelli & B.R. Hora, *sp. nov.*

Holotype: BRAZIL, Espírito Santo State, Alto Caparaó Municipality: Parque Nacional do Caparaó, $20^{\circ}27.3'S$ $41^{\circ}48.3'W$, 2317 m alt., saxicolous, próximo a placa indicativa da Trilha para o Pico da Bandeira, 18 November 2011, *B.R. Hora 1160* (SP 466028). MycoBank 811284

Thallus saxicolous, grayish white, lustrous, subsatin until $20\times$, satin above $30\times$, 4.5 cm broad, membranaceous, lacinate. **Laciniae** anisotomic dichotomous, 1.0–1.7 mm wide, overlapped, loose adnate, longitudinal axis distended; transversal cut plane to slight convex, border coplanar to descendant; upper surface firm; transversal cracks frequent, a few deep, branched

or not; slight crumpled to crumpled; pruina absent; emaculate; lateral margin smooth, repand, closed; black line evident and complementary, thicker on axils; cilia black, satin above 30 \times , pigment absent, acting as rhizines, slightly sinuous, subulate, furcate to irregularly branched, frequent, all over the margin; apical zone ascendant to coplanar, apex truncate, coplanar; axils oval; secondary laciniae and lacinules absent. Lacking isidia and soredia. **Pustules** frequent, orbicular to labriform, not confluent, eciliate, laminal to subapical and in the margin of damaged laciniae, 0.2–0.75 \times 0.25 mm, breaking down into granules, pigment absent; born as blackened swellings that burst apically to produce granules and granular soredia; when older the granules are shed exposing the dark upper side of the lower cortex; granules and soredia concolored to blackish, caducous. **Medulla** white, pigment absent, texture normal. **Lower surface:** apical zone brown, lustrous, velvety until 20 \times , subvelvety at 30 \times , subsatin above 40 \times , attenuated limit, rugulose, with rhizines; proximal part black, sublustrous, cosatin to the apical zone, continuous, crumpled. **Rhizines** black, sublustrous, cosatin, furcate to dichotomous, a few trichotomous, slight curved, subulate, not gummed, a few interlaced, not anastomosed, first branched after $\frac{1}{3}$ of length, 1–3 \times branched, 0.35–0.6 \times 0.05 mm, abundant, all over the lower surface. **Apothecia** absent. **Pycnidia** subapical, immerse, ostiole black; conidia straight filiform, 5–6.25 \times 1.25 μm .

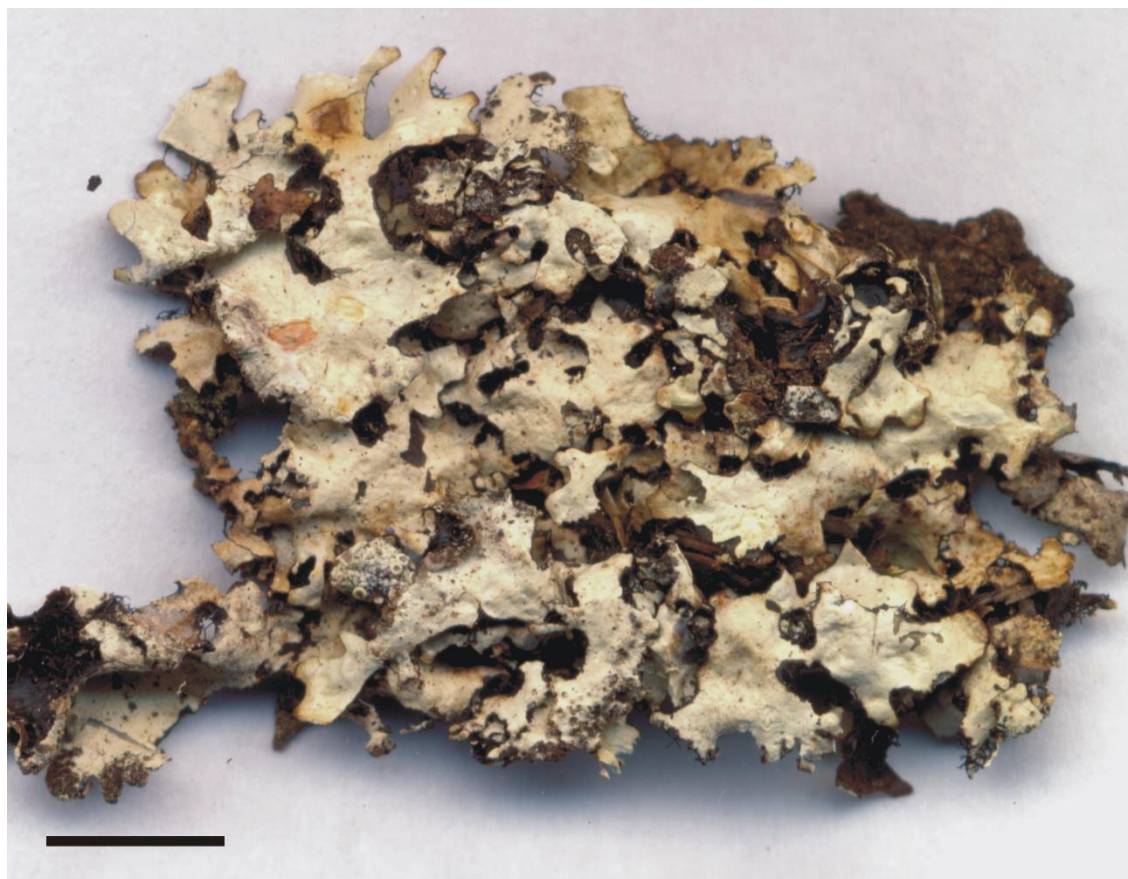
Chemistry: cortex K⁺ yellow UV⁻; medulla K⁺ yellow, C⁺ pink evanescent, KC⁺ pink evanescent, P⁻, UV⁻.

Distribution: saxicolous on Southeastern Brazil.

Comments: *Hypotrachyna nashii* is characterized by the saxicolous satin above 30 \times thallus, ciliate, anisotomic dichotomous laciniae, overlapped, slight crumpled to crumpled upper surface without pruina and maculae. It develops granular-sorediate pustules, has a white medulla, a lower surface with a brown apical zone and black proximal part; the rhizines are black, furcated to dichotomous, a few trichotomous, a few interlaced, 1 to 3 times branched, and the conidia are straight filiform, 5–6.25 \times 1.25 μm .

Hypotrachyna nashii is similar in habit to *H. gracilescens* that does not develop pustules, soredia and isidia, has laciniae anisotomic dichotomous to sympodial, smooth to crumpled upper surface and with pruina, the lower surface is black without apical zone, dichotomous rhizines, 2 to 5 branched, and conidia subbifusiform to filiform, 5–6.25 \times 0.62–1.25 μm .

For comparison with *H. corrugata* see the comments under this species.



Figures 2. Holotype. *Hypotrachyna nashii*. (scale 10 mm).

Hypotrachyna gracilescens (Vain.) Hale

Parmelia gracilescens Vain. Acta Soc. Fauna Fl. Fenn. 7(7): 53. 1890. Holotype: BRAZIL, Minas Gerais [State], [Catas Altas Municipality]: Caraça, 1400-1500 m.s.m, frequens supra rupes, 5 April 5 May 1885, *Vainio, Lichenes Brasilienses exsiccati 1517* (TUR-V!).

Thallus saxicolous, brown (herbaria), lustrous, velvety at 10×, subsatin at 20×, satin above 30×, membranaceous, 7.0 cm broad, lacinate. **Laciniae** anisotomic dichotomous to subsympodial, (0.5–) 1–1.5 (–1.75) mm wide, overlapped, adnate, longitudinal axis distended, conformed to substrate; transversal cut straight to concave, border coplanar; upper surface firm, transversal cracks not branched and not cicatrized; smooth to crumpled; pruina on apex of the laciniae; emaculate; lateral margin smooth, repand, closed; black line thick; cilia black, satin above 30×, curved, cylindrical, apex truncate, acting as rhizines, dichotomous, 1–3 branched, frequent, pigment absent, 0.35–0.75 × 0.03–0.075 mm; apical zone descendant, apex truncate, coplanar; axils roundish to quadratic; secondary laciniae absent. **Lacinules** few,

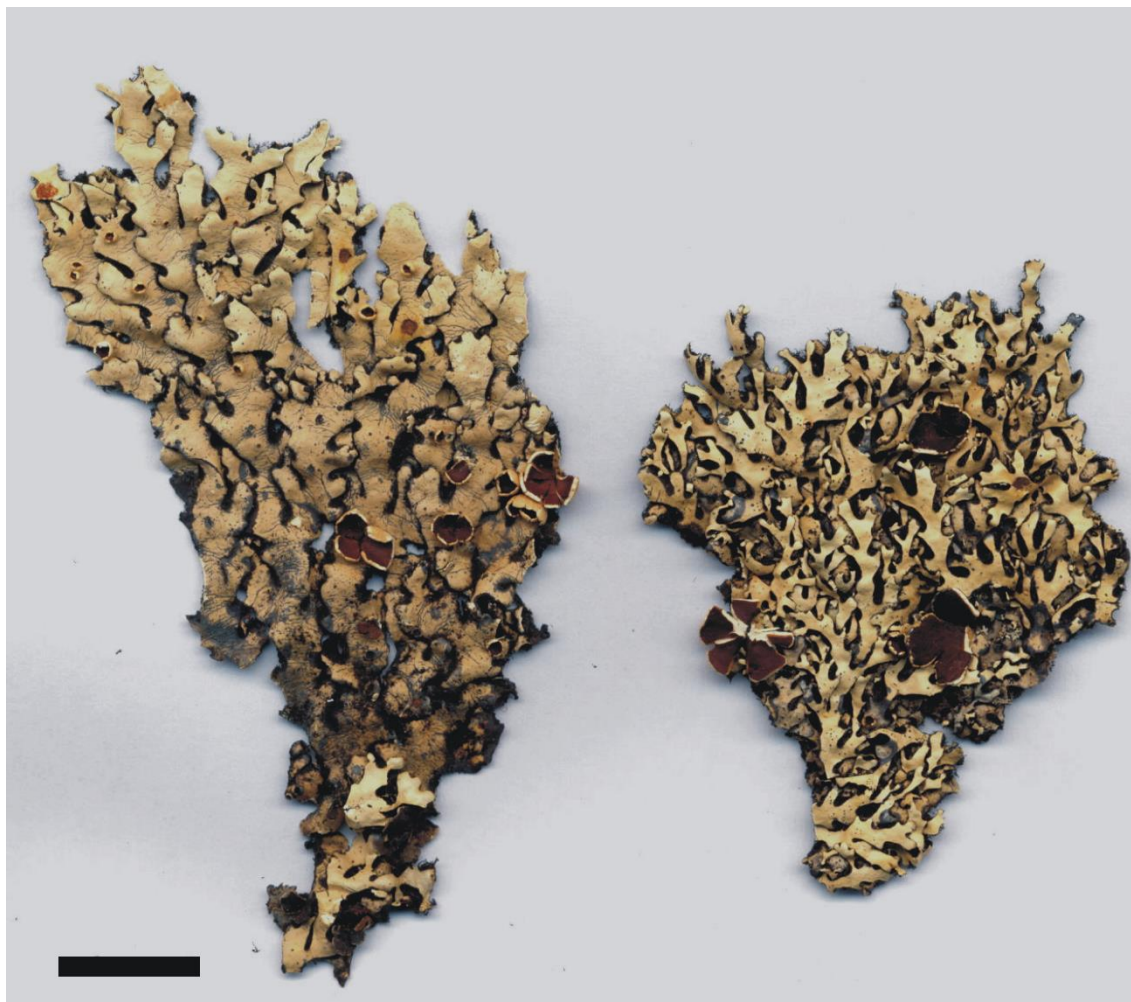
born as small expansions of the laciniae margins and become elongate but not ramified; always with constricted basis, some of them detached and fixed on the lamina by rhizines; concolored, black line evident, lower side black, apices truncate. Lacking pustules, soredia, and isidia. **Medulla** white, pigment absent, compact. **Lower surface** totally black, smooth, sublustrous, velvety at 10×, subsatin at 20×, satin above 30×, continuous, smooth to rugulose. **Rhizines** black, abundant, subulate, dichotomous, first branched after half-length, 2–5 branched, curved, sinuous, not gummed, interlaced, anastomosed, lustrous, cosatin, 0.5–1.0 × 0.05 mm, all over the lower surface. **Apothecia** laminal, sessile, up to 7.0 mm diameter, cupuliform when young, prostrate when old; disc brown, cleft since young, cleft at 1/2 of diameter, pruina absent, imperforate; margin crenulated, not continuous, naked; amphithecia smooth, concolored, naked; stipe inexistent; ascospores ellipsoid, 8.75–11.25 × 6.25–7.5 μm, epispore 1.25 μm. **Pycnidia** laminal, immerse, ostiole black; conidia subbifusiform to filiform, 5–6.25 × 0.62–1.25 μm.

Chemistry: cortex K+ yellow, UV-; medulla K+ yellow, C-, KC+ pink evanescent, P-, UV-.

Distribution: saxicolous in Southeastern Brazil.

Comments: *Hypotrachyna gracilescens* is characterized by the saxicolous thallus, satin above 30×, ciliate overlapped anisotomic dichotomous to subsympodia laciniae, the upper surface is smooth to crumpled, pruinose, emaculate; the medulla is white, the lower surface is totally black (without a apical zone), the rhizines are dichotomous 2 to 5 times branched and interlaced, the ascospores are ellipsoid 8.75–11.25 × 6.25–7.5 μm, and the subbifusiform to filiform conidia, 5–6.25 × 0.62–1.25 μm.

See comparisons with to *H. corrugata* and *H. nashi* in the comments under those species.



Figures 3. Holotype. *Hypotrachyna gracilescens*. (scale: 10 mm).

Acknowledgements

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CAPITULO 5

Martiana, a new genus segregated from *Hypotrachyna* (*Parmeliaceae*)

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Martiana, a new genus segregated from *Hypotrachyna* (Parmeliaceae)
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Abstract. The new genus *Martiana* (Parmeliaceae) is presented as segregate from *Hypotrachyna*, characterized by the joint production of evernic and lecanoric acid (without barbatic acid) as major secondary metabolites associated to a specific assemblage of morphological characters. *Martiana rockii* is designal as the type species. The new genus embraces till now 11 species, five of them new. We provide detailed descriptions for all species we had access to the type material and an identification key.

Key word: evernic, lecanoric, rocky fields, Serra da Mantiqueira

Introduction

The genus *Hypotrachyna* was proposed by Vainio. (1890) in his monograph on Brazilian lichens as *Parmelia* subgenus *Parmelia* section *Hypotrachyna* that he divided into the subgroups *Irregularis*, *Cyclocheila* and *Sublinearis*. In 1964, Hale & Kurokawa reviewed the section *Hypotrachyna* and understood that *Sublinearis* represented very well the section and raised it to subgenus. Years later, Hale (1974) recognized *Hypotrachyna* as genus. Explanations on the creation and history of *Hypotrachyna* are provided by Hale (1975), Sipman et al. (2009) and Hora et al. (2015a).

The genus *Hypotrachyna* include about 230 species occurring generally at altitudes between 730 and 3700 m and it is cosmopolite (Hale 1975, Elix 1994, Sipman et al. 2009).

Hypotrachyna s.l. includes species that share sublinear, often elongate, apically subtruncate adnate to rarely substipitate branches mostly lacking cilia, imperforate apothecia, dichotomously branched rhizines uniformly distributed on a black lower surface, the upper cortex consisting of a palisade plectenchyma with pored epicortex, bifusiform conidia and having ascospores of medium size (Hale 1974, Elix 1994, Sipman et al. 2009, Thell et al. 2012). However, Hora et al. (2015b) understood that *Hypotrachyna* s.s. is composted by species close to *H. brasiliiana* (Vain.) Hale that produces lichexanthone associated with protocetraric acid and whose typically laciniate thallus is very regularly dichotomous ramified, eciliate, the lower side totally black without an apical zone and with sparse little ramified erect and not curved rhizines; the laminal to subapical apothecia are adnate to rarely

substipitate, involute when old, 1–4 cleft since young, the ascospores ellipsoid about 8–12 × 4–8 μm, and the conidia probably exclusively bifusiform.

Divakar et al. (2010, 2013) and Thell (2012) considered *Hypotrachyna* a polyphyletic genus, and this is supported by the morphologic studies of Hora et al. (2015a, b) who yet comment that, together the morphology, chemistry is a major characteristic to support the division of *Hypotrachyna* s.l. into other genera.

Nevertheless, this not is a information new on lichenological studies. Culberson & Culberson (1970) considered the importance of chemistry on lichens and confirm that it might be used together with morphology. Hale (1975) reaffirmed this in his monograph about *Hypotrachyna* on Tropical America, relating chemistry to morphology and concluding that *Hypotrachyna* has chemical subgroups with homogeneous morphology, the evernic-lecanoric acid [*Hypotrachyna rockii* (Zahlbr.) Hale group] being one of those.

In a text about chemical and morphological evolution of *Parmelia* section *Hypotrachyna*, Culberson & Hale (1973) proposed that the species producing barbatic and evernic acids constitute a chemical and evolutionary group. The authors divided the known 22 species in four groups, one of them with evernic and lecanoric acids [*H. rockii*, *H. bogotensis* (Vain.) Hale, *H. pulvinata* (Fée) Hale and *H. taylorensis* (Mitch.) Hale] forming the second group, cosmopolite but occurring principally in the American Continent. *Hypotrachyna chicitae* (Hale) Hale was placed separately in the fourth group because producing obtusatic and norobtusatic acids beyond the evernic and lecanoric. However, Hale (1975) later included *H. chicitae* in the evernic-lecanoric group, not commenting about *H. taylorensis*, which does not occur in Tropical America.

Though commenting that the species with barbatic and evernic acids are morphologically similar, the phylogenetic tree obtained by Divakar et al. (2013) showed that the clade formed by those species is not supported and, therefore, the group of species producing just evernic and lecanoric, the *Hypotrachyna rockii* group, might be distinct from that producing also barbatic acid.

Therefore, we present here the new genus *Martiana* to accommodate the *H. rockii* group, with 11 species, five of them new to the science.

Material and methods

The descriptive protocol developed by GEL (Canêz & Marcelli, 2006) for access the morphological characters of the *Parmeliaceae*, which is now widely extended to verify more than 150 characters, was used to standardize the descriptions. Several used characteristics are new (e.g. satin and velvety surfaces, primary and secondary laciniae/lobes, complementary black line) and many of the classically used whose concepts are variable according the authors became strictly defined, as lobes, laciniae, lacinules, lobules, rhizines, and cilia (Hora et al., 2015a, b, c). Most of the modifications were directed to describe with minutiae details that have demonstrated effective and/or important to distinguish Brazilian species, much of them historically overlooked or erroneously considered be too much variable because the small amount of specimens the researchers deal with and/or because the limited field knowledge with these taxa they had.

Several of the species treated below are typically pustulate.

In the literature, there are several interpretations on what pustules are and how they look like. Nevertheless, these structures are not mentioned in lichenology textbooks and many lichenologists are unaware of them and of their importance, what renders many misinterpretations of apparently inflate and pustuloid shapes and folds, including certain types of soralia and thicker isidia all over the literature. This wonders the Brazilian lichenologists because pustules are abundant and diversified in Brazillian species, where exists a great number of common widespread pustulate species in many genera of *Parmeliaceae* and *Pyxinaceae*.

Pustules may occur in any part of a thallus and their disposition is as characteristic as that of soredia and isidia, but have a morphological variability much greater than those have, since isidia may become pustulate in some species and pustules produce soredia and/or isidioid structures in other.

Because their variability, importance, and species-specificity, we felt obligate to assume a very definite concept of pustules, as we did with other characteristics (Hora et al., 2015a, b, c). Therefore, we consider pustules all the swellings or inflate structures that are hollow or have inside a very loose medulla and are, because this, typically fragile. Solid or swelled-like structures that are rigid or produced by thalline folds or convexities can be pustuloid in appearance, but are not pustules.

Most commonly, pustules arise as swellings that detach the cortex and algal layer from the medulla below. They can be, for example, granular, rugose, verrucose, arbuscular or have

a distinctive peculiar shape, may remain simple or get ramified in a range of patterns, may remain entire or open in several species-specific manners, sometimes to produce granules and/or soredia. Some burst apically exposing the medulla inside, while other burst in a way that nothing remains inside and so exposing the upper side of the lower cortex. Sometimes, they breakdown totally into soredia or granules, of manner that they can be visualized only in the initial stages of soredia production.

It is common that the soredia arise from pustuloid swellings that very early originate them. We do not consider these swellings as pustules but an almost obligatory stage of the soredia production. We consider the soredia of true pustular origin when the pustules can be plenty characterized before producing them.

Pustules can be very specifically localized as those occurring restricted to the isidia, that become inflate and delicate, or be extensive all over entire surfaces as the lamina or amphithecia, sometimes shedding schizidioid plates.

Another common confusion commonly found in the literature involves the concept of dactyl and their relationship with pustules. The term dactyl was used and very well defined by Krog & Swinscow (1979) to describe the structures found in *Parmelia [Hypotrachyna] polydactyla* Krog & Swinscow. These structures, that have an inflate appearance and may be somewhat digitiform (at least in the initial stages), have, at least in the basis, a compact medulla that is continuous to the thalline one and, because this, are firmly attached to the thallus. When mechanically removed, they leave on the thallus a bundle of hyphae like remains of an umbilical cord, sometimes including all the basis of the dactyl. Because it is not impossible that dactyls become pustulate, the presence of the basal attachment is the only reliable feature to distinguish dactyls from pustules in the most complicate cases.

Results and discussion

Hale (1975) have already stated that the *Hypotrachyna rockii* group is clearly a chemical group inside *Hypotrachyna* genus. Divakar et al. (2006) commented that the *Hypotrachyna* clade required a revision in the generic concept.

When confronted with Divakar et al. (2013) results, we immediately identified their results as corresponding to those that we were obtaining from our own morphological analysis of *Hypotrachyna* species.

Considering all this information together, we state that the *Hypotrachyna rockii* group makes a sound morphological, chemical and molecular entity that we segregate here in a new genus.

***Martiana Marcelli* & B.R. Hora, gen. nov. (Parmeliaceae)**

Type species: *Parmelia rockii* Zahlbr. Ann. Mycol. 10: 379. 1912.

Etymology: the genus name is given in honor to C.F.P. Martius [1794–1868], the eminent German botanist and ethnologist who, together the zoologist J.B. Spix, made the first extensive botanic and zoological expedition to Brazil in 1817–1820, and published after this the Flora Brasiliensis and other works of fundamental importance to the botany (Marcelli 1998).

Martiana is characterized by the associated production of evernic acid and lecanoric acid in saxicolous or corticolous thalli whose satin is already characterized at magnification 30×, are short lacinate to lacinate, have laterally overlapping laciniae, maculae and cilia present or absent, medulla white, bicolor or cream. The lower surface has an apical zone brown and a proximal part black, rhizines black, dichotomous, curved, 0–8 times branched. The apothecia are cupuliform when young and plane-petaloid when old, with discs brown to dark brown, ascospores 10–21.5 × 6.2–17.5 µm and conidia filiform or sublageniform 5–6.25 × 1.25–2.5 µm.

We consider that *Hypotrachyna* s.s. embraces a relatively small group of species close to *H. brasiliana* that produces lichexanthone associated with protocetraric acid and whose typically lacinate thallus is very regularly dichotomous ramified, eciliate, the lower side totally black without an apical zone; the rhizines are sparse, little ramified, erect, and not curved; the laminal to subapical apothecia are adnate to rarely substipitate, involute when old, 1–4 cleft since young, the ascospores ellipsoid about 8–12 × 4–8 µm, and the conidia probably exclusively bifusiform (Hora et al. 2015c).

***Martiana rockii* (Zahlbr.) B.R. Hora & Marcelli, comb. nov.**

Parmelia rockii Zahlbr. Ann. Mycol. 10: 379. 1912. Holotype: U.S.A., Hawaii, Kauai, leg. Rock 7, s.d. (holotype W!, isotype in US!, W!). MycoBank 811359.

Thallus saxicolous, brown (herbaria), sublustrous, subvelvety at 10×, subsatin at 20×, satin above 30×, 24 cm broad, subcoriaceous, short laciniate. **Laciniae** anisotomic dichotomous, 0.7–2.0 mm wide, laterally overlapping, loose adnate; longitudinal axis distended, transversal cut plane to convex, border coplanar; upper surface slight crumpled, irregularly to rimose cracked, firm, pruina absent, maculae effigurate to subreticulate toward the central part; lateral margin repand to straight, continuous, closed; black line evident and inflated; cilia black, sublustrous, velvety at 20×, subsatin at 30×, satin above 40×, dichotomous to irregular, $0.3\text{--}0.45 \times 0.05\text{--}0.07$ mm, cylindrical, slender, coplanar, a few acting as rhizines, frequent, all over the margin; apical zone ascendant, apex truncate, descendant; axils oval, a few elliptic; secondary laciniae and lacinules absent. Lacking true soredia and isidia. **Pustules** laminal, erupting, hemispheric or subglobose that growth by proliferation into arbuscular cauliflower shaped structures, a process that produces each time smaller pustular units that reach finally the size of soredia, then ecorticate; the opened pustules are somewhat blackish because, after the opening, the white exposed medulla is transformed into lower cortex, as also happens to the pedicel of the cauliflower shaped structures. **Medulla** white. **Lower surface:** apical zone light brown, lustrous, velvety 10×, subvelvety at 20×, satin above 30×, attenuated limit, rugulose, with rhizines; proximal zone black, opaque, subsatin at 20×, satin above 30×, veined, continuous. **Rhizines** black, opaque, cosatin, dendroid, principally dichotomous to irregular, sometimes trichotomous, straight to not rare curved, not interlaced, not gummed, not anastomosed, first branched after half-length, (1–) 2–4 branched, (0.25–) 1–2 × 0.05 mm, sparse. **Apothecia** infundibuliform to cupuliform when young and plane-petaloid when old, substipitate, the older prostrated, 7.5 (–9) mm, laminal; disc brown becoming dark brown when old, open, imperforate; margin crenulate-lobate and involute since young, frequently with pustules; amphithecia smooth, yellowing toward the stipe, naked, emaculate, densely rugulose when old; stipe very short, yellow, up to 0.6 mm diameter, narrow; ascospores randomly organized, ellipsoid, $12\text{--}15 \times 6.25\text{--}9$ μm. **Pycnidia** laminal to submarginal, abundant, immerse, ostiole black; conidia short filiform straight (5–) $6\text{--}7.5 \times 2.5$ μm.

Chemistry: cortex K+ yellow, UV-; medulla K- , C+ pink evanescent (quickly), KC+ pink evanescent (slowly), P-, UV-. (atranorin, evernic acid, and lecanoric acid).

Distribution: Africa, America, Asia, Europe, India and Papua New Guinea (Sipman et al. 2009).

Comments: *Martiana rockii* is characterized by the saxicolous thallus satin above 30×, whose laterally overlapping short laciniae are maculate and ciliate, developing laminal not truly sorediate pustules that develop a black parts by transforming their exposed inner medulla and the pedicels into lower cortex; the medulla is white, the lower surface has a light brown apical zone and a black proximal part; the rhizines are principally dichotomous to irregularly branched, curved, the first branched after half-length, 1 to 4 times branched; the apothecia are infundibuliform to cupuliform when young and plane-petaloid when old, the ascospores 12–15 × 6.25–9 μm, the and conidia (5–) 6–7.5 × 2.5 μm.

Though described here for the first time, the transformation of thallus parts into lower cortex is not rare in *Hypotrachyna* s.l. and may can occur, for example, in autoincompatibility processes (Hora et al 2015a) or in the basis of the amphithecia of some species, when even rhizines are produced [e.g. *Lyngenella osseoalbida* (Lyng) B.R. Hora & Marcelli (Hora et al. 2015b)]. In *M. rockii*, everything in the pustules that is not upper cortex is eventually transformed into lower cortex; since the blackening process expands as the pustules grow, significant parts of the thallus may become blackened.

The development process of the pustules of *M. rockii* is very peculiar, because it is a typical process of proliferation and not ramification. However, instead producing identical units, the pustules proliferation in *M. rockii* produces smaller units that, by its time, produce other yet smaller units and so on, of manner that the size of the units get reduced till the soredia size, the last units being ecorticate and very similar to true soredia; however, because the ontogeny, they are in the reality tiny pustular units. This process is not difficult to visualize in the bigger pustules; however, when small yet young pustules proliferate, the first produced units may be already soredia-size and decorticate, inducing people call them soredia.

Martiana rockii is somewhat similar in habit to *Hypotrachyna laevigata* (Smith) Hale, which is corticolous, has imbricate sublinear laciniae, with true soredia and dense rhizines (fide Hale 1975).

Other similar specie is *M. aspera*, which is subopaque, is eciliate emaculate, the medulla is pigmented reacting K+ red below the soralia, and the rhizines are 1–3 branched.

Martiana damazioi is also pustulate but its thallus satin is characterized only at magnification 50×, is emaculate, the medulla is light brown below the pustules, and the rhizines are curly.

For comparison with *M. everniastroides* and *M. sipmanii* see comments under those species.

***Martiana bogotensis* (Vain.) Marcelli & B.R. Hora, comb. nov.**

Parmelia bogotensis Vain., Hedwigia 38: 122. 1899. Holotype: Colombia, Bogotá, s.d., leg. Weir 53 (TUR-V!, isotype in BM!). Lectotypified by Hale 1975: 23. MycoBank 811360.

= *Parmelia culmigena* Zahlbr., Beih. Bot. Centralbl. 19: 81. 1905. Holotype: Ecuador, El Altar, 4000 m, 1903, leg. Meyer 381 (W). Lectotypified by Hale 1975: 23.

Thallus corticolous, brown (herbaria), sublustrous to opaque, velvety at 10×, subsatin at 20×, satin above 30×, 2.6 cm broad, membranaceous, sublaciniate. **Laciniae** dichotomous to irregular, 0.5–0.8 (–2.0) mm wide, laterally overlapping, adnate; longitudinal axis undulate; transversal cut varied, concave to convex, border coplanar; upper surface smooth, continuous on distal part and irregularly reticular cracked on proximal part, fragile, pruina absent; maculae punctiform to effigurate, abundant, dense; lateral margin smooth to irregular, closed, slight repand; black line evident on axils; cilia absent; apical zone plane (?), apex truncate to rounded (?); axils oval; secondary laciniae absent; lacinules marginal, few, coplanar to ascendant, simple to 1–2 branched, 0.2–1 × 0.1 mm. Lacking pustule and soredia. **Isidia** laminal, not constricted at base, brown, with open apices and exposing the medulla, caducous, 0.1–0.20 × 0.1 mm, lustrous, dolioliform, simple, sinuous; start as small brown granules that growth in diameter and length at the same time; mostly aggregate into rows. **Medulla** white, pigment absent, loose. **Lower surface:** apical zone (?) light brown, attenuated limit; proximal zone black, sublustrous, velvety at 10×, satin above 20×, continuous, smooth to veined. **Rhizines** black, cosatin, subulate, simple to dichotomous, 0–2(–4) branched, curved, a few curly, 0.5–1.5 (2.25) × 0.05–0.13 mm, sparse. **Apothecia** absent. **Pycnidia** absent. **Chemistry:** cortex K+ yellow, UV-; medulla K- but gelatinous, C+ faint pink evanescent, KC+ pink evanescent quickly gelatinous, P-, UV-. (atranorin, evernic acid, and lecanoric acid).

Distribution: Neotropical region, southern Chile, and Gough Island (Sipman et al. 2009).

Comments: *Martiana bogotensis* is characterized by the corticolous thallus, sublustrous to opaque, satin above 30×, membranaceous, the dichotomous to irregular sublaciniae with an smooth upper surface, punctiform to effigurate maculae, dolioliform isidia with open apices, medulla is white, the lower surface with a light brown apical zone and a black proximal part, satin above 20× with rhizines black, simple to dichotomous, 0–2 (–4) times branched, little frequent, mostly curved (a few curly).

The holotype is much damaged and the observation the some parts, as the distal portions of the laciniae; moreover, the upper cortex detaches easily and the medulla is very thin.

Martiana bogotensis is similar in habit to *M. nuda*, which has the saxicolous thallus lacking isidia, a cream medulla and the simple to furcated rhizines, straight to curved.

Other somewhat similar also isidiate species is *Hypotrachyna imbricatula* (Zahlbr.) Hale, which does not produces evernic acid in medulla, has a thallus minute satin even at magnification 50×, white medulla and slightly branched isidia, constrict at base, slightly sinuous, erect, not caducous, and denser toward the proximal region.

***Martiana caparoensis* B.R. Hora & Marcelli, sp. nov.**

Holotype: Brazil, Espírito Santo State, Alto Caparaó Municipality, Parque Nacional do Caparaó, 20°27.3 'S 41°48.3' W, 2317 m alt., saxicolous, próximo a placa indicativa da Trilha para o Pico da Bandeira, B.R. Hora 1211, 18–XI-2011 (SP 466029). MycoBank 811342.

Thallus saxicolous, gray, submembranaceous, opaque on distal part and lustrous on proximal part, subsatin up to 20×, satin above 30×, 7cm broad, laciniate. **Laciniae** anisotomic dichotomous, 0.7–1.5 mm wide, laterally overlapped to overlapped, adnate; longitudinal axis distended, transversal cut plane, border coplanar; upper surface firm, continuous, smooth to slight crumpled, pruina absent, maculae absent; lateral margin smooth, repand, closed; black line evident, thicker on axils; cilia black, satin above 20×, 0.2–0.5 × 0.03 mm, reacting K-, coplanar, sinuous, subulate, simple, frequent, all over the margin; apical zone ascendant, apex round to truncate, descendant; axils oval, a few elliptic; secondary laciniae absent. Lacinules concolored, on proximal part, anisotomic dichotomous to irregular, 0.3–0.7 mm, plane, apex round to truncate, lower surface black; grow from the lateral margin of the laciniae, become spatulate and then ramify prostrate on the thallus. Lacking pustule, soredia, and isidia. **Medulla** white, pigment absent, compact. **Lower surface:** apical zone brown, lustrous, satin above 30×, attenuated limit, slight crumpled, with rhizines; proximal zone black, lustrous, satin above 40×, continuous, smooth to crumpled. **Rhizines** black, lustrous, cosatin, dichotomous, a few simple, first branched after 1/3 of length, 0–4 branched, curved and sinuous, interlaced, not gummed, not anastomosed, subulate, 0.4–1.0 × 0.02–0.03 mm, abundant, all over the lower surface. **Apothecia** cupuliform when young and involute when old, up to 5 mm diam., adnate, laminal; disc dark brown, rare blackened, pruina absent, cleft at 1/3 of diameter, involute, 3 to 5 folds, imperforate; margin thick, crenulate, naked;

amphithecia smooth, emaculate, naked; stipe very short; ascospores ellipsoid, $11.2\text{--}21.2 \times 6.2\text{--}17.5$ (-20) μm , epispore $3.1 \mu\text{m}$. **Pycnidia** laminal to subapical, immerse, ostiole black; conidia straight short filiform, $5\text{--}6.25 \times 1.25 \mu\text{m}$.

Chemistry: cortex K⁺ yellow, UV⁻; medulla K⁺ cream gelatinous (the liquid), C⁺ pink evanescent, KC⁺ pink evanescent, P⁻, UV⁻. (atranorin, evernic acid, and lecanoric acid).

Distribution: southeastern Brazil.

Comments: *Martiana caparoensis* is characterized by the saxicolous thallus, opaque on distal part and lustrous on proximal part, satin characterized only at 50 \times , the anisotomic dichotomous laciniae, smooth to slight crumpled upper surface, cilia presence, medulla is white, the lower surface with a brown apical zone and a black proximal part satin above 30 \times , smooth to crumpled, with black rhizines, 0 to 4 times branched, curved and sinuous, dichotomous (few simple); the apothecia are cupuliform when young and involute when old, cleft at $\frac{1}{3}$ of diameter, 3 to 5 folded, ellipsoid ascospores, $11.2\text{--}21.2 \times 6.2\text{--}17.5$ (-20) μm with a very thick epispore $3.1 \mu\text{m}$, and conidia straight filiform, $5\text{--}6.25 \times 1.25 \mu\text{m}$.

Martiana caparoensis is somewhat similar to the corticolous *M. chicitae* that has the satin already characterized at magnification 30 \times , the laciniae dichotomous to sympodial, the upper surface minute crumpled, the lower surface has a light brown apical zone, the apothecia plane with continuous discs, and the elliptic ascospores $10\text{--}11 \times 5\text{--}5.5 \mu\text{m}$.

Other similar species is *M. elixii* whose thallus is opaque, pruinose, the satin is visible only above 40 \times , and the rhizines are 1 to 3 times branched.

Martiana caparoensis is similar in habit to *M. itatiaiaensis* that has the lustrous thallus, satin above 30 \times , the upper surface is crumpled, the lower surface with a brown to mostly ivory apical zone, the proximal part with the satin above 30 \times , the rhizines curved, simple to squarrose.

Additional material examined. Brazil, Espírito Santo State, Alto Caparaó Municipality, Parque Nacional do Caparaó, $20^{\circ}25.1'S$ $41^{\circ}50.5'W$, 1371m alt., leg. B.R. Hora 1208, 14–XI-2011 (B).

***Martiana chicitae* (Hale) B.R. Hora & Marcelli, comb. nov.**

Parmelia chicitae Hale, Phytology 22:30. 1971. Holotype: Costa Rica, Along the Carretera Inter-Americana at Asunción, Cerro de La Muerte, 3335 m, 28 Mar 1967, leg. Culberson 13210 (US!, isotypes in DUKE and TNS). MycoBank 811361.

Thallus corticolous, white slight yellowish on distal part and dark gray on proximal part, lustrous, velvety at 10×, subvelvety at 20×, satin above 30×, 4.6 cm broad, submembranaceous, laciniate. **Laciniae** dichotomous to sympodial, (0.4–) 1–1.7 mm wide, overlapped, adnate; longitudinal axis distended; transversal cut straight, border coplanar; upper surface continuous, minute crumpled, firm, pruina absent, maculae absent; lateral margin repand, closed, smooth; black line evident and inflate; cilia black, subdichotomous to dichotomous, frequently sinuous, a few curly, subulate, abundant, 1–3 branched, 0.5–1.5 (–2.5) × 0.05–0.75 mm, cosatin to upper surface, all over the margin; apical zone ascendant to descendant, apex acute, coplanar; axils mostly oval to a few elliptic; secondary laciniae and lacinules absent. Lacking pustules, soredia, and isidia. **Medulla** white, pigment absent, texture normal. **Lower surface:** apical zone light brown, sublustrous, subvelvety at 10×, subsatin at 20×, satin above 30×, attenuated limit, with rhizines; proximal zone black, subopaque, subvelvety at 10×, subsatin at 20×, satin above 30×, continuous, smooth to irregularly rugulose. **Rhizines** black, simple to irregular dichotomous, slender, slight anastomosed, interlaced, not gummed, cosatin, 0.5–1.0(–1.5) × (0.3–) 0.05–0.075 (–1) mm, abundant. **Apothecia** laminal, plane; disc continuous, smooth to crenulated; amphithecia continuous, smooth, naked; stipe very short; ascospores elliptic, 10–11 × 5–5.5 μm, epispore 0.7–0.8 μm. **Pycnidia** laminal, immerse, ostiole black; conidia not found.

Chemistry: cortex K⁺ yellow, UV⁻; medulla K⁺ milky yellow, C⁺ pink to faint orange evanescent, KC⁺ orange evanescent, P⁻, UV⁺ whitish blue. Atranorin, evernic acid, lecanoric acid, and obtusatic acid.

Distribution: Neotropical (Sipman et al. 2009).

Comments: *Martiana chicitae* is characterized by the lustrous satin above 30× and corticolous thallus, the dichotomous to sympodial laciniae, overlapped, ciliate, the upper surface is minute crumpled, the medulla is white, the lower surface with a light brown apical zone and a black proximal zone satin above 30×, the rhizines are black, slightly anastomosed, the apothecia are

laminal, plane, with continuous discs, and the ascospores are elliptic, $10\text{--}11 \times 5\text{--}5.5 \mu\text{m}$, with a thin episore $0.7\text{--}0.8 \mu\text{m}$.

Martiana chicitae is similar in habit to *Lyngenella palmarum* (Lynge) B.R. Hora & Marcelli that also does not have pustule, soredia, and isidia. However, *L. palmarum* has medulla with the “palmarum complex”, is eciliate, has the satin visible already above magnification $20\times$, the apothecia are concave when young and become subplane when old, and the ascospores are ellipsoid to suboval $8.75\text{--}11.5 \times 6.25\text{--}7.5 \mu\text{m}$ (Hora et al 2015b).

Martiana chicitae is similar to *M. elixii* by lacking pustules, soredia, and isidia, but *M. elixii* is saxicolous, has the satin visible above $40\times$, laciniae anisotomic dichotomous, upper surface smooth, and the lower surface with a dark brown apical zone.

For comparison with *M. caparoensis* see the comments under that species.

***Martiana elixii* B.R. Hora & Marcelli, sp. nov.**

Holotype: Brazil, Espírito Santo State, Santa Marta Municipality, Parque Nacional do Caparaó, $20^{\circ}29.88'S$ $41^{\circ}43.99'W$, 965 m alt., saxicolous in the forest near the Guard Post, B.R. Hora 993, 17–XI-2011 (SP 466030). MycoBank 811343.

Thallus saxicolous, grayish white, opaque, subsatin up to $30\times$, satin above $40\times$, 4 cm broad, lacinate. **Laciniae** anisotomic dichotomous, 0.5–1.5 mm, laterally overlapping, adnate, longitudinal axis distended; transversal cut convex, border coplanar; upper surface firm, continuous, smooth, pruina at the apices of laciniae, maculae absent; lateral margin smooth, sinuous to irregularly cut; black line strong evident, complementary, thicker on axils; cilia black, $0.25\text{--}0.7 \times 0.05\text{--}0.1 \text{ mm}$, pigment absent, sublustrous, subsatin at $20\times$, satin above $30\times$, sinuous, subulate, furcate, a few simple, coplanar to descendant and acting as rhizines, frequent, all over the margin; apical zone ascendant, apex round, coplanar; axils oval; secondary laciniae and lacinules absent. Lacking pustules soredia, and isidia. **Medulla** white, pigment absent, texture normal. **Lower surface** apical zone dark brown, sublustrous, velvety at $10\times$, subsatin at $20\times$, satin above $30\times$, smooth, with rhizines, proximal part black, opaque to sublustrous, subsatin at $20\times$, satin above $30\times$, continuous, smooth. **Rhizines** black, till the apices of the laciniae, sublustrous, subsatin at $30\times$, satin above $40\times$, dichotomous, few trichotomous, first branched after $\frac{1}{3}$ of length, 1–3 branched, sinuous, a few curved, not gummed, little interlaced, little anastomosed, subulate, frequent. **Apothecia** absent. **Pycnidia** absent.

Chemistry: cortex K⁺ yellow, UV⁻; medulla K⁺ yellow, C⁻, KC⁺ orange to red, P⁻, UV⁻. Atranorin, evernic acid, and lecanoric acid.

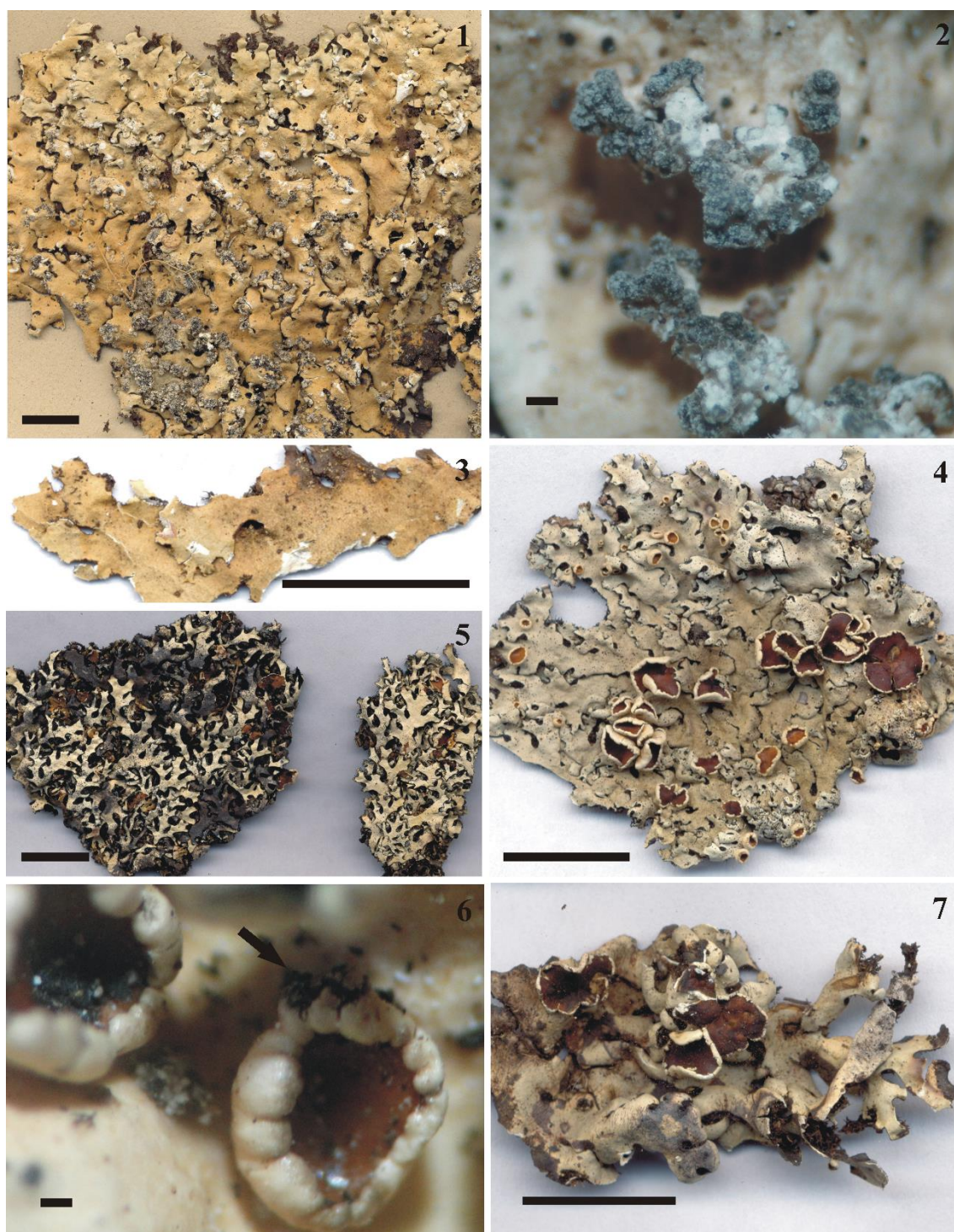
Distribution: southeastern Brazil.

Comments: *Martiana elixii* is characterized by the thallus saxicolous, opaque, satin above 40×, pruinose at apices of laciniae, ciliate, medulla white, lower surface opaque to sublustrous, satin above 30×, rhizines black, satin above 40×, dichotomous, a few curved, 1 to 3 times branched.

Martiana elixii is similar in habit to *M. itatiaiaensis*, whose thallus has the satin visible above 30×, is epruinose, has the lower surface sublustrous satin above 40×, the rhizines sublustrous satin above 30×, squarrose, 0 to 4 times branched.

For comparison with *M. caparoensis* and *M. chicitae* see the comments under those species.

Additional examined material. Brazil, Minas Gerais State, Itamonte Municipality, Parque Nacional do Itatiaia, paredão exposto ao lado da Estrada, 22°21'57.5"S 44°42'58.6"W, 2330 m alt., on rock, leg. B.R. Hora & M.P. Marcelli 1423 (B), 29–III-2012.



Figures 1-7. Holotypes. 1. *Martiana rockii*. 2. *M. rockii*, detail of pustules. 3. *M. bogotensis*. 4. *M. caparoensis*. 5. *M. chicitae*. 6. *M. chicitae*, detail of apothecia. 7. *M. elixii*. (scales: 1-3-4-5-7= 10 mm; 2-6= 5 mm).

***Martiana everniastroides* (Sipman) B.R. Hora & Marcelli, comb. nov.**

Hypotrachyna everniastroides Sipman. Willdenowia 16: 279. 1986. Holotype: Colombia, Cordillera Central, Huila: La Plata, Vereda La Candelaria, E-slopes, headwaters of the Río La

Candelaria, 2300m, corticolous on shrubs in *Blechnum-Sphagnum*, leg. J. Aguirre C. & H.J.M. Sipman 6164, 1–I-1984 (holotype COL, isotype in B!). MycoBank 811362.

Thallus corticolous, subopaque, subvelvety at 10×, subsatin at 20×, satin above 30×, 3 cm broad, submembranaceous, strong laciniate. **Laciniae** dichotomous to subsympodial, (0.3–) 0.5–1.0 (–1.5) mm wide, contiguous to little laterally overlapping, loose adnate; longitudinal axis distended, transversal cut convex, border coplanar; upper surface firm; transversal cracks not cicatrized, branched; pruina absent, maculae effigurate on proximal part and strong punctiform on the distal; lateral margin smooth, repand, closed; black line evident; cilia absent; apical zone distended, apex truncate, coplanar; axils oval; secondary laciniae and lacinules absent. Lacking pustules and isidia. **Soralia** at first subterminal and pustuloid in origin, spread on the laciniae apices till 5.0 mm long, get all the laciniae breadth, making them strongly canaliculate and vermiform-contorted; soredia farinose, white, not caducous. **Medulla** white, pigment absent, compact. **Lower surface:** apical zone light brown to dark brown, lustrous, subvelvety at 20×, subsatin at 30×, satin above 40×, attenuated limit, with rhizines; proximal zone black, opaque, subvelvety at 20×, subsatin at 30×, satin above 40×, smooth to slight rugulose. **Rhizines** black, lustrous, cosatin, dendroid, dichotomous, 3–8 branched, first branching after 1/3 of length, strongly interlaced, not gummed, not anastomosed, abundant, all over the lower surface. **Apothecia** absent. **Pycnidia** laminal, subapical, ostiole black; conidia not found.

Chemistry: cortex K+ yellow, UV-; medulla K- , C+ pink aqueous evanescent, KC+ pink aqueous evanescent, P-, UV-. Atranorin, evernic acid, and lecanoric acid.

Distribution: Costa Rica and Colombia, above 2300 m (Sipman et al. 2009).

Comments: *Martiana everniastroides* is characterized by the corticolous thallus strongly dichotomous to subsympodial laciniate with satin already visible at 30×, maculate, eciliate, subapically sorediate, medulla is white, the rhizines are dendroid and dichotomous 3–8 branched and strongly interlaced.

Martiana everniastroides is somewhat similar in habit to the saxicolous short laciniate *M. rockii* which has laminal pustules not truly sorediate, the rhizines are not dendroid and only 1 to 4 times branched.

***Martiana itatiaiaensis* B.R. Hora & Marcelli, sp. nov.**

Holotype: Brazil, Minas Gerais State, Itamonte Municipality, Parque Nacional do Itatiaia, Abrigo Rebouças, 20°23'08.2"S 44°43'46"W, 2380 m alt., on rock, leg. B.R. Hora & M.P. Marcelli 1308 (SP 466031). Mycobanck 811344.

Thallus saxicolous, light gray, lustrous subsatin at 10×, minute satin at 20×, satin above 30×, 4.9 cm broad, lacinate. **Laciniae** anisotomic dichotomous, 0.8–1.3 mm wide, laterally overlapping to imbricate, adnate; longitudinal axis undulate, transversal cut concave, convex near the apex, border coplanar; upper surface firm, continuous, crumpled, pruina absent, maculae absent; lateral margin smooth, repand, closed; black line little evident, thicker on axils; cilia black, satin above 30×, coplanar, sinuous, subulate, simple, a few furcate, all over the margin; apical zone ascendant, apex acute, descendant; axils oval; secondary laciniae absent. Lacinules concolored, laminal on proximal part, anisotomic dichotomous, 0.25–0.5 mm wide, plane, apex round, black line little evident, lower surface black, overlapped; grow from expansions of the lateral margin of the laciniae, become spatulate before ramifying. Lacking pustules, soredia, and isidia. **Medulla** white, pigment absent, texture normal. **Lower surface:** apical zone brown, mostly ivory, sublustrous, satin above 30×, papillate, with rhizines; proximal zone black, sublustrous, satin above 40×, continuous, veined to verruculose. **Rhizines** black, sublustrous, satin above 30×, a few simple to mostly squarrose, curved, subulate, not gummed, little interlaced, not anastomosed; first branching after 1/3 of length, a few since of base; 0–4 branched, 0.25–0.55 × 0.03–0.05 μm, abundant all over the lower surface. **Apothecia** cupuliform when young (no old apothecia present), 1.4 mm diameter, substipitate, subterminal; disc light brown, pruina absent, not cleft, open, imperforated; margin thin, crenulate, smooth, naked; amphithecia smooth, emaculate, naked; stipe 0.3 × 0.7 μm; smooth, naked; immature. **Pycnidia** absent.

Chemistry: cortex K+ yellow, UV-; medulla K-, C+ faint pink evanescent, KC+ pink evanescent, P-, UV-. Atranorin, evernic acid, and lecanoric acid.

Distribution: southeastern Brazil.

Comments: *Martiana itatiaiaensis* is characterized by the saxicolous satin above 30×thallus, anisotomic dichotomous laciniae laterally overlapped to imbricate and ciliate, the medulla is white, a lower surface with a mostly ivory apical zone, papillate, the rhizines are mostly squarrose, curved, 0 to 4 times branched, the apothecia are cupuliform with entire discs.

For comparison to *M. caparoensis* and *M. elixii* see the comments under those species.

***Martiana nuda* Marcelli & B.R. Hora, sp. nov.**

Holotype: Brazil, Minas Gerais State, Itamonte Municipality, Parque Nacional do Itatiaia, Laje 2 near the laje beside the river, 20°23'08.2"S 44°43'46"W, 2380 m alt., on rock, leg. B.R. Hora & M.P. Marcelli 1396, 23–II-2012 (SP 466032). MycoBank 811345.

Thallus saxicolous, grayish white on distal part and blackened on proximal part, lustrous on distal part and opaque on proximal part, minute satin up to 40×, 8.0 cm broad, lacinate. **Laciniae** anisotomic dichotomous, 1.8–3.2 mm wide, laterally overlapping to imbricated, loose adnate; longitudinal axis distended, transversal cut concave, border coplanar; upper surface firm, continuous, slight crumpled, pruina absent, maculae absent; lateral margin smooth, undulate, closed; black line evident, thicker on axils; cilia absent; apical zone ascendant, apex rounded, descendant; axils oval; secondary laciniae and lacinules absent. Lacking pustules, soredia, and isidia. **Medulla** cream yellowish, pigment K-, compact. **Lower surface:** apical zone brown, lustrous, satin at 30×, attenuated limit, papillate, with rhizines; proximal zone black, satin at 20×, smooth to slightly rugulose. **Rhizines** black, sublustrous, satin above 30×, simple to furcate, straight to curved, cylindrical, not gummed, little interlaced, not anastomosed, 0.45–0.7 × 0.05–0.075 mm, abundant, all over the lower surface. **Apothecia** absent. **Pycnidia** submarginal, immerse, ostiole black; conidia straight short filiform, 5–7.5 × 1.25 μm.

Chemistry: cortex K+ yellow, UV-; medulla K+ yellow, C+ pink evanescent, KC+ orange, P-, UV-. Atranorin, evernic acid, and lecanoric acid.

Distribution: southeastern Brazil.

Comments: *Martiana nuda* is characterized by the saxicolous thallus, lustrous on distal part and opaque on proximal part, minute satin up to 40×, the laterally overlapping to imbricate laciniae, the upper surface is slight crumpled; lacking cilia, maculae; and pruina; the medulla is yellowish cream, the rhizines are black, sublustrous, satin above 30×, simple to furcated, straight to curved, and the conidia are straight filiform 5–7.5 × 1.25 μm.

M. nuda is somewhat similar in habit to *M. bogotensis*, that has isidia, white medulla, and the rhizines are simple to dichotomous and curved to a few curly.

Additional material examined. Brazil, Minas Gerais State, Itamonte Municipality, Parque Nacional do Itatiaia, Laje 2 near the laje beside the river, 20°23'08.2"S 44°43'46"W, 2380 m alt., on rock, leg. B.R. Hora & M.P. Marcelli 1392, 23–II-2012 (B).

***Martiana sipmanii* Marcelli & B.R. Hora, sp. nov.**

Holotype: Brazil, Espírito Santo State, Santa Marta Municipality, Parque Nacional do Caparaó, forest near the Guard Post, 20°29.889'S 41°43.992'W, 965 m alt., on rock, leg. B.R. Hora 1030 (SP 466033).

MycoBank 811346.

Thallus saxicolous, subopaque, velvety at 10×, subsatin at 20×, satin above 30×, 5.7 cm broad, subcoriaceous, lacinate. **Laciniae** anisotomic dichotomous, laterally overlapping to a few contraposed, loose adnate; longitudinal axis undulate, transversal cut concave to convex, border coplanar; upper surface firm, cracked, slight crumpled, pruina absent, maculae extensive all over the upper cortex; lateral margin smooth, little sinuous, coplanar, close; black line subtle, thicker on axils; cilia black, satin above 30×, 0.3–0.75 × 0.05–0.1 mm, acting as rhizines, slender, subulate, simple to furcate, all over the margin, denser on axils; apical zone ascendant, apices roundish, descendant; axils rounded; secondary laciniae absent. Lacinules concolored, delicate, irregularly branched, 0.1–0.5 mm wide, plane to canaliculate, slender, coplanar, apex round, black line absent, lower surface black, frequent on irregularly cut parts of the lateral margin and on margins of open pustule, principally on the center of the thallus; grow from expansions of the lateral margin of the laciniae that become spatulate and then ramify dichotomously. Lacking soredia and isidia. **Pustules** caducous, abundant, irregularly shaped to extensive on the crest of laciniae, 0.5–1.8 mm, erumpent; begin as swellings on the laciniae crests that burst to expose the medulla without getting sorediate; eventually fall, leaving exposed as scars the upper side of the lower cortex. **Medulla** with the upper ⅔ white and light brown below, the pigment K-, texture normal. **Lower surface:** apical zone brown, lustrous, velvety at 10×, subvelvety at 20×, subsatin at 30×, satin above 40×, attenuated limit, papillate, without rhizines; proximal zone black, opaque, subvelvety at 10×, subsatin at 20×, satin above 30×, continuous, crumpled to rugulose. **Rhizines** black, sublustrous to opaque, cosatin, simple to dichotomous, first branched after ⅓ of length, 0–3 branched, sinuous to curved, subulate, not gummed, little interlaced, anastomosed, 0.30–1.25 × 0.03–0.1 mm, pigment absent, frequent, all over the lower surface. **Apothecia** absent. **Pycnidia** absent.

Chemistry: cortex K+ yellow, UV-; medulla K-, C+ pink, KC+ orange, P+ straw, UV-. Atranorin, evernic acid, and lecanoric acid.

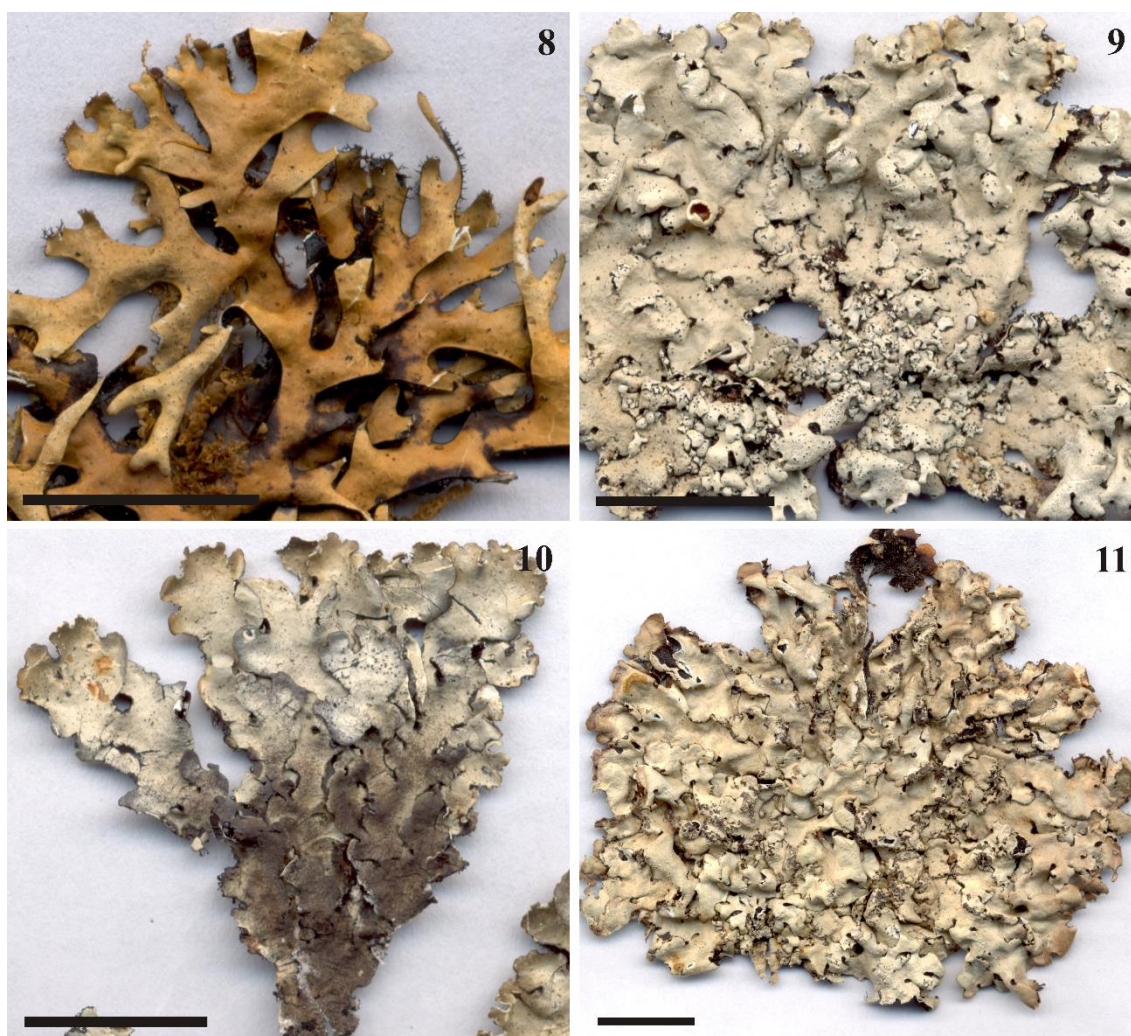
Distribution: southeastern Brazil.

Comments: *Martiana sipmanii* is characterized by the saxicolous subopaque thallus, anisotomic dichotomous laciniate and satin above 30×, maculate, ciliate; the lacinae are laterally overlapped to a few contraposed, the upper surface is slightly crumpled, and has open caducous not soresdiate pustule on the crests of the lacinae; the inferior 1/3 of the medulla is light brown; the rhizines are black, sublustrous to opaque, satin above 30×, simple to dichotomous, sinuous to curved, and 0 to 3 times branched.

Martiana sipmanii is similar in habit to the also pustulate *Lyngenella subsipmanii* B.R. Hora & Marcelli whose thallus is opaque, subsatin even at magnification 50×, does not have any contraposed lacinae, the pustules are entire and brownish inside but the medulla is totally white; the rhizines are opaque, already satin at 30×, mostly sinuous, just a few curved.

Other species similar by presence the pustule is *M. rockii* that has a short not contraposed lacinae, laminal pustule not soresdiate, medulla white, rhizines curved principally dichotomous to irregularly 1 to 4 times branched. Moreover, *M. rockii* has a peculiar ontogeny of the pustules (see description and comments under that species).

Martiana aspera is also a pustulate species, but its pustules develop lower cortex at the base and the thallus is neither ciliate nor maculate.



Figures 8-11. Holotypes. 8. *Martiana everniastroides*. 9. *M. itatiaiaensis*. 10. *M. nuda*. 11. *M. sipmanii* (scales:10 mm).

Other new combinations

***Martiana pulvinata* (Fée) Marcelli & B.R. Hora, comb. nov.**

Parmelia pulvinata Fée, Essai Crypt. Écorc. Exot. Officin. 123. 1824. Type collection: Tropical America (lectotype, G). Lectotypified by Hale 1975:59.

≡ *Parmelia caraccensis* f. *pulvinata* (Fée) Zahlbr., Cat. Lich. Univ. 6: 58. 1929.

According Sipman et al. (2009) this is a corticolous species with white macule, lacking isidia, pustule, and soredia, with white medulla and ascospores $10\text{--}13 \times 6\text{--}7 \mu\text{m}$.

***Martiana taylorensis* (Mitch.) B.R. Hora & Marcelli, comb. nov.**

Parmelia taylorensis Mitch. Revista Bio. 2: 215. 1961.

According Groner & Dietrich (1996) this species has areas of exposed lower cortex and regenerative lobules, a few pustules and no true soredia.

Key to the species included in *Martiana* and fully described above

- 1a. Thallus with isidia, pustules or soredia 2
- 1b. Thallus without those 5
- 2a. Thallus with isidia *M. bogotensis*
- 2b. Thallus without isidia 3
- 3a. Thallus with soredia, without pustules *M. everniastroides*
- 3b. Thallus with pustules 4
- 4a. Thallus with sorediate pustules, cilia present, the lower $\frac{1}{3}$ of the medulla light brown
..... *M. sipmanii*
- 4b. Thallus with not truly sorediate pustules (see text), cilia absent, and medulla totally white
..... *M. rockii*
- 5a. Saxicolous, medulla yellowish cream *M. nuda*
- 5b. Saxicolous or corticolous, medulla white 6
- 6a. Rhizines squarrose, curved; upper surface crumpled *M. itatiaiaensis*
- 6b. Rhizines simple to dichotomous, only a few curved to sinuous; upper surface smooth to
slightly crumpled 7
- 7a. Thallus satin above 40 \times , upper surface smooth, pruina present *M. elixii*
- 7b. Thallus already satin above 30 \times , upper surface smooth to slightly crumpled or minute
crumpled 8
- 8a. Corticolous; upper surface minute crumpled, ascospores 10–11 \times 5–5.5 μm
..... *M. chicitae*
- 8b. Saxicolous; upper surface smooth to slight crumpled; ascospores, 11.2–21.2 \times 6.2–17.5
(–20) μm *M. caparoensis*

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CAPITULO 6

Six new saxicolous species of Hypotrachyna (Parmeliaceae) from southeastern Brazil

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Six new saxicolous species of *Hypotrachyna* (*Parmeliaceae*) from southeastern Brazil

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Abstract

We describe six new saxicolous species from southeast Brazil, *Hypotrachyna etii*, *H. fracta*, *H. iarae*, *H. martiana*, *H. palui*, and *H. vexillina*.

Key words – rocky fields, Serra da Mantiqueira

Introduction

Hypotrachyna was proposed by Vainio (1890) in his monograph on Brazilian lichens as *Parmelia* subgenus *Parmelia* section *Hypotrachyna*. About 80 years later, Hale (1974) recognized *Hypotrachyna* as genus, with base on *Parmelia* subgenus *Hypotrachyna* of Hale & Kurokawa (1964). Details on the creation and history of *Hypotrachyna* are provided by Hale (1975), Sipman et al. (2009) and Hora et al. (2015a).

Nowadays the genus is estimate to embrace about 230 accepted species, and is cosmopolite at altitudes between 730 and 3700 (Hale 1975, Elix 1994, Sipman et al. 2009).

Hale (1975) included in *Hypotrachyna* those *Parmeliaceae* with sublinear, often elongate, apically subtruncate lobes, adnate to rarely substipitate imperforate apothecia, and dichotomously branched rhizines uniformly distributed on the black lower surface, the upper cortex consisting of palisade plectenchyma with a pored epicortex. Later this concept was extended by several authors to state that the species are mostly lacking cilia and share branched rhizines, bifusiform conidia, and spores of medium size (Hale, 1974; Elix 1994, Sipman et al. 2009; Thell et al. 2012). However, Hora et al. (2015b) understood that

Hypotrachyna s.s. is composed by a relatively small group of species close to *H. brasiliana* (Nyl.) Hale that produce lichexanthone associated with protocetraric acid and whose typically lacinate thallus is very regularly dichotomous ramified, eciliate, the lower side totally black without an apical zone, with sparse little ramified erect and not curved rhizines, laminal to subapical adnate to rarely substipitate apothecia that are involute when old and 1–4 cleft since young, ascospores ellipsoid about $8\text{--}12 \times 4\text{--}8 \mu\text{m}$ and the conidia probably exclusively bifusiform.

When working on the revision of the Brazilian species of *Hypotrachyna* s.l. we found six new species that are described here.

Material and Methods

The descriptive protocol developed by GEL (Canêz & Marcelli 2006) for access the morphological characters of the *Parmeliaceae*, which is now widely extended to verify more than 150 characters, was used to standardize the descriptions. Several used characteristics are new (e.g. satin and velvety surfaces, primary and secondary laciniae/lobes, complementary black line) and many of the classically used whose concepts are variable according the authors became strictly defined, as lobes, laciniae, lacinules, lobules, rhizines, cilia, and pustules (Hora et al. 2015a-f). Most of the modifications were directed to describe with minutiae details that have demonstrated effective and/or important to distinguish Brazilian species, much of them historically overlooked or erroneously considered be too much variable because the small amount of specimens the researchers deal with and/or because the limited field knowledge with these taxa they had.

The new species

Hypotrachyna etii B.R. Hora & Marcelli, **sp. nov.**

Fig. 1

MycoBank 811285.

Holotype: Brazil, Minas Gerais State, São Thomé das Letras Municipality, campo rupestre de candeia, trilha atrás do campo de futebol, saxicolous, $21^{\circ}42'54.8''\text{S}$ $44^{\circ}58'31.8''\text{W}$, 1340 m alt., leg. B.R. Hora & M.P. Marcelli 1784, 16-VIII-2012 (SP 466034).

Thallus saxicolous, dirty gray, lustrous, velvety at $10\times$, minute satin at $40\times$, pergaminaceous, 10 cm broad, lacinate. **Laciniae** anisotomic dichotomous to subsympodial, 0.7–1.4 mm wide,

laterally overlapping, loose adnate; longitudinal axis distended; transversal cut plane to convex, border coplanar; upper surface firm; transversal cracks deep, not branched, not cicatrized, frequent; smooth on distal part and crumpled on proximal part; pruina absent; maculae faint, effigurate, laminal; lateral margin smooth, straight, closed; black line very evident; cilia black, pigment absent, satin above 30 \times , straight, cylindrical or truncate, 0.1–0.35 \times 0.03–0.06 mm, acting as rhizines, simple, few, all over the margin; apical zone prostrate, descendant when above the substrate, apex truncate and coplanar; axils oval to quadratic. Secondary laciniae anisotomic dichotomous, overlapping, prostrate, 0.4–0.6 mm, black line evident, lateral margin smooth, repand, closed, tending to canaliculate. Lacinules absent. Lacking pustules, soredia; and isidia. **Medulla** white, pigment absent, compact. **Lower surface:** apical zone brown, sublustrous, velvety at 20 \times , satin above 40 \times , attenuated limit, smooth, with rhizines; proximal zone black, sublustrous, velvety 20 \times , satin above 30 \times , continuous, crumpled. **Rhizines** black, pigment absent, sublustrous, satin above 30 \times , mostly dichotomous, a few trichotomous, subulate, not gummed, not anastomosed, not interlaced, first branched after half-length, 0.25–0.85 \times 0.05–0.1 mm, all over the lower surface. **Apothecia** cupuliform when old, till 4.5 mm diameter, adnate, laminal; disc dark brown, pruina absent, 1–4 cleft, folded when old, imperforate; margin thin, emaculate, smooth when young and crenate when old, naked; amphithecia smooth, emaculate, naked; stipe very short; ascospores oval 8.75–10.0 \times 6.25–7.5 μm , epispore 1 μm . **Pycnidia** laminal, immerse, ostiole black, abundant; conidia sublageniform, 5.62–6.25 \times 1.25 μm .

Chemistry: cortex K⁺ yellow, UV⁻; medulla K⁻, C⁻, KC⁺ rose evanescent, P⁻, UV⁺ blue. Atranorin, colensoic acid.

Distribution: Only the holotype is known.

Comments: *Hypotrachyna etii* is saxicolous, lustrous and minute satin at 40 \times , with anisotomic dichotomous to subsympodial laciniae and laterally overlapped; the upper surface is smooth on distal part and crumpled on proximal part, with effigurate maculae, downturned cilia acting as rhizines, and, with secondary laciniae; the medulla is white; the rhizines are black, mostly dichotomous, moderately branched (1 to 3 times), sinuous and subulate, but not interlaced, not gummed and not anastomosed; the apothecia are cupuliform when old, with crenate margin; the ascospores are oval, 8.75–10.0 \times 6.25–7.5 μm , and the sublageniform conidia 5.62–6.25 \times 1.25 μm .

Hypotrachyna etii was initially identified as *H. gracilescens*, whose thallus is already satin at 40×, the lower surface totally black, has the rhizines more branched (2 to 5 times) and interlaced, the conidia subbifusiform to filiform, and produces alectoronic acid on the medulla (Hora et al. 2015c).

H. etii is similar to *H. fracta* that has the anisotomic dichotomous laciniae, the upper surface is transversally rugulose on proximal part and slight crumpled on the distal, cilia absent, non secondary laciniae, rhizines cylindrical with truncated apex, ascospores ellipsoid somewhat narrower (8.75–) 10–11 × 5–6.25 μm, and the conidia are both straight filiform and sublageniform, somewhat longer 5–8 × 1.0 μm.

The epithet refers to the traditional abbreviation for extra-terrestrial, given after the constant visitors of the type place, according the ufologists a traditional and internationally recognized place of spaceships landing.

Hypotrachyna fracta B.R. Hora & Marcelli, **sp. nov.**

Fig. 2

MycoBank 811286.

Holotype: Brazil, Minas Gerais State, Catas Altas Municipality, Reserva Particular do Patrimônio Natural, Campo de Fora, 20°06'58.5"S 43°31'01.3"W, 1485 m alt., leg. B.R. Hora & M.P. Marcelli 1570, 19-VI-2012 (SP 466035).

Thallus saxicolous, dirt gray, lustrous, subtlety velvety at 20×, satin above 30×, 4.5 cm broad, appearance subcoriaceous but fragile, lacinate. **Laciniae** anisotomic dichotomous, 0.5–1.4 mm wide, lateral overlapping, adnate; longitudinal axis conformed to substrate; transversal cut varied, border ascendant; upper surface firm; transversal cracks not branched, abundant on lamina, deep and not cicatrized; transversally rugulose on proximal part and slightly crumpled on distal part, pruina absent; maculae distinct, effigurate, laminal; lateral margin smooth, straight, closed; black line very evident; cilia absent; apical zone descendant, apex truncate, descendant; axils oval; secondary laciniae and lacinules absent. Lacking pustules, soredia, and isidia. **Medulla** white, pigment absent, compact. **Lower surface:** apical zone brown, lustrous, satin above 40×, attenuated limit, smooth, with rhizines; proximal zone black, lustrous, velvety at 10×, subsatin at 20×, satin above 30×, continuous, crumpled. **Rhizines** black, pigment absent, sublustrous, satin above 40×, furcate to dichotomous, coplanar ramifying, first branched after 1/3 of length, 1–2 branched, sinuous, cylindrical with truncate apex, not gummed, nor anastomosed, not interlaced, 0.2–0.5 × 0.05 mm, few, sparse. **Apothecia** concave, till 2.5 mm diameter, adnate, laminal; disc dark brown, pruina absent, 2-

cleft when young at 1/8 of diameter, open, imperforate, upon ageing the clefts grown together the disc, keeping the 1/8 proportion; margin thin, crenulate, naked, with black line when young; amphithecia smooth, emaculate, naked; stipe very short; ascospores ellipsoid, (8.75–) 10–11 × 5–6.25 µm, epispore 1.25 µm. **Pycnidia** laminal, immerse, ostiole black, conidia both straight filiform and sublageniform in a same pycnidium, 5–8 × 1.0 µm.

Chemistry: cortex K⁺ yellow, UV⁻; medulla K⁻, C⁻, KC⁺ faint yellow, P⁻, UV⁻. Atranorin, colensoic acid and two substance not identified.

Distribution: Only the holotype is known.

Comments: *Hypotrachyna fracta* is characterized by the thallus appearance subcoriaceous but in fact is very fragile, with anisotomic dichotomous laciniae and laterally overlapped, the upper surface is transversally rugulose on proximal part and slight crumpled on distal part, with abundant and deep transversal cracks, cilia absent, effigurate maculae, the medulla is white; the rhizines are cylindrical with truncated apex, little branched (1 to 2 times), the ascospores ellipsoid (8.75–) 10–11 × 5–6.25 µm, and the conidia are both straight filiform and sublageniform in a same pycnidium, 5–8 × 1.0 µm.

In a first moment, *Hypotrachyna fracta* was identified as *H. gracilescens*, whose thallus is satin above 40×, the upper surface is smooth to crumpled, emaculate, produces cilia, the lower surface is totally black, rhizines more branched (2 to 5 times) and interlaced, and subbifusiform to filiform conidia, 5–6.25 × 0.62–1.25 µm.

For comparison to *H. etii* see the comments under this species.

The epithet refers to the abundant transversal deep not cicatrized cracks on the laciniae.

Hypotrachyna iarae B.R. Hora & Marcelli, **sp. nov.**

Fig. 3

MycoBank 811287.

Holotype: Brazil, Minas Gerais State, Catas Altas Municipality, Reserva Particular do Patrimônio Natural, Taboões, paredão da segunda queda d'água, saxicolous, leg. B.R. Hora & M.P. Marcelli 809, 21-VII-2011 (SP 466036).

Thallus saxicolous, yellowish gray, sublustrous, velvety up to 20×, satin above 40×, 6 cm broad, membranaceous, laciniate. **Laciniae** anisotomic dichotomous, 0.7– 1.2 mm wide, imbricate, adnate; longitudinal axis conformed to the substrate; transversal cut varied, border coplanar; upper surface firm; transversal cracks branched or not, deep, subtle; slightly

crumpled, pruina absent; maculae distinct, effigurate, all over the primary laciniae; lateral margin smooth, sinuous, closed; black line evident; cilia absent; apical zone descendant; apex truncate, coplanar; axils elliptic to oval. Secondary laciniae on proximal part, anisotomic dichotomous, overlapping, prostrate, 0.3–0.8 mm breadth, longitudinal axis conformed to the primary laciniae; transversal cut convex, lateral margin smooth, repand, black line thicker than those of the primary laciniae. Lacinules absent. Lacking pustules, soredia, and isidia. **Medulla** white, pigment absent, texture normal. **Lower surface:** apical zone brown, lustrous, subsatin at 30×, satin above 40×, attenuate limit, smooth, with rhizines; proximal zone black, lustrous, velvety at 20×, satin above 30×, continuous, smooth to slightly crumpled. **Rhizines** black, pigment absent, sublustrous, satin above 20×, dichotomous to irregularly branched, a few furcate, coplanar, first branched after half-length, 1–3 branched, few sinuous, subcylindrical, not gummed, not anastomosed, not interlaced, 0.5–1.05 × 0.05 mm, few, sparse, all over the lower surface. **Apothecia** cupuliform, until 2.8 mm diameter, adnate, laminal; disc dark brown, pruina absent, not cleft, open when young and involute when old, imperforate; margin thin, crenate since young, naked; amphithecia smooth, emaculate, naked; stipe inexistent; ascospores ellipsoid, 10–11.25 × 5–6.25 μm, epispore 1 μm. **Pycnidia** laminal to submarginal, immerse, ostiole black; conidia sublageniform, 3.75 × 1.25 μm.

Chemistry: cortex K+ yellow, UV-; medulla K-, C+ rose evanescent, KC+ orange, P+ yellow, UV+ white. (Atranorin, 5-O-methylhiascic acid, 3-methoxy-2,4-di-O-methylgyrophoric acid and one substance not identified).

Distribution: Only the holotype is known.

Comments: *Hypotrachyna iarae* is characterized by the saxicolous, sublustrous, and satin above 40× thallus, with anisotomic dichotomous laciniae, eciliate, the upper surface is slight crumpled and effigurate maculae, and with secondary laciniae; the medulla is white and normal, the lower surface has a brown apical zone and the rhizines are subcylindrical and little branched (1 to 3 times); the apothecia are cupuliform with dark brown entire discs and involute when old, the ascospores are ellipsoid and have 10–11.25 × 5–6.25 μm, and conidia are sublageniform, 3.75 × 1.25 μm.

Hypotrachyna iarae is chemically similar with *Parmelinopsis damaziana* (Zahlbr.) Hale, which has the thallus minute satin at 40×, with short laciniae, upper surface is smooth

and emaculate, cilia frequent, the rhizines are simple to generally subsquarrose and irregular branched, and the ascospores are $(8.75-10-16.25 \times (7.5-8.75-13.75) \mu\text{m}$.

The name of specie is given after the Brazilian indigenous folkloric entity, a woman protector of fresh water, the Iara, that means habitant of the river.

Additional material: Brazil, Minas Gerais State, Catas Altas Municipality, Reserva Particular do Patrimônio Natural, Cascatinha, ao lado da cachoeira, saxicolous, 21-VII-2011, leg. B.R. Hora & M.P. Marcelli 783 (B), 771 (BM), 796 (US).

Hypotrachyna martiana Marcelli & B.R. Hora, **sp. nov.**

Fig. 4

MycoBank 811288.

Holotype: Brazil, Minas Gerais State, Itamonte Municipality, Parque Nacional do Itatiaia, paredão exposto ao lado da estrada, $22^{\circ}21'57.5''\text{S } 44^{\circ}42'58.6''\text{W}$, 2330 m alt., saxicolous, leg. B.R. Hora & M.P. Marcelli 1422, 25-VIII-2012 (SP 466037).

Thallus saxicolous, dark gray on proximal part, whitish gray on distal part, sublustrous, velvety up to $20\times$, subsatin at $30\times$, satin above $40\times$, 4.5 cm broad, membranaceous, laciniate. **Laciniae** anisotomic dichotomous to subsympodial, 0.9–2.0 mm wide, overlapping, loose adnate; longitudinal axis distended; transversal cut coplanar to concave, border coplanar; upper surface very fragile, with a few subtle to deep transversal cracks, crumpled, pruina absent, maculae absent; lateral margin smooth, repand, closed; black line subtle, ticker on axils; cilia black, satin above $30\times$, $0.25-0.6 \times 0.03-0.1$ mm, with a golden pigment reacting K^+ royal blue, acting as rhizines, straight to sinuous, subulate, simple to furcate, few, all over the margin; apical zone ascendant, apex truncate, coplanar; axils oval to quadratic; secondary laciniae and lacinules absent. Lacking isidia. **Pustules** frequent, linear, subapical, 0.45–1.0 mm; start as orbicular swellings of the upper cortex, which become linear-coalescent when start to break down to produce soredia. Soredia granular K^- , not caducous. **Medulla** ocher on upper $\frac{1}{3}$ and white below, loose, pigment K^- , also present below the pustules. **Lower surface:** apical zone brown, sublustrous, velvet up to $40\times$, attenuate limit, papillate, slightly rugulose, with rhizines; proximal zone black, lustrous, velvety up to $30\times$, satin above $40\times$, continuous, slight rugulose. **Rhizines** black, lustrous, cosatin, pigment absent, anisotomic dichotomous to irregularly branched, mostly sinuous, a few curved, subulate, not gummed, interlaced, not anastomosed, first branched after $\frac{1}{3}$ of length, 3–5 branched, $0.35-0.75 \times 0.05 (-0.1)$ mm,

abundant, all over the lower surface. **Apothecia** absent. **Pycnidia** laminal, immerse, ostiole black; conidia straight filiform, $7.5\text{--}8.75 \times 1.25 \mu\text{m}$.

Chemistry: cortex K⁺ yellow, UV⁻; medulla K⁻, C⁺ rose evanescent, KC⁺ rose evanescent, P⁻, UV⁻. Atranorin, gyrophoric acid and three not identified substances.

Distribution: Only the holotype is known.

Comments: *Hypotrachyna martiana* is characterized by the saxicolous, sublustrous and satin above 40 \times thallus, with anisotomic dichotomous to subsympodial laciniae, ciliate and overlapped, the upper surface is very fragile and crumpled, with, soresiate linear pustules, the medulla is ocher K⁻ on upper $\frac{1}{3}$, the pigment also present below the pustules; the lower surface has a brown apical zone and rhizines black, mostly sinuous, very branched (3 to 5 times), and the conidia are straight filiform $7.5\text{--}8.75 \times 1.25 \mu\text{m}$.

Hypotrachyna martiana is somewhat similar to the corticolous *Hypotrachynella oreadica* B.R. Hora & Marcelli, which produces both gyrophoric acid and lecanoric acids, has the satin visible above 20 \times , paracladial and subsympodial sublaciniae, the upper surface is little crumpled to crumpled, with macule, the medulla is mostly white, however slightly cream near the algae layer, and cream on amphithecia, the lower surface with apical zone ivory to light brown and rhizines curly, gummed and contorted, the mostly sublageniform and a few bifusiform conidia, $5\text{--}7.5 \times \text{ca. } 1.25 \mu\text{m}$ (Hora et al. 2015a).

For comparison to *H vexillina* see comments under that species.

The epithet is a tribute to C.F.P. Martius [1794–1868], the eminent German botanist and ethnologist who, together the zoologist J.B. Spix, made the first extensive botanic and zoological expedition to Brazil in 1817–1820, and published after this the Flora Brasiliensis and other works of fundamental importance to the botany (Marcelli 1998).

Hypotrachyna palui Marcelli & B.R. Hora, **sp. nov.**

Fig. 5

MycoBank 811289.

Holotype: Brazil, Minas Gerais State, Catas Altas, Reserva Particular do Patrimônio Natural Santuário do Caraça, trilha para a Capelinha, saxicolous, $20^{\circ}25'48.1''\text{S } 43^{\circ}29'16.8''\text{W}$, 1300 m alt., leg. B.R. Hora 1608, 20-VI-2012 (SP 466038).

Thallus saxicolous, grayish white, opaque, velvety at 10×, subvelvety at 20×, subsatin at 30×, satin above 40×, 5.5 cm broad, submembranaceous, long laciniate. **Laciniae** anisotomic dichotomous, (0.7–) 1.0–1.5 (–1.7) mm wide, laterally overlapping, loose adnate; longitudinal axis distended; transversal cut convex, border coplanar; upper surface firm, continuous, slightly crumpled, pruina absent, maculae absent; lateral margin smooth, repand, closed; black line inexistent; cilia absent; apical zone ascendant, apex truncate, descendant; axils elliptic to oval; secondary laciniae absent. Lacinules 0.5–1.2 mm × 0.4–0.6, little frequent, lower surface black, morphologically similar to the laciniae. Lacking pustules, soredia, and isidia. **Medulla** white, pigment absent, texture normal. **Lower surface:** apical zone brown to dark brown, sublustrous, subvelvety at 10×, subsatin at 20×, satin above 30×, attenuated limit, papillate, with rhizines; proximal zone black, opaque, cosatin to the apical zone, smooth to slightly rugulose. **Rhizines** black, lustrous, cosatin, dichotomous a few simple, straight a few curly, subulate, interlaced, not gummed, anastomosed, abundant, coplanar, pigment absent, first branched after 1/3 of length, 1–3 branched, 0.25–1.0 × 0.025–0.05 mm. **Apothecia** absent. **Pycnidia** laminal, frequent, ostiole black, conidia straight filiform, 2.5–5 × 1.0 µm.

Chemistry: cortex K-, UV+ yellow; medulla K+ faint yellow, C-, KC+ reverts the K reaction, P+ orange, UV-. Lichexanthone and protocetraric acid.

Distribution: Only the holotype known.

Comments: *Hypotrachyna palui* is characterized by the saxicolous, opaque thallus, loose adnate, eciliate, and satin above 40×, with anisotomic dichotomous and long laciniae, laterally overlapping; the upper surface is slightly crumpled, the medulla totally white, the lower surface has a brown to dark brown apical zone; the rhizines are black, interlaced, and the conidia are short straight filiform 2.5–5 × 1.0 µm.

The rhizines of *H. palui* are not projecting beyond the margins as those of *Vainia vainio* (Sipman, Elix & T. Nash) B.R. Hora & Marcelli, which has lichexanthone and echinocarpic acid, the thallus corticolous, the laciniae dichotomous to subsympodial and upper surface very slightly scrobiculate, the medulla white with spots cream near lower cortex, the rhizines anastomosed, and the conidia straight filiform 6 × 1 µm (Hora et al 2015f).

Other somewhat alike species is *H. brasiliiana* because the long laciniae and the joint presence of lichexanthone and protocetraric acid. However, *H. brasiliiana* has a white medulla, the upper surface shallowly rugulose, the rhizines scarce and dichotomous.

The epithet is given after Father Lauro Palú, CM, who dedicates his life in registering with love and in minutia the wonderful nature of the Caraça Mountains both in photograph and poetry, giving unrestrictive incentive to scientific research in that Natural Reserve, and who completed 50 years of ordination in 2014.

Hypotrachyna vexillina B.R. Hora & Marcelli, **sp. nov.**

Fig. 6

MycoBank 811290.

Holotype: Brazil, Espírito Santo State, Alto Caparaó Municipality, Parque Nacional do Caparaó, trilha para o Pico da Bandeira, saxicolous, 20°26'26.40'S 41°47.93'W, 2853 m alt., leg. B.R. Hora 1222, 18–XI–2011 (SP 466039).

Thallus saxicolous, yellowish white, lustrous, subsatin up to 20×, satin above 30×, 3.5 cm broad, membranaceous, laciniate. **Laciniae** anisotomic dichotomous, (0.8–) 1.0–1.6 mm wide, overlapping, elevate; longitudinal axis distended to ascendant; transversal cut slight canaliculated, border coplanar; upper surface firm, continuous, smooth to slightly crumpled on proximal part, pruina absent, maculae absent; lateral margin crenate, undulate, closed; black line evident; cilia black, velvety up to 20×, satin above 30×, 0.25–1.0 × 0.03–0.075 mm, pigment absent, acting as rhizines, anisotomic dichotomous to a few furcate, frequent, all over the margin; apical zone descendant, a few plane, apex truncate, coplanar; axils acute; secondary laciniae absent. Lacinules concolored, dichotomous, 0.3–1.0 mm, plane, apex roundish, black line evident, lower surface black, grow from the pustules, become spatulate upon growing and leave the pustules with a rhizinate appearance. Lacking isidia. **Pustules** abundant, orbicular and confluent, on the laciniae crests, 0.01–0.9 mm; grow from swellings that break down into granules (corticated) and soredia; the granules give origin to lacinules turning the pustules apparently rhizinate. **Medulla** white, pigment absent, normal. **Lower surface:** apical zone brown, lustrous, velvety up to 20×, satin above 30×, attenuated limit, with rhizines; proximal zone black, lustrous, subsatin at 20×, satin above 30×, continuous, slight crumpled. **Rhizines** black, lustrous, subsatin up to 30×, satin above 40×, dichotomous to irregularly branched, first branched after 1/3 of length, 1–5 branched, curved, a few straight, subulate, interlaced, anastomosed, not gummed, 0.5–0.75 × 0.05–0.1 μm, abundant, all over the lower surface. **Apothecia** cupuliform, rare, until 0.3 mm diameter, sessile, laminal; disc light brown, pruina absent, not cleft, open, imperforate; margin thin, darkened, smooth, naked; amphithecia eroded, emaculate, naked; stipe inexistent; immature. **Pycnidia** laminal, immerse, ostiole black; conidia not found.

Chemistry: cortex K⁺ yellow, UV- medulla K⁺ rose, C⁺ rose evanescent, KC⁺ rose to orange, P⁻, UV-. Atranorin, gyrophoric acid, and one not identified substance.

Distribution: Only the holotype known.

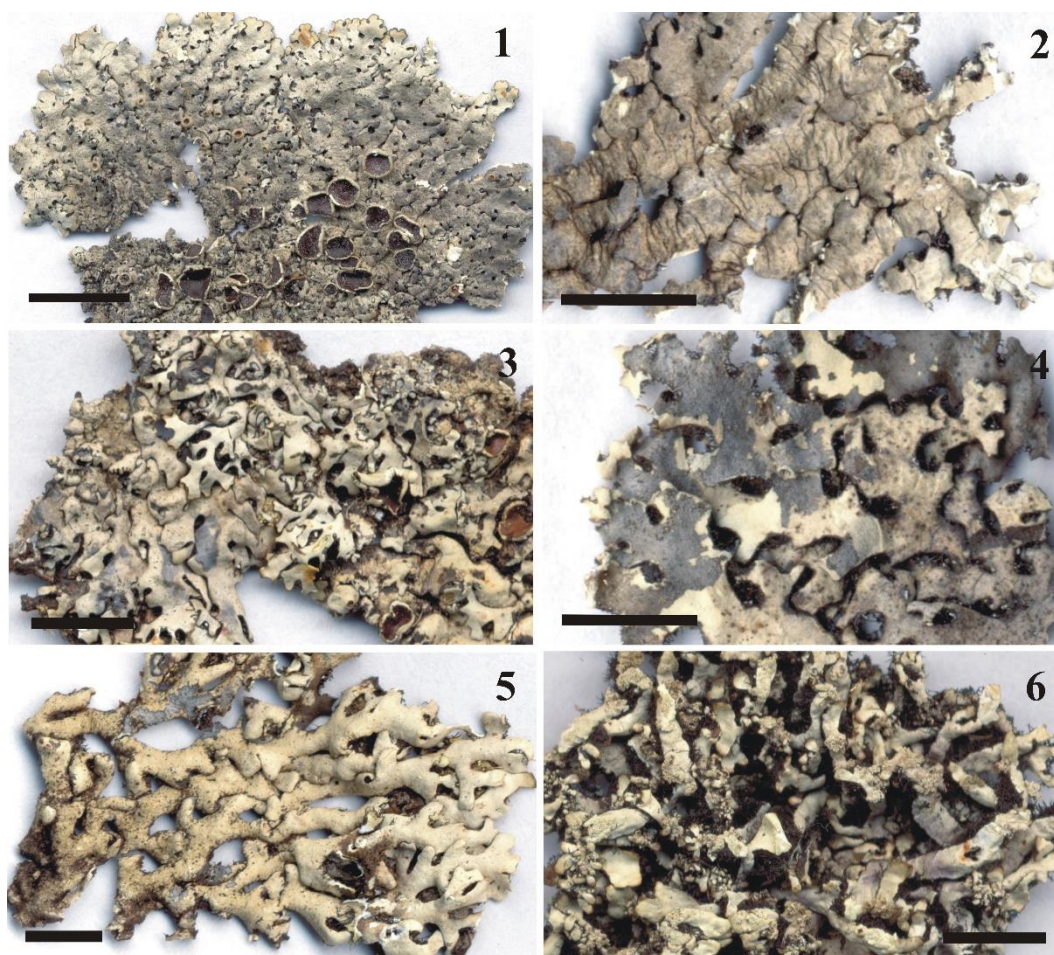
Comments: *Hypotrachyna vexillina* is characterized by the saxicolous, lustrous and satin above 30× thallus, the anisotomic dichotomous laciniae, ciliate, with the upper surface smooth to slightly crumpled, with pustule soredate, the medulla white, the lower surface with a brown apical zone; the rhizines black, mostly curved, interlaced, anastomosed, and 1 to 5 times branched.

H. vexillina is similar to *H. martiana* whose thallus is satin above 40×, has the anisotomic dichotomous to subsympodial laciniae and an upper surface is very fragile and crumpled, the medulla is partially ocher, with mostly sinuous 3 to 5 times branched rhizines.

The epithet (from the Latin vexillum: flag, "bandeira" in Portuguese) is a reference to the type locality (Pico da Bandeira = Flag Peak).

Acknowledgements

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Figures 1-6. Holotypes. 1. *Hypotrachyna etii*. 2. *H. fract.* 3. *H. iarae*. 4. *H. martiana*. 5. *H. palui*. 6. *H. vexiliana*. (scales: 1= 10 mm; 2-3-4-5-6= 5 mm).

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CAPITULO 7

***Vainia*, a new genus segregated from *Hypotrachyna* (*Parmeliaceae*)**

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***Vainia*, a new genus segregated from *Hypotrachyna* (*Parmeliaceae*)¹**

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¹ Part of the PhD thesis of the first author

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Titulo resumido: (*Vainia*, new genus of *Parmeliaceae*.)

Abstract

The new genus *Vainia* (Parmeliaceae) is presented as segregate from *Hypotrachyna*, characterized by the joint production of echinocarpic acid and lichexanthone as major secondary metabolites associated to a specific assemblage of morphological characters. *Vainia vainioi* is the type species. The new genus embraces until now five species, three of them new. We provide detailed descriptions for all species we had access to the type material and an identification key.

Key words: caatinga, cerrado, rocky fields, Serra da Mantiqueira, Vale do Catimbau

Resumo

O gênero *Vainia* (Parmeliaceae), apresentado como segregado de *Hypotrachyna*, é caracterizado por produzir ácido equinocárpico e liquexantona como metabolitos secundários principais associados a caracteres morfológicos específicos. *Vainia vainioi* é a espécie tipo. O novo gênero contém cinco espécies, sendo três novas. Nós descrevemos detalhadamente todas as espécies, incluindo os tipos a que tivemos acessos, e apresentamos uma chave de identificação.

Palavras-chave: caatinga, cerrado, campos rupestres, Serra da Mantiqueira, Vale do Catimbau

Introduction

Hypotrachyna was proposed by Vainio (1890) in his monograph on Brazilian lichens as *Parmelia* subgenus *Parmelia* section *Hypotrachyna*, which he divided in the subgroups *Irregularis*, *Cyclocheila*, and *Sublinearis*. About 80 years later, Hale (1974) recognized *Hypotrachyna* as genus, with base on *Parmelia* subgenus *Hypotrachyna* of Hale & Kurokawa (1964). Details on the creation and history of *Hypotrachyna* are provided by Hale (1975), Sipman et al. (2009) and Hora et al. (2015a).

Nowadays, *Hypotrachyna* is considered cosmopolite, occurring mostly at altitudes between 730 and 3700 m (Elix 1994, Hale 1975, Sipman et al. 2009) and estimate to embrace about 230 accepted species.

The genus includes species with sublinear often elongate apically subtruncate laciniae, which are adnate to rarely substipitate branched, mostly lacking cilia and sharing branched rhizines, imperforate apothecia, bifusiform conidia, and spores of medium size (Hale 1974, Elix 1994, Sipman et al. 2009, Thell et al. 2012). However, Hora et al. (2015b) understood that *Hypotrachyna* s.s. is composed by species close to *H. brasiliana* (Vain.) Hale, producing lichexanthone associated with protocetraric acid and whose typically laciniate thallus is very regularly dichotomous ramified, eciliate, the lower side totally black without an apical zone and with sparse little ramified erect and not curved rhizines; the laminal to subapical apothecia are adnate to rarely substipitate, involute when old, 1–4 cleft since young, the ascospores ellipsoid about $8\text{--}12 \times 4\text{--}8 \mu\text{m}$, and the conidia probably exclusively bifusiform.

In his classical monograph on *Hypotrachyna* in Tropical America, Hale (1975) clearly considered the genus composed by chemical subgroups, e.g., the gyrophoric acid containing group, the evernic-lecanoric acids group, the lividic acid group, the alectoronic acid group.

He did not make mention to an echinocarpic acid containing group because only two species had it, even so not as the principal metabolite, *H. dentella* (Hale & Kurok.) Hale and *H. thysanota* (Kurok.) Hale, which have respectively barbatic acid and microphyllinic acid as major metabolites.

It was only in the last decade that Sipman (1992) and Sipman et al. (2009) described *H. vainioi* Sipman, Elix & T. Nash and *H. adaffinis* Sipman, two species with echinocarpic acid and lichexanthone as major metabolites.

Hora et al. (2015 a,b,c,d) assumed and emphasized the importance of the association between the secondary metabolites and morphology to recognize the subgroups existing in *Hypotrachyna* s.l., and segregated from it three new genera *Hypotrachynella*, *Lyngenella* e

Martiana, which fortuitously fitted the phylogenetic results of Divakar et al. (2013) on *Hypotrachyna*.

While working on the revision and inventory of Brazilian *Hypotrachyna* species, we were confronted with three new species that produce echinocarpic acid as major metabolite. Together with the two already known they formed a sound unit that can be recognized and circumscribed in the same morphological base of those other three genera.

So, we describe below the new genus *Vainia*, with five species, three of them new to the Science.

Material and Methods

The descriptive protocol developed by GEL (Canêz & Marcelli 2006) for access the morphological characters of the *Parmeliaceae*, which is now widely extended to verify more than 150 characters (Hora et al. 2015a, b, c, d, e), was used to standardize the descriptions. Most of the modifications were directed to describe with minutiae details that have demonstrated effective and/or important to distinguish Brazilian species, much of them historically overlooked or erroneously considered be too much variable because the small amount of specimens the researchers deal with and/or because the limited field knowledge with these taxa they had.

Results

***Vainia* B.R. Hora & Marcelli, gen. nov. (*Parmeliaceae*)**

Type species: *Hypotrachyna vainioi* Sipman, Elix & T. Nash. Flora Neotropica Monograph 104: 160. 2009.

Etymology: the genus name is given in honor to the Finnish lichenologist E. A. Vainio [1853-1929], declared the Father of Brazilian Lichenology (Marcelli 1998, Marcelli & Ahti 1998), who launched the basis of the actual taxonomic knowledge of *Parmeliaceae* in his classical study of Brazilian lichens (Feuerer 1998).

Vainia is characterized by the thallus laciniate satin above 30×, principally dichotomous and principally lateral overlapping, lacking maculae and cilia; the medulla is bicolored in most species; the rhizines are interlaced, anastomosed and curved, simple to dichotomous branched (0 to 5 times), and with the first branching after 1/3 of length; the

apothecia are substipitate to adnate, cupuliform when young; the ascospores are (9–) 10–12 × 6–8 µm and the conidia short filiform 2–6 × 1–1.25 µm; produces lichexanthone and medullar echinocarpic acid as major metabolites.

We consider that *Hypotrachyna* s.s. embraces a relatively small group of species close to *H. brasiliiana* that produces lichexanthone associated with protocetraric acid and whose typically lacinate thallus is very regularly dichotomous ramified, eciliate, the lower side totally black without an apical zone; the rhizines are sparse, little ramified, erect, and not curved; the laminal to subapical apothecia are adnate to rarely substipitate, involute when old, 1–4 cleft since young, the ascospores ellipsoid about 8–12 × 4–8 µm, and the conidia probably exclusively bifusiform (Hora et al. 2015c).

***Vainia vainioi* (Sipman, Elix & T. Nash) B.R. Hora & Marcelli, comb. nov.**

Hypotrachyna vainioi Sipman, Elix & T. Nash. Flora Neotropica Monograph 104: 160. 2009. Type: Brazil, Minas Gerais [State], Catas Altas [Municipality], Serra do Caraça, near Caraça Monastery, along trail to Capela do Sagrado Coração, Varginha, 20°06'S 43°29'W, 1300 m alt., *H. Sipman 40720*, 17-IX-1997 (holotype: B!). MycoBank 811363.

Thallus corticolous, light gray with darkened on central part, lustrous, velvety at 10×, subsatin at 20×, minute satin at 30×, satin above 40×, 8 cm broad, submembranaceous, lacinate. **Laciniae** dichotomous to subsympodial, (0.3–) 0.5–1.0 (–1.5) mm wide, contiguous to lateral overlapping, adnate; longitudinal axis distended; transversal cut convex to plane, border coplanar; upper surface firm, continuous, very slight scrobiculate, pruina absent, macule absent; lateral margin smooth, repand, closed; black line evident, principally on axils; cilia absent; apical zone plane, apex roundish to subtruncate, coplanar; axils elliptic to oval; secondary laciniae absent; lacinules only adventitious, at blackened parts and margins, resulting of regenerative process, mostly spatulate when young and lacinuloid when older, 0.3–1.0 × 0.5–1.2 mm. Lacking pustules; soredia, and isidia. **Medulla** white, spots cream near the lower cortex, pigment K-. **Lower surface:** apical zone brown, lustrous, subvelvety at 10×, subsatin at 20×, satin above 30×, papillate, attenuated limit, with rhizines; proximal zone black, sublustrous, cosatin the apical zone, rugulose. **Rhizines** black, dichotomous, cosatin, subulate, very interlaced, much curved, anastomosed, not gummed, abundant, dense, first branched after 1/3 of length, 2–5 branched, 0.45–2.5 × 0.03–0.05 mm. **Apothecia** laminal, cupuliform when young, plane and prostrate when old and substipitate, adnate, until 10 mm

of diameter; disc brown, cleft from $\frac{1}{3}$ to $\frac{2}{3}$ of radius, cleft since young, imperforate; margin naked, crenulate and not continuous since young; amphithecia continuous, emaculate, the young smooth, irregularly more evidently scrobiculate than the upper surface when older; stipe very short, as yellow as the amphithecia; ascospores elliptic (9–) $10\text{--}12 \times 6\text{--}8 \mu\text{m}$, episporium $1 \mu\text{m}$. **Pycnidia** laminal, few, ostiole black; conidia straight filiform $6 \times 1 \mu\text{m}$.

Chemistry: cortex K-, UV+ yellow; medulla K+ yellow to green, C+ faint milky, KC gelatinous, P+ orange on upper half and light yellow on lower half, UV-.

Distribution: Only the type specimen is known (Sipman et al. 2009).

Comments: *Vainia vainioi* is characterized by the corticolous, lustrous, and satin above $40\times$ thallus, with eciliate dichotomous to subsympodial laciniae, not cracked, and laterally overlapping; the medulla is white but with spots cream yellowish near the lower cortex; the lower surface is satin above $30\times$ with an apical zone brown and proximal part rugulose; the rhizines are black and 2 to 5 times dichotomous, very interlaced, anastomosed, and much curved; the apothecia are laminal and cupuliform when young to plane and prostrate when old, cleft since young, and the ascospores elliptic (9–) $10\text{--}12 \times 6\text{--}8 \mu\text{m}$ with an episporium $1 \mu\text{m}$ thick, and the conidia straight short filiform $6 \times 1 \mu\text{m}$.

Vainia extraterrestris (see below) is very similar and has also not pustules, soredia, and isidia; nevertheless, it is a saxicolous species whose laciniae are dichotomous to irregular, laterally overlapping to imbricate, the medulla has the upper part white but is salmon near the lower surface, which is smooth to crumpled, has rhizines furcate to dichotomous only 1 to 3 times branched, and the conidia somewhat shorter and wider $3.75\text{--}5 \times 1.25 \mu\text{m}$.

Vainia vainioi is similar to *V. adaffinis*, which is sorediate, has laciniae contiguous to slightly laterally overlapped, dichotomous to subdichotomous, upper surface fragile, medulla totally white, and the rhizines are dichotomous to furcate only 1 to 3 times branched.

For comparison with *V. marcellii* see the comments under this specie.

***Vainia adaffinis* (Sipman) B.R. Hora & Marcelli, comb. nov.**

Hypotrachyna adaffinis Sipman, Trop. Bryol. 6: 16. 1992. Type: Venezuela, Estado Bolivar, Cerro Guaiquinima, near NE edge upper plateau (war camp 2), $5^{\circ}54'N$ $63^{\circ}27'W$, 1250 m alt, H. Sipman 26792b, 08-II-1990 (holotype: VEN; isotype: B!). MycoBank 811364.

Thallus corticolous, ivory, opaque, velvety at 10×, subvelvety at 20×, subsatin at 30×, satin above 40×, coriaceous, 2.7 cm broad, laciniate. **Laciniae** dichotomous to subdichotomous, (0.5–) 0.9–2.5 mm wide, contiguous to slightly laterally overlapping, adnate; longitudinal axis distended; transversal cut slight convex, border coplanar; upper surface fragile, continuous, slight crumpled, pruina absent, macule absent; lateral margin smooth, repand, closed; black line evident; cilia absent; apical zone plane, apex truncate, coplanar; axils oval to elliptic; secondary laciniae and lacinules absent. Lacking pustules and isidia. **Soralia** capitate, globular, subterminal in most the laciniae, some laminal, rarely terminal, white, the older light greyish, mostly not coalescent, not originated from cortical swellings, (0.4–) 0.8–1.5 (–2.0) mm diameter; soredia subgranular, not caducous. **Medulla** white, pigment absent, loose in upper half and compact in lower half. **Lower surface** totally black, lustrous, subvelvety at 10×, subsatin at 20×, satin above 30×, slight rugulose, occasionally transversal cracked. **Rhizines** black, dichotomous to furcate, cosatin, interlaced, anastomosed, not gummed, first branched after 1/3 of length, 0.15–0.25 × 0.025 μm, 1–3 branched, abundant, all over the lower surface. **Apothecia** laminal, substipitate to adnate, until 1 mm diameter, cupuliform, pumpkin-like; disc brown, pruina absent continuous, open, smooth; margin thin, naked, incise-crenate; amphithecia smooth, continuous, naked, emaculate, yellowish, sulcate; stipe very short to inexistent, emaculate, yellower than thallus and amphithecia, naked; ascospores immature. **Pycnidia** absent.

Chemistry: cortex K-, UV+ yellow; medulla K-, C-, KC-, P-, UV-.

Distribution: Known from Neotropical mountains and Andes (Sipman et al. 2009).

Comments: *Vainia adaffinis* is corticolous, ivory, opaque and satin above 40×, with dichotomous to subdichotomous laciniae, contiguous to slightly laterally overlapped; the upper surface is fragile and sorediate, the medulla is white; the lower surface is totally black, satin above 30×, and slight rugulose; the rhizines are black and dichotomous to furcate, interlaced, anastomosed, little branched (1 to 3 times); the apothecia are laminal, substipitate to adnate and pumpkin-like.

Vainia adaffinis is somewhat similar to *V. pernambucana* that is not sorediate, has a thallus sublustrous satin above 30×, the anisotomic dichotomous laciniae imbricated to lateral overlapping, medulla is white on upper 1/3 and salmon in the lower 2/3, the lower surface with an apical zone brown, and the rhizines are simple to furcate.

For comparison to *V. vainioi* see the comments under that specie.

***Vainia extraterrestris* B.R. Hora & Marcelli, sp. nov.**

Holotype: Brazil, Minas Gerais State, São Thomé das Letras Municipality, cerrado rupestre between shrub, on rock, 21°42'53.5"S 44°58'53.4"W, 1230 m alt., B.R. Hora & M.P. Marcelli 1725, 15-VII-2012 (SP 466040). MycoBank 811348.

Thallus saxicolous, whitish gray, sublustrous, velvety at 10×, subvelvety at 20×, subsatin at 30×, satin above 40×, 8.5 cm broad, subcoriaceous, laciniate. **Laciniae** dichotomous to irregular, (0.7–) 1–2 mm wide, laterally overlapping to imbricate, adnate; longitudinal axis distended to descendant; transversal cut convex, coplanar; upper surface firm, continuous, slightly rugulose to crumpled, pruina absent, maculae absent; lateral margin smooth, repand, closed; black line absent; cilia absent; apical zone ascendant, apex truncate, descendant; axils elliptic to oval; secondary laciniae absent. Lacinules adventitious, at first spatulate, become similar the laciniae upon ageing, the majority appear be naturally born and not consequence of a regrowth process, 0.3–1.2 mm × 1.0–2.0 mm. Lacking pustules, soredia, and isidia. **Medulla** white, salmon near the lower surface, pigment reacting K⁺ red, texture normal. **Lower surface:** apical zone light brown, lustrous, velvety at 10×, subvelvety at 20×, subsatin at 30×, satin above 40×, attenuated limit, with rhizines; proximal zone black, lustrous, cosatin the apical zone, continuous, smooth to crumpled. **Rhizines** black, subulate, furcate to dichotomous, curved, interlaced, not gummed, not anastomosed, first branched after half-length, 1–3 branched, abundant, 0.35–0.85 × 0.03–0.05 mm, all over the lower surface. **Apothecia** absent. **Pycnidia** laminal, few, ostiole black; conidia straight short filiform, 3.75–5 × 1.25 μm.

Chemistry: cortex K⁻, UV⁺ yellow; white medulla K⁺ faint yellow, pigmented medulla K⁺ red, C⁺ milky, KC reverts the K reaction of the white medulla, P⁺ orange, UV⁻.

Distribution: Only the type known.

Comments: *Vainia extraterrestris* is characterized by the saxicolous satin above 40×, thallus, the dichotomous to irregular laciniae, laterally overlapped to imbricate; the upper surface is rugulose to crumpled; the medulla mostly white but salmon K⁺ red near the lower surface, which has a brown apical zone; the rhizines are furcate to 1 to 3 times dichotomous, curved and interlaced, but are not anastomosed, and the conidia are straight filiform 3.75–5 × 1.25 μm.

V. extraterrestris is similar to *V. pernambucana* in lacking pustules, soredia, and isidia. However, *V. pernambucana* has thallus satin above 30×, anisotomic dichotomous, the upper surface is strongly crumpled on proximal part and slightly crumpled on distal part, the medulla is white in upper 1/3 and salmon in lower 2/3, the anastomosed, simple to furcated rhizines, and the conidia are shorter 2.5–3.75 μm.

Vainia marcellii also does not have vegetative propagules, but its thallus is satin above 30×, the laciniae are anisotomic dichotomous, the upper surface is smooth to slight crumpled, the salmon part of medulla reacts K+ purple, and the rhizines are anastomosed,

For comparison with *V. vainioi* see the comments under that species.

The epithet refers to the type locality, an internationally known place of extraterrestrial landing and ufological research.

***Vainia marcellii* B.R. Hora & M.L.L. Buril, sp. nov.**

Holotype: Brazil, Pernambuco State, Buíque Municipally, Parque Nacional do Vale do Catimbau, caatinga, saxicolous, *M.L.L. Buril 651*, 14-VIII-2012 (SP 466041). MycoBank 811349.

Thallus saxicolous, gray, lustrous, subvelvety at 10×, subsatin at 20×, satin above 30×, 4.3 cm broad, submembranaceous, laciniate. **Laciniae** anisotomic dichotomous, 0.8–1.9 mm wide, laterally overlapping, adnate; longitudinal axis distended; transversal cut convex to concave, border coplanar; upper surface firm, smooth to slightly crumpled; transversal cracks, few branched, a few cicatrized; pruina absent, maculae absent; lateral margin smooth, repand, closed; black line absent; cilia absent; apical zone ascendant, apex truncate, descendant; axils oval to elliptic; secondary laciniae absent. Lacinules similar the laciniae, on proximal part, overlapped on the laciniae, at first spatulate, become ramified and then grow in length, 0.5–1.5 × 0.3–3.0. Lacking pustules, soredia, and isidia. **Medulla** white, salmon near to the lower cortex, pigment K+ purple. **Lower surface:** apical zone brown, lustrous, velvety at 10×, subsatin at 20×, satin above 30×, attenuated limit, smooth, with rhizines; proximal zone, black, subopaque, velvety at 10×, subvelvety at 20×, subsatin at 30×, satin above 40×, continuous, crumpled. **Rhizines** black, slender, curved, interlaced, subulate, anastomosed, not gummed, simple to irregularly dichotomous, a few trichotomous, first branched after 1/3 of length, 0–3 branched, abundant, all over lower surface. **Apothecia** cupuliform when young (old apothecia absent), 1.3 mm diameter, adnate, laminal; disc brown, pruina absent, continuous, open, imperforate; margin thin, smooth to very slightly crenulate, naked; amphithecia smooth,

emaculate, naked; stipe absent; ascospores immature. **Pycnidia** laminal, immerse, ostiole black; conidia filiform, (3.75–) 5–6.25 × 1.25 µm.

Chemistry: cortex K-, UV+ yellow; white medulla K+ yellow, salmon medulla K+ purple, C+ milky yellow, KC+ yellow gelatinous, P-faint orange, UV-.

Distribution: Only the type known.

Comments: *Vainia marcellii* is saxicolous, lustrous and has the satin characterized above 30×, the laciniae are laterally overlapping; the upper surface is smooth to slightly crumpled; the medulla is white but salmon near the lower surface and the pigment reacts K+ purple; the lower surface has an apical zone brown; the rhizines are interlaced, anastomosed, curved, slender, simple to irregularly 0 to 3 times dichotomous; the apothecia are cupuliform when young, and the conidia filiform, (3.75–)5–6.25 × 1.25 µm.

V. marcellii is similar to *V. vainioi* whose thallus is corticolous with the satin above 40×, the laciniae contiguous to lateral overlapping, the upper surface very slight scrobiculate, the medulla white with spots cream yellowish near the lower cortex, pigment K-; the rhizines are dichotomous, much curved, very interlaced, 2 to 5 times branched, and conidia are filiform 6 × 1 µm.

For comparison with *V. pernambucana* and *V. extraterrestris* see the comments under those species.

The epithet is a tribute to my advisor and co-advisor of Lourdes Buriel, Dr. Marcelo Pinto Marcelli, who introduced us into the lichen taxonomy, in particular to the wonderful and intriguing world of the *Parmeliaceae*.

***Vainia pernambucana* M.L.L. Buril, Marcelli & B.R. Hora, sp. nov.**

Holotype: Brazil, Pernambuco State, Buíque Municipally, Parque Nacional do Vale do Catimbau, caatinga, saxicolous, *M.L.L. Buril* 736, 14-VIII-2012 (SP 466042). MycoBank 811350.

Thallus saxicolous, whitish gray, sublustrous, subvelvety at 10×, subsatin at 20×, satin above 30×, 5.5 cm broad, subcoriaceous, lacinate. **Laciniae** anisotomic dichotomous, 1.0–2.0 mm wide, imbricate to laterally overlapping, adnate; longitudinal axis undulate; transversal cut convex to concave, border coplanar; upper surface firm, continuous; few transversal cracks not branched, cicatrized; strongly crumpled on proximal part to slight crumpled on distal part, pruina absent, macule absent; lateral margin smooth, repand, closed; black line absent; cilia absent; apical zone descendant, apex truncate, coplanar; axils oval to elliptic, a few quadratic; secondary laciniae absent. Lacinules on proximal part, overlapping on the laciniae, at first spatulate, rarely ramified, 0.5–0.8 × 0.7–1.3 mm. Lacking pustules, soredia, and isidia. **Medulla** white in upper 1/3 and salmon in lower 2/3, pigment reacting K+ red, compact. **Lower surface:** apical zone brown, lustrous, sub velvety at 10×, subsatin at 20×, satin above 40×; attenuated limit, papillate, without rhizines; proximal zone black, subopaque, velvety at 10×, subsatin at 20×, satin above 30×, continuous, rugulose. **Rhizines** black, pigment absent, sublustrous, cosatin, curved, interlaced, not gummed, anastomosed, simple to furcate, first branched after 1/3 of length, abundant. **Apothecia** cupuliform, very young, immature. **Pycnidia** laminal, immerse, ostiole black; conidia short filiform 2.5–3.75 × 1.25 µm.

Chemistry: cortex K-, UV+ yellow; white medulla K+ yellow, salmon medullar pigment K+ red, C+ faint rose, KC-, P-, UV-.

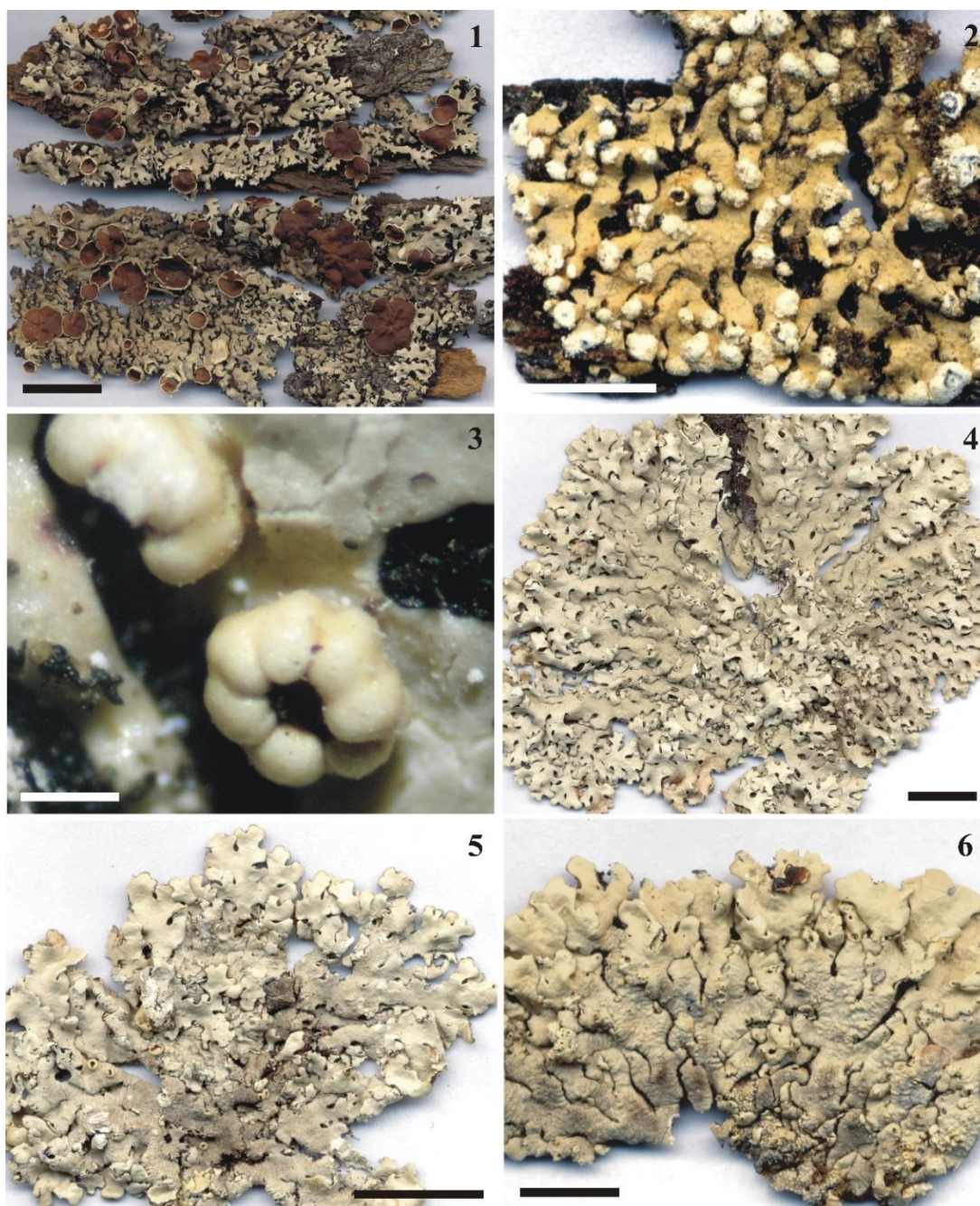
Distribution: Only the type known.

Comments: *Vainia pernambucana* is saxicolous, sublustrous, and has the satin characterized above 30×; the with laciniae are anisotomic dichotomous and imbricated to lateral overlapped; the upper surface is strongly crumpled on proximal part and slight crumpled on distal part; the medulla is characteristically white on upper 1/3 and salmon on the lower 2/3; the lower surface present an apical zone brown; the rhizines are curved, interlaced, anastomosed, simple to furcated; the apothecia are cupuliform when young and the conidia are filiform 2.5–3.75 × 1.25 µm.

V. pernambucana is similar to *V. marcellii* in lacking pustules, soredia, and isidia; however *V. marcellii* has a lustrous thallus, the laciniae laterally overlapped, the upper surface smooth to slight crumpled, the salmon part of the medulla reacting K+ purple, the rhizines till 3 times branched, and the conidia longer (3.75–) 5–6.25 μm .

For comparison with *V. extraterrestris* see the comments under that species.

The epithet is a reference to the Pernambuco State, northeastern Brazil, where the specie was collected.



Figures 1-6. Holotypes. 1. *Vainia vainioi*. 2. *V. adaffinis*. 3. *V. adaffinis*, detail of apothecia. 4. *V. extraterrestris*. 5. *V. marcellii*. 6. *V. pernambucana*. (scales: 1-2-4-5= 10 mm; 3-6= 5 mm).

Key to species of *Vainia*

- 1a. Soredia present 2. *V. adaffinis*
 1b. Soredia absent 2
 2a. Medulla white with spots of a pigment cream yellowish K- near the lower cortex, corticolous 1. *V. vainioi*
 2b Medulla white above, pigment salmon K+ near the lower cortex, saxicolous.....3
 3a. Pigment reacting K+ red, satin above 40×or 30× 4
 3b. Pigment reacting K+ purple, satin above 30× 5 *V. marcellii*
 4a. Satin above 40×, upper surface slightly rugulose to crumpled, conidia 3.75–5 µm long 4. *V. extraterrestris*
 4b. Satin above 30×, upper surface strong crumpled on proximal part and slight crumpled distal part, conidia 2.5–3.75 µm long 3. *V. pernambucana*

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Conclusões Gerais

Hypotrachyna é um gênero polifilético que precisa de uma nova circunscrição para acomodar melhor as espécies pertencentes a esse grupo.

Uma nova circunscrição foi proposta restringindo *Hypotrachyna* às espécies próximas de *H. brasiliana*, espécie tipo do gênero, que produzem liquexantona associada com ácido protocetrárico, tendo talo tipicamente laciniado e muito ramificado dicotomicamente, sem cílios, com lado de baixo totalmente negro, sem zona apical; as rizinas são esparsas, pouco ramificadas, eretas e nunca curvadas; os apotécios são de laminais a subapicais com ascósporos elipsoides com cerca de 8–12 × 4–8 μm, e conídios provavelmente exclusivamente, bifusiformes (os conídios precisam ser confirmados em revisão dos tipos).

Depois da determinação da nova circunscrição de *Hypotrachyna* tornou-se necessária a criação de novos gêneros para acomodar as espécies que não se adequavam a nova circunscrição. Para tanto, foram sugeridos quatro novos gêneros segregados de *Hypotrachyna* s.l.: *Hypotrachynella*, *Lyngenella*, *Martiana* e *Vainia*.

Para a criação dos gêneros foi necessária a atualização constante do protocolo GEL onde foram acrescentadas novas características e aprimoramento da definição de outras já estabelecidas, como o acetinado, a definição de cílios, a ramificação e conformação das rizinas, a autoincompatibilidade entre lacínios e/ou outras estruturas do talo, e a definição de lacínios primários e secundários e lacínulos.

Novas espécies foram descritas tanto para *Hypotrachyna* s.l. quanto para os novos gêneros

Segue abaixo a lista das 50 espécies estudadas e descritas em detalhe, com destaque **em negrito** para as 24 novas.

1. ***Hypotrachyna corrugata* B.R. Hora & Marcelli, sp. nov.**
2. *Hypotrachyna densirhizinata* (Kurok.) Hale
3. ***Hypotrachyna etii* B.R. Hora & Marcelli, sp. nov.**
4. *Hypotrachyna explendens* (Hale) Hale
5. ***Hypotrachyna fracta* B.R. Hora & Marcelli, sp. nov**
6. *Hypotrachyna gracilescens* (Vain.) Hale
7. ***Hypotrachyna iarae* B.R. Hora & Marcelli, sp. nov.**

8. *Hypotrachyna martiana* B.R. Hora & Marcelli, sp. nov.
9. *Hypotrachyna nashii* Marcelli & B.R. Hora, sp. nov.
10. *Hypotrachyna palui* B.R. Hora & Marcelli, sp. nov.
11. *Hypotrachyna protenta* Hale
12. *Hypotrachyna protentoides* B.R. Hora & Marcelli, sp. nov.
13. *Hypotrachyna serrana* Marcelli & B.R. Hora, sp. nov.
14. *Hypotrachyna vexillina* B.R. Hora & Marcelli, sp. nov.
15. *Hypotrachynella caapora* Marcelli & B.R. Hora, sp. nov.
16. *Hypotrachynella chlorocarpa* (Mull. Arg.) Marcelli & B.R. Hora, comb. nov.
17. *Hypotrachynella everniaeformis* (A. Zahlbr.) Marcelli & B.R. Hora, comb. nov.
18. *Hypotrachynella marcellii* B.R. Hora, sp. nov.
19. *Hypotrachynella mogiana* B.R. Hora & Marcelli, sp. nov.
20. *Hypotrachynella multifida* (Mull. Arg.) B.R. Hora & Marcelli, comb. nov.
21. *Hypotrachynella neodissecta* (Hale) B.R. Hora & Marcelli, comb. nov.
22. *Hypotrachynella oreadica* B.R. Hora & Marcelli, sp. nov.
23. *Hypotrachynella puiggarii* Marcelli & B.R. Hora, sp. nov.
24. *Hypotrachynella subpluriformis* (Zahlbr.) B.R. Hora & Marcelli, comb. nov.
25. *Lyngenella dactylifera* (Vain.) B.R. Hora & Marcelli, comb. nov.
26. *Lyngenella damazioi* B.R. Hora & Marcelli, sp. nov.
27. *Lyngenella immaculata* (Kurok.) B.R. Hora & Marcelli, comb. nov.
28. *Lyngenella klauskalbii* (Sipman, Elix & T. Nash) B.R. Hora & Marcelli, comb. nov.
29. *Lyngenella livida* (Taylor) Marcelli & B.R. Hora, comb. nov.
30. *Lyngenella novella* (Vain.) B.R. Hora & Marcelli, comb. nov.
31. *Lyngenella osseoalbida* (Lyng.) B.R. Hora & Marcelli, comb. nov.
32. *Lyngenella palmarum* (Lyng.) B.R. Hora & Marcelli, comb. nov.
33. *Lyngenella perexigua* (Marcelli & Ribeiro) B.R. Hora & Marcelli, comb. nov.

34. *Lyngenella regis* (Lyngé) B.R. Hora & Marcelli, comb. nov.
35. *Lyngenella subsipmanii* B.R. Hora & Marcelli, **sp. nov.**
36. *Lyngenella virensica* (Elix, T. Nash & Sipman) B.R. Hora & Marcelli, comb. nov.
37. *Martiana bogotensis* (Vain.) Marcelli & B.R. Hora, comb. nov.
38. *Martiana caparoensis* **B.R. Hora & Marcelli, sp. nov.**
39. *Martiana chicitae* (Hale) B.R. Hora & Marcelli, comb. nov.
40. *Martiana elixii* **B.R. Hora & Marcelli, sp. nov.**
41. *Martiana everniastroides* (Sipman) B.R. Hora & Marcelli, comb. nov.
42. *Martiana itatiaiaensis* **B.R. Hora & Marcelli, sp. nov.**
43. *Martiana nuda* **B.R. Hora & Marcelli, sp. nov.**
44. *Martiana rockii* (Zahlbr.) B.R. Hora & Marcelli, comb. nov.
45. *Martiana sipmanii* **B.R. Hora & Marcelli, sp. nov.**
46. *Vainia adaffinis* (Sipman) BR Hora & Marcelli, comb. nov.
47. *Vainia extraterrestris* **B.R. Hora & Marcelli, sp. nov.**
48. *Vainia marcellii* **BR Hora & L. Buril, sp. nov.**
49. *Vainia pernambucana* **L. Buril, Marcelli & B.R. Hora, sp. nov.**
50. *Vainia vainioi* (Sipman, Elix & T. Nash) B.R. Hora & Marcelli, *comb. nov.*

Outras sete espécies estavam colocadas em sinonímia e foram aceitas como espécies validas. Algumas delas foram elevadas de variedade a espécie:

51. *Hypotrachynella chlorocarpa* (Mull.Arg.) Marcelli & B.R. Hora
52. *Hypotrachynella everniaeformis* (Zahlbr.) Marcelli & B.R. Hora
53. *Hypotrachynella multifida* (Mull.Arg.) B.R. Hora & Marcelli
54. *Hypotrachynella subpluriformis* (Zahlbr.) B.R. Hora & Marcelli
55. *Lyngenella osseoalbida* (Lyngé) B.R. Hora & Marcelli
56. *Lyngenella perexigua* (Marcelli & Ribeiro) B.R. Hora & Marcelli

57. *Lyngenella regis* (Lyngé) B.R. Hora & Marcelli

Além destas foram recombinaadas 9 espécies nos novos gêneros, cujos tipos ainda não tivemos acesso e, portanto, não foram descritas de acordo com nosso protocolo:

58. *Hypotrachynella osorioi* (Hale) Marcelli & B.R. Hora

59. *Hypotrachynella pluriformis* (Nyl.) B.R. Hora & Marcelli

60. *Hypotrachynella revoluta* (Flörke) Marcelli & B.R. Hora

61. *Lyngenella osseoalba* (Vain.) B.R. Hora & Marcelli

62. *Lyngenella polydactyla* (Krog & Swinscow) Marcelli & B.R. Hora

63. *Lyngenella pustulifera* (Hale) Marcelli & B.R. Hora

64. *Lyngenella subformosana* (Elix, T.N. Nash & Sipman) B.R. Hora & Marcelli

65. *Martiana pulvinada* (Fée) Marcelli & B.R. Hora

66. *Martiana taylorensis* (Mitch.) B.R. Hora & Marcelli

O gênero *Hypotrachyna* s. l. está longe de uma solução. Novos gêneros certamente serão segregados em futuro próximo e muitas novas espécies esperam para serem descritas no Brasil.

ANEXO 1

**Protocolo para análise de espécimes de
Parmeliaceae utilizado pelo GEL**

Hypotrachyna sp. Autor(es)

Bibl. 2012 (tese): 99.

data de descrição: / / 2014.

Autor da descrição: xxxxxx

Outros nomes mencionados na etiqueta (com autor e data):

Dados de Etiqueta

Local de depósito: XX (holotipo); XX (isotipo)

Tipo de tipo (conforme etiqueta): holotipo, isotipo, etc

Coletor: Xxxxx nº xx

Data de coleta: / / .

Local:

Substrato:

frase anotada:.

observado (se diferente ou não anotado):

Escaneado? Não, Sim Data: / / 20.

Fotos? Não, Sim Data: / / 20 .

Anotações pertinentes na exsicata: não há.

Montagem, estado e composição do material:

Reações de spot anotadas (com autor e data):

Metabólitos secundários anotados (com autor e data):

Medidas de ascósporos, conídios e anatomia anotados (com autor e data):

Outras observações (inclusive outros nomes na exsicata): estéril

Graus de abundância (exemplo para cílios; vale para outras coisas):

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

DESCRIÇÃO**TALO**

- substrato,
- cor (parte distal e proximal),
- brilho → lustroso / sublustroso / opaco / aveludado / outro (parte distal e proximal)
- acetinado → aveludado / subaveludado / subacetinado / acetinado → a 10×, a 20×, a 30× (caso ainda não seja acetinado a 30, verificar a 40 e 50×)
- hábito: laciniado/lobado,
- integridade → íntegro / demidiado (com o centro morto) / autoincompatível
- textura: membranáceo, pergamináceo, coriáceo
- xx cm de tamanho,

;

lacínios/sublacínios/lobos

- autoincompatibilidade → não / sim / cor das partes mortas / descrição das partes mortas;
- integridade → íntegros / segmentados (comprimento dos segmentos)
- ramificação (comprimento) → curta / longa (se longa, medir entrenós)
- ramificação (padrão) → dicotômica (anisotômica/isotômica) / simpodial / irregular / lacerada / outra
- axilas → redondas / ovaladas / auriculadas / agudas / quadráticas / irregulares / rasgadas / outro
- **base** xx mm larg.,
- **maior largura**,
- **comprimento** ca. xx mm (no caso de talos demidiados) / cor das partes mortas,
- disposição → espalhados / contíguos / sobrepostos lateralmente / amontoados / contrapostos / encavalados / outro
- adnação → adnatos / frouxo adnatos / conformados ao substrato / elevados/ revolutos,
- **eixo longitudinal** → distendido / ascendente / ondulado / outro
- **corte transversal** → côncavo / plano / convexo / parte um, parte outro (descreva) / outro
- corte transversal (ascendência da borda) → coplanar / ascendente / descendente / involuta / revoluta / outra
- **superfície** (resistência) → firme, quebradiça (descreva BEM)
- superfície (continuidade) → contínua / reticulada / quebrada / outro

- superfície (relevo) → lisa / amarrotada / escrobiculada / foveolada / rugosa / verrucosa / outra
- **pruína** → presença, distribuição
- **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 / outro
- margem lateral (integridade) → fechada / aberta (descrever processo e possível associação com estruturas vegetativas ou reprodutivas) --- verificar também margem apical
- **linha negra** → presença, espessura e variação no talo
- **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
-

;

lacínios/sublacínios/lobos secundários

- presença
- origem → marginais nos... (descreva locais e idades) / outro
- ramificação → dicotômica (anisotômica/isotômica) / simpodial / irregular / lacerada / 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?

;

lacínulos / lóbulos

- presença
- cor → concoloridos / outro
- distribuição
- ramificação;
- xx–xx × xx–xx mm,
- conformação (lâmina e ápice) → lâmina plana / canaliculada / outro, 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
- modo de desenvolvimento,
- outra característica relevante (veja lista das características de lacínulos e lobos, acima; anote qualquer coisa diferente)

;

máculas e pseudomáculas

- ausentes ou fracas/distintas,
- puntiformes / lineares / reticulares / efiguradas / outro
- distribuição
- verificar se originam quebras / pseudocifelas / sorédios / pústulas / etc.

;

CÍLIOS

- presença,
- 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 (não esquecer de verificar também as rizinas!)
- 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 (descreva muito bem; terminologia a ser melhorada)
- xx-xx × xx-xx mm,
- ascendência → praticamente eretos / ascendentes / coplanares ao lobo (lacínio, etc) / descendentes / funcionando como rizinas / outro (descrever MUITO bem)
- ramificação simples / furcados / irregularmente ramificados / cespitosos / dicotômicos (tipo) / esgarçados / fibrilosos / outro
- abundância → raros / poucos / frequentes / abundantes / densos / contíguos
- distribuição → em toda a margem / axilas das crenas / axilas dos lobos / etc etc etc.

;

PÚSTULAS

- presença
- abundância
- forma,
- confluência → mencionar se eles se fundem ao crescerem, como e quanto,
- distribuição,
- tamanho
- erupção → erupcentes / não erupcentes
- íntegras / rebentam em (erupcentes)... / se desmancham em / etc (descreva MUITO bem toda a ontogenia)
- origem e desenvolvimento
- caducas → não / sim (descrever processo e consequências)
- pigmento K+ ou K- (verifique a medula dentro e abaixo procurando pigmentos)
- **NÃO SE ESQUEÇA DE VERIFICAR AS REAÇÕES DO INTERIOR DA PÚSTULA**

;

SORAIS E SORÉDIOS

OBS.: CUIDADO - sorais são por definição áreas delimitadas e, portanto, um soral não pode ser "extensivo", que não é uma forma definida; nesse caso adaptar a descrição para falar apenas dos sorédios e não dos sorais.

SORAIS

- presença
- 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 (mm),
- 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)
- 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) → na borda de placas corticais / interplacas corticais / microsinuosidades marginais nos ... / não é necessário mencionar (não adiciona coisa alguma à descrição dos sorais) / outro (não tenha preguiça; observe muito bem esta característica)
- ontogenia:
- **NÃO SE ESQUEÇA DE VERIFICAR AS REAÇÕES DE SPOT DO SORAL**

;

ISÍDIOS

- presença
- cor → da base / do ápice
- brilho → lustrosos / opacos / outro
- abundância
- 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 / 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 não contemplados na descrição 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 /
- forma - curvatura → retos / curvos (descrever) / sinuosos / outro (sempre 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** → constricta / não constricta (dica: normalmente os de base constricta deixam uma cicatriz ao cair, os de base não constricta deixam a sua base no talo ao caírem; i.e. procure os vestígios e pense)
- ramificação → simples / ramificados (descrever e quantificar as ramificações) / antleriformes / coraloides / coplanar / 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 BEM a quantidade, disposição, tamanho e outros atributos dos cílios)
- eretos / procumbentes,
- descrever de forem sorediados, pustulados, se desenvolverem lóbulos, etc.
- origem e desenvolvimento (DETALHADO)
- autoincompatibilidade → se presente, afeta produção, coloração ou ramificação dos isídios? Como?;

;

OUTRA ORNAMENTAÇÃO (SÓ MENCIONAR SE PRESENTE): lóbulos, filídios, dáctilos, esquizídios, etc etc etc (verificar os mesmos atributos de sorais e isídios);

.

MEDULA

- cor → branca / amarelo claro ou forte / salmão / ocre/ marrom,
- bicolorida ? → citar proporção (em espessura) e distribuição das cores,
- **pigmento** → ausente/ presente (se presente descrever detalhadamente a disposição),
- 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

Zona marginal (região distal; delimitada pela cor e não pela presença de rizinas)

- cor → marrom / negra / branca / marfim / variegada (dizer como) / outra
- brilho → lustroso / sublustroso / opaco / aveludado / outro
- acetinado acima de xx ×
- largura (mm)
- limite → atenuado / nítido
- relevo → lisa / papilada / amarrotada / rugosa / rugulosa / verrucosa / verruculosa / venada / papilada / etc. etc. etc.;
- presença de papilas → papilado (abundância, cor - anote a diferença de cor entre base e ápice, se houver)
- presença de rizinas → rizinado / errizinado

;

Parte proximal

- cor → marrom / negra / branca / marfim / variegada (dizer como) / outra
- brilho → lustroso / sublustroso / opaco / aveludado / outro
- acetinado acima de xx ×
- continuidade → contínua / fendida (descrição: abundância, disposição, ramificação, cicatrização, elevação das margens, etc.)
- relevo da superfície → lisa / papilada / amarrotada / rugosa / rugulosa / verrucosa / verruculosa / venada / papilada / etc. etc. etc.;

;

Rizinas (descrever relação de distribuição com a margem e a borda)

- presença → ausentes / ausentes da zona marginal (xx mm) / presentes inclusive na zona marginal / outro
- dimorfismo → monomórficas / dimórficas (descrever os dois tipos em detalhe e a distribuição relativa deles : se misturados, se regionalizados - como?)
- cor → negras / concoloridas / base isso ápice aquilo / etc etc 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
- acetinado acima de xx ×
- ramificação → simples / furcadas/ trifurcadas / irregularmente ramificadas/ dicotômicas / dendroides / esgarçadas / fibrilosas / palmadas / fasciculadas / mistura do quê com quê em que proporção / etc etc etc
- ramificação → arbusculares / coplanares / etc
- altura do primeiro ramo → desde a base / desde próximo à base / após 1/3 / após metade da altura / após 2/3 / etc.
- ramificação (número, quando mais que furcadas) → de .. a .. / mais que ... / pelo menos ...
- forma → retas / sinuosas / curvadas / crespas / outro
- orientação → eretas / inclinadas / recurvadas / tombadas em direção ao centro / outro
- agregação → isoladas / aglutinadas / emaranhadas / ápice emaranhado / "lambidas" (ainda sem nome; parecem que foram lambidas, com aparência molhada e coladas, ou quase, ao lado de baixo)

- afilamento → subuladas / cilíndricas / (descreva muito bem) (terminologia a ser estabelecida; não está bom assim)
- tamanho → monométricas / dimétricas / outro
- xx-xx × xx-xx mm,
- abundância → raras / poucas / frequentes/ abundantes/ formando tomento,
- distribuição → homoganeamente distribuídas / agrupadas (onde? grupo de quantas?)

REPRODUÇÃO INDIRETA

apotécios ausentes, presentes

picnídios ausentes, presentes

APOTÉCIOS

- forma → planos/ côncavos/ bulados / sub-bulados / cupuliformes (taça de conhaque) / infundibuliforme (taça de martini, funil) / gomado (verticalmente vincados, em forma de moranga, como tendo gomos) / convexos,
- xx-xx mm diâm.,
- adnação → adnatos / subpedicelados / pedicelados / subbulados / bulados / outro,
- disposição → laminais / submarginais/ sub terminais / no ápice de lacínios / outro,
- ;
- **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. etc. 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 (medir)
- 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, entendeu?]
- margem (ornamentação) → nua / coronada / ciliada / pustulada / isidiada / lobulada / sorediada (descrever com MUITO detalhe)
- ;
- **anfitécio** (relevo) → liso / vincado / rugoso / amarrotado / escrobiculado / etc etc etc (descrever do alto para a base, onde se inicia e termina o relevo; associe também com a idade do apotécio)
- anfitécio (maculação) → emaculado / maculado (descrever, inclusive distribuição)

- anfitécio (ornamentação) → não ornamentado / isidiado / sorediado / ciliado / rizado / escábrido / pustulado (descrever em DETALHE, inclusive distribuição)
- ;
- **estipe** (posição) → central / excêntrico
- estipe → xx-xx × xx-xx mm (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 etc etc
- estipe (maculação) → emaculado / maculado (descrever, inclusive distribuição)
- estipe (ornamentação) → não ornamentado / isidiado / sorediado / ciliado / pustulado (descrever em DETALHE, inclusive distribuição),
- **NÃO SE ESQUEÇA DE VERIFICAR AS REAÇÕES DE SPOT DA MEDULA DO ANFITÉCIO, DA BASE DO APOTÉCIO E DA MEDULA DO ESTIPE**
- ;
- **epitécio** xx μm, formado por...
- ;
- **himênio** xx μm alt.
- ;
- **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

- quantidade por asco → 8/asco ; 16/asco
- forma → 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.
- anotar presença de gúttulas → uniguttulado / biguttulado / gúttulas ausentes / etc

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
- forma → retos / ligeiramente curvados / curvados / outros

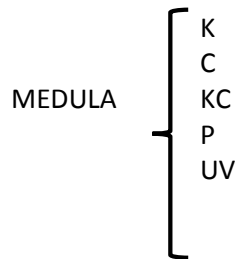
xx-xx × ca. xx μm.

TESTES DE COLORAÇÃO

- se a medula for bicolorida, fazer as reações em ambas e mencionar

- não esqueça dos sorais, apotécios e outras partes, onde as reações podem ser diferentes.
- NÃO SE ESQUEÇA DE VERIFICAR AS REAÇÕES DE SPOT DA MEDULA DO ANFITÉCIO, DA BASE DO APOTÉCIO E DA MEDULA DO ESTIPE.
- use esta seta se necessário: →
- não esqueça de anotar reações do tipo: branco leitoso, amarelo leitoso, buraco, bolhas, gelificação, limpeza (some o conteúdo e fica apenas a esponja do micélio), etc...

CÓRTEX SUPERIOR K, P, UV



AMOSTRADO PARA QUÍMICA: SIM / NÃO

Substâncias de importância taxonômica: após TLC

Descrições e informações existentes na literatura, internet, teses, etc. (cole aqui o protólogo, descrições, ilustrações, comentários e/ou trechos retirados de outros trabalhos para comparação). Isso toma tempo, mas vai ser de uma ajuda inestimável. Não se esqueça de anotar a referência completa de forma a poder ser mencionada em qualquer bibliografia no futuro.