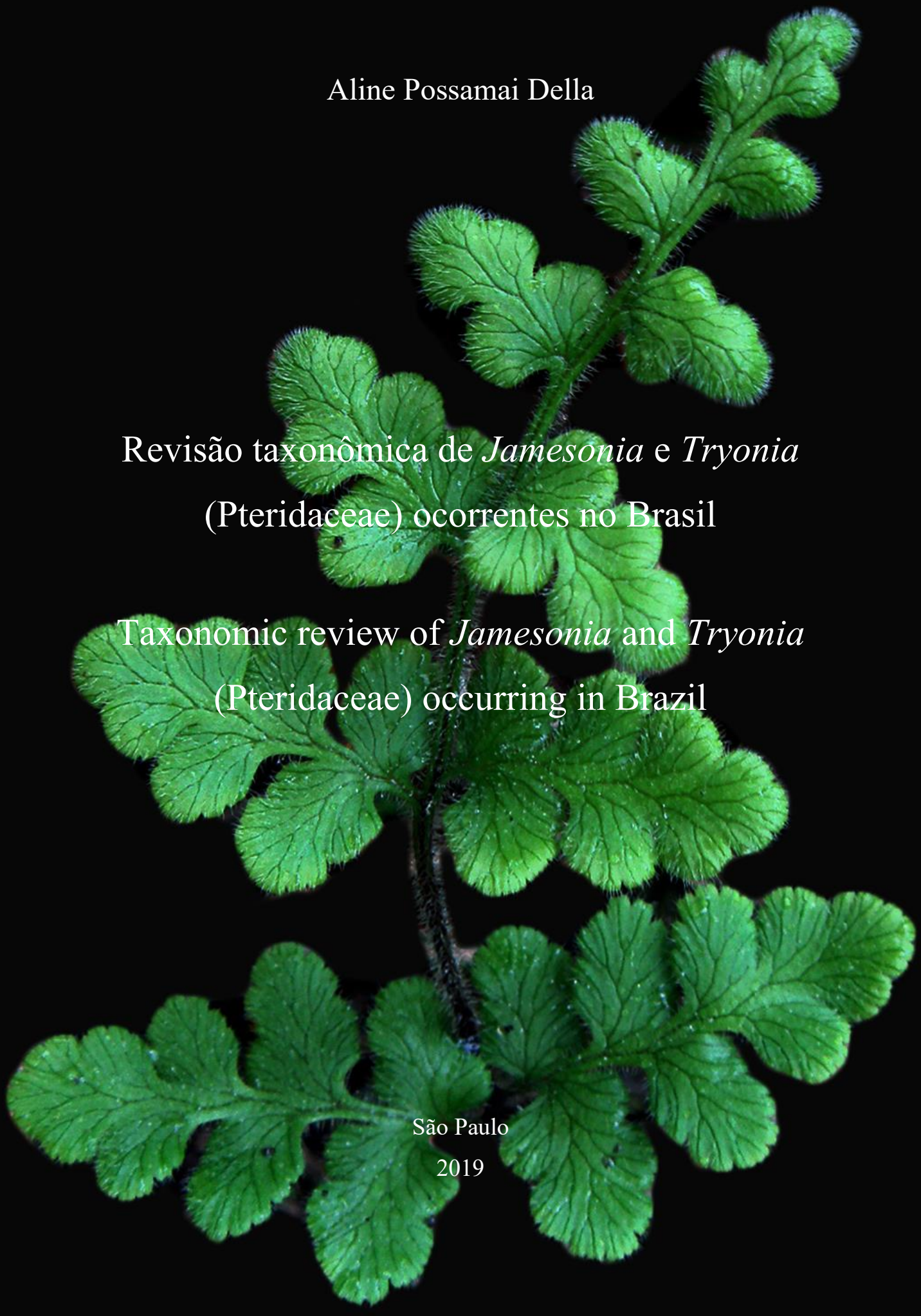
Aline Possamai Della



Revisão taxonômica de *Jamesonia* e *Tryonia* (Pteridaceae) ocorrentes no Brasil

Taxonomic review of *Jamesonia* and *Tryonia* (Pteridaceae) occurring in Brazil

São Paulo
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Dissertação apresentada ao Instituto de Biociências da Universidade de São Paulo, para a obtenção de Título de Mestre em Ciências Biológicas, na Área de Botânica.

Orientador: Dr. Jefferson Prado

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Prof. Dr. Jefferson Prado

Orientador

Dedicatória

Dedico este trabalho aos meus pais,

Rui e Albertina

Epígrafe

"Ninguém ignora tudo. Ninguém sabe tudo. Todos nós sabemos alguma coisa. Todos nós ignoramos alguma coisa. Por isso aprendemos sempre".

Paulo Freire

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Índice

Introdução Geral

Pteridaceae E.D.M.Kirchn. é a terceira maior família de samambaias homosporadas (Sánchez-Baracaldo 2004b), com 53 gêneros e 1211 espécies (PPG I 2016), o que equivale a cerca de 10% das samambaias leptosporangiadas atuais (Schuettpelz *et al*. 2007). Está distribuída pelo mundo inteiro (cosmopolita), mas concentra-se especialmente em regiões úmidas tropicais e áridas (Sánchez-Baracaldo 2004b, Prado *et al.* 2007), onde ocupa uma ampla variedade de hábitats (áreas abertas, ambientes rochosos, aquáticos e mangues), incluindo espécies terrícolas, rupícolas, epífitas e aquáticas (Prado *et al.* 2007, Schuettpelz *et al*. 2007). No Brasil, ocorrem 23 gêneros e 198 espécies distribuídas em todos os domínios fitogeográficos (Prado 2015, Flora do Brasil 2020, em construção), sendo, portanto, a família de samambaia mais diversa do nosso país (Prado *et al*. 2015).

Essa família apresenta morfologia muito diversificada, sendo difícil distingui-la através de uma única característica (Prado 2005). Assim, como caracteres diagnósticos podemos destacar os esporângios localizados na face abaxial dos segmentos ao longo das nervuras, ou na margem da lâmina foliar, sendo frequentemente protegidos pela margem reflexa da lâmina (pseudoindúsio), ou ainda cobrindo toda face abaxial da lâmina (Sehnem 1972, Tryon & Tryon 1982, Schuettpelz *et al*. 2007); e pelo número de cromossomos, com n = 29 ou 30, ou múltiplos desses (Tryon & Tryon 1982, Schuettpelz *et al*. 2007).

Em função da ampla disparidade ecológica, bem como morfológica a classificação dessa família tem sido muito controversa, com circunscrição de táxons divergentes entre os autores (Prado *et al*. 2007, Schuettpelz *et al*. 2007). A família já compreendeu duas tribos, Lonchitideae e Pterideae, que englobavam alguns gêneros de Dryopteridaceae, Dennstaedtiaceae e Tectariaceae (Ching 1940). Posteriormente, esses táxons foram segregados e as tribos deixaram de ser reconhecidas por Copeland (1947), para compreenderem cerca de 10 famílias distintas por Pichi Sermolli (1982). Tryon & Tryon (1982) voltaram a reconhecer tribos dentro da família (Adianteae, Ceratopterideae, Cheilantheae, Platyzomateae, Pterideae e Taenitideae), as quais foram elevadas a subfamílias por Tryon (1986): Adiantoideae, Ceratopteridoideae, Cheilanthoideae, Platyzomatoideae, Pteridoideae e Taenitidoideae. As circunscrições até esse momento eram baseadas apenas em caracteres morfológicos.

A partir do final dos anos 90 e início dos anos 2000, houve um crescente aumento em filogenias moleculares, as quais serviram de base para classificações subsequentes. Nesse sentido, podemos destacar a importante classificação proposta por Smith *et al*. (2006) para samambaias, que reconheceu cinco grupos monofiléticos dentro de Pteridaceae. Estes podem ser reconhecidos no nível de família ou de subfamília: Parkeriaceae ou Parkerioideae, Adiantaceae ou Adiantoideae, Cryptogrammaceae (sem subfamília definida), Sinopteridaceae ou Cheilanthoideae, Pteridaceae *s.str.* ou Pteridoideae. Christenhusz & Chase (2014), também com base em dados morfológicos e moleculares, consideraram cinco subfamílias, sendo elas: Cryptogrammoideae, Ceratopteridoideae, Pteridoideae, Cheilanthoideae e Vittarioideae. E em 2016, foi publicado o Pteridophyte Phylogeny Group (PPG I), a classificação mais recente das licófitas e samambaias, que igualmente reconheceu cinco subfamílias dentro de Pteridaceae: Parkerioideae, Cryptogrammoideae, Pteridoideae, Vittarioideae e Cheilanthoideae.

Apesar da falta de consenso na circunscrição e no status hierárquico do grupo no nível infra-família, como demonstrado em parágrafos acima, Pteridaceae é considerado um grupo monofilético (Smith *et al*. 2006, Prado *et al*. 2007, Schuettpelz & Pryer 2007, PPG I 2016). A subfamília Pteridoideae também tem se configurado como monofilética em diversos trabalhos (Cochran *et al*. 2014, PPG I 2016, Zhang *et al.* 2017). No entanto, apresenta difícil circunscrição morfológica, abrangendo atualmente 14 gêneros e cerca de 400 espécies, as quais ocorrem em ampla variedade de hábitats.

Inclusos em Pteridoideae estão os gêneros neotropicais *Jamesonia* Hook. & Grev. e *Eriosorus* Fée, que foram agrupados, em função de estudos filogenéticos realizados com base na análise de dados moleculares mostrarem que conjuntamente formam um grupo monofilético; quando tratados separadamente *Jamesonia* seria polifilético e *Eriosorus* parafilético (Sánchez-Baracaldo 2004a). Assim, reconhece-se apenas *Jamesonia*, uma vez que este gênero foi descrito antes de *Eriosorus*, sendo, portanto, o nome mais antigo e o que tem prioridade. Essa subfamília também abrange o gênero *Tryonia* Schuettp. *et al*., que foi recentemente descrito, a partir da segregação de alguns táxons, que antes compunham *Eriosorus*, também a partir de análises filogenéticas com dados moleculares.

A seguir será apresentado de forma resumida um histórico dos gêneros *Jamesonia*, *Eriosorus* e *Tryonia*. Para um histórico mais completo dos dois primeiros gêneros, veja Tryon (1962, 1970).

Jamesonia Hook. & Grev.

William Hooker & Robert Greville descreveram o gênero *Jamesonia* em 1830 na obra intitulada *Icones Filicum*, baseados na coleta do naturalista William Jameson, realizada nos Andes. Esses autores atribuíram esse nome ao gênero em homenagem ao coletor, sendo descrita nessa obra apenas *J. pulchra* (espécie tipo do gênero). Alguns anos mais tarde, Gustav Kunze descreveu quatro novas espécies de *Jamesonia* para os Andes no *Die Farrnkraüter* (1846), apresentando muitos detalhes morfológicos.

Johann F. Klotzsch no seu estudo da flora da região equatorial do Novo Mundo (1847), considerou *Jamesonia* como uma seção de *Gymnogramma*. Nesse período, o gênero *Gymnogramma* era composto por seis seções (*Ceratopteris*, *Eriosorus*, *Gymnogramma*, *Jamesonia*, *Neurogramma* e *Pleurosorus*). A partir de coletas realizadas na Venezuela e Colômbia para a *Florae Columbiae* (1862–1965), Hermann Karsten descreveu cinco novas espécies, destacando aspectos químicos.

Subsequentemente, William J. Hooker, no quinto volume do seu *Species Filicum* (1864), promoveu a maior mudança na circunscrição de *Jamesonia*, ao reconhecer uma única espécie, *J. imbricata*, com quarto variedades. Maximilian Kuhn alterou isso no seu trabalho intitulado *Chaetopterides* (1882), onde ele voltou a reconhecer a existência de seis espécies de *Jamesonia*. Além disso, esse autor juntou algumas seções de *Gymnogramma* (entre elas a seção de *Jamesonia*) para compor um novo gênero *Psilogramme.*

Anos depois, Ludwig Diels no seu estudo de Polypodiaceae (1899) no *Die Natürlichen Pflanzenfamilien* voltou a reconhecer o gênero *Jamesonia*, com a existência de oito espécies. O nome *Jamesonia* foi amplamente usado posteriormente, na classificação de *Filicinae* (1938) de Carl Christensen, no *Genera Filicum* (1947) de Edwin B. Copeland, e em outros estudos.

Em 1962, Alice F. Tryon publicou sua monografia do gênero *Jamesonia*, onde ela apresentou uma extensiva revisão taxonômica das 19 espécies de *Jamesonia* consideradas até aquele momento. Sendo a maioria dessas espécies encontradas nos Andes (Sánchez-Baracaldo 2004a)

Depois da publicação da monografia de Tryon (1962), Nakazato & Gastony (2003) combinaram a espécie *Anogramma osteniana* Dutra no gênero *Jamesonia*, a partir de analises filogenéticas incluindo dados moleculares (usando o marcador plastidial *rbcL*).

Até esse momento, *Jamesonia* era morfologicamente caracterizado por frondes lineares, geralmente indeterminadas, pinadas, densamente tomentosas, com pinas

geralmente inteiras e imbricadas, e pelos esporângios protegidos pela margem reflexa da pina (Tryon 1962).

Eriosorus Fée

A espécie mais antiga descrita para o gênero *Eriosorus* foi tratada inicialmente como *Grammitis cheilanthoides* por Olof Swartz (1806), baseado em uma coleta realizada na Ilha de Tristão da Cunha, por Aubert du Petit-Thouars em 1793. Posteriormente, Niçaise Desvaux (1827) combinou essa espécie para o gênero *Gymnogramma*, e descreveu outros dois táxons similares com base nas coletas dos naturalistas Alexander von Humboldt e Aimé Bonpland, realizadas em Caracas na Venezuela.

Em 1852, Antoine L. Fée reconheceu esses táxons como distintos de *Gymnogramma,* e propôs o gênero *Eriosorus* para acomodá-los, com base nos esporângios sem indúsio e dispostos ao longo das nervuras. Nessa época, muitos táxons que posteriormente seriam incorporados em *Eriosorus* foram descritos como parte de *Anogramma* e Hemionitideae.

Depois da descrição do gênero *Jamesonia,* Gustav Kunze combinou *Gymnogramma* (aqui incluso *Eriosorus*) em *Jamesonia*, no seu trabalho intitulado *Farrnkraüter* (1846). Esse conceito foi aceito por menos de duas décadas, até o trabalho de Georg Mettenius, que em sua publicação *Filices* (1864) considerou *Jamesonia* como sinônimo de *Gymnogramma*.

Poucos anos depois, Maximilian Kuhn em seu trabalho intitulado *Chaetopterides* (1882), considerou *Jamesonia* e *Eriosorus* como parte de um novo gênero, *Psilogramme*. Em seu trabalho, ele tratou *Jamesonia* e *Eriosorus* em diferentes subgêneros. Entretanto, no *Genera Filicum* (1947), Edwin B. Copeland separou esses grupos e reconheceu novamente o nome *Eriosorus*, que foi amplamente aceito nas décadas seguintes.

Em 1970, Alice F. Tryon publicou sua monografia do gênero *Eriosorus*, onde ela apresentou uma extensiva revisão das 35 espécies consideradas até aquele momento. A autora em sua monografia comenta a intima associação de *Eriosorus* e *Jamesonia*, que pode ser evidenciada pela grande quantidade de híbridos formados entre espécies desses dois gêneros.

Depois da publicação da monografia de Tryon, novas espécies foram descritas, tais como: *Erosorus angustus*, *E. ascendens* e *E. madidiensis*, endêmicas da Bolívia

(Kessler & Smith 2007). Além disso, *E. areniticola*, endêmica do Brasil, que foi segregada de *E. myriophyllus* (Schwartsburd & Labiak 2008).

O conceito do gênero *Eriosorus*, até esse momento, era definido pela grande variedade morfológica da fronde, 1−6 pinada, com textura delicada, e pela margem das pinas planas, não involutas ou cobrindo os esporângios (Tryon 1970, Sánchez-Baracaldo 2004a, Cochran *et al*. 2014).

Recente circunscrição de *Jamesonia*

Como visto acima, alguns autores já haviam pontuado a íntima associação de *Jamesonia* e *Eriosorus*, baseados na morfologia e frequente formação de híbridos. Assim, com a inclusão de dados moleculares houve um avanço no entendimento dessa relação. Sánchez-Baracaldo (2004a) realizaram analises filogenéticas com dados moleculares obtidos do sequenciamento dos seguintes marcadores: ETS, *rps4* e *rps4-trnS* de 16 espécies de *Jamesonia* e 13 espécies de *Eriosorus*. Como resultado, essa autora obteve uma filogenia onde as espécies dos dois gêneros formavam um clado, bem sustentado (em análise de Parcimônia com valor de bootstrap: 100). Quando vistos de forma isolada, *Jamesonia* é polifilético, e *Eriosorus* é parafilético. Assim, as espécies de *Eriosorus* foram combinadas para *Jamesonia* (Christenhusz *et al.* 2011), uma vez que o último nome tem prioridade, porque é o mais antigo.

Depois da combinação das espécies de *Eriosorus* em *Jamesonia*, Pabón-Mora & González (2016) combinaram a espécie *Nephopteris maxonii* Lell. para o gênero *Jamesonia*. Eles empregaram analises filogenéticas baseadas em dados moleculares (*atpA*, *chlL*, *rbcL* e *rps4*), e constataram que *N. maxonii* forma um clado bem sustentado (em análise de Parcimônia com valor de bootstrap: 100), com outras espécies de *Jamesonia*.

No mesmo ano, Boudrie & Cremers (2016) realizaram a combinação de duas variedades da espécie *Eriosorus paucifolius* (A.C. Sm.) Vareschi em *Jamesonia* (*J. paucifolia* (A.C. Sm.) Christenh. var. *neblinae* (A.F. Tryon) Boudrie & Cremers and *J. paucifolia* (A.C. Sm.) Christenh. var. *steyermarkii* (A.F. Tryon) Boudrie & Cremers).

E mais recentemente, Rojas-Alvarado (2017a, b, 2019) descreveu três novas espécies (*Jamesonia erecta* A. Rojas, *J. panamensis* A. Rojas e *J. retroflexa* A. Rojas), e combinou outras três espécies (*J. galeana* (A.F. Tryon) A. Rojas, *J. glandulifera* (Hieron.) A. Rojas, *J. refracta* (Kunze ex Klotzsch) A. Rojas e *J. retrofracta* (Grev. & Hook.) A. Rojas) em *Jamesonia*. Essas espécies novas, no entanto, foram descritas e combinadas com base na revisão de poucos materiais, o que geram dúvidas acerca do

reconhecimento delas como táxons novos. Assim, hoje se reconhece cerca de 50 espécies de *Jamesonia*, por volta de uma dezena híbridos e algumas variantes morfológicas descritas por Tryon (1970), que podem corresponder a híbridos.

Distribuição de *Jamesonia*

Jamesonia, na atual circunscrição, ocorre do sul do México ao sudeste da Bolívia, no Brasil e no Uruguai, de 600 a 5000 metros de altitude (Tryon 1962, Tryon 1970, Tryon & Tryon 1982, Sánchez-Baracaldo 2004a). Apesar dessa ampla distribuição, esse gênero é mais frequente nos parámos andinos, um ecossistema caraterizado por ventos fortes, altos níveis de insolação, de umidade do solo e atmosférica, temperaturas frias (-2 °C até 12 °C), localizados em altitudes de 3200 a 5000 metros (acima da linha das árvores e abaixo da linha de neve permanente) (Tryon 1962, Tryon & Tryon 1982, Sánchez-Baracaldo 2004a, Sánchez-Baracaldo & Thomas 2014).

Os páramos andinos foram formados recentemente com a orogenia dos Andes, que ocorreu principalmente no Cenozoico. A orogenia e as mudanças glaciais (ciclos glaciais) foram responsáveis pela diversificação das linhagens presente nesses ecossistemas, o que pode explicar a grande quantidade de espécies endêmicas dessa região (Sklenár *et al.* 2011).

As espécies de *Jamesonia* presentes em áreas expostas dos páramos apresentam adaptações morfológicas, que as permitem sobreviver nas condições citadas acima, tais como: frondes reduzidas, pubescentes e coriáceas, com uma quantidade grande de pinas, e com crescimento indeterminado (não são totalmente desenvolvidas) (Sánchez-Baracaldo 2004a, Sklenár *et al*. 2011, Cochran *et al*. 2014, Sánchez-Baracaldo & Thomas, 2014). Múltiplas linhagens de *Jamesonia* obtiveram, por convergência evolutiva, essas características, que representam vantagem adaptativa para a ocupação dos páramos (Sánchez-Baracaldo & Thomas 2014). Esse gênero é também um exemplo potencial de recente radiação adaptativa, porque ele é morfologicamente e ecologicamente diverso e está presente em hábitats de origem recente (Sánchez-Baracaldo 2004a).

Sánchez-Baracaldo & Thomas (2014) apresentaram dois morfo-tipos para o gênero: o "morfo-tipo *Jamesonia*" e o "morfo-tipo *Eriosorus*", que estão correlacionados com o hábitat ocupado. O "morfo-tipo *Jamesonia*" que apresenta muitas frondes, pinas pequenas e frequentemente coriáceas, presentes geralmente em áreas expostas, em especial nos páramos. E o "morfo-tipo *Eriosorus*" que apresenta

poucas frondes, pinas longas e membranáceas, presentes em florestas nebulares e hábitats sombreados dos páramos (Sánchez-Baracaldo & Thomas 2014).

Segregação do novo gênero, *Tryonia* Schuettp., J. Prado & A.T. Cochran

Com as análises filogenéticas realizadas por Sánchez-Barcaldo (2004a), Prado *et al*. (2007) e Schneider *et al*. (2013), pode-se verificar que uma espécie de *Eriosorus* (*E. myriophyllus* (Sw.) Copel.) é mais relacionada com outras espécies da subfamília Pteridoideae, do que com aquelas de *Eriosorus* e *Jamesonia*. Essa espécie seria grupo irmão das outras espécies desses dois gêneros. Assim, Cochran *et al.* (2014) realizaram um estudo mais detalhado, baseado em quarto marcadores plastidiais (*atpA, chlL, rbcL* e *rps4*), objetivando compreender o real posicionamento de *E. myriophyllus*. Como resultado os autores verificaram que essa espécie e outras duas, anteriormente não amostradas, pertencentes a *Eriosorus* (*E. schwackeanus* e *E. areniticola*), são mais intimamente relacionadas a *Austrogramme* E. Fourn., *Pterozonium* Fée, *Syngramma* J. Sm. e *Taenitis* Willd. ex Schkuhr do que com *Jamesonia*.

Essa relação foi fortemente suportada e as implicações são significativas se o monofiletismo for um critério para a delimitação de gênero (Cochran *et al.* 2014). E dado que o tipo de *Jamesonia* saiu num clado "grande" com espécies desse gênero, bem como o tipo de *Eriosorus*, que também saiu num clado bem resolvido, um novo gênero foi proposto pelos autores, para acomodar esses táxons. Esse novo gênero não tem uma posição filogenética totalmente resolvida ainda, mas parece corresponder a um grupo monofilético (Cochran *et al.* 2014).

Tryonia compreende quarto espécies: *T. areniticola* (Schwartsb. & Labiak) Schuettp. *et al.* (endêmica do Brasil), *T. myriophylla* (Sw.) Schuettp. *et al.* (não endêmica, ocorrendo no Brasil e Uruguai), *T. schwackeana* (Christ) Schuettp. *et al.* (endêmica do Brasil), e *T. sellowiana* (Mett. ex Kuhn) Schuettp. *et al.* (endêmica do Brasil) (Cochran *et al.* 2014, Prado 2015). Esse gênero ocorre na Mata Atlântica, ao longo de córregos sombreados, em arenito úmido e sombreado ou em locais mais abertos (mas aqui sombreados por arbustos), de 600 a 2300 m de altitude (Cochran *et al.* 2014).

Em 2017, Rojas-Alvarado descreveu uma nova espécie de *Tryonia* (*T. macrophylla*) para a Colômbia. Entretanto, esse binômio não foi validamente publicado, uma vez que apresenta problema de tipificação (dois espécimes foram citados como holótipo). Assim, em 2019 o mesmo autor, em uma nova publicação, corrigiu esse problema. No entanto, de acordo com a descrição apresentada, *T.*

macrophylla apresenta escamas no rizoma, raque e costa atropurpúreas, o que não se aplica a *Tryonia*. Além disso, essa espécie ocorre nos páramos e todas as outras espécies de *Tryonia* são endêmicas da Mata Atlântica. Desta forma, acredita-se que *T. macrophylla* seria melhor posicionada em *Jamesonia*. Entretanto, um estudo mais detalhado deve ser realizado para uma conclusão mais precisa acerca da posição correta deste táxon.

As espécies de *Tryonia* são similares àquelas de *Jamesonia*, diferem dessas pela presença de raque estramínea (ao invés de castanha) e pela morfologia da fronde (Cochran *et al.* 2014). *Tryonia* tem frondes "generalistas", isto é, triangular alongadas e bem desenvolvidas. Enquanto que *Jamesonia* tem frondes "especializadas" complexas e escandentes ou compactas e lineares. Algumas espécies de *Eriosorus* são "intermediárias" entre esses dois extremos e uma espécie de *Jamesonia* (*J. congesta*) apresenta frondes generalistas e raque não estramínea, uma outra tem raque estramínea com frondes especializadas (*J. flexuosa*).

Histórico de estudos realizados no Brasil que incluíram *Jamesonia* e *Tryonia*

No volume I, parte 2 da *Flora Brasiliensis* (Baker 1870) foram citadas duas espécies de *Tryonia* (*T. myriophylla* e *T. sellowiana*) e uma espécie de *Jamesonia* (*J. insignis*), as quais foram tratadas como parte de *Gymnogramma*. Nesse importante estudo da flora brasileira foram apresentadas breves descrições em latim e um cabeçalho taxonômico com os sinônimos desses táxons.

No segundo fascículo de Plantas Novas Mineiras (Schwacke 1900) foram citadas *Tryonia myriophylla*, *T. schwackeana* e *T. sellowiana*, tratadas como *Gymnogramma,* e uma espécie de *Jamesonia* (*J. brasiliensis*). Nessa obra foram apresentadas descrições em francês e comentários sobre distribuição geográfica.

Nos estudos de Brade (1942, 1956), sobre a flora do Parque Nacional do Itatiaia, foi mencionada a ocorrência de *Tryonia myriophylla*, *Jamesonia brasiliensis*, *J. cheilanthoides* e do híbrido entre essas duas última espécies. O autor apresenta uma lista com as espécies presentes no Parque, e comenta principalmente sobre a suposta origem desses táxons, uma vez que *Jamesonia* é um gênero muito representativo nos Andes. Assim, o autor propõe que essas espécies possam ter chegado ao Itatiaia a partir de migração dos Andes, via correntes de vento (dispersão à longas distâncias). Mais recentemente Condack (2006), em levantamento realizado na parte alta do Parque do Itatiaia, encontrou além dessas espécies citadas por Brade, *J. insignis*.

No estudo da flora do Morro do Baú (Ilhota, Santa Catarina) (Reitz 1950), destacou-se a ocorrência de *Tryonia myriophylla* na porção mais alto do Morro, sendo apresentado comentários sobre as características ecológicas dos locais onde encontrou-se essa espécie.

Na Flora Ilustrada Catarinense (Sehnem 1972) foi apontada a presença de *Tryonia myriophylla* nos estados de Santa Catarina e do Rio Grande do Sul, e de *Jamesonia osteniana* para esse último estado. Foram apresentadas descrições sucintas, chaves de identificação, comentários taxonômicos, notas sobre características ecológicas, distribuição geográfica, material examinado e ilustrações (fotos de exsicatas).

Na lista de espécies da Flora da Serra do Cipó (Windisch 1987) foi citada a presença de *Tryonia sellowiana*. Posteriormente, em estudo complementar Prado (1997) apontou a ocorrência também de *T. myriophylla*, com apresentação de descrição morfológica, ilustrações, lista de material examinado e comentários taxonômicos e ecológicos.

No levantamento da flora vascular rupestre dos Morros Sapucaia e do Cabrito, ambos localizados no Rio Grande do Sul (Fernandes & Baptista 1988) foi informada a presença de *Tryonia myriophylla*. Nas listas de plantas vasculares de Catolés, na Chapada Diamantina, Bahia (Prado & Labiak 2003) e do núcleo Curucutu, do Parque Estadual da Serra do Mar, São Paulo (Garcia & Pirani 2005), também foi reportada a presença dessa espécie. Nesse último estudo foi citada a ocorrência de *Jamesonia biardii*.

Nas dissertações de mestrado de: Schwartsburd (2006), para o Parque Estadual de Vila Velha, Paraná, foi mencionada a ocorrência de *Tryonia areniticola* e *T. myriophylla*; Michelon (2012), para o Parque Estadual do Guartelá, Paraná, também reportou a ocorrência das mesmas espécies de Schwartsburd (2006); Rolim (2007), para o Parque Estadual do Itacolomi, Minas Gerais, apontou a presença de *T. myriophylla* e *T. sellowiana*; e de Viveros (2010), para a Reserva Particular do Patrimônio Natural Santuário do Caraça, Minas Gerais, registrou *Jamesonia flexuosa*, *J. insignis*, *T. myriophylla* e *T. sellowiana*. Esses estudos apresentaram chaves de identificação, pequenas descrições morfológicas, comentários ecológicos e lista de material examinado.

Dentre os trabalhos de checklists e/ou listas de espécies destacam-se: Melo & Salino (2007), sobre fragmentos florestais da APA Fernão Dias em Minas Gerais, onde foi apontada a ocorrência de *Tryonia myriophylla*; Menini-Neto *et al.* (2009), sobre a

flora não arbórea de uma floresta de grota na Serra da Mantiqueira em Minas Gerais, em que verificaram a ocorrência de *Jamesonia biardii*; Prado & Hirai (2011), para o estado de São Paulo, onde foi registrada a presença de *J. biardii*, *J. insignis* e *T. myriophylla*; Souza *et al.* (2012), sobre as pteridófitas da Serra Negra (Minas Gerais), onde citaram a ocorrência de *J. biardii*; Salino *et al.* (2013), para o Parque Estadual do Rio Preto, Minas Gerais, onde foi registrada a existência de *T. myriophylla* e *T. sellowiana*; Funez & Gasper (2014), sobre o Parque Nacional da Serra de Itajaí (Santa Catarina), onde citaram *T. myriophylla*; a mesma espécie é mencionada no inventário florístico florestal de Santa Catarina por Gasper *et al.* (2012); Gonzatti *et al.* (2016), sobre a região costeira do Rio Grande do Sul, apontaram a presença de *J. osteniana* e *T. myriophylla*; e, mais recentemente, Pereira & Labiak (2018), em levantamento da flora do Parque Estadual do Pico do Paraná, citaram a ocorrência de *J. insignis*.

Justificativas

Por *Jamesonia* e *Tryonia* serem gêneros relativamente pequenos no Brasil, com a maioria das espécies endêmicas e com ocorrências restritas à Mata Atlântica brasileira, estudos florísticos como este, ora proposto, são importantes pois permitem um maior conhecimento da nossa flora, já que novos dados serão gerados a partir de trabalhos de campo e revisões de coleções de herbários. Em segundo lugar, são a base para trabalhos posteriores, que busquem compreender as relações das espécies desses gêneros, bem como seus posicionamentos nas filogenias (por exemplo de *Tryonia*, de forma mais precisa dentro de Pteridoideae).

É de fundamental importância a realização de um estudo taxonômico dos gêneros *Jamesonia* e *Tryonia* para o Brasil, com revisão de literatura, avaliação de material herborizado e coletas novas, tendo em vista o recente desmembramento de *Tryonia* do complexo *Jamesonia-Eriosorus*. Essa recente circunscrição, não acompanhada de uma atualização nomenclatural de todos os táxons, gerou uma certa confusão tanto na diferenciação dos gêneros, quanto no posicionamento das espécies, o que contribui para identificações incorretas nos trabalhos mais recentes.

Novas informações taxonômicas são de grande auxílio para uma caracterização morfológica mais aprofundada e adequada dos gêneros e das espécies envolvidas, para a atualização das áreas de distribuição dos táxons (espécies e seus híbridos), visto que grande parte das espécies parecem ser endêmicas do Brasil; para descrição dos hábitats, assim como para a elaboração de chaves de identificação atualizadas. Essas

informações também são úteis como subsídios para pesquisas em conservação e em ecologia.

Outra justificativa é a inexistência de registros de revisões taxonômicas recentes de *Jamesonia* e *Tryonia* para o Brasil de forma abrangente. Mesmo para outros países em que as espécies desses gêneros ocorrem são poucos os estudos taxonômicos realizados, após a segregação e novas circunscrições dos gêneros. A inexistência desses estudos aumenta a possibilidade de ocorrência de novos registros ou de espécies novas, ainda não descritas para a ciência.

Este trabalho também visa contribuir com o projeto da Flora do Brasil 2020 (online), que pretende até o ano de 2020 inserir descrições, ilustrações, áreas de ocorrência dos táxons de todas as samambaias e licófitas do Brasil.

Objetivos

Nossos objetivos foram: 1) realizar o estudo taxonômico, com base morfológica, para as espécies dos gêneros *Jamesonia* e *Tryonia* ocorrentes no Brasil, apresentando descrições, chaves de identificação, mapas de distribuição, ilustrações e comentários para todos os táxons reconhecidos; 2) caracterizar as condições ecológicas de ocorrência das espécies; 3) contribuir com o projeto da Flora do Brasil 2020 (online, em construção).

Os resultados são apresentados em três capítulos, escritos em inglês e formatados para submissão à publicação em diferentes periódicos no Brasil e exterior: o primeiro intitulado trata do gênero *Jamesonia*: "*Jamesonia* (Pteridaceae) in Brazil", o segundo sobre o gênero *Tryonia*: "*Tryonia* (Pteridaceae) in Brazil", e o terceiro sobre a descrição de uma espécie híbrida, oriunda do Estado do Rio de Janeiro: "*Jamesonia* ×*intermedia*: a new hybrid between *J. biardii* and *J. insignis* (Pteridaceae) from Brazil".

Referências

Baker, J.G. 1870. Cyatheaceae et Polypodiaceae. In: Martius, C. F. P. & Eichler, A. G. *Flora Brasiliensis*. Munchen, Wien, Leipzig, 1: 358–382.

Boudrie, M. & Cremers, G. 2016. Nomenclatural Note on the Pteridophyte Flora of the Guianas. **American Fern Journal 106**: 171–174.

Brade, A.C. 1942. A composição da flora pteridófita do Itatiaia: contribuição para a fitogeografia dessa região. **Rodriguésia 6**: 29–43.

Brade, A.C. 1956. A flora do Parque Nacional do Itatiaia. Ministério do Meio Ambiente, **Boletim 5**.

Ching, R.C. 1940. On natural classification of the family "Polypodiaceae". **Sunyatsenia 5**: 201–268.

Christenhusz, M.J.M. & Chase M.W. 2014. Trends and concepts in fern classification. **Annals of Botany 113**: 571–594.

Christenhusz, M.J.M., Zhang, X.C. & Schneider, H. 2011. A linear sequence of extant families and genera of lycophytes and ferns. **Phytotaxa 19**: 7–54.

Cochran, A.T., Prado, J. & Schuettpelz, E. 2014. *Tryonia*, a new Taenitidoid fern genus segregated from *Jamesonia* and *Eriosorus* (Pteridaceae). **PhytoKeys 35**: 23–43.

Condack, J.P.S. 2006. *Pteridófitas ocorrentes na região alto montana do Parque Nacional do Itatiaia: análise florística e estrutural*. Dissertação de Mestrado, Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Escola Nacional de Botânica Tropical.

Copeland, E.B. 1947. *Genera Filicum*. Chronica Botanica Walthan.

Fernandes, I. & Baptista, L.R.M. 1988. Levantamento da flora vascular rupestre do Morro Sapucaia e do Morro do Cabrito. **Acta Botanica Brasilica 1**: 95–102.

Flora do Brasil 2020 em construção. Jardim Botânico do Rio de Janeiro. Disponível em: < http://floradobrasil.jbrj.gov.br/ >. Acesso em: 31 Jul. 2019.

Funez, L.A. & Gasper, A.L. 2014. Parque Nacional da Serra do Itajaí (Southern Brazil) shrub and herbs flora. **CheckList 10**: 1249–1259.

Garcia, R.J.F. & Pirani, J.R. 2005. Análise florística, ecológica e fitogeográfica do Núcleo do Curucutu, Parque Estadual da Serra do Mar (São Paulo, SP) com ênfase nos campos junto à crista da Serra do Mar. **Hoehnea 32**: 1–48.

Gasper, A.L., Salino, A., Vibrans, A.C., Sevegnani, L., Verdi, M., Korte, A., Santos, A.S., Dreveck, S., Cadorin, T.J., Schmitt, J.L. & Caglioni, E. 2012. Pteridófitas de Santa Catarina: um olhar sobre os dados do Inventário Florístico Florestal de Santa Catarina, Brasil. **Acta Botanica Brasilica 26**: 421–434.

Gonzatti, F., Machado, L. & Windisch, P.G. 2016. Distribution patterns of ferns and lycophytes in the coastal region of the state of Rio Grande do Sul, Brazil. **Acta Botanica Brasilica 30**: 239–253.

Kessler, M. & Smith, A.R. 2007. New species and other nomenclatural changes for ferns from Bolivia. **Brittonia 59**: 186–197.

Melo, L.C.N. & Salino, A. 2007. Pteridófitas em fragmentos florestais da APA Fernão Dias, Minas Gerais, Brasil. **Rodriguésia 58**: 207–200.

Menini-Neto, L., Matozinhos, C.N., Abreu, N.L., Valente, A.S.M., Antunes, K., Souza, F.S., Viana, P.L. & Salimena, F.R.G. 2009. Flora vascular não-arbórea de uma floresta de grota na Serra da Mantiqueira, Zona da Mata de Minas Gerais, Brasil. **Biota Neotropica 9**: 149–161.

Michelon, C. 2012. *Samambaias e licófitas do Parque Estadual do Guartelá, Paraná.* Dissertação de Mestrado, Universidade Federal do Paraná.

Nakazato, T. & Gastony, G.J. 2003. Molecular phylogenetics of *Anogramma* species and related genera (Pteridaceae: Taenitidoideae). **Systematic Botany 28**: 490–502.

Pabón-Mora, N. & González, F. 2016. *Nephopteris* out of the clouds: Molecular evidence places the enigmatic *N. maxonii* (Pteridaceae) within the *Jamesonia* clade. **Brittonia 68**: 83−92.

Pereira, J.B.S. & Labiak, P.H. 2018. Checklist of fern and lycophytes from the highlands of Pico Paraná State Park. **Rodriguésia 69**: 301−307.

Pichi Sermolli, R.E.G. 1982. A further contribution to the nomenclature of the families of Pteridophyta. **Webbia 35**: 223–337.

PPG I. 2016. A community-derived classification for extant lycophytes and ferns. **Journal of Systematics and Evolution 54**: 563–603.

Prado, J. 1997. Flora da Serra do Cipó, Minas Gerais: Pteridaceae – Adiantoideae e Taenitidoideae. **Boletim da Universidade de São Paulo 16**: 115–118.

Prado, J. 2015. Pteridaceae in Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro. Disponível em: <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB91951>. Acesso em: 3 março 2018.

Prado, J. & Hirai, R.Y. 2011. Checklist das licófitas e samambaias do estado de São Paulo, Brasil. **Biota Neotropica 11**:161–190.

Prado, J. & Labiak, P.H. 2003. Pteridófitas. In: Zappi, D.C., Lucas, E., Stannard, B.L., Lughadha, E.N., Pirani, J.R., Queiroz, L.P., Atkins, S., Hind, D.J.N., Giulietti,

A.M., Harley, R.M. & Carvalho, A.M. 2003. **Boletim da Universidade de São Paulo 21**: 359–360.

Prado, J., Rodrigues, C.N., Salatino, A. & Salatino, M.L. 2007. Phylogenetic relationships among Pteridaceae, including Brazilian species, inferred from *rbcL* sequences. **Taxon 56**: 355–368.

Prado, J., Sylvestre, L. da S., Labiak, P.H., Windisch, P.G., Salino, A., Barros, I.C.L., Hirai, R.Y., Almeida, T.E., Santiago, A.C.P., Kieling-Rubio, M.A., Pereira, A.F.N., Øllgaard, B., Ramos, C.G.V., Mickel, J.T., Dittrich, A.O., Mynssen, C.M., Schwartsburd, P.B., Condack, J.P.S., Pereira, J.B.S. & Matos, F.B. 2015. Diversity of ferns and lycophytes in Brasil. **Rodriguésia 66**: 1073–1083.

Reitz, R. 1950. Vegetação do Morro do Baú. **Rodriguésia 13**: 267–288.

Rojas-Alvarado, A.F. 2017a. El complejo *Jamesonia flexuosa* (Kunth) Christenh. (Pteridaceae) para el Neotrópico. **Acta Botanica Malacitana 42**: 33–40.

Rojas-Alvarado, A.F. 2017b. Novedades en *Jamesonia* Hook. & Grev. y *Tryonia* Schuettp., J. Prado & A.T. Cochran (Pteridaceae) para el Neotrópico. **Acta Botanica Malacitana 42**: 111–118.

Rojas-Alvarado, A.F. 2019. Corrections in Recently Described Species of Ferns and Lycophytes from the Neotropics. **Open Access Library Journal 6**: e5172.

Rolim, L.B. 2007. *Pteridófitas do Parque Estadual do Itacolomi, Minas Gerais, Brasil.* Dissertação de Mestrado, Universidade de Brasília.

Salino, A., Mota, N.F.O. & Almeida, T.E. 2013. Lycophytes and monilophytes in Rio Preto State Park, Minas Gerais, Brazil. **Acta Botanica Brasilica 27**: 252–263.

Sánchez-Baracaldo, P. 2004a. Phylogenetics and biogeography of the neotropical fern genera *Jamesonia* and *Eriosorus* (Pteridaceae). **American Journal of Botany 91**: 274–284.

Sánchez-Baracaldo, P. 2004b. Phylogenetic relationships of the subfamily Taenitidoideae, Pteridaceae. **American Fern Journal 94**: 126–142.

Sánchez-Baracaldo, P. & Thomas, G.H. 2014. Adaptation and convergent evolution within the *Jamesonia-Eriosorus* complex in High-elevation biodiverse Andean hotspots. **PlosOne 9**: 1–11.

Schneider, H., He, L., Hennequin, S. & Zhang, X.C. 2013. Towards a natural classification of Pteridaceae: inferring the relationships of enigmatic pteridoid fern species occurring in the Sino-Himalaya and Afro-Madagascar. **Phytotaxa 77**: 49–60.

Schuettpelz, E., Schneider, H., Huiet, L., Windham, M.D. & Pryer, K.M. 2007. A molecular phylogeny of the fern family Pteridaceae: Assessing overall relationships and the affinities of previously unsampled genera. **Molecular Phylogenetics and Evolution 44**: 1172–1185.

Schwacke, W. 1900. *Plantas Novas Mineiras*. Imprensa Official do Estado de Minas Gerais: Minas Gerais 2: 17–19.

Schwartsburd, P. B. & Labiak, P.H. 2008. *Eriosorus areniticola* (Pteridaceae), a new species from Brazil. **American Fern Journal 98**: 160–163.

Schwartsburd, P.B. 2006. *Pteridófitas do Parque Estadual de Vila Velha, Paraná, Brasil.* Dissertação de Mestrado, Universidade Federal do Paraná.

Sehnem, A. 1972. Pteridáceas. In: Reitz, R. *Flora Ilustrada Catarinense*. Herbário Barbosa Rodrigues, Itajaí.

Sklenár, P., Dusková, E. & Balslev, H. 2011. Tropical and Temperate: Evolutionary history of Páramo flora. **Botanical Review 77**: 71–108.

Smith, A.R., Pryer, K.M., Schuettpelz, E., Korall, P., Schneider, H. & Wolf, P.G. 2006. A classification for extant ferns. **Taxon 55**: 705–731.

Souza, F.S., Salino, A., Viana, P.L. & Salimena, F.R.G. 2012. Pteridófitas da Serra Negra, Minas Gerais, Brasil. **Acta Botanica Brasilica 26**: 378–390.

Tryon, A.F. 1962. A monograph of the fern genus *Jamesonia.* **Contributions from the Gay Herbarium of Harvard University 191**: 109–197.

Tryon, A.F. 1970. A monograph of the fern genus *Eriosorus*. **Contributions from the Gray Herbarium of Harvard University 200**: 54–174.

Tryon, R.M. 1986. Some new names and combinations in Pteridaceae. **American Fern Journal 76**: 184–186.

Tryon, R.M. & Tryon, A.F. 1982. *Fern and allied plants, with special reference to tropical America*. Springer-Verlag, New York.

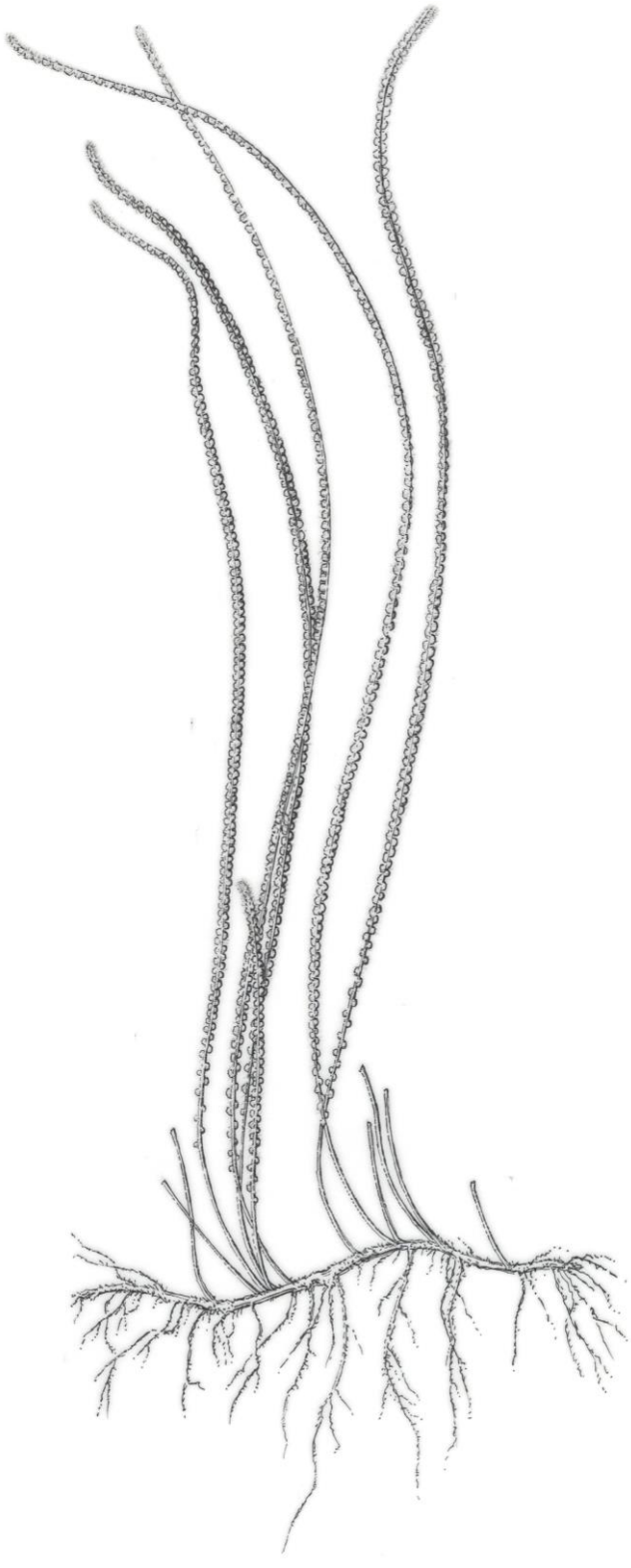
Viveros, R.S. 2010. *Pteridófitas da Serra do Caraça, Minas Gerais*. Dissertação de Mestrado, Universidade Federal de Minas Gerais.

Zhang, L., Zhou, X.M., Lu, N.T. & Zhang, L.B. 2017. Phylogeny of the fern subfamily Pteridoideae (Pteridaceae; Pteridophyta), with the description of a new genus: *Gastoniella*. **Molecular Phylogenetics and Evolution 109**: 59–72.

Windisch, P.G. 1987. Pteridófitas. In: Giulietti, A.M., Menezes, N.L., Pirani, J.R., Meguro, M. & Wanderley, M.G.L. Flora da Serra do Cipó, Minas Gerais: caracterização e lista de espécies. **Boletim de Botânica da Universidade de São Paulo 9**: 18–34.

Capítulo I

Jamesonia (Pteridaceae) in Brazil



Esse artigo será submetido a *Biota Neotropica*.

Jamesonia (Pteridaceae) in Brazil

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Abstract: *Jamesonia* is a genus of Neotropical ferns that comprises about 50 species, distributed from Mexico to Uruguay. In spite of this wide distribution, this group is more diverse in Andean páramos and subpáramos. Due to the recent changes in its circumscription, with the junction of *Eriosorus* and segregation of *Tryonia*, the objective of this work was to carry out the taxonomic study of *Jamesonia* for Brazil, in order to elaborate its monograph to the Flora of Brazil 2020. This study was based on morphological analyses of specimens deposited in 25 Brazilian herbaria, plus online images of types, field expeditions in the southern and southeastern regions of Brazil, revision of the literature, and scanning electronic microscopy of the spores. Seven species and two hybrids were recognized: *J. biardii*, *J. brasiliensis*, *J. cheilanthoides*, *J. flexuosa*, *J. insignis*, *J. osteniana*, *J. rufescens*, *J. brasiliensis* × *J. cheilanthoides*, and *J.* ×*intermedia*, respectively. A distinct specimen, from the border of Brazil (Amazonas) and Venezuela, was treated as *Jamesonia* sp., due to the presence of only one material. Identification key, descriptions and illustrations are provided for the species and hybrids, as well as, geographical distribution data, comments, list of selected material examined for each taxon, and a full list of all exsiccatae analyzed.

Keywords: Altitude Fields, Brazilian Atlantic Rainforest, *Eriosorus*, ferns, flora, Pteridoidea.

Jamesonia (Pteridaceae) no Brasil

Resumo: *Jamesonia* é um gênero de samambaias Neotropical, que compreende cerca de 50 espécies, distribuídas do México ao Uruguai. A pesar dessa ampla distribuição, esse grupo é mais diverso nos páramos e subpáramos andinos. Devido as recentes mudanças na sua circunscrição, com a junção de *Eriosorus* e a segregação de *Tryonia*, o objetivo desse trabalho foi realizar o estudo taxonômico de *Jamesonia* para o Brasil, a fim de elaborar sua monografia para a Flora do Brasil 2020. Esse estudo foi baseado

na análise morfológica de espécimes depositados em 25 herbários nacionais, mais imagens dos tipos online, expedições de campo para as regiões sul e sudeste do Brasil, revisão de literatura, e microscopia eletrônica de varredura dos esporos. Sete espécies e dois híbridos foram reconhecidos: *J. biardii*, *J. brasiliensis*, *J. cheilanthoides*, *J. flexuosa*, *J. insignis*, *J. osteniana*, *J. rufescens*, *J. brasiliensis* × *J. cheilanthoides* e *J.* ×*intermedia*, respectivamente. Um espécime distinto, da fronteira do Brasil (Amazonas) com a Venezuela, foi tratado como *Jamesonia* sp., devido a presença de somente um material. Chaves de identificação, descrições e ilustrações foram apresentadas para as espécies e híbridos, bem como, dados de distribuição geográfica, comentários, lista de material selecionado examinado para cada táxon e uma lista contendo todas as exsicatas analisadas.
Palavras-chave: campos de altitude, *Eriosorus*, Flora, Mata Atlântica Brasileira, Pteridoidea, samambaias.

Introduction

Jamesonia Hook. & Grev. (Pteridaceae) is a Neotropical fern genus with ca. 50 species (PPG 2016), which occurs from southern Mexico to southern Bolivia, north and southeast Brazil, Uruguay, and the islands of Tristan da Cunha and Gough, located in the South Atlantic Ocean (Tryon 1970, Sánchez-Baracaldo 2004a). In spite of this wide distribution, this group is more diverse in Andean páramos and subpáramos, occurring frequently associated with rocks and cloud forests, from 1500 to 5000 m elevation (Tryon 1970, Sánchez-Baracaldo 2004a).

Jamesonia, in the present circumscription, encompasses the genus *Eriosorus* Fée, since phylogenetic analyses based on molecular data have concluded, when treated separately, these genera are polyphyletic and paraphyletic, respectively (Sánchez-Baracaldo 2004a). Thus, the intimate association of these genera proposed by Alice Tryon in 1970, based only on morphology, has been proved.

Plants of this genus can be distinguished by the "specialized" fronds, complex and scandent, or compact and linear, and by the color brown of the rachis (Cochran et al. 2014). Besides, two morphotypes can be seen, according to the correspondence between the pattern of frond morphology and occupied habitat. The plants with the "*Jamesonia* morphotype" has many fronds, and short pinnae, often coriaceous, which are associated with exposed areas, predominantly of the páramos (Sánchez-Baracaldo & Thomas 2014). And, the "*Eriosorus* morphotype" has few fronds, and long pinnae,

chartaceous to membranaceous, which are associated with cloud forests and habitats sheltered in the páramos (Sánchez-Baracaldo & Thomas 2014).

After the monographs of Tryon (1962, 1970), few taxonomic works have been done with the group, we can highlight: Sánchez-Baracaldo (2004a), who presented a phylogeny for the subfamily Taenitidoidea, where she verified that *Jamesonia* and *Eriosorus* are not monophyletic. The same author (Sánchez-Baracaldo 2004b), with extensive sampling of species of these genera, found that the "*Jamesonia* morphotype" probably had several origins, which were derived from more than one element of *Eriosorus*. Christenhusz (2011) performed the combinations of several (thirty six combinations) *Eriosorus* species in *Jamesonia*. Sánchez-Baracaldo & Thomas (2014), who presented biogeographic analyses, in which they considered possible adaptive radiation of *Jamesonia* with the emergence of the Andes, as well as, evolutionary convergence among species with the "*Jamesonia* morphotype". Cochran et al. (2014), who segregated some species, previously part of *Eriosorus*, to form a new genus, *Tryonia* Schuettp. et al. And more recently the description of some new species (*J. erecta* A. Rojas, *J. panamensis* A. Rojas and *J. retroflexa* A. Rojas), from the Andes of Colombia, Panama, and Ecuador, respectively, by Rojas-Alvarado (2017a, b, 2019).

In Brazil, some floristic studies included species of this genus, such as: Baker (1870), Schwacke (1900), Brade (1942, 1956), Sehnem (1972), Windisch (1984), Condack (2006), Prado & Sylvestre (2010), Prado & Hirai (2011), Salino & Viveros (2012), Prado (2015), Prado et al. (2015), Gonzatti et al. (2016), and Pereira & Labiak (2018). However, the *Jamesonia* taxa were not the main focus of these studies, being little discussed and/or highlighted.

Thus, the main goal of the present study is to present a taxonomic treatment of *Jamesonia* for Brazil, to provide information for a better understanding and identification of its species, and contribute with the project Flora of Brazil 2020, coordinated by the Instituto de Pesquisas Jardim Botânico do Rio Janeiro (JBJR).

Material and methods

For this study were analyzed material from the following herbaria: BHCB, CESJ, ESA, FCAB, FLOR, FURB, HAS, HB, HBR, HRCB, ICN, MBM, MBML, PACA, R, RB, RBR, RFA, SJRP, SP, SPF, UB, UEC, UCPB, and VIES (herbaria acronyms according to Thiers (2019, continuously updated)). The types and another specimens stored in international herbaria were consulted through the available online images.

Field expeditions were carried out in the states of Minas Gerais, Rio de Janeiro, and Rio Grande do Sul. The specimens were collected according to the technical recommendations proposed by Fidalgo & Bononi (1984) and incorporated in the Herbaria of the Instituto de Botânica (SP) and of the Departamento de Botânica, Universidade de São Paulo (SPF).

The terminology of vegetative and reproductive structures followed Lellinger (2002) and Tryon & Lugardon (1990). Habitat characteristics and ecological aspects were described from the information present in the herbarium labels, direct observations in the field, and bibliography.

Spore images of all taxa were taken with a Scanning Electronic Microscope (SEM). The spores of specimens stored in the SP herbarium were fixed on stubs using double-sided tape and were not submitted to any previous chemical treatment. The stubs were then coated with gold and analyzed under the SEM (Model: Philips XL30).

The distribution maps were drawn using the software ArcGIS v. 10.5 (ESRI 2016). The geographical coordinates were taken from the herbarium labels or taken during the field works. For the materials without information on geographic coordinates, the coordinates of the municipality were estimated using Google maps (www.google.com/intl/en/earth/). The estimated coordinates were cited in brackets in the material examined. The shape files of Brazil and the Conservation Units were obtained from IBGE (2015) and ICMBio (2019) websites, respectively.

In the selected material examined, only one specimen per state was listed and the states were cited in alphabetic order. All specimens examined (which include those not cited in the select material examined section) are listed in Appendix I (the number in parentheses corresponds to the number of the species in the taxonomic treatment).

Results and discussion

Due to the recent changes in the circumscription of *Jamesonia* and segregation of *Tryonia*, confusions can be generated to identify these taxa, so the key below ca be used to distinguish them.

Key for the genera *Jamesonia* and *Tryonia* in Brazil

1. Rachises brown; petioles concolorous; adaxial and abaxial surfaces of the pinna covered by eglandular hairs; fronds erect, arcuate, semi-scandent, scandent or scrambling. ……..…...……..…… ***Jamesonia***

1. Rachises stramineous; petioles bicolorous; adaxial and abaxial surfaces of the pinna covered by glandular hairs; fronds erect, arcuate or decumbent. …… ***Tryonia***

Jamesonia Hook. & Grev., Icon. Filic.: t. 178. 1830. Type: *Jamesonia pulchra* Hook. & Grev.

Plants terrestrial or rupicolous. **Rhizomes** short-creeping, dark brown, moderately to densely covered by erect to appressed hairs and rigid bristles, the hairs dark brown, reddish-brown or golden-brown, multicellular, glandular or eglandular, the apical cell elongated with apex rounded, globose, or rarely slightly bulbous, the bristles dark brown, reddish-brown, or golden-brown, with darker-colored thickened transverse cell walls, apex long-filiform, base with 2−7 cells wide, the apical cell elongated with apex rounded, globose or rarely slightly bulbous. **Fronds** monomorphic, erect, arcuate, semi-scandent, scandent or scrambling, with indeterminate or determinate growth; **petioles** semi-cylindrical, adaxially grooved, rarely cylindrical or plane, concolorous, dark brown, sometimes shiny, glabrous to moderately covered by hairs on both surfaces, the hairs glandular or eglandular, hyaline to brown, tortuous to erect, multicellular, the apical cell elongated with apex rounded or globose; **laminae** pinnate to 3-pinnate-pinnatisect, or more divided into *J. flexuosa*, triangular, linear, or less often narrowly triangular and narrowly elliptic, membranaceous to coriaceous; **rachises** straight or flexuous, ellipsoidal, triangular, or more often semi-cylindrical, adaxially grooved, dark brown, glabrous to densely covered by hairs on both surfaces, the hairs similar to those of the petioles; **pinnae** reflexed, patent or ascending, often triangular, sometimes orbicular, ovate, deltate, lanceolate or oblong, alternate to opposite, gradually tapering towards the apex, stalked, the stalk cylindrical to semi-cylindrical, adaxially grooved, dark brown, straight or sometimes curved, adaxial and abaxial surface of pinnae glabrous to densely covered by hairs, the hairs similar to those of the petioles; **ultimate segments** bifurcate, sometimes simple, orbicular or ovate, the margins entire, crenate or crenate-denticulate, plane, sometimes recurved, whitish; occasionally with hairs, the hairs similar to those of the petioles; **veins** usually furcate, sometimes simple, reaching or not the laminae margin. **Sori** along the veins or sometimes spread along of all abaxial surface of the segments; **sporangia** with capsule usually pyriform or orbicular, stomia with 12−26 indurated cells, short-stalk, stalks 2–3 celled (Tryon 1970); **spores** trilete, tetrahedral, brown, with equatorial flange, and

deltoid base on distal surface; 40.0−67.8 µm diam., x=29 (Tryon 1970). Gametophyte spathulate with lateral meristem (Tryon 1970).

According Sánchez-Baracaldo (2004a) and PPG I (2016), *Jamesonia* is a monophyletic and Neotropical genus of leptosporangiate ferns, composed by ca. 50 species. The species occur from southern Mexico to southern Bolivia, north, southeast and south Brazil, Uruguay, and in the islands of Tristan da Cunha and Gough. Most of these species occur in the Andean páramos and subpáramos, at 1500−5000 meters of elevation. In Brazil, there are 8 species and two hybrids, which occur in the Brazilian Atlantic Rainforest, in altitude fields and cloud forests (Figure 1), at 1000−2702 meters of elevation (with the exception of *J. osteniana*, which occurs at lower elevations, 50−140 m).

Key for *Jamesonia* species in Brazil

1. Plants annual, not exceeding 8.0 cm tall; rhizomes erect, covered by glandular hairs, the hairs often with 2−4 celled; Rio Grande do Sul (Brazil) and Uruguay. …….…….. ***J. osteniana***
1. Plants perennial, 8.0 cm – 4 m long; rhizomes creeping, covered by glandular or eglandular hairs and bristles, the hairs often with 10 or more celled; Brazil (North, Southeast, and South). …...…….....……...……..……...…..... 2
2. Laminae linear; pinnate or pinnate-pinnatisect. …..…….....…….……..… 3
3. Pinnae orbicular, coriaceous, 0.1−0.3 × 0.2−0.3 cm. …..……..…… ***J. brasiliensis***
3. Pinnae ovate to triangular, chartaceous, 0.3−1.2 × 0.3−0.7 cm. …... ***J. cheilanthoides***
2. Laminae triangular or elongate triangular, less often narrowly triangular or narrowly elliptic; 2-pinnate-pinnatifid or more divided; if pinnate-pinnatisect never linear. ……..…….....…… 4
4. Rachises flexuous; fronds semi scandent, scandent or scrambling, rare erect. ….… 5
5. Ultimate segments bifurcate; margins entire. …..…….……..……..…. ***J. flexuosa***
5. Ultimate segments ovate or orbicular; margins crenate or denticulate-crenate. …….……..……..... ***J. insignis***
4. Rachis straight; fronds erect to slightly arcuate. …….……..……...……. 6
6. Ultimate segments ovate, margins crenate. …...……...……...…. ***J. rufescens***
6. Ultimate segments bifurcate; margins entire. ……...……..…..……..... 7
7. Hairs and bristles of the rhizome golden-brown; petioles and rachises moderately covered by hairs. …….……..……... ***Jamesonia* sp.**

7. Hairs and bristles of the rhizome dark brown; petioles and rachises glabrous or with sparse hairs. ……..…….…..……...….. ***J. biardii***

1. ***Jamesonia biardii*** (Fée) Christenh., Phytotaxa 19: 20. 2011. *Anogramma biardii* Fée, Crypt. Vasc. Brésil 1: 241, pl. 77, fig. 1. 1869. *Psilogramme biardii* (Fée) Kuhn, Festschr. 50 Jähr. Jub. Königstädt. Realschule Berlin: 336. 1882. *Eriosorus biardii* (Fée) A.F.Tryon, Contr. Gray Herb. 200: 166, fig. 36. 1970. Lectotype (designated by Tryon 1970): BRAZIL. Rio de Janeiro: Serra dos Órgãos, VI-1869, *A.F.M. Glaziou 3331* (P barcode P0060351[image!]; isolectotypes: NY barcodes 00144494[image!]; 00144495[image!]; 00144496[image!]; S-R n.S-R321[image!], US barcode 00142117[image!]).

Figures: 2a-i, 3a-b, 5.

Plants terrestrial. **Rhizomes** short-creeping, 1.0−4.0 mm diam, dark brown, densely covered by hairs and rigid bristles, the hairs dark brown, multicellular, glandular or eglandular, the apical cell elongated with apex rounded or globose, 0.5−2.0 mm long, the bristles dark brown, with darker-colored thickened transverse cell walls, apex long-filiform, base with 2−4 cell wide, apical cell elongated with apex rounded or globose, 0.6−2.0 mm long. **Fronds** erect to slightly arcuate, determinate growth, 20.0−78.0 × 5.6−11.5 cm; **petioles** semi-cylindrical, adaxially grooved, 10.0−30.0 cm × 1.0 mm, dark brown, shiny, glabrous to sparsely covered by hairs on both surfaces, the hairs 0.5−1.6 mm long, eglandular, hyaline, tortuous, multicellular, the apical cell elongated with apex rounded; **laminae** 2-pinnate-pinnatisect, elongate-triangular, 11.0−64.0 × 5.6−11.5 cm, chartaceous; **rachises** straight, semi-cylindrical, adaxially grooved, dark brown, glabrous to sparsely covered by hairs on both surfaces, the hairs similar to those of the petioles; **pinnae** patent to slightly ascending, triangular, the basiscopic side slightly larger, 3.0−7.0 × 1.8−4.5 cm, alternate to subopposite, gradually tapering towards the apex (pinnatisect), stalked, the stalk 1.8−6.0 mm long, 0.6−0.8 mm diam, semi-cylindrical, adaxially grooved, dark brown, straight, adaxial and abaxial surfaces of pinnae glabrous to sparsely covered by hairs, the hairs similar to those of the petioles; **costae** straight, semi-cylindrical, adaxially grooved, dark brown, glabrous; **pinnules** triangular, 1.0−3.0 × 0.5−2.3 cm, alternate, stalked, the stalk 1.0−3.0 mm long, 0.6 mm diam., semi-cylindrical, adaxially grooved, dark brown, straight; **ultimate segments** bifurcate, sometimes simple, margins entire, plane, whitish; **veins** usually furcate, not reaching the laminae margin. **Sori** on the veins in

the proximal portion of the segments; **spores** dark brown, proximal surface tuberculate, mainly near trilete aperture, distal surface slightly rugose, 58.0−57.5 μm diam.

Distribution and ecology: *Jamesonia biardii* is endemic to Brazil, it grows in shrub forests in the Espírito Santo and Rio de Janeiro states, at 2000−2100 m elevation. It is a threatened species (in danger - EN) according to the Red List of the Brazilian Flora, version 2012.2 (CNCFlora 2019).

Selected material examined: BRAZIL**.** Espírito Santo: Castelo, Forno Grande, [20°31'S, 41°06'W], 12-VIII-1948, *A.C. Brade 19246* (ICN, MO, RB). Rio de Janeiro: Serra dos Órgãos, Campos das Antas, [22°27'S, 43°02'W], 2100 m, 27-V-1869, *A.F.M. Glaziou s.n.* (RB 36474).

Jamesonia biardii can be recognized in having 2-pinnate-pinnatisect, elongated-triangular laminae, triangular, chartaceous pinnae, with the adaxial and abaxial surface glabrous or with sparse hairs, the hairs eglandular, hyaline, apical cell elongated with apex rounded, and straight and glabrous rachises.

Tryon (1970) emphasized the close relationship of *Jamesonia biardii* and *J. flexuosa* based on the similarity of the form and indument of ultimate segments, as well as through the geographic proximity. However, this relationship has not been proven by phylogenetic analysis based on molecular data yet, since the most recent record of *J. biardii* dated 1948 in the herbaria visited.

This species was cited for Núcleo do Curucutu, Serra do Mar (São Paulo, SP – *L.C.Q.M.P. Sampaio & R.J.F. Garcia 222*) by Garcia & Pirani (2005), for Serra da Mantiqueira (Minas Gerais – *P.L. Viana & F.S. Souza 2006*) by Menini-Neto et al. (2009), and for Serra Negra (Minas Gerais – *P.L. Viana & F.S. Souza 2006*) by Souza et al. (2012), but these specimens were wrongly identified and in fact are *Tryonia myriophylla* (Sw.) Schuettp. et al.

Tryonia myriophylla is easily distinguished from *Jamesonia biardii* by its stramineous petioles (distally) and rachises (vs. dark brown); pinnae moderately to densely covered by glandular hairs and less often eglandular on both surfaces (vs. surfaces glabrous to sparsely covered eglandular hairs).

2. ***Jamesonia brasiliensis*** Christ, Farnk. Erde: 75. 1897. Lectotype (designated by Tryon 1970): BRAZIL. Rio de Janeiro: Serra do Itatiaia, entre rochedos abaixo das Agulhas Negras, 2200 m, III-1984, *E.H.G. Ule s.n.* (P barcode P00602710[image!]; isolectotypes: R!; BM barcode BM000936676[image!]).

Figs. 2j-p, 3c-d, 4a-c, 5.

Plants rupicolous or terrestrial. **Rhizomes** short-creeping, 0.7−1.9 mm diam., dark brown, moderately to densely covered by hairs and rigid bristles, the hairs reddish brown, multicellular, glandular, the apical cell globose to slightly bulbous, 1.7−3.0 mm long, the bristles reddish brown, with darker-colored thickened transverse cell walls, apex long-filiform, base with 2 cells wide, apical cell globose to slightly bulbous, 1.7−2.6 mm long. **Fronds** erect to arcuate, indeterminate growth, 26.0−61.5 × 0.4−0.7 cm; **petioles** cylindrical or semi-cylindrical, adaxially grooved, 4.0−7.5 cm × 0.4−0.6 mm, dark brown, shiny, glabrous to sparsely covered by hairs on both surfaces, the hairs 0.5−3.0 mm long, eglandular, hyaline, tortuous, multicellular, the apical cell elongated with apex rounded; **laminae** pinnate, linear, 21−54 × 0.4−0.7 cm, with apical bud densely covered by hairs, the hairs similar to those of the petioles, coriaceous; **rachises** straight, ellipsoidal or triangular, dark brown, adaxially moderately covered by the hairs, abaxially densely covered by hairs, the hairs similar to those of the petioles; **pinnae** reflexed to slightly ascending, orbicular, 0.1−0.3 × 0.2−0.3 cm, usually subopposite or sometimes alternate at lamina base, abrupt to gradually tapering proximally, sometimes gradually tapering towards the apex, short-stalked, the stalk 0.4−0.7 mm long, 0.1−0.2 mm diam., cylindrical, dark brown, curved, adaxial surface of pinnae sparsely to moderately covered by hairs, the hairs similar to those of the petioles, abaxial surface of pinnae densely covered by hairs, the hairs ca. 0.5−1.5 mm long, eglandular, hyaline, tortuous, 2−4-celled, apical cell elongated with apex rounded, the margins entire, sometimes undulate, strongly recurved, ciliate, membranous, whitish; **veins** usually furcate, sometimes simple, reaching or not the lamina margin. **Sori** usually on the proximal portion of the pinnae, or sometimes spread along of all abaxial surface of the pinnae; **spores** dark brown, proximal surface with coalescent tuberculate, mainly near trilete aperture, distal surface slightly rugose to laevigate, 48.0−53.5 μm diam.

Distribution and ecology: *Jamesonia brasiliensis* occurs in cracks of rocks partially shaded in the Itatiaia Mountains (Rio de Janeiro and Minas Gerais), at 2200−2600 m

elevation. It is a threatened species (critically endangered - CR) according to the Red List of Brazilian Flora, version 2012.2 (CNCFlora 2019).

Selected material examined: BRAZIL**.** Minas Gerais: Itamonte, 22°22’21.5”S, 45°08’26.9"W, 2300−2500 m, 11-VII-2007, *A. Salino 12459* (BHCB). Rio de Janeiro: Itatiaia, Parque Nacional do Itatiaia, caminho para as Prateleiras, às margens do Rio Campo Belo, 22°21'95.3”S, 44°42'95.5”W, 2440 m, 01-IX-2017, *A.P. Della 49* (RB, SP).

Jamesonia brasiliensis is easily recognized by its linear and pinnate fronds, with indeterminate growth (with large apical bud), orbicular and coriaceous pinnae, abaxially densely covered by hairs, the hairs eglandular, hyaline, tortuous, 2−4-celled, apical cell elongated with apex rounded, and straight rachises.

This species has been considered endemic of Itatiaia (Brazil), however, Tryon (1962) cited some collections of this species for Bolivia and Peru. However, for Tryon, the Bolivian plants differ slightly from de Brazilian ones by the smaller pinnae, more rigid, and by the upper surface glabrous. Probably, this name is not correctly applied to the Bolivian plant.

3. ***Jamesonia cheilanthoides*** (Sw.) Christenh., Phytotaxa 19: 20. 2011. *Grammitis cheilanthoides* Sw., Syn. Fil. (Swartz) 23: 219, 419. 1806. *Gymnogramma cheilanthoides* (Sw.) Kaulf., Enum. Fil.: 71. 1824. *Psilogramme cheilanthoides* (Sw.) Kuhn, Festschr. 50 Jähr. Jub. Königstädt. Realschule Berlin: 335. 1882. *Eriosorus cheilanthoides* (Sw.) A.F.Tryon, Brit. Fern Gaz. 9: 271. 1966. Holotype: TRISTAN DA CUNHA, s. d., s. col. (S-P n.S-P6352[image!]).

Figs. 2q-w, 3e-f, 4d-f, 6.

Plants rupicolous or terrestrial. **Rhizomes** short-creeping, 0.2−2.6 mm diam., dark brown, moderately to densely covered by hairs and rigid bristles, the hairs reddish brown, multicellular, glandular, apical cell globose to slightly bulbous, 1.0−2.3 mm long, the bristles reddish brown to dark brown, with darker-colored thickened transverse cell walls, apex long-filiform, base with 2 or 3 cells wide; apical cell globose to slightly bulbous, 0.7−1.6 mm long. **Fronds** erect to arcuate, indeterminate growth, 24.0−120.0 × 0.6−1.5 cm; **petioles** cylindrical or semi-cylindrical, adaxially grooved, sometimes plane, 5.0−17.0 cm × 0.4−1.0 mm, dark brown, shiny, glabrous to sparsely

covered by hairs on both surfaces, the hairs of the proximal portion similar to those the rhizomes, of distal portion the hairs with 0.3−2.0 mm long, eglandular, hyaline or dark brown, tortuous, multicellular, the apical cell elongated with apex rounded; **laminae** pinnate-pinnatisect, linear, 19.0−113.0 × 0.6−1.5 cm, with a small apical bud moderately to densely covered by hairs, the hairs similar to those of distal portion of the petioles, chartaceous; **rachises** straight, semi-cylindrical, adaxially grooved, dark brown, moderately to densely covered by hairs on both surfaces, the hairs similar to those of the distal portion of the petioles; **pinnae** patent to slightly ascending, ovate to triangular, 0.3−1.2 × 0.3−0.7 cm, alternate, gradually tapering proximally, sometimes gradually tapering towards the apex, short-stalked, the stalk 0.4−1.7 mm long, 0.2−0.5 mm diam., cylindrical, dark brown, straight, sometimes curved, adaxial surface of pinnae sparsely to moderately covered by hairs, abaxial surface of pinnae sparsely to moderately covered by hairs on the veins, the hairs similar to those of the distal portion of the petioles; **ultimate segments** bifurcate, sometimes simple, margins entire, plane, sometimes recurved, whitish; **veins** usually furcate, sometimes simple, reaching or not the laminae margin. **Sori** along the veins or sometimes spread along of all abaxial surface of the pinnae; **spores** dark brown, proximal surface tuberculate, mainly near trilete aperture, distal surface tuberculate, 51.5−54.0 µm diam.

Distribution and ecology: *Jamesonia cheilanthoides* occurs in Bolivia, Brazil, Peru, and Tristan da Cunha Island, mainly at 2400−3900 m elevation (Tryon 1970). In Brazil, it can be found in cracks of rocks partially shaded in the Itatiaia Mountains (Rio de Janeiro and Minas Gerais States), at 2300−2500 m elevation. It is a threatened species (critically endangered - CR) according to the Red List of Brazilian Flora, version 2012.2 (CNCFlora 2019).

Selected material examined: BRAZIL**.** Minas Gerais: Itamonte, Parque Nacional do Itatiaia, a caminho da nascente do Rio Aiuruoca, 22°22’21.3”S, 44°40’42.9”W, 2300–2500 m, 11-VII-2007, *A. Salino* et al. *12453* (BHCB). Rio de Janeiro: Itatiaia, Parque Nacional do Itatiaia, caminho para o abrigo Rebouças, 22°23'5.3”S, 44°40'94.3”W, 2400 m, 01-IX-2017, *A.P. Della & C. Mynssen 50* (RB, SP).

Jamesonia cheilanthoides is characterized by having pinnate-pinnatisect and linear fronds, with indeterminate growth (with small apical bud), ovate to triangular and chartaceous pinnae, abaxially sparsely to moderately covered by hairs on veins, the

hairs eglandular, hyaline, tortuous, multicellular, apical cell elongated with apex rounded, and straight rachises.

According to the available online image of the type (S-P barcode S-P6352), the collection site is Mauritius Islands, which was interpreted as an error. This specimen was actually collected in the Tristan da Cunha Island (Tryon 1970).

According to Tryon (1970), this species shows high chromosome number (n=174) and considerable morphological variation, mainly due to hybridization.

4. ***Jamesonia brasiliensis* × *Jamesonia cheilanthoides***

Gymnogramma longifolia Baker, Ann. Bot. 5: 484. 1891. Lectotype (designated by Tryon 1970): BRAZIL CENTRAL. s.d., *Glaziou 7017* (K barcode K000633139[image!]; isolectotypes: BM barcode BM000936694[image!]; NY barcodes 00144508 [image!], 00144509[image!]; B barcode B_20_0072891[image!]; P barcode P00603543[image!]; S-R n.S-R-2675[image!]).

Gymnogramma elongata Grev. & Hook. var. *itatiaiensis* Brade, Arch. Jard. Bot. Rio de Janeiro 13: 64, tab. 3, 5, fig. 1–2. 1954. Lectotype first step designated by Tryon (1970) and second step here designed: BRAZIL. Rio de Janeiro: Serra do Itatiaia, Pedra do Altar, 2500 m, III-1937, *A.C. Brade 15435* (RB barcode 00585705[image!]; isolectotype: RB barcode 00585575[image!]).

Gymnogramma jamesonioides Brade, Arch. Jard. Bot. Rio de Janeiro 13: 64, tab. 4, 5, fig. 3. 1954. Lectotype first step designated by Tryon (1970) and second step here designed: BRAZIL. Rio de Janeiro: Serra do Itatiaia, Pedra do Eco, 2400 m, III-1937, *A.C. Brade 15436* (RB barcode 00543307[image!]; isolectotypes: SP!; RB barcode 00585703[image!]; 00585702[image!]).

Figs. 3g-h, 6, 7o-w.

Plants rupicolous or terrestrial. **Rhizomes** short-creeping, 1.2−2.1 mm diam, dark brown, moderately covered by hairs and rigid bristles, the hairs reddish brown, multicellular, glandular, the apical cell globose to slightly bulbous, 1.7−2.3 mm long, the bristles reddish brown to dark brown, with darker-colored thickened transverse cell walls, apex long-filiform, base with 2−7 cells wide, apical cell globose to slightly bulbous, 2.7−3.2 mm long. **Fronds** erect to arcuate, indeterminate growth, 41.0−77.0 × 0.5−2.3 cm; **petioles** cylindrical or semi-cylindrical, adaxially grooved, 14.0−22.0 cm × 0.6−1.0 mm, dark brown, glabrous or sparsely covered by hairs on both surfaces, the hairs in the proximal portion similar to those the rhizomes, in distal portion hairs

with 0.5−2.5 mm long, eglandular, hyaline, tortuous, multicellular, the apical cell elongated with apex rounded; **laminae** pinnate-pinnatifid to pinnate-pinnatisect, less frequent pinnate, linear, 24.0−53.0 × 0.5−2.3 cm, with apical bud moderately to densely covered by hairs, the hairs similar to those of the distal portion of the petioles, chartaceous to coriaceous; **rachises** straight, ellipsoidal, triangular or more often semi-cylindrical, adaxially grooved, dark brown, sparsely to densely covered by hairs on both surfaces, the hairs similar to those of the distal portion of the petioles; **pinnae** reflexed to slightly ascending, oblong, ovate or orbicular, 0.3−1.4 × 0.2−0.8 cm, alternate to subopposite, abrupt to gradually tapering proximally, sometimes gradually tapering towards the apex, short-stalked, the stalk 0.8−1.6 mm long., 0.3−0.4 mm diam., cylindrical, dark brown, straight to curved, adaxial surface of pinnae sparsely to moderately covered by hairs, abaxial surface of the pinnae moderately to densely covered by hairs, the hairs similar to those of the distal portion of the petioles; **ultimate segments** orbicular in the proximal portion of the pinnae, ovate in distal portion of the pinnae, the margins entire, sometimes undulate, recurved or not, whitish; **veins** usually furcate, sometimes simple, reaching or not the laminae margin. **Sori** along the veins; **spores** dark brown, proximal surface with coalescent tuberculate, mainly near trilete aperture, distal surface slightly rugose to laevigate, 50.3−64.4 μm diam.

Distribution and ecology: This hybrid taxon occurs in cracks of rocks partially shaded in the Itatiaia Mountains (Rio de Janeiro and Minas Gerais States), at 2400−2500 m elevation.

Selected material examined: BRAZIL**.** Minas Gerais: Itamonte, 22°22’21.5”S, 45°08’26.9”W, 2500 m, 11-VII-2007, *A. Salino 12443* (BHCB). Rio de Janeiro: Itatiaia, Parque Nacional do Itatiaia, Pedra do Eco, [22°22'S, 44°37'W], 2400 m, III-1937, *A.C. Brade s.n.* (SP 32847).

The specimens hybrid between *Jamesonia brasiliensis* × *J. cheilanthoides* are easily recognized by their aborted or irregular spores and by the intermediate morphology of the plants between the parental species. Sometimes, it is more like one of the parents (pinnae orbicular coriaceous, like in *J. brasiliensis*) or with pinnae ovate to triangular, chartaceous (like in *J. cheilanthoides*)). The spores are badly formed due to the exaggerated development of equatorial expansion (Sylvestre 1995; Condack 2006).

Brade (1954) treated the hybrid as *Gymnogramma elongata* var. *itatiaiensis* and as *G. jamesonioides*, when comparing these plants with *Jamesonia brasiliensis*, which are very similar, differing, however, by the herbaceous textured of the leaves.

Tryon (1970) observed that *Jamesonia cheilanthoides* and *J. brasiliensis* growing on the edges of the same rock, the first one mainly on the shaded sides or under the suspended rock, and the second in sunny and exposed places. In these places, where these two species occur nearby, there are aggregations of individuals with intermediate characteristics and with aborted or irregular spores (Tryon 1970). Some of these forms were recognized as taxonomically distinct (species or varieties), when disassociated from the site of their collection (such as Brade 1954). However, they were interpreted by Tryon (1970) as elements of a hybrid complex based on field observations and spore irregularity.

5. ***Jamesonia flexuosa*** (Kunth) Christenh., Phytotaxa 19: 21. 2011. *Grammitis flexuosa* Kunth., Nov. Gen. et Sp. 1: 5. 1815[1816]. *Psilogramme flexuosa* (Kunth) Kuhn., Festschr. 50 Jähr. Jub. Königstädt. Realschule Berlin: 339. 1882. *Eriosorus flexuosus* (Kunth) Copel., Gen. Fil.: 58. 1947. Lectotype (designated by Tryon 1970): VENEZUELA. Near Caracas, s.d., *Humboldt & Bonpland s.n.* (B barcode B_20_0072743[image!]; isolectotype: P barcode P00603533[image!]).

Figs. 7a-g, 8a-d, 9.

Plants terrestrial. **Rhizomes** short-creeping, 2.5−4.0 mm diam., dark brown, densely covered by hairs and rigid bristles, the hairs reddish brown, multicellular, eglandular (rarely glandular), the apical cell elongated with apex rounded, rarely globose, 0.7−2.3 mm long, the bristles reddish-brown to dark brown, with darker-colored thickened transverse cell walls, apex long-filiform, base with 4−6 cells wide, apical cell elongated with apex rounded, less frequent globose, 1.2−3.0 mm long. **Fronds** scrambling or scandent, erect in young (rarely in older plants), indeterminate growth, (sometimes exceeding 4 m length); **petioles** semi-cylindrical, adaxially grooved, 24.0−88.0 × 0.6−1.7 mm (incomplete plant measures), dark brown, glabrous to sparsely covered by hairs, mainly in groove, the hairs 0.2−1.7 mm long, eglandular, dark brown or hyaline, tortuous, multicellular, the apical cell elongate with apex rounded; **laminae** 3-pinnate to 1−2-pinnatisect to 6-pinnate, triangular, 32.0−60.0 × 12.0−24.0 cm (incomplete plant measures), membranaceous to chartaceous; **rachises** flexuous, semi-cylindrical, adaxially grooved, dark brown, abaxially and adaxially

glabrous or with sparse hairs, mainly in groove, the hairs similar to those of the petioles; **pinnae** usually ascending, triangular, 6.0−28.0 (43.0) × 3.0−11.0 (13.0) cm, alternate, gradually tapering towards the apex (pinnatisect), stalked, the stalk 2.0−17.0 mm long, 0.5−2.0 mm diam, semi-cylindrical, adaxially grooved, dark brown, straight, adaxial surface of pinnae glabrous to sparsely covered by hairs, abaxial surface of the pinnae sparsely covered by hairs, mainly in the ultimate segments near sporangia, and on veins, the hairs similar to those of the petioles; **costae** flexuous, semi-cylindrical, adaxially grooved, dark brown, glabrous to sparsely covered by hairs on both surfaces, mainly in groove, the hairs similar to those of the petioles; **pinnules** triangular to ovate, 2.0−12.0 × 1.5−5.0 cm; **costules** flexuous, semi-cylindrical, adaxially grooved, dark brown, glabrous or sparsely covered by hairs, mainly in groove, the hairs similar to those of the petioles; **segments** triangular, 0.8−1.2 × 0.3−0.7 cm; **ultimate segments** bifurcate, sometimes simple, the margin entire, plane, whitish; **veins** usually furcate, not reaching the laminae margin. **Sori** on the veins in the proximal or distal portion of the ultimate segments; **spores** dark brown, proximal surface with coalescent ridges, mainly near trilete aperture, distal surface laevigate, 43.2−50.3 μm diam.

Distribution and ecology: *Jamesonia flexuosa* is the species with broader geographic distribution of the genus. It occurs from southern Mexico to Bolivia, in north and southeast of Brazil and in the Greater Antilles, at 800−4200 m elevation. In Brazil, it can be found in humid places inside of cloud forest, at 1800−2702 m elevation, in the Amazonas, Roraima, and Minas Gerais States. It is a threatened species (in danger - EN) according to the Red List of Brazilian Flora, version 2012.2 (CNCFlora 2019).

Selected material examined: BRAZIL**.** Amazonas: Santa Isabel do Rio Negro, Parque Nacional do Pico da Neblina, trilha da Bacia do Gelo para Serra do Vento, 00°47'14"N, 66°01'26"W, 2000 m, 22-IX-2012, *R.C. Forzza* et al. *7280* (RB). Minas Gerais: Catas Altas, Parque Natural do Caraça, no alto do Pico do Inficcionado, 20°08’01.8"S, 43°45'31,1"W, 2030 m, 25-V-2004, *A. Salino & R.C. Mota 9576* (BHCB). Roraima: Vira Onça, Monte Roraima, 05°18’N, 60°59’W, 2702 m, 07-I- 2008, *N.F.O. Mota 1240* (BHCB).

Jamesonia flexuosa is recognizes by its 3-pinnate-1−2-pinnatisect to 6-pinnate very divided, scrambling or scandent laminae, with indeterminate growth (can reach up to 4 m in length), triangular, oblong or lanceolate, membranaceous to chartaceous

pinnae, adaxial and adaxial surface glabrous or moderately covered by hairs, the hairs eglandular, apical cell are elongated with apex rounded, flexuous rachises, costa, and costule, bifurcate ultimate segments.

Jamesonia flexuosa was erroneously cited by Tryon (1970) for Espírito Santo State in Brazil, based on a collection by *Glaziou 17539*, carried out on the "Cerro Batatal", which is located adjacent to the Reserva Particular do Patrimônio Natural Santuário do Caraça (Catas Altas) in Minas Gerais State (Salino & Viveros 2012).

According to Tryon (1970), there are many variants of this species, which are products of hybridization with other taxa. Recently, one variety of this species established by the author has been recognized as a distinct species, *Jamesonia galeana* (A.F.Tryon) A.Rojas (in Rojas-Alvarado 2017a). However, the segregation of this taxon was based only on the morphology.

In the specimens analyzed, we can observe a variation in the color of the petioles, rachises, costa, and costule. In the Brazilian and Venezuelan specimens, they are dark brown, whereas in the specimens from Colombia, Ecuador, and Bolivia they are stramineous. The gathering by *M. Sundue et al. 1715* (RB), from Costa Rica, presents rachises moderately covered by hairs on both surfaces.

According to Salino & Viveros (2012), the plants from Minas Gerais State (Serra do Caraça) present glandular hairs on the laminae, mainly on the veins, which have small and globular apical cells, almost inconspicuous. The verified specimens from this locality and those from Amazonas and Roraima States, do not present glandular hairs on the lamina. Glands are rarely seen in the bristles and hairs of the rhizomes, in specimens collected in Serra do Caraça.

6. ***Jamesonia insignis*** (Mett.) Christenh., Phytotaxa 19: 21. 2011. *Gymnogramma insignis* Mett., Linnaea 36: 70. 1869. *Psilogramme insignis* (Mett.) Kuhn, Festschr. 50 Jähr. Jub. Königstädt. Realschule Berlin: 337. 1882. *Eriosorus insignis* (Mett.) A.F.Tryon, Contr. Gray Herb. 200: 152, fig. 32. 1970. Lectotype (designated by Tryon 1970): BRAZIL. Border of Rio de Janeiro and Minas Gerais, Serra Negra, 1816–1821, *A.F.C.P. Saint-Hilaire B' 72* (B barcode B_20_0072879[image!]; isolectotypes: P barcodes P00603549 [image!], P00603550[image!], P00603551[image!]).

Figs. 7h-o, 8e-f, 9.

Plants terrestrial or rupicolous. **Rhizomes** short-creeping, 0.3−3.5 mm diam, dark brown, densely covered by hairs and rigid bristles, the hairs dark brown,

multicellular, glandular, the apical cell globose, 0.3−3.0 mm long, the bristles dark brown, with darker-colored thickened transverse cell walls, apex long-filiform, base with 2−6 cells wide, apical cell globose, 3.0−3.7 mm long. **Fronds** erect or more often semi-scandent, indeterminate growth, 35.0−105.0 × 6.0−20.5 cm; **petioles** semi-cylindrical, adaxially grooved, rarely plane, 16.0−63.0 cm × 1.0−2.0 mm, dark brown, shiny, sparsely to moderately covered by hairs on both surfaces, the hairs in the proximal portion similar to those of the rhizomes, at distal portion the hairs with 0.4−0.9 mm long, glandular or eglandular, hyaline to dark brown, sometimes bicolorous, erect, multicellular, the apical cell globose or elongated with apex rounded; **laminae** 2-pinnate-pinnatifid to 3-pinnate-pinnatisect, (rarely) pinnate-pinnatisect, triangular to elongate-triangular, 8.0−42.0 × 4.5−20.5 cm, with apical bud densely covered by hairs, the hairs eglandular similar to those at distal portion of the petioles, chartaceous; **rachises** flexuous, sometimes semi-flexuous, semi-cylindrical, adaxially grooved, dark brown, moderately covered by hair on both surfaces, especially in the axils of the pinnae, the hairs similar to those of the petioles; **pinnae** proximal usually reflexed or patent, distal ascending, triangular, the basiscopic side slightly larger, 2.1−17.5 × 1.2−8.3 cm, alternate, rarely sub opposite, gradually tapering towards the apex (pinnatisect to pinnatifid), long-stalked, the stalk 2.3−11.0 mm long, 0.1−0.7 mm diam., semi-cylindrical, adaxially grooved, dark brown, straight, adaxial surface of pinnae moderately covered by hairs, mainly between the veins, abaxial surface of pinnae moderately to densely covered by hairs mainly on veins, the hairs eglandular similar to those of the petioles; **costa** flexuous, semi-cylindrical, adaxially grooved, dark brown, moderately covered by hairs on both surfaces, the hairs similar to those of the petioles; **pinnules** ovate to triangular, 1.0−4.0 × 0.7−2.6 cm, alternate, short-stalked, the stalk 0.6−8.0 mm long, 0.6−0.7 mm diam., semi-cylindrical, adaxially grooved, dark brown, straight; **ultimate segments** ovate or orbiculate, margins crenate to denticulate-crenate, usually plane, sometimes slightly recurved, whitish, with hairs similar to those of the petioles; **veins** furcate, reaching the lamina margin. **Sori** on the veins in distal portion of the segments; **spores** dark brown, proximal surface with coalescent ridges, mainly near trilete aperture, distal surface slightly rugate, 67.1−68.0 μm diam.

Distribution and ecology: *Jamesonia insignis* occurs only in Brazil in the states of Minas Gerais, Paraná, Rio de Janeiro, and São Paulo, in moist and shady places in the cloud forest, rock fields, and altitude fields, close to outcrops, at 1000−2030 m

elevation. There is no record of occurrence for this species in the state of Espírito Santo (in the herbaria visited), but it is estimated that it occurs in this state. It is a threatened species (vulnerable - VU) according to the Red List of Brazilian Flora, version 2012.2 (CNCFlora 2019).

Selected material examined: BRAZIL**.** Minas Gerais: Carrancas, Serra dos Perdizes, 21°35’11.9"S, 44°35’48.9"W, 1560 m, 02-XII-2007, *L.L. Giacomin 3330* (BHCB). Paraná: Campina Grande do Sul, Parque Estadual do Pico do Paraná, 25°15’S, 48°48’W, 1750 m, 22-V-2008, *J.B.S. Pereira* et al. *274* (UPCB). Rio de Janeiro: Frade de Macaé, [22°15'S, 42°06'W], 1000 m, 17-II-1932, *A.C. Brade 15802* (ICN, RB). São Paulo: Campos do Jordão, [22°41'S, 45°28'W], 5−20-II-1937, *P.C. Porto 3108* (RB).

Jamesonia insignis is characterized by having 2-pinnate-pinnatifid to 3-pinnate-pinnatisect, triangular fronds, triangular and chartaceous pinnae, with adaxial and abaxial surfaces moderately covered by hairs, the hairs eglandular, hyaline to brown, sometimes bicolorous, erect, apical cell elongated with apex rounded, flexuous rachises, ovate or orbiculate ultimate segments, with several superficial lobes, and the margins crenate to denticulate-crenate.

The presence of this species in the state of Paraná has been recently confirmed in a checklist of ferns and lycophytes from the highlands of the Pico Paraná State Park (Pereira & Labiak 2018). This is the southernmost location of its distribution.

Some studied specimens present morphological variations: The plants from Paraná State (p.e., *V. Ariati et al. 1220*; *J.B.S. Pereira et al. 274)* are smaller and less divided (pinnate-pinnatisect), whereas few specimens of the Rio de Janeiro State (p.e., *Santos-Lima 417*; *A.C. Brade s.n. (RB 33995)*) have robust leaves with few lobes and fully brown hairs on the fronds. According to Tryon (1970), these variations probably reflect different levels of ploidy, but this hypothesis was not tested in the present account. Additionally, some fronds have flexuous rachises more demarcated than others.

The plants from Paraná can be confused with *Jamesonia rufescens* by the shape and size of the frond and ultimate segments, as well as by the crenate margin of the segments. However, it is distinguished by presence of glandular hairs and bristles on the rhizome, whereas *J. rufescens* has eglandular hairs and bristles. In addition, *J. insignis* has flexuous or slightly flexuous rachises (vs. straight in *J. rufescens*).

7. ***Jamesonia ×intermedia*** A.P.Della & J.Prado, Amer. Fern J. (submitted). Type: BRAZIL. Rio de Janeiro: Petrópolis, Parque Nacional da Serra dos Órgãos, Bom Fim, Pico do Alcobaça, 22°28'22.9"S, 43°07'00.4"W, 1689 m, 27-II-2019, *A.P. Della et al. 69* (holotype: SP; isotypes: NY, RB, SPF).

Figs. 4g-h, 8g-h, 10a-k, 11, 14a-c.

Plants terrestrial or rupicolous. **Rhizomes** short-creeping, 2.5−3.0 mm diam, dark brown, densely covered by hairs and bristles, the hairs dark brown, multicellular, glandular, the apical cell globose, 0.2−2.2 mm long, the bristles dark brown, with darker-colored thickened transverse cell walls, apex long-filiform, base with 2−5 cells wide, apical cell globose, 1.3−2.4 mm long. **Fronds** semi-scandent, indeterminate growth, 83.0−125.0 × 13.0−19.5 cm; **petioles** semi-cylindrical, adaxially grooved, 60.0−92.5 cm × 0.6−1.6 mm, bicolorous (proximally dark brown and distally stramineous) on young plants and concolorous (dark brown) on adult plants, at proximal portion moderately covered by hairs on both surfaces, at distal portion sparsely covered by hairs to glabrous on both surfaces, the hairs with 0.3−1.6 mm long, glandular or eglandular, hyaline to dark brown, sometimes bicolor, erect, multicellular, the apical cell globose or elongated with apex rounded; **laminae** 2-pinnate-pinnatisect to 3-pinnate-pinnatifid, triangular, 18.0−32.5 × 13.0−19.5 cm, coriaceous; **rachises** flexuous, semi-cylindrical, adaxially grooved, stramineous in young plants and brown in adult plants, abaxially and adaxially glabrous or with sparse hairs, mainly in the groove and on the axils of the pinnae, the hairs eglandular, similar to those of the petioles; **pinnae** usually ascending, triangular, the basiscopic side slightly larger, 5.0−12.5 × 3.5−8.0 cm, alternate, gradually tapering towards the apex (pinnatisect, long-attenuate), long-stalked, the stalk 9.0−27.0 mm long, 0.6−1.2 mm diam, semi-cylindrical, adaxially grooved, stramineous in young plants and brown in adult plants, straight, adaxial surface of pinnae glabrous to sparsely covered by hairs, abaxial surface of pinnae sparsely to moderately covered by hairs, mainly on veins, the hairs eglandular, similar to those of the petioles; **costae** flexuous, semi-cylindrical, adaxially grooved, stramineous in young plants and brown in adult plants, abaxially and adaxially glabrous or with sparse hairs, mainly in the groove, the hairs eglandular, similar to those of the petioles; **pinnules** triangular, sometimes ovate, 1.2−4.5 × 1.0−3.7 cm, alternate, short-stalked, the stalk 4.0−1.2 mm long, 0.6−0.8 mm diam, semi-cylindrical, adaxially grooved, stramineous in young plants and brown in adult plants, straight; **costules** flexuous, semi-cylindrical, adaxially grooved, stramineous in young plants

and brown in adult plants, abaxially and adaxially glabrous or with sparse hairs, mainly in the groove, the hairs eglandular, similar to those of the petioles; **ultimate segments** triangular to ovate, 0.4−1.5 × 0.4−1.0 cm, margins crenate, plane to recurved, whitish; **veins** usually furcate reaching the laminae margin. **Sori** on the veins, forming several lines along the segments; **spores** dark brown, without content, proximal surface with coalescent ridges, mainly near trilete aperture, distal surface, laevigate, 40.0−60.0 μm diam.

Distribution and ecology: This hybrid taxon is endemic to Brazil and occurs only in the Serra dos Órgãos, in the Rio de Janeiro State. It grows at the edge of the trail to the Pico do Alcobaça, at 1650−1670 m elevation. The soil of this region is shallow, dark, and humid, arranged under a rocky slab. The plant was found between grasses and bromeliads.

Selected material examined: BRAZIL. Rio de Janeiro: Petrópolis, Parque Nacional da Serra dos Órgãos, Bom Fim, Pico do Alcobaça, 22°28’17”S, 43°07’00”W, 1650 m, 04-VI-2017, *J.M.A. Braga 17-002* (RB).

Jamesonia ×*intermedia* is recognized by its 2-pinnate-pinnatisect to 3-pinnate-pinnatifid laminae, triangular and coriaceous pinnae, with adaxial surface glabrous or with sparse hairs, abaxial surface moderately covered by hairs, mainly on veins, the hairs eglandular, hyaline, tortuous, apical cell elongated with apex rounded, rachises, costa and costule flexuous and stramineous in young plants and brown in adult plants, and elongate-triangular to ovate ultimate segments, with several superficial lobes, with crenate margins.

This taxon is a hybrid between *Jamesonia insignis* and *J. biardii* (Della et al., submitted). With the first shares size and shape of the pinnae, pinnules, and ultimate segments, as well as crenate margin of the lamina. With the second, it shares the pubescence of the lamina and rachises. Also, it presents withered spores, without content. See Chapter 3 for more details about distribution, ecology, and comments about this hybrid.

8. ***Jamesonia osteniana*** (Dutra) G.J.Gastony, Syst. Bot. 28(3): 490–502. 2003. *Anogramma osteniana* Dutra, Ostenia (Montevideo): 5–6, Figs. 1–2. 1933. Lectotype (designated by Nakazato & Gastony 2003): BRAZIL. Rio Grande do Sul: São

Leopoldo, Morro das Pedras, 01-IX-1932, *J. Dutra 48* (ICN!; isolectotypes: R!; BM barcodes BM000936633[image!], BM000936632[image!]; P barcode P00602783[image!], S-R n.S-R-323[image!]; US barcode 00142043[image!]).

Figs. 11, 12a-e, 13a-b, 14d-e.

Plants terrestrial. **Rhizomes** erect, short, 0.5−1.2 mm diam., castaneous, moderately covered by hairs, the hairs hyaline, 2−4-celled, glandular, the apical cell globose, 0.1−0.5 mm long. **Fronds** erect, determinate growth, 0.8−6.8(−8.5) × 0.6−2.2(−2.6) cm; **petioles** semi-cylindrical, adaxially grooved, to plane, 0.4−4.5 cm × 0.2−0.5 mm, bicolorous, proximally castaneous, distally stramineous, sparsely to moderately covered by hairs on both surfaces, the hairs similar to those of the rhizomes; **laminae** 1-pinnatisect, 2-pinnatisect-pinnatifid, 1-pinnate-2-pinnatisect, ovate or deltate, 0.4−3.2(−4.2) × 0.6−2.2(−2.6) cm, membranaceous; **rachises** straight, semi-cylindrical, adaxially grooved, to plane, stramineous, sparsely to moderately covered by hairs on both surfaces, the hairs similar to those of the rhizomes; **pinnae** ascending, deltate, 0.6−1.5 × 0.5−1.0 cm, alternate, gradually tapering towards the apex (pinnatisect to pinnatifid), stalked, the stalk 2.0−3.0 mm long, 0.3−0.4 mm diam., semi-cylindrical, adaxially grooved, stramineous, straight, sparsely to moderately covered by hairs on both surfaces, the hairs similar to those of the rhizomes; **costae** inconspicuous, sparsely to moderately covered by hairs on both surfaces, the hairs similar to those of the rhizomes; **segments** deltate; **ultimate segments** frequently bifurcate, sometimes simple, margins entire, sometimes undulate, plane, whitish, with hairs, the hairs similar to those of the rhizomes; **veins** usually furcate, sometimes simple, not reaching the lamina margin. **Sori** on veins at distal portion of the segments; **spores** dark brown, proximal surface tuberculate, mainly near trilete aperture, distal surface laevigate, 48.8−49.4 μm diam.

Distribution and ecology: *Jamesonia osteniana* occurs in humid ravines along roadsides and river margins in the Rio Grande do Sul State (Brazil). Also, in Uruguay between rocks, at 50−140 m elevation. In Viamão (Rio Grande do Sul), a small population was verified in a ravine of roadside, between grasses, in an area of cattle pasture and cultivation of *Pinus*. The plants were present in small spots without vegetation around, with exposed soil. It is a plant with annual sporophyte (the sporophyte is “visible” and fertile, usually from September to January. The period between September and October is the best one to collect this species. This species was

included in the list of priority species for conservation in Uruguay, because it is considered a threatened species (Soutullo et al. 2009).

Selected material examined: BRAZIL. Rio Grande Do Sul: Viamão, Beco do Pesqueiro, [30°09'S, 50°57'W], 07-XI-2018, *A.P. Della* et al. *55* (SP).

This species is easily recognized by its small size (maximum 8.5 cm tall), 1-pinnatisect to 2-pinnatisect-pinnatifid, ovate or deltate, membranaceous laminae, sparsely to moderately covered on both surfaces by glandular, hyaline, 2−4-celled hairs, straight rachises, frequently bifurcate and, sometimes, simple ultimate segments, with entire or, sometimes, with undulate and plane margins.

This taxon was described as part of the genus *Anogramma*, but Nakazato & Gastony (2003), based on molecular phylogenetic analyses, found that *A. osteniana* is sister and more closely related to *Jamesonia* and *Eriosorus*. This species forms a monophyletic group together another species of these two genera and with high support (ML = 100). So it was combined into *Jamesonia*. The similarity of the laminae and spores have already been indicative of the phylogenetic proximity of *A. osteniana* with *Jamesonia* and *Eriosorus* (Nakazato & Gastony 2003).

However, this species can be distinguished from *Jamesonia* by the presence of erect rhizome, covered only by glandular hairs and absence of bristles; by the color of the rachis stramineous, rather than brown or dark brown; and by the short (few cells) glandular hairs of the laminae. Additionally, this species is annual and occurs at 50−140 m elevation (vs. perennial plants and growing in high elevations). The phylogenetic position of this species is being studied by the present authors and the results will be part of another paper.

9. ***Jamesonia rufescens*** (Fée) Christenh., Phytotaxa 19: 21. 2011. *Gymnogramma rufescens* Fée, Gen. Filic.: 181, t. 19C, fig. 3. 1852. *Psilogramme rufescens* (Fée) Kuhn, Festschr. 50 Jähr. Jub. Königstädt. Realschule Berlin: 336. 1882. *Eriosorus rufescens* (Fée) A.F.Tryon., Rhodora 65: 56. 1963. Lectotype (here designated): PERU. s.d., *Mathews 1814* (P barcode P00603554[image!]; isolectotype: P barcode P00603564[image!]).

Figs. 12f-l, 13c-f, 14f-h, 15.

Plants rupicolous or terrestrial. **Rhizomes** short-creeping, 1.0−3.0 mm diam, dark brown, moderately to densely covered by hairs and bristles, the hairs reddish brown to black, multicellular, eglandular, the apical cell elongated with apex rounded, 1.0−1.4 mm long, the bristles dark brown to black, with darker-colored thickened transverse cell walls, apex long-filiform, base with 2 cells wide, apical cell elongated with apex rounded, 1.0−1.4 mm long. **Fronds** erect to arcuate, determinate growth, 6.0−47.0 × 1.1−8.0 cm; **petioles** semi-cylindrical, adaxially grooved, 1.4−36.0 cm × 0.6−1.0 mm, dark brown, moderately to densely covered by hairs on both surfaces, the hairs at the proximal portion similar to those of the rhizome, at distal portion the hairs with 1.0−2.0 mm long, eglandular, brown to hyaline, sometimes bicolorous, erect to slightly tortuous, multicellular, the apical cell elongated with apex rounded; **laminae** pinnate-pinnatisect to pinnate-pinnatifid, triangular, sometimes ovate, 2.0−12.3 × 1.1−8.0 cm, chartaceous to coriaceous; **rachises** straight, semi-cylindrical, adaxially grooved, dark brown, moderately to densely covered by hair on both surfaces, the hairs similar to those of the distal portion of the petioles; **pinnae** patent to ascending, triangular to ovate, the basiscopic side slightly larger, 1.1−4.5 × 0.5−3.0 cm, alternate to opposite, gradually tapering towards the apex (pinnatisect to pinnatifid), sessile to short-stalked, the stalk 0.2−2.0 mm long., 0.7−1.3 mm diam, semi-cylindrical, adaxially grooved, dark brown, often with laminae decurrent, straight, adaxial surface of pinnae moderately to densely covered by hairs, abaxial surface of pinnae moderately to densely covered by hairs, mainly on veins, the hairs similar to those at distal portion of the petioles; **ultimate segments** ovate, the margin crenate, plane, sometimes recurved, whitish, with hairs similar to those at distal portion of the petioles; **veins** furcate reaching or not the laminae margin. **Sori** on veins, forming several lines along the segments; **spores** dark brown, proximal surface with coalescent ridges, mainly near trilete aperture, distal surface strongly tuberculate, 59.3−60.0 μm diam.

Distribution and ecology: *Jamesonia rufescens* occurs in Bolivia, Brazil, Colombia, Ecuador, Peru, and Venezuela, at 2000–3600 m elevation (Tryon 1970). In Brazil, it can be found in Parque Estadual dos Três Picos (PETP), Rio de Janeiro State, at 2000 m elevation. It grows in a partially shaded place, with dark and shallow soil, arranged on a rock slab. It is a threatened species (critically endangered - CR) according to the Red List of Brazilian Flora, version 2012.2 (CNCFlora 2019). The small population found in the PETP is threatened by the flow of people along the trail, due to the absence of more effective equipment to help climb the rock slab, thus vegetation is used as

support. Several cases of vegetation tipping (mainly of bromeliads) were verified along the trail to the Pico Menor and Pico Médio.

Selected material examined: BRAZIL**.** Rio de Janeiro: Nova Friburgo, Parque Estadual dos Três Picos, trilha para os Picos Menor e Médio, [22°20'S, 42°43'W], 02-III-2019, *A.P. Della* et al. *73.* (SP).

Jamesonia rufescens is recognized by its pinnate-pinnatisect to pinnate-pinnatifid, triangular or sometimes ovate lamina, triangular to ovate pinnae, moderately to densely covered by hairs, the hairs eglandular, brown to hyaline, sometimes bicolorous, erect to slightly tortuous, apical cell elongated with apex rounded, straight rachises, ovate ultimate segments, with several superficial lobes, and crenate margins.

Tryon (1970) selected the published illustration to be the lectotype of *Gymnogramma rufescens*. However, the original material was located at Paris Herbarium and according to the Article 9.12 of the International Code of Nomenclature for Algae, Fungi, and Plants (Turland et al. 2018), in the designation of a lectotype, specimens have priority over illustrations. So, the original material at P herbarium was chosen as the lectotype.

Tryon (1970) did not mention the presence of this species in Brazil. Only Windisch (1984) published a paper that presented its occurrence. He discussed the similarity of the plant collected by *Capell s.n.* (FCAB 0273), in the Pico da Caledônia, with *Jamesonia rufescens* described by Tryon (1970). Windisch (1984) concluded that it is another case of disjunction between species occurring in the Andes and in high regions of the southeastern of Brazil.

The Brazilian plants present only eglandular hairs on the rhizomes, petioles, rachises, and laminae, whereas a analyzed plant from Bolivia (*J.C. Solomon 16157*, MBM, MO) shows glandular hairs on the petioles, rachises, and laminae. It suggests that the Brazilian plants can be a distinct species, but more studies are necessaries to confirm this assumption.

10. ***Jamesonia* sp.**

Figs. 12m-u, 13g-h, 15.

Plants terrestrial. **Rhizomes** short-creeping, 1.5−2.5 mm diam., dark brown, densely covered by tortuous hairs and bristles, the hairs golden-brown, multicellular,

glandular or eglandular, the apical cell globose or elongated with apex rounded, 0.3−3.5 mm long., the bristles golden-brown, with darker-colored thickened transverse cell walls, apex long filiform, base with 2 cell of wide, apical cell globose or elongated with apex rounded, 3.0−3.5 mm long. **Fronds** erect to slightly arcuate, indeterminate growth, 42.0−53.0 × 5.0−9.0 cm; **petioles** semi-cylindrical, adaxially grooved, 17.0−21.0 cm × 1.0−2.0 mm, dark brown, shiny, moderately covered by hairs, mainly in groove, the hairs in the proximal portion similar to those of the rhizomes, at distal portion the hairs with 0.5−3.0 mm long, glandular or eglandular, hyaline, tortuous, multicellular, the apical cell globose or elongated with apex rounded; **laminae** 2-pinnate-pinnatisect, less often pinnate-2-pinnatisect, narrowly triangular to narrowly elliptic, 30.0−32.0 × 5.0−9.0 cm, chartaceous; **rachises** straight, semi-cylindrical, adaxially grooved, dark brown, moderately covered by hairs, mainly in the groove, the hairs eglandular, similar to those at distal portion of the petioles; **pinnae** usually ascending, narrowly triangular, 3.5−6.0 × 1.4−2.5 cm, alternate to opposite, sometimes slightly tapering proximally, gradually tapering towards the apex (pinnatisect), short-stalked, the stalk 1.5−2.0 mm long, 0.6−0.8 mm diam., semi-cylindrical, adaxially grooved, dark brown, straight, adaxial surface of pinnae sparsely to moderately covered by hairs, abaxial surface of pinnae sparsely to moderately covered by hairs, mainly on the veins, the hairs eglandular, similar to those at distal portion of the petioles; **costae** straight, semi-cylindrical, adaxially grooved, dark brown, moderately covered by hairs, mainly in groove, the hairs eglandular, similar to those at distal portion of the petioles; **pinnules** (or segments) ovate to oblong, 0.6−1.4 × 0.5−0.7 cm, alternate, short-stalked, the stalk 1.0−2.0 mm long, 0.5−0.6 mm diam., semi-cylindrical, adaxially grooved, dark brown, straight; **ultimate segments** bifurcate, sometimes simples, margins entire, plane, whitish; **veins** usually furcate, sometimes simple, reaching or not the laminae margin. **Sori** on veins in the proximal portion of the ultimate segments; **spores** dark brown, proximal surface with coalescent ridges, mainly near trilete aperture, distal surface strongly tuberculate, 58.0−61.9 μm diam.

Distribution and ecology: *Jamesonia* sp. occurs in forests along river margins, mixed with dense populations of Bromeliaceae, in the Cuiabixi Igarapé, in the Parque Nacional do Pico da Neblina, at 2060 m elevation.

Material examined: BRAZIL. Amazonas: Santa Isabel do Rio Negro, Parque Nacional do Pico da Neblina, 00°47’18”N, 66°01’15”W, 2060 m, 20-IX-2012, *R.C. Forzza* et al. *7203* (RB).

Jamesonia sp. is characterized by having pinnate-2-pinnatisect to 2-pinnate-pinnatisect, narrowly triangular to narrowly elliptic fronds, narrowly triangular, and chartaceous pinnae, adaxial and abaxial surface sparsely to moderately covered by hairs, the hairs eglandular, hyaline, apical cell elongated with apex rounded, straight rachises, ovate to oblong pinnules (or segments), bifurcate ultimate segments, with entire or plane margins.

Based on the key of *Eriosorus* by Tryon (1970), the putative name for this specimen is *Jamesonia congesta* (Christ) Christenh., which resembles the studied specimen by the hairs and bristles of the rhizome, and the shape and division of the lamina (narrowly triangular to narrowly ovate, 2-pinnate-pinnatisect). However, *J. congesta* presents rachis and both surfaces of lamina densely covered by glandular and eglandular hairs (vs. rachises and both surfaces of the lamina sparsely to moderately covered by only eglandular hairs).

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Author’s contributions

A. P. Della: substantial contribution in the concept and design of the study, contribution to data collection, contribution to data analysis and interpretation, and contribution to manuscript preparation.

J. Prado: substantial contribution in the concept and design of the study, contribution to data analysis and interpretation, contribution to manuscript preparation, and contribution to critical revision, adding intellectual content.

Conflicts of interest

The authors declare that they have no conflict of interest related to the publication of this manuscript.

References

BAKER, J.G. 1870. Cyatheaceae et Polypodiaceae. In Flora Brasiliensis (C.F.P. Martius & A.G. Eichler, orgs.). Munchen, Wien, Leipzig, v.1, pars 2, p. 358–382.

BRADE, A.C. 1942. A composição da flora pteridófita do Itatiaia: Contribuição para a fitogeografia dessa região. Rodriguésia 15: 29–43.

BRADE, A.C. 1954. Contribuição para o conhecimento da flora da serra do Itatiaia, Brasil. Arch. Jard. Bot. Rio de Janeiro 13: 64.

BRADE, A.C. 1956. A flora do Parque Nacional do Itatiaia. Ministério do Meio Ambiente, Boletim 5, p. 112.

CHRISTENHUSZ, M.J.M., ZHANG, X.C. & SCHNEIDER, H. 2011. A linear sequence of extant families and genera of lycophytes and ferns. Phytotaxa 19: 7–54.

CNCFLORA. 2019. *Eriosorus* and *Jamesoni*a in Lista Vermelha da flora brasileira versão 2012.2 Centro Nacional de Conservação da Flora. http://cncflora.jbrj.gov.br/portal/pt-br/profile/ (last access in 08/02/ 2019).

COCHRAN, A.T., PRADO, J. & SCHUETTPELZ, E. 2014. *Tryonia*, a new taenitidoid fern genus segregated from *Jamesonia* and *Eriosorus* (Pteridaceae). PhytoKeys 35: 23–43.

CONDACK, J.P.S. 2006. Pteridófitas ocorrentes na região alto montana do Parque Nacional do Itatiaia: análise florística e estrutural. Dissertation, Escola Nacional de Botânica Tropical, do Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Rio de Janeiro.

ESRI. 2016. ArcGIS release 10.5. Redlands, CA: Environmetal Systems Research Institute.

FIDALGO, O. & BONONI, V.L.R. (coords.) 1984. Técnicas de coleta, preservação e herborização de material botânico. Instituto de Botânica, São Paulo, Manual 4, p. 61.

GARCIA, R.J.F. & PIRANI, J.R. 2005. Análise florística, ecológica e fitogeográfica do Núcleo do Curucutu, Parque Estadual da Serra do Mar (São Paulo, SP) com ênfase nos campos junto à crista da Serra do Mar. Hoehnea 32: 1–48.

GONZATTI, F., MACHADO, L. & WINDISCH, P.G. 2016. Distribution patterns of ferns and lycophytes in the coastal region of the state of Rio Grande do Sul, Brazil. Acta Bot. Brasil. 30: 239–253.

IBGE. 2015. Mapas. https://mapas.ibge.gov.br/bases-e-referenciais/bases-cartograficas/malhas-digitais.html (last access in 16/05/2019).

ICMBIO. 2019. Mapa Temático e Dados Geoestatísticos das Unidades de Conservação Federais. http://www.icmbio.gov.br/portal/geoprocessamentos/51-menu-servicos/4004-downloads-mapa-tematico-e-dados-geoestatisticos-das-uc-s (last access in 16/05/2019).

LELLINGER, D.B. 2002. A Modern Multilingual Glossary for Taxonomic Pteridology. Pteridologia 3A. Washington, American Fern Society.

MENINI NETO, L., MATOZINHOS, C.N., ABREU, N.L., VALENTE, A.S.M, ANTUNES, K., SOUZA, F.S., VIANA, P.L. & SALIMENA, F.R.G. Non-arboreal vascular flora of a ravine forest in the Mantiqueira Range, Zona da Mata of Minas Gerais, Brazil. Biota Neotrop., 9(4): http://www.biotaneotropica.org.br/v9n4/en/abstract?inventory+b n0100 9042009 (last access in 10/07/2019).

NAKAZATO, T. & GASTONY, G.J. 2003. Molecular phylogenetics of *Anogramma* species and related genera (Pteridaceae: Taenitidoideae). Syst. Bot. 28: 490–502.

PEREIRA, J.B.S. & LABIAK, P.H. 2018. Checklist of ferns and lycophytes from the highlands of Pico Paraná State Park, Paraná, Brazil. Rodriguésia 69: 301–307.

PPG I. 2016. A community-derived classification for extant lycophytes and ferns. J. Syst. Evol. 54: 563–603.

PRADO, J. 2015. Pteridaceae in Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro. http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB91951 (last access in 08/01/2018).

PRADO, J. & HIRAI, R.Y. Checklist of lycophytes and ferns of São Paulo State, Brazil. Biota Neotrop. 11(1a): http://www.biotaneotropica.org.br/v11n1a/en/abstract ?inventory+bn 0121101a2011 (last access in 10/07/2019).

PRADO, J. & SYLVESTRE, L.S. 2010. As samambaias e licófitas do Brasil. In Catálogo de plantas e fungos do Brasil (R.C. Forzza, J.F.A. Baumgratz, C.E.M.

Bicudo, D. Canhos, A.A. Carvalho Jr., A. Costa, D.P. Costa, M. Hopkins, P.M. Leitman, L.G. Lohmann, E.M. Lughadha, L.C. Maia, G. Martinelli, M. Menezes, M.P. Morim, M. Nadruz, A.L. Peixoto, J.R. Pirani, J. Prado, L.P. Queiroz, V.C. Souza, J.R. Stehmann, L.S. Sylvestre, B.M.T. Walter & D.C. Zappi, orgs.). Jardim Botânico do Rio de Janeiro, Rio de Janeiro, v. 1, p. 69–74.

PRADO, J., SYLVESTRE, L.S., LABIAK, P.H., WINDISCH, P.G., SALINO, A., BARROS, I.C.L., HIRAI, R.Y., ALMEIDA, T.E., SANTIAGO, A.C.P., KIELING-RUBIO, M.A., PEREIRA, A.F.N., ØLLGAARD, B., RAMOS, C.G.V., MICKEL, J.T., DITTRICH, V.A.O., MYNSSEN, C.M., SCHWARTSBURD, P.B., CONDACK, J.P.S., PEREIRA, J.B.S. & MATOS, F.B. 2015. Diversity of ferns and lycophytes in Brazil. Rodriguésia 66: 1073–1083.

ROJAS-ALVARADO, A.F. 2017a. El complejo *Jamesonia flexuosa* (Kunth) Christenh. (Pteridaceae) para el Neotrópico. Acta Bot. Malac. 42: 33-40.

ROJAS-ALVARADO, A.F. 2017b. Novedades en *Jamesonia* Hook. & Grev. y *Tryonia* Schuettp., J. Prado & A.T. Cochran (Pteridaceae) para el Neotrópico. Acta Bot. Malac. 42: 111–118.

ROJAS-ALVARADO, A.F. 2019. Corrections in Recently Described Species of Ferns and Lycophytes from the Neotropics. OALibJ 6: e5172.

SALINO, A. & VIVEROS, R.S. 2012. Flora II: As pteridófitas da Serra do Caraça. In: Serra do Caraça (C. Ottoni, org.). Edição do autor, Belo Horizonte, v. 1, p. 82–97.

SÁNCHEZ-BARACALDO, P. 2004a. Phylogenetics and biogeography of the neotropical fern genera *Jamesonia* and *Eriosorus* (Pteridaceae). Amer. J. Bot. 91: 274–284.

SÁNCHEZ-BARACALDO, P. 2004b. Phylogenetic relationships of the subfamily Taenitidoideae, Pteridaceae. Amer. Fern J. 94: 126–142.

SÁNCHEZ-BARACALDO, P. & THOMAS, G.H. 2014. Adaptation and convergent evolution within the *Jamesonia-Eriosorus* complex in High-elevation biodiverse Andean hotspots. PlosOne 9: 1–11.

SCHWACKE, W. 1900. Plantas Novas Mineiras. Imprensa oficial do estado de Minas Gerais, Minas Gerais 2: 17–19.

SEHNEM, A. 1972. Pteridáceas. In Flora Ilustrada Catarinense (R. Reitz, ed.). Herbário Barbosa Rodrigues, Itajaí, pars. 1, p. 1–88.

SOUTULLO, A., ALONSO, E., ARRIETA, D., BEYHAUT, R., CARREIRA, S., CLAVIJO, C., CRAVINO, J., DELFINO, L., FABIANO, G., FAGUNDEZ, C., HARETCHE, F., MARCHESI, E., PASSADORE, C., RIVAS, M., SCARABINO, F., SOSA, B. & VIDAL, N. 2009. Especies Prioritarias para la Conservación em Uruguay. Proyecto Fortalecimiento del Processo de Implementación del Sistema Nacional de Áreas Protegidas, serie de informes, v. 16, p. 1–95.

SOUZA, F.S., SALINO, A., VIANA, P.L. & SALIMENA, F.R.G. 2012. Pteridófitas da Serra Negra, Minas Gerais, Brasil. Acta Bot. Brasil. 26: 378–390.

SYLVESTRE, L.S. 1995. Palinologia das Polypodiaceae "sensu lato" do Planalto do Itatiaia, Rio de Janeiro, Brasil. Arch. Jard. Bot. Rio de Janeiro 33: 9–73.

THIERS, B. 2019. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih/ (last access in 13/06/2019).

TRYON, A.F. 1962. A monograph of the fern genus *Jamesonia*. Contrib. Gray Herb. Harv. Univ. 191: 109–197.

TRYON, A.F. 1970. A monograph of the fern genus *Eriosorus*. Contrib. Gray Herb. Harv. Univ 200: 54–174.

TRYON, A.F. & LUGARDON, B. 1990. Spores of Pteridophyta. Springer-Verlag, New York, USA.

TURLAND, N. J., WIERSEMA, J. H., BARRIE, F. R., GREUTER, W., HAWKSWORTH, D. L., HERENDEEN, P. S., KNAPP, S., KUSBER, W.-H., LI, D.-Z., MARHOLD, K., MAY, T. W., MCNEILL, J., MONRO, A. M., PRADO, J., PRICE, M. J. & SMITH, G. F. (eds.) 2018: International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. Regnum Vegetabile 159. Glashütten: Koeltz Botanical Books.

WINDISCH, P.G. 1984. *Eriosorus rufescens*: mais uma pteridófita "andina" ocorrente no Sudeste do Brasil. Eugeniana 7: 12–18.

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Figure 1. Habitats of *Jamesonia* species in Brazil. **A, B**. Trail to the Pico do Alcobaça, Parque Nacional da Serra dos Órgãos, Petrópolis (RJ). **C**. Parque Nacional do Itatiaia, Itatiaia (RJ), in background Pico das Agulhas Negras. **D, E**. Trail to the Pico Menor e Médio, Parque Estadual dos Três Picos, Nova Friburgo (RJ). **F**. Road ravine located in Viamão (RS). **A**. J.M. Braga. **B–F**. A.P. Della.

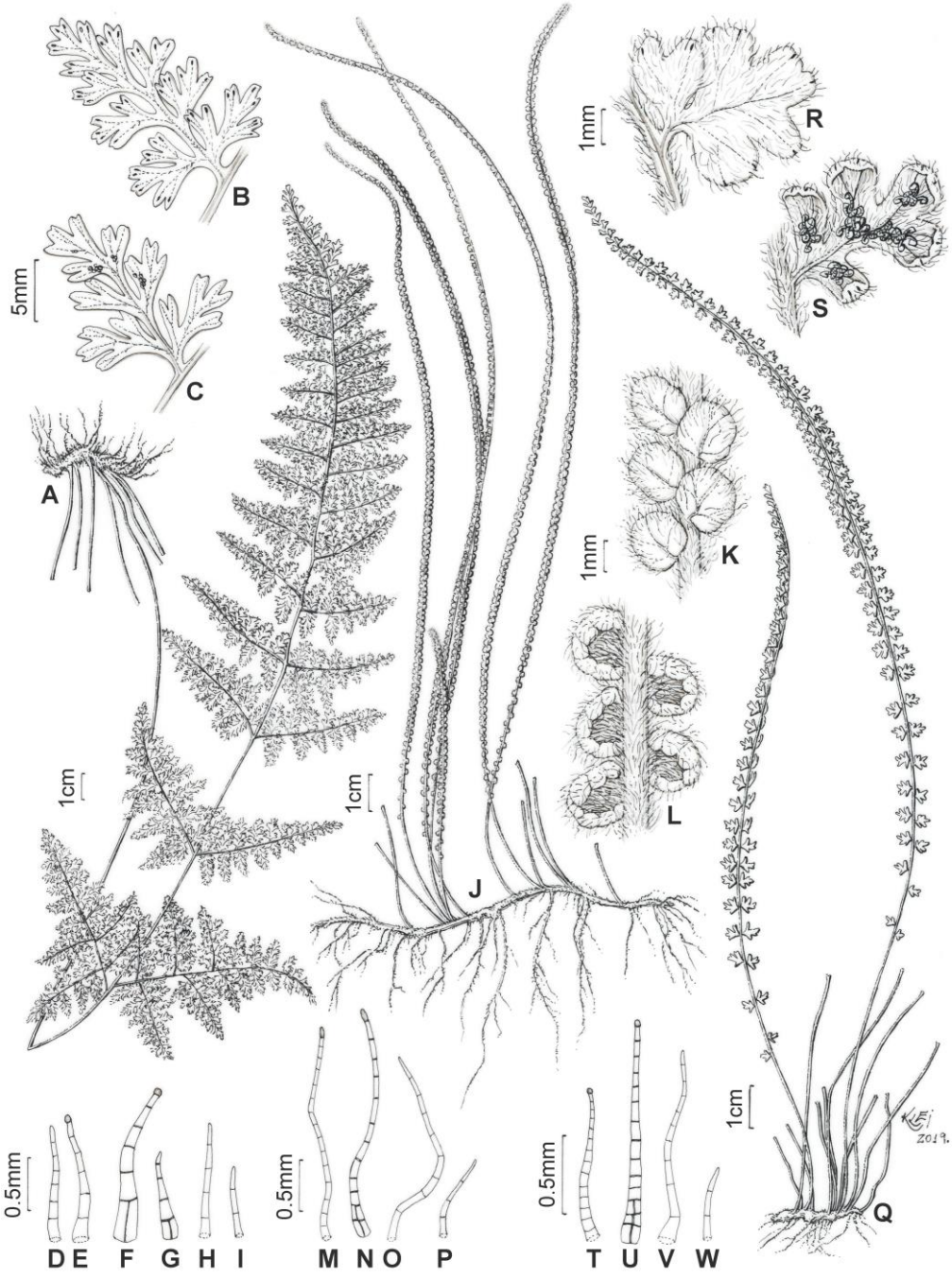


Figure 2. A–I. *Jamesonia biardii*. **A**. Habit. **B, C**. Adaxial and abaxial surfaces of the pinna, respectively. **D–G**. Hairs and bristles of the rhizome. **H**. Hair of the petioles and rachis. **I**. Hair of the lamina. **J–P**. *J. brasiliensis*. **j**. Habit. **K, L**. Adaxial and abaxial surfaces of the pinnae, respectively. **M, N**. Hair and bristle of the rhizome. **O**. Hair of the petiole, rachis and adaxial surface of the lamina. **P**. Hair of the abaxial surface of the lamina. **Q–W**. *J. cheilanthoides*. **Q**. Habit. **R, S**. Adaxial and abaxial surfaces of the pinna, respectively. **T, U**. Hair and bristle of the rhizome. **V**. Hair of the petiole, rachis and adaxial surface of the lamina. **W**. Hair of the abaxial surface of the lamina. **A–I**. *A.C. Brade 16515* (RB). **J**. *J. Prado 1122* (SP). **K–P**. *A.P. Della* et al. *49* (RB, SP). **Q**. *A.P. Della & C.M. Mynssen 50* (RB, SP). **R–W**. *P.G. Windisch 611* (ICN).

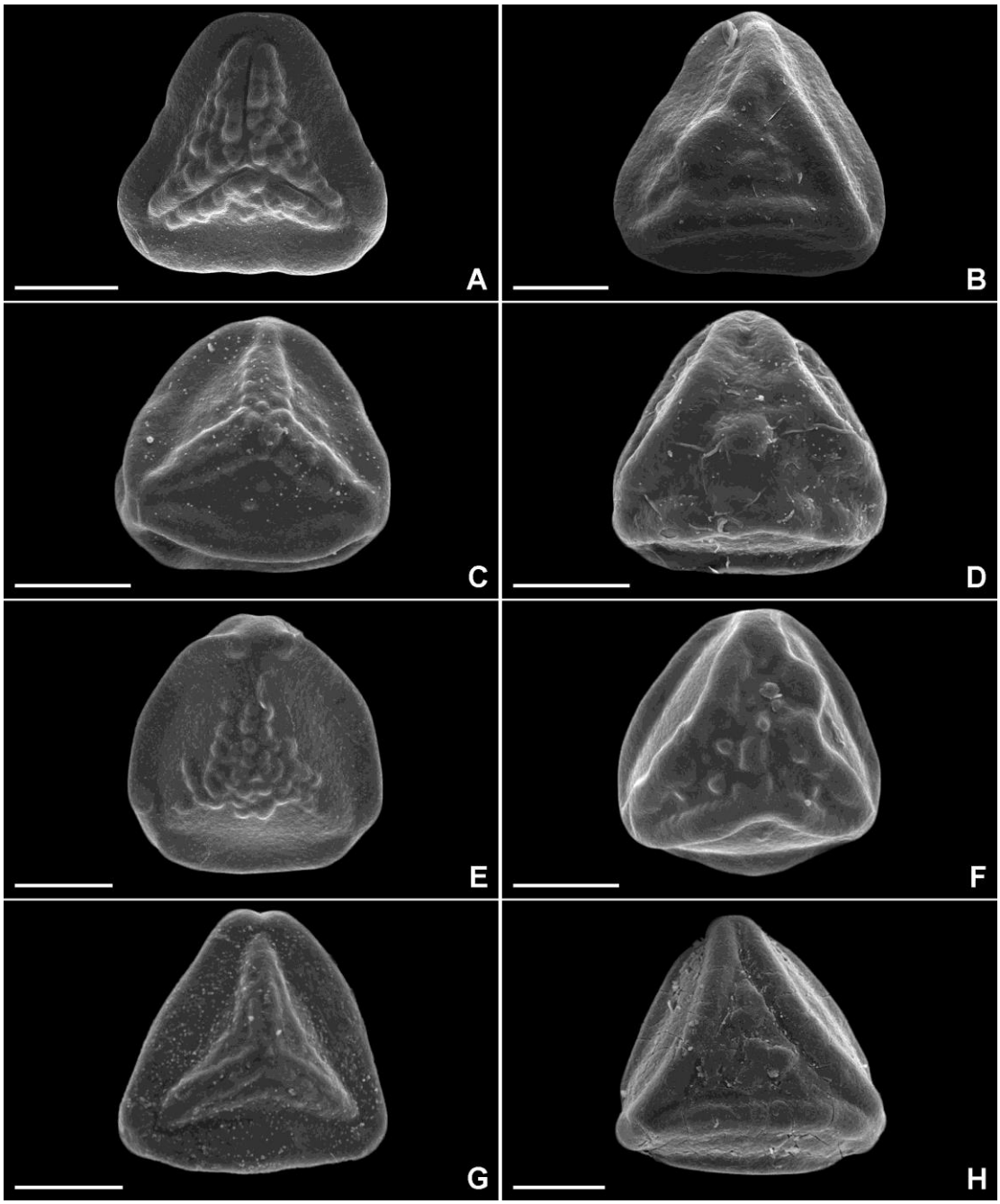


Figure 3. Photomicrographies of *Jamesonia* spores. **A, B**. *Jamesonia biardii*. **C, D**. *Jamesonia brasiliensis.* **E, F**. *Jamesonia cheilanthoides*. **G, H**. *Jamesonia brasiliensis* × *Jamesonia cheilanthoides*. Left column showing proximal surface, right column showing distal surface. Scale bars = 20 µm. **A, B**. *A.C. Brade 16515* (RB). **C, D**. *J. Prado* et al. *1122* (SP). **E, F**. *A.P. Della & C.M. Mynssen 50* (RB, SP). **G, H**. *s. c., s.n.* (SP 468185).

Figure 4. A–C. *Jamesonia brasiliensis*. **A**. Habit. **B, C**. Adaxial and abaxial surfaces of the pinna, respectively. **D–F**. *J. cheilanthoides*. **D**. Habit. **E, F**. Adaxial and abaxial surfaces of the pinna, respectively. **G–H**. *J.* × *intermedia*. **G**. Habit. **H**. Adaxial surface of the pinnae. **A–C**. R.Y. Hirai & J. Prado. **D–F**. T.V. Costa. **G**. J.M. Braga. **H**. A.P. Della.

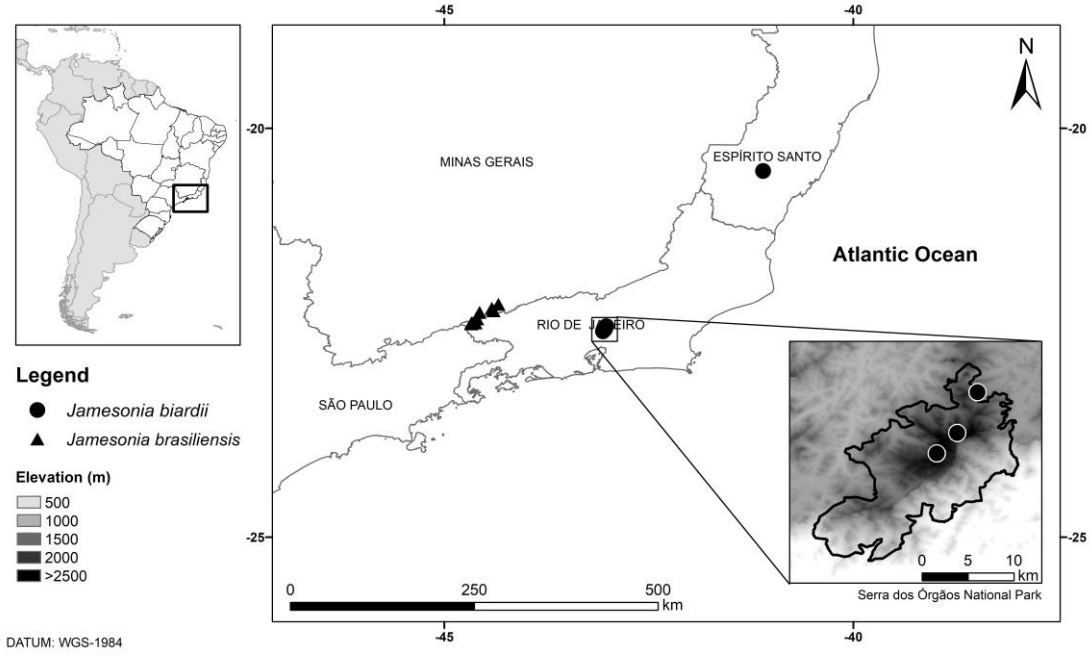


Figure 5. Distribution of *Jamesonia biardii* and *J. brasiliensis* in Brazil.

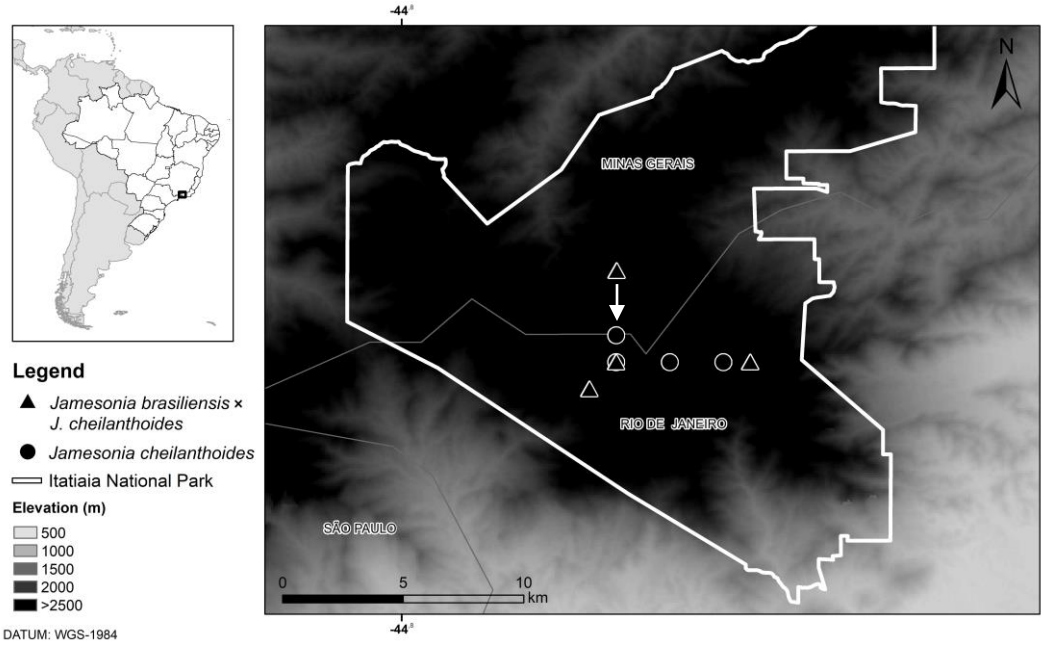


Figure 6. Distribution of *Jamesonia cheilanthoides* and *J. brasiliensis* × *J. cheilanthoides* in Brazil.

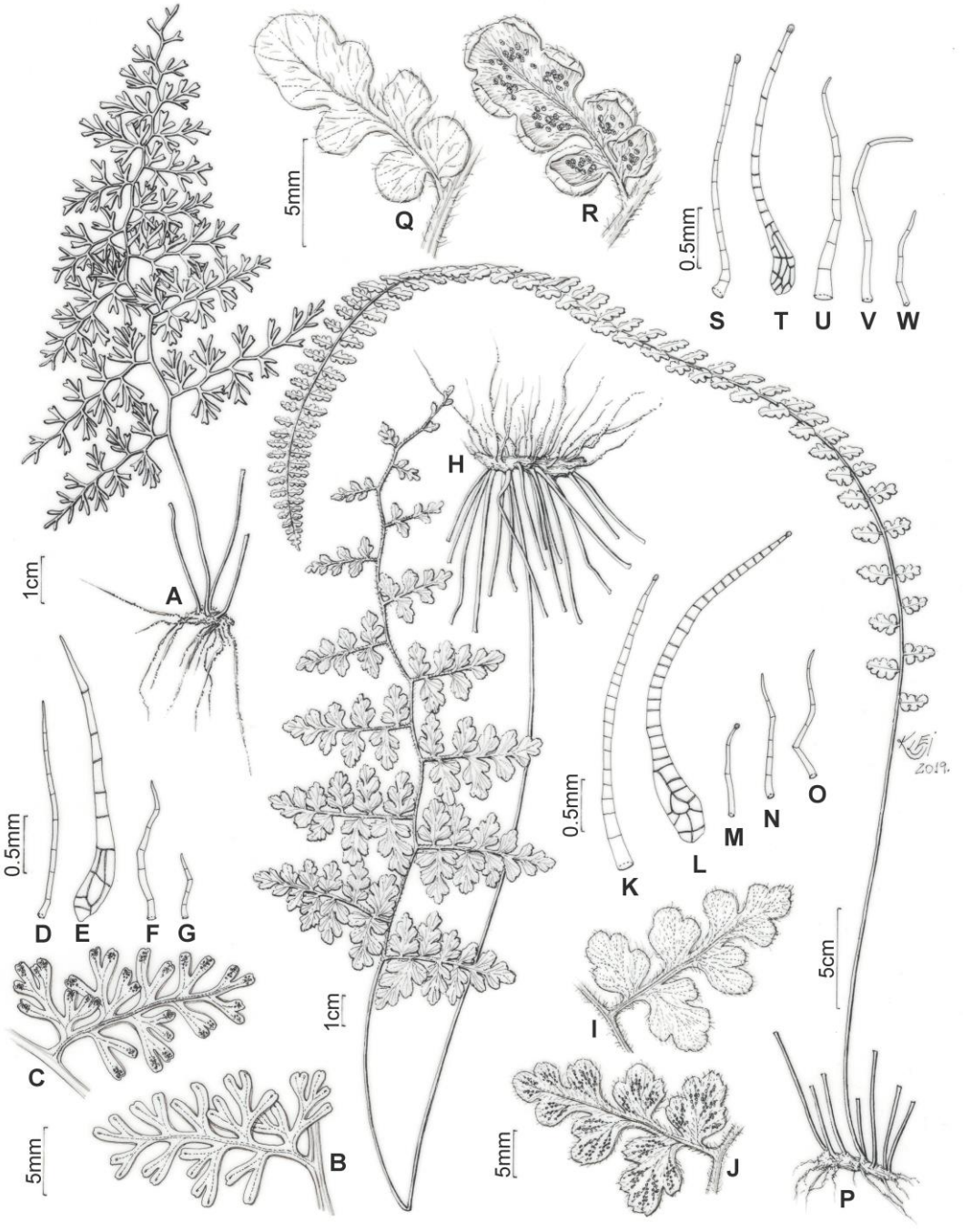


Figure 7. A–G. *Jamesonia flexuosa*. **A**. Habit. **B, C**. Adaxial and abaxial surfaces of the pinna, respectively. **D**, **E**. Hair and bristle of the rhizome. **F**. Hair of the petiole and rachis. **G**. Hair of the lamina. **H–O**. *J. insignis*. **H**. Habit. **I**, **J**. Adaxial and abaxial surfaces of the pinna, respectively. **K, L.** Hair and bristle of the rhizome. **M, N**. Hairs of the petiole. **O**. Hair of the rachis and lamina. **P–W**. *J. brasiliensis* × *J. cheilanthoides*. **P**. Habit. **Q, R**. Adaxial and abaxial surfaces of the pinna, respectively. **S, T**. Hair and bristle of the rhizome. **U**. Hair of the petiole and rachis. **V, W**. Hairs of the adaxial and abaxial surfaces of the lamina. **A–G**. *R.C. Forzza* et al. *7257* (RB). **H–O.** *J. Prado* et al. *s.n.* (SPF 60080). **P–W**. *s. c. s.n.* (SP 468185).

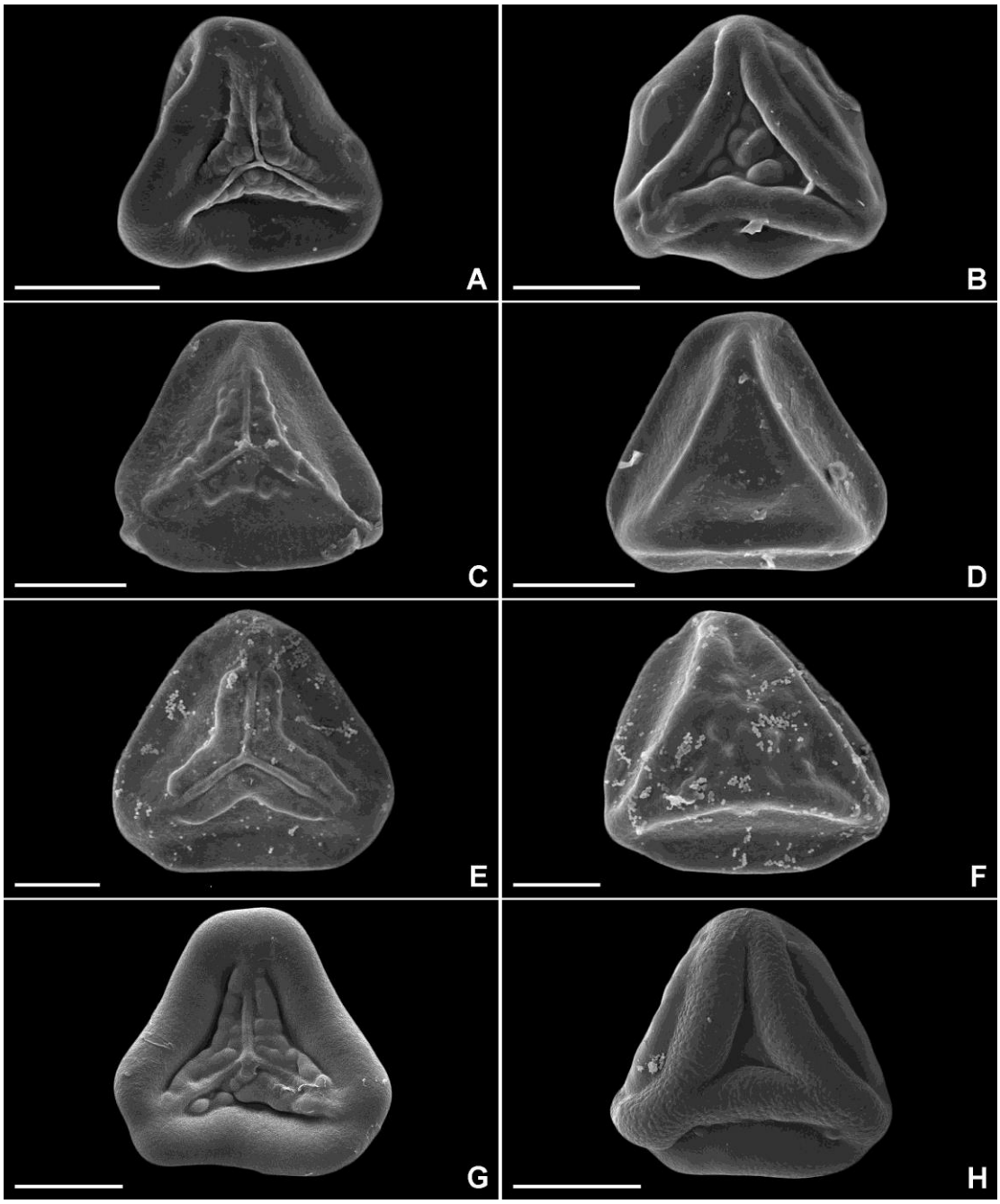


Figure 8. Photomicrographies of *Jamesonia* spores. **A**, **B.** *Jamesonia flexuosa,* from Brazil. C, **D**. *Jamesonia flexuosa,* from Colombia. **E, F.** *Jamesonia insignis*. **G, H.** *Jamesonia* ×*intermedia*. Left column showing proximal surface, right column showing distal surface. Scale bars = 20 µm. **A, B**. *R.C. Forzza* et al. *7280* (RB). **C, D**. *A.E. Brant & G.E. Martinez 1365* (MBM). **E, F**. *V. Ariati* et al. *1220* (MBM). **G, H**. *A.P. Della* et al. *72* (SP)

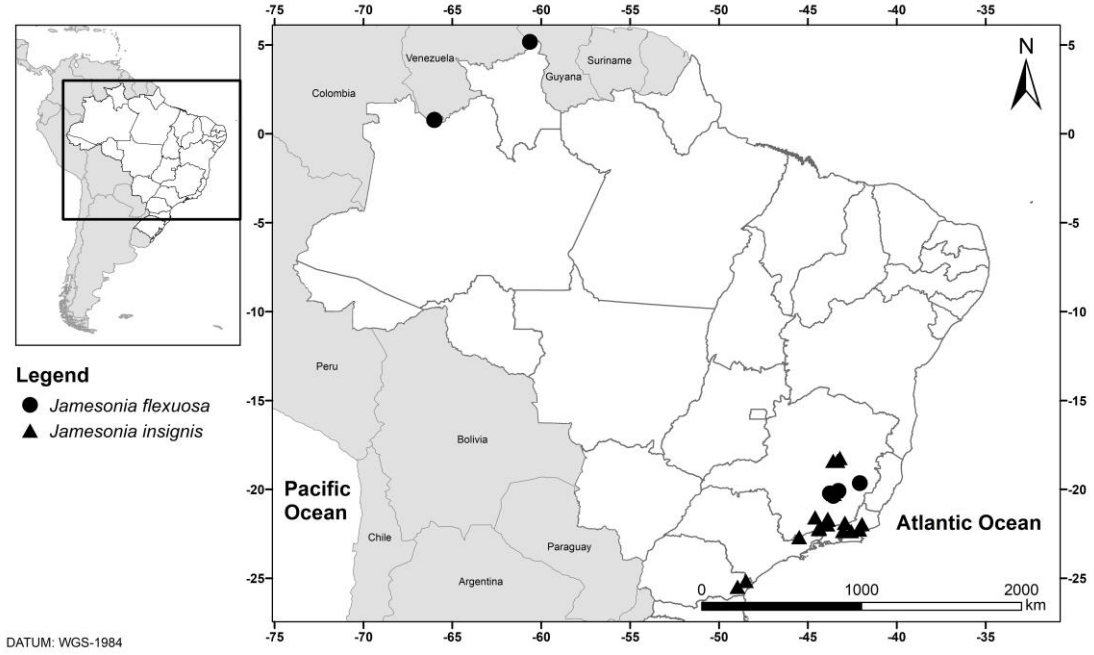


Figure 9. Distribution of *Jamesonia flexuosa* and *J. insignis* in Brazil.

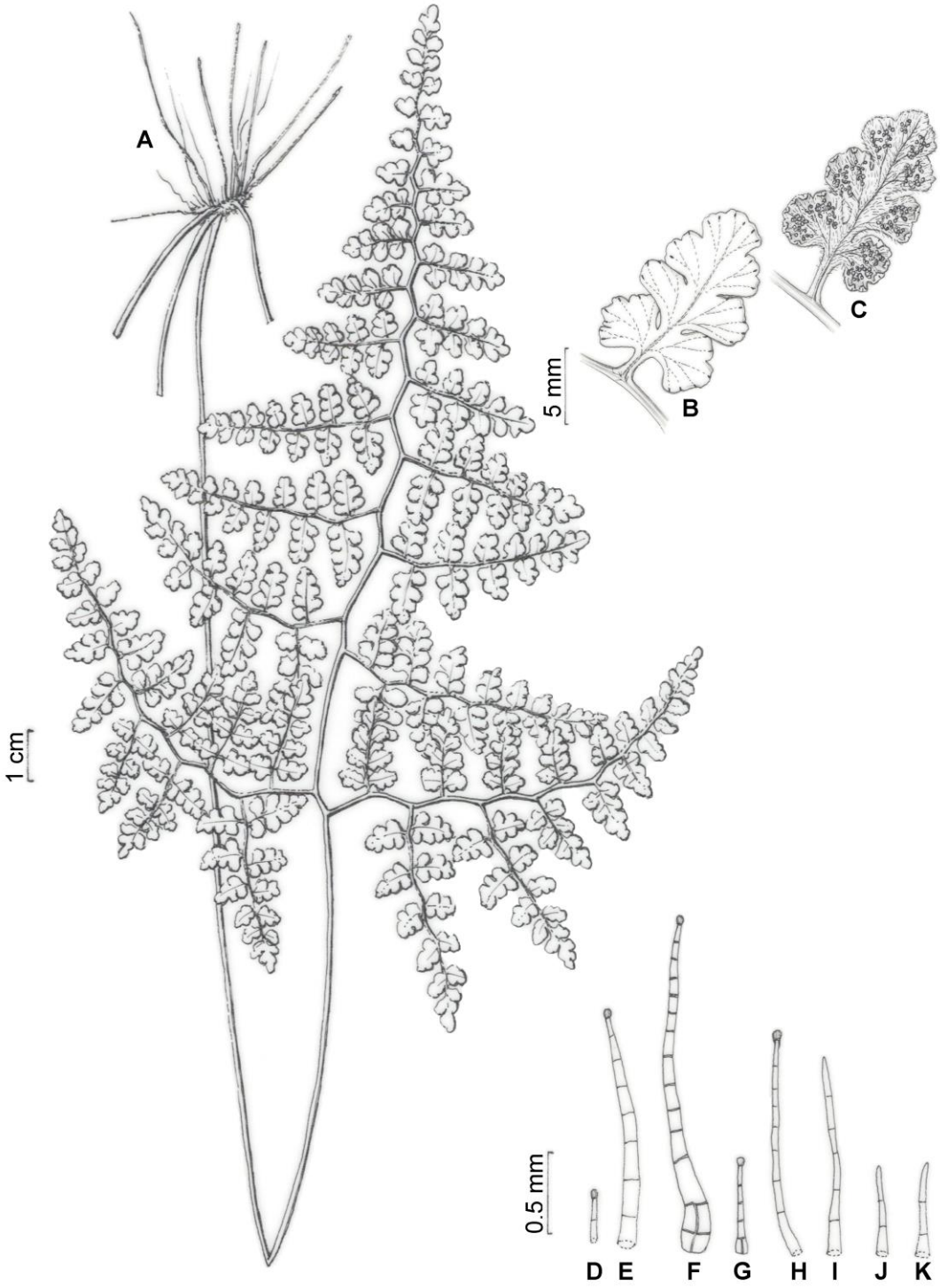


Figure 10. A–K. *Jamesonia ×intermedia*. **A**. Habit. **B, C**. Adaxial and abaxial surface of the pinna, respectively. **D, E**. Hairs of the rhizome. **F, G**. Bristles of the rhizome. **H, I**. Hairs of the petioles. **J**. Hair of the rachis. **K**. Hair of the lamina. **A–K**. *A.P. Della* et al. *69* (SP).

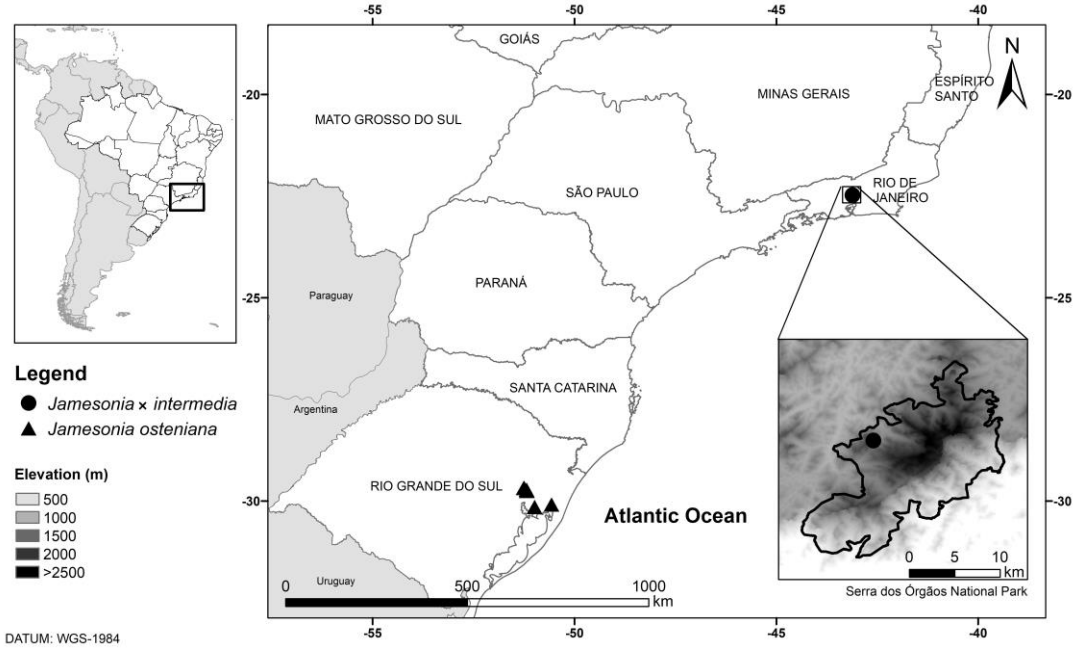


Figure 11. Distribution of *Jamesonia ×intermedia* and *J. osteniana* in Brazil.

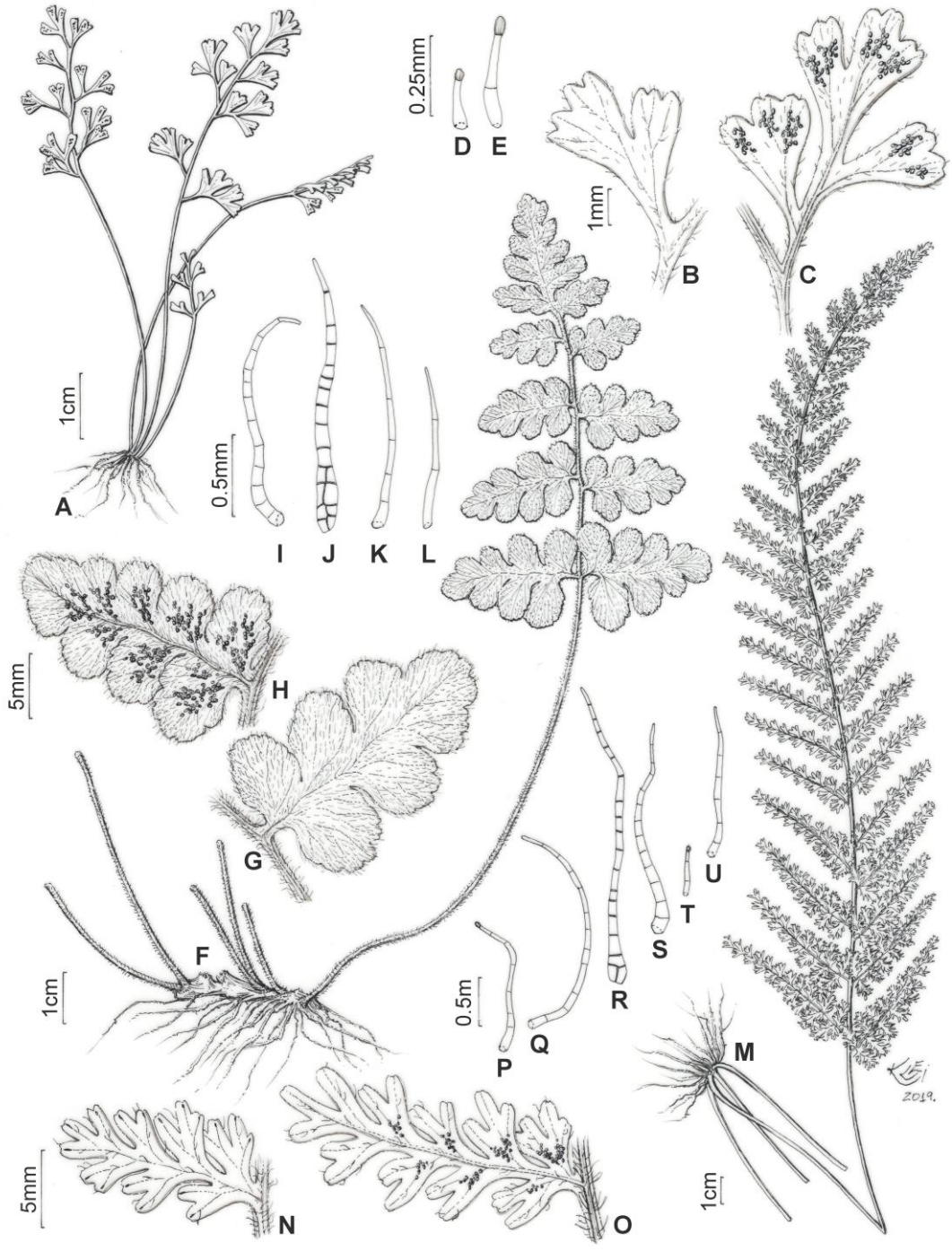


Figure 12. A–E. *Jamesonia osteniana*. **A**. Habit. **B, C**. Adaxial and abaxial surfaces of the lamina, respectively. **D, E**. Hair of the rhizome, petiole, rachis and lamina. **F–L**. *J. rufescens*. **F**. Habit. **G, H**. Adaxial and abaxial surfaces of the pinna, respectively. **I, J**. Hair and bristle of the rhizome. **K**. Hair of the petiole and rachis. **L**. Hair of the lamina. **M–U**. *J.* sp. **M**. Habit. **N, O**. Adaxial and abaxial surfaces of the pinna, respectively. **P–R**. Hairs and bristle of the rhizome. **S, T**. Hairs of the petioles. **U**. Hair of the rachis and lamina. **A**. *A.P. Della* et al. *55* (SP). **B–E**. *Leite 1851* (SP). **F–L**. *J.P.S. Condack & C.B. Gomes 721* (FCAB). **M–U**. *R.C. Forzza* et al. *7203* (RB).

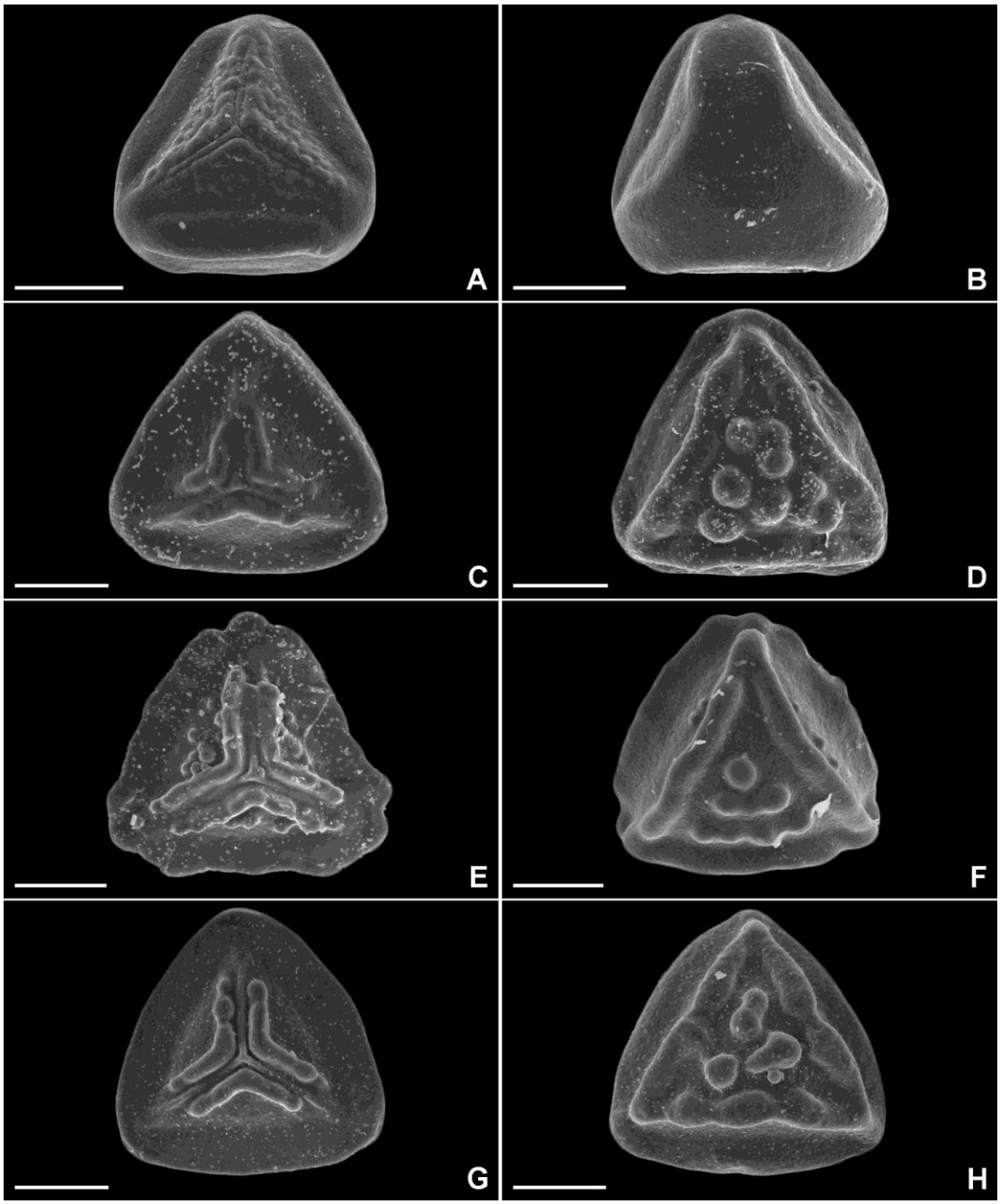


Figure 13. Photomicrographies of *Jamesonia* spores. **A, B**. *Jamesonia osteniana*. **C, D**. *Jamesonia rufescens*, from Brazil. **E, F**. *Jamesonia rufescens*, from Bolivia. **G, H**. *Jamesonia* sp. Left column showing proximal surface, right column showing distal surface. Scale bars = 20 µm. **A, B**. *A.P. Della* et al. *56* (SP). **C, D**. *J.P.S. Condack & C.B. Gomes 721* (FCAB). **E, F**. *Solomon 16157* (MBM). **G, H**. *R.C. Forzza* et al. *7203* (RB).

Figure 14. A–C. *Jamesonia ×intermedia*. **A**. Abaxial surface of the lamina. **B**. Apex of the frond. **C**. Young frond. **D–E**. *J. osteniana*. **D**. Habit. **E**. Abaxial surface of the lamina. **F–H**. *J. rufescens*. **F**. Habit. **G**, **H**. Adaxial and abaxial surfaces of the lamina, respectively. **A.** J.M. Braga**. B, C** and **F–H**. A.P. Della. **D, E**. S. Bordignon.

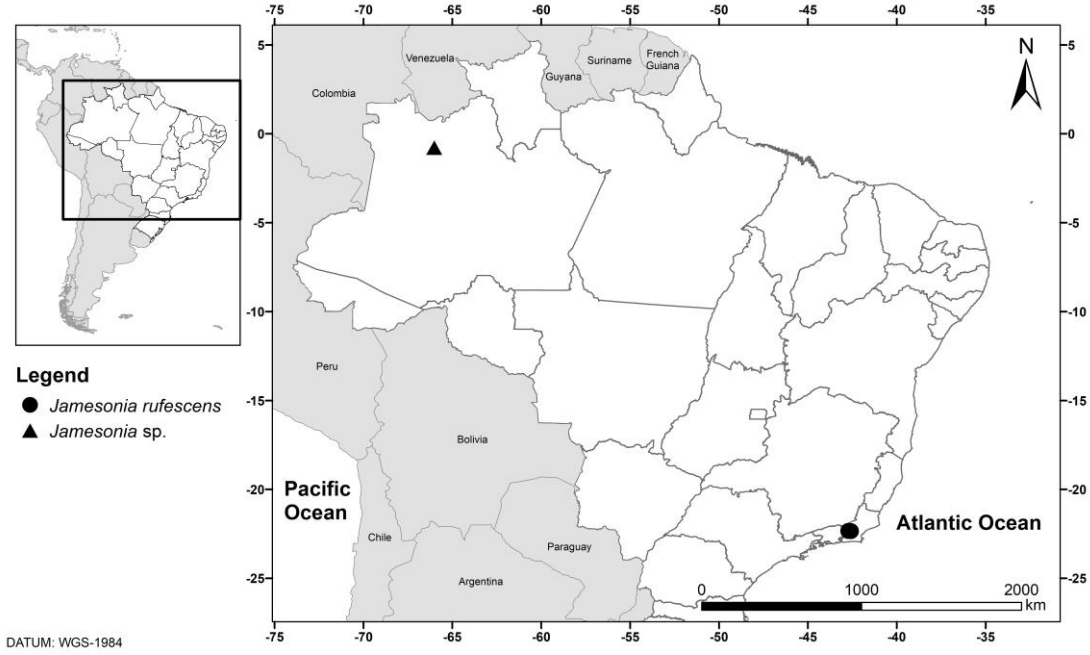


Figure 15. Distribution of *Jamesonia rufescens* and *Jamesonia* sp. in Brazil.

Appendix I

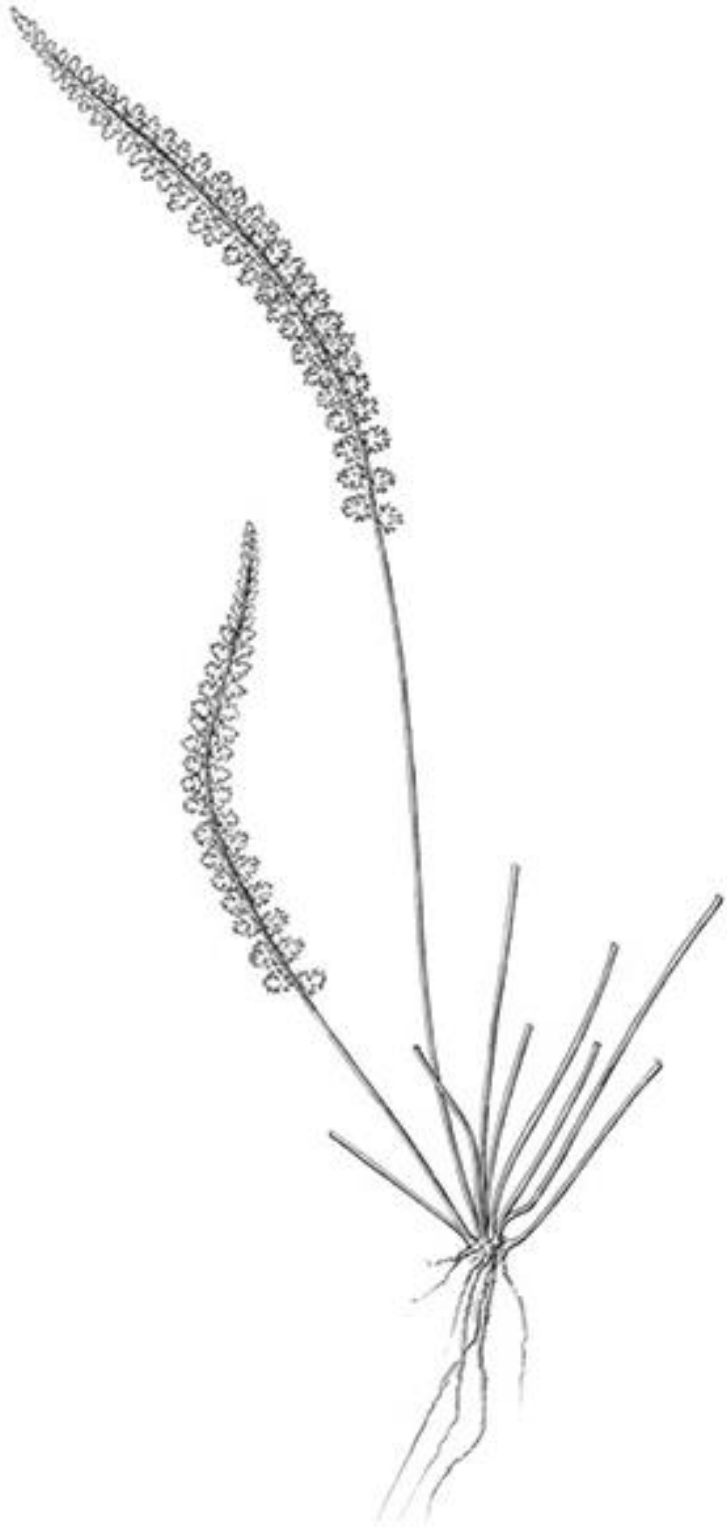
List of Exiccatae

(The number in parenthesis refers to the species number in the taxonomic treatment)

Acosta-Arteaga, CE.: 715 (5), 820 (5), 882-A (5).
Alice & Fay, L.: 2396 (3), 2596 (5).
Almeida, T.E. et al.: 3 (6), 556 (6), 580 (6), 1249 (6).
Alphred & Brade, A.C: 84 (5).
Alston, A.H.G: 7465 (5).
Barcia, J.: 1167 (2).
Bordignon, S.A.L.: *s.n.* (HAS 44935) (8).
Brade, A.C.: 99 (4), 9523 (1), 10108 (2), 10792 (1), 12478 (1), 15532 (2), 15533 (2), 15534 (4), 15802 (6), 16515 (1), 19246 (1), *s.n.* (SP 32847) (4).
Braga, J.M.A. et al.: 17-002 (7), 2856 (2).
Brant, A.E. & Martinez, G.E.: 1365 (5).
Canestraro, B.K. et al.: 508 (2).
Capell, P.: 23 (6), *s.n.* (FCAB 0273) (9).
Carvalho, F.A. et al.: 340 (5).
Castilho, I.O.M. & Salino, A.: 07 (4), 09 (2).
Cesar, O.: *s.n.* (HRCB 2914) (2).
Condack, J.P.S.: 362 (3).
Condack, J.P.S. & Cortines, E.: 392 (6), 411 (2), 412 (3).
Condack, J.P.S. & Gomes, C.B.: 721 (9), 727 (9).
Costa, E.F. et al.: 46 (6).
Costa, T.V. et al.: *s.n.* (R *s.n.*) (2).
Damasio, L.: *s.n.* (RB 36473) (5).
Della, A.P. & Mynssen, C.M.: 50 (3).
Della, A.P. et al.: 49 (2), 55 (8), 56 (8), 57 (8), 58 (8), 67 (7), 68 (7), 69 (7), 70 (7), 72 (7), 73 (9), 74 (9), 75 (9), 76 (9).
Dusén, P.: 400 (2), *s.n.* (R *s.n.*) (2).
Emmerich, M.: 3719 (2).
Enujgia, L.: 1410 (2).
Forzza, R.C. et al.: 7203 (10), 7257 (5), 7280 (5).
Giacomini, L.L.: 3330 (6).
Glaziou, A.F.M.: 78 (1), 5327 (2), 15739 (5), *s.n.* (RB 36474) (1), *s.n.* (BHCB 1440) (2).
Gutiérrez, V.G. & Sánchez, M.J.: *s.n.* (RB *s.n.*) (5).
Heringer, G. et al.: 167 (6).
Imaguire, I.: 461 (2).
Irwin, H.S. et al.: *s.n.* (UB 01363) (6).
Jackson, F.C.C.V.J.: *s.n.* (US-image! [US01473702] (8).
Jimenez, I.: 1816 (3).
Killip, E.P.: 38117 (5).
Krieger, L.: 15248 (6), *s.n.* (CES J8374) (6).
Kurt et al.: *s.n.* (SPF 60198) (2).
Labiak, P.H. et al.: 2852 (3), 4463 (2).
Lanstyak, L.: 100 (2).
Leite, J.E.: 1851 (8).
Leitman, M. et al.: 310 (6).
Lindeman, J. & Haas, H.: 5608 (2).
Lisboa, M.L.G.: *s.n.* (CESJ 35937) (6).

Capítulo II

Tryonia (Pteridaceae) in Brazil



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Tryonia (Pteridaceae) in Brazil

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Abstract: *Tryonia* is a monophyletic genus of leptosporangiate ferns, composed by four species, which occur mainly in the Brazilian Atlantic Rainforest reaching to Uruguay. Considering its recent segregation of *Jamesonia* and *Eriosorus*, the objective of this work was to carry out the taxonomic study of *Tryonia* for Brazil, in order to elaborate its monograph to the Flora of Brazil 2020. The present study was based on morphological analyses of material deposited in 25 Brazilian herbaria plus some other collections deposited in foreigner herbaria, recent collections made by the authors, and scanning electronic microscopy of the spores. Additionally, a wide revision of the literature was also carried out. Four species were recognized: *T. areniticola, T. myriophylla*, *T. schwackeana*, and *T. sellowiana*. Are presented an identification key for the species, descriptions, illustrations, as well as geographic distribution data, comments, list of selected material examined for each taxon, and a full list containing all exsiccatae studied.

Key words: Brazilian Atlantic Rainforest, *Eriosorus*, flora, *Jamesonia*, Pteridoidea.

Introduction

Tryonia Schuettp. et al. is a Neotropical fern genus recently segregated of *Jamesonia* Hook. & Grev. and *Eriosorus* Fée. (Cochran et al. 2014). This genus was segregated because previous molecular studies, that included samplings of *Jamesonia* and *Eriosorus*, showed that one species of *Eriosorus* (*E. myriophyllus* (Sw.) Copel.) is, actually, more related to other species of the Pteridoideae than to those of *Eriosorus* or *Jamesonia* (Sánchez-Barcaldo 2004a,b; Prado et al. 2007; Schneider et al. 2013).

Cochran et al. (2014), based in additional molecular and morphogical data, have found that *Eriosorus myriophyllus*, *E. schwackeanus*, and *E. areniticola* are more closely related to *Austrogramme* E. Fourn., *Pterozonium* Fée, *Syngramma* J. Sm., and

Taenitis Willd. ex Schkuhr than with *Jamesonia*. This relationship has been strongly supported, and the implications are significant if monophyly is used as a criterion for genus delimitation (Cochran et al. 2014).

Since the *Jamesonia* and *Eriosorus* types came out in well-defined clades along with other species of these genera, and because there are no other valid generic names for the group of *E. myriophyllus*, the authors proposed a new genus, *Tryonia*, to accommodate these isolated taxa. This new genus does not have a precise and fully resolved phylogenetic position, yet into Pteridoidea, but correspond to a monophyletic group (Cochran et al. 2014).

Tryonia comprises four species: *T. areniticola* (Schwartsb. & Labiak) Schuettp. et al., *T. myriophylla* (Sw.) Schuettp. et al., *T. schwackeana* (Christ) Schuettp. et al. and *T. sellowiana* (Cochran et al. 2014; Prado 2015). These species occur mainly in the Brazilian Atlantic Rainforest, except for *T. myriophylla*, which also occurs in Uruguay, near the Brazilian border. They grow along shaded streams, in moist and shaded sandstone, or in more open places (but here shaded by shrubs), at 600 to 2300 m (Cochran et al. 2014). This genus can be differentiated from *Jamesonia* by the presence of stramineous rachis and elongate-triangular fronds ("generalists") (Cochran et al. 2014).

Previously, the species here treated in *Tryonia* were considered as belonging to *Eriosorus*, revised by Tryon (1970) and *Jamesonia* also revised by Tryon (1962).

For Brazil, the species now considered in *Tryonia*, appeared in floristics surveys of states floras or regional taxonomic treatments for state and/or national parks, such as: Baker (1870), Sehnem (1972), Prado and Sylvestre (2010), Prado and Hirai (2011), Gasper et al. (2012), Prado (2015), Prado et al. (2015), Windisch (1987), Fernandes and Baptista **(**1988), Prado (1997), Prado and Labiak (2003), Garcia and Pirani (2005), Condack (2006), Schwartsburd & Labiak (2007), Melo and Salino (2007), Rolim (2007), Salino and Viveiros (2012), Michelon and Labiak (2013), Souza (2012), Salino et al. (2013), Funez and Gasper (2014), and Gonzatti et al. (2016), respectively.

More recently, Rojas-Alvarado (2017, 2019) described a new species, *Tryonia macrophylla*, for Colombia. However, in the species description presented there is an information that the species has scales on rhizome, as well as rachis and costa atropurpureous. These morphogical features do not apply to the genus *Tryonia*, which presents hairs and bristles on the rhizomes and stramineous rachis. In addition, the genus *Tryonia* occurs mainly in the Brazilian Atlantic Rainforest, whereas this *T. macrophylla* occurs only in the Colombian páramos. Based on these evidences, *T.*

macrophylla probably belongs to another fern genus, but only additional studies can fix this hypothesis.

The main goal of this study is to present a taxonomic treatment of *Tryonia* for the Brazilian territory in order to conclude part of the treatment of all Pteridaceae for the project Flora of Brazil 2020, coordinate by the Instituto de Pesquisas Jardim Botânico do Rio Janeiro (JBJR).

Material and methods

For this study were examined material of the following herbaria: BHCB, CESJ, ESA, FCAB, FLOR, FURB, HAS, HB, HBR, HRCB, ICN, MBM, MBML, PACA, R, RB, RBR, RFA, SJRP, SP, SPF, UB, UEC, UCPB, and VIES (herbaria acronyms according to Thiers (2019), continuously updated). Specimens deposited in international herbaria (mainly the types) were consulted through the available images online.

In addition, field expeditions in the states of Minas Gerais, Rio de Janeiro, and Santa Catarina were also realized to observe and to collect material for morphological analyses. The specimens were collected according to the techniques proposed by Fidalgo and Bononi (1984) and incorporated in the Herbarium of the Instituto de Botânica (SP) and Herbarium of the Department of Botany, Universidade de São Paulo (SPF).

The morphological terminology follows Lellinger (2002) and Tryon and Lugardon (1990). Observations of the morphology of the spores for each taxon were maiden in Scanning Electronic Microscopy (SEM). The spores were not submitted to any previous chemical treatment. Samples were fixed on stubs using double-sided tape and subsequently, each stub was metalized with gold, and then analyzed under the SEM (Philips XL30).

For each accepted taxon, distribution maps were prepared using the software ArcGIS v. 10.5 (ESRI 2016). The geographic coordinates were taken from the herbarium labels or taken during the field works. For those specimens with no geographical coordinates, the coordinates of the municipality were estimated using Google maps (the estimated coordinates are in brackets in the cited specimens examined). The Brazilian shapefiles of the IBGE (2015) and of the Conservation Units were obtained in the ICMBio website (2019).

A list of all studied specimens is presented in the Appendix I (the number in parentheses is relative to the number of the species in the taxonomic treatment).

Results and discussion

As *Tryonia* was recently segregated of *Jamesonia*, confusions can be generated to identify these taxa, so the key below ca be used to distinguish them.

Key for the genera *Tryonia* and *Jamesonia* in Brazil

1. Rachises stramineous; petioles bicolorous; adaxial and abaxial surfaces of the pinna covered by glandular hairs; fronds erect, arcuate or decumbent. …..…….… ***Tryonia***

1. Rachises brown; petioles concolorous; adaxial and abaxial surfaces of the pinna covered by eglandular hairs; fronds erect, arcuate, semi-scandent, scandent or scrambling. ……...…….…...…… ***Jamesonia***

Tryonia Schuettp., J.Prado & A.T.Cochran, PhytoKeys 35: 35–37. 2014. Type. *Tryonia myriophylla* (Sw.) Schuettp., J.Prado & A.T.Cochran. (*Gymnogramma myriophylla* Sw.).

Plants rupicolous or terrestrial. **Rhizomes** short-creeping, sometimes erect at apex, dark brown, moderate to densely covered by erect or appressed hairs and rigid bristles, the hairs dark brown, reddish-brown or goldish-brown, multicellular, glandular, the apical cell globose, the bristles dark brown, reddish-brown or goldish-brown, with darker-colored thickened transverse cell walls, apex long filiform, base with 2−3 cell of wide, apical cell globose. **Fronds** monomorphic, erect, arcuate or decumbent, with determinate or indeterminate growth; **petioles** semi-cylindrical, adaxially grooved, sometimes plane, bicolorous, proximally castaneous, distally stramineous, occasionally shiny, glabrous to densely covered by hairs on both surfaces, the hairs, glandular or eglandular, hyaline, sometimes brown, tortuous to erect, multicellular, the apical cell elongated with apex rounded or globose; **laminae** pinnate-pinnatifid to 2-pinnate-pinnatisect, triangular, trullate, elongate-triangular, narrowly elliptic or linear, membranaceous or coriaceous; **rachises** straight to slightly flexuous, semi-cylindrical, adaxially grooved, stramineous, sparsely to densely covered by hairs on both surfaces, the hairs similar to those of the petioles; **pinnae** reflexed, patent to ascending, triangular, narrowly triangular, ovate or linear, alternate to subopposite,

gradually tapering towards the apex (pinnatisect), stalked, the stalk semi-cylindrical, adaxially grooved, stramineous, straight, adaxial surface of pinnae sparsely to densely covered by hairs, abaxial surface sparsely to densely covered by hairs, mainly on the veins, the hairs similar to those of the petioles; **ultimate segments** bifurcate, occasionally simple, the margin entire, plane or strong enrolled, whitish; **veins** usually furcate, sometimes simple, reaching or not the laminae margin. **Sori** on the veins, sometimes spread along of all abaxial surface of the segments; **sporangia** with capsule usually pyriform or orbicular, stomia with 2–4 indurated cells, short-stalked, stalks 1–2-celled (Tryon 1970; Cochran et al. 2014); **spores** trilete, tetrahedral, brown, with equatorial flange, and deltoid base on distal surface, 48.2−72.0 μm diam., x=29 (Tryon 1970; Cochran et al. 2014). Gametophyte spathulate with a lateral meristem (Tryon 1970).

According to Cochran et al. (2014) and PPG I (2016), *Tryonia* is a monophyletic and Neotropical genus of leptosporangiate ferns, formed by four species. The species occur mainly in the Brazilian Atlantic Rainforest, in altitude fields, on the edge of trails, and ravines on the roadside, often between 800 and 2400 meters of elevation (Figure 1). Lower altitudes (100–200 m) are recorded for plants collected in Santa Catarina and Rio Grande do Sul states.

Key for *Tryonia* in Brazil

1. Laminae pinnate-pinnatifid or 2-pinnate-pinnatisect, triangular, trullate or elongate-triangular, rare elliptic; ultimate segments mostly with emarginated apices.
    2. Plants rupicolous; petioles glabrous or sparsely covered by eglandular hairs; pinnae adaxially glabrous to moderately covered by eglandular hairs, glandular hairs are less often. …..……..……..…….…… 1. *T. areniticola*
    2. Plants terrestrial; petioles moderate to densely covered by glandular hairs; pinnae adaxially moderately to densely covered by glandular hairs, eglandular hairs are less often. ……...……....…….... 2. *T. myriophylla*
1. Laminae pinnate-pinnatisect; narrowly elliptic to linear, rare narrowly triangular; ultimate segments usually with acute apices.
    3. Pinnae narrowly triangular to linear, coriaceous; petioles glabrous to moderately covered by hairs; laminae adaxially glabrous to sparsely covered by hairs; sori protected by the curved margin of the laminae. ..…… 4. *T. sellowiana*

3. Pinnae ovate to triangular, membranaceous; petioles moderate to densely covered by hairs; laminae adaxially moderately to densely covered by hairs; sori not protected by the curved margin of the laminae. …..... 3. *T. schwackeana*

1. ***Tryonia areniticola*** (Schwartsb. & Labiak) Schuettp. et al., PhytoKeys 35: 40. 2014. *Eriosorus areniticola* Schwartsb. & Labiak, Amer. Fern J. 98(3): 160, fig. 1A–D. 2008. *Jamesonia areniticola* (Schwartsb. & Labiak) Christenh., Phytotaxa 19: 20. 2011. Holotype: BRAZIL. Paraná: Jaguariaíva, Parque Estadual do Cerrado, 12-IV-1994, PH Labiak 182 (UPCB barcode UPCB0002547[image!]; isotypes: SP!, UC, image!).

Figs. 2a-j, 3a-b, 4a-c, 5.

Plants rupicolous. **Rhizomes** short-creeping, sometimes erect in the apex, 0.5−3.0 mm diam., brown to dark brown, moderately to densely covered by hairs and rigid bristles, the hairs reddish-brown, multicellular, glandular, the apical cell globose, 0.3−1.0 mm long, the bristles reddish-brown to dark brown, with darker-colored thickened transverse cell walls, apex long filiform apex, base with 2−3 cell of wide, apical cell globose, 0.5−1.3 mm long. **Fronds** erect, determinate growth, 2.4−27.0 × 1.0−4.5 cm; **petioles** plane to semi-cylindrical, adaxially grooved, 1.0−7.0 cm × 0.1−0.4 mm, proximally castaneous, distally stramineous, glabrous to sparsely covered by hairs on both surfaces, the hairs in the proximal portion similar to those the rhizomes, in distal portion hairs with 0.1−1.2 mm long, eglandular, or less often glandular, hyaline, sometimes brown, tortuous, multicellular, the apical cell elongated with apex rounded, or less often globose; **laminae** pinnate-pinnatifid to 2-pinnate-pinnatisect, elongate-triangular to linear, 1.7−22.0 × 1.0−4.5 cm, membranaceous; **rachises** straight, semi-cylindrical, adaxially grooved, stramineous, glabrous to moderately covered by hairs on both surfaces, the hairs similar to those in distal portion of petioles; **pinnae** patent to slightly ascending, ovate to triangular, 0.5−2.5 × 0.4−1.2 cm, alternate to subopposite, gradually tapering towards the apex (pinnatisect to pinnatifid), stalked, the stalk 0.4−1.2 mm long, 0.1−0.2 mm diam., semi-cylindrical, adaxially grooved, stramineous, adaxial surface of pinnae glabrous to moderately covered by hairs, abaxial surface sparsely to moderately covered by hairs mainly on the veins, the hairs similar to those in distal portion of petioles; **costa** straight, semi-cylindrical, adaxially grooved, stramineous, sparsely to moderately covered by hairs on both surfaces, the hairs similar to those in distal portion of petioles; **pinnules** or **segments** ovate, 2.0−8.0 × 2.0−7.0 mm, alternate to subopposite, sessile or stalked, the

stalk 0.4 mm long, 0.4 mm diam., semi-cylindrical, adaxially grooved, or plane, stramineous, straight; **ultimate segments** bifurcate, occasionally simple, with emarginate apices, the margin entire, plane, whitish; **veins** usually furcate, sometimes simple, reaching or not the laminae margin. **Sori** on the veins; **spores** dark brown, proximal surface slightly rugose, mainly near trilete aperture, distal surface laevigate, 48.2−57.4 μm diam.

Distribution and ecology: *Tryonia areniticola* occurs only in Brazil in the states of São Paulo, Paraná, Santa Catarina and Rio Grande do Sul, in rock cracks and in sandstones, often humid and shaded, at 250–1000 m elevation.

Selected specimens examined: BRAZIL. Paraná: Balsa Nova, Serra de São Luís, [25º27'S, 49º42'W], 1000 m, 16-VII-1970, G Hatschbach 24474 (MBM). Rio Grande do Sul: Montenegro, Morro do Cabrito, [29º40'S, 51º27'W], 255 m, 20-XII-1988, I Fernandes 457 (ICN). Santa Catarina: Rio do Sul, Morro dos Três Picos, [27°16'S, 49°30'W], 937 m, 26-VII-2017, F Gonzatti & E Valduga 3645 (HUCS). São Paulo: Analândia, Serra do Cuscuzeiro, Gruta de Nossa Senhora de Lourdes, [22º6'S, 47º39'W], 920 m, 25-III-1989, A Salino 691 (BHCB).

This species can be recognized in having laminae pinnate-pinnatifid to 2-pinnate-pinnatisect, elongate-triangular to linear, pinnae ovate to triangular, ultimate segments ovate, adaxial surface of the pinnae glabrous to moderately covered by hairs, abaxial surface sparsely to moderately covered by hairs mainly on veins, the hairs often eglandular. Additionally, the petioles are glabrous to sparsely covered by hairs, and the rachis are glabrous to moderately covered by hairs; the hairs are often eglandular.

The specimens recognized as *Tryonia areniticola* by Schwartsburd and Labiak (2008) were treated by Tryon (1970) as "depauperate forms" of *T. myriophylla*.

In the phylogenetic study by Cochran et al. (2014), *Tryonia areniticola* appears as genetically indistinguishable from *T. myriophylla*. However, as the specimen of *T. arenticola* sequenced in this study was not collected at the type locality, the authors decided to keep T. areniticola as a distinct taxon, but new analyses should be carried out for a more precise conclusion if *T. areniticola* is conspecific with *T. myriophylla*.

2. ***Tryonia myriophylla*** (Sw.) Schuettp. et al., PhytoKeys 35: 40. 2014. *Gymnogramma myriophylla* Sw., Kongl. Vetensk. Acad. Handl. 1817(1): 58. 1817. *Psilogramme*

myriophyllus (Sw.) Kuhn, Festschr. 50 Jähr. Jub. Königstädt. Realschule Berlin: 339. 1882. *Eriosorus myriophyllus* (Sw.) Copel., Gen. Fil.: 58. 1947. *Jamesonia myriophylla* (Sw.) Christenh., Phytotaxa 19: 21. 2011. Lectotype (designated by Tryon 1970). BRAZIL. [Minas Gerais]: Villa Rica [now Ouro Preto], VIII-1815, GW Freyriss s.n. (S-R. n.S-R-2467[image!]; isolectotypes: BM barcode BM000936677[image!]; S-R. n.S-R-2469[image!]).

Figs. 2k-t, 3c-d, 4d-f, 6.

Plants terrestrial. **Rhizomes** short-creeping, sometimes erect in the apex, 1.0−4.0 (13.0) mm diam., brown to dark brown, moderately to densely covered by hairs and rigid bristles, the hairs reddish-brown, multicellular, glandular, the apical cell globose, 0.1−2.0 mm long, the bristles reddish-brown to dark brown, with darker-colored thickened transverse cell walls, apex long filiform apex, base with 2−3 cell of wide, apical cell globose, 0.4−3.0 mm long. **Fronds** erect to arcuate, determinate growth, 13.0−127.0 × 3.5−18.5(26.0) cm; **petioles** semi-cylindrical, adaxially grooved, sometimes plane, 5.0−47.0 cm × 0.3−3.0 (3.5) mm, proximally castaneous, distally stramineous, moderately to densely covered by hairs on both surfaces, the hairs in the proximal portion similar to those the rhizomes, in distal portion hairs with 0.2−1.4 mm long, glandular, or less often eglandular, hyaline, sometimes brown, tortuous, multicellular, the apical cell globose, or less often elongated with apex rounded; **laminae** 2-pinnate-pinnatisect, triangular to trullate, less often ovate, and rare elliptic, 9.0−80.0 × 3.5−18.5(26.0) cm, membranaceous to chartaceous; **rachises** straight to slightly flexuous, semi-cylindrical, adaxially grooved, stramineous, moderately to densely covered by hairs on both surfaces, the hairs similar to those in distal portion of petioles; **pinnae** patent to strongly ascending, triangular, occasionally ovate, sometimes the basiscopic side slightly larger, 2.0−12.7(28.0) × 1.3−5.0(7.3) cm, alternate to subopposite, proximal pinnae longer than the median ones, or with the same size, rarely less, gradually tapering towards the apex (pinnatisect), stalked, the stalk 1.0−5.0 mm long, 0.3−1.3 mm diam., semi-cylindrical, adaxially grooved, stramineous, adaxial surface of pinnae moderately to densely covered by hairs, abaxial surface moderately to densely covered by hairs mainly on the veins, the hairs similar to those in distal portion of petioles; **costa** straight to slightly flexuous, semi-cylindrical, adaxially grooved, stramineous, moderately covered by hairs on both surfaces, the hairs similar to those in distal portion of petioles; **pinnules** or **segments** triangular or ovate, 0.3−2.4(3.7) × 0.2−1.3 cm, alternate to subopposite, the stalk 0.3−1.7 mm long, 0.4−0.9

mm diam., semi-cylindrical, adaxially grooved, or plane, stramineous, straight; **ultimate segments** bifurcate, occasionally simple, with emarginate apices, the margin entire, plane, whitish; **veins** usually furcate, sometimes simple, reaching or not the laminae margin. **Sori** on the veins in the proximal portion of the segments, or sometimes spread along of all abaxial surface of the segments; **spores** dark brown, proximal surface slightly rugose, mainly near trilete aperture, distal surface laevigate, 49.0−53.0 μm diam.

Distribution and ecology: This species occurs in Brazil and Uruguay. In Brazil can be found in the states of Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul. It grows mainly in ravines of roadside and trails, often at 700−2560 m elevation. According to Tryon (1970), this species has a broad ecological tolerance, being adapted to dry conditions and intense luminosity.

Selected material examined: BRAZIL. Bahia: Rio de Contas, Pico das Almas, Entre o Campo do Queiroz e o Pico, 13°31’29.3”S, 41°57’46,1”W, 1765 m, 18-I-2012, VAO Dittrich & AA Vale 1790 (CESJ). Espírito Santo: Castelo, [20°36’S, 41°10’W], 12-VIII-1948, AR Schultz s.n. (ICN 1750). Minas Gerais: Catas Altas, RPPN Santuário do Caraça, ao lado da Ponte estreita, saída atrás da igreja principal, [20°3’S, 43°16’W], 26-XI-2018, AP Della 64 (SP). Paraná: Piraquara, Mananciais da Serra, [25°26’S, 49°2’W], 12-XII-2008, C Michelon et al. 207 (HUCP, MBM). Rio de Janeiro: Itatiaia, campo para Macieiras, [22°22’S, 44°37’W], 25-IV-1989, L Sylvestre et al. 213 (RB). Rio Grande do Sul: Sapucaia do Sul, Morro Sapucaia, [29°49’S, 51°6’S], 290 m, 25-II-1986, I Fernandes 50 (ICN). Santa Catarina: Rio dos Cedros, estrada Palmeiras-Rio Bonito, próximo à Cascata Formosa, 26°33’34”S, 49°22’21”W, 789 m, 22-IV-2016, LA Funez 4754 (FURB). São Paulo: Campos do Jordão, São José dos Alpes, bifurcação para o mirante, [22°42’S, 45°27’W], 2200 m, 21-III-1996, J Prado & MP Marcelli 775 (SP).

Tryonia myriophylla is recognized by its laminae 2-pinnate-pinnatisect, triangular to trullate, pinnae triangular, ultimate segments triangular or ovate, adaxial and abaxial surface of pinnae moderately to densely covered by hairs, mainly by glandular hairs.

There is a great variation in the shape and size of the fronds in this species, some fronds are big (74.0−127.0 × 13.0−18.5 cm) and triangular to elongate-triangular,

whereas others are small (12.0−32.0 × 3.5−8.8 cm) and ovate. The insertion of the pinnae in relation to the main rachis also varies from patent to strongly ascending. All these variations have been observed among individuals from the same population. Apparently, there is no correlation between these variations with the habitat of the specimens.

3. ***Tryonia schwackeana*** (Christ) Schuettp. et al., PhytoKeys 35: 40. 2014. *Gymnogramma schwackeana* Christ in Schwacke, Pl. Nov. Mineir. 2: 18. 1900. *Eriosorus schwackeanus* (Christ) Copel., Gen. Fil.: 59. 1947. *Jamesonia schwackeana* (Christ) Christenh., Phytotaxa 19: 21. 2011. Lectotype (designated by Tryon 1970): BRAZIL. Minas Gerais: Ouro Preto, 19-II-1893, Schwacke 9389 (P barcode P00603566[image!]; isolectotype: GH barcode 00021287[image!], RB barcode 00543308[image!]).

Figs. 3e-f, 4g-h, 7a-i, 8.

Plants rupicolous or terrestrial. **Rhizomes** short-creeping, 1.0−5.0 mm diam., brown to dark brown, moderately to densely covered by hairs, and less often by bristles, the hairs goldish-brown to reddish-brown, multicellular, glandular, the apical cell globose, 0.4−2.7 mm long, the bristles goldish-brown, reddish brown or dark brown, with darker-colored thickened transverse cell walls, apex long filiform, base with 2 cell of wide, apical cell globose, 2.0−3.0 mm long. **Fronds** erect, arcuate or decumbent, determinate growth, sometimes indeterminate, (1.6)6.5−54.0 × (0.5)0.8−8.5 cm; **petioles** semi-cylindrical, adaxially grooved, (0.5)2.3−30.0 cm × (0.2)0.4−0.5 mm, proximally castaneous, distally stramineous, moderately to densely covered by hairs on both surfaces, the hairs 0.2−1.7 mm long, glandular, hyaline to castaneous, sometimes bicolorous, often erect, usually with 2−3 cells, the apical cell globose; **laminae** pinnate-pinnatisect, narrowly elliptic to linear, or less often lanceolate or narrowly triangular, (1.1)4.0−30.0 × (0.5)0.8−8.5, membranaceous; **rachises** straight, semi-cylindrical, adaxially grooved, stramineous, moderately to densely covered by hair on both surfaces, the hairs similar to those of the petioles; **pinnae** patent, sometimes slightly ascending or reflexed, ovate to triangular, (0.2)0.3−4.8 × (0.2)0.3−1.6 cm, usually alternate or sometimes subopposite, **proximal pinnae** longer than the median ones, or with the same size, or sometimes abruptly tapering proximally, gradually tapering towards the apex, short-stalked, the stalk (0.2)0.3−3.0 mm long, 0.2−0.4 mm diam., semi-cylindrical, adaxially grooved, stramineous, straight, adaxial surface of pinnae

moderately to densely covered by hairs, abaxial surface moderately to densely covered by hairs, mainly on veins, the hairs similar to those of the petioles; **ultimate segments** often bifurcate, sometimes simple, with acute apices, sometimes rounded, the margin entire, plane, whitish, occasionally with hairs similar to those of the petioles; **veins** usually furcate, sometimes simple, with enlarged clavate tips, usually not reaching the laminae margin. **Sori** on the veins in the proximal portion of the segments; **spores** dark brown, proximal surface with coalescent ridges, mainly near trilete aperture, distal surface slightly tuberculate, 68.3−72.0 μm diam.

Distribution and ecology: This species is endemic to Brazil and occurs only in the states of Bahia and Minas Gerais. It grows under or between rocks, or even in cracks of rocks, in general in humid and shaded places in rocky fields; at 1140−1850 m elevation.

Selected material examined: BRAZIL. Bahia: Abaíra, Cabeceira, Riacho Fundo atrás da Serra do Bicota, 13º23'S, 41º51'W, 1480 m, 25-X-1993, W Gasnev 2310 (HUEFS, SP). Minas Gerais: Santana do Riacho, Serra do Espinhaço, between Conceição do Mato Dentro and Lagoa Santa, off MG-010, in Serra do Cipó National Park at crossing of Rio Três Pontinhas, 19º15'56.0"S, 43º32'36.8"W, 1320 m, 17-I-2010, E Schuettpelz et al. 1433 (DUKE, MO, SP).

Tryonia schwackeana is easily recognized by its fronds pinnate-pinnatisect, petioles moderately to densely covered by glandular hairs, pinnae ovate to triangular, membranaceous, plane, adaxial and abaxial surface of the lamina moderately to densely covered by glandular hairs.

Tryon (1970) considered this species as synonymous with *Tryonia sellowiana*. However, these two species are different and they can be distinguished by the characters presented in the key.

Sometimes, *Tryonia schwackeana* can be confused with *T. areniticola*. However, it is distinguished by the great amount of glandular hairs (only present glandular hairs) in the lamina, whereas *T. areniticola* presents a greater quantity of eglandular hairs (the glandular ones are sparse). In addition, *T. schwackeana* has petioles moderately to densely covered by glandular hairs (vs. petioles glabrous or sparsely covered by eglandular hairs in *T. areniticola*).

4. ***Tryonia sellowiana*** (Mett. ex Kuhn) Schuettp. et al., PhytoKeys 35: 40. 2014. *Gymnogramma sellowiana* Mett. ex Kuhn, Linnaea 36: 69. 1869. *Psilogramme sellowiana* (Mett. ex Kuhn) Kuhn, Festschr. 50 Jähr. Jub. Königstädt. Realschule Berlin: 337. 1882. *Eriosorus sellowianus* (Mett. ex Kuhn) Copel., Gen. Fili.: 59. 1947. *Jamesonia sellowiana* (Mett. ex Kuhn) Christenh., Phytotaxa 19: 21. 2011. Lectotype (designated by Tryon 1970): BRAZIL. 13-VIII, F. Sello 1365 (B barcode B_20_0073009[image!]; isolectotype: B barcode B_20_0073010[image!]).

Figs. 3g-h, 7j-r, 9a-c, 10.

Plants rupicolous or terrestrial. **Rhizomes** short-creeping, 0.6−1.5 mm diam., dark brown, moderately to densely covered by hairs and bristles, the hairs dark brown, multicellular, glandular, the apical cell globose, 0.1−2.0 mm long, the bristles dark brown, with darker-colored thickened transverse cell walls, apex long filiform, base with 2 cell of wide, apical cell globose, 1.5−2.0 mm long. **Fronds** erect, indeterminate growth, (5.0)14.0−67.0 × (0.2)0.8−4.0 cm; **petiole** semi-cylindrical, adaxially grooved, (2.5)3.0−46.0 cm × 1.1−1.7 mm, proximally castaneous, distally stramineous, glabrous to moderately covered by hairs on both surfaces, the hairs 0.2−1.7 mm long, glandular, hyaline, erect to tortuous, bicellular to multicellular, the apical cell globose; **laminae** pinnate-pinnatisect, rarely 2-pinnate, narrowly elliptic to linear (2.5)13.0−57.0 × 0.8−4.0 cm, coriaceous; **rachises** straight, semi-cylindrical, adaxially grooved, stramineous, moderately to densely covered by hairs on both surfaces, the hairs similar to those of the petioles; **pinnae** patent to strongly ascending, narrowly triangular to linear, 0.4−4.0 × 0.2−0.7 cm, alternate, sometimes subopposite, gradually tapering proximally and towards the apex (pinnatisect), short-stalked, the stalk 0.5−1.0 mm long, 0.3−0.5 mm diam., semi-cylindrical, adaxially grooved, stramineous, straight, adaxial surface of pinnae glabrous or with sparse hairs, abaxial surface of the pinnae sparsely to moderately covered by hairs on veins, the hairs similar to those of the petioles; **proximal pinnae** shorter than the median ones; **ultimate segments** bifurcate, with acute apices, margin entire, recurved; **veins** furcate or simple with enlarged clavate tips or not, reaching the laminae margin. **Sori** on the ultimate segments protected by the curved edge of the laminae; **spores** dark brown, proximal surface with coalescent ridges, mainly near trilete aperture, distal surface strongly tuberculate, 54.3−54.4 μm diam.

Distribution and ecology: This species is endemic to Brazil and it occurs only in the Espinhaço Range and the Quadrilátero Ferrífero in the Minas Gerais state. It grows among rocks, or at their base, in areas frequently exposed to the sun, in rocky fields and cloud forest; 1300−2050 m elevation. In these areas, the soil is shallow, under a rock slab. Lowland individuals have fronds of lesser length and width than the fronds of highland plants.

Selected material examined: BRAZIL**.** Minas Gerais: Catas Altas, Reserva Particular do Patrimônio Natural Santuário do Caraça, na entrada da Gruta de Lourdes, [20°05’37.5”S, 43°28’35.6”W], 1437 m, 21-XI-2018, AP Della et al. 61 (SP).

Tryonia sellowiana is characterized by having fronds pinnate-pinnatisect, petioles glabrous to moderately covered by glandular hairs, pinnae narrowly triangular to linear, coriaceous, strong enrolled, and adaxial surface of the lamina glabrous to sparsely covered by glandular hairs, the abaxial lamina surface is moderately to densely covered by glandular hairs.

In the Reserva Natural do Santuário do Caraça (MG) it can be found in the lower portions of the area, mainly in rock crevices and in the upper part of the Serra (Pico do Inficcionado) occurs in fields with grasses and bromeliads.

In the fertile fronds, the margins of the pinnules became curled leaving them perfectly orbicular (Salino and Viveros 2012). The coriaceous laminae and bead-like enrolled pinnules are aspects that seem to reflect the xeric habitats (Tryon 1970).

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Author' contributions

A.P. Della: substantial contribution in the concept and design of the study, contribution to data collection, contribution to data analysis and interpretation, and contribution to manuscript preparation.

J. Prado: substantial contribution in the concept and design of the study, contribution to data analysis and interpretation, contribution to manuscript preparation, and contribution to critical revision, adding intelectual content.

Conflict of interest

The authors declare that they have no conflict of interest.

References

Baker JG (1870) Cyatheaceae et Polypodiaceae. In Martius CFP, Eichler AG (org.) Flora Brasiliensis. Munchen, Wien, Leipzig, 1: 358–382.

Cochran AT, Prado J, Schuettpelz E (2014) *Tryonia*, a new taenitidoid fern genus segregated from *Jamesonia* and *Eriosorus* (Pteridaceae). PhytoKeys 35: 23–43.

Condack JPS (2006) Pteridófitas ocorrentes na região alto montana do Parque Nacional do Itatiaia: análise florística e estrutural. Dissertation, Escola Nacional de Botânica Tropical, do Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Rio de Janeiro.

Fernandes I, Baptista LRM (1988) Levantamento da flora vascular rupestre do Morro Sapucaia e Morro do Cabrito, Rio Grande do Sul. Acta Bot. Brasil. 1:95–102.

Fidalgo O, Bononi VLR (coords.) (1984) Técnicas de coleta, preservação e herborização de material botânico. Instituto de Botânica, São Paulo, Manual 4, p. 61.

Funez LA, Gasper AL (2014) Parque Nacional da Serra do Itajaí (Southern Brazil) shrub and herbs flora. Check List 10: 1249–1259.

Garcia RJF, Pirani JR (2005) Análise florística, ecológica e fitogeográfica do Núcleo do Curucutu, Parque Estadual da Serra do Mar (São Paulo, SP) com ênfase nos campos junto à crista da Serra do Mar. Hoehnea 32:1–48.

Gasper AL, Salino A, Vibrans AC et al. (2012) Pteridófitas de Santa Catarina: um olhar sobre os dados do Inventário Florístico Florestal de Santa Catarina, Brasil. Acta Bot. Brasil. 26: 421–434.

Gonzatti F, Machado L, Windisch PG (2016) Distribution patterns of ferns and lycophytes in the Coastal Region of the state of Rio Grande do Sul, Brazil. Acta Bot. Brasil. 30: 239–253.

ESRI. 2016. ArcGIS release 10.5. Redlands, CA: Environmetal Systems Research Institute.

IBGE (2015) Mapas. https://mapas.ibge.gov.br/bases-e-referenciais/bases-cartograficas/malhas-digitais.html. Accessed 16 May 2019.

ICMBIO (2019) Mapa Temático e Dados Geoestatísticos das Unidades de Conservação Federais. http://www.icmbio.gov.br/portal/geoprocessamentos/51-menu-servicos/4004-downloads-mapa-tematico-e-dados-geoestatisticos-das-uc-s. Accessed 16 May 2019.

Lellinger DB (2002) A modern multilingual glossary for taxonomic pteridology. The American fern society, USA.

Melo LCN, Salino A (2007) Pteridófitas em fragmentos florestais da APA Fernão Dias, Minas Gerais, Brasil. Rodriguésia 58: 207–220.

Michelon C, Labiak PH (2013) Samambaias e licófitas do Parque Estadual do Guartelá, Paraná. Hoehnea 40: 191–204.

PPG I (2016) A community-derived classification for extant lycophytes and ferns. J. Syst. Evol. 54: 563–603.

Prado J (1997) Flora da Serra do Cipó: Pteridaceae-Adiantoideae e Taenitidoideae. Boletim de Botânica da Universidade de São Paulo 16: 115–118.

Prado J (2015) Pteridaceae in Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro. http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB91951. Accessed 07 December 2018.

Prado J, Hirai RY (2011) Checklist das licófitas e samambaias do Estado de São Paulo, Brasil. Biota Neotrop. 11: 162–190.

Prado J, Labiak PH (2003) Pteridófitas. In Zappi DC, Lucas E, Stannard BL et al. (org.) Lista das plantas vasculares Chapada Diamantina, Bahia, Brasil. Boletim de Botânica da Universidade de São Paulo 21: 359–360.

Prado J, Sylvestre LS (2010) As samambaias e licófitas do Brasil. In: Forzza RC, Baumgratz JFA, Bicudo CEM et al. (orgs.) Catálogo de plantas e fungos do Brasil, v. 1, Jardim Botânico do Rio de Janeiro, Rio de Janeiro, pp 69–74.

Prado J, Sylvestre LS, Labiak PH et al. (2015) Diversity of ferns and lycophytes in Brazil. Rodriguésia 66: 1073–1083.

Prado J, Rodrigues CN, Salatino A, Salatino ML (2007) Phylogenetic relationships among Pteridaceae, including Brazilian species, inferred from *rbcL* sequences. Taxon 56: 355–368.

Rojas-Alvarado AF (2017). Novedades en *Jamesonia* Hook. & Grev. y *Tryonia* Schuettp., J. Prado & A.T. Cochran (Pteridaceae) para el Neotrópico. Acta Bot. Malac. 42: 111–118.

Rojas-Alvarado AF (2019) Corrections in Recently Described Species of Ferns and Lycophytes from the Neotropics. Open Access Library Journal 6: e5172.

Rolim LB (2007) Pteridófitas do Parque Estadual do Itacolomi, Minas Gerais, Brasil. Dissertation, Universidade de Brasília, Brasília.

Salino A, Viveros RS (2012) Flora II: As pteridófitas da Serra do Caraça. In: Ottoni C (org.) Serra do Caraça, v. 1, Edição do autor, Belo Horizonte, pp. 82–97.

Salino A, Mota NFO, Almeida TE (2013) Lycophytes and monilophytes in Rio Preto State Park, Minas Gerais, Brazil. Acta Bot. Brasil. 27: 252–263.

Sánchez-Baracaldo P (2004a) Phylogenetics and biogeography of the neotropical fern genera *Jamesonia* and *Eriosorus* (Pteridaceae). Amer. J. Bot. 91: 274–284.

Sánchez-Baracaldo P (2004b) Phylogenetic relationships of the subfamily Taenitidoideae, Pteridaceae. Amer. Fern J. 94: 126–142.

Schneider H, He L, Hennequin S, Zhang XC (2013) Towards a natural classification of Pteridaceae: inferring the relationships of enigmatic pteridoid fern species occurring in the Sino-Himalaya and Afro-Madagascar. Phytotaxa 77: 49–60.

Schwartsburd PB, Labiak PH (2007) Pteridófitas do Parque Estadual de Vila Velha, Paraná, Brasil. Hoehnea 34: 159–209.

Schwartsburd PB, Labiak PH (2008) *Eriosorus areniticola* (Pteridaceae), a new species from Brazil. Amer. Fern J. 98: 160–163.

Sehnem A (1972) Pteridaceae. In: Reitz R (org.) Flora Ilustrada Catarinense. Herbário Barbosa Rodrigues, Itajaí, pars 1, p. 1–244.

Souza FS (2012) Pteridófitas da Serra do Caparaó, Brasil: Inventário e relações florísticas. Dissertation, Universidade Federal de Juiz de Fora, Juíz de Fora.

Thiers B Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium http://sweetgum.nybg.org/ih/. Accessed 13 June 2019.

Tryon AF (1962) A monograph of the fern genus *Jamesonia*. Contributions from the Gray Herbarium of Harvard University 191: 109–197.

Tryon AF (1970) A monograph of the fern genus *Eriosorus*. Contributions from the Gray Herbarium of Harvard University 200: 54–174.

Tryon AF, Lugardon B (1990) Spores of Pteridophyta. Springer-Verlag, New York, USA.

Windisch PG (1987) Pteridófitas. In Giulietti AM, Menezes NL, Pirani JR et al. (org.) Flora da Serra do Cipó, Minas Gerais: caracterização e lista das espécies. Boletim Botânica da Universidade de São Paulo 9: 18–34.

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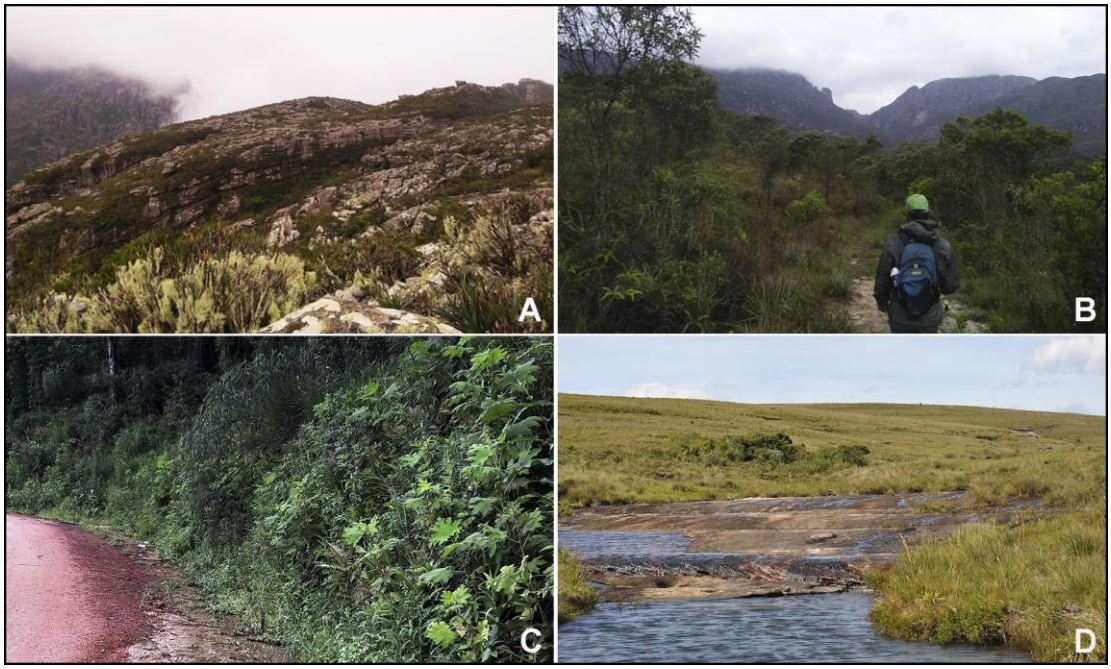


Fig. 1 Habitats of *Tryonia* species in Brazil. **A, B**. Reserva Particular do Patrimônio Natural Santuário do Caraça, Catas Altas (MG). **A**. View from the top of the Pico do Inficcionado. **B**. Trail to the Pedra da Paciência. **C**. Road ravine located in the city of Rio dos Cedros (SC). **D**. Parque Estadual de Vila Velha, Ponta Grossa (PR). **A-C**. AP Della. **D**. PH Labiak.

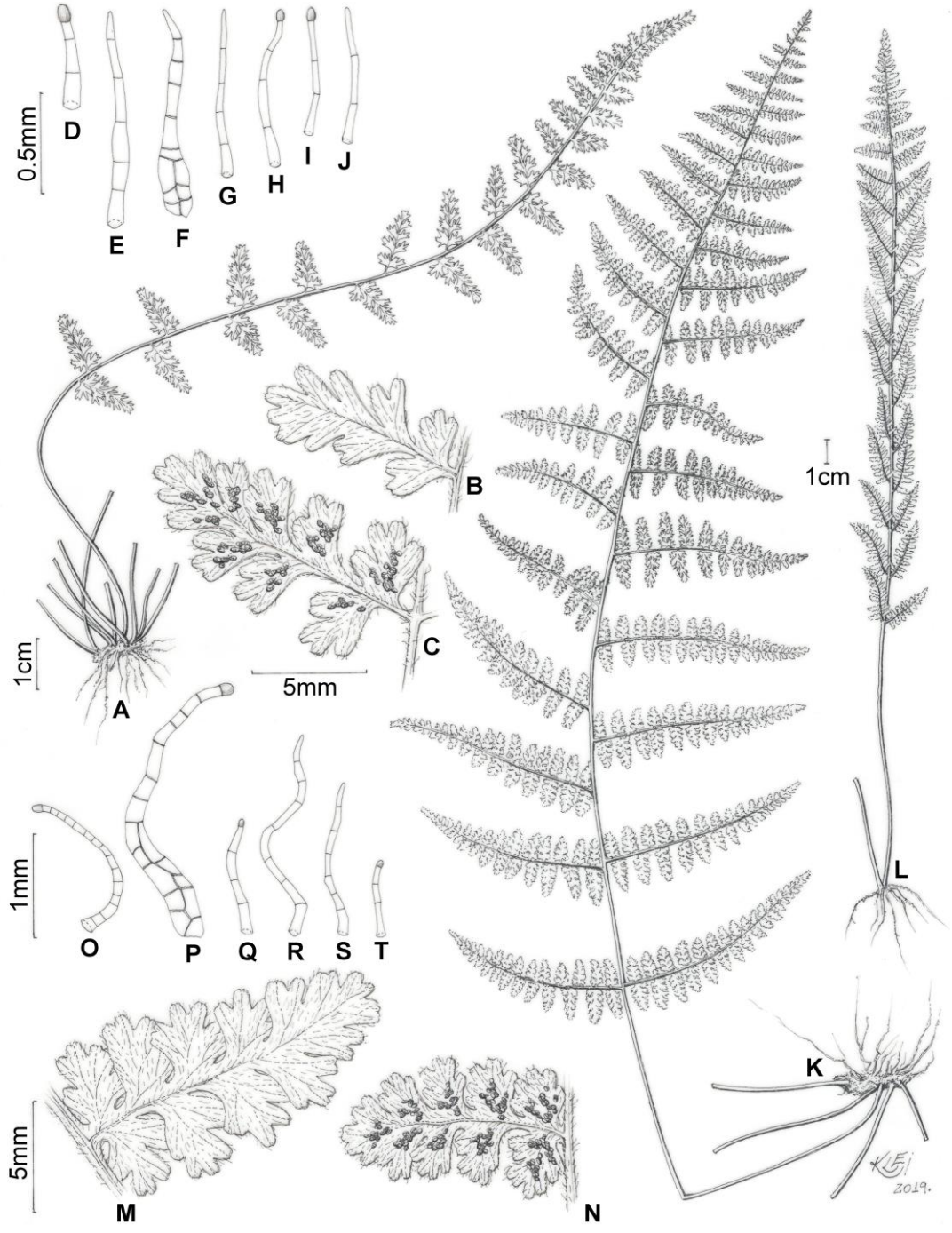


Fig. 2 A–J. *Tryonia areniticola*. **A**. Habit. **B, C**. Adaxial and abaxial surfaces of the pinna, respectively. **D–F**. Hairs and bristles of the rhizome. **G, H**. Hairs of the petiole and rachis. **I, J**. Hairs of the lamina. **K–T**. *T. myriophylla*. **K**. Habit. **L**. Frond with pinnae strongly ascending. **M, N**. Adaxial and abaxial surfaces of the pinna, respectively. **O, P**. Hairs and bristles of the rhizome. **Q, R**. Hairs of the petiole and rachis. **S, T**. Hairs of the lamina. **A–J**. Hatschbach 20130 (PACA). **K–T**. Matos & CA Royer 2505 (UPCB) and J Prado & MP Marcelli 775 (SP).

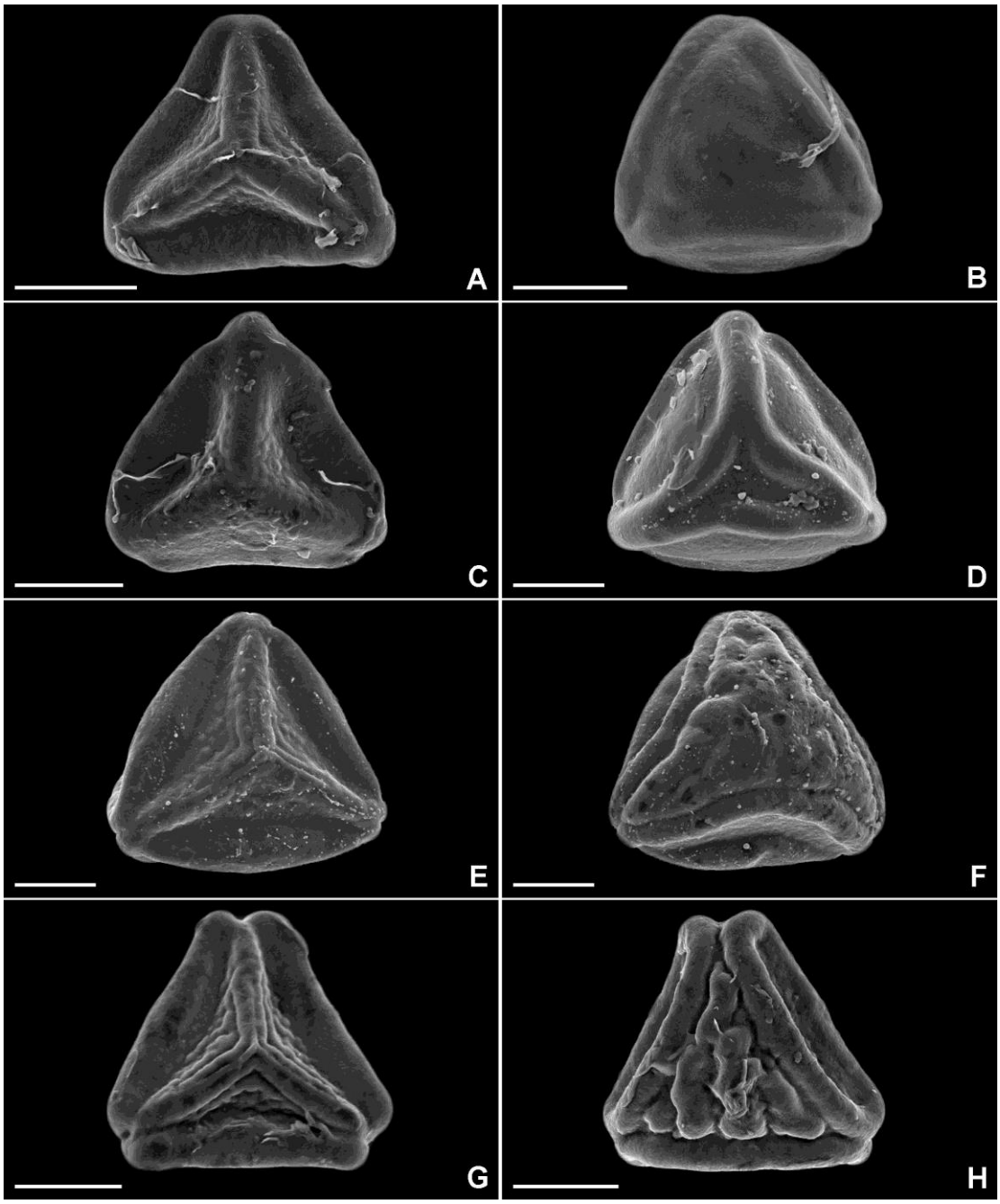


Fig. 3 Photomicrographies of *Tryonia* spores. **A, B**. *Tryonia areniticola*. **C, D**. *Tryonia myriophylla.* **E, F**. *Tryonia schwackeana.* **G, H**. *Tryonia sellowiana.* Left column showing proximal surface, right column showing distal surface. Scale bars = 20 μm. **A, B**. *Prado* et al. *1779* (SP). **C, D**. Lima & Zimmermam 90 (SP). **E, F**. Stannard & H Queiroz s.n. (SP 291700). **G, H**. Prado et al. s.n. (SP 291647).

Fig. 4 A–C. *Tryonia areniticola*. **A**. Habit. **B, C**. Adaxial and abaxial surfaces of the pinna, respectively. **D–F**. *T. myriophylla*. **D**. Habit. **E, F**. Adaxial and abaxial surfaces of the frond, respectively. **G, H**. *T. schwackeana*. **G**. Habit. **H**. Abaxial surface of the frond. **A–C**. P.H. Labiak. **D, E** and **G, H**. RY Hirai & J Prado. **F**. AP Della.

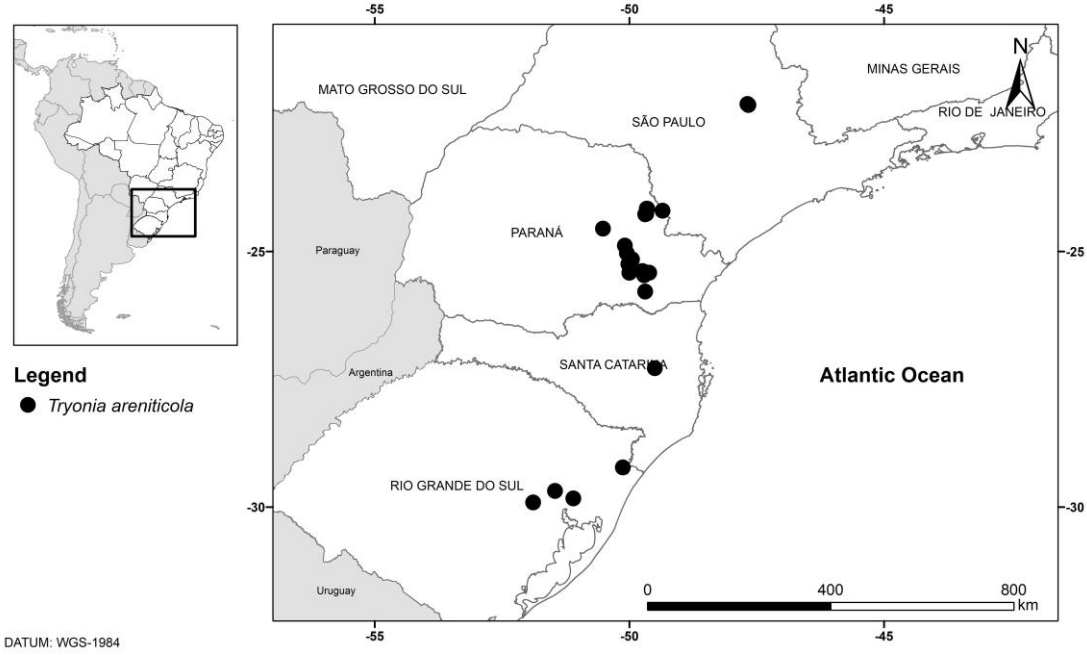


Fig. 5 Distribution of *Tryonia areniticola* in Brazil.

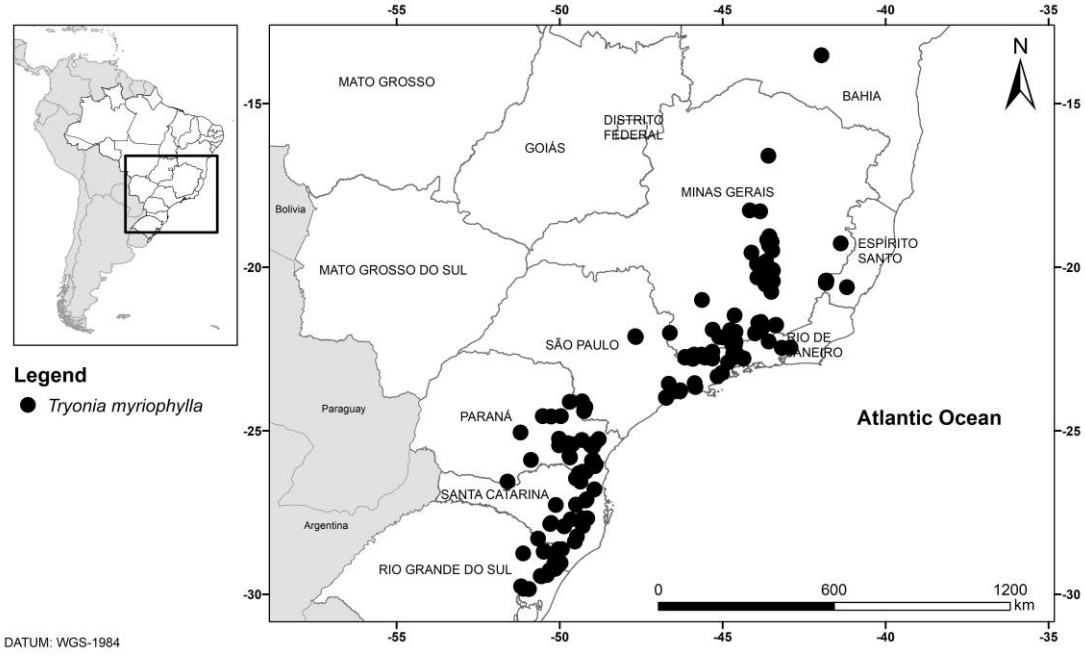


Fig. 6 Distribution of *Tryonia myriophylla* in Brazil.

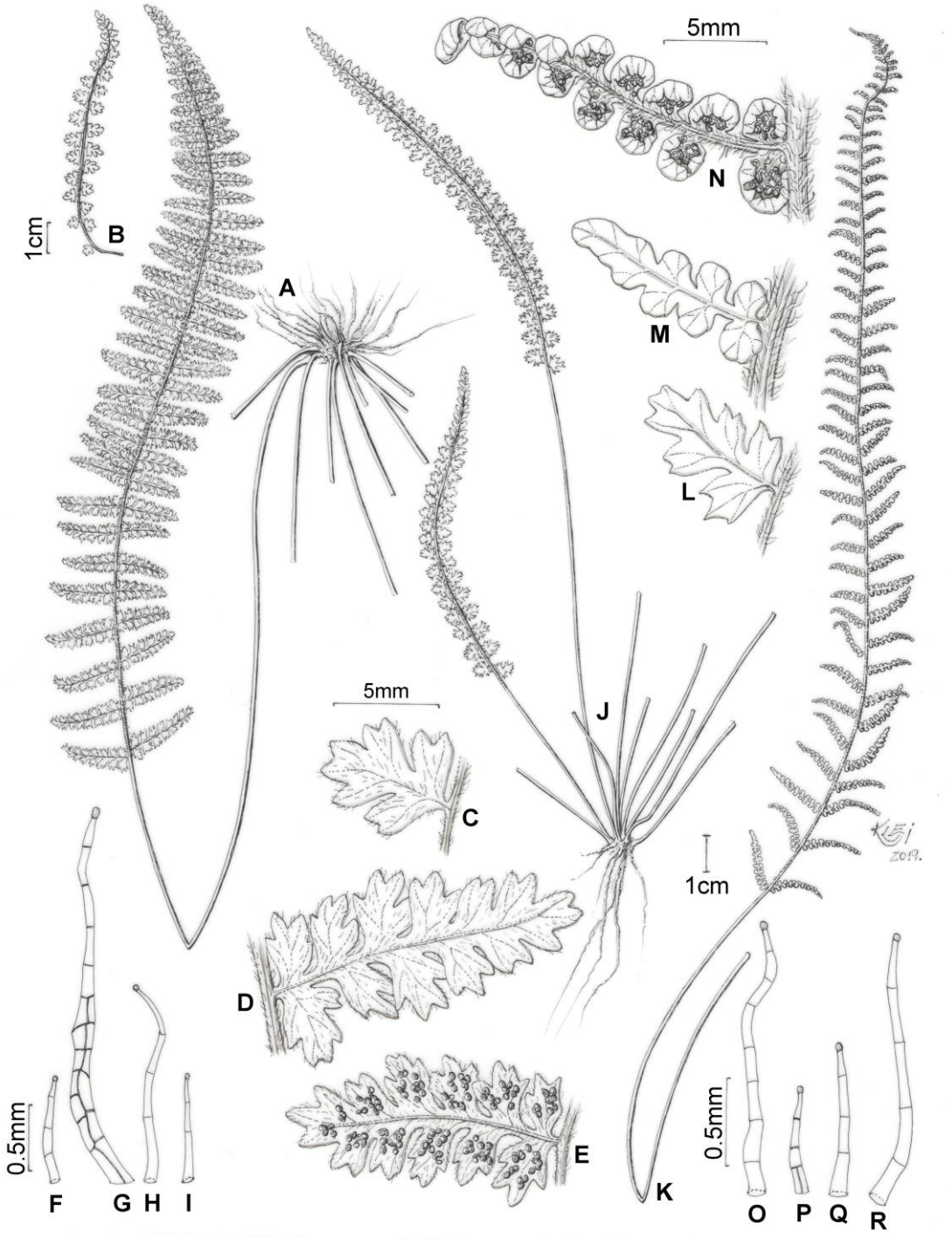


Fig. 7 A–I. *Tryonia schwackeana*. **A**. Habit. **B**. Sterile frond. **C**. Sterile pinna. **D, E**. Adaxial and abaxial surface of the pinna, respectively. **F, G**. Hair and bristle of the rhizome. **H**. Hair of the petiole and rachis. **I**. Hair of the lamina. **J–R**. *T. sellowiana*. **J**. Habit. **K**. Fertile frond. **L**. Sterile pinna. **M, N**. Adaxial and abaxial surface of the pinna, respectively. **O, P**. Hair and bristle of the rhizome. **Q**. Hair of the petiole and rachis. **R**. Hair of the lamina. **A–I**. E Schuettpelz et al. 1433, 1434 (SP). **J–N**. AP Della et al. *66* (SP). **O–R**. J Prado et al. s.n. (SP 2991647).

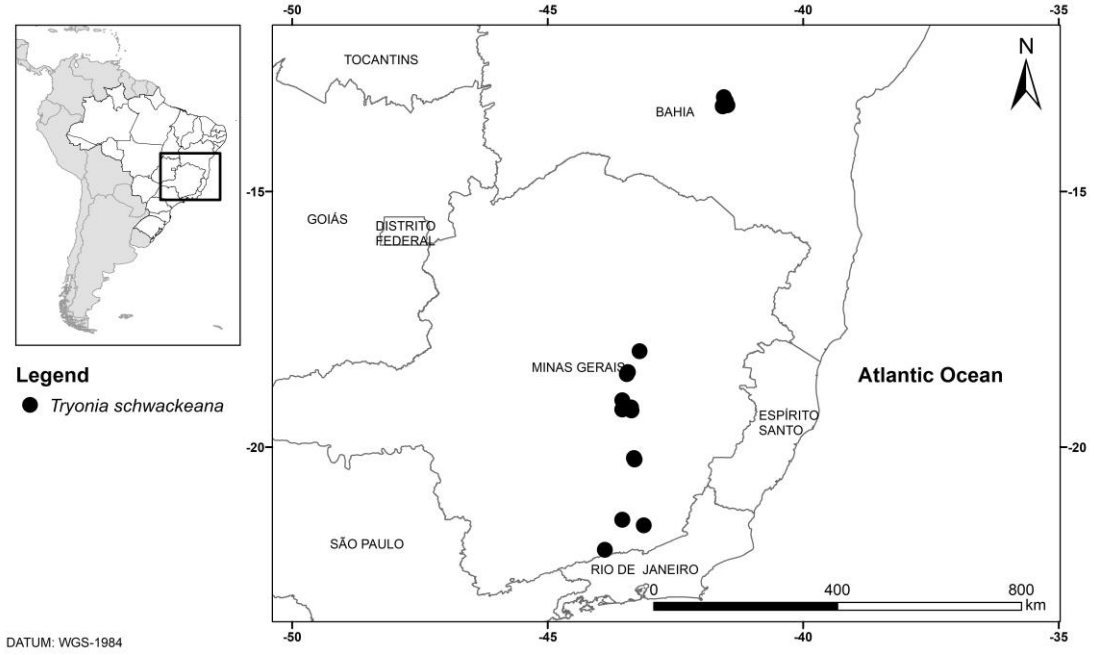


Fig. 8 Distribution of *Tryonia schwackeana* in Brazil.

Fig. 9 A-C. *Tryonia sellowiana*. **A**. Habit. **B, C**. Adaxial and abaxial surfaces of the pinna, respectively. **A–C**. AP Della.

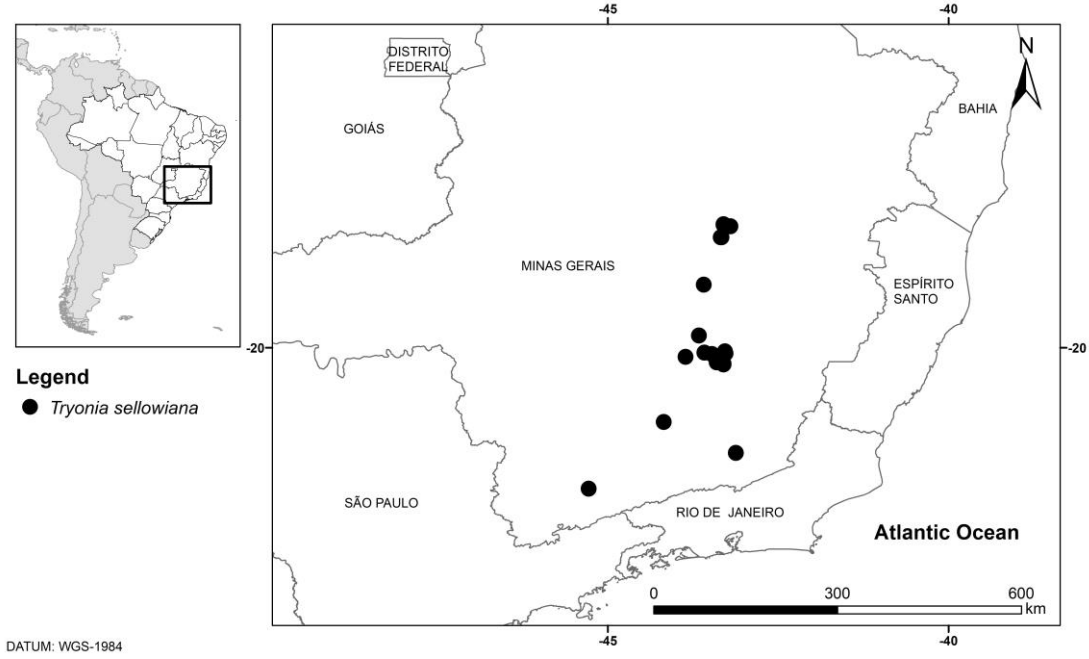


Fig. 10 Distribution of *Tryonia sellowiana* in Brazil.

Appendix I
List of Exiccatae

(The number in parenthesis refers to the species number in the taxonomic treatment)

Almeida, T.E. et al.: 5 (4), 534 (4), 540 (4), 1177 (2), 1513 (2), 2540B (2), 3391 (2).
Amaral, M.: s.n. (BHCB 3756) (2).
Amorim, L.: 13 (2).
Arruda, A.J. et al.: 180 (2).
Badini, J.: 123 (2), 268 (3), 269 (4).
Badini, J. & Maielo, L.S.: 1378 (2).
Barbosa, E. & Cordeiro, J.: 171 (1).
Barbosa, E. et al.: 480 (1).
Barreto, C. & Brade, A.C.: 482 (2), 498 (2).
Barreto, H.L.M. & Brade, A.C.: 8193 (2).
Barreto, M.M. & Brade, A.C.: 3534 (2).
Brade, A.C.: 5117 (2), 10050 (2), 10165 (2), 14298 (3), 14495 (2), 15537 (2), 15538 (2), 19096 (2), 19489 (2), 21112 (2), 21906 (2).
Brade, A.C. & Chaufo, S.: 19051 (2).
Bueno, R.: 4106 (2), 4467 (2), 4481 (2), s.n. (ICN 67619) (2), s.n. (ICN 67618) (2).
Bueno, R. & Kazmirizak, C.: s.n. (ICN 124325) (1).
Câmara, U.C.: s.n. (CESJ 9439) (3).
Camargo, O.R.: 3923 (2).
Campanholo, R.: 45 (2).
Canestraro, B.K.: 1149 (2).
Canestraro, B.K. & Labiak, P.H.: 347 (2).
Canestraro, B.K. et al.: 687 (2).
Capell, P.: s.n. (RB 82127) (2).
Carauta, J.P.P.: 3066 (2).
Cardoso, A.: s.n. (BHCB 214436) (2).
Carmo, F.F.: 4352 (2).
Caxambu, M.G. et al.: 2086 (2).
Cervi, A.C. et al.: 2682 (1), 2701 (1).
Christenhusz, J.M.M. et al.: 4746 (2), 4785(1), 4815 (2).
Cislinski, J. & Torezan, J.M.D.: 34 (1).
Condack, J.P.S.: 315 (2), 323 (2), 456 (2).
Cordeiro, J. et al.: 2310 (2), 2928 (2).
Damasio, L.: 1248 (4), 1260 (3), 12745 (4), s.n. (RB 36472) (2), s.n. (R 20985) (2), s.n. (RB 36484) (4), s.n. (RB 36479) (4).
Davis, P.H. & Sphepherd, G.J.: 61008 (1).
Della, A.P.: 59 (2), 60 (2), 61 (4), 62 (2), 64 (2).
Della, A.P. & Silva, D.H.: 66 (4).
Della, A.P. & Simplicio D.C.: 65 (4).
Dittrich, V.A.O. & Dittrich, V.L.O.: 1148 (1).
Dittrich, V.A.O. & Torres, R.F.: 357 (2).
Dittrich V.A.O. & Vale, A.A.: 238 (4), 1790 (2).
Dittrich, V.A.O. et al.: 1869 (2), 1920 (2).
Dombrowski, L.T.H.: 6514 (1), 7145 (2).
Dombrowski, L.T.H. & Kuniyoshi, Y.S.: 2259 (2), 4485 (2), 5127 (2).
Dreveck, S. et al. 132 (2).
Dusén, P.: s.n. (R 15588) (2).
Dutra, J.: 160 (2), 258 (2).
Engels, M. & Lozano, E.D.: 2207 (2).

11908 (2), 11977 (2), 12268 (2), 12594 (2), 12686 (2), 12941 (2), 13062 (2).

Salino, A. & Melo, L.C.N.: 6392 (2).

Salino, A. & Mota, R.C.: 8905 (2), 8870 (4), 9586 (4).

Salino, A. et al.: 1977 (2), 4239 (2), 6224 (2), 7117 (2), 7505 (2), 9333 (4), 9355 (3), 10545 (4), 10985 (2), 11436 (2), s.n. (UEC 25766) (2).

Sampaio, L.C.Q.M.P. & Garcia, R.J.F.: 222 (2).

Scaramuzza, C.A.M. & Souza, V.C.: s.n. (ESA 63754) (2).

Scaramuzza, C.A.M. et al.: 696 (2), 1150 (2).

Schnell, R.: 8565 (2).

Schuettpelz, E. et al.: 1411 (3), 1431 (2), 1433 (3), 1434 (3), 1467 (2), 1449 (2), 1461 (2).

Schultz, A.R.: s.n. (ICN 1750) (2).

Schwacke: 7564 (3), 9258 (4), 9777 (4), 10315 (4), 10658 (4), 10701 (4), 11302 (3), 12304 (3), 12745A (4), 14417 (4), 14418 (4), 14476 (2), 21572 (2), s.n. (SP 21572) (3).

Schwartsburd, P.B. & Matos, F.B.: 240 (1), 439 (1).

Schwartsburd, P.B. et al.: 880 (1), 1159(1).

Sehnem, A.: s.n. (SP 50568) (2), s.n. (PACA 78563) (2), s.n. (PACA 78562) (2), s.n. (PACA 78561) (2), s.n. (PACA 78560) (2), s.n. (PACA 1158) (2), s.n. (PACA 78548) (2), s.n. (PACA 78549) (2), s.n. (PACA 78550) (2), s.n. (PACA 78551) (2), s.n. (PACA 78552) (2), s.n. (PACA 78554) (2), s.n. (PACA 78555) (2), s.n. (PACA 78556) (2), s.n. (PACA 926) (2).

Senna, R.M.: 676 (2).

Silva, A.T.: 493 (2), 534 (2).

Silva, J.M.: 6991 (1), 7822(1).

Silva, J.M. et al.: 3317 (1).

Silveira, A.: 52 (2).

Smith, L.B. & Reitz, R. 10400 (2).

Souza, F.S.: 1300 (2).

Souza, F.S. & Miranda, E.: 1645 (2).

Souza, F.S. et al.: 190 (2), 1002 (2).

Souza, G. et al.*:* 190 (2).

Souza, V.C. et al.: 3486 (2), 25072 (2), 25431 (2).

Sucre, D. & Krieger, L.: 6796 (2).

Stannard, B. et al.*:* 52055 (3).

Sylvestre, L.S. & Condack, J.P.S.: 1745 (2).

Sylvestre, L.S. & Silva, A.J.R.: 123 (2).

Sylvestre, L.S. et al.: 213 (2).

Tamandaré, F. & Brade, A.C.: 6503 (2).

Tessmann, G.: 1951 (2).

Toledo & Brade, A.C.: s.n. (RB 30829) (2).

Turma de BOT III - 2º semestre: s.n. (CESJ 36810) (2).

Usteri, A.: s.n. (SPF 83407) (2), s.n. (SPF 83406) (2).

Viana, M.M. & Almeida, T.E.: 15 (2), 16 (4).

Viana. P.L. & Souza, F.S.: 2006 (2).

Vieira, C.M. et al.: 824 (4).

Vital, D.M.: s.n. (SP 85936) (2).

Viveros, R.S.: 71 (2).

Wacket, D.C.M.: s.n. (RB 36471) (2).

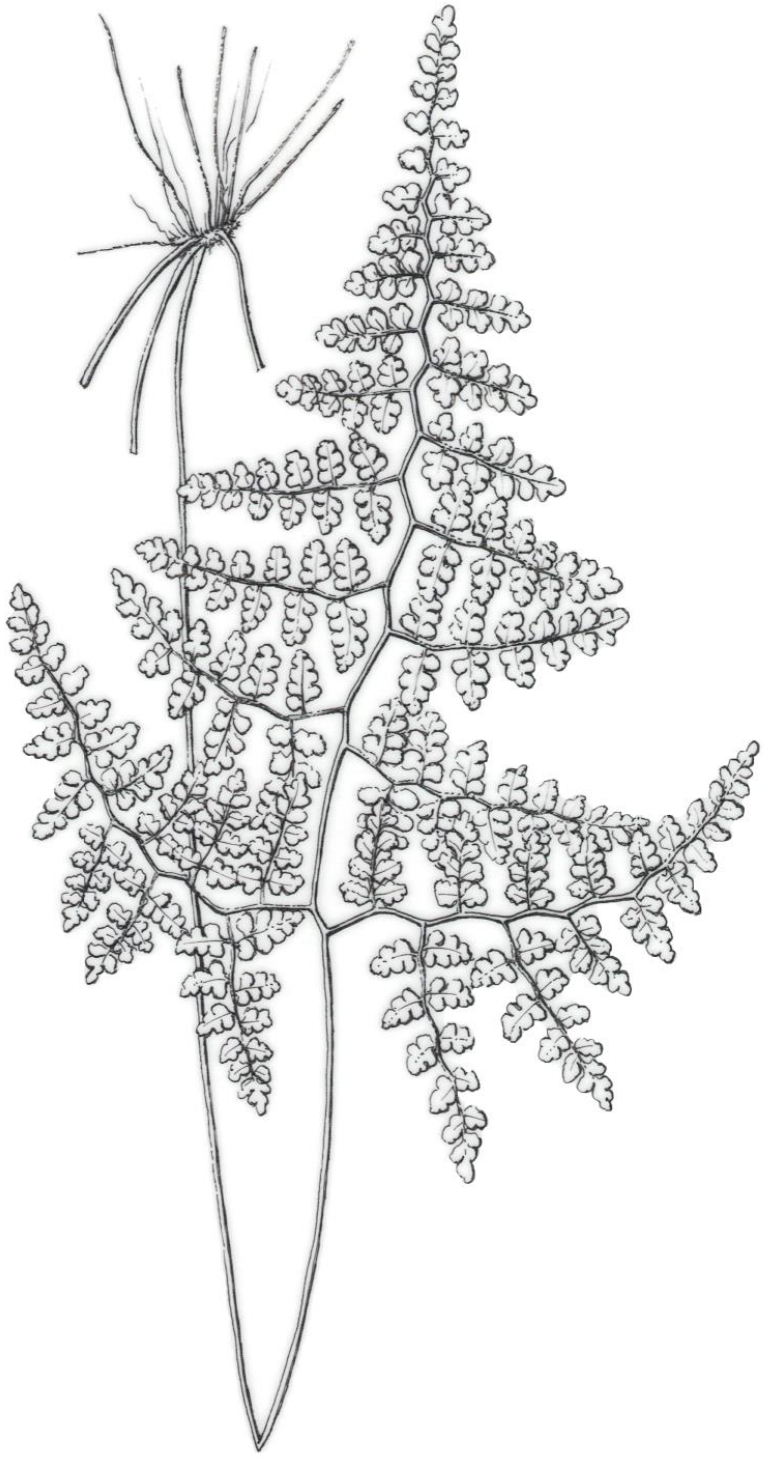
Wacket, M. & Rosenstock: 214 (2).

Wells, R. & Windisch, P.G.: 178 (4), 476 (2), 478 (4), 507 (4), 516 A-B (4).

Wiebke, M.L.: s.n. (PACA 78546) (2).
Windisch, P.G.: 4158 (2), 4950 (2), 5901 (2), 6824b (2), 8746 (2).
Yano, O. & Marcelli, M.P.: 1528 (2).
Zappi et al.: 255 (3), s.n. (SPF 51660) (2).
***s. c.*:** s.n. (RB 169860) (2), s.n. (ICN 258) (2), s.n. (CESJ 20714) (2), s.n. (CESJ 2710) (2), s.n. (RBR 26619) (2), 428 (2), 13630 (2).

Capítulo III

Jamesonia ×intermedia: a new hybrid between *J. biardii* and *J. insignis* (Pteridaceae) from Brazil



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Jamesonia ×intermedia: A New Hybrid Between *J. biardii* and *J. insignis* (Pteridaceae) from Brazil

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ABSTRACT.—In this paper we describe and illustrate a new hybrid, *Jamesonia ×intermedia*, from Serra dos Órgãos, Rio de Janeiro State, Brazil. The hybrid shows intermediate morphology between its putative parents (*J. biardii* (Fée) Christenh. and *J. insignis* (Mett.) Christenh.) in lamina dissection, shape of the ultimate segments, and pubescence of the adaxial surface of the pinnae and rachises. Additionally, most spores are aborted.

KEYWORDS.—Brazilian Atlantic Rainforest, *Eriosorus*, ferns, hybridization, Pteridoideae

Jamesonia Hook. & Grev. belongs to the Pteridoideae subfamily of Pteridaceae and comprises about 50 species, with a geographical distribution restricted to the Neotropics (Schuettpelz *et al*., 2007; Zhang *et al*., 2017; PPG I, 2016). Most of the species of this genus occur in the Andean páramos and subpáramos, from 800 to 5000 m in elevation. In Brazil, seven species and one hybrid were known (excluding the present report); they occur mainly in the Brazilian Atlantic Rainforest, in Campos de Altitude and cloud forests, above 1500 m in elevation (Della & Prado, in preparation).

In the last decades, the delimitation of *Jamesonia* has changed considerably, with the inclusion of *Eriosorus* Fée (Sánchez-Baracaldo, 2004a; 2004b) and the

segregation of *Tryonia* Schuettp. *et al.* (Cochran *et al*., 2014). Thus, in the present circumscription (sensu PPG I, 2016), the genus can be recognized in having 1−6-pinnate, triangular, linear, or less often narrowly triangular and narrowly elliptic, erect to scandent laminae and by the brown rachises.

Hybridization cases are common in *Jamesonia*. Tryon (1962; 1970), in her monographs of the genera *Jamesonia* and *Eriosorus*, described nine hybrids (*Eriosorus hirtus* var. *gladulosus* × *E. flexuosus* var. *flexuosus*, *E. hispidulus* var. *hispidulus* × *Jamesonia* sp., *E. warscewiczii* × *J. scammanae*, *E. cheilanthoides* × *J. brasiliensis*, *E. cheilanthoides* × *Jamesonia* sp., *E. cheilanthoides* × *E. flexuosus* var. *flexuosus*, *E. flexuosus* var. *flexuosus* × *E. warscewiczii*, *E. flexuosus* var. *flexuosus* × *E. paucifolius*, and *E. glaberrimus* × *E. congestus*), besides five morphological "variants" (involving the species *E. hispidulus*, *E. novogranatensis*, *E, rufescens*, *E. hirsutulus*, and *E. flexuosus*). Among these hybrids, only one was reported from Brazil: *E. cheilanthoides* × *J. brasiliensis*. These "variants", the term used by Tryon, can be considered hybrids because they have aborted or irregular spores. Tryon (1962; 1970) verified the existence of abortive spores or/and the failure of chromosome pairing in the meiotic cells of all hybrids described.

During the preparation of the taxonomic treatment of *Jamesonia* for the Flora of Brazil 2020 (online), a large population of a new hybrid was found. Thus the main goal of the present paper is to describe this new hybrid, based on the material collected recently in the Serra dos Órgãos, Rio de Janeiro State, Brazil.

Materials and Methods

The specimens were collected at the Pico do Alcobaça, Serra dos Órgãos, Petrópolis (Rio de Janeiro, Brazil) and were deposited at NY, RB, SP, and SPF (herbarium acronyms according to Thiers (2019), continuously updated).

Morphological terms follow Lellinger (2002) and Tryon and Lugardon (1990). Scanning electronic microscopy (SEM) analyses were carried out to verify spore morphology. The spores were not submitted to any previous chemical treatment. Samples were fixed on stubs using double-sided tape and subsequently, each stub was metalized with gold, and then analyzed under the SEM (Philips XL30). Spores of three specimens were analyzed.

The distribution map was drawn using the software ArcGIS v. 10.5 (ESRI, 2016). The shape files of Brazil and Conservation Units were obtained form IBGE (2015) and ICMBio (2019) websites, respectively.

Jamesonia* ×*intermedia A.P. Della & J. Prado, **hyb. nov.** TYPE.—BRAZIL. Rio de Janeiro: Petrópolis, Parque Nacional da Serra dos Órgãos, Bom Fim, Pico do Alcobaça, 22°28'22.9"S, 43°07'00.4"W, 1689 m, 27 Feb 2019, *A.P. Della et al. 69* (holotype: SP; isotypes: NY, RB, SPF). (Figs. 1G–L, 2–5).

DIAGNOSIS.—*Jamesonia* ×*intermedia* can be recognized in having 2-pinnate-pinnatisect to 3-pinnate-pinnatifid laminae; triangular and coriaceous pinnae, with adaxial surface glabrous or with sparse hairs, abaxial surface moderately covered by hairs; flexuous rachises, costae, and costules, stramineous in young plants and brown in adult plants; and elongate-triangular to ovate ultimate segments, with crenate margins. In addition, the spores of the hybrid are "withered" and empty.

Plants terrestrial or rupicolous. **Rhizomes** short-creeping, 2.5–3.0 mm diam., densely covered by hairs and bristles, the hairs dark brown, multicellular, glandular, 0.2−2.2 mm long, the bristles dark brown, with darker-colored thickened transverse cell walls, apex long-filiform, base with 2−5 cells wide, apical cell globose, 1.3−2.4 mm long. **Fronds** monomorphic, 83.0−125.0 × 13.0−19.5 cm; **petioles** semi-cylindrical, adaxially grooved, 60.0−92.5 cm × 0.6−1.6 mm, bicolorous on young plants and totally brown on older plants, glabrous to moderately covered by hairs on both surfaces, the hairs with 0.3−1.6 mm long, glandular or eglandular, hyaline to castaneous, sometimes bicolorous, erect, multicellular; **laminae** 2-pinnate-pinnatisect to 3-pinnate-pinnatifid, triangular, semi-scandent, gradually tapering towards the apex (long-attenuate, pinnatisect), with usually 10−12 pairs of lateral pinnae, 18.0−32.5 × 13.0−19.5 cm, coriaceous; **rachises**, **costae** and **costules** flexuous, semi-cylindrical, adaxially grooved, green to stramineous on young plants and totally brown on older plants, abaxially and adaxially glabrous to sparsely covered by hairs, mainly in the groove and on the axils of the pinnae, the hairs eglandular, similar to those of the petioles; **pinnae** usually ascending, triangular, the basiscopic side slightly larger, 5.0−12.5 × 3.5−8.0 cm, alternate, long-stalked, the stalk 9.0−27.0 mm long, 0.6−1.2 mm diam, semi-cylindrical, adaxially grooved, stramineous to brown, adaxial surface of the pinnae glabrous or less often sparsely covered by hairs, abaxial surface sparsely to moderately covered by hairs, mainly on the veins, the hairs eglandular, similar to those of the petioles; **primary pinnules** triangular, sometimes ovate, 1.2−4.5 × 1.0−3.7 cm, alternate, stalked, the stalk 4.0−1.2 mm long, 0.6−0.8 mm diam, semi-cylindrical,

adaxially grooved, green, stramineous to brown; **secondary pinnules or segments** triangular to ovate, 0.4−1.5 × 0.4−1.0 cm; margins crenate, often recurved; **veins** usually furcate, with enlarged clavate tips reaching the laminae margin. **Sori** on the veins, forming several lines along the segments; **spores** mostly abortive, dark brown, proximal surface with coalescent ridges, mainly near trilete aperture, distal surface laevigate, 40.0−60.0 μm. diam.

DISTRIBUTION AND HABITAT.—*Jamesonia* ×*intermedia* grows on the edge of trails, in a partially shaded place, between grasses and bromeliads, in the Pico do Alcobaça, Serra dos Órgãos, Rio de Janeiro State (Figure 2), at 1650−1689 m elevation (Figures 3 and 4). The soil of this region has a broad rocky base, and a thin layer of dark organic matter, often moist. The hybrid is semi-scandent.

ETYMOLOGY.—The specific epithet refers to the presence of intermediate morphological characters between the putative parentals.

PARATYPES.—Brazil. Rio de Janeiro: Petrópolis, Parque Nacional da Serra dos Órgãos, Bom Fim, Pico do Alcobaça, 22°28’22.9”S, 43°07’00.4”W, 1689 m, 27 Feb 2019, *A.P. Della et al. 67* (SP); idem, *A.P. Della et al. 68* (SP); idem, *A.P. Della et al. 70* (SP); idem, *A.P. Della et al. 72* (SP); idem, 22°28’17”S, 43°07’00”W, 1650 m, 04 Jun 2017, *J.M.A. Braga 17-002* (RB).

This hybrid shows morphology intermediate between *Jamesonia insignis* (Mett.) Christenh. and *J. biardii* (Fée) Christenh. (See Table 1 and Figure 1). It more closely resembles *J. insignis* than *J. biardii* in the size and shape of the pinnae, pinnules, and ultimate segments, as well as crenate margins of the laminae. On the other hand, it resembles *J. biardii* by the glabrous or rarely sparsely eglandular hairs on the adaxial surface of the laminae and glabrous to sparsely eglandular hairs on the rachises.

Jamesonia ×*intermedia* is currently known only in the Serra dos Órgãos, Rio de Janeiro State. However, its occurrence in other places where its putative parents occur, is probable.

In Scanning electronic microscopy analyses, most of the spores are "withered" (Figure 5). The spores appear to have a cavity (concave aspect) on the proximal surface (Figure 5A, C), probably due to the absence of content. These irregular spores measure 40.0−50.4 μm. Some spores showed "regular" (turgid) morphology (Figure 5E-H) and

measure 49.9−60.0 μm. The size of these “regular” spores is similar to those of *J. insignis* and *J. biardii*.

In the region of Petrópolis, and specifically around the Pico do Alcobaça, has been impacted by agriculture. As the hybrid was found only in a single population in the Pico, further human impacts could put the population at risk. In addition, another possible threat is fire, which this year burned several areas around to the Parque Nacional da Serra dos Órgãos.

Putative parental species were not found occurring close with the hybrid population. The populations of the putative parents, *Jamesonia insignis* and *J. biardii,* occur only in more preserved environments in the same locality, whereas the hybrid occurs in one disturbed area. In the same locality of the hybrid population occur other species of *Jamesonia*: *J. brasiliensis* Christ, *J. cheilanthoides* (Sw.) Christenh. *and J. rufescens* (Fée) Christenh., but they have morphology quite distinct of the putative parents and the hybrid specimens. Thus, We believe that they are not involved with formation of the hybrids.

According to our observations of the population of this hybrid in the field, the plants multiply vegetatively by the growth of the rhizomes. We did not investigate if the apomictical reproduction is present, because at a first glance we thought that it was a different species, but not of hybrid origin.

ACKNOWLEDGEMENTS

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LITERATURE CITED

COCHRAN, A.T., J. PRADO, and E. SCHUETTPELZ. 2014. *Tryonia*, a new Taenitidoid fern genus segregated from *Jamesonia* and *Eriosorus* (Pteridaceae). PhytoKeys 35: 23–43.

ESRI. 2016. ArcGIS release 10.5. Redlands. CA: Environmental Systems Research Institute.

IBGE. 2015. Mapas. Available at <https://mapas.ibge.gov.br/bases-e-referenciais/bases-cartograficas/malhas-digitais.html.>. Access on 16 May 2019.

ICMBIO. 2019. Mapa Temático e Dados Geoestatísticos das Unidades de Conservação Federais. Available at < http://www.icmbio.gov.br/portal/geoprocessamentos/ 51-menu-servicos/4004-downloads-mapa-tematico-e-dados-geoestatisticos-das-uc-s>. Access on 16 May 2019.

LELLINGER, D. B. 2002. A modern multilingual glossary for taxonomic pteridology. The American Fern Society, USA.

PPG I. 2016. A community-derived classification for extant lycophytes and ferns. Journal of Systematics and Evolution 54: 563–603.

SÁNCHEZ-BARACALDO, P. 2004a. Phylogenetics and biogeography of the neotropical fern genera *Jamesonia* and *Eriosorus* (Pteridaceae). American Journal of Botany 91: 274–284.

SÁNCHEZ-BARACALDO, P. 2004b. Phylogenetic relationships of the subfamily Taenitidoideae, Pteridaceae. American Fern Journal 94: 126–142.

SCHUETTPELZ, E., H. SCHNEIDER, L. HUIET, M.D. WINDHAM, and K.M. & PRYER. 2007. A molecular phylogeny of the fern family Pteridaceae: Assessing overall relationships and the affinities of previously unsampled genera. Molecular Phylogenetics and Evolution 44: 1172–1185.

THIERS, B. 2019. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. Available at <http://sweetgum.nybg.org/ih/>. Access on 13 June 2019.

TRYON, A. F. 1962. A monograph of the fern genus *Jamesonia*. Contributions from the Gray Herbarium of Harvard University 191: 109–197.

TRYON, A. F. 1970. A monograph of the fern genus *Eriosorus*. Contributions from the Gray Herbarium of Harvard University 200: 54–174.

TRYON, A. F. and B. LUGARDON. 1990. Spores of Pteridophyta. Springer-Verlag, New York, USA.

ZHANG, L., X.M. ZHOU, N.T. LU, and L.B. ZHANG. 2017. Phylogeny of the fern subfamily Pteridoideae (Pteridaceae; Pteridophyta), with the description of a new genus: *Gastoniella*. Molecular Phylogenetics and Evolution 109: 59–72.

TABLE 1. Morphological comparison among *Jamesonia insignis*, *J. biardii* and the new hybrid, *Jamesonia* ×*intermedia*.

Characters	Taxa		
	J. insignis	*J.* ×*intermedia*	*J. biardii*
Rhizome indument	Glandular hairs and bristles	Glandular hairs and bristles	Glandular and eglandular hairs and bristles
Habit/Frond size	Semi-scandent 35.0−105.0 × 6.0−20.5 cm	Semi-scandent 83.0−125.0 × 13.0−19.5 cm	Erect to slightly arcuate 20.0−78.0 × 5.6−11.5 cm
Petiole size and indument	16.0−63.0 × 1.0−2.0 cm Sparsely to moderately covered by glandular and eglandular hairs	6.0−92.5 × 0.6−1.6 cm Glabrous to moderately covered by glandular and eglandular hairs	10.0−30.0 × 1.0 cm Glabrous to sparsely covered by eglandular hairs
Lamina dissection and shape	2-pinnate-pinnatisect to 3-pinnate-pinnatisect Triangular	2-pinnate-pinnatisect to 3-pinnate-pinnatifid Triangular	2-pinnate-pinnatisect Elongate-triangular
Lamina texture	Chartaceous	Coriaceous	Chartaceous
Rachis shape and indument	Flexuous Moderately covered by eglandular hairs	Flexuous Glabrous to sparsely covered by eglandular hairs	Straight Glabrous to sparsely covered by eglandular hairs
Pinna size, shape and indument	2.1−17.5 × 1.2−8.3 cm Triangular Adaxial moderately covered by eglandular hairs Abaxial moderate to densely covered by eglandular hairs	5.0−12.5 × 3.5−8.0cm Triangular Adaxial glabrous to sparsely covered by eglandular hairs Abaxial sparse to moderately covered by eglandular hairs	1.0−3.0 × 0.5−2.3 cm Triangular Adaxial and abaxial glabrous to sparsely covered by eglandular hairs
Stalk of pinna size	2.3−11.0 × 0.1−0.7 mm	9.0−27.0 × 0.6−1.2 mm	1.0−3.0 × 0.6 mm
Ultimate segments shape	Ovate to orbiculate	Elongate-triangular to ovate	Bifurcate
Lamina margin	Crenate to denticulate-crenate	Crenate	Entire
Spore size and morphology	67.1−67.8 μm Proximal surface with coalescent ridges, distal surface rugose	Irregular: 40.0−50.4 μm Regular: 49.9−60.0 μm Proximal surface with coalescent ridges, distal surface laevigate	53.7−57.5 μm Proximal surface tuberculate, distal surface rugose

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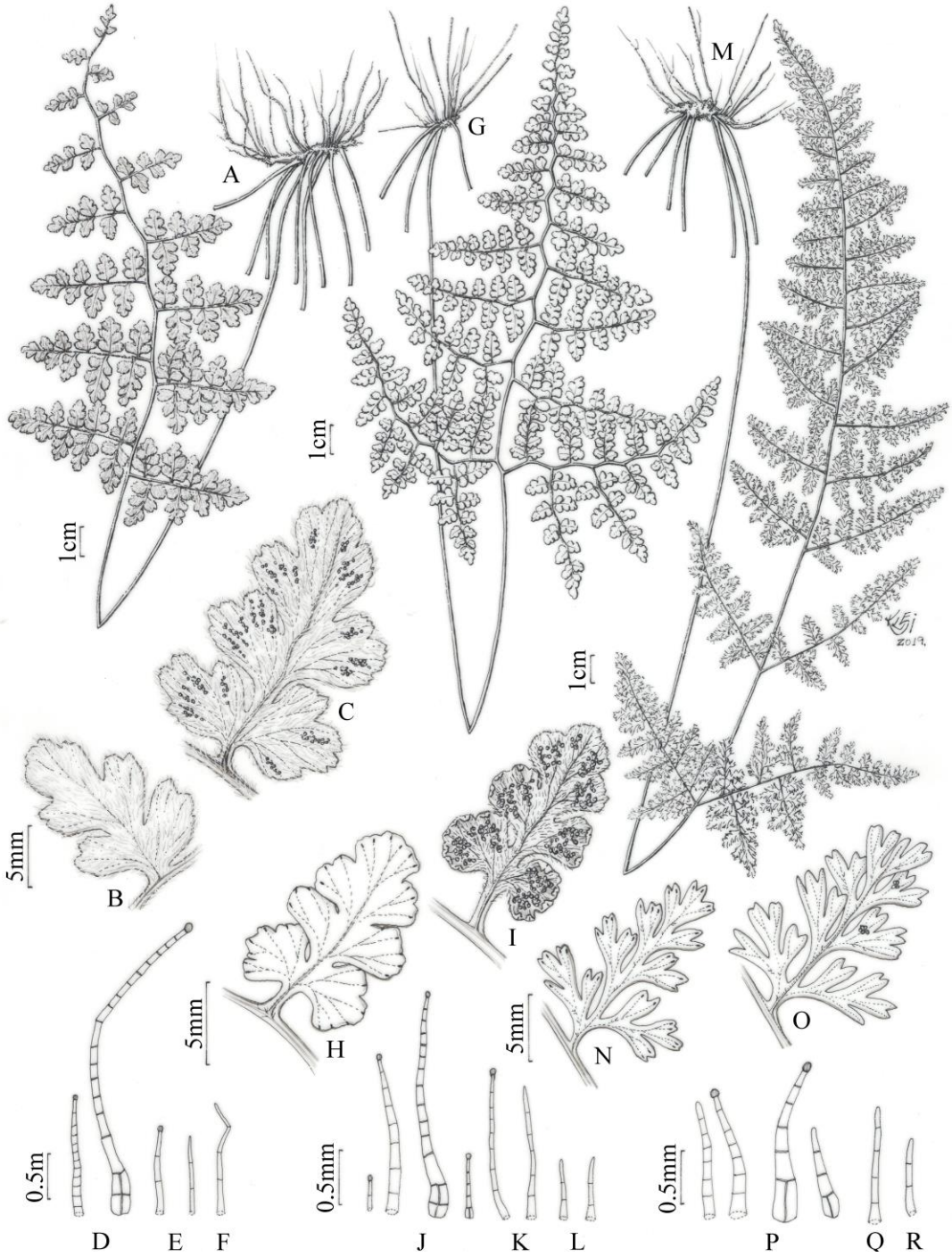

FIG. 1. **A–F**. *Jamesonia insignis*. **A**. Habit. **B, C**. Adaxial and abaxial surfaces of the pinna, respectively. **D**. Hair and bristle of the rhizome. **E**. Hairs of the petiole. **F**. Hair of the rachis and lamina. **G–L**. *J.* ×*intermedia*. **G**. Habit. **H, I**. Adaxial and abaxial surfaces of the pinna, respectively. **J**. Hairs and bristles of the rhizome. **K**. Hairs of the petiole. **L**. Hairs of the lamina. **M–R**. *J. biardii*. **M**. Habit. **N, O**. Adaxial and abaxial surfaces of the pinna, respectively. **P**. Hairs and bristles of the rhizome. **Q**. Hairs of the petiole and rachis. **R**. Hairs of the lamina. **A–F**. *J. Prado et al. s.n.* (SPF 60080). **G-L**. *A.P. Della et al. 69* (SP). **M–R**. *A.C. Brade 16515* (RB).

FIG. 2. **A–G**. *Jamesonia ×intermedia*. **A–C**. Habit. **D, E**. Adaxial and abaxial surfaces of the pinna, respectively. **F**. Fertile pinnae. **G**. Young frond. **A, F**. J.M. Braga. **B–E**, **G**. A.P. Della.

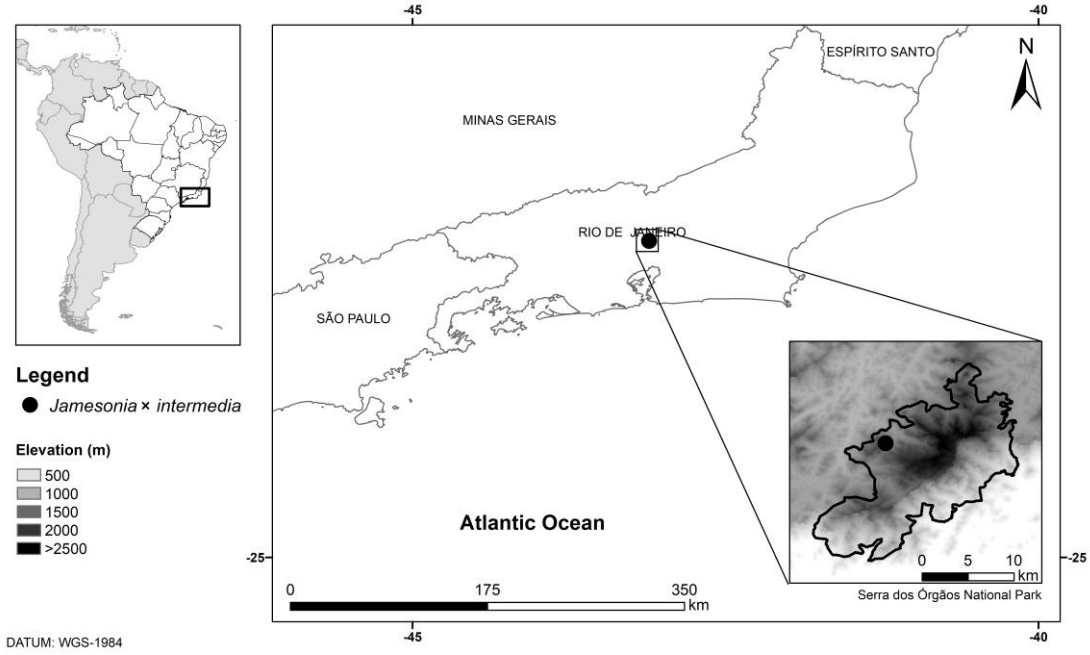

FIG. 3. Distribution of *Jamesonia* ×*intermedia* in Brazil.

FIG. 4. **A, B**. Habitats of *Jamesonia* ×*intermedia*. **A**. View of the Pico do Alcobaça, Serra dos Órgãos, Rio de Janeiro State. **B**. Trail to the Pico do Alcobaça. **A, B**: A.P. Della.

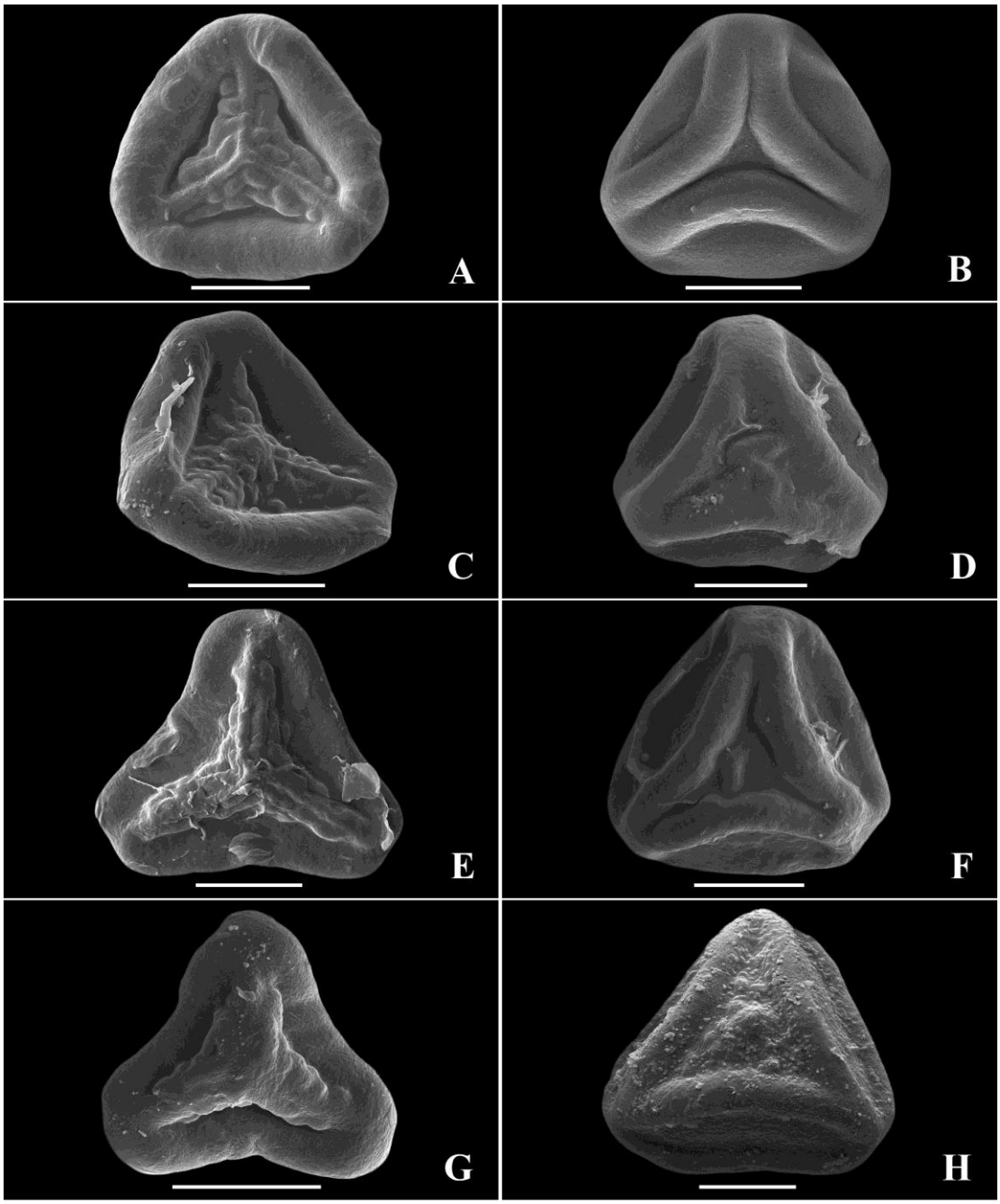

FIG. 5. SEM photomicrographs of *Jamesonia* ×*intermedia* spores. **A–D**. Irregular spores. **E–H**. Regular spores. Left column showing proximal surface, right column showing distal surface. Scale bars = 20 μm. **A**, **C–G**. *A.P. Della et al. 69* (SP). **B**. *A.P. Della et al. 72* (SP). **H**. *A.P. Della et al. 67* (SP).

Considerações Finais

Ao longo da revisão de 25 herbários nacionais foram estudadas um total de 713 exsicatas pertencentes a sete espécies de *Jamesonia*, dois híbridos e um indivíduo distinto, que apresenta apenas uma coleta e que foi aqui tratado como *Jamesonia* sp., bem como 4 espécies de *Tryonia*. Alice Tryon nas monografias de 1962 e 1970 citou um híbrido e cinco espécies de *Jamesonia* e duas de *Tryonia* para o nosso país, respectivamente. Assim, verificou-se que nesses últimos 57 anos houve um aumento no conhecimento desses gêneros, dado principalmente pela ampliação da quantidade de coletas realizadas nesse período. Inclusive no presente trabalho é apresentado um novo híbrido em *Jamesonia* para a Serra dos Órgãos, com base em coletas realizadas em 2017 e 2019.

Jamesonia biardii é a única espécie que não possui coletas recentes nos herbários visitados. Os registros existentes são de Glaziou e Brade (dos anos 1868-1948), para a Serra dos Órgãos (RJ) e para o Pico do Forno Grande (ES). Provavelmente, a difícil acessibilidade ao local de ocorrência, bem como alterações antrópicas, devem ter reduzido as populações dessa espécie.

Foi constatado que a morfologia geral da fronde (frondes generalistas vs. frondes especializadas) e a coloração da raque são boas características para a identificação dos gêneros, tal como descrito por Cochran *et al.* (2017). Além disso, verificamos que as espécies de *Jamesonia* brasileiras apresentam frequentemente tricomas não glandulares em ambas as faces da lâmina, o pecíolo é concolor (castanho), ao passo que em *Tryonia* há predominantemente tricomas glandulares nas faces da lamina e o pecíolo é bicolor (porção proximal castanha e distal estramínea).

Foram reconhecidos dois híbridos (*Jamesonia brasiliensis* × *J. cheilanthoides* e *J.* ×*intermedia*) e quatro espécies de *Jamesonia* (*J. biardii*, *J. insignis*, *Jamesonia* sp., aqui também considerando *J. brasiliensis*) endêmicas do Brasil. Três espécies de *Tryonia* também são endêmicas: *T. areniticola*, *T. schwackeana* e *T. sellowiana*. As outras espécies de *Jamesonia*, além do Brasil, ocorrem nos Andes (com exceção de *J. osteniana* que ocorre no Uruguai) e *T. myriophylla* que ocorre também no Uruguai.

A maioria das espécies desses dois gêneros apresenta distribuição relativamente restrita (com exceção de *T. areniticola*, *T. myriophylla* e *J. insignis*). Dado o constante desmatamento e fragmentação de áreas, algumas dessas espécies já podem ser categorizadas como ameaçadas de extinção. Assim, ações que visem conservar as áreas

de ocorrência das espécies são importantes e altamente recomendadas. Por exemplo, *Jamesonia osteniana* foi encontrada em barrancos na margem de pequenas estradas de terra, próximas do litoral do Rio Grande do Sul, fora de áreas de proteção ambiental.

Rio de Janeiro é o estado brasileiro com maior número de espécies de *Jamesonia* (*J. biardii*, *J. brasiliensis*, *J. cheilanthoides*, *J. insignis* e *J. rufescens*, além dos híbridos *J.* ×*intermedia* e *J. brasiliensis* × *J. cheilanthoides*). Brade (1940, 1956) já havia destacado que é frequente a presença de samambaias andinas em serras da região sudeste do Brasil e principalmente nas serras do Rio de Janeiro. Esse autor cita que provavelmente esses elementos andinos chegaram ao Brasil por meio da dispersão dos esporos pelas correntes de vento.

Na região sul do Brasil, nos Campos da Altitude, Pampas e Aparados da Serra, há registro apenas de *Tryonia areniticola* e *T. myriophylla*. No Rio Grande do Sul, ocorre *Jamesonia osteniana*, no entanto, essa planta está presente em barrancos nas margens de estradas em áreas próximas de Porto Alegre e em altitudes muito baixas, comparadas com outras espécies desse gênero no Brasil. E como visto antes, há características morfológicas que suportariam a segregação de *J. osteniana* desse gênero, porém mais estudos são necessários.

Nas regiões altas do norte do país, até o momento tem-se registro de ocorrência de *J. flexuosa* e de *Jamesonia* sp. Provavelmente, outras espécies de *Jamesonia* ocorram nessas áreas, mas a dificuldade de acesso (áreas indígenas) e os custos de viagem para estas localidades são fatores limitantes para realização de novas coletas.

Os dados obtidos neste estudo estão sendo incorporados ao site da Flora do Brasil 2020 online, contribuindo dessa forma para a ampliação do conhecimento desses grupos no Brasil.

Resumo

Jamesonia e *Eriosorus* são gêneros de samambaias Neotropicais pertencentes a Pteridaceae, que foram unidos em função de estudos filogenéticos com base molecular. Esses gêneros formam um grupo monofilético bem sustentado (separadamente constituem grupos parafiléticos). Assim, atualmente se reconhece apenas *Jamesonia*, uma vez que é o nome mais antigo e o que tem prioridade. Esse gênero apresenta ampla distribuição geográfica, do México ao Uruguai, sendo, no entanto, mais frequente nos páramos e subpáramos andinos, entre 600 a 5000 metros de altitude. Em 2014, algumas espécies de *Jamesonia* foram segregadas, em função de serem mais aparentadas filogeneticamente com *Austrogramme* E. Fourn., *Pterozonium* Fée, *Syngramma* J. Sm. e *Taenitis* Willd. ex Schkuhr do que com *Jamesonia*. Assim, um novo gênero, *Tryonia*, foi descrito para acomodar esses táxons. *Tryonia* é endêmico da Mata Atlântica e ocorre principalmente no Brasil, chegando até o Uruguai. Hoje são reconhecidas ca. de 50 espécies de *Jamesonia* e quatro de *Tryonia*. Tendo em vista essas mudanças na circunscrição desses gêneros, o objetivo desse trabalho foi realizar a revisão taxonômica de *Jamesonia* e *Tryonia* para o Brasil, a fim de contribuir com o projeto da Flora do Brasil 2020 online. Esse estudo foi baseado em análises morfológicas de espécimes armazenados em 25 herbários nacionais, mais imagens dos tipos disponíveis online, expedições de campo para as regiões sul e sudeste do Brasil, revisão de literatura, bem como estudos de microscopia eletrônica de varredura dos esporos. Foram registrados dois híbridos (*J. brasiliensis* × *J. cheilanthoides* e *J.* ×*intermedia*) e sete espécies de *Jamesonia* (*J. biardii*, *J. brasiliensis*, *J. cheilanthoides*, *J. flexuosa*, *J. insignis*, *J. osteniana* e *J. rufescens*), além de um indivíduo distinto, da fronteira do Brasil com a Venezuela, tratado como *Jamesonia* sp. Também foram reconhecidas quatro espécies de *Tryonia* (*T. areniticola*, *T. myriophylla*, *T. schwackeana* e *T. sellowiana*). Os resultados são apresentados em três capítulos, o primeiro com a revisão de *Jamesonia*, o segundo com a de *Tryonia* e o terceiro com a descrição de um novo híbrido, *J.* ×*intermedia* para a Serra dos Órgãos (Rio de Janeiro). Nesses capítulos são apresentadas chaves de identificação, descrições, ilustrações para todos os táxons, bem como dados de distribuição geográfica, comentários, lista de material examinado selecionado para cada táxon, e uma lista completa com todas as exsicatas verificadas.

Palavras-chave: Campos de Altitude, *Eriosorus*, flora, Mata Atlântica, Pteridoidea, samambaias.

Abstract

Jamesonia and *Eriosorus* are genera of Neotropical ferns that belong to Pteridaceae, which were lumped according to molecular-based phylogenetic studies. These genera form a well-supported monophyletic group (separately they are paraphyletic). Thus, only *Jamesonia* is currently recognized, because it is the oldest name and it has priority. This genus has wide geographical distribution, from Mexico to Uruguay, but it is more diverse in Andean páramos and subpáramos, at 600-5000 m altitude. In 2014, some species of *Jamesonia* were segregated, because they were more phylogenetically related to *Austrogramme* E. Fourn., *Pterozonium* Fée, *Syngramma* J. Sm. and *Taenitis* Willd. ex Schkuhr than *Jamesonia*. Thus, a new genus, *Tryonia*, was described to accommodate these taxa. *Tryonia* is endemic of the Brazilian Atlantic Rainforest and occurs mainly in Brazil, reaching Uruguay. Today are recognized ca. 50 species of *Jamesonia* and four of *Tryonia*. Due to the changes in the circumscription of these genera, the aim of this study was to carry out the taxonomic study of *Jamesonia* and *Tryonia* for Brazil, to contribute to the project of the Flora of Brazil 2020 online. This study was based on morphological analyses of specimens deposited in 25 Brazilian herbaria, plus online images of types, field expeditions in the southern and southeastern regions of Brazil, revision of the literature, as well as scanning electronic microscopy of the spores. Two hybrids (*J. brasiliensis* × *J. cheilanthoides* and *J.* ×*intermedia*) and seven species of *Jamesonia* (*J. biardii*, *J. brasiliensis*, *J. cheilanthoides*, *J. flexuosa*, *J. insignis*, *J. osteniana* and *J. rufescens*) were recognized, besides a distinct specimen, from the border of Brazil and Venezuela treated as *Jamesonia* sp. Were also recognized four species of *Tryonia* (*T. areniticola*, *T. myriophylla*, *T. schwackeana* e *T. sellowiana*). The results are presented in three chapters, the first with the revision of *Jamesonia*, the second with the *Tryonia*, and the third with the description of a new hybrid, *J.* ×*intermedia* to Serra dos Órgãos (Rio de Janeiro). These chapters provide identification key, descriptions, illustrations for the taxa, as well as geographical distribution data, comments, list of selected material examined for each taxon, and a full list of all exsiccatae analyzed.

Keywords: Altitude Fields, Brazilian Atlantic Rainforest, *Eriosorus*, ferns, flora, Pteridoidea.


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