MARINA LEMY KOGA

Briófitas do Parque Estadual do Rio Turvo (PERT), no Estado de São Paulo

Dissertação apresentada ao Instituto de Botânica da Secretaria de Infraestrutura e Meio Ambiente, como parte dos requisitos exigidos para a obtenção do título de MESTRE em BIODIVERSIDADE VEGETAL E MEIO AMBIENTE, na Área de Concentração de Plantas Avasculares e Fungos em Análises Ambientais.

SÃO PAULO
2020

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"Sonhos são adoráveis. Mas são só sonhos. São fugazes, efêmeros, bonitos. Sonhos não se tornaram realidade só porque você sonhou. É o esforço que faz as coisas acontecerem. É o esforço que cria mudança."

Shonda Rhimes, roteirista norte-americana

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RESUMO

As briófitas são plantas avasculares, poiquiloídricas (são altamente susceptíveis à absorção e perda de umidade) e dependentes de água para a reprodução sexuada. São reconhecidas 1.582 espécies de briófitas para o Brasil e 911 spp. para o Estado de São Paulo (SP). O Parque Estadual do Rio Turvo (PERT) é uma grande unidade de conservação (área aproximada de 74 mil hectares), localizada no sul de SP, mais especificamente na região do Vale do Ribeira. A Mata Atlântica (MA) é o domínio fitogeográfico que apresenta a maior taxa de riqueza (1.356 spp.) e endemismo de briófitas no país, ocupando posição privilegiada na lista de *hotspots* do planeta. Visando fornecer subsídios para a preservação desse importante e ameaçado domínio, este estudo propôs a realização de um levantamento florístico no PERT, seguindo o método de caminhadas livres, discutindo a distribuição geográfica das espécies, a colonização por substratos e aspectos reprodutivos. Foram encontradas 414 spp., que representam 45% da riqueza conhecida para SP e 30% para a MA, sendo 7 spp. de antóceros, 203 de hepáticas e 204 de musgos. Quanto aos aspectos ecológicos, houve predominância da colonização em substrato corticícola (40% das ocorrências), forma de vida em tapete (47% das espécies) e do sistema sexual dioico, indicando que características ambientais, como a alta umidade, vegetação densa e consequente sombreamento são fatores determinantes na composição florística. Apesar de estar sujeito à intervenção antrópica, o PERT demonstra sua relevância pela imensa biodiversidade que abriga, evidenciada pela considerável presença de espécies raras e ocorrências inéditas de 16 spp. para SP. Com o intuito de compreender as diferenças de riqueza e composição florística entre áreas de Mata Atlântica distribuídas ao longo de um gradiente latitudinal, realizamos uma análise comparativa de similaridade a partir da matriz de presença e ausência de espécies de 18 unidades de conservação e áreas que apresentassem mais de 100 spp. de briófitas, distribuídas nas zonas tropical e temperada, incluindo o PERT. A análise de agrupamento obtida pelo programa PAST resultou em quatro grupos, cujas similaridades podem ser atribuídas ao tipo de vegetação em comum, relevo, clima e longitude, visto que regiões interioranas diferem das litorâneas, principalmente no quesito pluviosidade anual. Das áreas aplicadas no estudo, a que mais se assemelha ao PERT é o Parque Estadual Serra do Mar, núcleo Santa Virgínia.

Palavras-chave: briófitas, antóceros, hepáticas, musgos, florística, distribuição, análise de similaridade, floresta ombrófila, unidade de conservação, Vale do Ribeira, Mata Atlântica.

ABSTRACT

Bryophytes are non-vascular, poiquilohydric plants (highly susceptible to absorption and loss of moisture) and dependent on water for sexual reproduction. 1,582 species of bryophytes are recognized for Brazil and 911 spp. for the State of São Paulo (SP). The Rio Turvo State Park (RTSP) is a large conservation unit (approximately 74,000 hectares), located in the south of SP, more specifically in the Vale do Ribeira region. The Atlantic Forest (AF) is the phytogeographic domain that has the greatest richness (1,356 spp.) and the highest rate of endemism of bryophytes in the country, occupying a privileged position in the list of hotspots on the planet. In order to provide subsidies for the preservation of this important and threatened domain, this study proposed the realization of a floristic survey in the RTSP, following the free-walking method, discussing the geographical distribution of species, colonization by substrates and reproductive aspects. 414 spp. were found, which represent 45% of the richness known for SP and 30% for AF, being 7 spp. of hornwortss, 203 of liverworts and 204 of mosses. Considering the ecological aspects, there was a predominance of corticolous substrate (40% of the occurrences), mat life form (47% of the species) and the dioicous sexual system, indicating that environmental characteristics, such as high humidity, dense vegetation and consequent shading rate are determining factors in the floristic composition. Despite the anthropic intervention in the area, RTSP demonstrates its relevance by harbouring a huge biodiversity, evidenced by the considerable presence of rare species and first occurrences of 16 spp. for SP. In order to understand the differences in richness and floristic composition among areas of the Atlantic Forest distributed along a latitudinal gradient, we performed a comparative analysis of similarity from a matrix (of presence and absence of species) embracing 18 conservation units and areas that presented more than 100 spp. of bryophytes, distributed in tropical and temperate zones, including the RTSP. The cluster analysis obtained by the PAST software resulted in four groups, whose similarities can be attributed to the type of vegetation in common, relief, climate and longitude, since inland regions differ from the coastal ones, especially in terms of annual rainfall. Of the areas applied in the study, the one that is most similar to RTSP is the Serra do Mar State Park, núcleo Santa Virgínia.

Keywords: bryophytes, hornworts, liverworts, mosses, floristics, distribution, similarity analysis, ombrophilous forest, conservation unit, Vale do Ribeira, Atlantic Forest**.**

LISTA DE FIGURAS

LISTA DE TABELAS

SUMÁRIO

1 INTRODUÇÃO GERAL

As plantas terrestres são unidas por uma ancestralidade comum, evidenciada pela presença de um embrião protegido pelo gametângio feminino, sendo assim, denominadas embriófitas (Vanderpoorten & Goffinet 2009). Dentre todos os grupos vegetais, as briófitas – cujos principais representantes são os musgos - são as únicas plantas terrestres que apresentam fase gametofítica haplóide, dominante e ramificada, e fase esporofítica diplóide, efêmera e não ramificada (Vanderpoorten & Goffinet 2009, Costa *et al.* 2010). São caracterizadas por seu pequeno porte, ausência de lignina nos tecidos vasculares e de sustentação e dependência de água para a reprodução sexuada (Costa *et al.* 2010). São encontradas em vários tipos de substratos - classificadas como corticícolas (habitando troncos e ramos vivos), epifilas (crescendo sobre folhas), epíxilas (vivendo sobre troncos e galhos em decomposição), terrícolas (solo) e rupícolas (superfície de pedras e rochas) (Luizi-Ponzo *et al*. 2006), dentre outros.

Elas exercem uma gama de serviços ecossistêmicos, participando na reciclagem de água, fixação de carbono e produção de biomassa (Hallingbäck & Hodgetts 2000), além de atuarem no ciclo de nitrogênio (Turetsky 2003). Contribuem para o processo de sucessão ecológica, ajudando na contenção da erosão do solo, são capazes de reter água, propiciando condições para o estabelecimento e o crescimento de outras plantas, e fornecem *habitat* para pequenos animais, como insetos, rotíferos, tardígrados e anuros (Glime 2017b). Em locais frios, onde há baixa produtividade de espermatófitas, a exemplo das regiões onde predominam tundras, animais como renas, patos, ovelhas, bois almiscarados e roedores adotam os musgos em sua dieta alimentar (Longton 1992).

As briófitas, em geral, conduzem água, nutrientes e metabólitos por capilaridade, sendo denominadas ecto-hídricas, neste caso. No entanto, há muitos gêneros que possuem tecidos condutores internos (endo-hídricos) e aqueles que absorvem o líquido pela superfície

do gametófito e o conduzem internamente (mixo-hídricos) (Delgadillo & Cárdenas 1990). As espécies ecto-hídricas, são muito utilizadas como bioindicadoras de poluentes no meio ambiente, sendo possível medir a quantidade de substâncias tóxicas presentes no ar, na água e no solo que se acumulam em sua biomassa ao longo do tempo (Frahm 2003).

Devido ao seu pequeno porte, tais plantas são susceptíveis às condições dos microclimas (Richards 1984). Nesta perspectiva, aspectos ecológicos, como forma de vida (anual, coxim, dendróide, flabelado, pendente, tapete, trama e tufo), tipos de substratos e formas de reprodução podem indicar características adaptativas aos microambientes colonizados (Batista *et al*. 2018).

Além de seu potencial ecológico, as briófitas apresentam uma gama de propriedades medicinais, antibacterianas, antivirais, antifúngicas, anticancerígenas e anti-inflamatórias (Fernández & Serrano 2009; Glime 2017c). Em estudos com hepáticas foram encontrados compostos secundários, como terpenóides e compostos aromáticos, que apresentavam uma série de atividades biológicas: inseticida, anti-herbivoria, citotóxica, piscicida, agente anti-HIV, reguladora de crescimento, agente antimicrobiano, antifúngico e outros (Asakawa 2008; Asakawa *et al.* 2013).

Tais plantas têm exercido um importante papel na sociedade (Hällingback & Tan 2010), considerando que, há muitos anos, as civilizações chinesa, indiana e nativa americana têm empregado as briófitas para fins medicinais (Glime 2017c). Em razão de sua propriedade antibiótica e da capacidade de absorção de três a quatro vezes maior que a do algodão, o musgo de turfeira (*Sphagnum*) foi amplamente utilizado para a fabricação de curativos durante a Primeira Guerra Mundial (Glime 2017c). O mesmo gênero tem sido aproveitado como fonte de combustível em países europeus, devido ao seu rápido crescimento vegetativo e poder calorífico superior ao da madeira (Chandra *et al.* 2017).

No Brasil, mais especificamente na região Cananéia, no Estado de São Paulo, adjacente ao Parque Estadual do Rio Turvo (PERT), os musgo de turfeira são conhecidos

popularmente por veludo, pelo seu aspecto felpudo, sendo explorado comercialmente para fins ornamentais, atuando como substratos para mudas e orquídeas, germinação de sementes e como material para embalar plantas enraizadas durante o transporte (Rancura *et al.* 2010).

As briófitas formam um grupo monofilético (Cole *et al.* 2019, Harris *et al.* 2020), sendo classificadas em três divisões: Anthocerotophyta (antóceros), Marchantiophyta (hepáticas) e Bryophyta (musgos) (Goffinet *et al.* 2009, Vanderpoorten & Goffinet 2009). Elas constituem o segundo maior grupo vegetal em número de espécies, com uma estimativa de 15.100 espécies distribuídas em mais de 1.200 gêneros reconhecidos para o mundo todo (Gradstein *et al.* 2001), das quais 10.000 espécies são de musgos, 5.000 de hepáticas e 100 de antóceros (Gradstein *et al.* 2001). Para o Brasil são registradas 1.610 espécies, conforme o catálogo de Yano (2011), enquanto o trabalho de Costa & Peralta (2015) reconhece 1.524 espécies de briófitas para o país. Entretanto, de acordo com os dados do projeto Flora do Brasil 2020 (Flora do Brasil 2020 em construção, 2020), a brioflora brasileira conta com 1.571 espécies, sendo que a região e o estado com maior número de espécies são o sudeste, com 1.232 espécies, e São Paulo, com 914 espécies.

O estado de São Paulo conta com 102 unidades de conservação estaduais, das quais 49 são de uso sustentável e 53 de proteção integral (Barradas 2019). Estas últimas contemplam 34 parques estaduais, sendo um deles o Parque Estadual do Rio Turvo (PERT). O PERT foi criado em 2008 e tem como objetivo preservar ecossistemas naturais de extrema importância, permitindo a realização de pesquisas científicas, atividades de lazer, turismo ecológico e educação ambiental (Brasil 2011).

Nesse contexto, a regularização e manutenção das UCs são de extrema relevância por abrigarem gigantesca biodiversidade, recursos genéticos e espécies em perigo de extinção, além de promoverem políticas públicas de proteção às paisagens naturais, à flora, à fauna e ao patrimônio histórico-cultural, de recuperação e restauração de áreas degradadas, de

valorização econômica pelo uso sustentável dos recursos naturais para fins de subsistência de populações locais e de turismo ecológico.

O PERT possui grande relevância histórica e arqueológica, pois abriga sambaquis fluviais, onde foi encontrado um dos fósseis humanos mais antigos da América, datado de 10.400 anos (Pivetta 2005). Além disso, o Parque está situado no domínio fitogeográfico de Mata Atlântica, onde há uma rica diversidade de flora e fauna, apresentando espécies ameaçadas de extinção, como o papagaio-de-peito-roxo e a onça-pintada (Portal do Governo do Estado de São Paulo 2018). O Parque é aberto para atividades ecoturísticas, como visitas ao Mirante do Aleixo (a 1,1 mil metros de altitude com vista para Cajati e ao mar de morros do parque), a Cachoeira do Azeite, a Gruta da Capelinha, a Trilha da Cachoeira e a Trilha das Andorinhas (Portal do Governo do Estado de São Paulo 2018).

A Mata Atlântica, que se localiza majoritariamente ao longo da costa brasileira, apresenta atualmente apenas 12% de sua extensão original (1,5 mi Km²) preservada (Ribeiro *et al.* 2011), e está incluída entre as áreas com maior perda de *habitat* e elevada taxa de endemismo, ocupando o quarto lugar da lista de 25 *hotspots* de conservação prioritária no planeta (Myers *et al.* 2000). Haja visto sua enorme importância, foi tombada como Patrimônio Nacional pela Constituição Federal de 1988, e lhe fora concedido o título de Reserva da Biosfera pela Unesco (SOS Mata Atlântica, 2018). De acordo com Costa *et al.* (2011), este é o domínio fitogeográfico com a maior taxa de riqueza e endemismo de briófitas no país, contando com 1.348 espécies (Flora do Brasil 2020 em construção, 2020).

As áreas do território brasileiro ocupadas pelo domínio da Floresta Atlântica apresentam muitas semelhanças no aspecto da paisagem, no entanto, exibem diferentes tipos vegetacionais: Ombrófila Densa, Ombrófila Mista (Mata de Araucárias), Ombrófila Aberta, Estacional Semidecidual, Estacional Decidual, Manguezais, Restinga e outros (IBGE 2012).

A Floresta Ombrófila Densa possui cinco formações de acordo com a hierarquia topográfica e a fisionomia florestal: Formação aluvial (sem variações topográficas);

Formação de Terras Baixas (5 a 100 m alt.); Formação de Submontana (100 a 600 m alt.); Formação de Montana (600 a 2.000 m alt.); e Formação de Alto-Montana (acima de 2.000 m alt.) (IBGE 2012). No PERT predomina a Floresta Ombrófila Densa de Montana (Paixão 2010).

Para as regiões de Mata Atlântica do estado de São Paulo, são encontradas várias publicações sobre a diversidade e distribuição de briófitas, como: Carmo *et al.* (2016), Peralta & Yano (2006; 2008; 2012), Visnadi (2002; 2004; 2005; 2006; 2009; 2012; 2013a; 2013b; 2015a; 2015b), Yano (1998), Yano & Peralta (2007; 2008) e Yano *et al.* (2009).

A análise dos levantamentos realizados em áreas com tamanho e localizados geograficamente próximos à área do PERT revela territórios com grande riqueza de espécies, sendo listadas 245 espécies de briófitas para o Parque Estadual da Ilha Anchieta (Peralta & Yano 2008) e 386 para o Parque Estadual da Serra do Mar, Núcleo de Santa Virgínia (Carmo *et al.* 2016).

Em comparação ao que se conhece sobre as fanerógamas, as avasculares apresentam um conhecimento incipiente em quase todos os campos, tanto na sua fisiologia, como na ecologia, filogenia e biogeografia (Hällingback & Tan 2010). Por esse motivo, vemos a importância de se estudar as briófitas, especialmente as que ocorrem em áreas de *hotspots*, conhecer sua distribuição geográfica, os tamanhos populacionais, assim como a sua susceptibilidade às mudanças climáticas, que tanto têm afligido o nosso planeta, para assim possibilitar o planejamento consciente e efetivo de medidas e tomadas de decisão para a conservação das espécies (Hällingback & Tan 2010). O investimento em estudos de flora e endemismo de cada região é mais que necessário para o preenchimento das lacunas desse conhecimento (Scott *et al.* 1997).

Tendo em vista a ausência de um levantamento florístico geral de briófitas no Parque Estadual do Rio Turvo (PERT), este trabalho busca contribuir para a ampliação do conhecimento brioflorístico em áreas preservadas, possibilitando o registro de novas

ocorrências para o estado de São Paulo, além de fornecer subsídios para o plano de manejo do Parque (ainda em construção), como para a preservação das unidades de conservação em geral.

2 OBJETIVOS ESPECÍFICOS

- Identificar as espécies de briófitas que ocorrem no Parque Estadual do Rio Turvo (PERT);

- Fornecer informações sobre a distribuição das espécies no Brasil por estados, domínios fitogeográficos e em escala mundial;

- Explicar a riqueza encontrada relacionando-a às características morfoecológicas das espécies – substratos, formas de vida, sistema sexual (monoicismo/dioicismo) e sistemas reprodutivos (sexuadas/assexuadas);

- Comparar, em termos de ausência/presença de espécies, o levantamento florístico do PERT e de outros trabalhos publicados referentes a áreas inseridas no domínio fitogeográfico Mata Atlântica, separadas em zonas tropical e temperada.

3 MATERIAL E MÉTODOS

3.1 Área de estudo: O Parque Estadual do Rio Turvo (PERT) possui uma área de mais de 73 mil hectares, abrangendo os municípios de Jacupiranga, Cajati e Barra do Turvo (Portal do Governo do Estado de São Paulo 2018), e está inserido no antigo Parque Estadual do Jacupiranga (PEJ), criado em 1969, que foi recategorizado em Mosaico de Unidades de Conservação do Jacupiranga (MOJAC) por meio da lei 12.810, aprovada na Assembleia Legislativa do Estado de São Paulo em 20 de dezembro de 2007 e sancionada pelo governador do Estado em 21 de fevereiro de 2008 (Bim *et al.* 2017).

O MOJAC está localizado no Vale do Ribeira, sudeste do estado de São Paulo (Fig. 1), entre os paralelos 24°38’18”S e 25°32’20”S e os meridianos 48°72’97”W e 47°85’36”W. O Vale do Ribeira possui uma extensão de 1,7 milhões de ha, praticamente 10% da área do estado de São Paulo, e se situa entre o oceano Atlântico e as Serras do Mar e de Paranapiacaba (Bim *et al.* 2017).

O Parque Estadual do Jacupiranga (PEJ), que possuía uma área com 139 mil ha de extensão, foi ampliado para mais de 154 mil ha quando se tornou o Mosaico de Unidades de Conservação de Jacupiranga (MOJAC), sendo este subdividido em três Parques Estaduais (Fig. 2): PE Caverna do Diabo (40.219,66 ha) nos municípios de Eldorado, Iporanga, Barra do Turvo e Cajati; PE do Rio Turvo (73.893,87 ha) nos municípios de Barra do Turvo, Cajati e Jacupiranga e PE Lagamar de Cananéia (40.758,64 ha) nos municípios de Cananéia e Jacupiranga (Lino 2009).

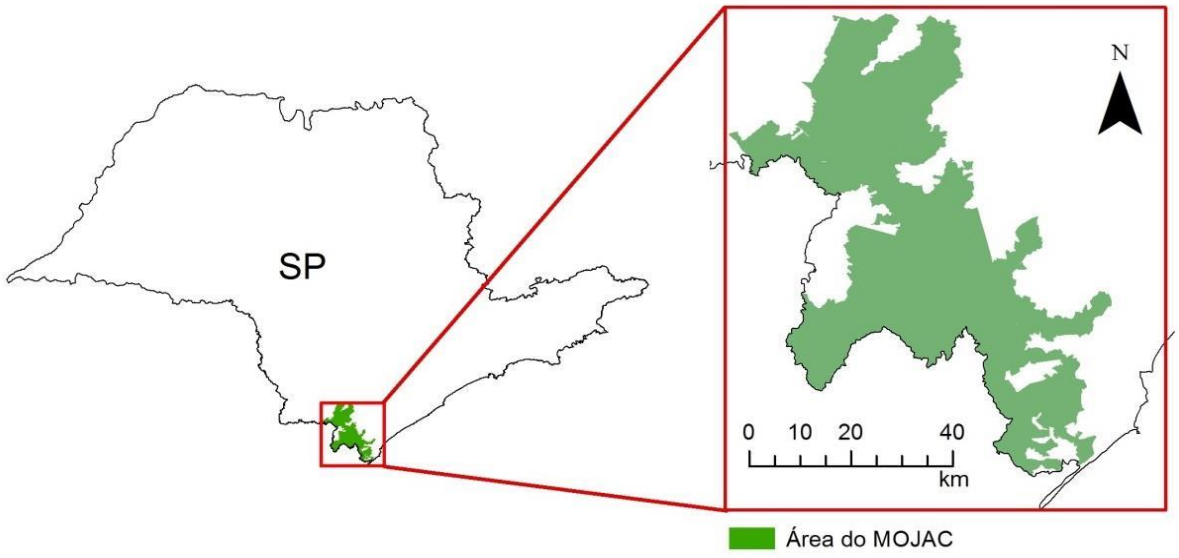

Figura 1. Localização do Mosaico de Unidades de Conservação de Jacupiranga (MOJAC) no Estado de São Paulo (Bim *et al.* 2017).

Além dos três Parques Estaduais, foram estabelecidas cinco Reservas de Desenvolvimento Sustentável (RDS) com mais de 12 mil ha, quatro Áreas de Proteção

Ambiental (APA) com mais de 73 mil ha, duas Reservas Extrativistas (RESEX) com quase 3 mil ha, totalizando 243.885,78 ha de extensão para o MOJAC (Bim *et al.* 2017).

O PERT está inserido na Bacia Hidrográfica do Rio Ribeira do Iguape, unidade geográfica pertencente à Região Hidrográfica do Atlântico Sudeste, e é cortado pelos rios Pardo, Turvo, Jacupiranga e seus afluentes (Paixão 2010).

De acordo com o trabalho de Ross (2002), a Bacia Hidrográfica do Rio Ribeira do Iguape é dividido em dois grandes domínios morfoestruturais: (1) a Faixa de Dobramentos do Atlântico, apoiada em rochas cristalinas antigas com um relevo mais acidentado; (2) a Depressão Tectônica do Baixo Ribeira, composta por rochas cristalinas muito erodidas e por rochas sedimentares mais antigas.

Dentro de cada domínio morfoestrutural há as Unidades de Sistemas Ambientais (USA), caracterizadas pelas interações do relevo com fatores ambientais, como solo, clima e vegetação. Nesse contexto, a Bacia Hidrográfica do Ribeira de Iguape e Litoral Sul apresenta cinco Unidades de Sistemas Ambientais: (1) Planície costeira Cananéia-Iguape; (2) Unidade de sistema das planícies e terraços fluviais do Ribeira do Iguape; (3) Colinas e morrotes da depressão tectônica do Baixo Ribeira; (4) Morros e escarpas das serras do Mar e Paranapiacaba; (5) Morros em superfície de cimeira do Alto Ribeira (Ross 2002).

A Unidade de Sistema Ambiental onde se situa o PERT é a 4, correspondente ao sistema de morros e escarpas das serras do Mar e Paranapiacaba; além das serras, abrange a região do médio e alto vale do Rio Ribeira de Iguape (Ross 2002).

A morfogênese da Bacia do Rio Ribeira de Iguape apresenta relevo montanhoso e vales profundos e estreitos (Ross 2002). Em partes baixas localizadas na Depressão Tectônica do Baixo Ribeira, as altitudes variam de 100 a 200 m alt., enquanto nas partes mais altas, variam entre 1000 e 1.200 m alt.. No entanto, predominam as altitudes médias, de 700 a 900 m alt. (Ross 2002).

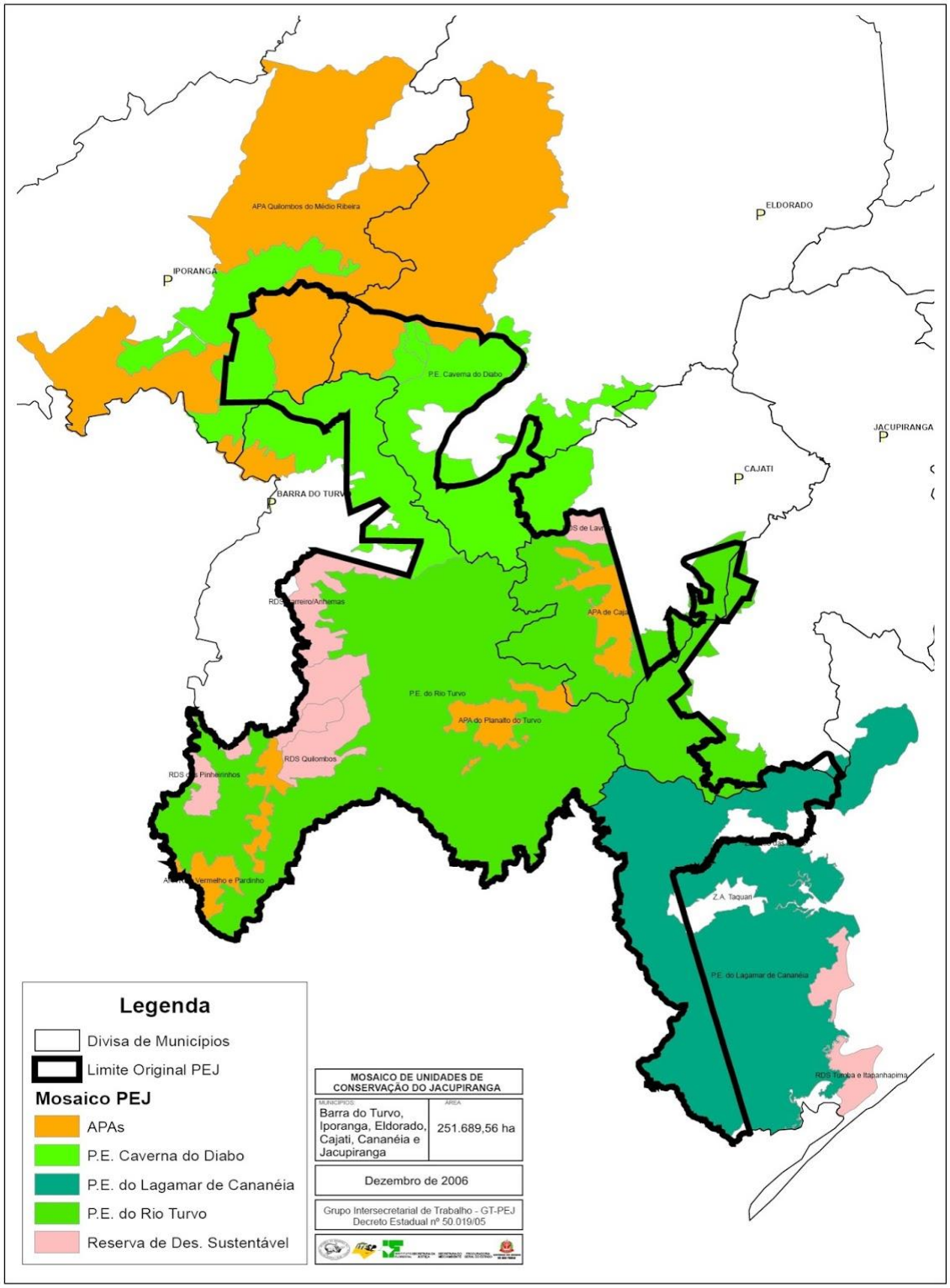

Figura 2: O Mosaico de Unidades de Conservação de Jacupiranga (MOJAC) no Estado de São Paulo (Blog do CRF Fundação Florestal 2016).

Os tipos de solo variam muito: há solos rasos, afloramentos rochosos, cambissolos álicos e cambissolos distróficos, associados aos solos podzólicos vermelho-amarelos e latossolos vermelho-amarelos (Ross 2002).

O sistema ambiental de morros e escarpas das serras do Mar e Paranapiacaba apresenta clima muito úmido e temperaturas relativamente baixas (variação mínima de 11 a 20º C; variação máxima de 22 a 32º C) (Ross 2002). De acordo com a classificação climática de Köppen-Geiger, essa região possui clima Cfa (clima temperado com verão quente) (Ross 2002). Enquanto áreas com altitude acima de 700 m são classificadas em Cfb (clima temperado, com verão ameno) (Lepsch *et al.* 1990 apud Dias 2009). Praticamente chove o ano todo, mas com menor intensidade em junho, julho e agosto, apresentando pluviosidades mínima e máxima de 1000 mm/ano e 3000 mm/ano, respectivamente (Ross 2002).

A região do PERT é caracterizada por floresta ombrófila densa de Montana, pois se localiza entre 600 e 2.000 metros de altitude. A vegetação é sempre verde, com árvores atingindo um dossel uniforme de aproximadamente 20 m, outras com até 40 m de altura (IBGE 2012).

A vegetação apresenta algumas zonas de transição com cidades e áreas de cultivo, se tornando heterogênea, em termos de estágios sucessionais: há áreas de capoeira onde prevalecem espécies pioneiras (arbustos e gramíneas), outras de níveis médio e avançado, com o predomínio de indivíduos de espécies climácicas (Paixão 2010).

3.2 Método de coleta: Foram coletadas mais de 800 amostras em três expedições de coleta no PERT, com duração de até três dias cada: uma em setembro de 2018, outra em março de 2019 e a última, em julho/agosto do mesmo ano. Adotamos o método de caminhadas livres (Filgueiras *et al.* 1994) pelas trilhas e aos arredores (Fig. 3), explorando todos os tipos de substratos disponíveis. Além disso, foram analisadas amostras que já estavam depositadas no herbário Maria Eneyda P. Kauffmann Fidalgo (SP).

Figura 3: Mapa do Parque Estadual do Rio Turvo (PERT), onde estão indicados os pontos de coleta (círculos amarelos). Organização: M. L. Koga/2019.

3.3 Tratamento das amostras: A metodologia para herborização e preservação de materiais segue Gradstein *et al.* (2001). O processo de herborização e identificação foi realizado no Núcleo de Pesquisa em Briologia do Instituto de Botânica, e todas as amostras estão depositadas no herbário SP.

Caracteres morfológicos e anatômicos foram analisados a partir da observação - com o auxílio de lupa - de gametófitos e esporófitos (estes últimos, se estiverem presentes) de cada espécime, hidratando-os com água, manipulando-os com um estilete e uma pinça histológica de ponta extrafina. Após a extração de partes das plantas, foram montadas lâminas a fim de observá-las ao microscópio óptico.

Para a identificação das amostras, a literatura utilizada foi baseada em Ballejos & Bastos (2009), Bastos & Yano (2009), Bordin & Yano (2013), Buck (1998), Câmara (2008 a; b), Câmara & Costa (2006), Frahm (1991); Gradstein & Costa (2003), Gradstein *et al.*

(2001), Peralta & Yano (2008), Sharp *et al.* (1994), Visnadi (2006), Yano & Peralta (2009; 2011), Zander (1993) e Zartman & Ilkiu-Borges (2007) .

O sistema de classificação adotado segue Renzaglia *et al.* (2009) para Anthocerotophyta, Crandall-Stotler *et al.* (2009) para Marchantiophyta, e Goffinet *et al.* (2009) para Bryophyta. A abreviação dos nomes dos autores na lista de espécies foi baseada em Brummitt & Powell (1992).

Para avaliar a eficiência do inventário realizado, foi construída a curva de acumulação de espécies (Fig. 4), calculada com base no estimador de riqueza por extrapolação através do programa Microsoft Excel (Hammer *et al.* 2001).

3.4 Coleta de dados ecológicos e de distribuição geográfica das espécies: todos os dados foram organizados numa tabela, incluindo os nomes das espécies, distribuição mundial, por estados e domínios fitogeográficos brasileiros, forma de vida, substratos colonizados, sistema sexual (monoico/dioico) e estruturas reprodutivas (assexuadas e sexuadas: femininas, masculinas e esporófitos), seguindo o método de Batista *et al.* 2018.

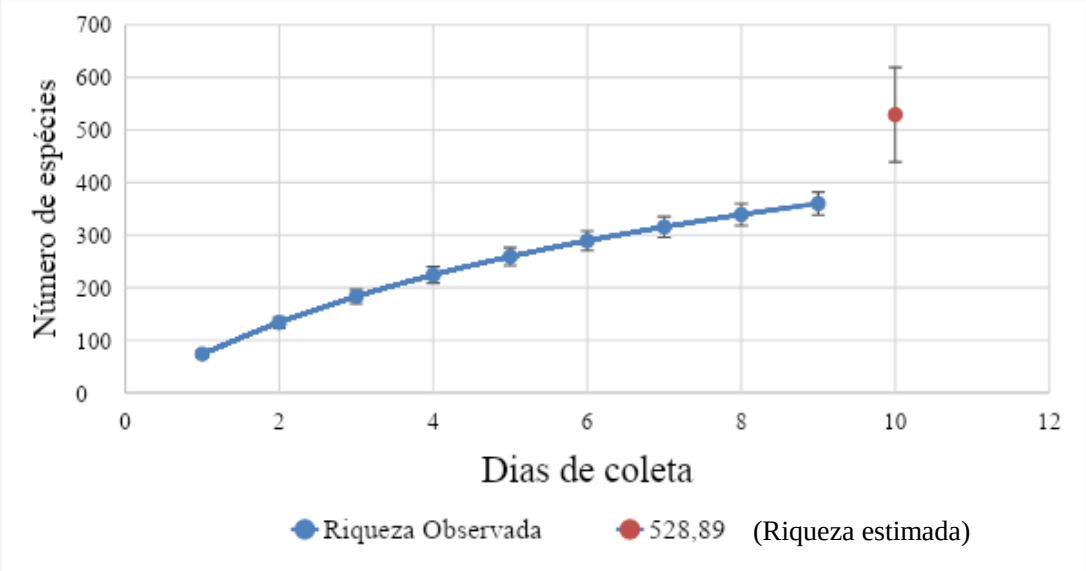

Figura 4: Curva de acumulação de espécies por extrapolação (número de espécies X dias de coleta.

O método aplicado para a distribuição em estados brasileiros foi descrito em Valente & Pôrto (2006). Os domínios fitogeográficos e distribuição mundial seguem Gradstein & Costa (2003), Costa *et al.* (2011) e Flora do Brasil 2020 (2020). Os substratos foram classificados de acordo com Robbins (1952), e as formas de vida, Mägdefrau (1982).

3.5 Análise comparativas: Foi realizada uma comparação, em termos de riqueza, entre o levantamento florístico do PERT e outros dezessete trabalhos de áreas de Mata Atlântica. Desta forma, foi construída uma matriz usando a presença e ausência das espécies como descritores binários, incluindo as espécies raras.

A análise de Agrupamento seguiu o Método de Ligação Média não Ponderada (UPGMA) utilizando o índice de similaridade de Jaccard (C = j/(a + b - j), em que "j" é o número de espécies encontrado em ambos os lugares, "a" é o número de espécies encontrado no local A, "b" é o número de espécies encontrado no local B) (Magurran 1988).

4 Resultados

Os resultados foram apresentados em dois capítulos nesta dissertação: 4.1 Capítulo 1 - Bryophytes of Rio Turvo State Park: integrating floristic, geographic distribution, reproduction and ecological traits as subsidy for conservation, e 4.2 Capítulo 2 - Comparing floristic inventories of the Rio Turvo State Park and seventeen Conservation Units distributed along the temperate and tropical Atlantic Forest based on floristic similarity and qualitative analysis of climatic and geographic factors. Ambos os capítulos foram redigidos no formato de artigo científico, nas normas do periódico Acta Botanica Brasilica, para o qual serão submetidos.

4.1 CAPÍTULO 1

Bryophytes of Rio Turvo State Park (SP), Brazil: integrating floristics, geographical distribution, reproduction and ecological traits as subsidy for conservation of the Atlantic Forest

Original Article: Manuscrito a ser submetido ao periódico Acta Botanica Brasilica

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Abstract

The Rio Turvo State Park (RTSP) is located in the Atlantic Forest of the State of São Paulo, more specifically, in the Vale do Ribeira region. Considering the lack of knowledge of the existent bryoflora in the Park, this study aimed to carry out a floristic inventory (following the random-walk method), discussing geographical distribution of the species in Brazil and worldwide, substrate colonization, life forms and reproduction aspects. We found 414 species, which represent 30% of all species known in Brazil: seven hornworts, 204 mosses and 203 liverworts. Dioicous species predominated in relation to monoicous ones; the most colonized substrate was tree trunk (40% of all species) and the predominant life form was mat (47%), indicating the floristic composition is influenced by the environmental conditions of the area (high humidity, dense vegetation and shading). Although the presence of anthropogenic intervention, the RTSP harbours a huge biodiverse potential, since 22% of the species have rare distribution, likewise 16 new occurrences for São Paulo State were recorded. The information provided in this study exalts the importance of this Conservation Unit in the preservation of bryophytes, actually, the all biodiversity involved in those ecosystems.

Keywords: floristics, inventory, distribution, bryophytes, liverworts, mosses, ombrophilous forest, Conservation Unit, Vale do Ribeira, Atlantic Forest.

Introduction

The law SNUC 9.985/2000 (Sistema Nacional de Unidades de Conservação) establishes the importance of Conservation Units in promoting public policies for the protection of natural landscapes, flora, fauna and historical-cultural heritage, for the recovery and restoration of degraded areas, for economic valorization by the sustainable use of natural resources that remain the subsistence of local populations and ecological tourism (Brasil 2011). Furthermore, they provide the development of scientific research and environmental monitoring studies, as well as a space for discussion, interpretation and environmental education (Brasil 2011). The Conservation Unit of Rio Turvo State Park (RTSP), São Paulo State, Brazil, founded in 2008, is located in the Atlantic Forest phytogeographic domain, harbouring several species of flora and fauna, including endangered species, such as the *Amazona vinacea* Kuhl (Psittacidae) and the *Panthera onca* L. (jaguar, Felidae) (Portal do Governo do Estado de São Paulo 2018). Moreover, the Park has a great archaeological significance because the presence of a fluvial sambaqui, where it was found one of the oldest human fossil of the Americas, dated 10,400 years AP (Pivetta 2005).

The Atlantic Forest - located mainly in the Brazilian coast, maintains only 12% of its original extension (1.5 mi Km²) preserved (Ribeiro *et al.* 2011) - is included among the areas with the greatest loss of habitat and high endemism rate, ranking fourth on the list of 25 priority conservation hotspots on the planet (Myers *et al.* 2000). Considering its enormous importance, it was declared a National Heritage by the Federal Constitution of 1988 and granted with the title of Biosphere Reserve by Unesco (SOS Mata Atlântica 2018). Comparing to the knowledge of vascular plants accumulated over the years, the field of Bryology is still incipient because little is known about their biology, ecology, distribution and bioprospection. For this reason, it is extremely important to invest efforts in researches on bryophytes - mainly the species that occur in hotspot areas – seeking to know about their geographic distribution, population sizes and susceptibility to anthropogenic environmental

changes, thereby, enabling a conscious planning conservation with effective measures to protect the biodiversity (Hällingback & Tan 2010). Scott *et al.* 1997 emphasize the necessary investment in studies of flora and endemism of different regions to filling the gaps that still remain.

According to Costa *et al.* (2011) this is the phytogeographic domain with the highest rate of bryophyte richness and endemism in the country, with 1,572 species, of which 1,347 are present in the Atlantic Forest, 915 in the State of São Paulo and 334 are endemic to Brazil (Flora do Brasil 2020 em construção, 2020). For the Atlantic Forest region of the state of São Paulo, there are several publications that have consistently contributed to the knowledge of the diversity and distribution of bryophytes, such as: Yano (1998), Visnadi (2002; 2004; 2005), Peralta & Yano (2006), Visnadi (2006), Yano & Peralta (2007), Peralta & Yano (2008), Yano & Peralta (2008), Visnadi (2009), Peralta & Yano (2012), Visnadi (2012; 2013a; 2013b; 2015a; 2015b), Carmo *et al.* (2016), Amélio *et al.* (2019) and Yano *et al.* (2019). The surveys carried out in Conservation Units of São Paulo State revealed territories with great species richness: 386 species for Serra do Mar State Park, Núcleo Santa Virgínia (Carmo *et al.* 2016), 490 for Campos do Jordão State Park (Amélio *et al.* 2019) and 440 for Ilha do Cardoso State Park (Yano *et al.* 2019).

Bryophytes are water-dependent for sexual reproduction, being closely influenced by the conditions of the microclimates due to their small size (Richards 1984) and the poikilohydric feature – low capacity to control the loss of water to the environment (Delgadillo & Cárdenas 1990). Giving their property in accumulating nutrients (Oishi & Hiura 2017), heavy metals and other substances, a lot of species are considered appropriate indicators for biomonitoring studies that evaluate the air, water pollution (Govindapyar *et al.* 2010) and measurement of the disturbance in neotropical rainforests (Drehwald 2005). Not only chemical studies are relevant to evaluate the atmospheric and other environment conditions (Oishi & Hiura 2017). Several ecological studies have been demonstrating the

relationship of life forms, colonization of different substrates, ways of reproduction, humidity and light tolerance (Batista & Santos 2016; Santos *et al.* 2017b; Batista *et al.* 2018).

Considering the lack of knowledge of the bryoflora of the RTSP, the purpose of this study was to carry out a floristic inventory of the bryophytes in RTSP, discussing geographical distribution of species in Brazil and worldwide, substrate colonization, life forms and reproduction aspects, then, providing subsidies for the Park's management plan (still under construction), as well as for the preservation of Conservation Units located in the Atlantic Forest phytogeographic domain.

Materials and methods

Study area - The Rio Turvo State Park (24º47'-24º57'S, 48º09'-48º25'W) is located in the Atlantic Forest phytogeographic domain, in the Vale do Ribeira region, south of São Paulo State. The total area has 73,893.87 ha and comprises the cities of Jacupiranga, Cajati and Barra do Turvo (Portal do Governo do Estado de São Paulo 2018). The vegetation is characterized by Dense Ombrophilous Forest and Mixed Ombrophilous Forest (IBGE 2012), with altitude ranging from 10 to 1,500 m a.s.l. (Bim & Furlan 2013). The climate can be defined as permanently humid subtropical, influenced by tropical and polar sea air masses (Monteiro 1973). Following the Köppen-Geiger classification, areas with lower altitude are classified as Cfa (humid subtropical climate), while areas at altitudes above 700m are Cfb (oceanic climate) (Lepsch *et al.* 1990 apud Dias 2009). The average temperature varies between 11 and 32º C (Ross 2002). It rains a lot during the year, with an average annual rainfall that ranges from 1,000 to 3,000 mm/year, but less intense in June, July and August (Ross 2002). The Park is inserted in the basin of the Ribeira do Iguape River where the main rivers Turvo, Jacupiranga and Pardo flow. The pedological aspect presents mountainous relief, deep and narrow valleys (Bim *et al.* 2017). The Park vegetation is predominantly primary, nonetheless there are some secondary succession patches occasioned by

anthropogenic intervention such as deforestation for habitation, farming activities and extractivism (Bim & Furlan 2013) of *Euterpe edulis* Mart. (Brazilian popular name: *palmito juçara*).

Sampling methods - We analyzed 401 samples founded in SP herbarium (Maria Eneyda P. Kaufmann Fidalgo) and 849 samples performed during this study in three expeditions in 2018 and 2019. We adopted the random-walk technique, that consists in walking freely (Filgueiras *et al.* 1994) through the trails and exploring all the available substrates around: soil, rocks, leaves, tree trunks, decaying tree trunks and artificial substrate.

Treatment of the specimens- The methodology for collection, herborization and preservation of material followed Gradstein *et al.* (2001), and the samples were included in SP herbarium. The identification of the species follows: Frahm (1991), Zander (1993), Sharp *et al.* (1994), Buck (1998), Gradstein *et al.* (2001), Gradstein & Costa (2003), Câmara & Costa (2006), Visnadi (2006), Zartman & Ilkiu-Borges (2007), Câmara (2008a), Peralta & Yano (2008), Câmara (2008b), Ballejos & Bastos (2009), Bastos & Yano (2009), Yano & Peralta (2009; 2011) and Bordin & Yano (2013).

The classification system follows Renzaglia *et al.* (2009) for Anthocerotophyta, Crandall-Stotler *et al.* (2009) for Marchantiophyta and Goffinet *et al.* (2009) for Bryophyta with adaptation from recent classification studies of certain genus and families. The abbreviation of the authors' name in the species list were based on Brummitt & Powell (1992).

The list is organized in alphabetical order by division, family, genus and species. The classification in phytogeographic domains, geographical distribution, life forms, types of substrates and reproduction strategies (sexual system and structures) follow the methods of Batista *et al.* (2018). To Brazilian geographical distribution the method is described in Valente & Pôrto (2006), which consider three status: wide (when a species occurs in ten or

more Brazilian states), moderate (in five to nine states) and rare (in one to four states). The phytogeographic domains and worldwide distribution followed Gradstein & Costa (2003), Costa *et al.* (2011) and Flora do Brasil 2020 (2020).

The substrates were classified according to Robbins (1952), in five categories: soil (terrestrial), rocks (rupicolous), leaves (epiphyllous), tree trunk (corticolous) and decaying trunk (epixylic) plus two additional categories "artificial" and "litter". The life forms followed Mägdefrau (1982), that classifies the bryophytes in nine classes: annuals, turfs, cushions, mats, wefts, pendants, tails, fans and dendroids.

With regard to reproduction we carefully checked in the specimens to identify their sexual system (dioicous or monoicous) and the presence of sexual (male and female gametangia, sporophyte) or asexual propagules (gemmae, tubbers).

Results

Species richness - A total of 1,250 samples were analyzed, which contained one to twelve species associated in each envelope. The total number of 414 species found represents 46% of the species known to São Paulo State, 31% to Atlantic Forest, 26% to the whole country and 10% to Neotropical Region (Tab.1).

Table 1. Distribution and richness of species found in the Rio Turvo State Park (RTSP) in relation to other regional scales. The percentage represents the richness found in the RTSP compared with the total number of species in each region.

Region	Richness (number of spp.)	References
Rio Turvo State Park	414	This Study
SP State	915 (45%)	Flora do Brasil 2020 (2020)
Atlantic Forest	1,349 (31%)	Flora do Brasil 2020 (2020)
Brazil	1,572 (26%)	Flora do Brasil 2020 (2020)
Neotropics	3,980 (10%)	Gradstein *et al.* (2001)

Table 2. List and characteristics of bryophytes species of Rio Turvo State Park. Phytogeographic domains (Phyt. dom.): AM = Amazon Rainforest; AT = Atlantic Forest; CA= Caatinga; CE = Cerrado; PA = Pampa; PL = Pantanal. Geographic distribution in Brazil: rare = rare distribution (occurrence in one to four Brazilian States; moderate = moderate distribution (in four to nine States); wide = wide distribution (ten or more States). Worlwide = worldwide distribution. 1st = First occurrence to SP State. Life forms: annual; turf; cushion; mat; weft; pendant; tail; fan; dendroid. Substrates: TT = tree trunk, SO = soil, RO = rock, DT = decaying trunk, LE = leaf, LT = litter, AR = artificial. Sexual System: FG = Female gametangia, MG = Male gametangia; S = Sporophyte; AS = Asexual propagule. Symbol: * in species = Endemic to Brazil.

Species	Phyt. Dom.	Brazil	Worldwide	1st	Life Form	TT	SO	RO	DT	LE	LT	AR	Sexual System	FG	MG	S	AS	Voucher
Division Anthocerotophyta																		
Dendrocerotaceae																		
Dendroceros breutelii Nees	AT	Rare (SP)	Endemic to Brazil		Mat	X							Monoicous			X		Peralta *et al.* 26698
Dendroceros crispatus Nees	AT	Rare (RJ, SP, PR, SC)	Australia, Africa, Neotropical		Mat	X							Monoicous			X		Peralta *et al.* 25539
Dendroceros crispus (Sw.) Nees	AT	Moderate	Africa, Neotropical		Mat	X							Monoicous			X		Peralta *et al.* 25538
Nothoceros vincentianus (Lehm. & Lindenb.) J.C. Villarreal	AT	Moderate	Neotropical		Mat				X				Monoicous			X		Peralta *et al.* 25397
Notothyladaceae																		
Phaeoceros carolinianus (Michx.) Prosk	CE, AT, PA	Moderate	Cosmopolitan		Mat		X						Monoicous		X	X		Peralta *et al.* 8467
Phaeoceros laevis (L.) Prosk.	AM, CE, AT, PA, PL	Wide	Cosmopolitan		Mat		X	X					Dioicous			X		Koga *et al.* 259
Phymatocerotaceae																		

Phymatoceros bulbiculosus (Broth.) Stotler, W. T. Doyle & Crand.-Stotl.	AT	Rare (ES, SP, PR)	Brazil, China, Russia		Mat		X				Dioicous			X	Peralta *et al*. 8412
Division Bryophyta															
Bartramiaceae															
Philonotis elongata (Dumort.) H.A. Crum & Steere	AM, CE, AT	Moderate	Neotropical		Turf			X			Dioicous				Peralta *et al.* 26569 p.p.
Philonotis longiseta (Michx.) E. Britton	AT	Rare (BA, CE)	Neotropical	X	Turf		X	X	X		Monoicous	X	X	X	Peralta *et al.* 26565
Philonotis uncinata (Schwägr.) Brid.	AM, CA, CE, AT, PA, PL	Wide	Cosmopolitan		Turf		X	X			Dioicous				Peralta *et al.* 8228
Brachytheciaceae															
Aerolindigia capillacea (Hornsch.) M. Menzel	AT	Rare (RJ, SP,SC, RS)	Africa, Neotropical		Turf	X					Monoicous	X		X	Peralta *et al.* 26658
**Brachythecium poadelphus* Müll. Hal.	AT	Rare (MG, RJ, SP)	Endemic to Brazil		Mat		X				Dioicous		X		Peralta *et al. 8*153
Brachythecium ruderale (Brid.) W.R. Buck	AT, PL	Moderate	Pantropical		Mat			X		X	Dioicous				Peralta *et al.* 25580
Helicodontium capillare (Hedw.) A. Jaeger	AM, CE, AT, PA	Wide	Neotropical		Weft	X		X	X		Monoicous	X		X	Peralta *et al.* 8461
Meteoridium remotifolium (Müll. Hal.) Manuel	AM, CE, AT	Wide	Neotropical		Pendant	X	X	X			Dioicous				Peralta *et al.* 8257
Rhynchostegium scariosum (Taylor) A. Jaeger	AT, CE	Moderate	Neotropical		Mat		X		X		Monoicous				Peralta *et al.* 25535
Squamidium brasiliense Broth.	AT	Moderate	Asia, Neotropical		Pendant	X					Dioicous				Peralta *et al.* 25546
Zelometeorium ambiguum (Hornsch.) Manuel	AM, AT	Moderate	Africa, Neotropical		Pendant	X	X				Dioicous				Peralta *et al.* 8268

Zelometeorium patulum (Hedw.) Manuel	AM, CE, AT, PL	Wide	Neotropical	Pendant	X						Dioicous					Peralta *et al.* 8221
Bryaceae																
Brachymenium consimile (Mitt.) A. Jaeger	AT	Moderate	Neotropical	Turf	X						Dioicous	X		X		Peralta *et al.* 8143
**Brachymenium hornschuchianum* Mart.	AT	Moderate	Endemic to Atlantic Forest	Turf	X						Dioicous	X		X		Koga *et al.* 99
Brachymenium radiculosum (Schwägr.) Hampe	CE, CA, AT	Wide	Neotropical	Turf	X			X			Dioicous	X		X		Oliveira *et al.* 41
Bryum argenteum Hedw.	AM, CA, CE, AT, PA	Wide	Cosmopolitan	Cushion						X	Dioicous	X		X		Oliveira *et al.* 50
Bryum atenense Williams	CA, CE, AT, PL	Moderate	South Hemisphere	Turf			X				Dioicous	X		X		Peralta *et al.* 25543
Bryum caespiticium Hedw.	CE, AT	Rare (MG, RJ, SP, TO)	Cosmopolitan	Turf			X				Monoicous	X	X			Peralta *et al.* 26639
Bryum limbatum Müll. Hal.	CE, AT	Wide	Neotropical	Turf			X				Dioicous					Peralta *et al.* 25352
Rhodobryum roseum (Hedw.) Limpr.	AT	Moderate	Cosmopolitan	Dendroid				X			Dioicous	X				Koga *et al.* 319
Rhodobryum subverticillatum Broth.	AM, AT	Moderate	Brazil, Uruguay	Dendroid				X			Dioicous	X		X		Peralta *et al.* 25396
Rosulabryum billarderi (Schwägr.) Spence	AM, CE, AT, PA, PL	Wide	Sub cosmopolitan	Turf		X	X				Dioicous					Canestraro *et al.* 1568
Rosulabryum densifolium (Brid.) Ochyra	CA, AT, PA	Wide	Australia, Neotropical	Turf		X	X				Dioicous		X			Koga *et al.* 268
Calymperaceae																
Calymperes afzelii Sw.	AM, CE, AT	Wide	Pantropical	Turf	X		X				Dioicous				X	Koga *et al.* 41

Octoblepharum albidum Hedw.	AM, CA, CE, AT, PA, PL	Wide	Pantropical	Turf	X						Monoicous	X		X	Peralta *et al.* 25577
Octoblepharum cocuiense Mitt.	AM, CE, AT	Wide	Neotropical	Turf				X			Monoicous			X	Peralta *et al.* 26557
Octoblepharum pulvinatum (Dozy & Molk.) Mitt.	AM, CA, CE, AT, PL	Wide	Neotropical	Turf		X					Monoicous			X	Koga *et al.* 279
Syrrhopodon africanus (Mitt.) Paris	AM, AT	Moderate	Neotropical	Turf	X		X				Monoicous			X	Peralta *et al.* 26570
Syrrhopodon cymbifolius Müll. Hal.	AM, CE, AT	Moderate	Neotropical	Turf	X				X		Monoicous	X		X	Peralta *et al.* 25530
Syrrhopodon gaudichaudii Mont.	AM, CA, CE, AT, PL	Wide	Pantropical	Turf	X		X				Dioicous			X	Peralta *et al.* 8489
Syrrhopodon incompletus Schwägr.	AM, CE, AT	Wide	Africa, Neotropical	Turf	X						Dioicous				Peralta *et al.* 8277
Syrrhopodon lycopodioides (Sw. ex Brid.) Müll. Hal.	AT	Rare (MG, RJ, SP)	Neotropical	Turf	X						Dioicous				Peralta *et al.* 25449
Syrrhopodon parasiticus (Brid.) Besch.	AM, CE, AT, PL	Wide	Pantropical	Turf	X						Dioicous				Koga *et al.* 51 p.p.
Syrrhopodon prolifer Schwägr.	AM, CA, CE, AT	Wide	Pantropical	Turf	X	X	X				Dioicous			X	Peralta *et al.* 8193
Cryphaeaceae															
Schoenobryum concavifolium (Griff.) Gangulee	AM, CE, AT, PA, PL	Wide	Cosmopolitan	Tail	X					X	Monoicous	X		X	Oliveira *et al.* 55
Daltoniaceae															
Adelothecium bogotense (Hampe) Mitt.	AT, PA	Moderate	Africa, Neotropical	Fan	X						Dioicous				Peralta *et al.* 26600 p.p.

Calyptrochaeta setigera (Mitt.) W. R. Buck	AM, AT	Moderate	Brazil, Venezuela		Dendroid			X		Dioicous	X		X	Peralta *et al.* 25491
Daltonia marginata Griff.	AT	Moderate	Neotropical		Turf	X				Monoicous	X		X	Peralta *et al.* 8284
Daltonia splachnoides (Sm.) Hook. & Taylor	AT	Rare (ES, MG, SP)	Neotropical		Turf	X				Monoicous				Peralta *et al.* 8365 p.p.
**Leskeodon aristatus* (Geh. & Hampe) Broth.	AT	Moderate	Endemic to Brazil		Turf	X				Monoicous	X	X	X	Peralta *et al.* 26598
Dicranaceae														
Bryohumbertia filifolia (Hornsch.) J.-P. Frahm	AM, CA, AT	Wide	Neotropical		Turf		X		X	Dioicous	X		X	Peralta *et al.* 8347
Dicranella lindgiana (Hampe) Mitt.	AM, CE, AT	Wide	Neotropical		Turf		X			Dioicous	X		X	Koga *et al.* 270
**Dicranella pabstiana* (Müll. Hal.) Mitt.	AT	Rare (MG, SC)	Endemic to Brazil	X	Turf		X			Dioicous	X		X	Peralta *et al.* 8249
Holomitrium arboreum Mitt.	AM, CE, AT	Wide	Neotropical		Turf	X		X		Dioicous	X		X	Peralta *et al.* 8230
Holomitrium crispulum Mart.	AM, CE, AT, PL	Wide	Neotropical		Turf	X		X	X	Dioicous	X		X	Peralta *et al.* 8477
Leucoloma serrulatum Brid.	AT	Moderate	Neotropical		Turf	X		X		Dioicous				Peralta *et al.* 8487
**Leucoloma triforme* (Mitt.) A. Jaeger	AT	Rare (ES, RJ, SP, PR)	Endemic to Brazil		Turf	X			X	Dioicous				Peralta *et al.* 8248
Entodontaceae														
**Entodon virens* (Hook. f. & Wilson) Mitt.	AT	Rare (RJ, SP)	Endemic to Brazil		Mat		X			Dioicous				Peralta *et al.* 26637
Erpodiaceae														
Solmsiella biseriata (Austin) Steere	CE, AT	Wide	Neotropical		Mat	X				Monoicous				Amélio *et al.* 866

Fissidentaceae

Fissidens acacioides Schrad.	CE, AT	Moderate	Brazil, Paraguay	Fan			X			Monoicous			Peralta *et al.* 8483
Fissidens asplenioides Hedw.	CE, AT	Wide	Pantropical	Fan			X			Dioicous	X		Peralta *et al.* 8513
Fissidens crispus Mont.	AM, CA, CE, AT, PA, PL	Wide	Pantropical	Fan	X	X	X			Dioicous/ Monoicous	X		Bordin *et al.* 2143
Fissidens curvatus Hornsch.	CE, AT	Moderate	Pantropical	Fan			X			Monoicous			Peralta *et al.* 26641
Fissidens flaccidus Mitt.	AM, CA, CE, AT, PA, PL	Wide	Pantropical	Fan		X				Monoicous		X	Koga *et al.* 245
Fissidens hornschuchii Mont.	AM, CA, CE, AT, PA, PL	Wide	Neotropical	Fan	X		X			Monoicous			Peralta *et al.* 25373
Fissidens lagenarius Mitt.	CA, CE, AT, PL	Wide	Neotropical	Fan	X					Monoicous	X	X	Peralta *et al.* 2140
Fissidens oblongifolius Hook. f. & Wilson	AT	Rare (RJ, SP)	Pantropical	Fan		X				Monoicous	X	X	Peralta *et al.* 8478
Fissidens oediloma Müll. Hal. ex Broth.	AT	Moderate	Brazil, Paraguay	Fan		X	X			Monoicous	X	X	Peralta *et al.* 8499
Fissidens pellucidus Hornsch.	AM, CA, CE, AT, PA, PL	Wide	Pantropical	Fan		X		X		Monoicous	X	X	Bordin *et al.* 2148
**Fissidens pseudoplurisetus* Bordin, Pursell & O. Yano	AT	Rare (SP, PR)	Endemic to Brazil	Fan	X					Monoicous	X	X	Bordin *et al.* 2139
Fissidens scariosus Mitt.	AM, CE, AT	Wide	Neotropical	Fan		X				Monoicous			Peralta *et al.* 25419
Fissidens serratus Müll. Hal.	AM, CA, CE, AT	Wide	Neotropical	Fan	X					Monoicous	X	X	Peralta *et al.* 2146

Fissidens submarginatus Bruch	AM, CA, CE, AT, PA, PL	Wide	Africa, Neotropical		Fan		X	X			Monoicous	X		X		Peralta *et al.* 8223
Fissidens weirii Mitt.	CE, AT	Moderate	Africa, Neotropical		Fan	X					Monoicous					Bordin *et al.* 2147
**Fissidens yanoae* Pursell	AT	Rare (SP, RS)	Endemic to Brazil		Fan	X					Monoicous	X	X			Bordin *et al.* 2142
Fissidens zollingeri Mont.	AM, CA, CE, AT, PL	Wide	Pantropical		Fan	X	X				Monoicous	X		X		Bordin *et al*. 2149
Funariaceae																
Entosthodon bonplandii (Hook.) Mitt.	CE, AT	Moderate	Neotropical		Turf		X				Monoicous	X		X		Peralta *et al.* 8447
Funaria calvescens Schwägr.	AM, CE, AT, PA	Wide	Cosmopolitan		Turf		X				Monoicous	X		X		Peralta *et al.* 8211
Helicophyllaceae																
Helicophyllum torquatum (Hook.) Brid.	AM, CA, CE, AT, PA, PL	Wide	Neotropical		Weft			X			Dioicous					Peralta *et al.* 26657 p.p.
Hypnaceae																
Chryso-hypnum diminutivum (Hampe) W. R. Buck	AM, CE, AT, PA, PL	Wide	Cosmopolitan		Mat				X		Monoicous	X		X		Peralta *et al.* 25381
Chryso-hypnum elegantulum (Hook.) Hampe	AM, CE, AT, PL	Wide	Neotropical		Weft	X		X	X		Monoicous	X	X	X		Amélio *et al.* 870
Mittenothamnium reptans (Hedw.) Cardot	CE, AT, PA	Wide	Neotropical		Weft			X	X		Monoicous	X		X		Peralta *et al.* 25477
Pseudotaxiphyllum distichaceum (Mitt.) Z. Iwats.	AT	Rare (DF, PR)	Asia, Neotropical	X	Mat			X			Monoicous					Peralta *et al.* 26651 p.p.
Puiggariopsis aurifolia (Mitt.) M. Menzel	AT	Moderate	Neotropical		Weft	X					Dioicous				X	Peralta *et al.* 8181

Vesicularia vesicularis (Schwägr.) Broth.	AM, CE, AT, PL	Wide	Neotropical	Mat	X			Monoicous					Peralta *et al.* 25478 p.p.
Hypopterygiaceae													
Hypopterygium tamarisci (Sw.) Brid. ex Müll. Hal.	AT	Moderate	Cosmopolitan	Dendroid	X		X	X	Dioicous/ Monoicous	X	X		Peralta *et al.* 8458
Lopidium concinnum (Hook.) Wilson	AT	Moderate	South Hemisphere	Dendroid	X				Monoicous	X	X		Peralta *et al.* 8313
Lembophyllaceae													
Orthostichella pachygastrella (Müll. Hal.) B. H. Allen & Magill	AT	Moderate	Neotropical	Pendant	X				Dioicous			X	Peralta *et al.* 8356
Orthostichella versicolor (Müll.Hal.) B. H. Allen & W. R. Buck	AM, AT	Wide	Africa, Neotropical	Pendant	X				Dioicous				Peralta *et al.* 26638
Leskeaceae													
Haplocladium microphyllum (Hedw.) Broth.	CE, AT	Moderate	Asia, Neotropical	Weft				X	Monoicous	X		X	Koga *et al.* 236
Leucobryaceae													
Campylopus arctocarpus (Hornsch.) Mitt.	CA, CE, AT, PA	Wide	Pantropical	Turf	X			X	Dioicous	X		X	Peralta *et al.* 8306
Campylopus flexuosus (Hedw.) Brid.	AT	Wide	Cosmopolitan	Turf	X				Dioicous	X		X	Peralta *et al.* 8404 p.p.
**Campylopus fragilis* (Brid.) Bruch & Schimp.	AT	Rare (MG, RJ, SC, SP)	Endemic to Brazil	Turf	X			X	Dioicous			X	Peralta *et al.* 8420
**Campylopus gemmatus* (Müll. Hal.) Paris	CE, AT	Moderate	Endemic to Brazil	Turf			X	X	Dioicous			X	Peralta *et al.* 25553
Campylopus heterostachys (Hampe) A. Jaeger	AM, CA, CE, AT	Wide	Neotropical	Turf		X			Dioicous	X		X	Peralta *et al.* 8170

Campylopus pilifer Brid.	AM, CA, CE, AT, PA	Wide	Cosmopolitan		Turf			X			Dioicous	X		X		Koga *et al.* 295
**Campylopus subcuspidatus* (Hampe) A. Jaeger	AT	Rare (MG, RJ, SP)	Endemic to Brazil		Turf			X			Dioicous					Peralta *et al.* 8154
Leucobryum albicans (Schwägr.) Lindb.	AM, CA, CE, AT	Wide	Neotropical		Cushion			X			Dioicous				X	Koga *et al.* 293
**Leucobryum clavatum* Hampe	CE, AT	Wide	Endemic to Brazil		Cushion		X		X		Dioicous				X	Peralta *et al.* 25536
Leucobryum crispum Müll. Hal.	AM, CE, AT	Wide	Neotropical		Cushion	X	X		X		Dioicous		X			Koga *et al.* 218
Leucobryum giganteum Müll. Hal.	AM, AT	Wide	Neotropical		Cushion		X				Dioicous					Koga *et al.* 324
Leucobryum martianum (Hornsch.) Hampe ex Müll. Hal.	AM, CA, CE, AT, PL	Wide	Neotropical		Turf	X		X			Dioicous					Koga *et al.* 289
Leucomiaceae																
Leucomium steerei B. H. Allen & Veling	AT	Rare (PA, RJ)	Brazil, French Guiana, Venezuela	X	Weft				X		Monoicous	X	X	X		Peralta *et al.* 25522 p.p.
Leucomium strumosum (Hornsch.) Mitt.	AM, AT	Wide	Pantropical		Weft			X			Monoicous	X	X	X		Peralta *et al.* 26536
**Rhynchostegiopsis brasiliensis* Broth.	AT	Rare (SP)	Endemic to Brazil		Weft	X					Dioicous					Peralta *et al.* 25380
Meteoriaceae																
Aerobryopsis capensis (Müll. Hal) M. Fleisch	AT	Rare (SE, SP)	Pantropical		Pendant	X					Dioicous					Peralta *et al.* 8335
Floribundaria flaccida (Mitt.) Broth.	AM, CE, AT, PL	Wide	Neotropical		Pendant	X				X	Dioicous					Peralta *et al.* 8163
Meteorium deppei (Hornsch.) Mitt.	CE, AT, PL	Wide	Neotropical		Pendant	X					Dioicous					Peralta *et al.* 8180

**Meteorium latifolium* (Lindb.) Broth.	AT	Moderate	Endemic to Brazil		Pendant	X				Dioicous				Peralta *et al.* 8184
Meteorium nigrescens (Hedw.) Dozy & Molk.	AM, CE, AT, PL	Wide	Pantropical		Cushion	X			X	Dioicous			X	Peralta *et al.* 8411
Meteorium teres Mitt.	AT	Moderate	Neotropical		Pendant	X				Dioicous				Peralta *et al*. 8234
Pseudotrachypus martinicensis (Broth.) W. R. Buck	AT	Rare (BA)	Brazil, Caribbean	X	Pendant			X		Dioicous				Peralta *et al.* 26606 p.p.
Neckeraceae														
Homaliodendron piniforme (Brid.) Enroth	AT	Moderate	Pantropical		Fan	X				Dioicous				Peralta *et al.* 25411
Neckera villae-ricae Besch.	AT	Moderate	Neotropical		Fan	X				Monoicous				Peralta *et al.* 25565
Neckeropsis disticha (Hedw.) Kindb.	AM, CE, AT, PL	Wide	Pantropical		Fan	X				Monoicous	X	X		Peralta *et al.* 25533
Neckeropsis undulata (Hedw.) Reichardt	AM, CA, CE, AT, PL	Wide	Neotropical		Fan	X				Monoicous				Koga *et al.* 22 p.p.
Pinnatella minuta (Mitt.) Broth.	AM, AT	Moderate	Pantropical		Fan	X				Dioicous	X	X		Peralta *et al.* 26688 p.p.
Porotrichodendron superbum Menz. ex Brid.	AT	Rare (PR, RS, SC)	Neotropical	X	Fan	X	X			Dioicous			X	Koga *et al.* 240
Porotrichum lancifrons (Hampe) Mitt.	AT	Moderate	Neotropical		Fan	X				Dioicous				Koga *et al.* 26
Porotrichum longirostre (Hook.) Mitt.	CE, AT	Moderate	Neotropical		Fan	X				Dioicous			X	Koga *et al.* 9
Porotrichum mutabile Hampe	AT	Moderate	Neotropical		Fan	X				Dioicous				Bordin *et al.* 2140 p.p.

Porotrichum substriatum (Hampe) Mitt.	AM, CE, AT	Wide	Africa, Neotropical	Fan	X	X		Dioicous				X	Peralta *et al.* 25387
Thamnomalia glabella (Hedw.) S. Olsson, Enroth & D. Quandt	AT	Moderate	Neotropical	Fan	X	X		Dioicous				X	Peralta *et al.* 8385
Orthodontiaceae													
Hymenodon aeruginosus (Hook. f. & Wilson)	AT, PA	Moderate	Neotropical	Turf	X			Dioicous	X		X		Peralta *et al.* 8311
Orthotrichaceae													
**Macrocoma brasiliensis* (Mitt.) Vitt	AT	Rare (SP, PR, SC, RS)	Endemic to Brazil	Mat			X	Monoicous	X	X	X		Oliveira *et al.* 54
Macrocoma orthotrichoides (Raddi) Wijk. & Margad.	AT	Moderate	India, Neotropical	Mat	X			Dioicous	X		X		Peralta *et al.* 8148
Macromitrium longifolium (Hook.) Brid.	AT	Moderate	Neotropical	Mat	X			Dioicous					Peralta *et al.* 8239
Macromitrium microstomum (Hook. & Grev.) Schwägr.	AT	Rare (PR, RJ, SP)	Cosmopolitan	Mat	X			Monoicous					Koga *et al.* 96 p.p.
Macromitrium richardii Schwägr.	AM, AT	Wide	Africa, Neotropical	Mat	X			Monoicous	X		X		Peralta *et al.* 8179
Schlotheimia appressifolia Mitt.	AT	Moderate	Neotropical	Cushion	X		X	Dioicous	X		X		Peralta *et al.* 8270
Schlotheimia jamesonii (Arn.) Brid.	AM, CE, AT, PA	Wide	Neotropical	Cushion	X		X	Dioicous	X		X		Peralta *et al.* 8395
**Schlotheimia merkelii* Hornsch.	CE	Moderate	Endemic to Brazil	Cushion	X		X	Dioicous	X		X		Oliveira *et al.* 42
Schlotheimia rugifolia (Hook. f.) Schwägr.	AM, CE, AT	Wide	India, Neotropical	Cushion	X			Dioicous	X		X		Peralta *et al.* 8348
Schlotheimia tecta Hook. f. & Wilson	AT	Moderate	Neotropical	Cushion	X			Dioicous	X	X			Peralta *et al.* 8175
Schlotheimia torquata (Sw. ex Hedw.) Brid.	AM, AT	Wide	Neotropical	Cushion	X			Dioicous	X		X		Peralta *et al.* 8271

Phyllogoniaceae															
Phyllogonium viride Brid.	AT	Wide	Africa, Neotropical		Pendant	X					Dioicous				Peralta *et al.* 8397
Pilotrichaceae															
**Callicostella apophysata* (Hampe) A. Jaeger	CE, AT	Rare (GO, RJ, SP)	Endemic to Brazil		Mat		X		X		Monoicous	X	X		Peralta *et al.* 25479
**Callicostella martiana* (Hornsch.) A. Jaeger	CE, AT	Moderate	Endemic to Brazil	X	Mat				X		Monoicous	X	X		Peralta *et al.* 25491 p.p.
Callicostella merkelii (Hornsch.) A. Jaeger	AM, CE, AT	Wide	Neotropical		Mat		X				Monoicous	X	X		Peralta *et al.* 8515
Callicostella microcarpa Ångström	AM, AT	Moderate	Neotropical		Mat			X			Monoicous				Koga *et al.* 303 p.p.
Crossomitrium epiphyllum (Mitt.) Müll. Hal.	AT	Rare (BA, SP)	Neotropical		Mat	X				X	Dioicous			X	Koga *et al.* 272
Cyclodictyon albicans (Hedw.) Kuntze	CE, AT	Wide	Neotropical		Mat	X		X	X		Monoicous	X	X		Peralta *et al.* 8429
Cyclodictyon limbatum (Hampe) Kuntze	AT	Moderate	Neotropical		Mat				X		Monoicous	X	X		Peralta *et al.* 25522 p.p.
Cyclodictyon varians (Sull.) O. Kuntze	AM, CE, AT	Moderate	Neotropical		Mat				X		Monoicous				Peralta *et al.* 25378
**Lepidopilidium brevisetum* (Hampe) Broth.	AT	Moderate	Endemic to Brazil		Mat	X					Dioicous				Peralta *et al.* 25462
Lepidopilidium nitens (Hornsch.) Broth.	AT	Moderate	Neotropical		Mat	X		X	X		Dioicous	X	X	X	Peralta *et al.* 8423
**Lepidopilum caudicaule* (Müll. Hal.) Broth.	AT	Moderate	Endemic to Brazil		Mat	X					Monoicous				Peralta *et al.* 25473
Lepidopilum longifolium Hampe	AT	Rare (RJ, SP)	Neotropical		Mat	X			X		Monoicous	X	X	X	Peralta *et al.* 8197

Lepidopilum muelleri (Hampe) Mitt.	AT	Moderate	Neotropical	Mat				X		Monoicous	X		X	Koga *et al.* 54
Lepidopilum scabrisetum (Schwägr.) Steere	AM, CE, AT	Wide	Neotropical	Mat	X					Dioicous				Koga *et al.* 244 p.p.
**Lepidopilum subsubulatum* Geh. & Hampe	AT	Moderate	Endemic to Brazil	Mat	X					Dioicous	X		X	Peralta *et al.* 25526
Lepidopilum surinamense Müll. Hal.	AM, CE, AT	Wide	Neotropical	Mat	X					Monoicous				Oliveira *et al.* 22 p.p.
Pilotrichum evanescens (Müll. Hal.) Crosby	AM, CE, AT	Wide	Neotropical	Fan	X					Dioicous				Peralta *et al.* 26643 p.p.
Thamniopsis incurva (Hornsch.) W. R. Buck	AM, AT	Wide	Neotropical	Mat			X	X		Monoicous	X		X	Peralta *et al.* 8308
Thamniopsis langsdorffii (Hook.) W. R. Buck	AT	Moderate	Neotropical	Mat	X	X	X	X		Monoicous	X		X	Peralta *et al.* 8392
Thamniopsis undata (Hedw.) W. R. Buck	CE, AT	Moderate	Neotropical	Mat	X		X			Monoicous	X		X	Peralta *et al.* 8211 p.p.
Trachyxiphium guadalupense (Brid.) W. R. Buck	AT	Moderate	Neotropical	Mat				X		Dioicous/ Monoicous				Peralta *et al.* 25521 p.p.
Trachyxiphium saxicola (R. S. Williams) Vaz-Imbassahy & Costa	CE, AT	Moderate	Neotropical	Mat			X			Monoicous				Peralta *et al.* 26569 p.p.
Plagiomniaceae														
Plagiomnium rhynchophorum (Hook. F.) T. J. Kop.	AM, CE, AT	Moderate	Cosmopolitan	Weft		X	X			Monoicous	X	X		Koga *et al.* 239
Polytrichaceae														
Pogonatum pensilvanicum (E. B. Bartram ex Hedw.) P. Beauv.	CE, AT	Wide	Neotropical	Turf	X					Dioicous	X	X	X	Peralta *et al.* 8446

Polytrichadelphus pseudopolytrichum (Raddi) G. L. Sm.	AT	Moderate	Neotropical	Turf	X						Dioicous				Peralta *et al.* 8204
**Polytrichum angustifolium* Mitt.	AT, PA	Moderate	Endemic to Brazil	Turf			X				Dioicous		X		Peralta *et al.* 8518
Polytrichum commune L. ex Hedw.	AM, CE, AT	Wide	Cosmopolitan	Turf		X	X				Dioicous				Peralta *et al.* 8178
Polyrichum juniperinum Willd. ex Hedw.	AM, CE, AT	Wide	Cosmopolitan	Turf		X	X	X			Dioicous	X		X	Peralta *et al.* 8226
Pottiaceae															
Barbula indica (Hook.) Spreng.	AM, CA, CE, AT,PL	Wide	Sub cosmopolitan	Cushion		X	X				Dioicous				Peralta *et al.* 25563
Chenia leptophylla (Müll. Hal.) R. H. Zander	AT	Moderate	Afro, Neotropical	Turf			X				Dioicous	X			Peralta *et al.* 25568
Didymodon australasiae (Hook. & Grev.) R. H. Zander	AT	Rare (SP, PR, RS)	Cosmopolitan	Cushion			X				Dioicous				Peralta *et al.* 26648
Hymenostylium aurantiacum Mitt.	CE, AT	Moderate	Asia, Neotropical, Oceania	Turf			X				Dioicous				Amélio *et al.* 861
Hyophila involuta (Hook.) A. Jaeger	AM, CA, CE, AT, PA, PL	Wide	Cosmopolitan	Turf		X	X				Dioicous				Peralta *et al.* 26691 p.p.
Leptodontium araucarieti (Müll. Hal.) Paris	AT	Moderate	Brazil, Bolivia, Peru	Turf		X					Dioicous				Peralta *et al.* 26529
Tortella humilis (Hedw.) Jenn.	CA, CE, AT, PA, PL	Wide	Cosmopolitan	Cushion			X	X		X	Monoicous	X	X	X	Peralta *et al.* 8208
Weissia jamaicensis (Mitt.) Grout	CE, AT	Moderate	Neotropical	Cushion		X	X				Dioicous				Koga *et al.* 243
Prionodontaceae															

Prionodon densus (Sw. ex Hedw.) Müll. Hal.	AT, PA	Moderate	Pantropical		Tail	X					Dioicous				Peralta *et al.* 8409
Pterobryaceae															
Henicodium geniculatum (Mitt.) W. R. Buck	AM, CE, AT, PL	Wide	Neotropical		Tail	X					Dioicous				Koga *et al.* 292
Orthostichidium quadrangulare (Schwägr.) B. H. Allen & Magill	CE, AT	Moderate	Neotropical		Pendant	X					Dioicous				Peralta *et al.* 26674
Orthostichopsis praetermissa W. R. Buck	AM, CE, AT	Moderate	Neotropical		Pendant	X					Dioicous				Koga *et al.* 207
Orthostichopsis tenuis (A. Jaeger) Broth.	AT	Moderate	Brazil, Argentina		Pendant	X					Dioicous				Peralta *et al.* 8235
Orthostichopsis tortipilis (Müll. Hal.) Broth.	AM, AT	Wide	Neotropical		Pendant	X					Dioicous				Peralta *et al.* 8449
Pireella pohlii (Schwägr.) Cardot	AM, CE, AT	Wide	Neotropical, USA		Fan			X			Dioicous				Peralta *et al.* 26683
Spiridentopsis longissima (Raddi) Broth.	AT	Moderate	Neotropical		Pendant	X					Monoicous				Peralta *et al.* 8337
Pylaisiadelphaceae															
Isopterygium tenerifolium Mitt.	AM, CE, AT	Wide	Neotropical		Weft	X	X				Monoicous	X	X		Peralta *et al.* 8425
Isopterygium tenerum (Sw.) Mitt.	AM, CA, CE, AT, PA, PL	Wide	Cosmopolitan		Mat	X			X		Monoicous	X	X		Peralta *et al.* 8305
**Pylaisiadelpha brasiliensis* H. A. Crum	AM	Rare (SP)	Endemic to Brazil		Mat	X			X		Monoicous	X	X		Oliveira *et al.* 13
Pylaisiadelpha tenuirostris (Bruch & Schimp.) W. R. Buck	CE	Rare (MS)	Pantropical	X	Mat				X		Monoicous	X	X		Peralta *et al.* 8363
Wijkia flagellifera (Broth.) H. A. Crum	AT	Moderate	Neotropical		Mat	X		X			Dioicous			X	Peralta *et al.* 8472
Racopilaceae															

Racopilum tomentosum (Hedw.) Brid.	AM, CE, AT, PA, PL	Moderate	Cosmopolitan	Mat	X	X			Monoicous	X	X	X		Koga *et al.* 244
Rhizogoniaceae														
Pyrrhobryum spiniforme (Hedw.) Mitt.	AM, CE, AT, PA	Wide	Cosmopolitan	Turf	X		X	X	Monoicous					Peralta *et al.* 8242
Rutenbergiaceae														
Pseudocryphaea domingensis (Spreng.) W. R. Buck	AM, CE, AT, PA	Wide	Neotropical	Tail	X				Dioicous				X	Peralta *et al.* 26679
Sematophyllaceae														
Aptychopsis estrellae (Müll. Hal.) P. S. Câmara, W. R. Buck & Carv.-Silva	AM, CE, AT	Wide	Neotropical	Mat	X				Monoicous	X		X		Peralta *et al.* 8237
Brittonodoxa subpinnata (Brid.) W. R. Buck, P. E. A. S. Câmara & Carv.-Silva	AM, CA, CE, AT, PA	Wide	Pantropical	Mat	X	X	X	X	Monoicous	X		X		Peralta *et al.* 8470
Colobodontium vulpinum (Mont.) S. P. Churchill & W. R. Buck	AM, CE, AT	Wide	Neotropical	Mat			X		Monoicous	X		X		Peralta *et al.* 8479
Donnellia commutata (Müll. Hal.) W. R. Buck	AM, CE, AT, PL	Moderate	Neotropical	Mat	X				Monoicous	X		X		Peralta *et al.* 25544
**Donnellia lageniformis* (Müll. Hal.) W. R. Buck	CE, AT	Moderate	Endemic to Brazil	Mat	X				Monoicous	X	X	X		Oliveira *et al.* 22
Microcalpe subsimplex (Hedw.) W. R. Buck	AM, CE, AT, PA	Wide	Neotropical	Mat	X				Monoicous	X		X		Koga *et al.* 288
**Pterogoniopsis paulista* (W.R. Buck & Vital) Carv.-Silva *et al.*	AT	Rare (SP, PR)	Endemic to Brazil	Mat	X				Monoicous	X		X		Peralta *et al.* 25415
Sematophyllum adnatum (Michx.) Brid.	AM, CA, CE, AT	Wide	Neotropical	Mat	X	X	X		Monoicous	X		X		Peralta *et al.* 8159

Sematophyllum lithophilum (Hornsch.) Ångström	AT	Moderate	Neotropical	Mat		X		Monoicous			Koga *et al.* 309 p.p.
Sematophyllum subpiliferum (Broth.) Broth.	AT	Moderate	Afro, Neotropical	Mat			X	Monoicous			Peralta *et al.* 25339
Sematophyllum tequendamense (Hampe) Mitt.	AT	Rare (BA, RJ, SC, SP)	Neotropical	Mat			X	Monoicous			Koga *et al.* p.p. 65
Taxithelium planum (Brid.) Mitt.	AM, CE, AT, PL	Wide	Pantropical	Mat		X		Monoicous			Koga *et al.* 312
Taxithelium pluripunctatum (Renauld & Cardot) W. R. Buck	AM, AT	Moderate	Neotropical	Mat			X	Monoicous	X	X	Oliveira *et al.* 8
Trichosteleum sentosum (Sull.) A. Jaeger	AM, AT	Moderate	Neotropical	Mat			X	Monoicous	X	X	Koga *et al.* 273
**Trichosteleum sublaevigatum* Herzog	AT	Rare (SP)	Endemic to Brazil	Mat			X	Monoicous	X	X	Peralta *et al.* 25470
Vitalia galipensis (Müll. Hal.) P. E. A. S. Câmara, Carv.-Silva & W. R. Buck	AM, CE, AT	Wide	Neotropical	Mat	X	X		Monoicous	X	X	Koga *et al.* 214
Sphagnaceae											
Sphagnum recurvum P. Beauv.	CE, AT	Moderate	Cosmopolitan	Turf	X			Monoicous			Peralta *et al.* 25359 p.p.
Stereophyllaceae											
Eulacophyllum cultelliforme (Sull.) W. R. Buck & Ireland	AM, CE, AT, PL	Wide	Neotropical	Mat		X		Monoicous			Peralta *et al.* 26664
Stereophyllum radiculosum (Hook.) Mitt.	AM, CE, AT, PL	Wide	Pantropical	Mat	X			Monoicous			Peralta *et al.* 26688 p.p.
Thuidiaceae											

Pelekium involvens (Hedw.) A. Touw	AM, CE, AT, PL	Wide	Africa, Neotropical	Weft		X		Monoicous	X	X	X		Peralta *et al.* 26681
*Pelekium minutulum (*Hedw.) A. Touw	AM, CE, AT, PL	Wide	Neotropical	Weft		X		Monoicous					Koga *et al.* 226 p.p.
Pelekium muricatulum (Hampe) A. Touw	CE, AT	Moderate	Neotropical	Weft	X			Monoicous					Amélio *et al.* 874 p.p.
Pelekium schistocalyx (Müll. Hal.) A. Touw	AM, CE, AT, PL	Wide	Neotropical	Weft		X		Monoicous					Peralta *et al.* 26651 p.p.
Pelekium sparsum (Hook. f. & Wilson) Soares, A. E. R. & Câmara, P. E. A. S.	AT	Moderate	America, Oceania	Weft	X		X	Monoicous	X	X			Peralta *et al.* 8200
Thuidium assimile (Mitt.) A. Jaeger	AT	Rare (RJ, SP)	Cosmopolita	Weft	X			Monoicous					Koga *et al.* 333
Thuidium tomentosum Schimp.	AM, CE, AT, PL	Wide	Neotropical	Weft		X		Dioicous					Peralta *et al.* 26633
Division Marchantiophyta													
Aneuraceae													
Aneura pinguis (L.) Dumort.	AT, PL	Wide	Sub cosmopolitan	Mat		X	X	Monoicous	X	X	X		Koga *et al.* 252
Riccardia chamedryfolia (With.) Grolle	CE, AT	Moderate	Sub cosmopolitan	Mat	X	X	X	Monoicous	X	X			Koga *et al.* 246
Riccardia digitiloba (Spruce ex Steph.) Pagán	AM, CE, AT, PL	Wide	Neotropical	Mat		X	X	Dioicous	X			X	Koga *et al.* 249
**Riccardia emarginata* (Steph.) Hell	AT	Rare (BA, MG, RJ, SP)	Endemic to Brazil	Dendroid	X			Monoicous	X	X			Peralta *et al.* 26565 p.p.
Riccardia fucoidea (Sw.) Schiffn.	AT	Rare (BA, ES, RJ, SP)	Neotropical	Dendroid		X		Dioicous/ Monoicous		X			Peralta *et al.* 26561

Riccardia glaziovii (Spruce) Meenks	AM, AT	Moderate	Brazil, Bolivia, Peru		Dendroid		X				Dioicous	X			Peralta *et al.* 26569 p.p.
**Riccardia regnellii* (Ångstr.) K. G. Hell	CE, AT	Wide	Endemic to Brazil		Dendroid				X		Monoicous	X	X	X	Amélio *et al.* 833
							Balantiopsida								
Isotachis aubertii (Schwägr.) Mitt.	AT	Moderate	Africa, Neotropical		Weft		X				Dioicous	X		X	Peralta *et al.* 8149
Neesioscyphus homophyllus (Nees) Grolle	AT	Rare (BA, MG, RJ, SP)	Brazil, Argentina		Weft		X				Dioicous	X		X	Peralta *et al.* 8435
							Calypogeiaceae								
Calypogeia lechleri (Steph.) Steph.	AT	Rare (BA, RJ, SP, RS)	Neotropical		Mat		X				Dioicous				Peralta *et al.* 26577
Calypogeia peruviana Nees & Mont.	AM, CE, AT	Wide	Neotropical		Mat	X	X	X			Dioicous				Peralta *et al.* 8316
Calypogeia uncinulatula Herzog	CE, AT	Rare (DF, MG, RJ, SP)	Neotropical		Mat				X		Dioicous				Koga *et al.* 305
Mnioloma cyclostipa (Spruce) R. M. Schust.	AT	Rare (MG, RJ, PR)	Neotropical	X	Mat		X				Dioicous				Peralta *et al.* 26631
							Cephaloziaceae								
Odontoschisma denudatum (Nees) Dumort.	AM, CE, AT	Moderate	Sub cosmopolitan		Weft		X				Dioicous			X	Peralta *et al.* 8424
							Cephaloziellaceae								
**Fuscocephaloziopsis crassifolia* (Lindenb. & Gottsche) Váňa & L. Söderstr.	AT	Moderate	Endemic to Brazil		Weft	X					Monoicous				Peralta *et al.* 26603
Kymatocalyx dominicensis (Spruce) Vána	AT	Moderate	Madagascar, Neotropical		Weft			X			Monoicous				Peralta *et al.* 8401
							Dumortieraceae								

Dumortiera hirsuta (Sw.) Nees	AM, CE, AT, PL	Wide	Sub cosmopolitan	Mat		X	X				Monoicous	X	X		Koga *et al.* 233
Frullaniaceae															
Frullania apiculata (Reinw., Blume & Nees) Dumort.	AM, CE, AT	Wide	Pantropical	Pendant	X						Monoicous				Oliveira *et al.* 45 p.p.
Frullania atrata (Sw.) Nees	AM, AT	Wide	Neotropical	Pendant	X			X	X		Dioicous	X			Koga *et al.* 111
Frullania brasiliensis Raddi	AM, AT	Wide	Neotropical	Pendant	X						Dioicous	X			Peralta *et al.* 8202
Frullania caulisequa (Nees) Nees	AM, CA, CE, AT, PA	Wide	Neotropical	Weft	X						Monoicous	X	X		Peralta *et al.* 8393
Frullania ericoides (Nees) Mont.	AM, CA, CE, AT, PA, PL	Wide	Pantropical	Weft	X						Dioicous	X		X	Peralta *et al.* 26676 p.p.
Frullania flexicaulis Spruce	AT	Rare (SP, SC)	Neotropical	Mat	X			X			Dioicous	X			Peralta *et al.* 25345
Frullania involuta Hampe ex Steph.	AT	Rare (MA, PE, RJ, SP)	Neotropical	Pendant	X						Dioicous	X			Peralta *et al.* 26622
Frullania kunzei (Lehm. & Lindenb.) Lehm. & Lindenb.	AM, CE, AT, PL	Wide	Neotropical	Weft	X						Monoicous	X	X	X	Peralta *et al.* 25353 p.p.
Frullania obscura (Sw.) Dumort.	CE, AT	Wide	Pantropical	Weft	X		X				Monoicous	X			Peralta *et al.* 8501
Frullania riojaneirensis (Raddi) Spruce	AM, CE, AT, PL	Wide	Pantropical	Weft	X		X	X			Monoicous	X			Koga *et al.* 114
Frullania setigera Steph.	AT	Moderate	Neotropical	Mat	X						Dioicous	X			Peralta *et al.* 8238
**Frullania vitalii* Yuzawa & Hatt.	CE, AT	Moderate	Endemic to Brazil	Mat	X						Monoicous	X	X	X	Peralta *et al.* 25572

Geocalycaceae													
**Saccogynidium caldense* (Angstr.) Grolle	AT	Moderate	Endemic to Brazil	Weft	X	X	X	X	Dioicous				Peralta *et al.* 8346
Herbertaceae													
Herbertus divergens (Steph.) Herzog	AT, CE	Wide	Neotropical	Turf				X	Dioicous				Koga *et al.* 322
Herbertus juniperoideus (Sw.) Grolle	AM, AT	Wide	Neotropical	Turf				X	Dioicous				Peralta *et al.* 8260
Jamesoniellaceae													
Syzygiella concreta (Gottsche) Spruce	AT	Rare (MG, SP)	Neotropical	Weft	X				Dioicous				Peralta *et al.* 8485
Lejeuneaceae													
Acanthocoleus aberrans (Lindenb. & Gottsche) Kruijt	CE, AT, PA	Wide	Africa, Neotropical	Mat	X				Monoicous	X	X	X	Peralta *et al.* 8214 p.p.
Anoplolejeunea conferta (C. F. W. Meissn.) A. Evans	AM, AT	Wide	Neotropical	Mat	X			X	Monoicous	X		X	Peralta *et al.* 8292
Archilejeunea ludoviciana (De Not. ex Lehm.) Gradst. & Geissler	AM, MA	Rare (AM, PR, SP)	Neotropical	Mat	X				Monoicous	X	X		Peralta *et al.* 26643
Bryopteris diffusa (Sw.) Nees	AM, CE, AT	Wide	Neotropical	Pendant	X			X	Dioicous	X			Peralta *et al.* 8367
Bryopteris filicina (Sw.) Nees	AM, CE, AT, PL	Wide	Neotropical	Pendant	X			X	Dioicous		X		Peralta *et al.* 8264
**Ceratolejeunea atlantica* Alvarenga & Ilk.-Borg.	AT	Rare (AL, BA, MG, SP)	Endemic to Brazil	Mat	X				Dioicous		X		Peralta *et al.* 8394
Ceratolejeunea ceratantha (Nees & Mont.) Steph.	AM, AT	Moderate	Brazil, Cuba, French Guiana	Mat	X				Dioicous				Peralta *et al.* 26541 p.p.
Ceratolejeunea cornuta (Lindenb.) Schiffn.	AM, AT	Wide	Neotropical	Mat	X		X		Dioicous/ Monoicous	X			Koga *et al.* 314

Ceratolejeunea fallax (Lehm. & Lindenb.) Bonner	AM, AT	Moderate	Neotropical	Mat	X		X			Dioicous		X		Peralta *et al.* 8256
Ceratolejeunea laetefusca (Austin) R. M. Schust.	AM, CE, AT	Wide	Neotropical	Mat	X					Dioicous				Peralta *et al.* 25394 p.p.
**Ceratolejeunea temnantha* (Spruce) Reiner-Drehwald	AM	Moderate	Endemic to Brazil	Mat					X	Monoicous	X	X		Peralta *et al.* 25430
Cheilolejeunea acutangula (Nees) Grolle	AM, CE, AT	Wide	Neotropical	Mat	X					Monoicous				Peralta *et al.* 8484
Cheilolejeunea clausa (Nees & Mont.)	AM, CE, AT, PL	Wide	Neotropical	Mat	X					Monoicous	X	X		Koga *et al.* 300
Cheilolejeunea discoidea (Lehm. & Lindenb.) Kachroo & R. M. Schust.	CE, AT, PL	Wide	Neotropical	Mat	X					Monoicous	X	X	X	Peralta *et al.* 26676
Cheilolejeunea filiformis (Sw.) W. Ye, R. L. Zhu & Gradst.	AT	Moderate	Neotropical	Weft	X	X	X	X	X	Dioicous	X	X		Peralta *et al.* 8190
Cheilolejeunea holostipa (Spruce) Grolle & R.-L. Zhu	AM, AT	Moderate	Neotropical	Mat			X			Dioicous				Peralta *et al.* 8247
Cheilolejeunea insecta Grolle & Gradst.	AT	Rare (MG, RJ, SP)	Brazil, Bolivia	Mat	X					Dioicous				Peralta *et al.* 25348 p.p.
Cheilolejeunea rigidula (Nees ex Mont.) R. M. Schust.	AM, CA, CE, AT, PL	Wide	Pantropical	Mat	X					Dioicous		X		Peralta *et al.* 8280
Cheilolejeunea unciloba (Lindenb.) Malombe	AT, CE	Moderate	Pantropical	Mat	X		X			Dioicous				Peralta *et al.* 8246
Cheilolejeunea xanthocarpa (Lehm. & Lindenb.) Malombe	AT, CE	Moderate	Pantropical	Mat	X					Monoicous				Peralta *et al.* 8144
**Cololejeunea contractiloba* A. Evans	AM	Rare (BA, PA, RJ, SP)	Endemic to Brazil	Mat				X	X	Monoicous	X	X		Peralta *et al.* 26684

**Cololejeunea diaphana* A. Evans	AM, CE, AT	Moderate	Endemic to Brazil		Mat	X			Monoicous	X				Peralta *et al.* 25376 p.p.
Cololejeunea lanciloba Steph.	AT	Rare (AL, PE)	Africa, Asia, Australia, Brazil	X	Mat			X	Monoicous					Peralta *et al.* 26540
Cololejeunea obliqua (Nees & Mont.) Schiffn.	AM, AT	Wide	Neotropical		Mat			X	Monoicous	X	X	X		Peralta *et al.* 26673
**Cololejeunea papilliloba* (Steph). Steph.	AT, PA	Rare (MG, SP, RS)	Endemic to Brazil		Mat			X	Monoicous				X	Peralta *et al.* 26540
Cololejeunea verwimpii P. Tixier	AT, PL	Moderate	Neotropical		Mat			X	Monoicous	X	X	X		Koga *et al.* 220
Colura calyptrifolia (Hook.) Dumort.	AT	Rare (MG, RJ)	Sub cosmopolitan		Mat	X			Monoicous	X	X	X		Peralta *et al.* 25427
Colura tenuicornis (A. Evans) Steph.	AT	Moderate	Pantropical		Mat			X	Dioicous	X		X		Peralta *et al.* 26595
Colura tortifolia (Nees & Mont.) Steph.	AM, AT	Rare (AC, PA, PE, SP)	Neotropical		Mat			X	Dioicous	X		X		Koga *et al.* 329
Cyclolejeunea luteola (Spruce) Grolle	AM, CE, AT	Moderate	Neotropical		Mat	X			Dioicous				X	Peralta *et al.* 25531
Dibrachiella parviflora (Nees) X. Q. Shi, R. L. Zhu & Gradst.	AM, AT	Moderate	Neotropical		Mat			X	Monoicous	X	X			Koga *et al.* 227
Diplasiolejeunea brunnea Steph.	AM, CE, AT	Wide	Neotropical		Mat			X	Dioicous	X		X		Peralta *et al.* 8378
Diplasiolejeunea cavifolia Steph.	AT	Moderate	Pantropical		Mat	X		X	Monoicous					Peralta *et al.* 25361 p.p.
Diplasiolejeunea pellucida (C. F. W. Meissn. ex Spreng)	AM, AT	Wide	Neotropical		Mat			X	Monoicous	X	X			Peralta *et al.* 25463
Diplasiolejeunea rudolphiana Steph.	AM, AT	Wide	Pantropical		Mat			X	Monoicous	X				Peralta *et al.* 25487 p.p.

Drepanolejeunea anoplantha (Spruce) Steph.	AM, AT	Moderate	Neotropical	Mat	X				Dioicous		X		Peralta *et al.* 8368
Drepanolejeunea campanulata (Spruce) Steph.	CA, AT	Moderate	Neotropical	Mat			X		Dioicous		X		Peralta *et al.* 8382
Drepanolejeunea granatensis (J. B. Jack & Steph.) Bischl.	AT	Rare (MG, RJ, SP)	Brazil, Colombia	Mat	X				Dioicous				Peralta *et al.* 8232 p.p.
Drepanolejeunea lichenicola (Spruce) Steph.	AT	Rare (BA, RJ, SP, PR)	Neotropical	Mat	X				Dioicous				Peralta *et al.* 25349 p.p.
Drepanolejeunea mosenii (Steph.) Bischl.	AM, AT	Wide	Neotropical	Mat		X	X		Dioicous		X		Peralta *et al.* 8281
Frullanoides densifolia Raddi	AM, CE, AT	Moderate	Neotropical	Mat	X	X			Dioicous	X		X	Peralta *et al.* 8514
Frullanoides tristis (Steph.) van Slageren	AT	Moderate	Pantropical	Mat	X				Monoicous	X			Peralta *et al.* 25560
Harpalejeunea molleri (Steph.) Grolle	AT, CE	Moderate	Neotropical, Europe	Mat	X				Dioicous	X		X	Peralta *et al.* 8216
Harpalejeunea oxyphylla (Nees & Mont.) Steph.	AM, AT	Moderate	Neotropical	Mat	X				Dioicous	X			Peralta *et al.* 25476
**Harpalejeunea schiffneri* S. W. Arnell	CE, AT, PL	Moderate	Endemic to Brazil	Mat	X				Monoicous	X	X	X	Peralta *et al.* 26675
Harpalejeunea stricta (Lindenb. & Gottsche) Steph.	AM, AT	Moderate	Brazil, Mexico, USA	Mat	X				Dioicous	X			Peralta *et al.* 25511
Harpalejeunea subacuta A. Evans	CA, AT	Rare (BA, MG, SP)	Neotropical	Mat	X	X			Dioicous	X		X	Peralta *et al.* 8212
Lejeunea adpressa Nees	AM, AT	Wide	Asia, Neotropical	Mat			X		Monoicous	X	X	X	Koga *et al.* 228
Lejeunea aphanes Spruce	AT	Rare (BA, CE)	Neotropical	Mat	X		X		Monoicous	X	X	X	Peralta *et al.* 25409
Lejeunea asthenica Spruce	AM, AT	Rare (AM, BA, SP)	Neotropical	Mat			X		Monoicous	X			Peralta *et al.* 26659

Lejeunea caulicalyx (Steph.) E. Reiner & Goda	AM, CE, AT, PL	Wide	Neotropical	Mat	X					Monoicous	X	X	X		Peralta *et al.* 8463
Lejeunea cerina (Lehm. & Lindenb.) Gottsche *et al.*	AM, AT	Moderate	Neotropical	Mat			X			Dioicous					Peralta *et al.* 8294 p.p.
Lejeunea cladogyna A. Evans	AT	Moderate	Brazil, Mexico, USA	Mat	X		X		X	Monoicous	X	X	X		Peralta *et al.* 25428
**Lejeunea cristulata* (Steph.) E. Reiner & Goda	AT	Moderate	Endemic to Brazil	Mat	X					Monoicous	X	X	X		Peralta *et al.* 25394
**Lejeunea cristuliflora* (Gottsche ex Steph.) E. Reiner & Goda	AT	Moderate	Endemic to Brazil	Mat			X	X		Monoicous	X				Oliveira *et al.* 58
**Lejeunea deplanata* Nees	CE, AT	Moderate	Endemic to Brazil	Mat	X			X		Monoicous					Peralta *et al.* 25403
Lejeunea elliottii Spruce	AT	Rare (BA)	Neotropical	Mat			X			Monoicous	X	X	X		Peralta *et al.* 26585
Lejeunea flagellifera C. J. Bastos, M. E. Reiner & Schäf.-Verw.	AT	Rare (BA, ES, SP)	Endemic to Brazil	Mat	X					Monoicous				X	Peralta *et al.* 25556 p.p.
Lejeunea flava (Sw.) Nees	AM, CA, CE, AT, PA, PL	Wide	Pantropical	Mat	X			X		Monoicous	X	X	X		Peralta *et al.* 8496
Lejeunea grossitexta (Steph.) M. E. Reiner & Goda	CA, AT	Moderate	Neotropical	Mat	X			X		Monoicous	X				Peralta *et al.* 8266
Lejeunea herminieri (Steph.) R. L. Zhu	CA	Rare (BA)	Neotropical	Mat	X					Monoicous					Peralta *et al.* 8195
Lejeunea laeta (Lehm. & Lindenb.) Gottsche	AT	Moderate	Neotropical	Mat				X		Monoicous	X	X			Peralta *et al.* 8355
Lejeunea laetevirens Nees & Mont.	AM, CA, CE, AT, PL	Wide	Cosmopolitan	Mat			X			Dioicous	X				Peralta *et al.* 25405 p.p.
Lejeunea lusoria (Lindenb. & Gottsche) Steph.	AT, CE	Moderate	Neotropical	Mat				X	X	Monoicous	X	X			Koga *et al.* 60

Lejeunea minutiloba A. Evans	AT	Rare (BA, MS, SP)	Neotropical		Mat				X		Dioicous	X	X	X		Koga *et al.* 271
Lejeunea obtusangula Spruce	AM, AT	Moderate	Neotropical		Mat	X	X		X		Monoicous	X	X	X		Koga *et al.* 50
**Lejeunea oligoclada* Spruce	AT	Wide	Endemic to Brazil		Mat	X					Dioicous		X			Peralta *et al.* 26567
Lejeunea pterigonia (Lehm. & Lindenb.) Mont.	AM, AT	Moderate	Neotropical		Mat		X	X	X	X	Monoicous					Peralta *et al.* 8150
Lejeunea puiggariana Steph.	AT, PL	Moderate	Neotropical		Mat	X					Dioicous	X		X		Peralta *et al.* 8436
Lejeunea raddiana Lindenb.	CA, AT	Moderate	Brazil, Bolivia		Mat			X	X		Dioicous	X				Peralta *et al.* 26554
Lejeunea subplana (Steph.) C. Bastos	AT	Rare (SP)	Endemic to Brazil		Mat	X			X		Monoicous	X	X	X		Peralta *et al.* 25527
Lejeunea terricola Spruce	AT	Rare (BA)	Neotropical		Mat	X			X		Monoicous	X		X		Peralta *et al.* 26645
Lepidolejeunea cuspidata (Gottsche) Heinrichs & Schäf.-Verw.	AT	Rare	Neotropical		Mat	X			X		Monoicous				X	Koga *et al.* 193
Lepidolejeunea involuta (Gottsche) Grolle	AM, AT	Wide	Pantropical		Mat				X		Dioicous				X	Peralta *et al.* 25476 p.p.
Leptolejeunea diversilobulata Bischl.	AT	Moderate	Brazil, Cuba, Peru		Mat				X		Dioicous	X	X			Peralta *et al.* 8320
Leptolejeunea elliptica (Lehm. & Lindenb.) Schiffn.	AM, CA, CE, AT	Wide	Neotropical		Mat				X		Dioicous/ Monoicous		X			Peralta *et al.* 8295
Leptolejeunea exocellata (Spruce) A. Evans	AM, CE, AT, PL	Wide	Neotropical		Mat				X		Monoicous					Peralta *et al.* 26534
Leptolejeunea maculata (Mitt.) Schiffn.	AM, AT	Rare (AM, BA, RJ)	Pantropical	X	Mat				X		Dioicous					Koga *et al.* 329 p.p.

Lopholejeunea nigricans (Lindenb.) Schiffn.	AM, CE, AT, PL	Wide	Pantropical		Mat	X					Dioicous/ Monoicous	X				Peralta *et al.* 8236
Marchesinia bongardiana (Lehm. & Lindb.) Trevis.	AT	Rare (BA, RJ, PR, MG)	Neotropical	X	Mat		X	X	X	X	Dioicous		X			Peralta *et al.* 8410
Marchesinia brachiata (Sw.) Schiffn.	AM, CE, AT	Wide	Neotropical		Mat				X		Dioicous/ Monoicous					Koga *et al.* 232
Metalejeunea cucullata (Reinw., Blume & Nees) Grolle	AT	Rare (BA, RJ, SP)	Neotropical		Mat	X					Monoicous	X				Peralta *et al.* 8254
Microlejeunea bullata (Taylor) Steph.	AM, CA, CE, AT, PA, PL	Wide	Neotropical		Mat					X	Dioicous					Peralta *et al.* 25349 p.p.
Microlejeunea cystifera Herzog	AT	Rare (BA, SP)	Brazil, French Guiana		Mat					X	Dioicous					Peralta *et al.* 25562
Microlejeunea globosa (Spruce) Steph.	AT	Moderate	Neotropical		Mat	X				X	Dioicous	X				Peralta *et al.* 8340
Neurolejeunea breutelii (Gottsche) A. Evans	AT	Moderate	Neotropical		Mat			X			Dioicous/ Monoicous	X				Peralta *et al.* 8245
*Odontolejeunea lunulata (*F. Weber) Schiffn.	AM, CE, AT	Wide	Pantropical		Mat	X				X	Monoicous	X	X	X		Peralta *et al.* 8372
Otigoniolejeunea huctumalcensis (Lindenb. & Gottsche) Y. M. Wei, R. L. Zhu & Gradst.	AM, AT	Moderate	Neotropical		Mat	X					Monoicous				X	Peralta *et al.* 25531
Prionolejeunea aemula (Gottsche) A. Evans	AM, CE, AT	Moderate	Neotropical		Mat	X		X			Monoicous		X			Peralta *et al.* 25379
Prionolejeunea denticulata (F. Weber) Schiffn.	AM, AT	Moderate	Endemic to Brazil		Mat			X			Monoicous					Koga *et al.* 310 p.p.
Prionolejeunea galliotii Steph.	AT, CE	Rare (BA)	Neotropical	X	Mat			X			Monoicous	X	X			Koga *et al.* 307

Pycnolejeunea densistipula (Lehm. & Lindenb.) Steph.	AT	Rare (BA, RJ, SP, SC)	Neotropical	Mat	X				Dioicous	X			Koga *et al.* 301
Rectolejeunea emarginuliflora (Gott. ex Schiffn.) Evans	AT	Rare (BA, SP)	Neotropical	Mat	X				Dioicous			X	Peralta *et al.* 26644
**Rectolejeunea versifolia* (Schiffn.) L. Söderstr. & A. Hagborg	AT	Wide	Endemic to Brazil	Mat	X				Dioicous/ Monoicous			X	Peralta *et al.* 26663
Stictolejeunea squamata (Willd. ex Weber) Schiffn.	AM, AT	Wide	Neotropical	Mat			X		Dioicous				Peralta *et al.* 26666
Vitalianthus aphanellus (Spruce) Bechteler, G.E. Lee, Schäf.-Verw. & Heinrichs	AM, AT	Rare (AM, AL, BA, SP)	Neotropical	Mat				X	Dioicous		X		Peralta *et al.* 25409 p.p.
**Vitalianthus bischlerianus* (K. C. Pôrto & Grolle) R. M. Schust. & Giancotti	AT	Moderate	Endemic to Brazil	Mat	X				Monoicous	X			Peralta *et al.* 25370
Xylolejeunea crenata (Nees & Mont.) X.-L. He & Grolle	AM, AT	Wide	Neotropical	Mat				X	Monoicous	X	X		Koga *et al.* 303
Lepidoziaceae													
Bazzania aurescens Spruce	AM, CE, AT	Moderate	Neotropical	Weft		X	X		Dioicous	X		X	Peralta *et al.* 8166
Bazzania cuneistipula (Gottsche & Lindenb.) Trevis.	AT	Rare (MG, RJ, SP)	Neotropical	Weft			X		Dioicous			X	Peralta *et al.* 26576 p.p.
Bazzania gracilis (Hampe & Gottsche) Steph.	AM, AT	Moderate	Neotropical	Weft	X				Dioicous			X	Peralta *et al.* 25393
**Bazzania heterostipa* (Steph.) Fulford	AT	Moderate	Endemic to Brazil	Weft	X			X	Dioicous			X	Peralta *et al.* 8494
Bazzania hookeri (Lindenb.) Trevis.	AM, AT	Wide	Neotropical	Weft	X		X	X	Dioicous			X	Peralta *et al.* 8243
Bazzania longistipula (Lindenb.) Trevis.	AT	Rare (MG, RJ, SP, PR)	Neotropical	Weft	X		X		Dioicous			X	Peralta *et al.* 8224

Bazzania phyllobola Spruce	AM, AT	Moderate	Neotropical	Weft			X			Dioicous			X	Peralta *et al.* 26575
Bazzania stolonifera (Sw.) Trevis.	CE, AT	Moderate	Neotropical	Weft	X					Dioicous			X	Peralta *et al.* 8345
Bazzania taleana (Gottsche) Fulford	AT	Rare (ES, RJ, SP, SC)	Neotropical	Weft	X					Dioicous			X	Peralta *et al.* 8146
Kurzia capillaris (Sw.) Grolle	AM, CE, AT	Wide	Africa, Neotropical	Weft	X					Dioicous				Peralta *et al.* 26553
Lepidozia brasiliensis Steph.	AT	Moderate	Neotropical	Weft	X		X			Dioicous				Peralta *et al.* 26609
Lepidozia cupressina (Sw.) Lindenb.	AT	Rare (BA, PE, RJ, SP)	Africa, Europe, Neotropical	Weft				X		Dioicous				Peralta *et al.* 8329 p.p.
Lepidozia inaequalis (Lehm. & Lindenb.) Lehm. & Lindenb.	AT	Moderate	Neotropical	Weft	X			X		Dioicous				Peralta *et al.* 25512
Telaranea nematodes (Gottsche ex Austin) M. A. Howe	AM, CE, AT	Wide	Pantropical	Weft		X		X	X	Monoicous	X			Peralta *et al.* 8417
				Lophocoleaceae										
Chiloscyphus leptanthus (Hook. f. & Taylor) J. J. Engel & R. M. Schust.	AT	Rare (PA, MG, SP, RS)	America do Sul	Weft			X			Dioicous				Koga *et al.* 261 p.p.
Chiloscyphus mandonii (Steph.) J. J. Engel & R. M. Schust.	AT	Rare	Neotropical	Weft		X		X		Dioicous				Peralta *et al.* 8452
Chiloscyphus martianus (Nees) J. J. Engel & R. M. Schust.	AM, CE, AT, PL	Wide	Africa, Neotropical	Weft	X	X	X	X		Monoicous	X	X		Peralta *et al.* 8307
Chiloscyphus muricatus (Lehm.) J. J. Engel & R. M. Schust.	AT	Moderate	America, Africa, Oceania	Mat	X			X		Monoicous	X	X		Peralta *et al.* 8289
Lophocolea bidentata (L.) Dumort.	AM, CE, AT	Wide	Sub cosmopolitan	Weft				X		Dioicous/ Monoicous				Peralta *et al.* 8468

Lophocolea heterophylla (Schrad.) Dumort.	AT, CE	Rare (BA, GO,SP)	Sub cosmopolitan		Weft					X	Dioicous					Peralta *et al.* 25552 p.p.
Lophocolea trapezoidea Mont.	AT	Rare (MG, RJ, RR, SP)	Neotropical		Weft		X				Dioicous					Peralta *et al.* 26620
Marchantiaceae																	
Marchantia berteroana Lehm. & Lindenb.	AT	Rare (MG, RJ, RS)	America, Africa, Oceania	X	Mat		X				Dioicous		X			Peralta *et al.* 25346
Marchantia chenopoda L.	AM, CE, AT, PL	Wide	Africa, Neotropical		Mat			X			Dioicous				X	Koga *et al.* 262
Marchantia papillata Raddi	AM, CE, AT, PL	Moderate	Pantropical		Mat		X				Dioicous				X	Peralta *et al.* 8506
Metzgeriaceae																	
Metzgeria albinea Spruce	CE, AT	Wide	Pantropical		Mat	X			X	X	Dioicous	X		X	X	Peralta *et al.* 8463
Metzgeria ciliata Raddi	AT	Wide	Neotropical		Mat	X					Dioicous				X	Peralta *et al.* 8252
Metzgeria conjugata Lindb.	AT	Moderate	Sub cosmopolitan		Mat	X				X	Dioicous		X			Peralta *et al.* 8353
Metzgeria dichotoma (Sw.) Nees	AT, CE	Moderate	Neotropical		Mat	X					Dioicous	X	X	X		Peralta *et al.* 8379
Metzgeria fruticola Spruce	AT	Moderate	Neotropical	X	Mat	X		X			Dioicous	X				Peralta *et al.* 25405
Metzgeria furcata (L.) Dumort	AM, CE, AT	Wide	Sub cosmopolitan		Mat	X			X		Dioicous		X			Koga *et al.* 70
Metzgeria hegewaldii Kuwah.	AT	Rare (SP, RS)	Neotropical		Mat	X			X	X	Dioicous		X			Koga *et al.* 59
Monocleaceae																	
Monoclea gottschei Lindb.	AM, AT, PA	Moderate	Neotropical		Mat		X	X			Dioicous					Peralta *et al.* 25401

Pallaviciniaceae														
Pallavicinia lyellii (Hook. f.) S. F. Gray	AM, CE, AT,PL	Wide	Sub cosmopolitan	Dendroid		X			Dioicous	X				Koga *et al.* 248
Symphyogyna aspera Steph.	AM, CE, AT, PL	Wide	Neotropical	Dendroid		X		X	Dioicous	X				Peralta *et al.* 8462
Symphyogyna brasiliensis (Nees) Nees & Mont.	AM, CE, AT	Wide	Neotropical	Dendroid	X	X		X	Dioicous	X	X			Peralta *et al.* 8199
Symphyogyna brongniartii Mont.	AM, AT	Moderate	Neotropical	Dendroid		X		X	Dioicous					Peralta *et al.* 25478
Symphyogyna podophylla (Thunb.) Mont. & Nees	AT	Moderate	Africa, Neotropical	Dendroid		X			Dioicous	X				Peralta *et al.* 8506
Pelliaceae														
Noteroclada confluens Taylor ex Hook. & Wilson	CE, AT	Moderate	Neotropical	Mat		X			Monoicous	X	X	X		Peralta *et al.* 8451
Plagiochilaceae														
Plagiochila adianthoides (Sw.) Lindenb.	CE, AT	Moderate	Neotropical	Tail	X		X		Dioicous		X			Peralta *et al.* 8164
Plagiochila aerea Taylor	AT	Moderate	Neotropical	Tail	X			X	Dioicous				X	Peralta *et al.* 8405
Plagiochila bifaria (Sw.) Lindenb.	AM, AT	Moderate	Neotropical	Tail	X		X		Dioicous					Peralta *et al.* 8182
Plagiochila corrugata (Nees) Nees & Mont.	AM, CE, AT	Wide	Neotropical	Tail	X		X		Dioicous				X	Peralta *et al.* 8517
Plagiochila crispabilis Lindenb.	AT	Rare (MG, RJ, SC, SP)	Neotropical	Tail	X		X	X	Dioicous	X	X			Peralta *et al.* 8384
Plagiochila cristata (Sw.) Lindenb.	AM, AT	Moderate	Neotropical	Tail	X		X	X	Dioicous		X			Peralta *et al.* 8375
Plagiochila exigua (Taylor) Taylor	AT	Rare (BA, MG, RJ,SP)	Africa, Neotropical	Tail			X		Dioicous				X	Peralta *et al.* 8225

Plagiochila gymnocalycina (Lehm. & Lindenb.) Lindenb.	AT	Moderate	Neotropical		Tail	X					Dioicous				X	Koga *et al.* 28
Plagiochila laetevirens Lindenb.	AT	Rare (AC, MT, PA, SP)	Neotropical		Tail	X					Dioicous	X		X		Peralta *et al.* 25520
Plagiochila macrostachya Lindenb.	AM, AT	Moderate	Neotropical		Tail	X					Dioicous					Peralta *et al.* 8428
Plagiochila patula (Sw.) Lindenb.	AM, AT	Moderate	Neotropical		Tail	X			X		Dioicous		X			Peralta *et al.* 8321
Plagiochila punctata (Taylor) Taylor	AT	Rare	Sub cosmopolitan	X	Tail	X		X			Dioicous				X	Peralta *et al.* 8162
Plagiochila raddiana Lindenb.	AM, CE, AT	Wide	Neotropical		Tail	X					Dioicous	X				Peralta *et al.* 8422
Plagiochila rutilans Lindenb.	AM, CE, AT	Wide	Neotropical		Tail	X					Dioicous	X				Peralta *et al.* 25371
Plagiochila simplex (Sw.) Lindenb.	AM, CE, AT	Wide	Neotropical		Tail	X					Dioicous	X				Peralta *et al.* 8314
Plagiochila subbindentata Taylor	AT	Moderate	Neotropical		Tail	X		X	X		Dioicous	X		X		Peralta *et al.* 8244
Plagiochila subplana Lindenb.	AM, AT	Wide	Neotropical		Tail			X	X		Dioicous	X	X			Koga *et al.* 80
Porellaceae																
Porella brasiliensis (Raddi) Schiffn.	CE, AT	Moderate	Neotropical		Pendant	X		X			Dioicous		X			Koga *et al.* 294
Radulaceae																
**Radula brasilica* K. Yamada	AT	Rare (SP, RJ)	Endemic to Brazil		Mat	X					Dioicous		X			Peralta *et al.* 8263
Radula complanata (L.) Dumort.	AT, CE	Wide	Sub cosmopolitan		Mat	X	X				Dioicous	X				Peralta *et al.* 8400
Radula fendleri Gottsche ex Steph.	AT	Moderate	Neotropical		Mat				X		Dioicous				X	Peralta *et al.* 8259

Radula javanica Gottsche	AM, CE, AT, PL	Wide	Pantropical	Mat	X	X	X			Dioicous	X		X		Peralta *et al.* 8373
Radula ligula Steph.	AT	Moderate	Brazil, Argentina	Mat	X					Dioicous					Peralta *et al.* 25400
Radula mammosa Spruce	AM, AT	Moderate	Neotropical	Mat					X	Dioicous					Peralta *et al.* 8309
Radula mexicana Lindenb. & Gottsche	AT	Moderate	Africa, Europe, Neotropical	Mat	X	X	X	X		Dioicous		X			Peralta *et al.* 8185
Radula quadrata Gottsche	AM, AT	Wide	Neotropical	Mat	X					Dioicous				X	Peralta *et al.* 25343
Radula sinuata Gottsche ex Steph.	AT	Moderate	Brazil, Bolivia, Colombia	Mat	X					Dioicous	X				Peralta *et al.* 25551
Radula stenocalyx Mont.	AM, AT	Moderate	Africa, Neotropical	Mat					X	Dioicous				X	Peralta *et al.* 26530 p.p.
Radula tectiloba Steph.	CE, AT, PL	Wide	Neotropical	Mat	X					Dioicous	X			X	Peralta *et al.* 8349 p.p.
Radula tenera Mitt. ex Steph.	AT	Moderate	Brazil, Colombia	Mat	X					Monoicous	X	X	X		Peralta *et al.* 8493
Ricciaceae															
Riccia stenophylla Spruce	CA, CE, AT, PA, PL	Wide	Neotropical	Annual			X			Monoicous	X		X		Koga *et al.* 211
Trichocoleaceae															
**Leiomitra flaccida* Spruce	AT	Moderate	Endemic to Brazil	Weft	X					Dioicous		X			Peralta *et al.* 8171
Trichocolea brevifissa Steph.	AT	Moderate	Neotropical	Weft				X		Dioicous					Peralta *et al.* 25490
Trichocolea tomentosa (Sw.) Gottsche	AT	Moderate	Neotropical	Weft	X					Dioicous					Peralta *et al.* 25490

There were identified 414 species of bryophytes (Tab. 2), 203 to Marchantiophyta (23 families, 62 genus), 204 to Bryophyta (38 families, 105 genus) and seven Anthocerotophyta (three families, four genus). There were recorded 16 new occurrences to SP (6%).

Among liverworts the richest families were Lejeuneaceae (98 species), Plagiochilaceae (17 spp.), Lepidoziaceae (14 spp.), Frullaniaceae and Radulaceae (12 spp. each), Aneuraceae (8 spp.), Lophocoleaceae and Metzgeriaceae (7 spp. each), Pallaviciniaceae (5 spp.). The most well-representative families of mosses were Pilotrichaceae (22 spp.), Fissidentaceae (17 spp.), Sematophyllaceae (16 spp.), Leucobryaceae (12 spp.), Bryaceae, Calymperaceae, Neckeraceae and Ortothrichaceae (11 spp. each). Finally, the richest family of hornworts, in terms of number of species, was Dendrocerotaceae (4 spp.).

Geographical Distribution (Brazilian States, phytogeographic domains and worldwide distribution) – Considering the distribution inside Brazil, 160 species (39%) have wide distribution, 161 species (39%) present moderate and 93 species (22%) have rare distribution.In terms of occurrence of species in the Brazilian phytogeographic domains, 94% occur in Atlantic Forest (AT), 45% in Amazon Forest (AM), 42% in Cerrado (CE), 17% in Pantanal (PL), 11% in Caatinga (CA) and 10% in Pampa (PA) (Fig 5).

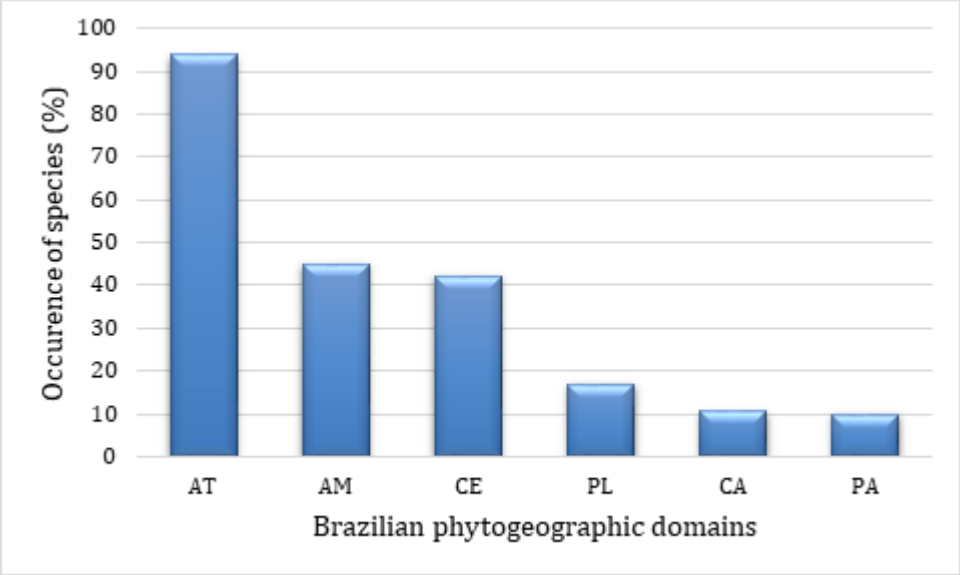

Figure 5. Percentage of species' occurrence in each Brazilian phytogeographic domain.

We highlight that 145 species (35%) are exclusive to AT, but only five species are exclusive to AM, two to CE and one to CA (*Schlotheimia merkelii*, *Pylaisiadelpha tenuirostris* and *Lejeunea herminieri* are new records to AT). On the other hand, 33% occur in three to six domains. The group of domains that share more species in common (48 spp., that represents 12% of the list) is composed of AM, AT and CE (Fig. 6). AM and AT share 57 species (14%), while CE and AT share 34 species (8%).

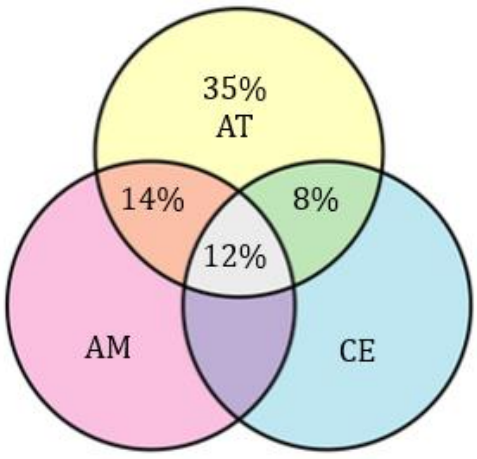

Figure 6. Percentage of species shared among Atlantic Forest (AT), Amazon Rainforest (AM) and Cerrado (CE).

Concerning worldwide distribution, 215 species (52%) are Neotropical, 65 spp. (16%) have disjunctive occurrence (species that were found in one to three countries in the same continent or specific localities in different continents), 46 spp. (11%) are endemic species to Brazil, 45 spp. (11%) are Pantropical, 25 spp. (6%) are cosmopolitan and 14 spp. (3%) are sub cosmopolitan.

Substrates and life form aspects - The most-well representative substrate was tree trunk – with 40% of the species – followed by rock, decaying trunk, soil and living leaves (Fig. 7). About 63% of the total species had preference for a single type of substrate. Some species demonstrated considerable potential to colonize different substrates: the moss *Thamniopsis langsdorffii* (Pilotrichaceae) and the liverworts *Saccogynidium caldense*, *Chiloscyphus martianus* (Lophocoleaceae) and *Radula mexicana* (Radulaceae) occurred simultaneously in tree trunk, soil, decaying trunks and rocks. *Cheilolejeunea filiformis* (Lejeuneaceae) was found inhabiting all the four substrates plus living leaves.

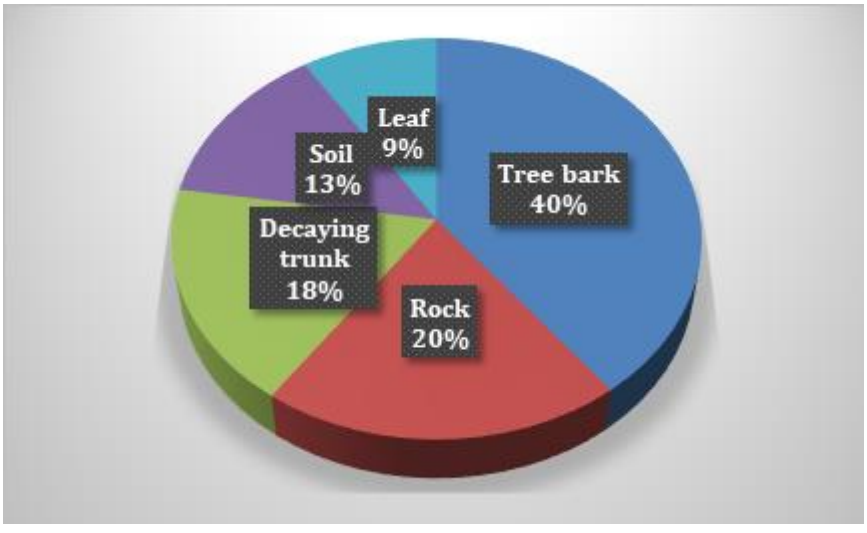

Figure 7. Percentage of species' occurrence per substrate.

The prevailing life form was mat (present in 47% of the total species), followed by turf, weft, fan, pendant, tail, cushion and dendroid (Fig. 8).

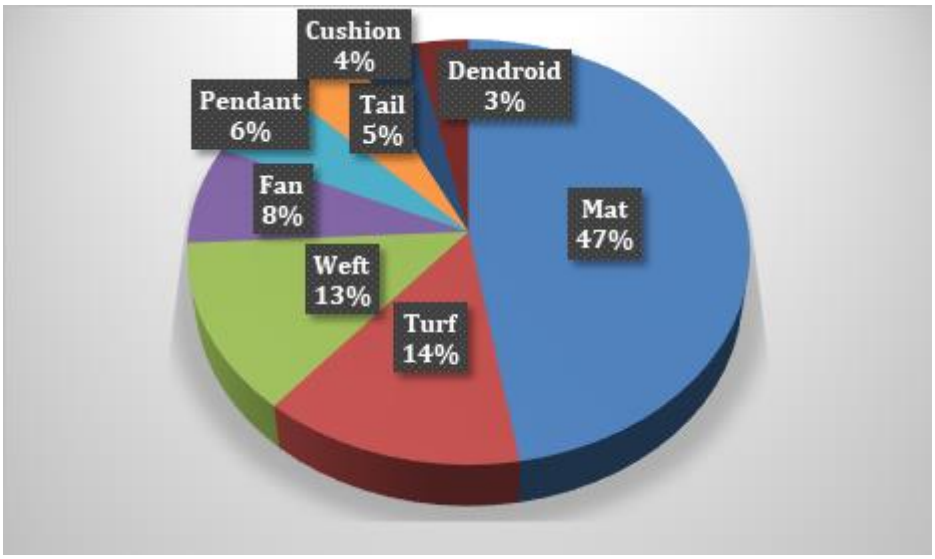

Figure 8. Percentage of species per life form.

Reproductive aspects - The prevailing sexual system was dioicous (56%), followed by monoicous (41%) and 3% of the total species exhibited both sexual systems. Considering the sexual expression, 53% of the species expressed sex - that means the species possess male (antheridia) and/or female gametangia (archegonia) - 32% exhibited sporophytes and 13% presented asexual reproduction (that included caducous leaves, gemmae, fragmented leaves, brood leaves and flagelliform-branches).

Of all species that expressed sex, 46% were dioicous, 51% monoicous and only 3% presented both sexual systems. Of all species that presented asexual reproduction, 82% were dioicous and only 16% were monoicous. Of all species that bore sporophyte, 65% were monoicous and 35% were dioicous (Fig. 9).

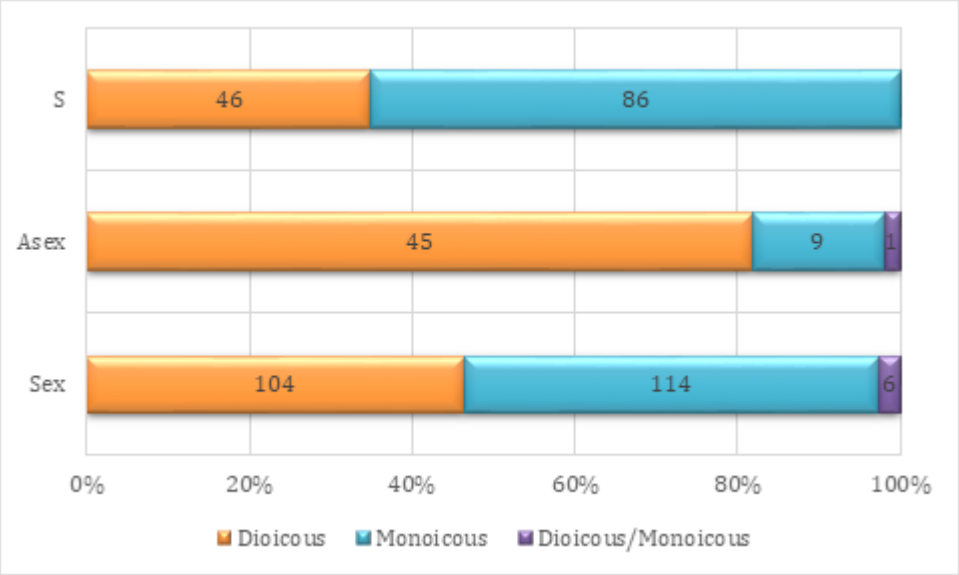

Figure 9. Number of species according to their reproductive strategies: dioicous and/or monoicous. Types of reproduction: S = presence of sporophyte, Asex = asexual reproduction, Sex = sexual reproduction.

Discussion

Species Richness - The richness of liverworts overcoming the mosses represents a common pattern in the floristic surveys in well-preserved areas in Atlantic Forest, as pointed out by Gradstein *et al.* (2001) in all Neotropic. This pattern was described in the Brazilian northeast, in the State of Bahia by Valente & Pôrto (2006), Bastos & Bôas-Bastos (2008), Bastos & Valente (2008) and Bôas-Bastos & Bastos (2009). In the Brazilian southeast was described in the State of Rio de Janeiro by Santos & Costa (2008) and in the State of São Paulo by Yano *et al.* (2009), Carmo *et al.* (2016), Visnadi (2012) and Yano *et al.* (2019).

Nonetheless, our study resulted in practically equal quantities of species of liverworts and mosses. Although the predominant vegetation is composed of Dense Ombrophilous Forest there are patches of Open Ombrophilous Forest (due to the presence of bamboo) and Mixed Ombrophilous Forest (evidenced by *Araucaria angustifolia*). Furthermore the fragments of secondary vegetation and the presence of rocky outcrop and waterfalls become the Park into a heterogeneous landscape. These elements can help explaining the equal numbers of species of liverworts and mosses.

Among mosses, according to Gradstein *et al.* (2001) in lowland rain forests there is predominance of four families: Calymperaceae, Fissidentaceae, Pilotrichaceae and Sematophyllaceae, which coincide with the results of this study. Further inventory surveys carried out in areas of Atlantic Forest - in the State of São Paulo such as Visnadi (2005), Yano & Peralta (2007), Peralta & Yano (2008), Visnadi (2009) and Carmo *et al.* (2016); in the State of Rio de Janeiro by Santos & Costa (2008); in Bahia by Valente *et al.* (2009) - presented Pilotrichaceae as the most well-representative family of mosses, followed by Fissidentaceae, Sematophyllaceae, Bryaceae, Orthotrichaceae and Leucobryaceae (not necessary in the same order).

As mentioned in Vaz-Imbassahy *et al.* (2008), Pilotrichaceae has 11 genus and 51 species and occurs mainly in Amazon Rainforest and Atlantic Forest domains, with the greatest richness in the South and Southeast regions of Brazil. Pilotrichaceae is characterized by well-developed double and elongate costae, presence of hialoderm in most of the species (Buck 1998; Gradstein *et al.* 2001) and leaves arranged in three complanate rows, with lateral asymmetric leaves and median symmetric leaves (Vaz & Costa 2006). These aspects may help the individuals absorb and conduct more water contributing to their colonization success.

From 38 families of mosses, 18 have only one or two species each, a ratio confirmed by the pattern proposed by Gradstein *et al.* (2001), who asserts in lowland rain forests approximately 50% of the families possess only one or two species each.

The most well-representative family was Lejeuneaceae, with richness of 48% of the total number of liverworts, which is compatible with the pattern observed in Gradstein (1995b), that points out Lejeuneaceae as the family with the largest number of species, with richness of 70% in lowland rain forest. However, this percentage tends to decrease as the altitude increase, as seen in lower montane rain forests, where 45% of the species of liverworts are constituted by Lejeuneaceae.

Tropical forests, mainly Atlantic Forest, are characterized by wet climate and a wide range of substrate that provide the colonization by Lejeuneaceae, as we could see: tree trunks, decaying tree trunks, soil, rocks and leaves inhabited by bryophytes (Gradstein *et al.* 2001; Carmo *et al.* 2016). Several inventory surveys carried out in this domain points out Lejeuneaceae as the richest family of liverworts: Visnadi (2005), Yano & Peralta (2007), Peralta & Yano (2008), Santos & Costa (2008), Valente *et al.* (2009), Visnadi (2009; 2015a), Carmo *et al.* (2016), Santos *et al.* (2017a) and Amélio *et al.* (2019).

As discussed in Gradstein (1992), Schuster (1983) and Wilson (2007), the recent diversification of Lejeuneaceae can be attributed to the expansion of angiosperm forests, which have provided a wide range of habitats.

Geographical Distribution - Although most of the species have wide or moderate distribution, 22% of the bryoflora have rare distribution, which is a very significant number, demonstrating the potential of the Rio Turvo State Park to the conservation of species that are concentrated in restricted geographical areas or habitats. Notwithstanding São Paulo State has been well sampled, taking into consideration all the surveys accomplished up to the present, the number of 16 new species occurrences emphasizes the importance of this study in contribute to the Brazilian bryoflora knowledge. The addition of geographical distribution data is extremely important to elaborate lists of regional threatened species that are based on the number of localities where those species usually occur (IUCN 2001).

Philonotis longiseta was reported only for the northeast Brazil, in the States of Bahia and Ceará (Oliveira & Peralta 2015). This is the third citation for the country. It has been usually found on rocks and wet tree trunks, next to waterfalls (Sharp *et al.* 1994). *Dicranella pabstiana* is restricted to Atlantic Forest at altitudes between 500-1000 m. The species has been recorded in Santa Catarina, the location of the material type, and recently in Minas Gerais (DM Carmo & DF Peralta unpubl. res). Other species such as *Callicostella martiana* occurs in a large range, between 0-1,000 m a.l.s. (Vaz & Costa 2006). *Leucomium steerei* has

been collected in montane rain forests, with records only in Serra dos Órgãos (RJ) and Serra dos Carajás (PA) (Moraes & Lisboa 2006).

Porotrichodendron superbum has been found in warm and humid montane rain forests and at the base of the mountains (Fuertes *et al.* 2015). In Brazil, it occurs from average altitudes in Mixed Ombrophilous Forest (this study: 400 m a.l.s.) to elevated altitudes in Dense High Mountain Ombrophilous Forest or cloud forest of Pico do Marumbi (alt: 1213 m a.l.s.), in the State of Parana (Santos *et al.* 2017a).

The first and unique reference of *Pylaisiadelpha tenuirostris* to Brazil is from Selviria municipality district in the State of Mato Grosso do Sul, characterized by Cerradão phytophisiognomy (Yano 2004). The specimen was collected in the base of the tree trunk, differently from the voucher specimen of this publication, which was found on decaying tree.

Mnioloma cyclostipa represents a peculiar species of transition land from Montane belt to Upper Montane belt. It had been recorded only above 1,000 m elevation (Santos *et al.* 2010). However, in the present study, the species occurs in distinct altitude range: 660 m a.l.s., on soil, along the banks of Turvo River.

Prionolejeunea galliotii is a typical species of dense ombrophilous forest, between altitudes 0-700 m a.l.s. Until then, it has been citated only for the State of Bahia (Bastos & Bôas-Bastos 2019).

Daniels *et al.* 2010 highlights *Cololejeunea lanciloba* as a polymorphic species, with several synonyms, such as *Cololejeunea katiae* (the synonymization was published in Pócs *et al.* 2014), which has been recorded only for Recife (PE).

Marchantia berteroana is classified as an endangered species (EN), according to IUCN Red List of threatened species. It occurs in dense ombrophilous forest and semideciduous mesophytic forest (CNCFlora 2012). Burning and clearing the rainforests are the factors that contribute to the habitat fragmentation and consequently, damaging the reproduction and dispersion of the species. In addition, is taken into consideration the

hipothesis of low sampling intensity assigned to the lack of studies in the family Marchantiaceae (CNCFlora 2012).

The fact of the Park harbours 5% of all endemic species of Brazil (275 spp. according to Costa & Luizi-Ponzo 2010) and 35% of the species listed in our survey occur exclusively in the Atlantic Forest domain enhances the importance of preserving the Park to sustain the existent biodiversity.

The most well-representative phytogeographic domains Atlantic Forest, Amazonia and Cerrado share several species between them. This is justifiable because the first two are characterized by tropical rainforests, which are located in the lower zone of the humid tropics (up to an altitude of 1,500 m.a.s.l. near the Equator and up to 600-700 m within the Tropics of Cancer and Capricorn), comprising evergreen, tall trees, shrubs, lianas and epiphytes, with annual rainfall of 1,500 mm up to 6,000-8,000 mm (Pócs 1982). With regard to Cerrado, there are several phytophisiognomies "*capões de mata*", slope forests (*matas de encosta*) and gallery forests (*matas de galeria*) that constitute a green oasis, providing humid microhabitats for the establishment of bryophytes (Pinheiro *et al.* 2012).

Concerning global scale, almost 50% of the species have Neotropical distribution. Neotropics comprises a very heterogeneous landscape, including hot tropical rain forests of the Amazon basin and Atlantic Forest, the high frozen mountains of Andes, dry savannas and scrubby vegetation of the Brazilian Planalto region and the exuberant tropical islands of the West Indies (Gradstein *et al.* 2001). This wide range of phytophisionomy provide a very rich and diverse flora, responsible for supply habitats for almost 4,000 species of bryophytes (Gradstein 2001).

Schuster (1983) assumes there are few species genuinely pantropical. It could be mentioned *Octoblepharum albidum*, *Calymperes afzelii* and *Fissidens asplenioides*. In liverworts it was observed that most of the species occurs in low and medium elevations, such as *Lejeunea flava* and *Cheilolejeunea xanthocarpa* (Schuster, 1983).

About 8% of the bryoflora are cosmopolitan/sub cosmopolitan. Mosses with this distribution is usually found in disturbed or open sites (Schuster 1983), like *Bryum argenteum* (collected on cement) and *Polytrichum juniperinum* (harvested on ravine in the edge of the highway). In the case of cosmopolitan hornworts, Schuster (1983) recorded the occurrence of *Phaeoceros laevis* in cultivated fields (we collected in the ravine behind of a abandoned house). Its long-viable spores are man-dispersed and typically mixed with seed grains and nursery stock (Schuster 1983).

Substrates and life form aspects – As we can see in our study, in tropical forests most of the bryophytes spread on tree trunks and branches – acting as epiphytes – and on decaying trunks (Richards 1984; Visnadi 2015a). It is important to highlight that in ombrophilous forests the most available substrate are tree trunks, shrubs and lianas (Grastein 1995a).

Several studies have demonstrated the relationship between the composition of corticicolous species of bryophytes and the conditions of the phorophyte, such as pH, roughness and water retention capacity, in addition, associating the percentage of coverage with the diameter of the breast height (DBH) (Batista & Santos 2016). Oliveira & Mota de Oliveira (2016) shows that, in fragments of Atlantic forest in northeastern of Brazil, the composition of species varies along a gradient of height. These diverse factors provide many microhabitats and niches that can be colonized by different communities (Smith 1982; Frahm 1990).

This wide range of microhabitats is not provided in other substrates like soil (Batista *et al.* 2018). Within the forests it is not common to find bryophytes on soil due to the great amount of litter and its fast decomposition (Frahm 2003). However, rupicolous species had great representativeness due to the presence of rock outcrops and rocks on the edge of waterfalls.

The presence of epiphyllous bryophytes is an important feature of tropical forests and represents an indicator of preserved native areas (Gradstein *et al.* 2001). Furthermore, the more humid, the greater the rate of migration from the trunks and branches to the leaves. By far, Lejeuneaceae is the most well-representative family of epiphyllous bryophytes (Frahm 2003). As the leaves represent an ephemeral substrate, the most successful species in colonization exhibited morphological adaptations, such as neoteny (reduction of the gametophyte), short life cycle, high fertility, asexual reproduction by gemmae and mucilaginous structure for fixation on the surface (Frahm 2003; Zartman 2003). The occurrence of epiphylls suggests the importance to continue protecting the RTSP.

The fact of 63% of the bryoflora are specific for a single type of substrate means that the RTSP has predominant stable environments, unlike the regeneration areas, which bryophytes use to establish in a wide range of substrates (Peralta & Yano 2008; Visnadi 2015a).

According to the model proposed by Bates (1998), mats are common in places with high to medium desiccation tolerance, shaded and lit, due to the own morphology of their gametophytes, which are creeping and branched, forming a moisture containment grid and carbon stock. In shaded habitats it is possible to associate the flat arrangement of stems and leaves of fans and mats with the optimization of the surface area for capturing light.

Turfs, which have dense foliage, are capable of storing water in the spaces between the leaves and gametophytes by capillarity (Glime 2017a), and have a protective layer against desiccation, which allows them to live under conditions of medium to high luminosity, favoring their proliferation in very damp places (Bates 1998).

Wefts are found in moist and moderately shaded condition (Bates 1998). Sollows *et al.* (2001) tested *Bazzania trilobata* and observed that the overlapping leaves provide a protection way against direct exposure that could harm the net photosynthesis of inner shoots. In addition, they realized that the overlapping leaves conserve more water.

In tropical and subtropical cloud forests there is a high rate of precipitation throughout the year and, consequently, high moisture, so pendants and tails stand out due to their feathery stems, which make it possible to collect water vapor droplets from the atmosphere (Richards 1984; Glime 2017a).

Cushions are found more frequently in dry environments, with a high incidence of light. Their gametophytes bundle in a compressed colony, causing a self-shading effect - when individuals physically very close to one another end up shading each other, protecting colonies from direct radiation from the sun (Bates 1998). As the stems are the same height, the wind turbulence and water evaporation are decreased (Glime 2017a). Furthermore, the colony shape provides stability and support for gametophytes, which do not have lignin (During *et al.* 2015).

Dendroids, which stand out in environments with medium humidity and brightness, climb higher layers towards the light elevating the stems from their horizontal shoots, since they grow from the base of logs (Bates 1998).

On certain occasions, particular species may vary their way of life suiting to the conditions of the environment. Rincon and Grimes (1989) attribute the phenotypic plasticity of life forms to foraging behavior towards water retention adaptation, then representing a competitive strategy to enhance the absorption of nutrients present in the soil and water.

Reproductive aspects - As reported in Hedenäs & Bisang (2011), there are more dioicous than monoicous species. According to Villarreal & Reiner (2013), 68% of liverworts species, 57% of mosses species and 40% of hornworts species are dioicous. In the study of Hedderson & Longton (1995) a proportion of 60% of dioicous species to 40% of monoicous species was observed, which is a similar result to our survey.

Ando (1980) assumes monoicous individuals – that posses both male and female sexual organs – as the sexual system that has more chances for fertilization. For this reason, bryophytes that inhabit recent and ephemeral substrates, such as decaying wood and living

leaves, have a greater tendency to the monoicism. Actually, all the twenty species that were adhered exclusively to decaying trees, or exclusively to leaves, or both substrates were monoicous. To avoid self-fertilization, several species have developed adaptations, as protandry (maturation of antheridia before archegonia on the same plant) and protogyny (maturation of archegonia before antheridia) (Maciel-Silva & Pôrto 2014).

According to Villarreal and Renner (2013), the mating systems depend on the spores size, but the inverse it is not confirmed. For example, dioicous species have smaller and numerous spores, that guarantee the conquest of a larger territory, since the spores are more easily dispersed forming mats of gametophytes, achieving even disturbed and ephemeral habitats. In addition, dioicous species generally grow more in size and have a more expansive life style, such as mat, to compensate for the lower production of sporophytes (Crawford *et al.* 2009). Our results confirm this statement since 35% of the dioicous species present mat as life form, followed respectively by turf (18%), weft (13%), pendant (10%), tail (9%), cushion (6%), fan (5%) and dendroid (4%).

Places subjected to the seasonal effects – long dry periods and irregular precipitation - like the humid enclave of Chapada do Araripe, located in the Caatinga dryland domain, the monoicism prevails – in view of this sexual system likely guarantees more fecundity (Batista *et al.* 2018). By contrast, Santos *et al.* 2017b assume that in more humid environments, such as the ombrophilous forests of the Atlantic Forest domain, there is a higher tendency to dioicism, considering the substantial water availability that contributes to the larger occurrence of sexual reproduction events. Moreover, our study confirmed this assumption.

One of the advantages of dioecism is that, from outbreeding, there is greater genetic variability, contributing to the broader morphological range of character states, as observed in the genus *Campylopus* (Frahm 1991), currently classified in the family Leucobryaceae. However, dioicism also presents disadvantages, for example, many species of bryophytes, when fixing in a habitat, form a colony consisting generally of only one sex, making out-

breeding difficult, as antherozoids (male gametes) need to travel great distances through the water blade to reach the archegonia (female gametes) (Haig 2016). For this reason, many dioicous species end up investing in asexual reproduction to guarantee the spread of populations (Frahm 2001; Maciel-Silva & Pôrto 2014). This pattern was observed in our study: 86% of the species that showed vegetative reproduction were dioicous.

Vegetative reproduction can be stimulated as a strategy of dispersion and colonization when plants are submitted to some selective pressure from the environment, such as temperature increase, direct incidence of sunlight and desiccation. During (1979) realized in rain forests it was common to find *Campylopus flexuosus* forming large turfs without vegetative reproduction, while in dry forests the plants behaved forming dense cushions with detachable branches.

Conclusion – The Rio Turvo State Park has a very rich bryoflora, counting with 414 species, which represent 10% of the Neotropic, 30% of Brazil and approximately 50% of the species known to São Paulo State. Although the presence of anthropogenic intervention in the area, the RTSP presents a great potential in harbouring species that are not very well known – 16 new occurrences for São Paulo State were recorded – and have restricted geographic distribution, such as *Pylaisiadelpha tenuirostris* and *Prionolejeunea galliotii* (both are second citation for Brazil) and *Marchantia berteroana* (an endangered species).

We could understand why some families predominated over other ones when we analyzed the ecological aspects, since they reflect the environmental conditions of the area. As expected in areas with a huge water availability, so with a higher probability of sexual reproduction, dioicous species are likely to predominate. In this way, the wet climate and shading caused by the forest canopy provided the prevalence of mat, which morphology enables a greater water storage and an optimized surface area to capture light.

The predominance of corticolous species can be assigned to the greater availability of tree trunks and branches, highlighting the magnificence of the dense forest structure in the

territory of the RTSP, as well as the significative presence of epiphylls is one more indicator of a well-preserved vegetation. All these data provide us subsidies to reinforce the importance of this Conservation Unit for the preservation not only of the RTSP's bryoflora but of all the biodiversity that are interconnected in those ecosystems.

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4.2 CAPÍTULO 2

Comparing floristic inventories of the Rio Turvo State Park and seventeen Conservation Units distributed along the temperate and tropical Atlantic Forest based on floristic similarity and qualitative analysis of climatic and geographic factors

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Abstract

The Atlantic Forest is one of the most endangered phytogeographic domains in the world, harbouring an incredible biodiversity, which have required great attention, mainly in the occurrence and distribution of the species. The Rio Turvo State Park (RTSP) is located in the Vale do Ribeira region, temperate zone in the State of São Paulo. The aim of the study was to compare several floristic inventories of bryophytes from eighteen locations (including RTSP) in the Atlantic Forest along the Brazilian's coast, in order to understand how the species are distributed in the temperate and tropical zones and what the factors that influence their pattern of distribution. The cluster analysis resulted in four distinct groups by similarity of absence/presence of species: one that is attributed to the type of vegetation and annual rainfall shared by the areas; two that are strongly influenced by longitude and the last is due to the relief and average temperature.

Keywords: similarity analysis**,** **f**loristics inventory, bryoflora, Vale do Ribeira, ombrophilous forests, dendrogram.

Introduction

The Rio Turvo State Park (RTSP), located in the Atlantic Forest phytogeographic domain, was renowned as a conservation unit (UC) by the law SNUC 9.985/2000 officially in 2008 (BIM *et al.* 2017). In the beginning, RTSP's territory was included in the Jacupiranga State Park (founded in 1969), which came to be named Jacupiranga Mosaic of Protected Areas (MOJAC) since 2008 (BIM & CAMPOLIM 2016), that comprehend another conservation unit with integral protection (Caverna do Diabo and Lagamar de Cananéia State Parks), Sustainable Development Reserves (SDR), Environmental Preservation Areas (EPA) and Extractive Reserves (ER), totaling 243.885,78 ha (BIM *et al.* 2017).

According to Bim & Campolim (2016), 89,8% of the area are composed of dense and mixed ombrophilous forests in good conservation status, while 10,2% corresponds to the area under subsistence agriculture (e.g. grains, banana) and livestock.

PERT harbour several species of flora and fauna, including endangered species, such as the *Amazona vinacea* Kuhl (papagaio-de-peito-roxo, Psittacidae), the *Panthera onca* L. (jaguar, Felidae) and the *Leontopithecus caissara* (mico-leão-da-cara-preta, Callitrichidae) (Bim & Furlan 2013). Furthermore, the Park has a great archaeological significance because the presence of a fluvial sambaqui, where it was found one of the oldest human fossil of the Americas, dated 10,400 years AP (Pivetta 2005).

Moreover, the Park is open for ecotourism activities, such as visits to Mirante do Aleixo (1,100 m a.s.l. with views of Cajati and Serra do Mar State Park), Cachoeira do Azeite, Gruta da Capelinha, Trilha da Cachoeira and Trilha das Andorinhas (Portal do Governo do Estado de São Paulo 2018).

Based on that, it is evident the importance of conservation units to promote public policies for the protection of natural landscapes and historical-cultural heritage; the restoration of degraded areas; its sustainable use for ecological tourism and subsistence of

local populations and the development of scientific research and environmental education (Brasil 2011).

The Atlantic Forest is the second greatest tropical rainforest of America, which is located eastern of the dry corridor, along the Brazilian coast, from northeastern to southern Brazil, eastern Paraguay and northeastern Argentina (Oliveira-Filho & Fontes 2000). In the beginning, the Atlantic Forest have covered around 150 mi ha, however, nowadays it remains only 12,4% of its original extension preserved (Ribeiro *et al.* 2009, SOS Mata Atlântica 2018).

The vegetation encompasses forest physiognomies such as rainforests, semi-deciduous forests, *Araucaria* forests in the south (temperate zone), mangrove, restinga and enclaves of "brejos" forests in the northeast (Oliveira-Filho & Fontes 2000, Tabarelli *et al.* 2005).

Its latitudinal range is between 4º and 32º, including tropical and temperate regions. Its altitude varies from sea level until 2,900 m a.s.l., with different types of soil and temperature fluctuation (Mantovani 2003). Its longitudinal range influences in the phyto physiognomies, since the rainfall level decreases from coastland (where it overcomes 4,000 mm throughout the year) to hinterland (1,000 mm/year) (Câmara 2003, Ribeiro *et al.* 2009).

All these geographical aspects have contributed to the giant biodiversity (and high endemism rate, however, it is the most inhabited phytogeographic domain in the country, sheltering more than 145 mi people (72% of Brazilian population) (SOS Mata Atlântica 2018), which have ranked fourth on the list of 25 priority conservation hotspots in the planet (Myers *et al.* 2000).

Considering its enormous importance, it was declared a National Heritage by the Federal Constitution of 1988, and it was granted with the title of Biosphere Reserve by Unesco (SOS Mata Atlântica, 2018). Taking these factors in account, we can see how it is so

essential to protect all the UCs for the maintenance of biodiversity in the limited area that still exists.

The Atlantic Forest is the domain with the highest rate of bryophyte richness and endemism in Brazil (Costa *et al.* 2011). From 1,572 species in the country, 1,347 are present in the Atlantic Forest, 915 in the State of São Paulo and 334 are endemic to Brazil (Flora do Brasil 2020 em construção, 2020).

A lot of bryophyte surveys were carried out in Atlantic Forest areas, covering along the Brazilian coast to hinterland. For example, there were recorded 208 species of bryophytes in Michelin Ecological Reserve (Bastos & Bôas-Bastos 2008, Bastos & Valente 2008, Bôas-Bastos & Bastos 2009) and 131 species in a remnant of Serra da Jibóia (Valente & Pôrto 2006, Valente et al. 2009), both areas from Bahia, in the northeast. In the southeast there were found several inventories with a very considerable richness, mainly in the State of São Paulo: in Campos do Jordão, Ilha do Cardoso and Rio Turvo State Parks there were identified 490 (Amélio *et al.* 2019), 440 (Yano *et al.* 2019) and 414 (ML Koga & DF Peralta unpubl. res.) species respectively. In the South region, more specifically in Pico do Marumbi State Park, (Parana) there were reported 364 species (Santos *et al.* 2017a).

Despite the wide range of bryophyte inventories, just a few approaches a comparative analysis among the other studies, in terms of floristic similarity: Carmo *et al.* (2015), Visnadi (2012; 2013a; 2013b; 2015a; 2015b). In a more extensive scale, Amorim *et al.* (2017) evaluated the similarity among twelve different areas in the southeastern Brazil testing the environmental factors that influenced in the distribution of the species.

Finally, the purpose of this study is to compare several floristic inventories of bryophytes from eighteen locations in the Atlantic Forest along the Brazilian coast, including the Rio Turvo State Park, in terms of absence and presence of taxa. Then, it is going to be possible to understand how the species are distributed in the temperate and tropical zones and what the factors that influence their pattern of distribution.

Materials and methods

Study area - The studied area is fully covered by Atlantic Forest and comprise the conservation unit named Rio Turvo State Park (24º 47'- 24º 57' S, 48º 09' - 48º 25' W), in the Vale do Ribeira region, south of São Paulo State. The total area has 73,893.87 ha and comprises the cities of Jacupiranga, Cajati and Barra do Turvo (Portal do Governo do Estado de São Paulo 2018). The vegetation is characterized by Dense Ombrophilous Forest and Mixed Ombrophilous Forest (IBGE 2012), with altitude ranging from 10 to 1,500 m a.s.l. (Bim & Furlan 2013). The climate can be defined as permanently humid subtropical, influenced by tropical and polar sea air masses (Monteiro 1973). Following the Köppen-Geiger classification, areas with lower altitude are classified as Cfa (humid subtropical climate), while areas at altitudes above 700m are Cfb (oceanic climate) (Lepsch *et al*. 1990). The average temperature varies between 11 and 32º C (Ross 2002). It rains a lot during the year, with an average annual rainfall that ranges from 1,000 to 3,000 mm/year, but less intense in June, July and August (Ross 2002). The Park is inserted in the basin of the Ribeira do Iguape River where the main rivers Turvo, Jacupiranga and Pardo flow. The pedological aspect presents mountainous relief, deep and narrow valleys (Bim *et al.* 2017). The Park vegetation is predominantly primary, nonetheless there are some secondary succession patches occasioned by anthropogenic intervention such as deforestation for habitation, farming activities and extractivism (Bim & Furlan 2013) of *Euterpe edulis* Mart. (Brazilian popular name: *palmito juçara*).

Comparative analysis - It was carried out a comparative analysis among eighteen selected bryofloristic inventories from different regions of Brazil, including the Rio Turvo State Park study (ML Koga & DF Peralta unpubl. res.). For this purpose, we built a matrix of presence and absence of species as binary descriptors including rare species. The list (ANEXO) is organized considering first of all the division, then family, genus and finally species. All the

names was actualized to the current names and the classification system follows Renzaglia *et al.* (2009) for Anthocerotophyta, Crandall-Stotler *et al.* (2009) for Marchantiophyta, and Goffinet *et al.* (2009) for Bryophyta with adaptation from recent classification studies of certain genus and families. The abbreviation of the authors' name in the species list were based on Brummitt & Powell (1992).

The adopted criteria to select the studies were: (1) the areas should be necessary from Atlantic Forest; the geographical location should be well-delimited (i.e. conservation units or a remnant with specified coordinates, municipalities and point of reference, like a well-known mountain of the region); (2) the applied collect methods should be random-walk technique; and (3) the list should have at least one hundred species, because this is the minimum amount compatible to the sampling effort used in the Rio Turvo State Park.

The selected floristic inventories (Tab. 3) carried out in the temperate zone were: ML Koga & DF Peralta unpubl. res., Peralta & Yano (2008, 2012), Visnadi (2012; 2013b; 2015a; 2015b), Santos *et al.* 2017a and Yano *et al.* (2009, 2019). In the tropical zone were: Amélio *et al.* (2019), Bastos & Bôas-Bastos (2008), Bastos & Valente (2008), Bôas-Bastos & Bastos (2009), Carmo *et al.* (2016), Santos & Costa (2008), Siqueira *et al.* (2011), Valente & Pôrto (2006), Valente *et al.* (2009), Visnadi (2013a) and Yano (2005).

Then we calculated the frequencies based on how many studies each species occurred.

Afterwards, it was drew up a cluster multivariate analysis applying the PAST software, version 3.19 (Hammer *et al.*, 2001). It was selected the Unweighted Pair Group Method using Arithmetic Averages (UPGMA) using the Jaccard similarity index ($C = j / (a + b - j)$, where "j" is the number of species found in both places, "a" is the number of species found at site A, "b" is the number of species found at site B) (Magurran 1988).

Results

Table 3. Characteristics of the 18 areas analysed in this study, separated by Temperate and Tropical Zone. Climate: Af = equatorial, fully humid, without dry season; Am = equatorial, sub humid, monsoonal, with rainy winter; Aw = equatorial with dry winter; Cfa = warm temperate, humid, with hot summer; Cfb = warm temperate, fully humid, warm summer; Cwb = warm temperate of altitude, with dry winter and humid summer. Total spp. = total number of species of bryophytes of each inventory.

UC/forest remnant	Vegetation	Coordinates	Area (ha)	Altitude (m a.l.s)	Climate	Rainfall (mm/year)	Total spp.
Temperate Zone							
Alto do Ribeira Touristic State Park, ARTSP- Apiaí, Guapiara, Iporanga/SP (Visnadi 2013b)	Dense Ombrophilous Forest/Open Ombrophilous Forest	24°16'40" - 24°38'30" S, 48°27'20" - 48°44'00" W	35,884	80-1,146	Cfb	1,963.30	109
Rio Turvo State Park, RTSP Barra do Turvo, Cajati, Jacupiranga/SP (ML Koga & DF Peralta unpubl. res.)	Dense/Mixed Ombrophilous Forest	24º 47'- 24º 57' S, 48º 09' - 48º 25' W	73,893	10-1,500	Cfa/Cfb	1,000-3,000	414
Pico do Marumbi State Park, PMSP Morretes, Quatro Barras, Piraquara/PR (Santos *et al.* 2017a)	Dense Sub-mountain/Mountain/ Upper Mountain Ombrophilous Forest/ Mixed Ombrophilous Forest	25° 24' – 25° 31' S, 48° 5' – 48° 58' W	8,745	300-1,539	Cfb	3,700	364
Ilha Anchieta State Park, IASP Ubatuba/SP (Peralta & Yano 2008)	Dense and sparse Atlantic Forest,, Restinga, Rocky shores, Mangrove, Anthropic Field	23º 31' - 23º 34' S, 45º 02' - 45º 05' W	828	0-339	Af	2,100	243
Juréia-Itatins Ecological Station, JIES - Iguape, Miracatu, Itariri, Peruíbe/SP (Visnadi 2012)	Dense Sub-mountain/Mountain/ Upper Mountain Ombrophilous Forest	24º 18' - 24º 32' S, 47º 00' - 47º 30´ W	92,223	450-1,240	Af	2,277.80	278
Ilha do Cardoso State Park, ICSP Cananéia/SP (Yano *et al.* 2019)	Pioneering Dunes Vegetation, Restinga, Tropical Pluvial Forest of Coastal Plain and Serra do Mar, Mangrove	25º03'05" - 25º18'18"S, 48º05'42" - 48º53'48"W	22,500	0-800	Af	>3,000	440
Francisco Affonso de Mello Natural Municipal Park, Serra do Itapeti, FAMNMP - Mogi das Cruzes/SP (Peralta & Yano 2012)	Dense Ombrophilous Forest	23° 29' 22" S, 46° 11' 55" W	352	807-1,140	Cwb	1,300-1,700	216
Intervales State Park, ISP - Eldorado Paulista, Guapiara, Iporanga, Ribeirão Grande e Sete Barras, além de Apiaí, Capão Bonito/SP (Visnadi 2015b)	Dense Ombrophilous Forest	24º 12' - 24º 32' S, 48º 03'- 48º 32' W	41,704	60-1,100	Cfb	1,450-1,750	220

Fontes do Ipiranga State Park, FISP São Paulo, SP (Visnadi 2015a)	Seasonal Semi-deciduous Forest	23°38’08”- 23º40’18” S, 46°36’48”- 46°38’00” W	493	798	Cwb	1,539.90	266
Alto da Serra de Paranapiacaba Biological Reserve, ASPBR Santo André/SP (Yano *et al.* 2009)	Dense Montane Ombrophilous Forest	23°46’00” - 23º47’10” S, 46°18’20” - 46º20’40” W	440	750-890	Cfb	3,380	239
		Tropical Zone					
Serra do Mar State Park, SMSP, núcleo Picinguaba Ubatuba/SP (Visnadi 2013a)	Dense Lowland Ombrophilous Forest, Restinga	23º15’00” - 23º27’50” S, 44º43’30” - 45º15’00” W	47,500	0-100	Af	>2,200	110
Serra do Mar State Park, SMSP, núcleo Santa Virgínia - São Luiz do Paraitinga, Natividade da Serra/SP (Carmo *et al.* 2016)	Dense Montane/ Upper Montane Ombrophilous Forest	23° 17' - 23° 24' S, 45° 03' - 45° 11' W	17,500	860-1,650	Af	>2,200	386
Campos do Jordão State Park, **CJSP** Campos do Jordão/SP (Amélio *et al.* 2019)	Mixed Ombrophilous Forest	22° 44' S, 45° 30' W	8,341	1,500-2,000	Cfb	1,804	490
El Nagual Private Natural Heritage Reserve, Serra dos Órgãos, ENPNHR Magé/RJ (Santos & Costa 2008)	Dense Sub-mountain Ombrophilous Forest	22º 32’ 35’’ S, 43º 03’ 56’’ W	17.2	170-450	Cfb	1,000-2,200	137
Vale do Rio Doce Natural Reserve, VRDNR Linhares, Jaguaré/ES (Yano 2005)	High Forest, Flooded Forest, Swamp Forest, Muçununga, Native Pasture, Capoeira	19º 06 - 19º 18' S, 39º 45' - 40º 19' W	22,000	28-65	Aw	1,403	136
Michelin Ecological Reserve, MER - Igrapiúna, Ituberá/BA (Bastos & Bôas-Bastos 2008, Bastos & Valente 2008, Bôas-Bastos & Bastos 2009)	Dense Lowland Ombrophilous Forest	13º 48’ 08"S, 39º 10’ 03" W	3,096	90-383	Af	2,015	208
Serra da Jibóia Remnant, SJR Santa Teresinha/BA (Valente & Pôrto 2006, Valente *et al.* 2009)	Dense Montane ombrophilous forest	12º 51’S, 39º 28’ W	600	400-800	Am	800-1200	131
São Luís Farm, SLF, **Planalto de Ibiapaba** Ubajara/CE (Siqueira *et al.* 2011)	Tropical Semi Evergreen Cloud Forest	3° 47’ 53” S, 40° 54’ 19” W	32	700-900	Am	1,350-1,750	102

Considering the eighteen floristic inventories included in the cluster multivariate analysis, the total number of species was 1,146. It resulted in a dendrogram (Fig. 10), which similarity among the species varies between 0.13 and 0.42. The cophenetic correlation coefficient was high (0.84), showing high faithfulness of the dendrogram to the pairwise distances of the original unmodeled data point.

It is possible to observe four distinct groups clearly related with the latitude range, consisted by the following areas: (1) Serra do Mar State Park - SMSP Núcleo Santa Virgínia (SP), RTSP (SP), Pico do Marumbi State Park - PMSP (PR) and Campos do Jordão State Park - CJSP (SP); (2) Ilha Anchieta State Park - IASP, Juréia-Itatins Ecological Station - JIES and Ilha do Cardoso State Park - ICSP (SP); (3) Intervales State Park - ISP and Fontes do Ipiranga State Park – FISP (SP); (4) Vale do Rio Doce Natural Reserve - VRDNR (ES), Michelin Ecological Reserve - MER and Serra da Jibóia Remnant - SJR (BA).

Only 13 % of the 1,146 species have frequency (f) greater than 0.5, in the other words, 13 % of the total list occurred in nine or more bryofloristic inventories. And 51 % of the species have f = 0.1; 18 % have f = 0.2; 10 % have f = 0.3; 8 % have f = 0.4; 8 % have f = 0.5 - 0.6 and 4% have f = 0.7 - 0.8. Only six species presented f = 0.9, and only one species occurred in all the eighteen studies (*Lejeunea flava*, Lejeuneaceae). Thirty species were collected exclusively in the RTSP.

Discussion

The group 1 can be explained by the high proximity among the four locations and elevated number of species (> 363). RTSP, PMSP and CJSP are characterized by mixed ombrophilous forest, high rainfall (more than 2,200 until 3,700 mm/year) and their predominant climate, according to Köppen-Geiger classification, is Cfb (warm temperate, fully humid, with frequent frosts) (Tab. 3). Although SMSP - Núcleo Santa Virgínia has a

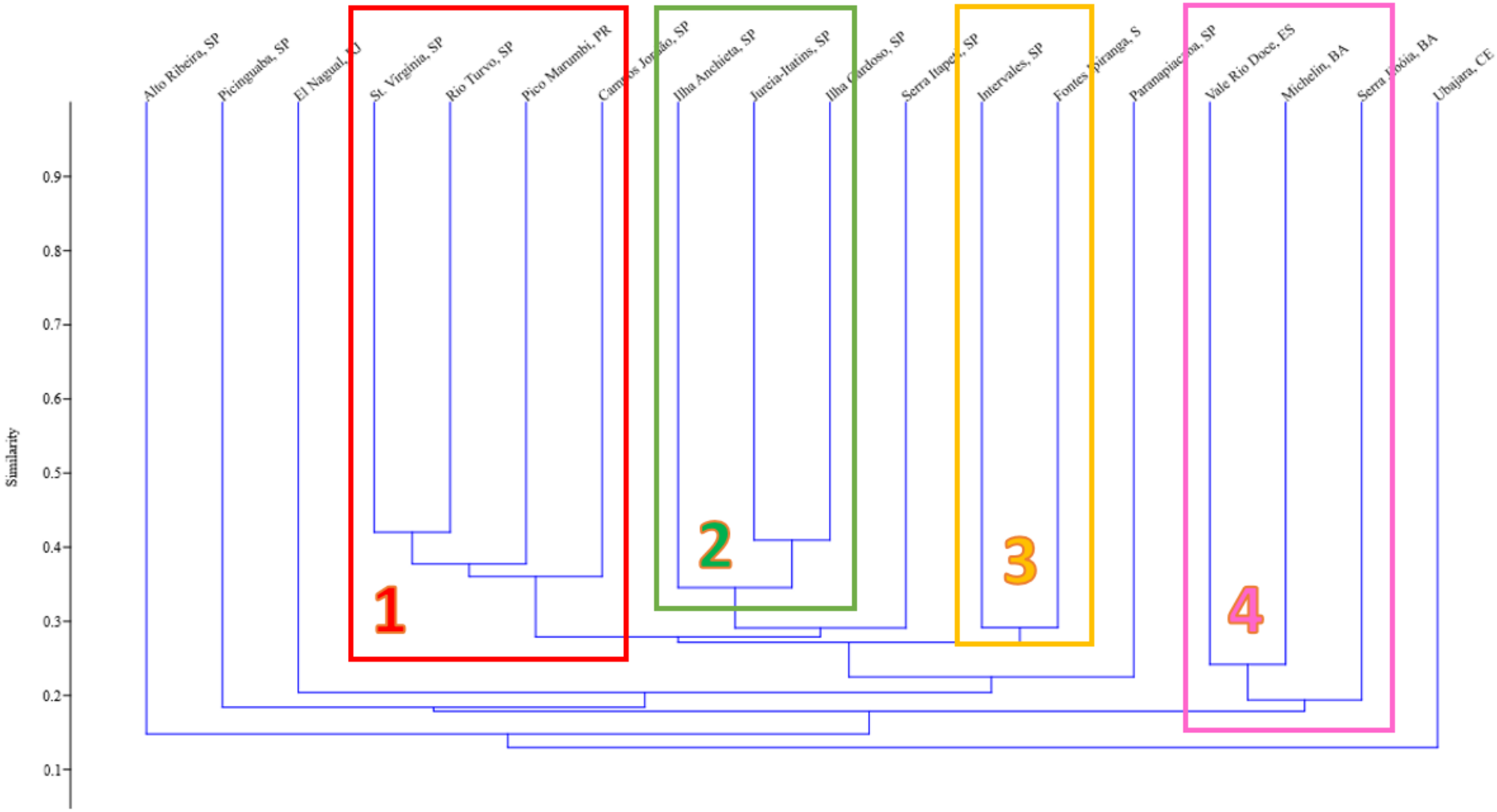

Figure 10. Dendrogram of the eighteen localities performed in PAST 3.19, highlighting the groups formed. Cophenetic correlation coefficient = 0.84

different climate (Af: equatorial fully humid), it is more similar to RTSP because it shares more species in common than the other areas. All of them present variable relief that reach high altitudes (1,500 - 2,000 m a.s.l.).

Amorim *et al.* 2017 demonstrated in their comparative analysis a correlation of the similarity among the areas of Atlantic Forest southeastern Brazil with the type of vegetation and altitude. They adopted the method of cluster analysis (UPGMA), but considering the Sørensen index. This correspondence was confirmed by the cluster that includes JIES, SMSP Núcleo Santa Virgínia and IASP.

Observing the group 2, the three places are united by the climate (Af: equatorial fully humid) and significant rainfall (2,100-3,000 mm/year). ICSP is nearer to JIES (both are located in the southern coast of the State of São Paulo, with a distance of 121 Km between them) than to IASP (that is located in the northern coast of SP, with a distance of 340 Km from JIES).

The discrepancy among the areas' size is evident when we compare JIES (whose area is larger than 90,000 ha) and ICSP (with a territory greater than 22,000 ha) with IASP, which has only 828 ha. In addition, the last one presented a very devastated vegetation (Peralta & Yano 2008), dominated by *Nectandra* spp., *Tabebuia cassinoides* (Lam.) D. C., *Simarouba* spp., *Clarisia racemosa Ruiz* & Pav., *Cedrela fissilis* Vell., *Dalbergia nigra* Vell., *Plathymenia* spp. and *Myrocarpus frondosus* Allemão (Guillaumon *et al.* 1989). These taxa represent indicators for vegetation in regeneration, composing the secondary lowland Atlantic rainforest in this island (Genini *et al.* 2009).

Visnadi (2015a) applied the UPGMA method too, but adopting the Sørensen index, then obtained high similarity (0,52) between the bryoflora of Ubatuba and Iguape municipalities, where are located IASP and JIES, respectively. According to Andrade *et al.* 2002, two floras are very similar when Sørensen index is greater than 0,5, whereas for Jaccard index it should be higher than 0,25 (Polisel & Franco 2010).

The high similarity between ISP and FISP (group 3) was confirmed by Visnadi (2015a) in the same analysis. The author attributes this proximity to their occurrence in the hinterland compared to the other inventories carried out in the coastline, in terms of longitude.

Oliveira-Filho & Fontes (2000) performed a comparative floristic study of vascular plants in Atlantic Forest taking into account several climatic variables and observed that the vegetation of the seaward and the inland of Serra do Mar distinguished due to the different annual precipitation levels. Torres *et al.* (1997) separated two distinct floristic zones of vascular plants based on the distance of the sea: coastal zone dominated by "hygrophilous forests" (with annual rainfall greater than 2,000 mm, without dry season) and hinterland zone by "mesophytic forests" (with average rainfall = 1,400 mm/year and a dry season). In fact, both Parks (ISP and FISP) exhibited lower annual rainfall than others that are located in the seaward of Serra do Mar, like JIES and ICSP (Tab. 3).

Actually, annual rainfall, temperature and distance from the ocean were the factors that have most impacted in the distribution of the bryophytes in Atlantic Forest areas that cover the southeastern Brazil (Amorim *et al.* 2017).

Raising the coastline to the north we can see the change of the relief (the mountain range's altitudes are lower and the distance from the coast is higher), specifically in the north of Rio Doce (Espírito Santo State), with the presence of lower rainforests called "Tabuleiros", that cover from northern Rio de Janeiro State to northeastern Brazil (Oliveira-Filho & Fontes 2000, Peixoto *et al.* 2008).

Giving continuity to the southern Bahia, we found MER, whose vegetation is described as a mosaic of four fragments of Dense Lowland Ombrophilous Forest with rubber trees (Bôas-Bastos & Bastos 2009). Its geographical proximity to the Rio Doce Natural Reserve can explain the similarity between them. Some species shared by both areas are:

Zelometeorium recurvifolium, *Calymperes lonchophyllum*, *Groutiella apiculata*, *Ceratolejeunea cubensis*, *Cololejeunea microscopica* and *Plagiochila montagnei*.

Regarding the southern Bahia yet, it is found another Atlantic Forest remnant: Serra da Jibóia, whose vegetation is characterized by Valente *et al.* (2006) as a singular hygrophilous forest surrounded by Caatinga, justifying the lower similarity to the cluster composed by Vale do Rio Doce and Michelin conservation units.

The bryophyte floristic studies carried out in Alto do Ribeira Tourist Park – ARTSP, Serra do Mar State Park - SMSP núcleo Picinguaba (SP), El Nagual Private Natural Heritage Reserve - ENPNHR (RJ) and São Luís Farm- SLF (CE) presented a very low similarity compared to all the other surveys. Our hypothesis suggests this is due to the similar sampling effort among them, since there were found 109, 110, 137 and 102 species of bryophytes, respectively.

Regarding to the nine species that were present in 90% of the floristic surveys, eight have wide distribution (present in 10 or more Brazilian States) with the following worldwide distribution: *Pyrrhobryum spiniforme* (Rhizogoniaceae) - cosmopolitan, *Syrrhopodon prolifer* (Calymperaceae) - pantropical, *Vitalia galipensis* (Sematophyllaceae) - neotropical, *Chiloscyphus martianus* (Lophocoleaceae) – Africa/Neotropical, *Frullania caulisequa* (Frullaniaceae) – Neotropical. In contrast, *Cheilolejeunea xanthocarpa* (Lejeuneaceae) showed moderate and pantropical colonization. Only one species occurred in all the eighteen studies (*Lejeunea flava*, Lejeuneaceae), it is present in every Brazilian phytogeographic domains (Amazonian Forest, Caatinga, Cerrado, Atlantic Forest, Pampa and Pantanal) and have wide and pantropical distribution (ML Koga & DF Peralta unpubl. res.).

With regard to the species restricted to RTSP there were found taxa with rare distribution (present in one to four Brazilian States), exclusively in Atlantic Forest and endemic to the country, such as *Dendroceros breutelii* (Dendrocerotaceae) and *Dicranella pabstiana* (Dicranaceae). There were identified rare liverworts limited to this

phytogeographic domain such as *Lophocolea trapezoidea* (Lophocoleaceae), *Marchantia berteroana* (Marchantiaceae) and *Plagiochila punctata* (Plagiochilaceae) (ML Koga & DF Peralta unpubl. res.).

Conclusion

The most similar area to Rio Turvo State Park was Serra do Mar State Park (Núcleo Santa Virgínia), sharing more species in common than the other ones. The pattern clustering of the Conservation Units and vegetation remnants in the Atlantic Forest can be explained by geographic location, relief, type of vegetation and climatic factors, such as temperature and precipitation.

We suggest the future floristic inventories should add in the material and methods section a rarefaction curve for estimating species richness. Then it will standardize the methodology and decrease distorcions in the next studies about comparisons based on floristic similarity.

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5 DISCUSSÃO GERAL

A lista de briófitas para o Parque Estadual do Rio Turvo apresentou 414 espécies ao todo, representando 78% da riqueza estimada pela curva de acumulação de espécies (Fig.4), levando a concluir que o esforço amostral empregado neste presente trabalho foi próximo do suficiente para alcançar o número de espécies existente.

Embora haja inúmeros levantamentos florísticos da região sudeste do Brasil, percebemos a importância deste trabalho pelos 15 registros inéditos de espécies para o Estado de São Paulo e um para o Brasil, além do fato de 22% da listagem apresentar distribuição rara. A brioflora do PERT representa 10% do que se conhece para o Neotrópico, 30% para o país e aproximadamente 50% para o Estado de São Paulo.

Com relação aos aspectos ecológicos, o substrato predominante foi o corticícola, com 40% das ocorrências de espécies; a forma de vida mais representativa foi o tapete (47% das espécies) e o sistema sexual prevalecente foi o dióico (60% da brioflora); características que podem resultar da interação com o ambiente, favorecendo a predominância de determinadas famílias em detrimento de outras.

Quanto à análise de similaridade abordada no capítulo 2, a área mais similar ao PERT foi o Parque Estadual Serra do Mar (Núcleo Santa Virgínia), por compartilharem mais espécies em comum que as demais áreas. O padrão de agrupamento das unidades de conservação e remanescentes florestais de Mata Atlântica indica que, variáveis climáticas e outros fatores como proximidade geográfica, relevo e vegetação influenciam na distribuição e composição de espécies.

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7. ANEXO

Annex. List of absence/presence of the 18 bryophyte floristic inventories considered in this study: Freq- frequency. 1- Michelin Ecological Reserve, MER/BA; 2- Serra da Jibóia Remnant, SJR/BA; 3- Serra do Mar, SMSP/SP, Núcleo Santa Virgínia/SP; 4- Pico do Marumbi State Park, PMSP/PR, 5- El Nagual Private Natural Heritage Reserve, ENPNHR/RJ, 6- São Luís Farm, SLF/CE, 7- Ilha Anchieta State Park, IASP/SP; 8- Francisco Affonso de Mello Natural Municipal Park, FAMNMP/SP; 9- Jureia-Itatins Ecological Station, JIEE/SP; 10- Alto do Ribeira Tourist State Park, ARTSP/SP; 11- Serra do Mar State Park, SMSP/SP, Núcleo Picinguaba; 12- Intervales State Park, ISP/SP; 13- Fontes do Ipiranga State Park, FISP/SP; 14- Vale do Rio Doce Natural Reserve, VRDNR/ES; 15- Alto da Serra de Paranapiacaba Biological Reserve, ASPBR/SP; 16- Ilha do Cardoso State Park, ICSP/SP; 17- Campos do Jordão State Park, CJSP/SP; 18- Rio Turvo State Park, RTSP/SP.

Species	Freq	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Anthoceros punctatus L.	0,2						X		X					X					
Dendroceros breutelii Nees	0,1																		X
Dendroceros crispatus Nees	0,1																		X
Dendroceros crispus (Sw.) Nees	0,4			X	X						X	X	X			X	X		X
Dendroceros rigidus Steph.	0,1															X			
Megaceros vincentianus (Lehm. & Lindenb.) Campb.	0,1					X		X											
Nothoceros minarum (Ness) J.C. Villarreal	0,2			X	X													X	
Nothoceros vincentianus (Lehm. & Lindenb.) J. C. Villarreal	0,1																X		X
Notothylas orbicularis (Schwein.) Sull.	0,1						X												
Phaeoceros carolinianus (Michx.) Prosk	0,1													X					X
Phaeoceros laevis (L.) Prosk.	0,4							X	X		X	X	X				X	X	X
Phymatoceros bulbiculosus (Broth.) Stotler, W. T. Doyle & Crand-Stotl.	0,2							X 1									X	X	X
Adelothecium bogotense (Hampe) Mitt.	0,1			X														X	
Amblystegium cf. *serpens* (Hedw.) BSG	0,1					X													
Amblystegium varium (Hedw.) Lindb.	0,1																	X	
Archidium julicaule Müll. Hal.	0,1																	X	
Leptodictyum riparium (L. ex Hedw.) Warnst.	0,1																X		

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Breutelia subtomentosa (Hampe) A. Jaeger	0,1				X														
Breutelia tomentosa (Sw. ex Brid.) A. Jaeger	0,1			X															
Leiomela aristifolia (A. Jaeger) Wijk & Margad.	0,1			X															
Leiomela bartramioides (Hook.) Paris	0,3			X	X				X				X					X	
Leiomela piligera (Hampe) Broth.	0,1																	X	
Philonotis cernua (Wilson) D.G. Griff. & W.R. Buck	0,1						X	X											
Philonotis elongata (Dism.) H.A. Crum & Steere	0,3			X			X	X										X	X
Philonotis gardneri (Müll. Hal.) A. Jaeger	0,1															X			
Philonotis hastata (Duby) Wijk & Argent	0,2				X		X	X											
Philonotis longiseta (Michx.) E. Britton	0,1						X												X
Philonotis sphaerocarpa (Hedw.) Brid.	0,1			X	X														
Philonotis uncinata (Schwägr.) Brid.	0,7			X		X	X	X	X	X	X	X	X	X				X	X
Aerolindigia capillacea (Hornsch.) M. Menzel	0,3			X							X		X					X	X
Brachythecium occidentale (Hampe) A. Jaeger	0,1								X										
Brachythecium poadelphus Müll. Hal.	0,2				X													X	X
Brachythecium plumosum (Hedw.) Schimp.	0,1													X					
Brachythecium ruderale (Brid.) W.R. Buck	0,4		X	X								X	X	X				X	X
Eurrhynchium clinocarpum (Taylor) Paris	0,1																	X	
Eurhynchium hians (Hedw.) Sande Lac.	0,2										X		X	X					
Meteoridium remotifolium (Müll. Hal.) Manuel	0,7	X		X	X	X			X		X	X	X	X		X	X	X	X
*Oxyrrhynchium pringlei (*Cardot) J. T. Wynns	0,1								X										
Palamocladium leskeoides (Hook.) E. Britton	0,1										X							X	
Platyhypnidium aquaticum (A. Jaeger) M. Fleisch.	0,2			X							X							X	
Platyhynidium riparioides (Hedw.) Dixon	0,1															X			
Rhynchostegium beskeanum (Müll. Hal.) A. Jaeger	0,1													X					

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Rhynchostegium conchophyllum (Taylor) A. Jaeger	0,1													X					
Rhynchostegium riparioides (Hedw.) Cardot in Tourret	0,1							X											
Rhynchostegium scariosum (Taylor) A. Jaeger	0,2			X				X										X	X
Rhynchostegium sellowii (Hornsch.) A. Jaeger	0,1													X		X			
Rhynchostegium serrulatum (Hedw.) A. Jaeger	0,3			X						X			X	X				X	
Squamidium brasiliense Broth.	0,5		X	X	X		X			X	X		X					X	X
Squamidium leucotrichum (Taylor) Broth.	0,6		X		X		X	X	X			X	X		X	X		X	
Squamidium macrocarpum (Spruce ex Mitt.) Broth.	0,1									X									
Squamidium nigricans (Hook. f.) Broth.	0,3				X		X	X	X									X	
Steerecleus beskeanus (Müll. Hal.) H. Rob.	0,1										X								
Torrentaria riparioides (Hedw.) Ochyra	0,1										X								
Zelometeorium ambiguum (Hornsch.) Manuel	0,4			X					X		X		X		X		X		X
Zelometeorium patens (Hook. f.) Manuel	0,3				X			X			X		X		X		X		
Zelometeorium patulum (Hedw.) Manuel	0,8	X		X	X	X	X	X	X	X	X		X	X	X		X	X	X
Zelometeorium recurvifolium (Hornsch.) Manuel	0,3	X						X		X	X				X				
Trematodon longicollis Michx.	0,4									X	X	X	X	X		X	X	X	
Anomobryum conicum (Hornsch.) Broth.	0,1																	X	
Anomobryum julaceum (Schrad. ex P. Gaertn. et al.) Schimp.	0,1																	X	
Brachymenium acuminatum Harv.	0,1																	X	
Brachymenium consimile (Mitt.) A. Jaeger	0,2			X					X									X	X
Brachymenium exile (Dozy & Molk.) Bosch & Sande Lac.	0,1							X											
Brachymenium hornschuchianum Mart.	0,2			X					X									X	X
Brachymenium patulum (Müll. Hal.) Schimp.	0,1				X														
Brachymenium radiculosum (Schwägr.) Hampe	0,3			X												X	X	X	X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Brachymenium regnelii Hampe	0,1																	X	
Brachymenium systylium (Müll. Hal.) A. Jaeger	0,1								X										
Bryum alpinum Huds. ex With.	0,1				X														
Bryum apiculatum Schwägr.	0,3			X						X 2		X 2		X			X	X	
Bryum argenteum Hedw.	0,6		X	X				X	X	X		X		X			X	X	X
Bryum atenense R.S. Williams	0,2											X		X					X
Bryum caespiticium Hedw.	0,2																X	X	X
Bryum cellulare Hook.	0,1						X												
Bryum challaense Broth.	0,1													X					
Bryum coronatum Schwägr.	0,4		X					X	X 3		X 3	X 3		X			X	X	
Bryum dichotomum Hedw.	0,1																	X	
Bryum leptocladon Sull.	0,1			X			X												
Bryum limbatum Müll. Hal.	0,5	X		X	X		X	X						X			X	X	X
Bryum muehlenbeckii Bruch & Schimp.	0,1			X															
Bryum paradoxum Schwägr.	0,1							X											
Bryum renauldii Röll ex Renauld & Cardot	0,1			X				X											
Bryum subapiculatum Hampe	0,2			X				X	X 4								X		
Gemmabryum exile (Dozy & Molk.) J. R. Spence & H. P. Ramsay	0,1								X										
Plagiobryoides limbata (Müll. Hal.) J.R. Spence	0,1											X							
Ptychostomum wrightii (Sull.) J.R. Spence	0,1	X																	
Rhodobryum andicola (Hook.) Paris	0,1													X					
Rhodobryum beyrichianum (Hornsch.) Müll. Hal.	0,3								X					X		X	X 5	X	
Rhodobryum grandifolium (Taylor) Schimp.	0,2	X	X 6															X	
Rhodobryum roseolum (Müll. Hal.) Paris	0,1				X										X 7				
Rhodobryum roseum (Hedw.) Limpr.	0,2				X													X	X
Rhodobryum subverticillatum Broth.	0,2				X													X	X
Rosulabryum billarderi (Schwägr.) Spence	0,3	X			X												X 8	X	X
Rosulabryum capillare (Hedw.) J.R. Spence	0,1												X	X					
Rosulabryum densifolium (Brid.) Ochyra	0,8	X		X 9	X	X 9		X 9	X	X		X	X 9	X 9		X	X 9	X	X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Rosulabryum huillense (Welw. & Dub.) Ochyra	0,3	X	X 10	X 10	X				X									X 10	
Rosulabryum pseudocapillare (Besch.) Ochyra	0,1																	X	
Calymperes afzelii Sw.	0,2	X						X									X		X
Calymperes erosum Müll. Hal.	0,2	X					X	X							X				
Calymperes levyanum Besch.	0,1														X		X		
Calymperes lonchophyllum Schwägr.	0,3	X				X				X					X		X		
Calymperes nicaraguensis Renauld & Cardot	0,1	X																	
Calymperes othmeri Herzog.	0,1							X							X				
Calymperes palisotii Schwägr.	0,4					X	X	X		X				X	X		X		
Calymperes tenerum Müll. Hal.	0,2					X				X							X		
Calymperes venezuelanum (Mitt.) Pitt	0,1		X																
Leucophanes molleri Müll. Hal.	0,2	X								X							X 11		
Octoblepharum albidum Hedw.	0,6	X	X			X	X	X	X	X				X	X		X		X
Octoblepharum cocuiense Mitt.	0,2									X						X			X
Octoblepharum erectifolium Mitt. ex R. S. Williams	0,1										X						X		
Octoblepharum pellucidum Müll. Hal.	0,1									X									
Octoblepharum pulvinatum (Dozy & Molk.) Mitt.	0,4	X				X		X		X			X		X		X		X
Syrrhopodon africanus (Mitt.) Paris	0,2									X			X				X		X
Syrrhopodon brasiliensis Reese	0,1														X		X		
Syrrhopodon cymbifolius Müll. Hal.	0,2			X													X		X
Syrrhopodon elongatus Sull.	0,2				X					X						X	X		
Syrrhopodon gardneri (Hook. f.) Schwägr.	0,2				X					X			X						
Syrrhopodon gaudichaudii Mont.	0,7	X		X		X		X	X	X			X	X		X	X	X	X
Syrrhopodon incompletus Schwägr.	0,5	X			X	X		X		X	X		X				X		X
Syrrhopodon lanceolatus (Hampe) W.D. Reese E.	0,1		X														X		
Syrrhopodon leprieurii Mont.	0,1																X		
Syrrhopodon ligulatus Mont.	0,3	X			X	X		X						X	X				

Species	Freq	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Syrrhopodon lycopodioides (Sw. ex Brid.) Müll. Hal.	0,1																	X	X
Syrrhopodon parasiticus (Brid.) Besch.	0,7	X	X	X			X	X	X	X		X	X		X		X	X	X
Syrrhopodon prolifer Schwägr.	0,9	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X
Syrrhopodon rigidus Hook. & Grev.	0,1									X					X				
Syrrhopodon tortilis Hampe	0,2			X	X												X		
Catagonium nitens (Brid.) Cardot	0,1				X														
Catagonium nitidum (Hook. f. & Wilson) Broth.	0,1																	X	
Cryphaea brevipila Mitt.	0,1												X						
Cryphaea filiformis (Hedw.) Brid.	0,1																	X	
Cryphaea rhacomitrioides Müll. Hal.	0,1																	X	
Schoenobryum concavifolium (Griff.) Gangulee	0,4			X			X		X		X		X					X	X
Adelothecium bogotense (Hampe) Mitt.	0,2			X														X	X
Calyptrochaeta albescens (Hampe) Buck	0,1			X															
Calyptrochaeta monilidontius (Hampe) O. Yano	0,1															X			
Calyptrochaeta setigera (Mitt.) W. R. Buck	0,3											X		X		X		X	X
Daltonia androgyma Geh. & Hampe	0,1															X			
Daltonia aristata Geh. & Hampe	0,1															X			
Daltonia bilimbata Hampe	0,1			X	X														
Daltonia brasiliensis Mitt.	0,1			X															
Daltonia gracilis Mitt.	0,1			X														X	
Daltonia marginata Griff.	0,2												X					X	X
Daltonia splachnoides (Sm.) Hook. & Taylor	0,2			X	X													X	X
Daltonia stenophylla Mitt.	0,1			X												X			
Leskeodon andicola (Spruce ex Mitt.) Broth.	0,1												X						
Leskeodon aristatus (Geh. & Hampe) Broth.	0,3			X	X	X		X									X		X
Leskeodon cubensis (Mitt.) Thér.	0,1									X									
Bryohumbertia filifolia (Hornsch.) J.-P. Frahm	0,7		X	X 12	X 12	X		X	X 12	X			X	X		X 12	X 12	X 12	X
Dicranella exigua (Schwägr.) Mitt.	0,1				X														
Dicranella fusca Broth.	0,1																	X	

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Dicranella guilleminiana (Mont.) Mitt.	0,1																	X	
Dicranella hilariana (Mont.) Mitt.	0,4				X	X		X	X	X		X	X				X		
Dicranella lindgiana (Hampe) Mitt.	0,1				X														X
Dicranella pabstiana (Müll. Hal.) Mitt.	0,1																		X
Dicranella varia (Hedw.) Schimp.	0,1				X														
Dicranodontium pulchoalare Broth subsp brasiliense (Herzog) J.-P Frahm	0,1				X														
Dicranoloma billarderii (Brid. ex Anon) Paris	0,1				X														
Holomitrium arboreum Mitt.	0,4		X		X										X	X	X	X	X
Holomitrium crispulum Mart.	0,4			X	X								X			X	X	X	X
Holomitrium nitidum Herzog	0,3				X					X						X	X	X	
Holomitrium longifolium Hampe	0,1			X															
Holomitrium olfersianum Hornsch.	0,3				X			X	X	X							X	X	
Leptotrichella brasiliensis (Duby) Ochyra	0,1									X		X							
Leucoloma cruegerianum (Müll. Hal.) A. Jaeger	0,3			X	X			X		X							X		
Leucoloma serrulatum Brid.	0,7	X	X	X	X	X		X	X	X			X			X	X		X
Leucoloma tortellum (Mitt.) A. Jaeger	0,1						X		X										
Leucoloma triforme (Mitt.) A. Jaeger	0,3			X	X												X	X	X
Microcampylopus curvisetus (Hampe) Giese & J.-P. Frahm	0,1																	X	
Pilopogon laevis (Taylor) Thériot	0,1								X									X	
Ceratodon purpureus (Hedw.) Brid.	0,1																	X	
Cladastomum ulei Müll. Hal.	0,1																	X	
Diphyscium longifolium Griff.	0,2			X	X												X		
Diphyscium peruvianum Spruce ex Mitt.	0,1															X			
Ditrichum crinale (Taylor) Kuntze	0,1																	X	
Ditrichum paulense Geh. ex Hampe	0,1																	X	
Rhamphidium dicranoides (Müll. Hal.) Paris	0,1				X													X	
Entodon beyrichii (Schwägr.) Müll. Hal.	0,1										X			X					

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Entodon jamesonii (Taylor) Mitt.	0,1																	X	
Entodon hampeanus Müll. Hal.	0,1													X					
Entodon virens (Hook. f. & Wilson) Mitt.	0,1																	X	X
Erythrodontium longisetum (Hook.) Paris	0,1								X									X	
Erythrodontium squarrosum (Hampe) Paris	0,1													X				X	
Erpodium glaziovii Hampe	0,1													X					
Solmsiella biseriata (Austin) Steere	0,1																		X
Dimerodontium balansae Müll. Hal.	0,1																	X	
Dimerodontium mendozense Mitt.	0,1								X									X	
Fabronia ciliaris (Brid.) Brid.	0,2						X		X			X						X	
Fissidens acacioides Schrad.	0,1																		X
Fissidens amoenus Müll. Hal.	0,2	X		X										X					
Fissidens anguste-limbatus Mitt.	0,2							X						X				X	
Fissidens angustifolius Sull.	0,1						X	X											
Fissidens asplenioides Hedw.	0,6			X	X	X	X		X		X		X				X	X	X
Fissidens bryoides Hedw.	0,2			X	X									X				X	
Fissidens crispus Mont.	0,2													X				X	X
Fissidens curvatus Hornsch.	0,1																	X	X
Fissidens cryptoneuron P. de la Varde	0,1						X												
Fissidens dendrophilus Brugg.-Nann. & R.A. Pursell	0,1												X						
Fissidens elegans Brid.	0,4			X	X				X					X	X		X	X	
Fissidens flabellatus Hornsch. in C. Mart.	0,1																X		
Fissidens flaccidus Mitt.	0,2					X								X					X
Fissidens goyazensis Broth.	0,1			X					X										
Fissidens guianensis Mont.	0,3				X		X	X						X	X		X		
Fissidens hornschuchii Mont.	0,3			X	X		X											X	X
Fissidens intromarginatus (Hampe) Mitt.	0,3						X	X						X			X	X	
Fissidens lagenarius Mitt.	0,3			X										X			X	X	X
Fissidens lindbergii Mitt.	0,1	X																	
Fissidens minutus Thwaites & Mitt.	0,2						X	X								X			

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Fissidens oblongifolius Hook. f. & Wilson	0,1																X		X
Fissidens oediloma Müll. Hal. ex Broth.	0,3			X	X												X	X	X
Fissidens pallidinervis Mitt.	0,1											X					X		
Fissidens palmatus Hedw.	0,2								X		X			X					
Fissidens pellucidus Hornsch.	0,5	X		X	X			X						X		X	X	X	X
Fissidens prionodes Mont.	0,2					X	X	X							X				
Fissidens pseudoplurisetus Bordin, Pursell & O. Yano	0,2			X	X														X
Fissidens radicans Mont.	0,2						X	X									X		
Fissidens rigidulus Hook. f. & Wilson	0,1												X					X	
Fissidens santa-clarensis Thér.	0,1	X	X																
Fissidens saprophilus Broth.	0,2			X										X				X	
Fissidens scariosus Mitt.	0,6	X		X	X			X	X				X	X	X	X		X	X
Fissidens serratus Müll. Hal.	0,5	X		X	X		X	X	X					X			X		X
Fissidens spurio-limbatus Broth.	0,1													X				X	
Fissidens submarginatus Bruch	0,4				X	X	X	X						X			X	X	X
Fissidens subradicans Broth.	0,1																X		
Fissidens termitarum (Herzog) Pursell	0,1																	X	
Fissidens weirii Mitt. var. weirii	0,4			X	X			X						X	X		X	X	X
Fissidens yanoae Pursell	0,2			X	X													X	X
Fissidens zollingeri Mont.	0,4	X					X	X	X					X	X			X	X
Entosthodon bonplandii (Hook.) Mitt.	0,4				X			X	X					X			X	X	X
Entosthodon puiggari Gehb. & Hampe	0,1																	X	
Enthostodon ramulosus (Hampe) M.S. Dias & D.F. Peralta	0,1																	X	
Funaria bonplandii (Hook.) Broth.	0,1															X			
Funaria calvescens Schwagr.	0,1																	X	X
Funaria hygrometrica Hedw.	0,3									X			X	X		X	X		
Physcomitrium umbonatum Mitt.	0,1													X					
Braunia subincana Broth.	0,1				X														
Hedwigidium integrifolium (P. Beauv.) Dixon	0,2			X	X													X	
Helicophyllum torquatum (Hook.) Brid.	0,1							X											X

Species	Freq	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Hookeria acutifolia Hook. & Grev.	0,2			X					X									X	
Puiggariopsis aurifolia (Mitt.) M. Menzel	0,2			X	X								X				X		
Calliergonella cuspidata (Hedw.) Loeske	0,1																	X	
Chryso-hypnum diminutivum (Hampe) W.R. Buck	0,7	X		X	X	X			X	X	X	X	X	X			X	X	X
Chryso-hypnum elegantulum (Hook.) Hampe	0,6	X		X		X		X	X	X	X				X		X	X	X
Chryso-hypnum squarrosulum (Cardot) N. Nishim. & Ando	0,1												X						
Ectropothecium leptochaeton (Schwägr.) W.R.Buck	0,2	X	X														X		
Mittenothamnium langsdorffii (Hook.) Cardot	0,1										X								
Mittenothamnium macrodontium (Hornsch.) Cardot	0,1															X			
Mittenothamnium reduncum (Schimp. ex Mitt.) Ochyra	0,2			X	X													X	
Mittenothamnium reptans (Hedw.) Cardot	0,4		X	X					X		X		X				X	X	X
Mittenothamnium simorrhynchum (Hampe) Cardot	0,1										X								
Phyllodon truncatulus (Müll. Hal.) W.R. Buck	0,2				X						X	X					X		
Pseudotaxiphyllum distichaceum (Mitt.) Z. Iwats.	0,1																		X
Puiggariopsis aurifolia (Mitt.) M. Menzel	0,3			X	X								X				X		X
Rhacopilopsis trinitensis (Müll. Hal.) E. Britton & Dixon	0,2							X		X				X					
Taxiphyllum ligulaefolium (E.B. Bartram) W.R. Buck	0,1				X														
Taxiphyllum taxirameum (Mitt.) M. Fleisch.	0,3			X				X	X							X	X		
Vesicularia vesicularis (Schwägr.) Broth.	0,7	X	X	X		X		X	X	X	X	X	X	X			X		X
Hypopterygium tamarisci (Sw.) Brid. ex Müll. Hal.	0,8		X 13	X 14	X 13	X		X	X	X	X	X	X	X		X	X	X 14	X
Lopidium concinnum (Hook.) Wilson	0,5			X	X				X		X		X	X		X		X	X
Orthostichella pachygastrella (Müll. Hal.) B.H. Allen & Magill	0,4			X	X						X		X	X			X	X	X
Orthostichella pentastica (Brid.) W.R. Buck	0,2		X			X		X	X										

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Orthostichella versicolor (Müll.Hal.) B.H.Allen & W.R.Buck	0,4			X	X					X	X		X				X	X	X
Orthostichela welwitschii (Duby) B.H. Allen & Magill	0,1			X															
Pilotrichella flexilis (Hedw.) Angström	0,4		X	X	X	X							X			X	X	X	
Lepyrodon tomentosus (Hook.) Mitt.	0,1																	X	
Rauiella lagoensis (Hampe) W.R. Buck	0,1																	X	
Haplocladium microphyllum (Hedw.) Broth.	0,2							X						X			X		X
Atractylocarpus brasiliensis (Müll. Hal.) R.S. Williams	0,2				X					X			X	X					
Atractylocarpus longisetus (Hook.) E.B. Bartram	0,1													X					
Campylopus aemulans (Hampe) A. Jaeger	0,1																	X	
Campylopus arctocarpus (Hornsch.) Mitt.	0,7		X	X	X			X	X	X			X	X		X	X	X	X
Campylopus carolinae Grout	0,1																	X	
Campylopus controversus (Hampe) A. Jaeger	0,1															X			
Campylopus cryptopodioides Broth.	0,4				X	X							X	X		X	X	X	
Campylopus cuspidatus (Hornsch.) Mitt.	0,1				X														
Campylopus dichrostis (Müll. Hal.) Paris	0,2			X	X													X	
Campylopus flexuosus (Hedw.) Brid. (Hedwig)	0,2				X			X									X		X
Campylopus fragilis (Brid.) Bruch & Schimp.	0,2				X									X					X
Campylopus gemmatus (Müll. Hal.) Paris	0,1																	X	X
Campylopus heterostachys (Hampe) A. Jaeger	0,4			X	X		X	X	X								X	X	X
Campylopus julaceus A. Jaeger	0,1				X														
Campylopus julicaulis Broth.	0,1									X			X						
Campylopus lamellinervis (Müll. Hal.) Mitt.	0,4			X	X					X		X	X	X			X	X	
Campylopus occultus Mitt.	0,3			X	X	X		X								X	X		
Campylopus perporosus Broth.	0,1															X			
Campylopus pilifer Brid.	0,5			X	X			X	X	X		X		X	X				X
Campylopus richardii Brid.	0,2				X					X							X		

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Campylopus savannarum (Müll. Hal.) Mitt.	0,3				X			X		X			X	X				X	
Campylopus subcuspidatus (Hampe) A. Jaeger	0,1				X														X
Campylopus surinamensis Müll. Hal.	0,1																	X	
Campylopus trachyblepharon (Müll. Hal.) Mitt.	0,3							X	X	X		X			X		X		
Campylopus thwaitesii (Mitt.) A. Jaeger	0,1				X												X		
Holomitriopsis laevifolia (Broth.) H. Rob.	0,1												X	X					
Leucobryum albicans (Schwägr.) Lindb.	0,4			X	X					X				X		X	X		X
Leucobryum albidum (Brid. ex P. Beauv.) Lindb.	0,4		X					X		X		X		X		X		X	
Leucobryum clavatum Hampe	0,5			X				X	X	X				X		X	X	X	X
Leucobryum crispum Müll. Hal.	0,8		X	X	X		X	X	X	X	X		X	X		X	X	X	X
Leucobryum giganteum Müll. Hal.	0,6	X		X	X					X			X	X	X	X	X	X	X
Leucobryum juniperoideum (Brid.) Müll. Hal.	0,1												X	X					
Leucobryum laevifolium Broth.	0,1																X		
Leucobryum martianum (Hornsch.) Hampe ex Müll. Hal.	0,5	X	X			X				X		X			X	X	X		X
Leucobryum sordidum Ångström	0,2									X				X		X			
Leucomium steerei B. H. Allen & Veling	0,1			X															X
Leucomium strumosum (Hornsch.) Mitt.	0,4			X	X			X	X	X		X					X		X
Philophyllum tenuifolium (Mitt.) Broth.	0,1															X		X	
Ochrobryum gardneri (Müll. Hal.) Mitt.	0,1						X								X				
Rhynchostegiopsis brasiliensis Broth.	0,1																		X
Leptobryum pyriforme (Hedw.) Wilson	0,1													X					
Aerobryopsis capensis (Müll. Hal) M. Fleisch.	0,2									X	X						X		X
Aerobryopsis plumaria (Hampe) M. Fleisch.	0,1		X																
Floribundaria flaccida (Mitt.) Broth.	0,6		X	X		X			X		X		X	X			X	X	X
Floribundaria floribunda (Dozy & Molk.) Fleisch.	0,1														X				
Floribundaria usneoides Müll. Hal.	0,1							X								X			

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Meteorium deppei (Hornsch.) Mitt.	0,4		X	X				X	X				X		X			X	X
Meteorium latifolium (Lindb.) Broth.	0,2			X														X	X
Meteorium nigrescens (Hedw.) Dozy & Molk.	0,6			X				X	X	X	X	X	X	X			X		X
Meteorium pseudoteres Buck	0,1			X														X	
Meteorium teres Mitt.	0,1			X															X
Toloxis imponderosa (Taylor) Buck	0,2			X	X													X	
Pseudotrachypus martinicensis (Broth.) W.R. Buck	0,2	X	X																X
Trachypus bicolor Reinw. & Hornsch.	0,1				X														
Helicodontium capillare (Hedw.) A. Jaeger	0,6	X		X				X	X	X	X		X	X			X	X	X
Homaliodendron piniforme (Brid.) Enroth	0,3	X			X			X					X				X		X
Isodrepanium lentulum (Wilson) E. Britton	0,2	X			X												X		
Neckera scabridens Müll. Hal.	0,1																	X	
Neckera villae-ricae Besch.	0,2			X	X											X			X
Neckera urnigera Müll. Hal.	0,1												X						
Neckeropsis disticha (Hedw.) Kindb.	0,6	X		X		X		X		X			X	X	X		X		X
Neckeropsis undulata (Hedw.) Reichardt	0,7	X		X		X		X	X	X	X		X	X	X		X	X	X
Pinnatella minuta (Mitt.) Broth.	0,1										X								X
Porotrichodendron superbum Menz. ex Brid.	0,1				X														X
Porotrichum filiferum Mitt.	0,2			X	X									X					
Porotrichum guatemalense Bartr.	0,1															X			
Porotrichum korthalsianum (Dozy & Molk.) Mitt.	0,5				X	X			X	X	X		X	X		X		X	
Porotrichum lancifrons (Hampe) Mitt.	0,2			X	X													X	X
Porotrichum leucocaulon (Müll. Hal.) Mitt.	0,2									X	X		X						
Porotrichum longirostre (Hook.) Mitt.	0,5			X	X	X		X	X	X							X	X	X
Porotrichum mutabile Hampe	0,4		X	X	X	X							X	X				X	X
Porotrichum substriatum (Hampe) Mitt.	0,6	X		X	X	X		X	X				X	X			X		X
Porotrichum thieleanum (Müll. Hal.) Mitt.	0,1				X													X	

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Thamnomalia glabella (Hedw.) S. Olsson, Enroth & D. Quandt	0,4	X 15		X 15	X					X 15						X 15	X 15		X
Thamnobryum fasciculatum (Sw. ex Hedw.) I. Sastre	0,3			X	X						X		X				X		
Hymenodon aeruginosus (Hook. f. & Wilson)	0,5			X	X				X		X		X	X		X	X		X
Orthodontium pellucens (Hook.) Bruch & Schimp.	0,1																	X	
Groutiella apiculata (Hook.) H.A. Crum & Steere	0,3	X	X				X								X		X		
Groutiella tomentosa (Hornsch.) Wijk & Margad.	0,1						X											X	
Groutiella tumidula (Mitt.) Vitt	0,3				X			X					X		X		X		
Macrocoma brasiliensis (Mitt.) Vitt	0,1																		X
Macrocoma frigida (Müll. Hal.) Vitt	0,1							X											
Macrocoma orthotrichoides (Raddi) Wijk. & Margad.	0,2			X					X				X						X
Macrocoma tenuis (Hook. & Grev.) Vitt	0,3			X	X									X			X	X	
Macromitrium argutum Hampe	0,1				X														
Macromitrium carionis Müll. Hal.	0,1																X		
Macromitrium catharinense Paris	0,1																	X	
Macromitrium cirrosum (Hedw.) Brid.	0,5	X	X	X	X			X	X				X				X	X	
Macromitrium contextum Hampe	0,1							X										X	
Macromitrium filicaule Müll. Hal.	0,1															X			
Macromitrium guatemalense Müll. Hal.	0,1								X									X	
Macromitrium hoehnei Herzog	0,1															X			
Macromitrium hornschuchii Müll. Hal.	0,1															X			
Macromitrium longifolium (Hook.) Brid.	0,2			X									X						X
Macromitrium microstomum (Hook. & Grev.) Schwägr.	0,2			X	X													X	X
Macromitrium podocarpi Müll. Hal.	0,1																	X	
Macromitrium punctatum (Hook. & Grev.) Brid.	0,4		X	X			X			X			X		X		X	X	
Macromitrium richardii Schwägr.	0,7		X	X	X			X	X	X	X		X			X	X	X	X
Schlotheimia appressifolia Mitt.	0,2												X					X	X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Schlotheimia capillaris Hampe	0,1																	X	
Schlotheimia elata Mitt.	0,1			X														X	
Schlotheimia jamesonii (Arn.) Brid.	0,6	X		X	X			X		X			X	X	X		X	X	X
Schlotheimia merkelii Hornsch.	0,1																	X	X
Schlotheimia rugifolia (Hook. f.) Schwägr.	0,7	X	X	X	X			X	X	X			X	X	X		X	X	X
Schlotheimia tecta Hook. f. & Wilson	0,6			X	X			X	X	X			X			X	X	X	X
Schlotheimia torquata (Sw. ex Hedw.) Brid.	0,4			X	X					X			X				X	X	X
Schlotheimia trichomitria Schwägr.	0,1																	X	
Zygodon obtusifolius Hook.	0,1																	X	
Zygodon reinwardtii (Hornsch.) A. Braun	0,1		X															X	
Zygodon viridissimus (Dicks.) Brid.	0,1																	X	
Phyllogonium viride Brid.	0,8	X	X	X	X	X		X	X	X			X	X		X	X	X	X
Actinodontium integrifolium (Broth.) S. P. Churchill	0,1		X																
Brymela fluminensis (Geh. & Hampe) W.R. Buck	0,1											X							
Callicostella apophysata (Hampe) A. Jaeger	0,1					X													X
Callicostella depressa (Hedw.) A. Jaeger	0,2					X				X				X			X		
Callicostella martiana (Hornsch.) A. Jaeger	0,1					X													X
Callicostella merkelii (Hornsch.) A. Jaeger	0,4			X	X	X		X		X		X					X		X
Callicostella microcarpa Ångström	0,1																		X
Callicostella pallida (Hornsch.) Angstr.	0,5			X	X			X		X		X	X	X		X	X		
Callicostella rivularis (Mitt.) A. Jaeger	0,1															X			
Callicostella rufescens (Mitt.) A. Jaeger	0,2				X	X								X					
Crossomitrium epiphyllum (Mitt.) Müll. Hal.	0,1							X											X
Crossomitrium patrisiae (Brid.) Müll. Hal.	0,4		X			X		X			X		X	X			X		
Crossomitrium saprophilum Broth.	0,1															X			
Cyclodictyon albicans (Hedw.) Kuntze	0,4					X			X		X		X	X				X	X
Cyclodictyon leucomitrium (Müll. Hal.) Broth.	0,1					X													

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Cyclodictyon limbatum (Hampe) Kuntze	0,1			X															X
Cyclodictyon olfersianum (Hornsch.) Kuntze	0,1																	X	
Cyclodictyon varians (Sull.) O. Kuntze	0,6			X	X			X	X		X		X	X			X	X	X
Hookeriopsis heterophylla Sehnem	0,1							X								X			
Hypnella pallescens (Hook.) A. Jaeger	0,1		X													X			
*Hypnella pilifera (*Hook. & Wilson) A. Jaeger	0,2			X	X											X		X	
Lepidopilidium aureo-purpureum (Geh. & Hampe) Broth.	0,1												X						
Lepidopilidium brevisetum (Hampe) Broth.	0,3			X	X	X												X	X
Lepidopilidium caudicaule (Müll. Hal.) Broth.	0,2					X								X			X		
Lepidopilidium entodontella (Broth.) Broth.	0,1															X			
Lepidopilidium gracilifrons (Müll. Hal.) Broth.	0,1									X									
Lepidopilidium laevisetum (Hampe) Broth.	0,1																X		
Lepidopilidium nitens (Hornsch.) Broth.	0,3		X 16	X	X											X			X
Lepidopilidium portoricense (Müll. Hal.) Margad. & Steere	0,2							X	X								X		
Lepidopilidium plebejum (Müll. Hal.) Sehnem	0,1					X								X					
Lepidopilum brevipes Mitt.	0,2			X												X		X	
Lepidopilum caudicaule (Müll.Hal.) Broth.	0,2			X	X													X	X
Lepidopilum cubense (Sull.) Mitt.	0,1			X			X												
Lepidopilum longifolium Hampe	0,2			X														X	X
Lepidopilum muelleri (Hampe) Mitt.	0,6			X	X	X		X	X	X			X	X			X	X	X
Lepidopilum ovalifolium (Duby) Broth.	0,1				X														
Lepidopilum pallidonitens (Müll. Hal.) Paris	0,1			X															
Lepidopilum scabrisetum (Schwägr.) Steere	0,7		X			X		X	X	X	X	X	X	X		X	X		X
Lepidopilum subsubulatum Geh. & Hampe	0,4			X		X				X			X	X				X	X
Lepidopilum surinamense Müll. Hal.	0,1							X											X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Pilotrichum evanescens (Müll. Hal.) Crosby	0,3					X		X		X							X		X
Thamniopsis cruegeriana (Mull. Hal.) W.R. Buck	0,1				X								X						
Thamniopsis incurva (Hornsch.) W.R. Buck	0,8		X	X	X	X		X	X	X		X	X	X		X	X	X	X
Thamniopsis langsdorffii (Hook.) W.R. Buck	0,5			X	X				X	X			X	X		X	X		X
Thamniopsis stenodictyon (Sehnem) Oliveira-e-Silva & Yan	0,1					X													
Thamniopsis undata (Hedw.) W.R. Buck	0,3			X	X				X					X		X			X
Trachyxiphium aduncum (Mitt.) W.R. Buck	0,1															X			
Trachyxiphium guadalupense (Brid.) W.R. Buck	0,4			X	X				X					X		X	X	X	X
Trachyxiphium saxicola (R.S. Williams) Vaz-Imbassahy & Costa	0,2			X	X														X
Trachyxiphium variabile (Hornsch. ex Mitt.) Buck	0,1			X												X			
Epipterygium immarginatum Mitt.	0,1				X														
Plagiothecium novogranatense (Hampe)	0,1																	X	
Plagiomnium rhynchophorum (Hook. F.) T. J. Kop.	0,3			X	X	X			X									X	X
Plagiothecium lucidum (Hook. f. & Wilson) Paris	0,1							X											
Pohlia elongata Hedw.	0,1											X						X	
Pohlia humilis (Mont.) Broth.	0,1																	X	
Pohlia mauiensis (Broth. ex E. B. Bartram) W. Schultze-Motel	0,1										X		X						
Pohlia tenuifolia (A. Jaeger) Broth.	0,2			X	X													X	
Schizymenium campylocarpum (Arn. & Hook.) Shaw	0,1																	X	
Atrichum androgynum (Müll. Hal.) A. Jaeger	0,3			X					X					X		X		X	
Atrichum polycarpum (Müll. Hal.) Mitt.	0,1															X			
Itatiella ulei (Broth. ex Müll. Hal.) G. L. Sm.	0,1																	X	
Itatiella riedeliana (Mont.) N. E. Bell & Hyvönen	0,1																	X	
Pogonatum campylocarpum (Müll. Hal.) Mitt.	0,1			X														X	

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Pogonatum pensilvanicum (E. B. Bartram ex Hedw.) P. Beauv.	0,3								X				X	X		X		X	X
Polytrichadelphus pseudopolytrichum (Raddi) G. L. Sm.	0,3								X				X			X		X	X
Polytrichum angustifolium Mitt.	0,2				X								X					X	X
Polytrichum commune L. ex Hedw.	0,6		X	X	X				X			X	X	X		X	X	X	X
Polyrichum juniperinum Willd. ex Hedw.	0,4			X	X				X			X		X		X		X	X
Acaulon uleanum Müll. Hal.	0,1																	X	
Barbula arcuata Griff.	0,1			X															
Barbula indica (Hook.) Spreng.	0,4			X								X	X	X			X	X	X
Barbula riograndensis E. B. Bartram	0,1		X		X														
Bryoerythrophyllum inaequalifolium (Taylor) R. H. Zander	0,1								X										
Chenia leptophylla (Müll. Hal.) R. H. Zander	0,3												X	X		X		X	X
Chionoloma schimperiana (Paris) M. Menzel	0,1								X										
Didymodon australasiae (Hook. & Grev.) R. H. Zander	0,1																		X
Didymodon rigidulus Hedw.	0,1								X										
Gymnostomum aeruginosum Sm.	0,1																X	X	
Hymenostylium aurantiacum Mitt.	0,1																		X
Hymenostylium recurvirostrum (Hedw.) Dixon	0,1										X							X	
Hyophila involuta (Hook.) A. Jaeger	0,7	X	X			X	X	X	X		X	X	X	X			X		X
Hyophiladelphus agrarius (Hedw.) R. H. Zander	0,2						X		X					X					
Leptodontium araucarieti (Müll. Hal.) Paris	0,1																	X	X
Leptodontium capituligerum Müll. Hal.	0,1																	X	
Leptodontium pungens (Mitt.) Kindb.	0,1																	X	
Leptodontium viticulosoides (P. Beauv.) Wijk & Margad.	0,1				X													X	
Leptodontium wallisii (Müll. Hal.) Kindb.	0,1																	X	
Micromitrium tenerum (Bruch & Schimp.) Crosby	0,1													X					

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Molendoa sendtneriana (Bruch & Schimp.) Limpr.	0,1																	X	
Oxystegus tenuirostris (Hook. & Taylor) A. J.E. Sm.	0,1																	X	
Pseudosymblepharis schimperiana (Paris) H. A. Crum	0,2										X			X				X	
Splachnobryum obtusum (Brid.) Müll. Hal.	0,1						X							X					
Streptopogon calymperes Müll. Hal.	0,1			X														X	
Streptopogon cavifolius Mitt.	0,1								X										
Syntrichia amphidiaceae (Müll. Hal.) R. H. Zander	0,1																	X	
Syntrichia laevipila Brid.	0,1																	X	
Tortella humilis (Hedw.) Jenn.	0,6			X	X				X	X		X	X	X		X	X		X
Tortella linearis (Sw. ex F. Weber & D. Mohr) R. H. Zander	0,1																	X	
Tortula amphidiaceae (Müll. Hal.) Broth.	0,1								X										
Tortula muralis Hedw.	0,1													X				X	
Trichostomum leptocylindricum Müll. Hal.	0,1																	X	
Trichostomum tenuirostre (Hook. & Taylor) Lindb.	0,1												X						
Tuerckheimia guatemalensis Broth.	0,1																	X	
Weissia breutelii Müll. Hal.	0,1																	X	
Weissia jamaicensis (Mitt.) Grout	0,1								X										X
Prionodon densus (Sw. ex Hedw.) Müll. Hal.	0,3			X					X				X					X	X
Calyptothecium duplicatum (Schwägr.) Broth.	0,1								X									X	
Calyptothecium rhystotis (Müll. Hal.) Broth.	0,1															X			
Henicodium geniculatum (Mitt.) W. R. Buck	0,4						X	X		X	X				X		X		X
Hildebrandtiella guyanensis (Mont.) W. R. Buck	0,1							X											
Jaegerina scariosa (Lor.) Arzeni	0,2						X	X		X									
Orthostichidium pentastichum (Brid.) B. H. Allen & Magill	0,1																X		
Orthostichidium quadrangulare (Schwägr.) B.H. Allen & Magill	0,1																X		X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Orthostichopsis latifolia Sehnem	0,1			X															
Orthostichopsis praetermissa W. R. Buck	0,3	X			X		X						X						X
Orthostichopsis subtenuis (Müll. Hal.) Broth.	0,1															X			
Orthostichopsis tenuis (A. Jaeger) Broth.	0,1																		X
Orthostichopsis tetragona (Sw. ex Hedw.) Broth.	0,2						X			X	X		X						
Orthostichopsis tijucae (Müll. Hal.) Broth.	0,1																	X	
Orthostichopsis tortipilis (Müll. Hal.) Broth.	0,5			X	X		X			X	X		X				X	X	X
Pireella pohlii (Schwägr.) Cardot	0,1										X								X
Pterobryon densum Hornsch.	0,3			X	X	X			X									X	
Spiridentopsis longissima (Raddi) Broth.	0,4			X				X		X			X			X	X		X
Ptychomnion cygnisetum (Müll. Hal.) Kindberg	0,1				X														
Ptychomitrium sellowianum (Müll. Hal.) A. Jaeger	0,1								X									X	
Ptychomitrium vaginatum Besch.	0,1			X															
Isopterygium affusum Mitt.	0,1			X									X						
Isopterygium byssobolax (Müll. Hal.) Paris	0,2													X		X		X	
Isopterygium subbrevisetum (Hampe) Broth.	0,2			X									X	X				X	
Isopterygium tenerifolium Mitt.	0,8	X		X	X		X	X	X	X		X	X	X	X		X	X	X
Isopterygium tenerum (Sw.) Mitt.	0,7	X					X	X		X	X	X	X	X	X	X	X		X
Pylaisiadelpha brasiliensis H.A. Crum	0,2			X						X						X			X
Pylaisiadelpha tenuirostris (Bruch & Schimp.) W. R. Buck	0,1																		X
Wijkia flagellifera (Broth.) H.A. Crum	0,6			X	X				X	X			X	X		X	X	X	X
Racopilum intermedium Hampe	0,2										X		X	X					
Racopilum tomentosum (Hedw.) Brid.	0,6		X	X		X	X	X	X	X							X	X	X
Rhacocarpus inermis (Mull. Hal.) Lindb.	0,1				X														
Rhacocarpus purpurascens (Brid.)	0,1			X	X														
Pyrrhobryum spiniforme (Hedw.) Mitt.	0,9		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Pseudocryphaea domingensis (Spreng.) W.R.Buck	0,1																		X
Rigodium toxarion (Schwägr.) Schimp.	0,1																	X	
Acroporium caespitosum (Hedw.) W.R. Buck	0,1				X										X 17				
Acroporium exiguum (Broth.) W.R. Buck & A. Schäfer-Verwimp	0,3			X									X	X		X		X	
Acroporium longirostre (Brid.) Buck	0,2		X	X													X		
Acroporium pungens (Hedw.) Broth.	0,6	X	X	X				X		X	X		X	X	X		X		
Aptychella proligera (Broth.) Herzog	0,1				X														
Aptychopsis estrellae (Müll. Hal.) P.S. Câmara, W.R. Buck & Carv.-Silva	0,7		X 18	X 18	X 18			X 18	X 18	X 18			X 18	X 18		X 18	X 18	X	X
Aptychopsis pungifolia (Hampe) Broth.	0,2			X	X					X				X					
Aptychopsis pyrrhophylla (Müll.Hal.) Wijk & Margad.	0,3				X							X	X			X		X	
Brittonodoxa litophila (Hornsch.) W. R. Buck *et al.*	0,3			X 19	X 19					X 19							X 19	X	X
Brittonodoxa subpinnata (Brid.) W. R. Buck, P. E. A. S. Câmara & Carv.-Silva	0,8	X 20	X 20	X 20		X 20	X 20	X 20	X 20	X 20		X 20	X 20	X 20		X 20	X 20	X	X
Colobodontium vulpinum (Mont.) S.P. Churchill & W. R. Buck	0,1																		X
Donnellia commutata (Müll. Hal.) W.R. Buck	0,4			X					X	X				X			X	X	X
Donnellia lagenifera (Mitt.) W. R. Buck	0,1																X	X	
Donnellia lageniformis (Müll. Hal.) W.R. Buck	0,1															X			X
Meiothecium boryanum (Müll. Hal.) Mitt.	0,1																X		
Meiothecium revolubile Mitt.	0,1									X							X		
Microcalpe subsimplex (Hedw.) W.R. Buck	0,7	X 21	X 21	X 21	X 21	X 21	X 21	X 21		X 21			X 21	X 21	X 21		X 21		X
Potamium sp.	0,1	X																	
Pterogonidium pulchellum (Hook.) Müll.Hal.	0,3	X					X	X		X						X			
Pterogoniopsis paulista (W.R. Buck & Vital) Carv.-Silva *et al.*	0,4			X 22	X 22								X 22	X 22		X 22		X	X
Rhaphidorrhynchium symbolax (Müll. Hal.) Broth.	0,1															X			

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Rhaphidostegium cylindrothecium Broth.	0,1												X						
Rhaphidostegium hoehnei Herzog	0,1															X			
Sematophyllum adnatum (Michx.) Brid.	0,3		X				X	X					X				X		X
Sematophyllum beyrichii (Hornsch.) Broth.	0,3	X		X	X					X		X		X					
Sematophyllum calamicolum (Müll. Hal.) Mitt.	0,1															X			
Sematophyllum cuspidiferum Mitt.	0,4			X			X	X	X				X	X				X 23	
Sematophyllum demissum (Wils.) Mitt.	0,1														X				
Sematophyllum leucostomum (Hampe) W.R. Buck	0,1												X					X	
Sematophyllum lonchophyllum (Mont.) J. Florsch.	0,1													X					
Sematophyllum subdepressum (Hampe) Broth.	0,2				X						X							X	
Sematophyllum subpiliferum (Broth.) Broth.	0,1																		X
Sematophyllum tequendamense (Hampe) Mitt.	0,2	X																X 24	X
Sematophyllum swartzii (Schwägr.) Welch & H.A. Crum	0,1			X														X	
Taxithelium juruense (Broth.) Broth.	0,1	X																	
Taxithelium planum (Brid.) Mitt.	0,5	X	X			X		X		X		X			X		X		X
Taxithelium portoricense R.S. Williams	0,1	X								X									
Taxithelium pluripunctatum (Renauld & Cardot) W. R. Buck	0,2	X													X				X
Trichosteleum brachydictyon (Besch.) A.Jaeger	0,1	X																	
Trichosteleum glaziovii (Hampe) Buck	0,2			X	X													X	
Trichosteleum hornschuchii (Hampe) A. Jaeger	0,1				X			X											
Trichosteleum intricatum (Thér.) J. Florsch	0,1						X												
Trichosteleum microstegium (Schimp. ex Besch.) A. Jaeger	0,1	X																	
Trichosteleum papillosum (Hornsch.) A.Jaeger	0,2	X								X					X				

Species	Freq	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Trichosteleum papilosissimum (Hampe) Broth.	0,1															X			
Trichosteleum sentosum (Sull.) A.Jaeger	0,2	X			X												X		X
Trichosteleum subdemissum (Schimp. ex Besch.) A. Jaeger	0,1																X		
Trichosteleum sublaevigatum Herzog	0,1															X			X
Vitalia galipensis (Müll. Hal.) P.E.A.S.Câmara, Carv.-Silva & W.R. Buck	0,9		X 25	X 25	X 25	X 25	X 25	X 25	X 25	X 25	X 25	X 25	X 25	X 25	X 25	X 25	X 25	X	X
Sphagnum aciphyllum Müll. Hal	0,1			X															
Sphagnum brasiliense Warnst	0,1																	X	
Sphagnum capillifolium (Ehrh.) Hedw.	0,1									X							X		
Sphagnum cyclophyllum Sull. & Lesq. in Gray	0,1				X														
Sphagnum divisum H.A. Crum	0,1				X													X	
Sphagnum erythrocalyx Hampe	0,1															X			
Sphagnum exquisitum H.A. Crum	0,1				X													X	
Sphagnum globicephalum Müll. Hal. ex Warnst.	0,1				X														
Sphagnum gracilescens Müll. Hal.	0,1																	X	
Sphagnum longistolo Müll. Hal.	0,1																	X	
Sphagnum magellanicum Brid.	0,2															X	X	X	
Sphagnum medium Limpr. var. molle (Schlieph.) Wijk & Margad.	0,1															X			
Sphagnum multiporosum H.A. Crum	0,1				X														
Sphagnum ovalifolium Warnst.	0,1				X														
Sphagnum palustre L.	0,2				X			X								X	X		
Sphagnum perichaetiale Hampe	0,3				X					X		X	X			X	X		
Sphagnum platyphylloides Warnst.	0,1			X															
Sphagnum pseudoramulinum H.A. Crum	0,1				X													X	
Sphagnum pulchricoma Müll. Hal. var. coloratum Warnst.	0,1															X			
Sphagnum ramulinum Warnst.	0,1																	X	
Sphagnum recurvum P. Beauv.	0,2															X	X		X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Sphagnum squarrosum Crome	0,1															X			
Sphagnum strictum Sull.	0,1				X														
Sphagnum subsecundum Nees in Sturm	0,2				X					X						X	X		
Sphagnum sucrei H.A. Crum	0,1				X														
Sphagnum tenellum (Brid.) Brid.	0,1				X														
Sphagnum tenerum Sull. & Lesq. ex Sull.	0,1															X		X	
Entodontopsis leucostega (Brid.) W.R. Buck & Ireland	0,1		X																
Entodontopsis nitens (Mitt.) W.R. Buck & Ireland	0,2							X		X				X					
Eulacophyllum cultelliforme (Sull.) W.R.Buck & Ireland	0,3		X				X	X			X		X						X
Pilosium chlorophyllum (Hornsch.) Müll. Hal.	0,3	X	X			X		X		X					X				
Stereophyllum radiculosum (Hook.) Mitt.	0,1																		X
Symphyodon imbricatifolius (Mitt.) S.P. Churchill	0,1				X														
Pelekium involvens (Hedw.) A. Touw	0,1																	X	X
Pelekium minutulum (Hedw.) A. Touw	0,2												X					X	X
Pelekium muricatulum (Hampe) A.Touw	0,1																		X
Pelekium scabrosulum (Mitt.) A.Touw	0,2	X		X									X						
Pelekium schistocalyx (Müll. Hal.) A. Touw	0,3					X 26			X				X				X		X
*Pelekium sparsum (*Hook. f. & Wilson) Soares, A.E.R. & Câmara, P.E.A.S.	0,2			X 27														X 27	X
Thuidiopsis furfurosa (Hook. f. & Wilson) M. Fleisch.	0,1				X														
Thuidium assimile (Mitt.) A. Jaeg.	0,1																	X	X
Thuidium bifidum A. Soares & P.E.A.S. Câmara	0,1																	X	
Thuidium brasiliense Mitt.	0,1				X													X	
Thuidium delicatulum (Hedw.) Bruch & Schimp.	0,4				X					X		X	X			X	X	X	
Thuidium pseudoprotensum (Müll. Hal.) Mitt.	0,3			X							X		X			X	X	X	
Thuidium tamariscinum (Hedw.) Bruch & Schimp.	0,2			X												X		X	

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Thuidium tomentosum Schimp.	0,6	X	X	X	X			X	X		X				X		X	X	X
Lethocolea glossophylla (Spruce) Grolle	0,1								X										
Tylimanthus laxus (Lehm. & Lindenb.) Steph.	0,2			X													X	X	
Adelanthus carabayensis (Mont.) Grolle	0,1																X	X	
Aneura intermedia Steph.	0,1															X			
Aneura pinguis (L.) Dumort.	0,6			X	X	X		X	X			X		X		X	X	X	X
Riccardia amazonica (Spruce) Schiffn.	0,2	X	X	X		X													
Riccardia cataractarum (Spruce) Schiffn.	0,2					X								X		X		X	
Riccardia chamedryfolia (With.) Grolle	0,8	X		X	X	X		X	X	X	X	X	X	X		X	X	X	X
Riccardia digitiloba (Spruce ex Steph.) Pagán	0,8	X		X	X	X		X	X	X		X		X	X	X	X	X	X
Riccardia emarginata (Steph.) Hell	0,3				X	X										X	X		X
Riccardia fucoidea (Sw.) Schiffn.	0,4		X	X 28	X 28	X							X			X		X 28	X
Riccardia glaziovii (Spruce) Meenks	0,5			X	X					X		X			X	X	X	X	X
Riccardia loefgrenii Steph.	0,1															X			
Riccardia metzgeriiformis (Steph.) Schiffn.	0,5			X		X				X		X	X	X		X	X	X	
Riccardia multifida (L.) S. F. Gray	0,1																X		
Riccardia regnellii (Ångstr.) K.G.Hell	0,6	X		X	X	X								X	X	X	X	X	X
Riccardia tenuicola (Spruce) Schiffn. ex Meenks	0,2			X													X	X	
Plagiochasma rupestre (Forster) Steph.	0,1										X								
Balantiopsis brasiliensis Steph.	0,1																	X	
Isotachis aubertii (Schwägr.) Mitt.	0,6			X	X				X		X	X	X	X		X	X	X	X
Isotachis inflata Steph.	0,1				X													X	
Isotachis multiceps (Lindb. & Gottsche) Gottsche	0,2				X								X					X	
Isotachis serrulata (Sw.) Gottsche	0,1			X														X	
Neesioscyphus argillaceus (Nees) Grolle	0,2			X								X				X		X	
Neesioscyphus bicuspidatus (Nees) Grolle	0,1				X														
Neesioscyphus homophyllus (Nees) Grolle	0,4				X				X			X	X	X				X	X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Calypogeia andicola Bischler	0,1														X				
Calypogeia grandistipula (Steph.) Steph.	0,1								X									X	
Calypogeia laxa Gottsche ex Lindenb.	0,4	X		X			X	X	X								X	X	
Calypogeia lechleri (Steph.) Steph.	0,1																		X
Calypogeia miquelii Mont.	0,1	X																	
Calypogeia peruviana Nees & Mont.	0,6		X	X	X					X		X	X	X		X	X	X	X
Calypogeia uncinulata Herzog	0,1																		X
Mnioloma caespitosum (Spruce) R.M. Schuster	0,1				X													X 29	
Mnioloma cellulosa (Spreng.) R. M Schust.	0,1																X		
Mnioloma cyclostipa (Spruce) R.M. Schust.	0,1				X 30														X
Odontoschisma brasiliense Steph.	0,1																X		
Odontoschisma denudatum (Nees) Dumort.	0,3			X	X					X							X	X	X
Odontoschisma falcifolium Steph.	0,3		X	X	X					X							X		
Odontoschisma longiflorum (Tay.) Steph.	0,4	X		X	X					X						X	X	X	
Odontoschisma variabile (Lindenb. & Gottsche) Trevis.	0,1													X				X	
Cephalozia crossii Spruce	0,1															X			
Cephaloziella divaricata (Sm.) Schiffn.	0,1												X					X	
Cephaloziella granatensis (J.B. Jack) Fulford	0,1													X				X	
Cephaloziopsis intertexta (Gottsche) R.M. Schust.	0,2							X		X						X	X		
Cylindrocolea planifolia (Steph.) R.M. Schust.	0,1						X							X					
Cylindrocolea rhizantha (Mont.) R.M. Schust.	0,4	X		X					X					X	X	X	X		
Fuscocephaloziopsis crassifolia (Lindenb. & Gottsche) Váňa & L. Söderstr.	0,2		X 31		X												X 31		X
Kymatocalyx dominicensis (Spruce) Vána	0,3			X				X		X							X		X
Chonecolea doellingeri (Nees) Grolle	0,2													X	X	X		X	
Cyathodium cavernarum Kunze	0,1										X								
Dumortiera hirsuta (Sw.) Nees	0,6				X	X		X	X		X	X		X		X	X	X	X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Fossombronia porphyrorhiza (Nees) Prosk.	0,6						X	X	X	X	X	X		X	X		X	X	
Frullania apiculata (Reinw., Blume & Nees) Dumort.	0,3	X	X	X													X		X
Frullania atrata (Sw.) Nees	0,3			X	X											X	X	X	X
Frullania beyrichiana (Lehm. & Lindenb.) Lehm. & Lindenb.	0,4		X		X			X	X	X				X			X	X	
Frullania brasiliensis Raddi	0,7		X	X	X			X	X	X		X	X	X	X		X	X	X
Frullania breuteliana Gottsche	0,1			X	X														
Frullania caulisequa (Nees) Nees	0,9	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Frullania curvilobula Schäf.-Verw. *et al.*	0,2			X	X												X		
Frullania dilatata (L.) Dumort.	0,2							X						X	X				
Frullania dusenii Steph.	0,1						X								X				
Frullania ecklonii (Spreng.) Spreng. in Gottsche *et al.*	0,1																X	X	
Frullania ericoides (Nees) Mont.	0,5			X				X	X	X				X	X		X	X	X
Frullania flexicaulis Spruce	0,2			X	X														X
Frullania glomerata (Lehm. & Lindenb.) Mont.	0,2								X	X							X	X	
Frullania grossifolia Steph.	0,1			X													X		
Frullania griffithsiana Gott.	0,1														X			X	
Frullania gymnotis Nees & Mont.	0,1							X							X				
Frullania involuta Hampe ex Steph.	0,1			X															X
Frullania kunzei (Lehm. & Lindenb.) Lehm. & Lindenb.	0,4			X	X	X				X		X		X				X	X
Frullania montagnei Gottsche	0,1	X																	
Frullania neesii Lindenb.	0,2							X	X						X		X		
Frullania neurota Tayl.	0,1														X				
Frullania obscura (Sw.) Dumort.	0,6			X		X 32		X 32	X 32	X 32		X 32	X 32		X 32		X 32	X	X
Frullania riojaneirensis (Raddi) Spruce	0,5					X	X	X	X	X	X				X		X		X
Frullania schaefer-verwimpii Yuzawa & Hatt.	0,1									X							X		
Frullania serrata Gottsche	0,1							X											
Frullania setigera Steph.	0,4	X		X	X					X			X				X	X	X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Frullania supradecomposita (Lehm. & Lindenb.) Lehm. & Lindenb.	0,1														X				
Frullania vitalii Yuzawa & Hatt.	0,3			X						X		X		X					X
Saccogynidium caldense (Angstr.) Grolle	0,4			X	X								X			X	X	X	X
Gongylanthus liebmannianus (Lindenb. & Gottsche) Steph.	0,1																	X	
Herbertus acanthelius Spruce	0,1				X														
Herbertus angustivittatus (Steph.) Fulford	0,1															X			
Herbertus divergens (Steph.) Herzog	0,1																		X
Herbertus juniperoideus (Sw.) Grolle	0,4		X 33	X 34	X 34				X 34				X				X 34	X 34	X
Herbertus pensilis Spruce	0,1				X													X	
Herbertus serratus Spruce	0,1																	X	
Anastrophyllum piligerum (Nees) Spruce	0,1																X	X	
Anastrophyllum tubulosum (Nees) Grolle	0,1																	X	
Jamesoniella rubricaulis (Nees) Grolle	0,1			X													X		
Syzygiella anomala (Lindenb. & Gottsche) Stephani	0,2			X	X												X	X	
Syzygiella concreta (Gottsche) Spruce	0,1																	X	X
Syzygiella contigua (Gottsche) Steph.	0,1				X														
Syzygyella geminifolia (Mitt.) Steph.	0,1																	X	
Syzygiella integerrima Steph.	0,1				X												X		
Syzygyella liberata Inoue	0,2			X	X													X	
Syzygyella perfoliata (Sw.) Spruce	0,2			X													X	X	
Syzygiella rubricaulis (Nees) Steph.	0,2				X								X					X	
Syzygyella sonderi (Gottsche) Feldberg *et al.*	0,1																	X	
Syzygyella uleana Steph.	0,1																	X	
Jungermannia amoena Lindenb. & Gottsche	0,1								X									X	
Jungermannia hyalina Lyell	0,2			X				X									X	X	
Jungermannia sphaerocarpa Hook.	0,1			X														X	
Acanthocoleus aberrans (Lindenb. & Gottsche) Kruijt	0,4	X		X				X	X			X					X	X	X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Acanthocoleus trigonus (Nees & Mont.) Gradst.	0,1			X				X											
Acrolejeunea emergens (Mitt.) Steph.	0,1									X					X				
Acrolejeunea torulosa (Lehm. & Lindenb.) Schiffn.	0,1						X										X		
Anoplolejeunea conferta (C.F.W. Meissn.) A. Evans	0,7		X	X	X				X	X	X		X	X		X	X	X	X
Aphanolejeunea asperrima Steph.	0,1	X															X		
Aphanolejeunea camillii (Lehm.) R.M. Schust.	0,1						X												
Aphanolejeunea clavatopapillata (Steph.) A. Evans	0,1	X																	
Aphanolejeunea ephemeroides Schust.	0,1														X		X		
Archilejeunea auberiana (Mont.) A. Evans	0,1							X		X									
Archilejeunea fuscescens (Hampe ex Lehm) Fulford	0,1														X		X		
Archilejeunea ludoviciana (De Not. ex Lehm.) Gradst. & Geissler	0,2				X												X		X
Blepharolejeunea securifolia (Steph.) R. M. Schust.	0,1																	X	
Brachiolejeunea laxifolia (Taylor) Schiffn.	0,2			X													X	X	
Brachiolejeunea leiboldiana (Gottsche & Lindenb.) Schiffn.	0,1												X						
Brachiolejeunea phyllorhiza (Nees) Kruijt & Gradst.	0,3			X	X					X	X							X	
Bromeliophila natans (Steph.) R.M. Schust.	0,1									X							X		
Bryopteris diffusa (Sw.) Nees	0,8	X	X	X	X		X	X		X	X		X	X	X	X	X	X	X
Bryopteris filicina (Sw.) Nees	0,8	X	X	X	X	X		X	X	X	X		X	X			X	X	X
Bryopteris fruticulosa Taylor	0,1							X											
Bryopteris trinitensis (Lehm. & Lindenb.) Lehm. & Lindenb.	0,1							X											
Caudalejeunea lehmanniana (Gottsche) A. Evans	0,2							X		X					X		X		
Ceratolejeunea atlantica Alvarenga & Ilk.-Borg.	0,1																X		X
Ceratolejeunea ceratantha (Nees & Mont.) Steph.	0,2	X								X									X
Ceratolejeunea coarina (Gottsche) Schiffn.	0,3	X		X				X		X		X					X		

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Ceratolejeunea confusa R.M. Schuster	0,3				X			X		X							X	X	
Ceratolejeunea cornuta (Lindenb.) Schiffn.	0,8	X	X	X	X	X		X	X	X	X	X	X				X	X	X
Ceratolejeunea cornutissima Steph.	0,1									X									
Ceratolejeunea cubensis (Mont.) Schiffn.	0,4	X		X		X		X		X					X	X	X		
Ceratolejeunea dussiana (Steph.) G. Dauphin	0,1															X			
Ceratolejeunea fallax (Lehm. & Lindenb.) Bonner	0,4	X		X						X				X			X	X	X
Ceratolejeunea guianensis (Nees & Mont.) Steph.	0,1																X		
Ceratolejeunea laetefusca (Austin) R.M.Schust.	0,3	X						X		X			X				X		X
Ceratolejeunea minuta G.Dauphin	0,1	X																	
Ceratolejeunea patentissima (Hampe & Gottsche) A. Evans	0,1															X			
Ceratolejeunea rubiginosa Gottsche ex Steph.	0,2									X						X	X		
Ceratolejeunea temnantha (Spruce) Reiner-Drehwald	0,1																		X
Ceratolejeunea umbonata Steph.	0,1															X			
Cheilolejeunea acutangula (Nees) Grolle	0,8	X	X	X	X			X	X	X		X	X	X		X	X	X	X
Cheilolejeunea adnata (Kunze) Grolle	0,4	X			X			X	X	X					X		X	X	
Cheilolejeunea aneogyna (Spruce) A. Evans	0,1																	X	
Cheilolejeunea beyrichii (Lindenb.) Reiner	0,1			X														X	
Cheilolejeunea caducifolia (Gradst. & Schäf.-Verw.) W. Ye & R.L. Zhu	0,1				X														
Cheilolejeunea clausa (Nees & Mont.) R. M. Schust.	0,6	X	X		X		X	X		X					X		X	X	X
Cheilolejeunea comans (Spruce) R.M. Schust.	0,2	X		X													X		
Cheilolejeunea conchifolia (A. Evans) W. Ye & R.L. Zhu	0,3		X 35					X 35				X		X	X 35		X 35		
Cheilolejeunea discoidea (Lehm. & Lindenb.) Kachroo & R.M.Schust.	0,4	X		X			X			X					X		X	X	X
Cheilolejeunea filiformis (Sw.) W. Ye, R. L. Zhu & Gradst.	0,8		X 36	X	X 36			X 36	X 36	X 36	X 36	X 36	X 36	X 36		X 36	X 36	X	X

Species	Freq	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Cheilolejeunea holostipa (Spruce) Grolle & R.-L. Zhu	0,5			X	X	X			X	X		X					X	X	X
Cheilolejeunea inflexa (Hampe ex Lehm.) Grolle	0,1	X																	
Cheilolejeunea insecta Grolle & Gradst.	0,1																	X	X
Cheilolejeunea intertexta (Lindenb.) Steph.	0,1																X		
Cheilolejeunea oncophylla (Ångstr.) Grolle & E. Reiner	0,4	X	X		X			X	X					X		X		X	
Cheilolejeunea rigidula (Nees ex Mont.) R.M. Schust.	0,6	X			X		X	X	X	X		X		X	X		X		X
Cheilolejeunea rubiginosa Steph.	0,1							X											
Cheilolejeunea trifaria (Reinw. et al.) Mizut.	0,6	X	X	X				X	X	X	X	X		X			X		
Cheilolejeunea unciloba (Lindenb.) Malombe	0,8	X 37	X 37	X	X		X	X 37	X	X			X	X	X 37	X 37	X 37	X	X
Cheilolejeunea xanthocarpa (Lehm. & Lindenb.) Malombe	0,9	X 38	X 38	X	X	X 38	X	X 38	X	X		X	X	X	X 38	X 38	X 38	X	X
Cololejeunea cardiocarpa (Mont.) A. Evans	0,4			X				X	X				X		X		X	X	
Cololejeunea clavatopapillata Steph.	0,2			X					X	X								X	
Cololejeunea contractiloba A. Evans	0,1																X39		X
Cololejeunea cornutissima (R. M. Schust.) Pócs	0,1								X										
Cololejeunea diaphana A. Evans	0,3				X					X		X		X				X	X
Cololejeunea gracilis (Jovet-Ast.) Pócs.	0,1			X	X														
Cololejeunea lanciloba Steph.	0,1																		X
Cololejeunea manaosensis (Herzog) O. Yano	0,2			X	X					X								X	
Cololejeunea microscopica (Taylor) Schiffn.	0,3	X 40		X	X									X		X 40		X	
Cololejeunea minuscula Pócs	0,1								X										
Cololejeunea minutissima (Sm.) Schiffn.	0,2			X										X		X	X		
Cololejeunea obliqua (Nees & Mont.) Schiffn.	0,6	X	X			X		X		X	X	X	X				X	X	X
Cololejeunea papilliloba (Steph). Steph.	0,4	X 41		X	X		X 41			X							X 41		X
Cololejeunea paucifolia (Spruce) Bernecker & Pócs	0,3			X		X 42		X 42								X 42	X 42		

Species	Freq	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Cololejeunea sicaefolia (Gottsche) Pócs & Bernecker	0,1	X 43												X					
Cololejeunea subcardiocarpa P. Tixier	0,3	X				X	X		X									X	
Cololejeunea submarginata P. Tixier	0,1																X		
Cololejeunea truncatifolia (Horik.) Mizut.	0,2			X											X 44		X 44	X	
Cololejeunea verwimpii P. Tixier	0,2								X								X		X
Cololejeunea vitalana P. Tixier	0,1												X				X		
Colura calyptrifolia (Hook.) Dumort.	0,2			X	X													X	X
Colura greig-smithii Jovet-Ast	0,1			X													X		
Colura tenuicornis (A. Evans) Steph.	0,4			X		X		X						X		X	X	X	X
Colura tortifolia (Nees & Mont.) Steph.	0,3	X	X					X									X		X
Colura ulei Jovet-Ast	0,1									X							X		
Cyclolejeunea chitonia (Tayl. ex Lehm.) A. Evans	0,1	X																	
Cyclolejeunea convexistipa (Lehm. & Lindenb.) A. Evans	0,3	X	X		X					X							X		
Cyclolejeunea grandistipula Steph.	0,1															X			
Cyclolejeunea luteola (Spruce) Grolle	0,3	X	X	X	X											X			X
Cyclolejeunea papillata Steph.	0,1															X			
Cyclolejeunea peruviana (Lehm. & Lindenb.) A. Evans	0,2		X							X							X		
Cyrtolejeunea holostipa (Spruce) A. Evans	0,1							X											
Dicranolejeunea axilaris (Nees & Mont.) Schiffn.	0,2			X	X													X	
Dibrachiella parviflora (Nees) X.Q. Shi, R.L. Zhu & Gradst.	0,4	X 45				X 45		X 45		X 45			X 45				X 45		X
Diplasiolejeunea alata Jovet-Ast	0,1					X													
Diplasiolejeunea brunnea Steph.	0,4	X	X	X	X			X		X							X		X
Diplasiolejeunea cavifolia Steph.	0,6	X		X		X	X	X		X		X	X				X		X
Diplasiolejeunea inermis P. Tixier	0,1				X												X		
Diplasiolejeunea latipuense P. Tixier	0,1	X																	
Diplasiolejeunea pellucida (C. F. W. Meissn. ex Spreng)	0,3	X	X							X							X		X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Diplasiolejeunea rudolphiana Steph.	0,4	X						X		X		X	X		X		X		X
Drepanolejeunea aculeata Bischl.	0,1																	X	
Drepanolejeunea anoplantha (Spruce) Steph.	0,6	X		X	X		X				X			X		X	X	X	X
Drepanolejeunea aracauriae Steph.	0,3	X		X	X												X	X	
Drepanolejeunea bidens (Steph.) A. Evans	0,2	X							X				X						
Drepanolejeunea biocellata A. Evans	0,2					X							X			X			
Drepanolejeunea campanulata (Spruce) Steph.	0,2				X													X	X
Drepanolejeunea capulata (Taylor) Steph.	0,1				X											X			
Drepanolejeunea crucianella (Tayl.) A. Evans	0,1	X	X																
Drepanolejeunea fragilis Bischl.	0,4	X	X	X	X		X									X	X	X	
Drepanolejeunea granatensis (J. B. Jack & Steph.) Bischl.	0,2			X													X		X
Drepanolejeunea grollei E. Reiner & Schafer	0,1																	X	
Drepanolejeunea lichenicola (Spruce) Steph.	0,5	X	X	X					X					X		X	X	X	X
Drepanolejeunea mosenii (Steph.) Bischl.	0,8	X		X	X	X		X	X	X	X	X	X	X		X	X	X	X
Drepanolejeunea orthophylla (Nees & Mont.) Bischl.	0,4	X	X	X	X			X		X						X	X		
Drepanolejeunea palmifolia (Nees) Steph.	0,1	X																	
Drepanolejeunea polyrhiza (Nees) Grolle & R.-L. Zhu	0,1																X		
Drepanolejeunea subdissitifolia Herzog	0,2													X		X	X		
Frullanoides corticalis (Lehm. & Lindenb.) van Slageren	0,1									X									
Frullanoides densifolia Raddi	0,3			X									X				X	X	X
Frullanoides liebmanniana (Lindenb & Gottsche) van Slageren	0,1																	X	
Frullanoides tristis (Steph.) van Slageren	0,3			X					X	X								X	X
Harpalejeunea ancistrodes (Spruce) Schiffn.	0,1															X			
Haplolejeunea cucullata (Steph.) Grolle	0,1									X									

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Harpalejeunea molleri (Steph.) Grolle	0,1																		X
Harpalejeunea oxyphylla (Nees & Mont.) Steph.	0,5	X		X	X	X				X						X	X	X	X
Harpalejeunea schiffneri S.W. Arnell	0,2									X							X		X
Harpalejeunea stricta (Lindenb. & Gottsche) Steph.	0,6	X		X	X			X	X					X		X	X	X	X
Harpalejeunea subacuta A. Evans	0,4		X						X	X		X	X			X	X		X
Harpalejeunea tridens (Besch. & Spruce) Steph.	0,3	X		X	X					X							X		
Harpalejeunea uncinata Steph.	0,1									X									
Lejeunea adpressa Nees	0,3								X	X		X		X			X		X
Lejeunea anomala Lindenb. & Gottsche	0,1																X		
Lejeunea aphanes Spruce	0,2			X													X	X	X
Lejeunea asperrima Spruce	0,1																X		
Lejeunea asthenica Spruce	0,1																	X	X
Lejeunea autoica Schust.	0,1														X				
Lejeunea bermudiana (A. Evans) R.M. Schust.	0,4			X	X			X	X					X	X		X	X	
Lejeunea boryana Mont.	0,1	X																	
Lejeunea caespitosa Lindenb. ex Gottsche	0,1							X							X				
Lejeunea calcicola R.M. Schust.	0,1									X							X		
Lejeunea cancellata Nees & Mont.	0,1							X							X				
Lejeunea capensis Gottsche	0,2			X			X											X	
Lejeunea cardotii Steph.	0,1							X											
Lejeunea caulicalyx (Steph.) E. Reiner & Goda	0,4	X		X	X		X							X 46			X	X	X
Lejeunea cerina (Lehm. & Lindenb.) Gottsche *et al.*	0,2	X			X													X	X
Lejeunea cladogyna A. Evans	0,2									X					X				X
Lejeunea cf. *compressiuscula* Steph.	0,1											X							
Lejeunea confusa E.W. Jones	0,1									X	X								
Lejeunea controversa Gottsche	0,4	X		X	X					X	X		X				X	X	
Lejeunea cristulata (Steph.) E.Reiner & Goda	0,5			X	X	X			X				X	X		X		X	X
Lejeunea cristuliflora (Gottsche ex Steph.) E.Reiner & Goda	0,2			X 47														X	X
Lejeunea deplanata Nees	0,3			X	X				X	X							X		X
Lejeunea diversicuspis Spruce	0,1																	X	

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Lejeunea elliottii Spruce	0,1	X																	X
Lejeunea filipes Spruce	0,3	X	X	X			X	X											
Lejeunea flagellifera C.J. Bastos, M.E. Reiner & Schäf.-Verw.	0,1																		X
Lejeunea flava (Sw.) Nees	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lejeunea glaucescens Gottsche	0,5				X			X	X	X	X	X	X		X	X			
Lejeunea grossiretis (Steph.) E. Reiner & Goda	0,2	X															X	X	
Lejeunea grossitexta (Steph.) M. E. Reiner & Goda	0,5			X	X				X			X	X	X			X	X	X
Lejeunea herminieri (Steph.) R. L. Zhu	0,2			X														X	X
Lejeunea immersa Spruce	0,1	X					X												
Lejeunea laeta (Lehm. & Lindenb.) Gottsche	0,4	X		X	X					X							X	X	X
Lejeunea laetevirens Nees & Mont.	0,8	X		X	X	X	X	X	X	X				X	X	X	X	X	X
Lejeunea lamacerina (Steph.) Schiffn.	0,1													X					
Lejeunea lepida Lindenb. & Gottsche	0,1							X											
Lejeunea lusoria (Lindenb. & Gottsche) Steph.	0,3			X 48		X 48			X 48				X 48				X 48		X
Lejeunea magnoliae Lindenb. & Gottsche	0,1	X																	
Lejeunea maxonii (A. Evans) X.-L. He	0,1							X							X				
Lejeunea minutiloba A. Evans	0,3												X	X	X		X		X
Lejeunea monimiae (Steph.) Steph.	0,2								X								X	X	
Lejeunea obtusangula Spruce	0,5	X 49		X 49		X 49		X 49	X 49	X 49		X 49					X 49		X
Lejeunea oligoclada Spruce	0,3			X	X												X	X	X
Lejeunea phyllobola Nees & Mont.	0,6	X	X	X				X		X		X		X	X	X	X	X	
Lejeunea pterigonia (Lehm. & Lindenb.) Mont.	0,5	X 50		X 50	X 50					X 50		X 50		X 50			X 50	X	X
Lejeunea puiggariana Steph.	0,3			X				X								X		X	X
Lejeunea raddiana Lindenb.	0,2			X									X				X		X
Lejeunea ramulosa Spruce	0,1																	X	
Lejeunea ruthii (A. Evans) R. M. Schust.	0,1																X	X	
Lejeunea serpillifolioides (Raddi) Gradst.	0,1																	X	
Lejeunea setiloba Spruce	0,1													X					

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Lejeunea subplana (Steph.) C. Bastos	0,1																		X
Lejeunea tapajosensis Spruce	0,1	X						X											
Lejeunea terricola Spruce	0,2							X 51	X 51								X 51		X
Lejeunea trinitensis Lindenb.	0,1													X					
Lejeunea ulicina (Taylor) Gottsche *et al.*	0,2									X		X		X					
Lejeunea villaumei (Steph.) Grolle	0,1											X							
Lepidolejeunea bidentula (J.B. Jack & Steph.) R.M. Schust.	0,2							X						X			X		
Lepidolejeunea cuspidata (Gottsche) Heinrichs & Schäf.-Verw.	0,1																		X
Lepidolejeunea involuta (Gottsche) Grolle	0,3	X		X										X			X		X
Leptolejeunea brasiliensis Bischl.	0,1			X													X		
Leptolejeunea diversilobulata Bischl.	0,2								X								X		X
Leptolejeunea elliptica (Lehm. & Lindenb.) Schiffn.	0,7	X	X	X		X	X	X	X	X					X	X	X	X	X
Leptolejeunea exocellata (Spruce) A. Evans	0,3			X				X									X	X	X
Leptolejeunea maculata (Mitt.) Schiffn.	0,1																		X
Leptolejeunea moniliata Steph.	0,1	X																	
Leptolejeunea obfuscata (Spruce) Steph.	0,1														X				
Lopholejeunea nigricans (Lindenb.) Schiffn.	0,6	X		X	X			X	X	X		X			X		X		X
Lopholejeunea subfusca (Nees) Schiffn.	0,6	X	X	X		X		X		X			X		X		X	X	
Marchesinia bongardiana (Lehm. & Lindb.) Trevis.	0,1				X														X
Marchesinia brachiata (Sw.) Schiffn.	0,7		X	X	X	X	X			X	X		X	X			X	X	X
Mastigolejeunea auriculata (Wilson) Schiffn.	0,2									X			X		X		X		
Mastigolejeunea innovans (Spruce) Steph.	0,1									X									
Mastigolejeunea plicatiflora (Spruce) Steph.	0,1									X							X		
Metalejeunea cucullata (Reinw., Blume & Nees) Grolle	0,2		X														X		X
Microlejeunea acutifolia Steph.	0,2	X		X	X														
Microlejeunea bullata (Taylor) Steph.	0,8	X	X	X	X	X		X	X	X			X	X	X	X	X	X	X

Species	Freq	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Microlejeunea capillaris (Gottsche)	0,1																X		
Microlejeunea cystifera Herzog	0,2				X											X	X		X
Microlejeunea epiphylla Bischl.	0,7	X	X	X	X		X	X	X	X				X	X		X	X	
Microlejeunea globosa (Spruce) Steph	0,3				X			X		X				X		X			X
Microlejeunea ruthii A. Evans	0,1									X									
Microlejeunea stricta (Lindenb. & Gottsche) Steph.	0,1	X												X					
Microlejeunea subaphanes Herzog	0,1															X			
Microlejeunea squarrosa J. Heinrichs *et al.*	0,1																	X	
Microlejeunea subulistipa Steph.	0,1																X		
Microlejeunea ulicina (Tayl.) Steph.	0,1														X				
Myriocoleopsis minutissima (Sm.) R. L. Zhu *et al.*	0,1				X														
Neopotamolejeunea uleana (Steph.) E. Reiner	0,1							X											
Neurolejeunea breutelii (Gottsche) A. Evans	0,4			X	X			X	X	X							X		X
Neurolejeunea seminervis (Spruce) Schiffn.	0,1														X				
Odontolejeunea decemdentata (Spruce) Steph.	0,1			X							X								
Odontolejeunea fissistipula Steph.	0,1															X			
Odontolejeunea lunulata (F. Weber) Schiffn.	0,5		X	X	X		X		X		X		X				X		X
Odontolejeunea rhomalea (Spruce) Steph.	0,1									X							X		
Oryzolejeunea saccatiloba (Steph.) Gradst.	0,2							X		X		X							
Otigoniolejeunea huctumalcensis (Lindenb. & Gottsche) Y. M. Wei, R. L. Zhu & Gradst.	0,2	X 52			X 53									X 53					X
Prionolejeunea aemula (Gottsche) A. Evans	0,4	X		X	X			X	X	X							X		X
Prionolejeunea denticulata (F. Weber) Schiffn.	0,1	X																	X
Prionolejeunea galliotii Steph.	0,1	X																	X
Prionolejeunea innovata A. Evans	0,1							X											
Prionolejeunea limpida Herzog	0,2									X		X					X		

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Prionolejeunea luensis Herz.	0,1		X																
Prionolejeunea mucronata (Sande Lac.) Steph.	0,1															X			
Prionolejeunea muricatoserrulata (Spruce) Steph.	0,1	X																	
Prionolejeunea scaberula (Spruce) Steph.	0,1	X			X														
Pycnolejeunea contigua (Nees) Grolle	0,3	X		X				X		X					X		X		
Pycnolejeunea densistipula (Lehm. & Lindenb.) Steph.	0,3	X		X						X							X		X
Pycnolejeunea macroloba (Nees & Mont.) Schiffn.	0,2	X								X					X		X		
Pycnolejeunea papillosa X.-L. He	0,1														X				
Rectolejeunea emarginuliflora (Gott. Ex Schiffn.) Evans	0,5	X		X				X		X				X	X	X	X		X
Rectolejeunea versifolia (Schiffn.) L. Söderstr. & A. Hagborg	0,5	X 54	X 54	X 54						X 54		X 54		X 54	X 54		X 54		X
Rectolejeunea flagelliformis A. Evans	0,2	X						X		X							X		
Rectolejeunea monoica R.M. Schust.	0,1	X																	
Rectolejeunea truncatilobula C. Bastos	0,1																X		
Schiffneriolejeunea polycarpa (Nees) Gradst.	0,4	X	X	X						X			X	X	X		X		
Stictolejeunea squamata (Willd. ex Weber) Schiffn.	0,4	X				X		X		X					X		X		X
Strepsilejeunea apicidens Herzog	0,1															X			
Symbiezidium barbiflorum (Lindenb. & Gottsche) A. Evans	0,4	X				X		X		X		X		X	X		X		
Symbiezidium transversale (Sw.) Trevis.	0,3	X	X					X		X					X		X		
Taxilejeunea isocalycina (Nees) Steph.	0,4			X	X				X	X	X		X			X	X		
Thysananthus auriculatus (Wilson & Hook) Sukkharak & Gradst.	0,1																	X	
Trocholejeunea bahamensis (A. Evans) R.M. Schust.	0,1									X									
Verdoornianthus griffinii Gradst.	0,1														X				
Vitalianthus aphanellus (Spruce) Bechteler, G.E. Lee, Schäf.-Verw. & Heinrichs	0,1																		X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Vitalianthus bischlerianus (K.C. Pôrto & Grolle) R.M. Schust. & Giancotti	0,4	X	X	X						X				X		X	X		X
Xylolejeunea crenata (Nees & Mont.) X.-L. He & Grolle	0,4	X		X	X					X				X		X	X		X
Lepicolea ochroleuca (Spreng.) Spruce	0,1				X														
Arachniopsis diacantha (Mont.) M.A. Howe	0,2	X	X			X													
Arachniopsis monodactyla (Spruce) R.M. Schust.	0,1									X									
Bazzania arcuata (Lindb. & Gottsche) Trevis.	0,1				X														
Bazzania aurescens Spruce	0,4		X	X	X				X								X	X	X
Bazzania cuneistipula (Gottsche & Lindenb.) Trevis.	0,3			X	X												X	X	X
Bazzania falcata (Lindenb.) Trevis.	0,1																X	X	
Bazzania gracilis (Hampe & Gottsche) Steph.	0,3			X	X												X	X	X
Bazzania heterostipa (Steph.) Fulford	0,4			X	X								X	X		X	X		X
Bazzania hookeri (Lindenb.) Trevis.	0,5			X	X				X	X			X			X	X	X	X
Bazzania jamaicensis (Lehm. & Lindb.) Trevis.	0,2				X												X	X	
Bazzania longistipula (Lindenb.) Trevis.	0,3					X							X			X	X		X
Bazzania nitida (F. Weber) Grolle	0,1																	X	
Bazzania pallidevirens (Steph.) Fulford.	0,1			X	X														
Bazzania phyllobola Spruce	0,2			X													X		X
Bazzania stolonifera (Sw.) Trevis.	0,3		X							X						X	X		X
Bazzania taleana (Gottsche) Fulford	0,2				X												X		X
Kurzia brasiliensis (Steph.) Grolle	0,2								X							X		X	
Kurzia capillaris (Sw.) Grolle	0,6			X	X			X		X		X	X	X		X	X	X	X
Kurzia flagellifera (Steph.) Grolle	0,1									X						X			
Lepidozia brasiliensis Steph.	0,2									X				X				X	X
Lepidozia coilophylla Taylor	0,3				X					X						X	X	X	
Lepidozia cupressina (Sw.) Lindenb.	0,3		X		X									X			X	X	X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Lepidozia inaequalis (Lehm. & Lindenb.) Lehm. & Lindenb.	0,3				X								X			X		X	X
Micropterygium campanense Spruce	0,1	X																	
Micropterygium reimersianum Herzog	0,1	X																	
Micropterygium trachyphyllum Reimers	0,1	X																	
Mytilopsis albifrons Spruce	0,1																X		
Paracromastigum pachyrhizum (Nees) Fulford	0,4			X	X				X	X			X	X				X	
Telaranea diacantha (Mont.) J.J. Engel & G.L. Merr.	0,3			X	X					X						X	X	X	
Telaranea nematodes (Gottshe ex Austin) M. A. Howe	0,8	X		X	X			X	X	X		X	X	X	X	X	X	X	X
Zoopsidella antillana (Steph.) R.M. Schust.	0,1									X									
Zoopsidella integrifolia (Spruce) R. M. Schust.	0,1																X		
Zoopsidella macella (Spruce) R. M. Schust.	0,1																X		
Chiloscyphus latifolius (Nees) J.J. Engel & R.M. Schust.	0,1											X		X					
Chiloscyphus leptanthus (Hook. f. & Taylor) J.J. Engel & R.M. Schust.	0,2									X				X		X 55			X
Chiloscyphus lindmannii (Steph.) J.J. Engel & R.M. Schust.	0,2			X					X 56					X				X	
Chiloscyphus mandonii (Steph.) J.J. Engel & R.M. Schust.	0,4			X		X 57								X		X 57	X 57	X	X
Chiloscyphus martianus (Nees) J.J. Engel & R.M. Schust.	0,9	X 58	X 58	X	X	X 58		X 58	X 58	X	X	X	X	X	X 58	X 58	X 58	X	X
Chiloscyphus muricatus (Lehm.) J.J. Engel & R.M. Schust.	0,5	X 59		X	X	X 59								X		X 59	X 59	X	X
Chiloscyphus platensis (C. Massal.) J.J. Engel	0,1													X					
Chiloscyphus perissodontus (Spruce) J.J. Engel & R.M. Schust.	0,3	X 60				X 60						X		X 61		X 60			
Chiloscyphus proteus (Herzog) J.J. Engel & R.M. Schust.	0,1				X														
Chiloscyphus pycnophyllus (Spruce) J.J. Engel & R.M. Schust.	0,1																	X	
Chiloscyphus quadridentatus (Spruce) J. J. Engel & R. M. Schust.	0,1										X								

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Clasmatocolea vermicularis (Lehm.) Grolle	0,1													X				X	
Heteroscyphus combinatus (Nees) Schiffn	0,1					X											X		
Heteroscyphus valdiviensis (Mont.) Schiffn.	0,1				X												X		
Lophocolea bidentata (L.) Dumort.	0,5	X		X		X	X	X	X								X	X	X
Leptoscyphus amphibolius (Nees) Grolle	0,2			X 62	X												X	X	
Leptoscyphus gibbosus (Tayl.) Mitt	0,1		X																
Leptoscyphus porphyrius (Nees) Grolle	0,3			X	X											X	X	X	
Leptoscyphus spectabilis (Steph.) Grolle	0,1																	X	
Lophocolea heterophylla (Schrad.) Dumort.	0,1																		X
Lophocolea liebmanniana Gottsche	0,1						X		X										
Lophocolea trapezoidea Mont.	0,1																		X
Lunularia cruciata (L.) Dumort.	0,1													X				X	
Marchantia berteroana Lehm. & Lindenb.	0,1																		X
Marchantia breviloba A. Evan	0,1																	X	
Marchantia chenopoda L.	0,6				X	X		X	X		X	X				X	X	X	X
Marchantia papillata Raddi	0,2				X												X		X
Marchantia polymorpha L.	0,1													X					
Metzgeria acuminata Steph.	0,1															X		X	
Metzgeria agnewiae Kuwah.	0,1																	X	
Metzgeria albinea Spruce	0,7		X	X	X	X		X	X	X			X	X		X	X	X	X
Metzgeria aurantiaca Steph.	0,4					X	X	X		X			X			X	X		
Metzgeria aurantiana Steph.	0,1														X				
Metzgeria bahiensis Schiffn.	0,2				X					X								X	
Metzgeria brasiliensis Schiffn.	0,2				X					X					X		X		
Metzgeria ciliata Raddi	0,2					X											X		X
Metzgeria conjugata Lindb.	0,5			X	X			X	X					X		X	X	X	X
Metzgeria consanguinea Schiffn.	0,2				X					X			X						
Metzgeria convoluta Steph.	0,3							X	X	X				X		X	X		

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Metzgeria cratoneura Schiffn. in Schiffner & S. Arnell, Österr. Akad. Wiss. Math.-Naturwiss	0,1																X	X	
Metzgeria decipiens (C. Massal.) Schiffn.	0,2			X										X		X			
Metzgeria dichotoma (Sw.) Nees	0,3			X							X			X		X			X
Metzgeria fruticola Spruce	0,1				X														X
Metzgeria furcata (L.) Dumort	0,6	X	X	X			X			X				X		X	X	X	X
Metzgeria hegewaldii Kuwah.	0,2				X													X	X
Metzgeria lechleri Steph.	0,2					X										X	X		
Metzgeria leptoneura Spruce	0,3								X		X					X	X	X	
Metzgeria myriopoda Lindb.	0,5			X	X	X				X		X	X	X		X	X		
Metzgeria psilocraspeda Schiffn.	0,1													X					
Metzgeria rufula Spruce	0,1										X								
Metzgeria schyphigera A. Evans	0,2			X													X	X	
Metzgeria subaneura Schiffn.	0,1															X		X	
Metzgeria uncigera A. Evans	0,3			X	X				X								X	X	
Monoclea gottschei Lindb.	0,4					X		X	X			X				X	X	X	X
Jensenia difformis (Nees) Grolle	0,1																	X	
Pallavicinia lyellii (Hook. f.) S. F. Gray	0,6		X	X		X	X						X	X		X	X	X	X
Symphyogyna aspera Steph.	0,8	X	X	X	X	X	X	X	X	X				X		X	X	X	X
Symphyogyna brasiliensis (Nees) Nees & Mont.	0,8			X	X	X		X	X	X	X	X	X	X		X	X	X	X
Symphyogyna brongniartii Mont.	0,2				X													X	X
Symphyogyna circinata Nees & Mont.	0,1															X			
Symphyogyna podophylla (Thunb.) Mont. & Nees	0,5			X	X				X	X				X		X	X	X	X
Noteroclada confluens Taylor ex Hook. & Wilson	0,3				X				X					X				X	X
Plagiochila adianthoides (Sw.) Lindenb.	0,3		X	X	X								X					X	X
Plagiochila aerea Taylor	0,3	X	X		X												X		X
Plagiochila bifaria (Sw.) Lindenb.	0,6		X	X	X				X				X	X		X	X	X	X
Plagiochila bryopterioides Spruce	0,1			X															
Plagiochila bunburii Taylor	0,2									X	X		X	X					
Plagiochila corrugata (Nees) Nees & Mont.	0,8		X	X	X	X	X	X	X	X		X	X	X		X	X	X	X

Species	Freq	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Plagiochila crispabilis Lindenb.	0,7	X 63		X 63	X 63	X 63		X 63		X	X 63		X 63	X 63		X	X 63		X
Plagiochila cristata (Sw.) Lindenb.	0,4			X	X						X					X	X	X	X
Plagiochila deflexirama Taylor	0,1																X	X	
Plagiochila disticha (Lehm. & Lindenb.) Lindenb.	0,6	X					X	X	X	X			X	X	X	X	X		
Plagiochila diversifolia Lindenb. & Gottsche	0,1		X																
Plagiochila exigua (Taylor) Taylor	0,3			X	X									X			X	X	X
Plagiochila gymnocalycina (Lehm. & Lindenb.) Lindenb.	0,5	X	X	X	X								X	X			X	X	X
Plagiochila hoehnei Herzog	0,1															X			
Plagiochila laetevirens Lindenb.	0,1																		X
Plagiochila lingua Steph.	0,1																X		
Plagiochila macrostachya Lindenb.	0,3			X	X					X							X	X	X
Plagiochila martiana (Nees) Lindenb.	0,6	X			X	X	X	X	X	X			X	X	X		X		
Plagiochila micropteryx Gottsche	0,4		X				X	X		X		X		X		X	X		
Plagiochila montagnei Nees	0,3	X		X						X					X		X	X	
Plagiochila patula (Sw.) Lindenb.	0,7	X		X	X	X	X			X	X		X	X			X	X	X
Plagiochila punctata (Taylor) Taylor	0,1																		X
Plagiochila raddiana Lindenb.	0,5	X		X		X	X	X						X		X	X		X
Plagiochila rutilans Lindenb.	0,6	X		X	X			X	X	X					X	X	X	X	X
Plagiochila simplex (Sw.) Lindenb.	0,6	X	X	X	X			X	X	X	X							X	X
Plagiochila subbindentata Taylor	0,2									X						X			X
Plagiochila subcontigua Herzog	0,1									X						X			
Plagiochila subplana Lindenb.	0,5	X		X	X	X		X					X			X	X		X
Plagiochila sullivantii Gott. ex Evans	0,1														X				
Plagiochila superba (Nees ex Spreng.) Mont. & Nees var. superba in d'Orbigny Voy. Amer. Mer.	0,1																X		
Plagiochila tenuis Lindenb.	0,1							X							X				
Plagiochila trichomanes Spruce	0,1															X			
Plagiochila uleana Steph.	0,1														X				

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Porella brasiliensis (Raddi) Schiffn.	0,3			X						X			X				X	X	X
Porella reflexa (Lehm. & Lindenb.) Trevis.	0,1																X		
Porella swartziana (Weber) Trevis.	0,2			X							X		X					X	
Radula affinis Lindenb. & Gott.	0,1														X				
Radula angulata Steph.	0,2			X	X							X						X	
Radula brasilica K. Yamada	0,2			X	X													X	X
Radula complanata (L.) Dumort.	0,1														X				X
Radula cubensis K. Yamada	0,1													X					
Radula decora Gottsche ex Steph.	0,1			X														X	
Radula elliottii Castle	0,1				X														
Radula fendleri Gottsche ex Steph.	0,2			X					X									X	X
Radula flaccida Lindenb. & Gottsche	0,1	X													X				
Radula gottscheana Taylor	0,2			X	X				X				X						
Radula javanica Gottsche	0,6	X		X	X	X		X	X	X					X		X	X	X
Radula kegelii Gottsche ex Steph.	0,6	X	X					X	X	X	X			X	X	X		X	
Radula ligula Steph.	0,1					X													X
Radula mammosa Spruce	0,3	X	X	X	X														X
Radula mexicana Lindenb. & Gottsche	0,4	X		X	X					X							X	X	X
Radula nudicaulis Steph.	0,5			X	X	X		X	X	X				X			X	X	
Radula obovata Castle	0,1																	X	
Radula pocsii K. Yamada	0,1									X									
Radula quadrata Gottsche	0,2			X					X									X	X
Radula recubans Taylor	0,6	X		X	X	X				X	X		X	X			X	X	
Radula schaefer-verwimpii Yamada	0,2			X	X													X	
Radula sinuata Gottsche ex Steph.	0,2			X									X					X	X
Radula stenocalyx Mont.	0,1																X		X
Radula tectiloba Steph.	0,2								X	X			X						X
Radula tenera Mitt. ex Steph.	0,3			X	X								X					X	X
Radula varilobula Castle	0,1																	X	
Radula voluta Taylor ex Gottsche	0,2			X									X					X	
Riccia brasiliensis Schiffn.	0,1													X					
Riccia enyae Jovet-Ast	0,1													X					
Riccia paranaensis Hässel	0,1																	X	
Riccia stenophylla Spruce	0,2						X							X					X

Species	Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Scapania portoricensis Hampe & Gottsche	0,2				X								X				X	X	
Leiomitra flaccida Spruce	0,4				X 64				X 64		X 64		X 64				X 64	X	X
Trichocolea argentea Herzog	0,1				X											X			
Trichocolea brevifissa Steph.	0,3		X		X				X								X	X 65	X
Trichocolea elegans Lehm.	0,1															X			
Trichocolea tomentosa (Sw.) Gottsche	0,2				X												X	X 66	X
Contagem		**208**	**131**	**386**	**364**	**137**	**102**	**243**	**216**	**278**	**109**	**110**	**220**	**266**	**136**	**241**	**433**	**490**	**414**

Synonyms of the species as written in the publications

1. Phaeoceros bulbiculosus (Broth.) Prosk.

2. Gemmabryum apiculatum (Schwägr.) J.R. Spence & H.P. Ramsay

3. Gemmabryum coronatum (Schwägr.) J. R. Spence & H. P. Ramsay

4. Gemmabryum subapiculatum (Hampe) J. R. Spence & H. P. Ramsay

5. Bryum beyrichianum (Horsch.) Müll. Hal.

6. Bryum grandifolium (Taylor) Müll. Hal

7. Bryum roseolum C. Muell.

8. Bryum billardierei Schwägr.

9. Bryum densifolium Brid.

10. Bryum huillense Welw. & Duby

11. Leucophanes muelleri Müll. Hal.

12. Campylopus filifolius (Hornsch.) Mitt.

13. Hypopterygium tamariscinum (Hedw.) Brid

14. Hypopterygium tamariscina (Hedw.) Brid. ex Müll. Hal.

15. Homalia glabella (Hedw.) Schimp.

16. Lepidopilidium portoricense (Müll. Hal.) H.A. Crum & Steere

17. Sematophyllum caespitosum (Hedw.) Mitt.

18. Acroporium estrellae (Müll. Hal.) W.R. Buck & A. Schäfer-Verwimp

19. Sematophyllum litophilum (Hornsch.) Ångstr.

20. Sematophyllum subpinnatum (Brid.) E. Britton

21. Sematophyllum subsimplex (Hedw.) Mitt.

22. Paranapiacabaea paulista Buck & Vital

23. Vitalia cuspidiferum (Mitt.) P.E.A.S. Câmara *et al.*

24. Aptychopsis tequendamense (Hampe) P.E.A.S. Câmara *et al.*

25. Sematophyllum galipense (Müll. Hal.) Mitt.

26. Cyrto-hypnum schistocalyx (Müll. Hal.) W.R. Buck & H.A. Crum

27. Thuidiopsis sparsa (Hook. & Wilson) Broth.

28. Riccardia fucoides (Sw.) C. Massal.

29. Mnioloma caespitosa (Spruce) R. M. Schust.

30. Mnioloma cyclostipum (Spruce) R.M. Schuster

31. Cephalozia crassifolia (Lindenb. & Gottsche) Fulford

*32. Frullania arecae (*Spreng.) Gottsche

33. Herbertus juniperoideus (Sw.) Grolle

34. Herbertus bivittatus Spruce

35. Leucolejeunea conchifolia (A. Evans) A. Evans

36. Omphalanthus filiformis (Sw.) Nees

37. Leucolejeunea unciloba (Lindenb.) A. Evans

38. Leucolejeunea xanthocarpa (Lehm. & Lindenb.) A. Evans

39. Aphanolejeunea contractiloba (A. Evans) R. M. Schust.

40. Aphanolejeunea microscopica var. exigua (A. Evans) Bernecker & Pócs

41. Aphanolejeunea kunertiana Steph.

42. Aphanolejeunea paucifolia (Spruce) E. Reiner

43. Aphanolejeunea sicaefolia (Gottsche ex Steph.) A. Evans

44. Aphanolejeunea truncatifolia Horik.

45. Archilejeunea parviflora (Nees) Steph.

46. Lejeunea glaucescens Gottsche

47. Lejeunea cristulaeflora (Gottsche ex Steph.) M. E. Reiner & Goda

48. Taxilejeunea lusoria (Lindenb. & Gottsche) Schiffn.

49. Taxilejeunea obtusangula (Spruce) A. Evans

50. Taxilejeunea pterigonia (Lehm. & Lindenb.) Schiffn.

51. Taxilejeunea terricola (Spruce) Steph.

52. Lejeunea huctumalcensis Lindenb. & Gottsche

53. Physantolejeunea huctumalcensis (Lindenb. & Gottsche) Heinrichs & Schäf.-Verw.

54. Rectolejeunea berteroana (Gottsche ex Steph.) A. Evans

55. Lophocolea leptantha (Hook. & Taylor) Taylor

56. Lophocolea lindmanii Steph.

57. Lophocolea mandonii Steph.

58. Lophocolea martiana Nees

59. Lophocolea muricata (Lehm.) Nees

60. Lophocolea perissodonta (Spruce) Steph.

61. Cryptolophocolea perissodonta (Spruce) L.Söderstr.

62. Heteroscyphus amphibolius (Nees) Schiffn.

63. Plagiochila patentissima Lindenb.

64. Trichocolea flaccida (Spruce) Spruce

65. Leiomitria brevifissa Steph.

66. Leiomitria tomentosa (Sw.) Gottsche