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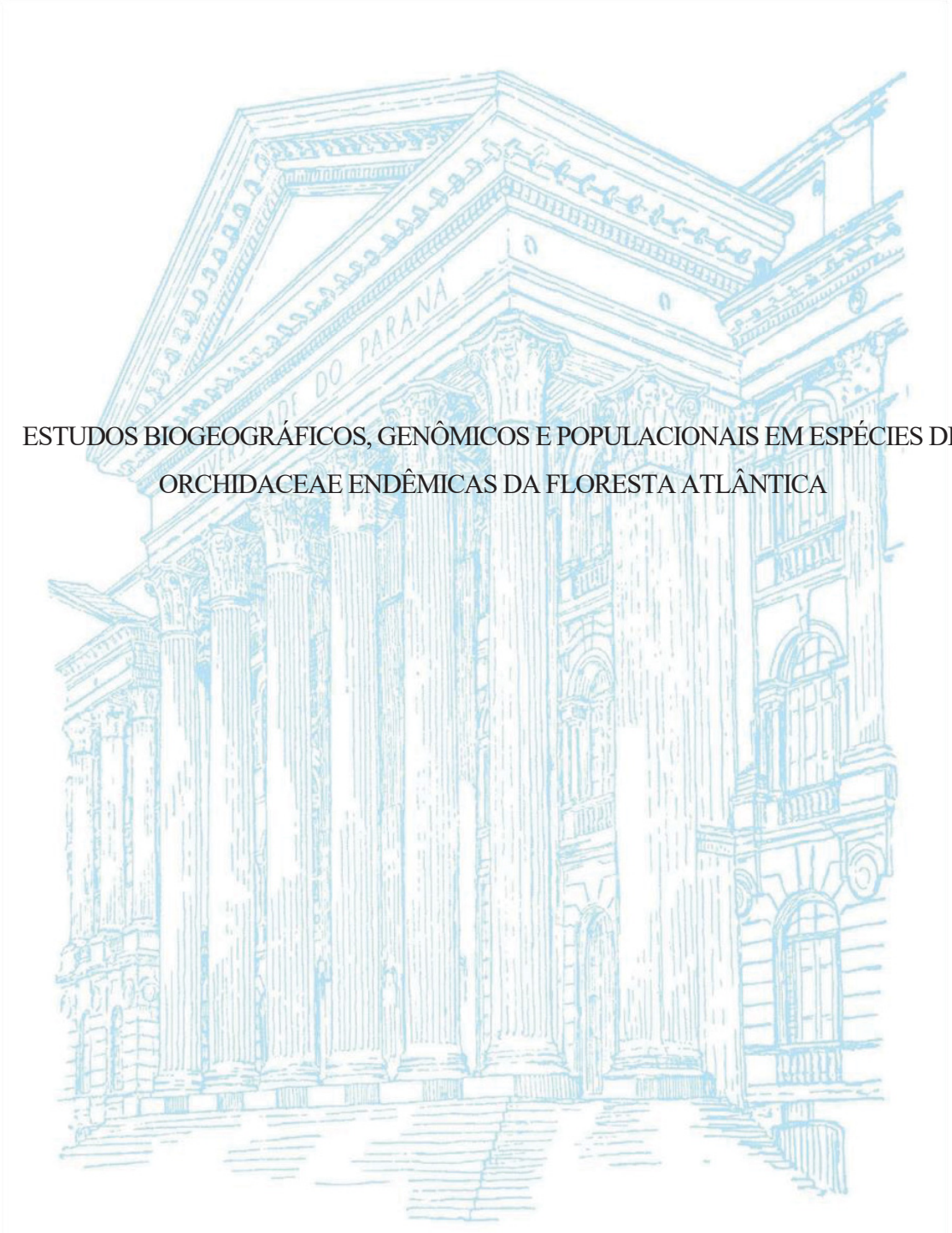
ANNA VICTORIA SILVÉRIO RIGHETTO MAUAD



ESTUDOS BIOGEOGRÁFICOS, GENÔMICOS E POPULACIONAIS EM ESPÉCIES DE ORCHIDACEAE ENDÊMICAS DA FLORESTA ATLÂNTICA

CURITIBA

2023

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ESTUDOS BIOGEOGRÁFICOS, GENÔMICOS E POPULACIONAIS EM ESPÉCIES DE ORCHIDACEAE ENDÊMICAS DA FLORESTA ATLÂNTICA

Tese apresentada como requisito parcial à obtenção do título de Doutorado, Curso de Pós-Graduação em Ecologia e Conservação, Setor de Ciências Biológicas, Universidade Federal do Paraná.

Orientador: Prof. Dr. Eric de Camargo Smidt
Co-orientadora: Profa. Dra. Viviane da Silva Pereira

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TERMO DE APROVAÇÃO

Os membros da Banca Examinadora designada pelo Colegiado do Programa de Pós-Graduação ECOLOGIA E CONSERVAÇÃO da Universidade Federal do Paraná foram convocados para realizar a arguição da tese de Doutorado de **ANNA VICTORIA SILVÉRIO RIGHETTO MAUAD** intitulada: **Estudos biogeográficos, genômicos e populacionais em espécies de Orchidaceae endêmicas da Floresta Atlântica**, sob orientação do Prof. Dr. ERIC DE CAMARGO SMIDT, que após terem inquirido a aluna e realizada a avaliação do trabalho, são de parecer pela sua APROVAÇÃO no rito de defesa.

A outorga do título de doutora está sujeita à homologação pelo colegiado, ao atendimento de todas as indicações e correções solicitadas pela banca e ao pleno atendimento das demandas regimentais do Programa de Pós-Graduação.

CURITIBA, 31 de Maio de 2023.

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ERIC DE CAMARGO SMIDT
Presidente da Banca Examinadora

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Barbosella miersii Schltr. Foto: Eric C. Smidt.

"*The Orchidaceae have all the earmarks of a group in active evolution; species, genera, tribes, and subtribes are all difficult to delimit. As such, I believe it is an excellent group for studying evolution*". Robert L. Dressler, 1993.

RESUMO

Neste estudo aborda-se a história evolutiva de orquídeas do Neotrópico, em diferentes níveis taxonômicos, tendo como recorte específico as espécies da Floresta Atlântica. A tese foi estruturada em três capítulos. No primeiro capítulo foram realizadas análises biogeográficas a partir de sequências genéticas de ITS e *matK* e de registros de ocorrências de 2203 espécies. Os dados foram coletados de bancos de dados públicos (GenBank e GBIF), e também produzidos em laboratório. Foi constatada a história evolutiva complexa e heterogênea das orquídeas na região, com forte influência das flutuações climáticas do Quaternário na diversificação rápida e recente do grupo. No segundo capítulo foram realizadas análises descritivas, comparativas e filogenômicas a partir de sequências do genoma plastidial completo de 11 espécies da subtribo Pleurothallidinae. Oito genomas foram sequenciados em laboratório, enquanto os outros três foram obtidos do GenBank. Como resultado, os genomas possuem estrutura e composição gênica similares, com apenas algumas variações nas bordas das regiões invertidas repetidas. Foram identificadas regiões de microssatélites, genes sob pressão de seleção positiva, e dez sequências de fragmento específico altamente variáveis, para as quais foram desenvolvidos *primers*. As análises filogenéticas demonstraram que essas dez sequências representam bem a variedade genética dos genomas inteiros e se mostram promissoras em estudos filogenéticos e populacionais na subtribo. No terceiro capítulo foi realizado um estudo filogeográfico e uma modelagem de distribuição de *Barbosella miersii*, espécie de Pleurothallidinae endêmica da Mata Atlântica, para inferir sobre fatores históricos e ecológicos envolvidos no endemismo da espécie. Foram testadas as sequências de fragmento específico identificadas no capítulo dois como altamente variáveis, sendo selecionadas as sequências dos espaçadores intergênicos *psbI-trnS*^{GCU} e *rpl32-trnL*^{UAG}, além do ITS, em seis populações da espécie. Os resultados mostram que a história evolutiva da espécie pode ser explicada pelas hipóteses de expansão glacial e de refúgios climáticos. A espécie apresenta distribuição restrita por conta da dispersão curta de sementes e da forte dependência de florestas tropicais densas e contínuas para sua expansão. A fragmentação da Floresta Atlântica por conta das mudanças climáticas e pelo desmatamento aumentam exponencialmente o risco de extinção, e por isto *B. miersii* está considerada como em perigo.

Palavras-chave: conservação; biodiversidade; endemismo; Neotrópico; plastoma.

ABSTRACT

This study approaches the evolutionary history of Neotropical orchids at different taxonomic levels, focusing on the species from the Atlantic Forest. The thesis was structured in three chapters. In the first chapter, biogeographic analyses were carried out from genetic sequences of ITS and *matK* and occurrence records of 2,203 species. Data were collected from public databases (GenBank and GBIF), and also produced in the laboratory. As a result, the evolutionary history of the orchids in the region is complex and heterogeneous, with a strong influence of the Quaternary climatic fluctuations in the rapid and recent diversification of the group. In the second chapter, descriptive, comparative, and phylogenomic analyses were performed based on the complete plastid genome sequences of 11 species of the subtribe Pleurothallidinae. Eight genomes were sequenced in the laboratory, while the other three were obtained from GenBank. As a result, the genomes have similar structure and genetic composition, with only a few variations at the borders of the inverted repeat regions. Microsatellite regions, genes under positive selection pressure, and ten highly variable fragment-specific sequences were identified, for which primers were developed. Phylogenetic analyses demonstrated that these ten sequences represent well the genetic variety of the entire genomes and are promising for the use in phylogenetic and population genetic studies in the subtribe. In the third chapter, a phylogeographical study and a species distribution modelling were performed in *Barbosella miersii*, a species of the Pleurothallidinae that is endemic to the Atlantic Forest, to infer about possible historical and ecological drivers of the endemism of the species. The ten-best fragment-specific sequences identified in chapter two were tested, selecting the intergenic spacers *psbI-trnS*^{GCU} and *rpl32-trnL*^{UAG}. These sequences were used in addition to the ITS in the analyses of six populations of the species. The results suggest that the evolutionary history of *B. miersii* can be explained by the hypotheses of glacial expansion and climatic refuges. The species has a restricted distribution due to the short dispersal of seeds and the strong dependence on dense and continuous tropical forests for its range expansion. The fragmentation of the Atlantic Forest due to climate change and deforestation exponentially increases the extinction risk of *B. miersii*. Therefore, the species is considered endangered.

Key-words: conservation; biodiversity; endemism; Neotropic; plastome.

SUMÁRIO

INTRODUÇÃO GERAL

Orchidaceae é a maior família de angiospermas no mundo, com mais de 29 mil espécies conhecidas (CHASE *et al.*, 2015; CHRISTENHUSZ e BYNG, 2016; GOVAERTS *et al.*, 2021). São plantas herbáceas cuja parte vegetativa varia muito em tamanho, forma e tipo de crescimento, e em geral possui estruturas modificadas para o armazenamento de água e nutrientes nas raízes (i.e., velame e raízes tuberosas) e no caule (pseudobulbo; - DRESSLER, 1993). As flores também se apresentam numa incrível variedade de cores, ornamentos e tamanhos, e podem ser solitárias ou dispostas em inflorescências. No entanto, a estrutura floral é bastante uniforme: flores trímeras, zigomorfas, com uma das pétalas modificadas (denominada labelo) e com o androceu e o gineceu fusionados em uma única estrutura (denominada coluna) são características das orquídeas (DRESSLER, 1993). O fruto é do tipo cápsula (seco e deiscente), e normalmente possui tricomas higroscópicos na parte interna que teoricamente auxiliam na dispersão das centenas de milhões de sementes produzidas (DRESSLER, 1993). As sementes são diminutas, variando de 0,1 a 6 mm de comprimento, e na maioria das espécies não possuem endosperma para nutrir o embrião reduzido (ARDITTI e GHANI, 2000). Ainda, o espaço entre o embrião e a testa (envoltório da semente) pode ser preenchido por ar, agindo como uma espécie de balão e permitindo que a semente permaneça na coluna de ar por muito tempo, permitindo-a ser carregada pelo vento por longas distâncias (ARDITTI e GHANI, 2000).

A família é dividida em cinco subfamílias: Apostasioideae, Cypripedioideae, Epidendroideae, Orchidoideae e Vanilloideae (PRIDGEON *et al.*, 1999, 2001, 2003, 2005, 2009, 2014; CHASE *et al.*, 2015). Apostasioideae é a menor e mais antiga, sendo restrita à região da Australásia (PRIDGEON *et al.*, 1999). Com base em inferências biogeográficas, as orquídeas ancestrais das demais subfamílias se divergiram de Apostasioideae no Período Cretáceo, há aproximadamente 120 milhões de anos atrás, chegando na região Neotropical por meio da conexão entre os continentes australiano, antártico e sul-americano (CHASE, 2001; GIVNISH *et al.*, 2016). Evidências paleopalinológicas suportam essa hipótese devido a presença de táxons tropicais na Antártica durante o Cretáceo, uma vez que as condições climáticas da época permitiam a manutenção de vegetação tropical (PROSS *et al.*, 2012). A partir desses ancestrais, divergiram-se Vanilloideae, depois Cypripedioideae, e por fim as subfamílias Orchidoideae e Epidendroideae (GIVNISH *et al.*, 2015, 2016). Ao contrário de

Apostasioideae, todas as demais subfamílias estão distribuídas por todo os continentes, muito provavelmente devido a ocasionais dispersões transoceânicas de sementes (DRESSLER, 1981; GIVNISH *et al.*, 2016).

Epidendroideae é disparadamente a maior subfamília, com cerca de 18.000 espécies e 650 gêneros (PRIDGEON *et al.*, 2005). Além de ser a mais diversa, Epidendroideae também possui as maiores taxas de diversificação para a família (GIVNISH *et al.*, 2015). Por conta disso, algumas das características dessa subfamília são consideradas responsáveis por acelerar a especiação nas orquídeas, como epifitismo, pólen aglutinado em polínias duras e distribuição majoritariamente tropical, com ocupação de hábitats montanhosos (DRESSLER, 1993; GIVNISH *et al.*, 2015). Essa diversificação recente e explosiva de Epidendroideae gerou uma ampla variação morfológica repleta de paralelismos que não foi acompanhada, ainda, pela variação genética mensurada até o momento entre os táxons, dificultando a identificação de grupos naturais e desafiando taxonomistas (DRESSLER, 1993; FREUDENSTEIN e CHASE, 2015; GIVNISH *et al.*, 2015).

Pleurothallidinae é uma subtribo de Epidendroideae que apresenta distribuição exclusivamente neotropical (PRIDGEON *et al.*, 2005). É composta por mais de 5.000 espécies em 44 gêneros, representando quase um quinto das espécies de Orchidaceae (KARREMANS, 2016). A partir de estudos filogenéticos usando dados moleculares verificou-se que Pleurothallidinae é um grupo monofilético, irmão das subtribos Laeliinae, grupo de orquídeas ornamentais mais populares no Brasil, e Ponerinae (PRIDGEON, SOLANO e CHASE, 2001; FREUDENSTEIN e CHASE, 2015; GIVNISH *et al.*, 2015). Juntas, as três subtribos detêm a maior taxa de diversificação para a família Orchidaceae, com origem relativamente recente estimada em 20 milhões de anos atrás, no período Mioceno (GIVNISH *et al.*, 2015).

A circunscrição dos gêneros de Pleurothallidinae é bastante problemática e muda continuamente devido à sua grande variedade morfológica, que carrega muitas homoplasias (PRIDGEON, 1982a, 1982b; NEYLAND, URBATSCH e PRIDGEON, 1995; LUER 1986a, 1986b; KARREMANS, 2016). Ainda, há baixa variação molecular entre as espécies, transparecida pela pouca resolução e baixo suporte dos clados e pelos ramos curtos nas filogenias, decorrente da grande diversificação recente de Pleurothallidinae (GIVNISH *et al.*, 2015). Essa situação é recorrente pela falta de conhecimento sobre as características genômicas de Pleurothallidinae, o que leva a utilização de uma pouca variedade de

marcadores moleculares nas filogenias (i.e., região nuclear ribossomal ITS e fragmentos do gene cloroplastidial *matK*), que acabam não captando informação suficiente para a separação das espécies. Essa situação de instabilidade nomenclatural atrapalha o avanço em questões evolutivas e voltadas à conservação, uma vez que a correta regulamentação do comércio dessas espécies e medidas efetivas de conservação dependem de Listas Vermelhas e de estudos de genética de populações.

Poucos estudos populacionais foram feitos até o momento na subtribo, sem muitas inferências sobre o estado de conservação das espécies. Ainda assim, esses estudos contribuíram grandemente para o conhecimento sobre os sistemas reprodutivos em Pleurothallidinae e padrões de estrutura genética das populações (e.g., BORBA *et al.*, 2001; BARBOSA, SILVA-PEREIRA e BORBA, 2013). Além destes, outros passos importantes foram dados em direção ao entendimento sobre a história evolutiva da subtribo através de estudos biogeográficos. Pleurothallidinae teve origem provavelmente na América Central e/ou nos Andes, e rapidamente se diversificou e dispersou para as florestas tropicais utilizando a própria cordilheira como rota de migração (Pérez-Escobar *et al.*, 2017). Já alguns gêneros da subtribo, assim como *Pabstiella* Brieger & Senghas, se diversificaram na Floresta Atlântica (Gutiérrez *et al.*, 2020). Isso indica que a região também pode ter contribuído para a diversificação rápida e recente das orquídeas neotropicais.

A Floresta Atlântica é uma das regiões mais biodiversas no mundo, abrigando 1–8% de todas as espécies terrestres conhecidas (MYERS *et al.*, 2000, SILVA e CASTELETI, 2003). Está localizada ao longo de toda a costa Leste do Brasil, chegando até o Nordeste da Argentina e do Paraguai (RIBEIRO *et al.*, 2011). A região é restringida em toda a sua extensão pela diagonal seca da América do Sul, uma formação de vegetações abertas e de clima mais seco (OLSON *et al.*, 2001; AZEVEDO *et al.*, 2020). A impressionante extensão geográfica da Floresta Atlântica compreende grandes gradientes latitudinais (3ºS–30ºS), longitudinais (35ºW–60ºW), altitudinais (0–2900 m acima do nível do mar), e pluviométricos (1000–4200 mm de chuva anual), o que propicia uma gama de fisionomias vegetais, como florestas ombrófilas densas, mistas e estacionais semi-deciduais, além de campos de altitude e matas de araucária (MORELLATO e HADDAD, 2000; OLIVEIRA-FILHO e FONTES, 2000; OLSON *et al.*, 2001; RIBEIRO *et al.*, 2011). A vegetação é tão variada quanto exclusiva: estima-se que 30% de todas as plantas vasculares endêmicas sejam da Floresta Atlântica (MYERS *et al.*, 2000).

Diante do exposto, esta tese teve como principal objetivo estudar a história evolutiva de orquídeas neotropicais, com ênfase em espécies endêmicas da Floresta Atlântica. A tese está estruturada em três capítulos. No capítulo 1: "Origem e diversificação das orquídeas endêmicas da Floresta Atlântica", foram realizadas análises biogeográficas na família Orchidaceae a partir de uma amostragem extensa das espécies da Floresta Atlântica, para se inferir sobre a história evolutiva da família na região. No capítulo 2: "Estudos filogenômicos em Pleurothallidinae (Orchidaceae)", foi realizado o primeiro estudo filogenômico na subtribo Pleurothallidinae com a finalidade de descrever e comparar as características do genoma plastidial e encontrar marcadores variáveis para serem utilizados em estudos filogenéticos e populacionais no grupo. No capítulo 3: "Filogeografia de *Barbosella miersii* (Orchidaceae, Pleurothallidinae), espécie endêmica da Floresta Atlântica brasileira", os marcadores variáveis identificados no capítulo 2 foram testados e selecionados para a realização de análises filogeográficas e modelagem de distribuição de *B. miersii*, com o objetivo de entender os fatores históricos e biológicos por trás da distribuição restrita da espécie e avaliar seu estado de conservação.

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CAPÍTULO 1

Origem e diversificação das orquídeas endêmicas da Floresta Atlântica

RESUMO

Orchidaceae possui mais de 29 mil espécies distribuídas em todos os continentes, com exceção da Antártica. Estudos biogeográficos na família mostraram que esse único continente sem orquídeas foi muito importante para a evolução do grupo no passado, e que as montanhas tropicais aceleraram a diversificação das espécies em tempos recentes. A Floresta Atlântica é a segunda região neotropical mais rica em orquídeas, porém a contribuição da região na diversificação recente do grupo ainda é pouco estudada. Diante disso, neste estudo foram realizadas análises biogeográficas em 2203 espécies de Orchidaceae, incluindo uma amostragem representativa das espécies da Floresta Atlântica, para inferir a história evolutiva da família na região. Como resultado, foi observado que as linhagens mais antigas de Orchidaceae possuem as espécies endêmicas de Floresta Atlântica mais recentes, o que sugere a ocorrência de eventos massivos de extinção em resposta ao aumento da aridez na América do Sul a partir do Oligoceno. Os grandes clados de espécies de Floresta Atlântica se originaram durante o Período Plioceno a partir de migrantes principalmente amazônicos, corroborando com estudos anteriores que apontaram os Andes como importante corredor de dispersão entre as Américas do Norte e do Sul e a Floresta Amazônica como principal fonte de diversidade do Neotrópico. Esses resultados reforçam evidências de conexões passadas entre as florestas Atlântica e Amazônica. No entanto, a diversificação das espécies da Floresta Atlântica ocorreu majoritariamente durante o Período Quaternário, sugerindo que as flutuações climáticas do Período e eventos de especiação *in situ* foram os fatores mais importantes para o aumento da diversidade das espécies da região. A identificação de diversos eventos de migração de e para a Floresta Atlântica em diferentes períodos geológicos ilustra a complexidade da história evolutiva das orquídeas na região.

INTRODUÇÃO

Existe uma relação positiva entre riqueza de espécies e área de distribuição geográfica nas famílias de Angiospermas (RICKLEFS e RENNER, 1994). De fato, a família Orchidaceae é a mais rica em espécies, com quase 30 mil espécies descritas (CHASE *et al.*, 2015; CHRISTENHUSZ e BYNG, 2016; GOVAERTS *et al.*, 2021), e também a que possui a maior amplitude latitudinal, abrangendo desde o arquipélago Ártico Canadense a 72ºN até a Terra do Fogo a 55ºS (PRIDGEON *et al.*, 1999, 2001, 2003, 2005, 2009, 2014). Além disso, as orquídeas são encontradas em quase todos os ambientes terrestres, exceto nas regiões desérticas e no continente da Antártica (PRIDGEON *et al.*, 1999, 2001, 2003, 2005, 2009, 2014). Interessantemente, esse único continente em que as orquídeas não são encontradas atualmente pode ter desempenhado um papel crucial na evolução da família. Givnish *et al.* (2016) realizaram o primeiro estudo biogeográfico de Orchidaceae, a partir do qual reforçaram estimativas anteriores de que a família teve origem durante o Período Cretáceo (Chase *et al.*, 2001), há aproximadamente 112 milhões de anos, na região onde atualmente é a Austrália. Naquele Período, até cerca de 40 milhões de anos atrás, a América do Sul, a Antártica e a Austrália ainda estavam unidas, e as temperaturas da época permitiam o crescimento de vegetação tropical a subtropical na Antártica (PROSS *et al.*, 2012). Essas condições, enquanto duraram, supostamente permitiram a ocupação das orquídeas na América do Sul, enquanto que os eventos tectônicos que se seguiram no Neotrópico, na Ásia e na Austrália foram fundamentais para a maior diversificação da família nessas áreas (GIVNISH *et al.*, 2016).

Apesar de Givnish *et al.* (2016) terem apontado menores taxas de diversificação no Neotrópico em comparação com o leste asiático e a Austrália, os dois grupos com as taxas de especiação mais rápidas da família (i.e., subtribos Laeliinae e Pleurothallidinae) são de distribuição exclusivamente neotropical (GIVNISH *et al.*, 2015). Os autores atribuíram essa discrepância ao fato de que o Neotrópico abriga linhagens antigas e de especiação lenta além das linhagens recentes e de especiação rápida e, ainda, relacionaram o surgimento da cordilheira dos Andes à diversificação rápida e relativamente recente das orquídeas neotropicais. No Neotrópico, os eventos de orogênese dos Andes são considerados os grandes responsáveis pela diversificação da flora durante o Período Neogeno (GENTRY, 1982; PÉREZ-ESCOBAR *et al.*, 2022), incluindo dois maiores grupos de orquídeas neotropicais:

tribo Cymbidieae e subtribo Pleurothallidinae (PÉREZ-ESCOBAR *et al.*, 2017). No caso de Cymbidieae, os Andes proporcionaram novos hábitats, enquanto que em Pleurothallidinae a cordilheira agiu como um corredor de dispersão entre a América Central e as florestas tropicais da América do Sul (PÉREZ-ESCOBAR *et al.*, 2017).

Essas florestas tropicais compreendem hoje a Floresta Amazônica e a Floresta Atlântica, também conhecida como Mata Atlântica. O surgimento dessas florestas provavelmente ocorreu no Período Neogeno, quando houve expansão das áreas secas de vegetação aberta por conta do aumento dos regimes de queimada em resposta à crescente aridez na região (SIMON *et al.*, 2009), o que culminou na formação da diagonal seca da América do Sul e separou as florestas tropicais que antes eram contínuas (ZACHOS *et al.*, 2001; MORLEY, 2011; AZEVEDO *et al.*, 2020). Atualmente, a Mata Atlântica consiste em uma faixa de floresta ombrófila densa que se estende por todo o litoral Leste do Brasil, transicionando para florestas estacionais semi-deciduais e campos de altitude em áreas de ecótono com vegetações abertas de clima seco (MORELLATO e HADDAD, 2000; OLIVEIRA-FILHO e FONTES, 2000; OLSON *et al.*, 2001; RIBEIRO *et al.*, 2011).

A Mata Atlântica é considerada um dos principais centros de biodiversidade do mundo (MYERS *et al.*, 2000). Hipóteses biogeográficas que tentam explicar a diversidade de espécies e os endemismos na Mata Atlântica estão relacionadas aos eventos climáticos do Neogeno e do Quaternário, uma vez que evidências filogenéticas e paleopalinológicas mostram que as espécies neotropicais alteraram diversas vezes seus padrões de distribuição em resposta às flutuações climáticas daquela época (COLINVAUX e DE OLIVEIRA, 2001; ANTONELLI *et al.*, 2018). Essas hipóteses, alimentadas por padrões filogeográficos de vários grupos de animais e plantas e por modelos paleoclimáticos, convergem em três principais conclusões: (1) houveram várias conexões entre a Mata Atlântica e a Floresta Amazônica, em diferentes locais e momentos, através da diagonal seca (COSTA, 2003; FIASCHI e PIRANI, 2009; BATALHA-FILHO *et al.*, 2013; SOBRAL-SOUZA, LIMA-RIBEIRO e SOLFERINI, 2015; LEDO e COLLI, 2017), (2) houve intensa substituição de espécies em resposta às variações climáticas, principalmente na região sul (BEHLING, 2002; COSTA *et al.*, 2018), e (3) regiões de maior estabilidade climática agiram como refúgios, que proporcionaram a diversificação de espécies durante esses longos períodos de instabilidade climática (CARNAVAL e MORITZ, 2008; CARNAVAL *et al.*, 2009; BATALHA-FILHO, CABANNE e MIYAKI, 2012; CARNAVAL *et al.*, 2014).

Portanto, a Mata Atlântica também pode ter sido importante para a diversificação recente das orquídeas neotropicais, embora essa relação seja menos estudada. Estudos biogeográficos em Cymbidieae sugerem que a Mata Atlântica é o centro de origem do clado *Ornithocephalus* (subtribo Oncidiinae; SMIDT *et al.*, 2018) e de algumas subtribos, como Catasetinae e Cyrtopodiinae (PÉREZ-ESCOBAR *et al.*, 2017). Já em Pleurothallidinae, o gênero *Pabstiella* Brieger & Senghas teve origem nos Andes e na América Central, mas foi na Mata Atlântica onde apresentou grande diversificação recente (GUTIÉRREZ M. *et al.*, 2021). Diante do exposto, o objetivo deste capítulo é explorar a história evolutiva das orquídeas da Mata Atlântica por meio de análises biogeográficas, relacionando os resultados às hipóteses mais aceitas sobre as origens da grande diversidade de espécies na região. Mais especificamente, a partir de dados de sequência do espaçador transcrito interno nuclear ribossomal (ITS) e do gene cloroplastidial da maturase K (*matK*), além dos registros de ocorrência atuais das espécies, buscaram-se respostas às seguintes questões: (a) quantas vezes as orquídeas colonizaram a Mata Atlântica? (b) Quando ocorreram os eventos de colonização? (c) De onde vieram as orquídeas da Mata Atlântica? (d) Qual a idade dos clados endêmicos da Mata Atlântica? E finalmente, (e) quando houve diversificação de clados endêmicos da Mata Atlântica? Com a ajuda de bancos de dados públicos, este estudo reuniu a amostragem mais extensa das espécies da Mata Atlântica até o momento, e é complementar aos estudos biogeográficos já realizados na família.

MATERIAIS E MÉTODOS

Devido à falta de uma lista formal das espécies de orquídeas endêmicas da Mata Atlântica, foi realizada uma listagem própria a partir de um filtro da Lista de Espécies da Flora do Brasil (BFG, 2015). Todos os nomes de espécies recuperados a partir desse filtro foram conferidos de acordo com o *site Plants of the World Online* (POWO), que também contém informações sobre a ocorrência das espécies. Alguns nomes de espécies foram atualizados com base em publicações recentes (e.g., SMIDT *et al.*, 2021a, 2021b; ROYER *et al.*, 2022). Daqui em diante, todas as espécies endêmicas da Mata Atlântica serão referenciadas simplesmente como espécies endêmicas, ficando subentendida a localidade do endemismo. Com essa lista de espécies foram identificados os gêneros que possuem espécies endêmicas, a partir dos quais foram feitas buscas no banco de dados do GenBank (NCBI) por

sequências do ITS e do *matK* – ambos os marcadores comumente sequenciados e considerados informativos em Orchidaceae (GRACE *et al.*, 2021). Também foram buscadas sequências disponíveis para gêneros filogeneticamente próximos e que não ocorrem da Mata Atlântica com base na última classificação de Orchidaceae (CHASE *et al.*, 2015).

Foram identificadas 77 amostras de DNA de espécies endêmicas no banco de DNA do Laboratório de Sistemática e Ecologia Molecular de Plantas da UFPR que não possuíam sequências disponíveis no GenBank para uma ou ambas as regiões escolhidas. Para essas amostras foram realizadas reações de PCR com o *kit* Invitrogen™ Platinum™ Taq DNA Polymerase (Life Technologies) seguindo as recomendações do fabricante e adicionando 0,2 mM de dNTPs, 0,2 mM de cada *primer*, 0,08 mg/mL de BSA e 20 ng de DNA para um volume final de 20 μL. Ainda, nas reações de amplificação do ITS foram utilizados DMSO a 0.08% e 1 M de betaína como aditivos. Foram utilizados os seguintes pares de primers: 17SE (5'-ACG AAT TCA TGG TCC GGT GAA GTG TTC G-3') e 26SE (5'-TAG AAT TCC CCG GTT CGC TCG CCG TTA C-3') para o ITS (SUN *et al.*, 1994), e 2.1F (5'-CCT ATC CAT CTG GAA ATC TTA G-3') e 5R (5'-GTT CTA GCA CAA GAA AGT CG-3') para o *matK* (FORD *et al.*, 2009). A programação do termociclador foi configurada da seguinte maneira: uma etapa de 1 min a 94ºC, seguida de 40 ciclos de três etapas, sendo (i) 30 s a 94ºC, (ii) 40 s a 51ºC (ITS) ou 53ºC (*matK*), e (iii) 40 s a 72ºC, finalizando com uma etapa de 5 min a 72ºC. O sucesso da amplificação foi verificado por meio de eletroforese horizontal em gel de agarose a 1% e corante GelRed® Nucleic Acid Gel Stain (Biotium) a 1x. Os produtos das PCRs foram purificados usando polietilenoglicol a 10% e etanol a 80% (PAITHANKAR e PRASAD, 1991).

O sequenciamento Sanger foi realizado por empresa especializada com um sequenciador Applied Biosystems 3500xl Genetic Analyzer (Life Technologies). As leituras obtidas do sequenciamento foram tratadas e analisadas através do programa Geneious Prime 2020.0.5 (Biomatters Ltd.). Mais especificamente, as extremidades das leituras com alta probabilidade de erro por par de base (> 0.05) foram removidas, e as leituras foram então sobrepostas por montagem *de novo* para a identificação e correção de ambiguidades para finalmente gerarem as sequências-consenso. As sequências novas foram combinadas com as sequências baixadas do GenBank para formar o conjunto de dados. Porém, houve a necessidade de dividir o conjunto de dados devido à grande quantidade de sequências obtidas. A composição e o posicionamento filogenético dos grandes clados aos quais as espécies

amostradas pertencem (e.g., subtribos, tribos e subfamílias) foram levados em conta para essa divisão e foram consultados na literatura (CHASE *et al.*, 2015; PÉREZ-ESCOBAR *et al.*, 2021), resultando em sete conjuntos de dados menores. Os conjuntos de dados finais são: (i) subfamílias Cypripedioideae e Vanilloideae (Apostasioideae como grupo externo), (ii) subfamília Orchidoideae (Cypripedioideae como grupo externo), (iii) subfamília Epidendroideae, tribos "basais" (Orchidoideae como grupo externo), (iv) subfamília Epidendroideae, tribos Collabieae, Vandeae e Cymbidieae "basais" (tribo Malaxideae como grupo externo), (v) tribo Cymbidieae (subtribo Oncidiinae como grupo externo), (vi) subfamília Epidendroideae, tribo Epidendreae, subtribos "basais" e Laeliinae (Cymbidieae como grupo externo), e (vii) tribo Epidendreae, subtribo Pleurothallidinae (Laeliinae como grupo externo).

Os conjuntos de dados foram alinhados separadamente pelo serviço *online* do programa MAFFT v.7 (KATOH, ROZEWICKI e YAMADA, 2019), com busca automática do melhor algoritmo de alinhamento para os dados e ajuste da direção das sequências. A partir dos alinhamentos foram realizadas análises filogenéticas de Máxima Verossimilhança no programa IQ-TREE v.2.2 (NGUYEN *et al.*, 2015; MINH, *et al.*, 2020), em 1000 replicações, e considerando o modelo de substituição nucleotídica GTR+Γ. Este modelo de substituição foi escolhido por ser um modelo simples, porém robusto, e amplamente utilizado em estudos filogenéticos na família (e.g., PÉREZ-ESCOBAR *et al*., 2021). Ademais, a subdivisão do conjunto de dados feita com base na proximidade filogenética tende a reduzir a quantidade de sequências muito divergentes dos alinhamentos, diminuindo assim a chance de violação das premissas de reversibilidade no tempo e de estacionaridade dos processos de substituição nucleotídica assumidas pelo modelo GTR+Γ (TAVARÉ, 1986; YANG, 1994). O suporte dos ramos foi calculado através de 1000 replicações do algoritmo *ultrafast bootstrap* (HOANG *et al.*, 2018). As árvores filogenéticas foram utilizadas inicialmente para a "limpeza" dos dados por meio da detecção de sequências com contaminantes e/ou mal identificadas, e também para a redução do número de sequências de clados que não ocorrem na Mata Atlântica. Depois de limpos, os alinhamentos finais de ITS e de *matK* foram concatenados por meio do programa SequenceMatrix v.1.9 (VAIDYA, LOHMAN e MEIER, 2011) para a realização das análises filogenéticas combinadas utilizando as mesmas configurações já descritas.

As árvores filogenéticas combinadas foram datadas utilizando o pacote de programas BEAST v.1.10.4 (SUCHARD *et al.*, 2018), considerando o modelo de relógio molecular

relaxado não correlacionado e de distribuição lognormal (DRUMMOND *et al.*, 2006). O relógio molecular foi calibrado usando uma distribuição uniforme devido à falta de uma estimativa específica para Orchidaceae das taxas de substituição nucleotídica, e considerando diferentes valores para cada partição (ITS e *matK*) para representar as diferenças conhecidas nas taxas evolutivas entre os genomas nuclear e cloroplastidial de plantas (DROUIN, DAOUD e XIA, 2008). Com isso, as taxas de substituição (em substituições por sítio por milhão de anos) foram configuradas da seguinte forma: para o ITS, média = 0,005, mínimo = 0,00005 e máximo = 0,01, seguindo os parâmetros utilizados por Pérez-Escobar *et al.* (2021); para o matK, média = 0,001, mínimo = 0,00001 e máximo = 0,0025, considerando que genes cloroplastidiais evoluem aproximadamente cinco vezes mais lentamente do que genes nucleares em Angiospermas (DROUIN, DAOUD e XIA, 2008). Para ambas as partições foi considerado o modelo de substituição nucleotídica GTR+Γ por ser o modelo utilizado na construção das árvores filogenéticas e por ser um modelo robusto para a estimativa do tempo de divergência mesmo em grandes conjuntos de dados (BARBA-MONTOYA, TAO e KUMAR, 2020). Foi calculada uma única árvore considerando ambas as partições a partir do modelo de especiação *Birth-Death* (GERNHARD *et al.*, 2008), porém mantendo a topologia da árvore de Máxima Verossimilhança. Os nós das árvores foram calibrados com base nas estimativas de Givnish *et al.* (2015), em milhões de anos atrás (Ma), usando distribuição normal, conforme indicado a seguir para cada conjunto de dados:

i. O ancestral comum mais recente (ACMR) da família Orchidaceae (média = 89,46 Ma, desvio-padrão = 6), o ACMR da subfamília Vanilloideae (média = 77,81 Ma, d.p. = 5,5) e o ACMR da subfamília Cypripedioideae (média = 31,3 Ma, d.p. = 6,5);
ii. A divergência entre as subfamílias Cypripedioideae e Orchidoideae (média = 74,63 Ma, d.p. = 7) e o ACMR de Orchidoideae (média = 54,39 Ma, d.p. = 5);
iii. A divergência entre as subfamílias Orchidoideae e Epidendroideae (média = 63,99 Ma, d.p. = 6) e o ACMR de Epidendroideae (média = 48,05 Ma, d.p. = 4,5);
iv. A divergência entre as Epidendroideae “basais” e “derivadas” (média = 36,56 Ma, d.p. = 2,5), o ACMR das Epidendroideae “derivadas” (média = 32,67 Ma, d.p. = 2,5), o ACMR da tribo Vandeae (média = 27,34 Ma, s.p. = 3) e o ACMR da tribo Cymbidieae (média = 24,06 Ma, d.p. = 2,5);

v. A divergência entre a subtribo Oncidiinae e as demais subtribos de Cymbideae (média = 20,3 Ma, d.p. = 2,5) e o ACMR destas subtribos (média = 17,45 Ma, d.p. = 2);
vi. A divergência entre as tribos Cymbidieae e Epidendreae (média = 30,05 Ma, d.p. = 2,5), o ACMR de Epidendreae (média = 32,1 Ma, d.p. = 2) e o ACMR da subtribo Laeliinae (média = 15,37 Ma, d.p. = 3);
vii. A divergência entre as subtribos Laeliinae e Pleurothallidinae (média = 19,82 Ma, d.p. = 3) e o ACMR de Pleurothallidinae (média = 14,2 Ma, d.p. = 3).

As análises de datação molecular rodaram por 50 a 100 milhões de gerações de MCMC, com amostragem de árvores e parâmetros a cada 1000 gerações. A convergência dos parâmetros foi verificada no programa Tracer v.1.7.1 (RAMBAUT *et al.*, 2018) a partir dos valores de tamanho efetivo da amostra (ESS) superiores a 200. As árvores de maior credibilidade de clados (árvores datadas) foram anotadas após o descarte dos primeiros 10% de árvores e foram visualizadas no programa FigTree v.1.4.1 (*Molecular Evolution, Phylogenetics and Epidemiology*).

As análises de reconstrução de áreas ancestrais foram realizadas com o método BBM (*Bayesian binary MCMC* – ALI *et al.*, 2012), implementado no programa RASP v.4.0 (YU, BLAIR e HE, 2020), utilizando as árvores datadas e as áreas de ocorrência das espécies. Este método opera de maneira similar ao método S-DIVA, o qual realiza uma média das frequências das áreas ancestrais de todas as árvores em cada nó (YAN, HARRIS e XINGJIN, 2010), porém o BBM faz os cálculos das frequências por meio de cadeias de MCMC ao invés de Máxima Verossimilhança (ALI *et al.*, 2012). Foram utilizados os parâmetros *default* do RASP, mas considerando um máximo de quatro áreas ancestrais ao invés de duas. Para a realização dessas análises, primeiro foram baixados todos os registros de ocorrência com coordenadas geográficas das espécies amostradas do banco de dados público GBIF (*Global Biodiversity Information Facility*), através do ambiente de programação R (https://www.r-project.org/), usando as funções do pacote rgbif v.0.9.8 (CHAMBERLAIN e BOETTIGER, 2017; CHAMBERLAIN *et al.*, 2023). Em segundo, para aumentar a qualidade dos registros recuperados, as coordenadas apresentando erros (e.g. localizações no oceano ou em áreas urbanas, latitude e longitude trocadas ou iguais, entre outros erros comuns encontrados em dados de coleções biológicas), foram identificadas e removidas por meio das funções do

pacote CoordinateCleaner v.2.0-20 (ZIZKA *et al.*, 2019, 2023). Por fim, as coordenadas limpas foram utilizadas para a codificação automatizada das áreas de ocorrência através das funções do pacote speciesgeocodeR v.2.0-10 (TÖPEL *et al.*, 2016). As áreas no Neotrópico foram codificadas com base nas biorregiões propostas por Morrone (2014) e Morrone *et al.* (2022) da seguinte forma: A = Mata Atlântica ("Parana dominion"), B = Caatinga ("Caatinga province"), C = Cerrado ("Cerrado province"), D = Pampas ("Chaco province" e "Pampean province"), E = Floresta Amazônica ("Boreal Brazilian dominion", "South Brazilian dominion" e "Xingu-Tapajós province"), F = Pacífico ("Pacific dominion"), G = porção Norte dos Andes ("Paramo province"), H = porção Sul dos Andes (todas as outras províncias da "South American transition zone"), J = Antilhas ("Antillean subregion") e K = Mesoamérica ("Mexican transition zone" e "Mesoamerican dominion"). Ao passo que as áreas fora do Neotrópico foram nomeadas assim: I = extremo sul da América do Sul, L = América do Norte, M = África e N = Australásia. Ao final da codificação automatizada, foi feita uma verificação manual para garantir a correta designação das áreas de ocorrência das espécies endêmicas. Espécies que não tiveram suas áreas designadas automaticamente, muitas vezes porque não possuem registros com coordenadas geográficas, foram codificadas manualmente com base nos *sites* POWO e speciesLink.

RESULTADOS

A lista de espécies endêmicas, feita com base nas informações combinadas da Lista de Espécies da Flora do Brasil e do POWO (Tabela S1), possui 1044 espécies. Essas espécies estão distribuídas em 106 gêneros, 17 subtribos, 11 tribos e quatro subfamílias, pois Apostasioideae é a única subfamília sem espécies da Mata Atlântica, ficando restrita à Australásia. Epidendroideae é a subfamília com o maior número de espécies endêmicas (905 spp., ca. 86,7%), seguida de Orchidoideae (121 spp, ca. 11,6%), enquanto que Vanilloideae possui 17 espécies (ca. 1,6%) e Cypripedioideae apenas uma espécie endêmica. Foram identificados 14 gêneros endêmicos, sendo 13 da subfamília Epidendroideae e apenas um de Orchidoideae (*Cotylolabium* Garay). Dos 13 gêneros endêmicos de Epidendroideae, dois são da tribo Epidendreae, subtribo Laeliinae (2 – *Leptotes* Lindl. e *Loefgrenianthus* Hoehne), e o restante é da tribo Cymbidieae, subtribos Catasetinae (1 – *Grobya* Lindl.), Oncidiinae (6 – *Chytroglossa* Rchb.f., *Phymatidium* Lindl., *Platyrhiza* Barb.Rodr., *Psychopsiella* Lückel &

Braem, *Rauhiella* Pabst & Braga e *Schunkea* Senghas), Stanhopeinae (1 – *Cirrhaea* Lindl.) e Zygopetalinae (3 – *Pabstia* Garay, *Paradisanthus* Rchb.f. e *Promenaea* Lindl.).

A amostragem compreende 2203 espécies no total, das quais 2023 são exclusivamente neotropicais, 901 ocorrem na Mata Atlântica e 497 são endêmicas (Tabela S2). Sendo assim, este estudo compreende ca. 47% das espécies endêmicas conhecidas, com representantes de todas as subfamílias, de nove tribos (exceto Codonorchideae e Thriphoreae), de 15 subtribos (exceto Triphorinae e Polystachyinae) e de 88 gêneros (aproximadamente 81,5%) da lista. Dessas 2203 espécies, 1975 possuem o ITS e 1658 o *matK* sequenciados, totalizando 3633 sequências analisadas. Menos da metade dos alinhamentos possuem dados faltantes, uma vez que 1439 espécies possuem ambas as sequências (ca. 65% da amostragem total). As informações sobre os alinhamentos combinados de cada conjunto de dados estão na Tabela 1.

Tabela 1: Número de táxons (N), grupo externo e descrição dos alinhamentos de ITS e *matK* combinados para os sete conjuntos de dados (Cj) utilizados nas análises. Os conjuntos de dados estão identificados da seguinte forma: (i) subfamílias Cypripedioideae e Vanilloideae, (ii) subfamília Orchidoideae, (iii) subfamília Epidendroideae, tribos "basais", (iv) subfamília Epidendroideae, tribos Collabieae, Vandeae e Cymbidieae "basais", (v) tribo Cymbidieae, (vi) subfamília Epidendroideae, tribo Epidendreae, subtribos "basais" e Laeliinae, e (vii) tribo Epidendreae, subtribo Pleurothallidinae. Comp. = comprimento total em pares de base, PIs = Parcimoniosamente Informativos.

Cj	N	Grupo externo	Comp. (pb)	Sítios invariáveis (%)	Sítios PIs (%)
i	73	*Apostasia shenzhenica* Z.J.Liu & L.J.Chen	2622	59,3	30,5
ii	422	*Selenipedium aequinoctiale* Garay	2618	38,9	46,9
iii	116	*Codonorchis lessonii* (d'Urv.) Lindl.	2451	53,4	31,0
iv	413	*Liparis nervosa* (Thunb.) Lindl.	2556	43,2	44,9
v	334	*Grandiphyllum auricula* (Vell.) Docha Neto	2313	55,8	31,2
vi	368	*Cyrtopodium andersonii* (Lamb. *ex* Andrews) R.Br.	2472	51,2	30,8
vii	493	*Arpophyllum giganteum* Hartw. ex Lindl.	2604	48,1	35,1

Foram identificados 157 eventos de colonização da Mata Atlântica (Figuras 1–7). O evento mais antigo ocorreu no Período Cretáceo na origem de Vanilloideae (Figura 1). Durante o Período Paleogeno foram observados três eventos de colonização: um em Orchidoideae na origem da subtribo Discyphinae (26,39 Ma, i.c.: 22,54–30,81 Ma; - Figura 2) e os outros dois em Epidendroideae, sendo um na tribo Wullschlaegelieae (Figura 3) e o outro na origem da tribo Cymbidieae (Figura 4). O número de eventos aumentou consideravelmente durante o Período Neogeno, com 78 eventos, muitos dos quais estão relacionados com a origem de todos os grandes clados compostos por espécies endêmicas em sua totalidade ou

maioria. O número de eventos durante o Período Quaternário permaneceu elevado, com 75 eventos, porém mais relacionados à colonização/recolonização por linhagens esparsas.

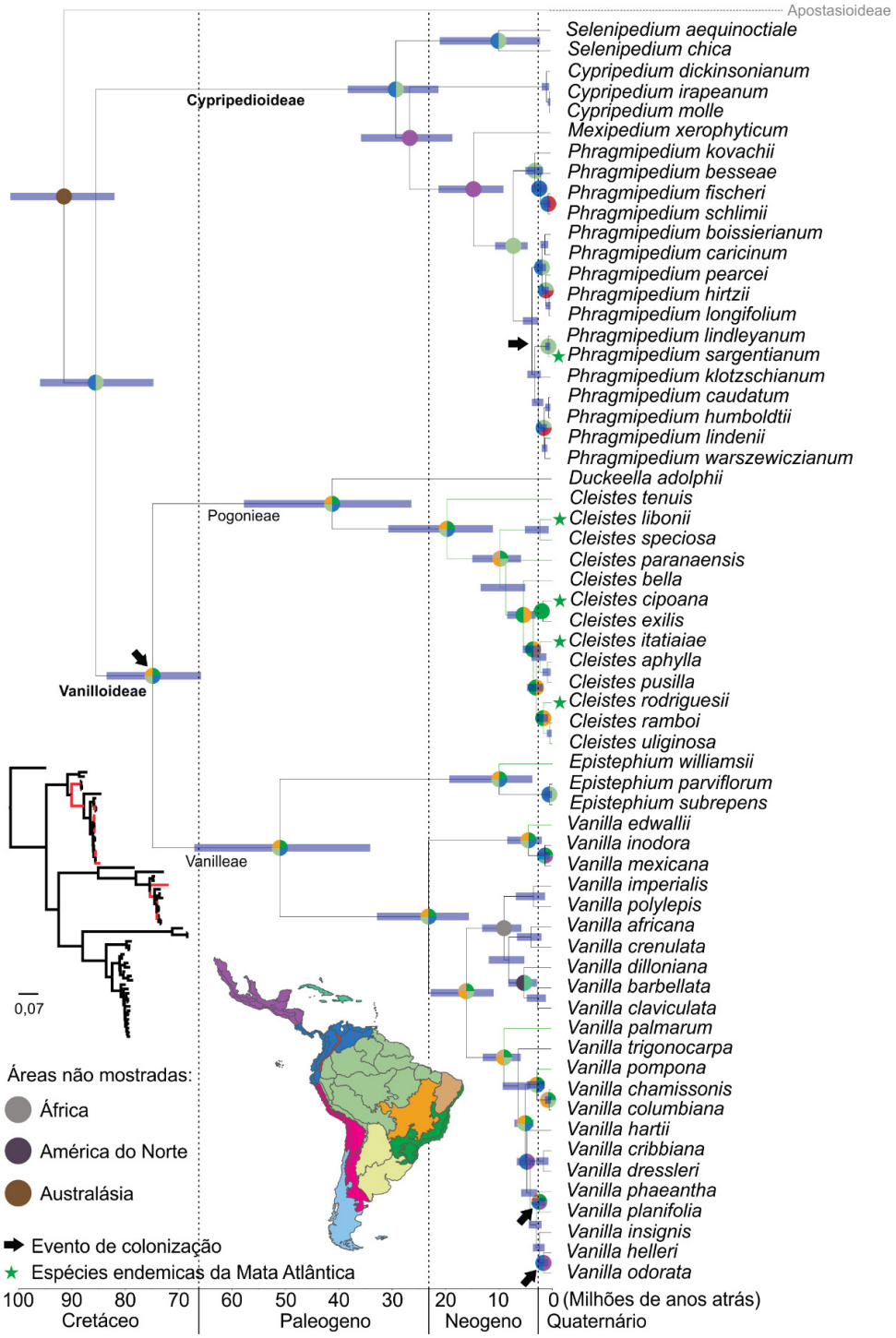

Figura 1: Reconstrução das áreas ancestrais e datação molecular das subfamílias Cypripedioideae e Vanilloideae. Nos nós, as cores correspondem à área ancestral mais provável e as barras azuis ao intervalo de confiança na estimativa da idade. Nós sem cores possuem a mesma área ancestral do nó anterior. Ramos verdes indicam espécies que ocorrem na Mata Atlântica. O filograma à esquerda mostra o comprimento dos ramos da árvore de Máxima Verossimilhança, cujos ramos vermelhos possuem suporte de bootstrap inferior a 85%.

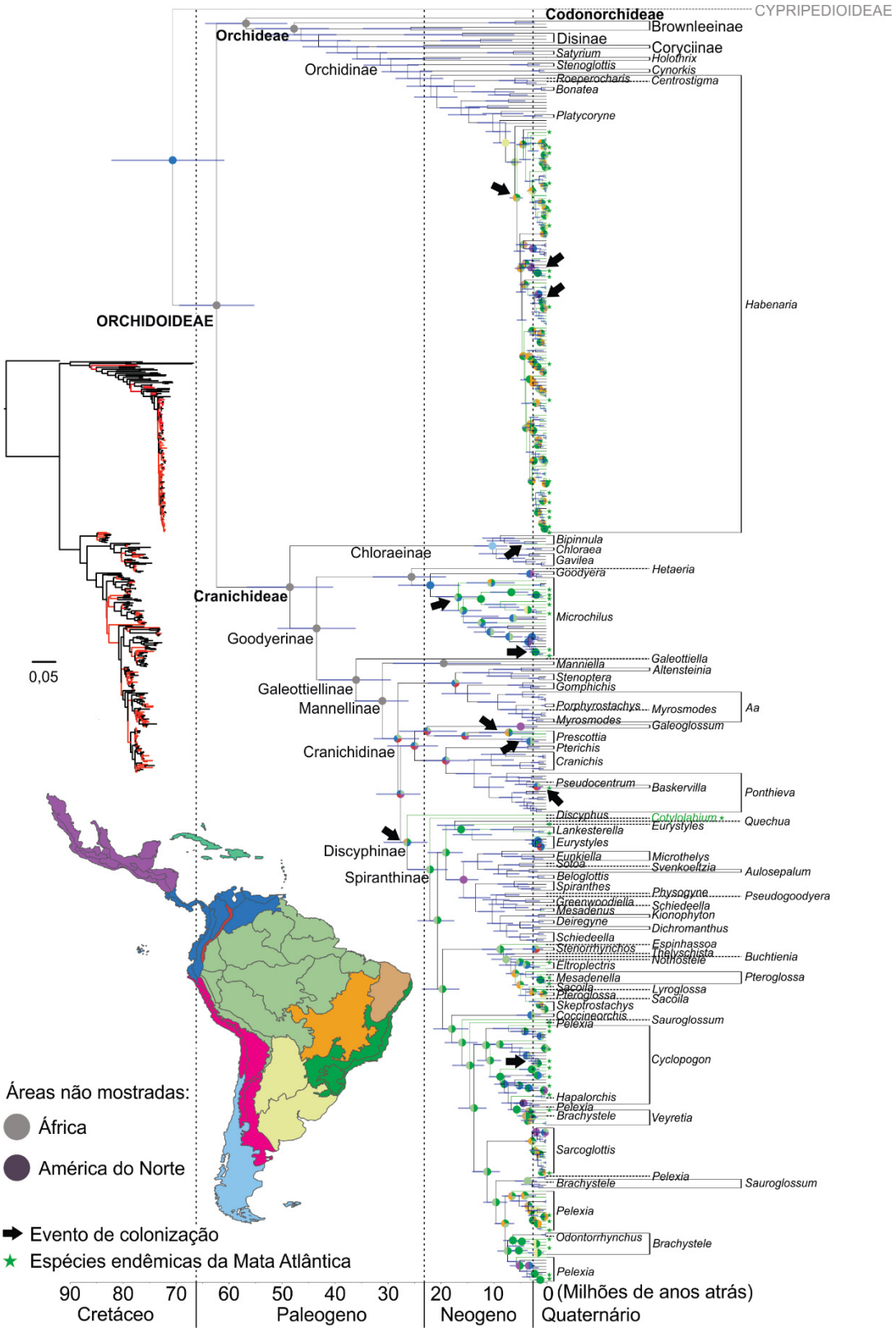

Figura 2: Reconstrução das áreas ancestrais e datação molecular da subfamília Orchidoideae. Nos nós, as cores correspondem à área ancestral mais provável e as barras azuis ao intervalo de confiança na estimativa da idade. Nós sem cores possuem a mesma área ancestral do nó anterior. Ramos verdes indicam espécies que ocorrem na Mata Atlântica. O filograma à esquerda mostra o comprimento dos ramos da árvore de Máxima Verossimilhança, cujos ramos vermelhos possuem suporte de bootstrap inferior a 85%.

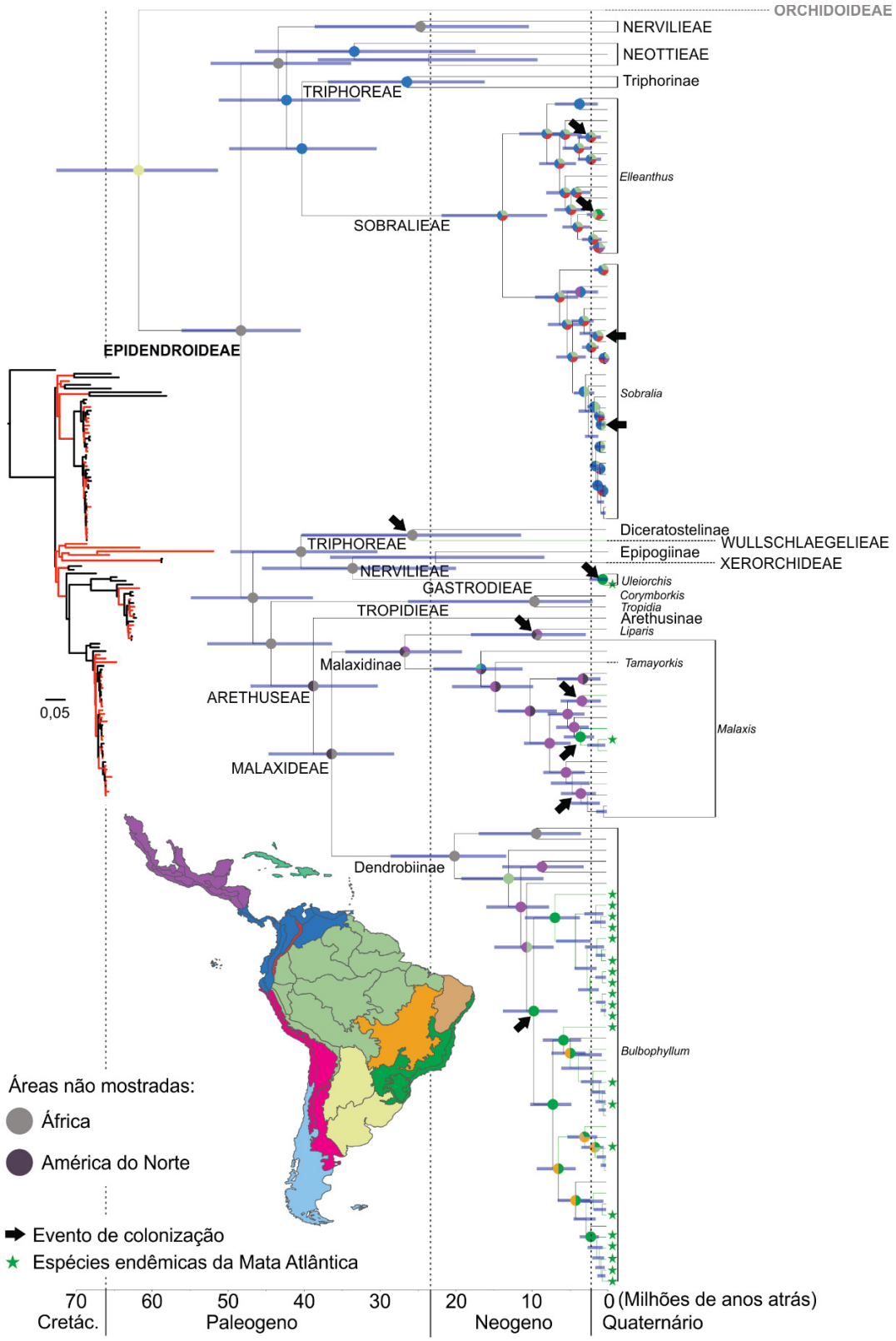

Figura 3: Reconstrução das áreas ancestrais e datação molecular de parte da subfamília Epidendroideae, tribos "basais". Nos nós, as cores correspondem à área ancestral mais provável e as barras azuis ao intervalo de confiança na estimativa da idade. Nós sem cores possuem a mesma área ancestral do nó anterior. Ramos verdes indicam espécies que ocorrem na Mata Atlântica. O filograma à esquerda mostra o comprimento dos ramos da árvore de Máxima rossimilhança, cujos ramos vermelhos possuem suporte de bootstrap inferior a 85%.

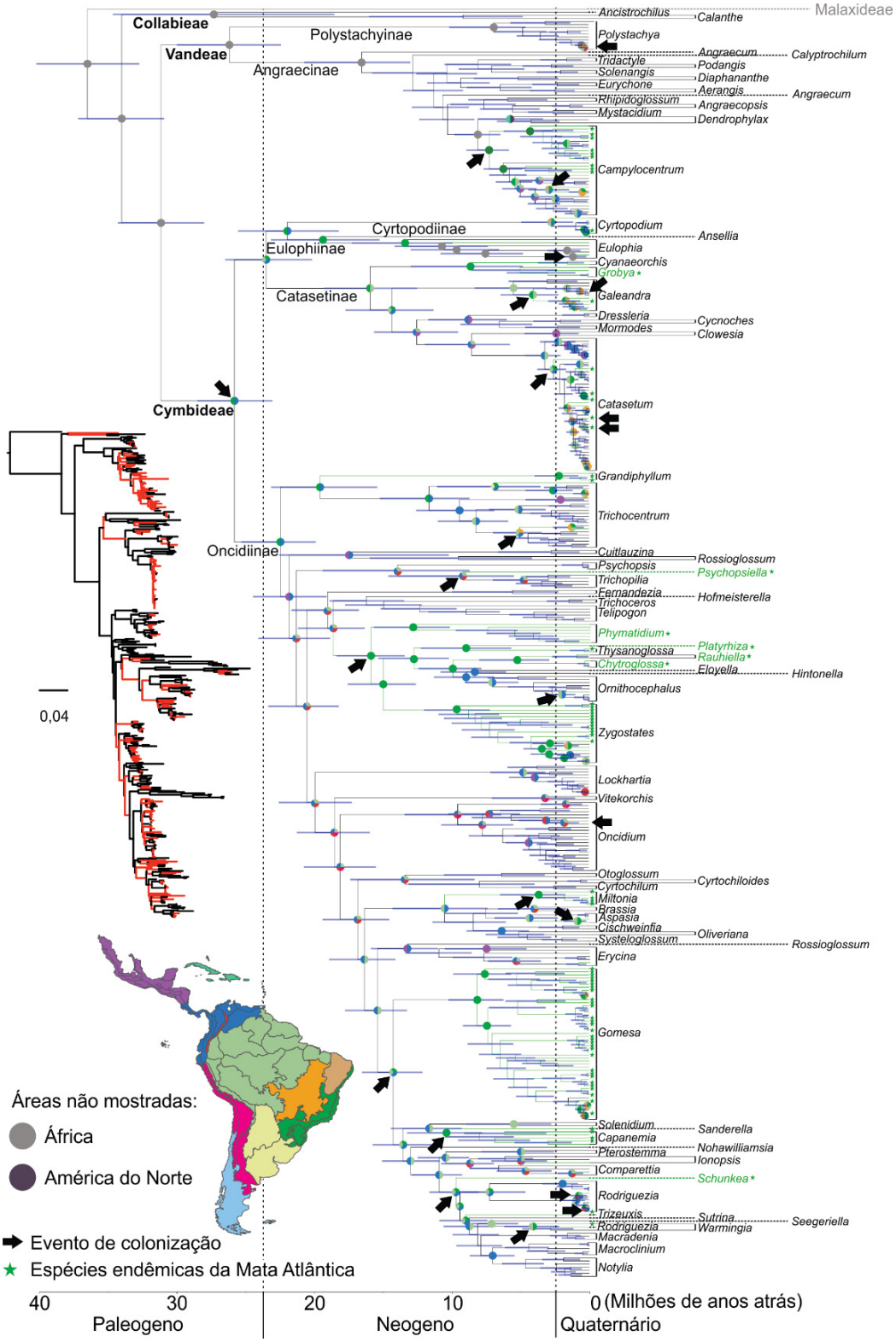

Figura 4: Reconstrução das áreas ancestrais e datação molecular de parte da subfamília Epidendroideae, tribos Pogonieae, Vandeae e parte de Cymbidieae. Nos nós, as cores correspondem à área ancestral mais provável e as barras azuis ao intervalo de confiança na estimativa da idade. Nós sem cores possuem a mesma área ancestral do nó anterior. Ramos verdes indicam espécies que ocorrem na Mata Atlântica. O filograma à esquerda mostra o comprimento dos ramos da árvore de Máxima rossimilhança, cujos ramos vermelhos possuem suporte de bootstrap inferior a 85%.

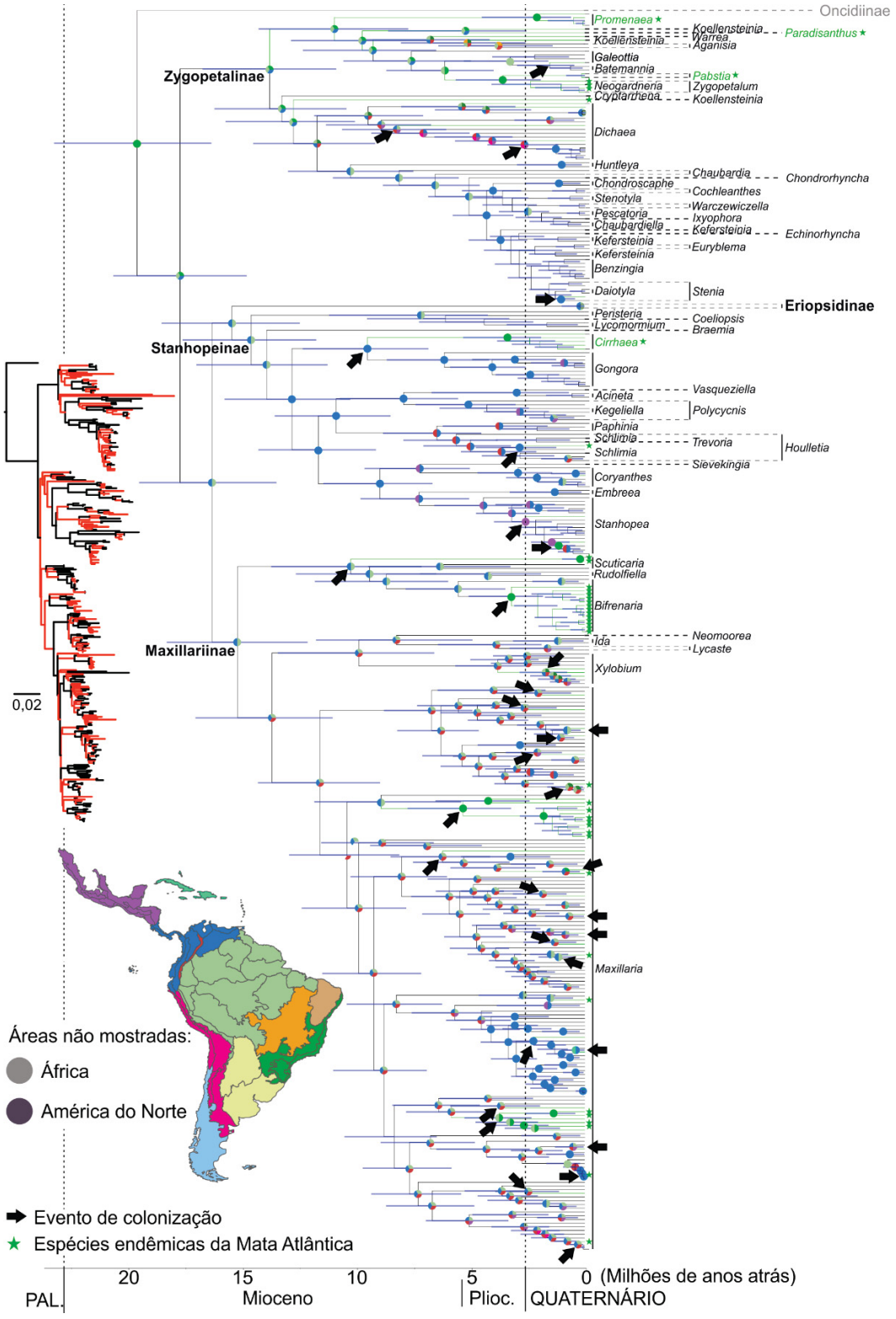

Figura 5: Reconstrução das áreas ancestrais e datação molecular de parte da tribos Cymbidieae (Epidenroideae). Nos nós, as cores correspondem à área ancestral mais provável e as barras azuis ao intervalo de confiança na estimativa da idade. Nós sem cores possuem a mesma área ancestral do nó anterior. Ramos verdes indicam espécies que ocorrem na Mata Atlântica. O filograma à esquerda mostra o comprimento dos ramos da árvore de Máxima rossimilhança, cujos ramos vermelhos possuem suporte de bootstrap inferior a 85%.

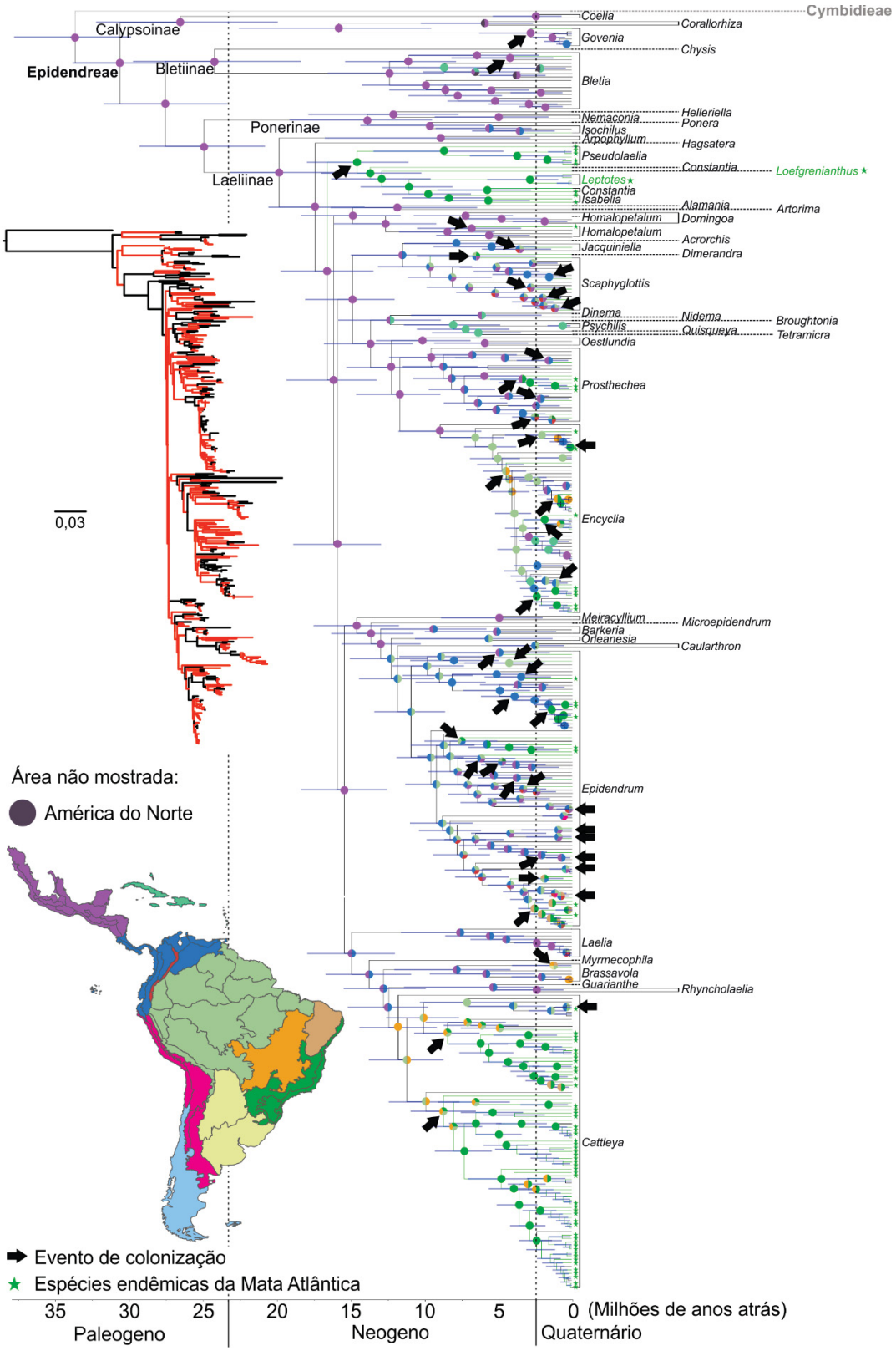

Figura 6: Reconstrução das áreas ancestrais e datação molecular de parte da subtribo Epidendreae (Epidendroideae). Nos nós, as cores correspondem à área ancestral mais provável e as barras azuis ao intervalo de confiança na estimativa da idade. Nós sem cores possuem a mesma área ancestral do nó anterior. Ramos verdes indicam espécies que ocorrem na Mata Atlântica. O filograma à esquerda mostra o comprimento dos ramos da árvore de Máxima rossimilhança, cujos ramos vermelhos possuem suporte de bootstrap inferior a 85%.

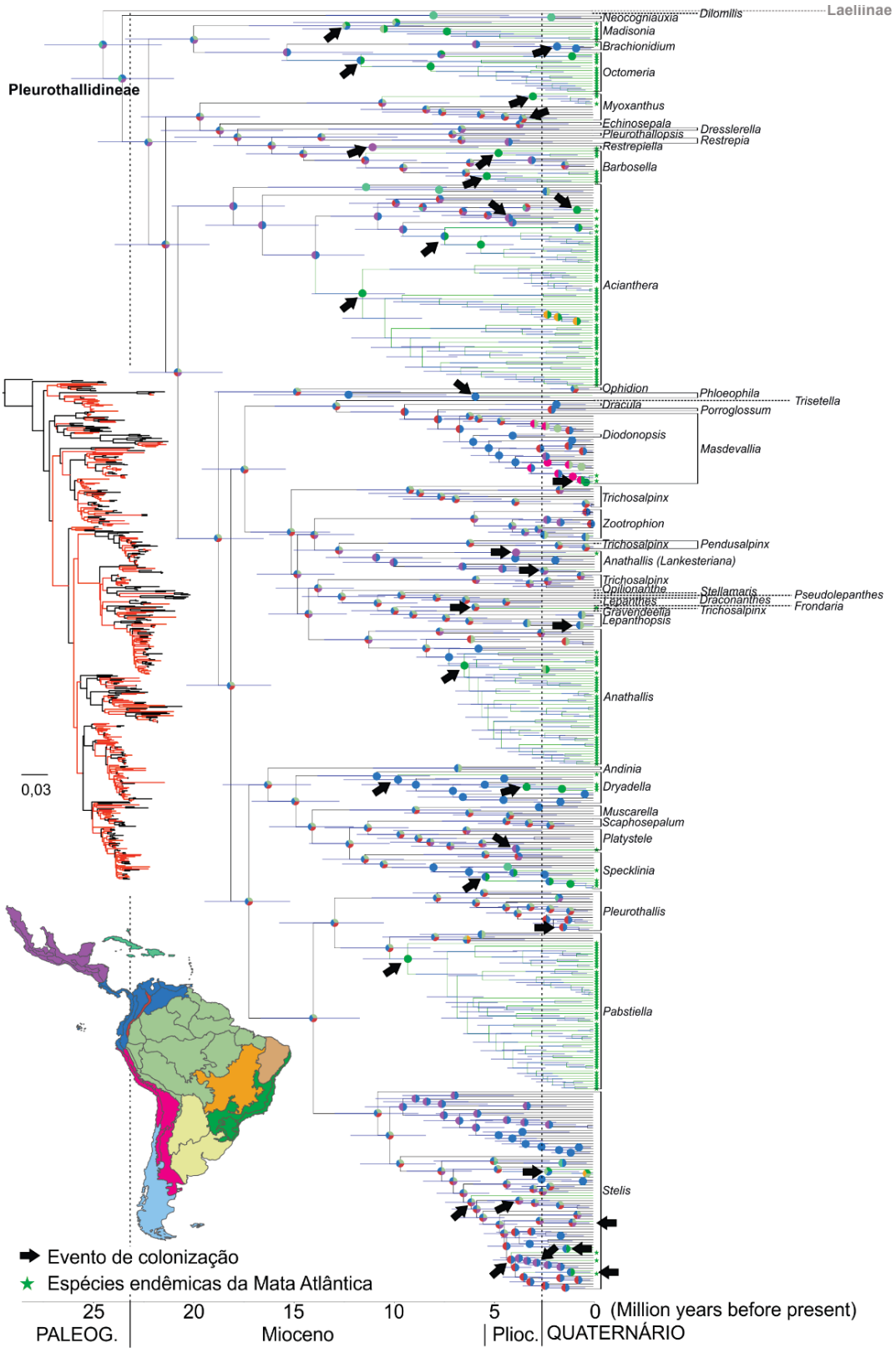

Figura 7: Reconstrução das áreas ancestrais e datação molecular da subtribo Pleurothallidinae (Epidendroideae, Epidendreae). Nos nós, as cores correspondem à área ancestral mais provável e as barras azuis ao intervalo de confiança na estimativa da idade. Nós sem cores possuem a mesma área ancestral do nó anterior. Ramos verdes indicam espécies que ocorrem na Mata Atlântica. O filograma à esquerda mostra o comprimento dos ramos da árvore de Máxima rossimilhança, cujos ramos vermelhos possuem suporte de bootstrap inferior a 85%.

De acordo com as reconstruções das áreas ancestrais, a Mata Atlântica é o local de origem da subtribo Eulophiinae e de 25 gêneros: *Campylocentrum* Benth., *Capanemia* Barb.Rodr., *Chytroglossa*, *Cirrhaea*, *Constantia* Barb.Rodr., *Grandiphyllum* Docha Neto, *Grobya*, *Isabelia* Barb.Rodr., *Lankesterella* Ames, *Leptotes*, *Loefgrenianthus*, *Miltonia* Lindl., *Neogardneria* Schltr. ex Garay, *Nohawilliamsia* M.W.Chase & Whitten, *Pabstia*, *Phymatidium*, *Platyrrhiza*, *Promenaea*, *Pseudolaelia* Porto & Brade, *Rauhiella*, *Sanderella* Kuntze, *Thysanoglossa* Porto & Brade, *Uleiorchis* Hoehne, *Zygopetalum* Hook. e *Zygostates* Lindl.. Foram observados grandes clados da Mata Atlântica em *Acianthera* Scheidw., *Anathallis* Barb.Rodr., *Barbosella* Schltr., *Bifrenaria* Lindl., *Bulbophyllum* Thouars, *Cattleya* Lindl., *Madisonia* Luer, *Microchilus* C.Presl, *Octomeria* R.Br., *Pabstiella* Brieger & Senghas e *Zygostates* (grado).

Os principais resultados das análises biogeográficas foram sumarizados na Figura 8. Ao contabilizar as áreas ancestrais dos ACMR potencialmente colonizadores (i.e., dos nós dos eventos de colonização), constatou-se que as biorregiões do Pacífico e da Floresta Amazônica foram as que mais contribuíram com migrantes para a Floresta Atlântica, apresentando uma prevalência de 29% e de 25%, respectivamente. As biorregiões da Mesoamérica, do Páramo (porção norte dos Andes) e da própria Floresta Atlântica também foram importantes, aparecendo em 14%, 13% e 11% cada uma entre as áreas ancestrais. São as biorregiões com menor prevalência o Cerrado (4%), a Caatinga (1,4%), a porção sul dos Andes (1%), as Antilhas (1%) e os Pampas (0,3%). A região do extremo sul da América do Sul apareceu em somente um evento de colonização, na subtribo Chloreinae (Orchidoideae, Chranichideae), enquanto que as áreas extra-neotropicais tiveram prevalência baixa: 1% da África e 0,3% da América do Norte.

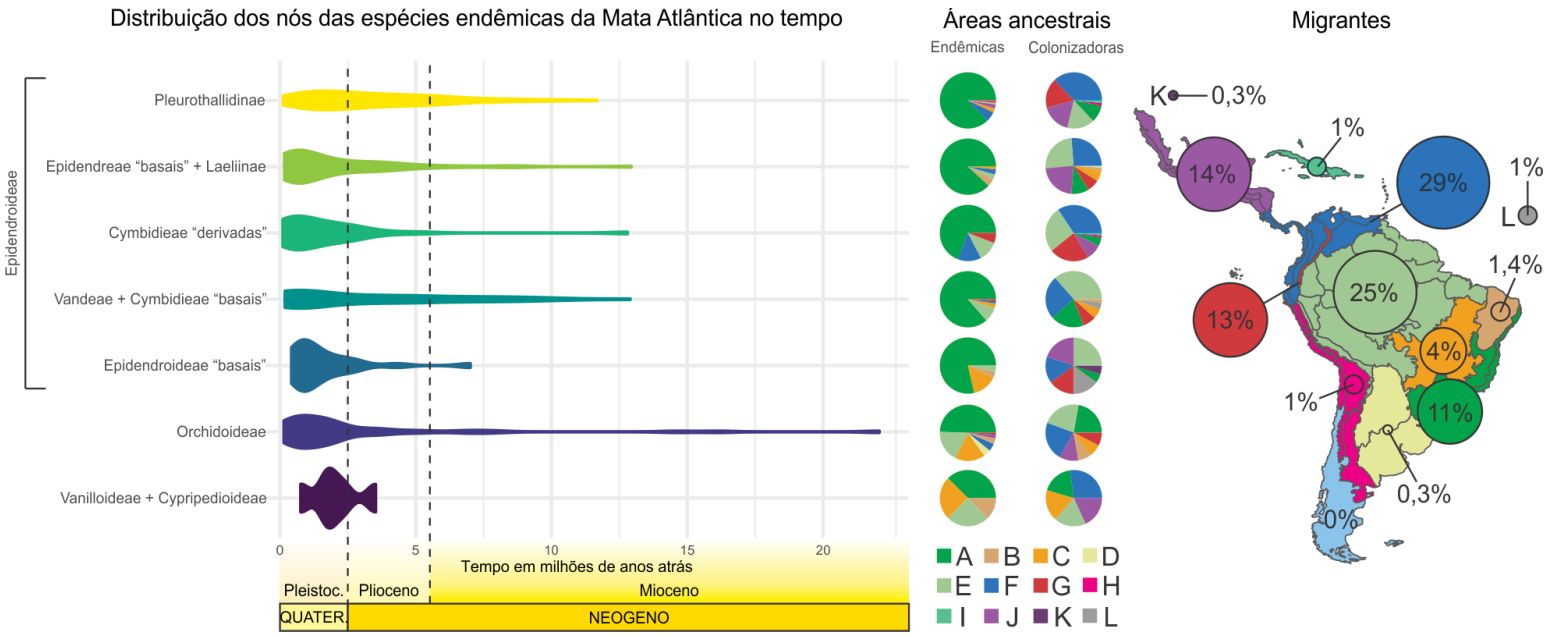

Figura 8: Resumo das análises biogeográficas. À esquerda, o gráfico de violino ilustra a distribuição dos nós das espécies endêmicas da Mata Atlântica por conjunto de dados ao longo do tempo. À direita, os gráficos de pizza mostram as porcentagens de cada área nas distribuições ancestrais nos nós das espécies endêmicas e dos eventos de colonização para cada conjunto de dados. O mapa está contabilizando a prevalência total de cada área em todos os eventos de colonização da Mata Atlântica, cujas cores são correspondentes aos dos gráficos de pizza.

Analisando as áreas ancestrais somente das espécies endêmicas (Figura 8) foi possível perceber que nas subfamílias mais antigas (i.e., Vanilloideae, Cypripedioideae) e nas orquídeas terrestres (Orchidoideae) a origem das espécies endêmicas atuais possui contribuições quase iguais entre linhagens que já ocorriam da Mata Atlântica e linhagens migrantes, provenientes principalmente da Amazônia e mais recentemente do Cerrado. Por outro lado, em Epidendroideae, percebe-se que a grande maioria das espécies endêmicas foram originadas a partir de diversificação *in situ*. O período em que as espécies endêmicas começaram a se originar também variou entre as subfamílias. Em Cypripedioideae e Vanilloideae as espécies endêmicas datam do Período Quaternário (0,77–2,35 Ma), enquanto que em Orchidoideae a linhagem mais antiga data do início do Período Neogeno (ca. 22,07 Ma). Já em Epidendroideae, as espécies endêmicas começaram a surgir ca. 7 Ma. Em todas as subfamílias o pico de diversificação das espécies endêmicas se deu no Período Quaternário.

DISCUSSÃO

A história evolutiva das orquídeas na Mata Atlântica é bastante complexa e não ocorreu da mesma forma em todos os grupos, como esperado de uma família tão diversa e heterogênea. As orquídeas se dispersaram de e para a Mata Atlântica diversas vezes e em períodos geológicos distintos. As espécies da Mata Atlântica são relativamente recentes em todas as subfamílias, começando a surgir a partir do Período Neogeno. No entanto, as reconstruções biogeográficas deste estudo e de Givnish *et al.* (2016) mostram que a origem das orquídeas em florestas Neotropicais é muito mais antiga. Apesar de ser difícil quantificar extinção sem a evidência de fósseis, as primeiras linhagens de orquídeas dessas florestas certamente sofreram inúmeras extinções em resposta aos eventos geológicos e climáticos que ocorreram na região desde quando lá se estabeleceram. Por outro lado, essas mesmas condições, promovidas principalmente pelo soerguimento dos Andes, propiciaram o estabelecimento e a diversificação de migrantes na América do Sul (GENTRY, 1982). Os ancestrais das espécies viventes da Mata Atlântica vieram principalmente de outras florestas do Neotrópico (51%) e de áreas montanhosas da América Central (14%) e dos Andes (13%), além de áreas mais extensas que incluíam a atual Mata Atlântica (11%). A grande maioria das espécies endêmicas são neoendêmicas, sendo apenas *Cotylolabium lutzii* (Pabst) Garay (22,07 Ma, i.c.: 18,71–26,31 Ma) e *Eurystyles lorenzii* (Cogn.) Schltr. (16,16 Ma, i.c.: 12,64–19,77 Ma) prováveis paleoendêmicas, ambas da subtribo Spiranthinae (Orchidoideae, Cranichideae). Em todas as subfamílias, a diversificação das espécies endêmicas ocorreu principalmente durante o Período Quaternário.

O primeiro evento de migração das orquídeas para a Mata Atlântica ocorreu durante o Cretáceo, há 74,89 milhões de anos (intervalo de confiança: 65,8–83,52 Ma), na origem da subfamília Vanilloideae (Figura 1). Naquele Período, as temperaturas eram mais elevadas e toda a América do Sul era coberta por florestas tropicais contínuas, portanto a Mata Atlântica atual ainda não havia sido formada, mas fazia parte de um grande contínuo de florestas tropicais (ZACHOS *et al.*, 2001; MORLEY, 2011). A origem Neotropical das subfamílias Vanilloideae e Cypripedioideae já foi sugerida também por Givnish *et al.* (2016), que apontaram como causa a migração de espécies australianas através da conexão entre a América do Sul, a Antártica e a Austrália que existia durante o Cretáceo. Depois deste grande evento de migração, os três eventos mais antigos aconteceram durante o Período Paleogeno (66–23,03 Ma), dos quais um se deu na subfamília Orchidoideae e os outros dois em Epidendroideae. Naquele Período as florestas neotropicais ainda estavam conectadas,

inclusive por meio de descontinuidades na cordilheira ainda em formação (ANTONELLI *et al.*, 2009; HOORN *et al.*, 2010; MONTES *et al.*, 2021). Os períodos de ótimo climático do Eoceno (56–33,9 Ma) favoreceram o estabelecimento de pequenas massas de terra entre as Américas Central e do Sul que permitiram algum fluxo migratório entre elas antes do fechamento do istmo do Panamá, o que só ocorreria milhões de anos depois (ZACHOS *et al.*, 2001; ANTONELLI *et al.*, 2009). No final do Período, durante o Oligoceno (33,9–23,03 Ma), a temperatura global começou a diminuir, fazendo surgir pequenas áreas de vegetação aberta (PAGANI *et al.*, 2005; LIU *et al.*, 2009).

Em Orchidoideae, o evento marcou a origem Neotropical da subtribo Discyphinae, durante o Oligoceno (26,39 Ma, i.c.: 22,54–30,81 Ma), a partir de ancestrais provenientes de uma área ampla abrangendo a Floresta Amazônica, o domínio do Pacífico, o Páramo e a América Central (Figura 2). Em Epidendroideae, os eventos que ocorreram no Paleogeno se referem à origem das tribos Wullschlaegelieae (Figura 3) e Cymbidieae (Figura 4), ambas provenientes de ancestrais africanos. É importante notar que esses eventos ocorreram milhões de anos depois da separação entre a América do Sul e o continente Africano e, por conta disto, são produtos de dispersões transoceânicas. Foram observados diversos outros eventos como estes nas análises biogeográficas. Em Vanilloideae: (1) do Neotrópico para a África em *Vanilla* Plum. ex Mill. (9,07 Ma, i.c.: 5,82–13,16 Ma), (2) da África para as Antilhas e América do Norte também em *Vanilla* (5,32 Ma, i.c.: 2,9–8,28 Ma). Em Orchidoideae: (3) do Neotrópico para a África (62,35 Ma, i.c.: 55,22–69,41 Ma), (4) da África para o extremo sul da América do Sul em Chloreinae (10,28 Ma, i.c.: 7,44–13,73 Ma), (5–7) da África para o Neotrópico três vezes, em Orchideae (*Habenaria* Willd. – 7,81 Ma, i.c.: 5,95–10,16 Ma), Cranichidae (28,16 Ma, i.c.: 24,11–32,72 Ma) e Goodyerinae (*Goodyera* R.Br. – 22,02 Ma, i.c.: 16,35–28,12 Ma). Em Epidendroideae: (9–11) da África para o Neotrópico três vezes, em Polystachyinae (*Polystachya* Hook. – 0,49 Ma, i.c.: 0,23–0,9 Ma), Angraecinae (*Campylocentrum* Benth. – 7,39 Ma, i.c.: 5,94–9,05 Ma) e Cymbidieae (22,56 Ma, i.c.: 19,98–25,4 Ma), (12) da África para as Antilhas e América do Norte em Angraecinae (*Dendrophylax* Rchb.f. – 5,86 Ma, i.c.: 3,49–8,18 Ma), e (13–14) do Neotrópico para a África duas vezes em Eulophiinae, em *Ansellia* Lindl. (19,46 Ma, i.c.: 15,35–23,24 Ma) e *Eulophia* R.Br. (13,5 Ma, i.c.: 10,05–17,36 Ma). Apenas três (1, 2 e 3) dos 14 eventos de dispersão transoceânica encontrados nas análises deste estudo são congruentes com a literatura (GIVNISH *et al.*, 2016), enquanto que os demais não foram recuperados por diferenças na

amostragem. Os eventos 6, 7 e 11 identificados aqui da África para o Neotrópico são, na verdade, da Ásia ou Indo-Malásia para o Neotrópico (GIVNISH *et al.*, 2016; SMIDT *et al.*, 2021b), além de outros eventos não recuperados aqui pelo fato de que espécies asiáticas não foram amostradas. Ainda, o evento 6 pode ter acontecido não por dispersão transoceânica, mas pela passagem pela Antártica, pois Smidt *et al.* (2021b) estimaram uma idade mais antiga de Cranichideae (ca. 47 Ma). Os demais eventos (4, 5, 8–10 e 12–14) foram identificados pela primeira vez neste estudo por compreender uma amostragem infragenérica maior.

Pelo fato de Orchidaceae possuir espécies nativas em todos os continentes (exceto na Antártica), é natural que subfamílias, tribos, subtribos, e até gêneros amplamente distribuídos (e.g., pantropicais) sejam disjuntos entre os continentes. Consequentemente, a possibilidade de dispersões longas transoceânicas na família já foi sugerida há muito tempo (DRESSLER, 1981; CHASE, 2001), mas torna paradoxal a dispersão de sementes em orquídeas (GIVNISH *et al.*, 2016). Por um lado, a distribuição cosmopolita (PRIDGEON *et al.*, 1999, 2001, 2003, 2005, 2009, 2014) e as adaptações das sementes para serem dispersas pelo vento (ARDITTI e GHANI, 2000) conferem às orquídeas os *status* de excelentes colonizadoras e de dispersoras por longas distâncias. Por outro lado, dispersões longas frequentes agem contra a diferenciação genética espacial no nível populacional e, por consequência, contra a especiação (HAMRICK e GODT, 1996), e como mencionado anteriormente, Orchidaceae é a maior família botânica em número de espécies. Estudos empíricos em distância de dispersão de sementes de orquídeas são poucos, mas já foram constatadas dispersões curtas tanto em orquídeas terrestres como em epífitas (MURREN e ELLISON, 1998; JERSÁKOVÁ e MALINOVÁ, 2007; BRZOSKO *et al.*, 2017;). Portanto, a grande diversidade de orquídeas está relacionada, em parte, à dispersão curta das sementes e, possivelmente, à distribuição de fungos micorrizos que auxiliam na germinação dessas sementes, que é ainda menos conhecida (GIVNISH *et al.*, 2015). Isso não significa que dispersões longas não ocorram, pois já foi documentada a dispersão natural de três espécies para o Havaí (WAGNER, HERBST e SOHMER, 1990), além das disjunções continentais de grupos com origem pós-Gondwana (DRESSLER, 1981; CHASE, 2001; GIVNISH *et al.*, 2016).

Voltando aos eventos de migração para a Mata Atlântica, a grande maioria deles ocorreu durante os Períodos Neogeno e Quaternário. Durante o Período Neogeno (23,03–2.58 Ma), a cordilheira dos Andes estava em suas fases finais de formação, passando por vários eventos de rápida orogênese que mudaram drasticamente a paisagem e o clima da América do

Sul (HOORN *et al.*, 2010). Aproximadamente na metade do Período, as atividades orogênicas resultaram na formação do escudo das Guianas e na alteração da drenagem da Bacia Amazônica para o leste, em direção ao Atlântico, formando assim o sistema hídrico atual da região (WESSELING e SALO, 2006, HOORN *et al.*, 2010). Além disso, com as cordilheiras atingindo altitudes maiores do que atualmente, formou-se uma forte barreira topográfica à circulação de umidade atmosférica na América do Sul (INSEL, POUSEN e EHLERS, 2010). Esse aumento drástico na aridez da região está relacionado à formação das grandes estepes da Patagônia e do deserto do Atacama (RECH *et al.*, 2006), além de favorecer regimes de queimada que expandiram áreas de vegetação aberta, culminando na formação do Cerrado (SIMON *et al.*, 2009; AZEVEDO *et al.*, 2020). Evidências paleopalinológicas mostram claramente a substituição de espécies higrófilas por espécies adaptadas ao clima seco, sugerindo que essas mudanças do Período causaram muitas extinções de táxons mais antigos da região (BARREDA e PALAZZESI, 2021; PALAZZESI *et al.*, 2021). Isso pode explicar o porquê de as linhagens mais antigas de Orchidaceae possuírem espécies muito recentes da Mata Atlântica (Figura 8). Após a chegada no Neotrópico durante o Cretáceo, os outros dois eventos de entrada na Mata Atlântica em Vanilloideae ocorreram somente no Período Quaternário em *Vanilla phaeantha* Rchb.f. + *V. planifolia* Andrews (2,47 Ma, i.c.: 1,4–3,76 Ma) e em *V. odorata* C.Presl (1,69 Ma, i.c.: 0,85–2,76 Ma), que foram re-colonizações a partir de linhagens da América Central e do domínio do Pacífico (Figura 1). Ainda, as espécies da Mata Atlântica dessa subfamília são todas de linhagens muito recentes, sendo a mais antiga delas a que contém *Cleistes tenuis* (Rchb.f. ex Griseb.) Schltr., do Período Neogeno (19,76 Ma, i.c.: 11,13–30,72 Ma; - Figura 1). Já em Cypripedioideae, o único evento ocorreu somente no Período Quaternário, originando a única espécie endêmica desta subfamília a partir de ancestrais amazônicos (0,77 Ma, i.c.: 0,43–1,36 Ma; - Figura 1). O mesmo pode ser observado em Orchidoideae (Figura 2) e nas tribos mais antigas de Epidendroideae (Figura 3). Em Orchidoideae, todas linhagens das espécies viventes de Mata Atlântica são recentes, com exceção da que contém *Discyphus scopulariae* (Rchb.f.) Schltr., da subtribo Discyphinae, e *Cotylolabium lutzii* e *Eurystyles lorenzii*, ambas da subtribo Spiranthinae. Essas espécies muito provavelmente são paleoendêmicas, isto é, são remanescentes de linhagens mais antigas que ocupavam uma área maior (STEBBINS, 1974; MORRONE, 2008), sendo neste caso o contínuo de florestas tropicais anterior à diagonal seca. Essas linhagens resistiram à aridez graças a refúgios florestais e/ou conseguiram se

adaptar às novas condições, uma vez que *D. scopulariae* também ocorre em áreas de Caatinga e de Cerrado atualmente.

Todos os grandes clados de espécies de orquídeas da Mata Atlântica tiveram origem no Neogeno a partir de migrantes de outras áreas Neotropicais, principalmente da Floresta Amazônica (que compreende também grande parte do domínio do Pacífico; Figura 8). Esses resultados corroboram os resultados de Antonelli *et al.* (2018) em relação a que a Floresta Amazônica é a principal fonte de espécies do Neotrópico. Os migrantes provenientes de vegetação aberta (e.g., Caatinga e Cerrado), além de serem escassos, são decorrentes de eventos de re-colonização (Figuras 2 e 4) ou de áreas ancestrais amplas (Figuras 1, 2 e 6). Isso também faz coro ao crescente conjunto de evidências em Orchidaceae de que haviam conexões entre as florestas Atlântica e Amazônica durante o Neogeno (GUTIÉRREZ M. *et al.*, 2021; SMIDT *et al.*, 2021b; MAUAD *et al.*, 2022). As hipóteses que suportam essas conexões sugerem que elas ocorreram em locais e momentos diferentes ao longo do Neogeno (BATALHA-FILHO *et al.*, 2013; SOBRAL-SOUZA, LIMA-RIBEIRO e SOLFERINI, 2015; LEDO e COLLI, 2017). Dessa forma, houve uma conexão ao Sul, interligando o Sul de ambas as florestas, a partir da metade até o final do Mioceno (ca. 11–5 Ma), e outras conexões mais recentes por meio de florestas de galeria, interligando o Leste amazônico à Mata Atlântica, durante o Plioceno até o final do Pleistoceno (ca. 0,9 Ma). Essa dinâmica estaria relacionada a diferenças na composição de espécies e no padrão de endemismo entre o Sul e o Norte da Mata Atlântica (LEDO e COLLI, 2017). Por conta disso, seria muito interessante verificar a história biogeográfica da família dentro da Mata Atlântica, comparando a distribuição da riqueza de espécies, as taxas de especiação, e as áreas ancestrais entre as duas regiões.

Além das conexões com a Floresta Amazônica, as flutuações climáticas do Período Quaternário estão ganhando relevância na explicação sobre a origem da diversidade e dos padrões de endemismo na Mata Atlântica (PERES *et al.*, 2020). As análises biogeográficas deste estudo mostram que a diversificação das espécies de orquídeas da Mata Atlântica, especialmente as endêmicas, ocorreu durante o Quaternário em todos os grupos (Figura 8). No entanto, a falta de análises de modelos climáticos e paleoclimáticos para essas espécies impede a conclusão empírica de que áreas de refúgio de fato promoveram a diversidade desses clados. De qualquer sorte, as variações climáticas do Pleistoceno somadas à dispersão

curta em ambientes de floresta densa favoreceram a especiação *in situ* e, com isso, promoveram a diversificação rápida e recente das orquídeas da Mata Atlântica.

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MATERIAL SUPLEMENTAR

Tabela S1: Lista de espécies de orquídeas endêmicas da Mata Atlântica.

Subfamília	Tribo	Subtribo	Espécies
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera acuminatipetala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera adiri*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera alborosea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera antennata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera asaroides*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera atrata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera atropurpurea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera bibarbellata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera bidentata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera bidentula*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera binotii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera brachiloba*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera bragae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera breviflora*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera caldensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera calopedilon*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera capanemae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera catujiensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera cephalopodiglossa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera crepiniana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera cristata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera cryptantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera cryptophoranthoides*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera duartei*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera dutrae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera echinosa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera exarticulata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera exdrasii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera fenestrata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera fornograndensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera freyi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera glanduligera*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera glumacea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera gouveiae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera gracilis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera gracilisepala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera hatschbachii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera heliconiscapa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera heringeri*

Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera hoffmannseggiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera hygrophila*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera hystrix*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera imitator*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera johannensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera jordanensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera karlii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera klingelfusii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera klotzschiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera langeana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera leptotifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera limae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera luteola*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera macropoda*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera macuconensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera maculiglossa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera magalhanesii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera malachantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera mantiquyrana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera marquesii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera marumbyana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera melachyla*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera micrantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera minima*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera modestissima*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera montana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera murexoidea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera muscicola*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera muscosa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera myrticola*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera nemorosa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera octophrys*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera oligantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera panduripetala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera papillosa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera parahybunensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera pardipes*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera pavimentata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera pectinata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera perdusenii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera pernambucensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera platystachys*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera punctatiflora*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera purpureoviolacea*

Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera recurva*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera rodriguesii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera rostellata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera saurocephala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera scabripes*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera serpentula*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera serrulatipetala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera sonderiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera spilantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera strupifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera subrotundifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera sulcata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera sulphurea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera teres*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera translucida*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera tristis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera variegata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera violaceomaculata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera wageneriana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera wawraeana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Acianthera welswindischiae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis aristulata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis articulata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis attenuata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis bleyensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis bocainensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis bolsanelloi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis carvalhoi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis colnagoi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis corticicola*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis crebrifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis dryadum*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis eugenii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis ferdinandiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis fernandiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis flammea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis gehrtii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis gerthatschbachii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis githaginea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis globifera*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis graveolens*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis guarujaensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis guimaraensii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis helmutii*

Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis heloisae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis imbricata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis johnsonii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis jordanensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis kautskyi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis kleinii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis laciniata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis lichenophila*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis linearifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis liparanges*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis lobiserrata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis longiglossa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis luteola*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis malmeana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis microblephara*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis microgemma*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis microphyta*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis muscoidea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis nectarifera*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis ova-trochilorum*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis pabstii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis paranapiacabensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis paula*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis peroupavae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis petersiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis petropolitana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis pilipetala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis piratiningana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis pubipetala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis pusilla*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis puttermansii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis radialis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis recurvipetala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis reedii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis rubrolimbata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis rudolfii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis seidelii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis similis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis simpliciglossa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis sororcula*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis spannageliana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis subnulla*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis tigridens*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis trullilabia*

Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis velvetina*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis vitorinoi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis welteri*
Epidendroideae	Epidendrae	Pleurothallidinae	*Anathallis ypirangae*
Epidendroideae	Cymbidieae	Oncidiinae	*Aspasia silvana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Barbosella australis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Barbosella cogniauxiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Barbosella crassifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Barbosella dusenii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Barbosella gardneri*
Epidendroideae	Epidendrae	Pleurothallidinae	*Barbosella macaheensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Barbosella miersii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Barbosella spiritu-sanctensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Barbosella trilobata*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria atropurpurea*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria aureofulva*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria calcarata*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria charlesworthii*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria clavigera*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria harrisoniae*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria inodora*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria leucorrhoda*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria mellicolor*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria parthonii*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria racemosa*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria silvana*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria stefanae*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria tetragona*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria tyrianthina*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria vitellina*
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria wittigii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Brachionidium restrepioides*
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele bicrinita*
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele scabrilingua*
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele subfiliformis*
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele widgrenii*
Epidendroideae	Epidendrae	Laeliinae	*Brassavola ceboletta*
Epidendroideae	Epidendrae	Laeliinae	*Brassavola flagellaris*
Epidendroideae	Epidendrae	Laeliinae	*Brassavola pitengoensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Brassia arachnoidea*
Orchidoideae	Cranichideae	Spiranthinae	*Buchtienia nitida*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum arianeae*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum atropurpureum*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum boudetianum*

Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum calimanianum*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum campos-portoi*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum cantagallense*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum glutinosum*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum granulosum*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum kautskyi*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum macroceras*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum malachadenia*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum melloi*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum micranthum*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum micropetaliforme*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum paranaense*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum regnellii*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum teimosense*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbophyllum uhl-gabrielianum*
Epidendroideae	Dendrobieae	Dendrobinae	*Bulbuphyllum napellii*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum brachycarpum*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum brevifolium*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum calostachyum*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum hirtlellum*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum insulare*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum itatiaiae*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum labiakii*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum organense*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum ornithorrhynchum*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum paludosum*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum parahybunense*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum pauloense*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum pernambucense*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum pubirhachys*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum schlechterianum*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum serranum*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum spannagelii*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum ulei*
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum wawrae*
Epidendroideae	Cymbidieae	Oncidiinae	*Capanemia adelaidae*
Epidendroideae	Cymbidieae	Oncidiinae	*Capanemia carinata*
Epidendroideae	Cymbidieae	Oncidiinae	*Capanemia gehrtii*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum × pohlianum*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum arietinum*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum bertioguense*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum brevilobatum*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum gardneri*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum hookeri*

Epidendroideae	Cymbidieae	Catasetinae	*Catasetum joaquinianum*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum labiatum*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum mattosianum*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum micranthum*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum punctatum*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum purum*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum rodigasianum*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum socco*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum triodon*
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum uncatum*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya acuensis*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya alaorii*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya alvaroana*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya bicalhoi*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya blumenscheinii*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya caulescens*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya cinnabarina*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya coccinea*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya colnagoi*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya crispa*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya dichroma*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya dormaniana*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya forbesii*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya gloedeniana*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya grandis*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya granulosa*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya guttata*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya harrisoniana*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya hoehnei*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya kautskyana*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya kerrii*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya lobata*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya locatellii*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya macrobulbosa*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya mantiqueirae*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya marcaliana*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya munchowiana*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya neokautskyi*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya nevesii*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya perrinii*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya porphyroglossa*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya praestans*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya purpurata*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya schilleriana*

Epidendroideae	Epidendrae	Laeliinae	*Cattleya schofieldiana*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya tenebrosa*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya tigrina*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya velutina*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya verboonenii*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya virens*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya warneri*
Epidendroideae	Epidendrae	Laeliinae	*Cattleya xanthina*
Epidendroideae	Cymbidieae	Oncidiinae	*Chytroglossa aurata*
Epidendroideae	Cymbidieae	Oncidiinae	*Chytroglossa marileoniae*
Epidendroideae	Cymbidieae	Oncidiinae	*Chytroglossa paulensis*
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea dependens*
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea fuscolutea*
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea longiracemosa*
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea nasuta*
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea seidelii*
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea silvana*
Vanilloideae	Pogonieae	-	*Cleistes calantha*
Vanilloideae	Pogonieae	-	*Cleistes cipoana*
Vanilloideae	Pogonieae	-	*Cleistes ionoglossa*
Vanilloideae	Pogonieae	-	*Cleistes itatiaiae*
Vanilloideae	Pogonieae	-	*Cleistes libonii*
Vanilloideae	Pogonieae	-	*Cleistes pallida*
Vanilloideae	Pogonieae	-	*Cleistes rodriguesii*
Orchidoideae	Codonorchideae	-	*Codonorchis canisioi*
Epidendroideae	Epidendrae	Laeliinae	*Constantia australis*
Epidendroideae	Epidendrae	Laeliinae	*Constantia rupestris*
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes bahiensis*
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes buerarementis*
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes lanata*
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes marcaliana*
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes pilosa*
Orchidoideae	Cranichideae	Spiranthinae	*Cotylolabium lutzii*
Orchidoideae	Cranichideae	Cranichidinae	*Cranichis candida*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon alexandrae*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon argyrifolius*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon calophyllus*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon dusenii*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon eldorado*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon eugenii*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon gardneri*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon hatschbachii*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon iguapensis*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon itatiaiensis*

Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon longibracteatus*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon multiflorus*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon oliganthus*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon organensis*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon proboscideus*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon subalpestris*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon torusus*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon truncatus*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon variegatus*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon venustus*
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon vittatus*
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium flavum*
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium gigas*
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium glutiniferum*
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium holstii*
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium intermedium*
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium kleinii*
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium palmifrons*
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea anchorifera*
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea brevicaulis*
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea bryophila*
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea elianae*
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea monsenii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella auriculigera*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella aviceps*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella catharinensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella crenulata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella kautskyi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella krenakiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella lilliputiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella susanae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella toscanoi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella vitorinoi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Dryadella wuerstlei*
Orchidoideae	Cranichideae	Spiranthinae	*Eltroplectris assumpcaoana*
Orchidoideae	Cranichideae	Spiranthinae	*Eltroplectris janeirensis*
Orchidoideae	Cranichideae	Spiranthinae	*Eltroplectris kuhlmanniana*
Orchidoideae	Cranichideae	Spiranthinae	*Eltroplectris schlechteriana*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia advena*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia bicalhoi*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia bohnkiana*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia bracteata*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia bragancae*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia dichroma*

Epidendroideae	Epidendrae	Laeliinae	*Encyclia fimbriata*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia fowliei*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia gallopavina*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia ionosma*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia joaosaiana*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia patens*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia pauciflora*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia spiritusanctensis*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia unaensis*
Epidendroideae	Epidendrae	Laeliinae	*Encyclia viridiflora*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum × belmillerae*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum × pinheiroi*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum × purpureum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum addae*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum ammophilum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum anatipedium*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum bothryanthum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum caldense*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum calimanianum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum campos-portoi*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum carvalhoi*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum chlorinum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum cooperianum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum filicaule*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum forcipatoides*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum fulgens*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum garciae*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum geniculatum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum goebelii*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum harrisoniae*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum henschenii*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum hololeucum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum infaustum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum kautskyi*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum loefgrenii*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum mantiqueiranum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum niveum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum obergii*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum paniculosum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum parahybunense*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum patentifolium*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum pernambucense*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum pessoae*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum proligerum*

Epidendroideae	Epidendrae	Laeliinae	*Epidendrum pseudavicula*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum puniceoluteum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum robustum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum sanchezii*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum saximontanum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum silvanum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum spinescens*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum veltenianum*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum waiandtii*
Epidendroideae	Epidendrae	Laeliinae	*Epidendrum zappii*
Vanilloideae	Vanilleae	-	*Epistephium portellianum*
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles cogniauxii*
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles crocodilus*
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles gardneri*
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles hoehnei*
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles lobata*
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles lorenzii*
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles rutkowskiana*
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles splendissima*
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra juncaeoides*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa albinoi*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa alvesiana*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa amicta*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa barkeri*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa bicornuta*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa brasiliensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa brieniana*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa cogniauxiana*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa colorata*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa concolor*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa croesus*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa cuneata*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa dasytyle*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa echinata*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa eleutherosepala*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa fischeri*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa florida*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa forbesii*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa francacesari*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa gardneri*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa glaziovii*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa gomezoides*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa gutfreundiana*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa handroi*

Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa hookeri*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa imperatoris-maximiliani*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa jucunda*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa kautskyi*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa laxiflora*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa leinigii*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa loefgrenii*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa majevskyae*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa marshalliana*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa microphyta*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa nitida*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa novaesae*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa ouricanensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa pabstii*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa paranensoides*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa pectoralis*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa petropolitana*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa planifolia*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa polyodonta*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa psyche*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa pubes*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa pulchella*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa radicans*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa ranifera*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa recurva*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa riograndensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa roczonii*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa sarcodes*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa sessilis*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa silvana*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa terassaniana*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa uhlii*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa uniflora*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa velteniana*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa venusta*
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa welteri*
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora bufonia*
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora meneziana*
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora vitorinoana*
Epidendroideae	Cymbidieae	Oncidiinae	*Grandiphyllum auricula*
Epidendroideae	Cymbidieae	Oncidiinae	*Grandiphyllum edwallii*
Epidendroideae	Cymbidieae	Oncidiinae	*Grandiphyllum hians*
Epidendroideae	Cymbidieae	Oncidiinae	*Grandiphyllum micranthum*
Epidendroideae	Cymbidieae	Catasetinae	*Grobya amherstiae*

Epidendroideae	Cymbidieae	Catasetinae	*Grobya fascifera*
Epidendroideae	Cymbidieae	Catasetinae	*Grobya galeata*
Epidendroideae	Cymbidieae	Catasetinae	*Grobya guieselii*
Orchidoideae	Orchideae	Orchidinae	*Habenaria achnantha*
Orchidoideae	Orchideae	Orchidinae	*Habenaria australis*
Orchidoideae	Orchideae	Orchidinae	*Habenaria belloi*
Orchidoideae	Orchideae	Orchidinae	*Habenaria brachyplectron*
Orchidoideae	Orchideae	Orchidinae	*Habenaria drepanopetala*
Orchidoideae	Orchideae	Orchidinae	*Habenaria dutrae*
Orchidoideae	Orchideae	Orchidinae	*Habenaria ernesti-ulei*
Orchidoideae	Orchideae	Orchidinae	*Habenaria galeandriformis*
Orchidoideae	Orchideae	Orchidinae	*Habenaria gnoma (=leptoceras?)*
Orchidoideae	Orchideae	Orchidinae	*Habenaria gustavo-edwallii*
Orchidoideae	Orchideae	Orchidinae	*Habenaria habenarioides*
Orchidoideae	Orchideae	Orchidinae	*Habenaria henscheniana*
Orchidoideae	Orchideae	Orchidinae	*Habenaria hieronymi*
Orchidoideae	Orchideae	Orchidinae	*Habenaria itatiayae*
Orchidoideae	Orchideae	Orchidinae	*Habenaria jordanensis*
Orchidoideae	Orchideae	Orchidinae	*Habenaria kleinii*
Orchidoideae	Orchideae	Orchidinae	*Habenaria macrodactyla*
Orchidoideae	Orchideae	Orchidinae	*Habenaria modestissima*
Orchidoideae	Orchideae	Orchidinae	*Habenaria nemorosa*
Orchidoideae	Orchideae	Orchidinae	*Habenaria novaesii*
Orchidoideae	Orchideae	Orchidinae	*Habenaria paranaensis*
Orchidoideae	Orchideae	Orchidinae	*Habenaria paulensis*
Orchidoideae	Orchideae	Orchidinae	*Habenaria paulistana*
Orchidoideae	Orchideae	Orchidinae	*Habenaria piraquarensis*
Orchidoideae	Orchideae	Orchidinae	*Habenaria pleiophylla*
Orchidoideae	Orchideae	Orchidinae	*Habenaria pycnostachya*
Orchidoideae	Orchideae	Orchidinae	*Habenaria rolfeana*
Orchidoideae	Orchideae	Orchidinae	*Habenaria rotundiloba*
Orchidoideae	Orchideae	Orchidinae	*Habenaria sceptrum*
Orchidoideae	Orchideae	Orchidinae	*Habenaria scheidmeyeri*
Orchidoideae	Orchideae	Orchidinae	*Habenaria sobraliana*
Orchidoideae	Orchideae	Orchidinae	*Habenaria ulei*
Orchidoideae	Orchideae	Orchidinae	*Habenaria uliginosa*
Orchidoideae	Orchideae	Orchidinae	*Habenaria umbracticola*
Orchidoideae	Cranichideae	Spiranthinae	*Hapalorchis cymbirostris*
Orchidoideae	Cranichideae	Spiranthinae	*Hapalorchis lindleyana*
Orchidoideae	Cranichideae	Spiranthinae	*Hapalorchis pandurata*
Orchidoideae	Cranichideae	Spiranthinae	*Hapalorchis stellaris*
Epidendroideae	Cymbidieae	Zygopetalinae	*Hoehneella gehrtiana*
Epidendroideae	Epidendrae	Laeliinae	*Homalopetalum hypoleptum*
Epidendroideae	Epidendrae	Laeliinae	*Homalopetalum joinvillense*

Epidendroideae	Cymbidieae	Stanhopeinae	*Houlletia brocklehurstiana*
Epidendroideae	Cymbidieae	Zygopetalinae	*Huntleya meleagris*
Epidendroideae	Epidendrae	Laeliinae	*Isabelia × pabstii*
Epidendroideae	Epidendrae	Laeliinae	*Isabelia pulchella*
Epidendroideae	Epidendrae	Laeliinae	*Isabelia virginalis*
Epidendroideae	Cymbidieae	Zygopetalinae	*Koellensteinia florida*
Epidendroideae	Cymbidieae	Zygopetalinae	*Koellensteinia spiralis*
Orchidoideae	Cranichideae	Spiranthinae	*Lankesterella caespitosa*
Orchidoideae	Cranichideae	Spiranthinae	*Lankesterella gnoma*
Orchidoideae	Cranichideae	Spiranthinae	*Lankesterella longicollis*
Orchidoideae	Cranichideae	Spiranthinae	*Lankesterella parvula*
Orchidoideae	Cranichideae	Spiranthinae	*Lankesterella pilosa*
Orchidoideae	Cranichideae	Spiranthinae	*Lankesterella spannageliana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Lepanthopsis legadensis*
Epidendroideae	Epidendrae	Laeliinae	*Leptotes bicolor*
Epidendroideae	Epidendrae	Laeliinae	*Leptotes bohnkiana*
Epidendroideae	Epidendrae	Laeliinae	*Leptotes pauloensis*
Epidendroideae	Epidendrae	Laeliinae	*Leptotes pohlitinocoi*
Epidendroideae	Epidendrae	Laeliinae	*Leptotes tenuis*
Epidendroideae	Epidendrae	Laeliinae	*Leptotes unicolor*
Epidendroideae	Epidendrae	Laeliinae	*Loefgrenianthus blanche-amesiae*
Epidendroideae	Cymbidieae	Oncidiinae	*Macradenia grandiflora*
Epidendroideae	Epidendrae	Pleurothallidinae	*Madisonia bradei*
Epidendroideae	Epidendrae	Pleurothallidinae	*Madisonia ianthina*
Epidendroideae	Epidendrae	Pleurothallidinae	*Madisonia vanderbergii*
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis cogniauxiana*
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis jaraguae*
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis pabstii*
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis pubescens*
Epidendroideae	Epidendrae	Pleurothallidinae	*Masdevallia curtipes*
Epidendroideae	Epidendrae	Pleurothallidinae	*Masdevallia discoidea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Masdevallia obscurans*
Epidendroideae	Epidendrae	Pleurothallidinae	*Masdevallia sururuana*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria binotii*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria calimaniana*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria caparaoensis*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria chlorantha*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria chrysantha*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria crocea*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria desvauxiana*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria echinophyta*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria elluziae*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria ferdinandiana*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria johannis*

Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria kautskyi*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria macrantha*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria marginata*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria milenae*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria monantha*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria mosenii*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria neowiedii*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria osmantha*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria paranaensis*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria phoenicanthera*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria piresiana*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria porphyrostele*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pterocarpa*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria rigida*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria rodriguesii*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria schunkeana*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria silvana*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria spiritusanctensis*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria subulata*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria turbinata*
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria ubatubana*
Orchidoideae	Cranichideae	Spiranthinae	*Mesadenella atroviridis*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus austrobrasiliensis*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus bidentiferus*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus bruxelii*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus caraguatatubensis*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus commelinoides*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus decorus*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus fimbrillaris*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus hylibates*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus kuczynskii*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus lindleyanus*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus malmei*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus mendoncae*
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus platensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia × castanea*
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia candida*
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia clowesii*
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia cuneata*
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia flava*
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia kayasimae*
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia moreliana*
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia phymatochila*
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia regnellii*

Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia russelliana*
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia spectabilis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Myoxanthus punctatus*
Epidendroideae	Epidendrae	Pleurothallidinae	*Myoxanthus ruschii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Myoxanthus seidelii*
Epidendroideae	Epidendrae	Laeliinae	*Nemaconia australis*
Epidendroideae	Cymbidieae	Zygopetalinae	*Neogardneria murrayana*
Epidendroideae	Cymbidieae	Oncidiinae	*Notylia longispicata*
Epidendroideae	Cymbidieae	Oncidiinae	*Notylia pubescens*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria aetheoantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria albopurpurea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria alexandri*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria aloefolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria alpina*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria anceps*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria andreana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria bradei*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria caetensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria caldensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria campos-portoi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria cariocana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria chamaeleptotes*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria chloidophylla*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria cochlearis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria concolor*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria corrigiosa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria crassilabia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria cucullata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria decumbens*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria diaphana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria ementosa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria estrellensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria exchlorophyllata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria exigua*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria fibrifera*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria fimbriata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria geraensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria glazioveana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria gracilicaulis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria gracilis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria hatschbachii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria helvola*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria hexalobata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria hoehnei*

Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria irrorata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria itatiaiae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria juncifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria leptophylla*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria lichenicola*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria lilliputana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria linearifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria lithophila*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria mauritii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria micrantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria minuta*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria montana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria multiflora*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria ochroleuca*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria octomeriantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria ouropretana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria palmyrabellae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria praestans*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria pumila*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria pusilla*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria recchiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria reitzii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria rhodoglossa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria riograndensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria rodeiensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria rodriguesii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria rohrii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria rotundiglossa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria rubrifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria sancti-angeli*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria sansoniana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria sarcophylla*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria serrana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria spannagelii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria stellaris*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria sulfurea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria tricolor*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria truncicola*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria tweediei*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria umbonulata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria unguiculata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria wawrae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Octomeria wilsoniana*
Epidendroideae	Cymbidieae	Oncidiinae	*Ornithocephalus brachystachyus*

Epidendroideae	Cymbidieae	Maxillariinae	*Pabstia jugosa*
Epidendroideae	Cymbidieae	Zygopetalinae	*Pabstia jugosa*
Epidendroideae	Cymbidieae	Zygopetalinae	*Pabstia viridis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella acrogenia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella alligatorifera*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella analoga*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella armeniaca*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella aurantiaca*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella aveniformis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella bacillaris*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella biriricensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella bofiae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella brachystele*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella bradei*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella brasilica*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella calcarata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella campestris*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella caraguatatubensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella carinifera*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella carrisii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella castellensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella colorata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella conceicionensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella conspersa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella cordilabia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella crassicaulis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella curti-bradei*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella dasilvae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella decurva*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella dracula*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella elegantula*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella eunapolitana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella fasciata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella fluminensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella fragae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella freyi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella fusca*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella garayi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella ghillanyi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella gracilicaulis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella granulosa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella henrique-aragonii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella ibiunensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella imbeana*

Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella intraptila*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella juquitibensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella leucopyramis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella leucosepala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella lineolata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella lingua*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella lobiglossa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella lueriana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella marinsiensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella matinhensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella melior*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella menegattii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella mentigera*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella miniatolineolata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella mirabilis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella miragliae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella muricatifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella novabelenensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella nymphalis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella osculator*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella pandurifera*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella pantherina*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella parvifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella pellifeloidis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella piraquarensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella pleurothalloides*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella podoglossa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella pseudotrifida*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella pterophora*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella punctatifolia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella purpurea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella quadridentata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella quasi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella recurviloba*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella rhombilabia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella ribeironensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella robertoi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella rubrolineata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella rupicola*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella ruschii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella sarcopetala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella savioi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella setibensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella silvanae*

Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella sordida*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella spathuliglossa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella stictophylla*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella tabacina*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella tenera*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella teschiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella transparens*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella tricolor*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella trifida*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella trimeropetala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella truncatilabia*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella truncicola*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella varellae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella vellozoana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella versicolor*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella villosisepala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella viridula*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella wacketii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella wanderbildtiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pabstiella wawreana*
Epidendroideae	Cymbidieae	Zygopetalinae	*Paradisanthus bahiensis*
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia itatiayae*
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia laminata*
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia lindmanii*
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia macropoda*
Cypripedioideae	-	-	*Phragmipedium sargentianum*
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium aquinoi*
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium delicatulum*
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium falcifolium*
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium geiselii*
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium hysteranthum*
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium limae*
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium mellobarretoi*
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium microphyllum*
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium vogelii*
Epidendroideae	Cymbidieae	Oncidiinae	*Platyrhiza quadricolor*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pleurothallis alborosea*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pleurothallis bowmanni*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pleurothallis ipyrangana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pleurothallis jacarepaguaensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pleurothallis karlii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Pleurothallopsis nemorosa*
Epidendroideae	Cymbidieae	Stanhopeinae	*Polycycnis silvana*
Epidendroideae	Vandeae	Polystachyinae	*Polystachya caespitosa*

Epidendroideae	Vandeae	Polystachyinae	*Polystachya rupicola*
Orchidoideae	Cranichideae	Cranichidinae	*Prescottia glazioviana*
Orchidoideae	Cranichideae	Cranichidinae	*Prescottia lancifolia*
Orchidoideae	Cranichideae	Cranichidinae	*Prescottia polyphylla*
Orchidoideae	Cranichideae	Cranichidinae	*Prescottia spiranthophylla*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea acuminata*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea catharinensis*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea dusenii*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea fuerstenbergiana*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea guttata*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea microptera*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea nigricans*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea ovatiloba*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea paranaensis*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea rollissonii*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea silvana*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea stapelioides*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea viridiflora*
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea xanthina*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea × suzanensis*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea × terassaniana*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea allemanoides*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea bohnkiana*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea bueraremensis*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea bulbosa*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea campos-portoi*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea ebanii*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea elisae*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea fausta*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea glumacea*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea itabirinhensis*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea kautskyi*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea regnelliana*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea serpentilingua*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea sessiliflora*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea silvana*
Epidendroideae	Epidendrae	Laeliinae	*Prosthechea squamata*
Epidendroideae	Epidendrae	Laeliinae	*Pseudolaelia aromatica*
Epidendroideae	Epidendrae	Laeliinae	*Pseudolaelia ataleiensis*
Epidendroideae	Epidendrae	Laeliinae	*Pseudolaelia brejetubensis*
Epidendroideae	Epidendrae	Laeliinae	*Pseudolaelia canaanensis*
Epidendroideae	Epidendrae	Laeliinae	*Pseudolaelia citrina*
Epidendroideae	Epidendrae	Laeliinae	*Pseudolaelia corcovadensis*
Epidendroideae	Epidendrae	Laeliinae	*Pseudolaelia dutrae*

Epidendroideae	Epidendrae	Laeliinae	*Pseudolaelia geraensis*
Epidendroideae	Epidendrae	Laeliinae	*Pseudolaelia pitengoensis*
Epidendroideae	Triphoeae	Triphorinae	*Psilochilus dusenianus*
Epidendroideae	Triphoeae	Triphorinae	*Psilochilus modestus*
Epidendroideae	Cymbidieae	Oncidiinae	*Psychopsiella limminghei*
Orchidoideae	Cranichideae	Spiranthinae	*Pteroglossa euphlebia*
Orchidoideae	Cranichideae	Spiranthinae	*Pteroglossa glazioviana*
Epidendroideae	Epidendrae	Laeliinae	*Pygmaeorchis brasiliensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Rauhiella brasiliensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Rauhiella seehaweri*
Epidendroideae	Cymbidieae	Oncidiinae	*Rauhiella silvana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Restrepiella ovatipetala*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia × kayasimae*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia bahiensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia bifolia*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia leucantha*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia limae*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia obtusifolia*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia pardina*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia pubescens*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia rigida*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia sticta*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia sucrei*
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia venusta*
Orchidoideae	Cranichideae	Spiranthinae	*Sacoila duseniana*
Epidendroideae	Cymbidieae	Oncidiinae	*Sanderella riograndensis*
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis alexandri*
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis catharinensis*
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis depinctrix*
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis juergensii*
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis ventricosa*
Epidendroideae	Cymbidieae	Oncidiinae	*Saundersia paniculata*
Epidendroideae	Epidendrae	Laeliinae	*Scaphyglottis brasiliensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Schunkea vierlingii*
Epidendroideae	Cymbidieae	Maxillariinae	*Scuticaria hadwenii*
Epidendroideae	Cymbidieae	Maxillariinae	*Scuticaria kaustky*
Epidendroideae	Cymbidieae	Maxillariinae	*Scuticaria novaesii*
Epidendroideae	Cymbidieae	Maxillariinae	*Scuticaria strictifolia*
Orchidoideae	Orchideae	Orchidinae	*Serapias polyaden*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia acutidentata*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia aurantiaca*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia barbosana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia deltoglossa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia gomesferreirae*

Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia hymenantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia integripetala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia laxiflora*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia scabripes*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia subpicta*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia susanensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Specklinia viridiflora*
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea buerarementis*
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea guttulata*
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea insignis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis aquinoana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis binotii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis caespitosa*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis capijumensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis carnosula*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis chlorantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis concava*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis dusenii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis freyi*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis gunningiana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis itatiayae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis kautsky*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis loefgrenii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis modesta*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis oligantha*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis palmeiraensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis pauloensis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis peliochyla*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis reitzii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis schenckii*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis sessilis*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis synsepala*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis thermophila*
Epidendroideae	Epidendrae	Pleurothallidinae	*Stelis triangularis*
Epidendroideae	Cymbidieae	Zygopetalinae	*Stenia bohnkiana*
Orchidoideae	Cranichideae	Spiranthinae	*Stigmatosema draculoides*
Orchidoideae	Cranichideae	Spiranthinae	*Stigmatosema garayana*
Orchidoideae	Cranichideae	Spiranthinae	*Stigmatosema hatschbachii*
Orchidoideae	Cranichideae	Spiranthinae	*Stigmatosema odileana*
Orchidoideae	Cranichideae	Spiranthinae	*Stigmatosema pedicellata*
Epidendroideae	Cymbidieae	Maxillariinae	*Sudamerlycaste rossyi*
Epidendroideae	Cymbidieae	Oncidiinae	*Thysanoglossa jordanensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Thysanoglossa spiritu-sanctensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum schwambachiae*

Epidendroideae	Epidendrae	Pleurothallidinae	*Trichosalpinx mathildae*
Epidendroideae	Epidendrae	Pleurothallidinae	*Trichosalpinx montana*
Epidendroideae	Epidendrae	Pleurothallidinae	*Trichosalpinx violacea*
Epidendroideae	Gastrodieae	-	*Uleiorchis prataensis*
Vanilloideae	Vanilleae	-	*Vanilla angustipetala*
Vanilloideae	Vanilleae	-	*Vanilla arcuata*
Vanilloideae	Vanilleae	-	*Vanilla bradei*
Vanilloideae	Vanilleae	-	*Vanilla capixaba*
Vanilloideae	Vanilleae	-	*Vanilla dietschiana*
Vanilloideae	Vanilleae	-	*Vanilla dungsii*
Vanilloideae	Vanilleae	-	*Vanilla organensis*
Vanilloideae	Vanilleae	-	*Vanilla parvifolia*
Vanilloideae	Vanilleae	-	*Vanilla paulista*
Epidendroideae	Cymbidieae	Zygopetalinae	*Warczewiczella candida*
Epidendroideae	Cymbidieae	Zygopetalinae	*Warczewiczella wailesiana*
Epidendroideae	Cymbidieae	Oncidiinae	*Warmingia eugenii*
Epidendroideae	Cymbidieae	Zygopetalinae	*Zygopetalum brachypetalum*
Epidendroideae	Cymbidieae	Zygopetalinae	*Zygopetalum crinitum*
Epidendroideae	Cymbidieae	Zygopetalinae	*Zygopetalum maxillare*
Epidendroideae	Cymbidieae	Zygopetalinae	*Zygopetalum monsenianum*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates bradei*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates castellensis*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates cornigera*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates cornuta*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates dasyrhiza*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates grandiflora*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates greeniana*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates kuhlmannii*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates linearisepala*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates lunata*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates multiflora*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates nunes-limae*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates octavioreisii*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates ovatipetala*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates pellucida*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates pustulata*
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates tripollinica*

Tabela S2: Espécies amostradas e seus respectivos códigos de acesso do GenBank e área de ocorrência, codificada como descrito na metodologia. Códigos de acesso precedidos de "#" se referem ao voucher das sequências produzidas neste estudo e que serão incluídas no GenBank.

Subfamília	**Tribo**	**Subtribo**	**Espécie**	**ITS**	***matK***	**Área**
Orchidoideae	Cranichideae	Cranichidinae	*Aa achalensis*	KX421909	KX421969	D
Orchidoideae	Cranichideae	Cranichidinae	*Aa calceata*	FJ473309		EH
Orchidoideae	Cranichideae	Cranichidinae	*Aa colombiana*	AM419766	AM900802	FGH
Orchidoideae	Cranichideae	Cranichidinae	*Aa leucantha*	FJ473307		FG
Orchidoideae	Cranichideae	Cranichidinae	*Aa maderoi*	AM419767	AM900803	EFG
Orchidoideae	Cranichideae	Cranichidinae	*Aa paleacea*	FJ473308	AJ309989	EFGH
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera adamantinensis*	AF366936		AC
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera aphthosa*	JQ306355		ACDE
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera asaroides*	AF275689		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera atropurpurea*	KT599874	KT709633	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera auriculata*	AF262856		ABCE
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera binotii*	JQ306361		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera bragae*	AF262852	#LRLO23	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera breedlovei*	KY084269	KY218743	K
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera breviflora*	JQ306359		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera capanemae*	JQ306367	#ALVTB2869	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera capillaris*	JQ306424		AEF
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera ciliata*	KR816548	KR816557	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera circumplexa*		KY218752	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera crepiniana*	KT599875	KT709634	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera crinita*	JQ306434		ADE
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera cryptantha*	JQ306433	#ALVTB2916	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera echinocarpa*	KF747840		EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera erinacea*	KY084293	KY218778	DEFK

Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera erosa*		KY218774	J
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera fabiobarrosii*	AF366938		AC
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera fenestrata*	AF262857	AF265468	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera foetens*	JQ306432		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera fornograndensis*	JQ306353	#ALVTB2884	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera glanduligera*	JQ306369	#MB543	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera glumacea*	AF262850		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera gracilisepala*	JQ306404	KT709636	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera hamata*	KY084277	KY218759	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera hatschbachii*	KT599876	KT709638	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera heringeri*	JQ306363		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera hondurensis*	KY084279	KY218760	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera hygrophila*	JQ306423		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera hystrix*	KT599877	KT709639	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera johannensis*	AF366939		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera johnsonii*	AF262920	KR816556	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera jordanensis*	JQ306378		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera karlii*	JQ306489	#ALVTB3450	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera klotzschiana*	JQ306445	#ALVTB3448	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera lepidota*	KY084285	KY218766	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera leptotifolia*	AF262854		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera limae*	JQ306450		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera luteola*	KX495754	KT709640	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera macropoda*	JQ306449	#WSM1281	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera maculiglossa*	JQ306453		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera mantiquyrana*	KT599878		ADE
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera melachila*	JQ306451		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera micrantha*	JQ306373		A

Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera minima*	JQ306382	#MLK130	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera montana*	JQ306358		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera nemorosa*	JQ306466	#ALVTB3384	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera ochreata*	AF366934	AY008458	ABC
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera octophrys*	KT599879	KT709643	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera oscitans*	KY988806	KY988625	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera panduripetala*	JQ306371		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera papillosa*	JQ306501	#LRLO32	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera pavimentata*	JQ306443		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera pectinata*	AF262849		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera perdusenii*	JQ306454		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera platystachys*	JQ306372	#MB652	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera prolifera*	JQ306374	KT709637	ABC
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera pubescens*	JQ306365	KT709645	ABDEFGJKL
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera punctatiflora*		KT709646	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera ramosa*	JQ306438		ACF
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera recurva*	MW364931	MW375123	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera rodriguesii*	JQ306446		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera rostellata*	JQ306394	#ABRA24	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera rubroviridis*	KY081774		GJK
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera saundersiana*	EF079371	EF079330	ABCDE
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera saurocephala*	JQ306394	AF265469	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera serpentula*	JQ306370		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera sicaria*	AF262848	AF302648	EFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera sonderiana*	JQ306496	#DCI441	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera strupifolia*	AF262855	#ALVTB3749	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera teres*	AF366937	#ABRA15	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera testifolia*	KR816551	KR816560	FGJK

Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera translucida*	JQ306368	#ALVTB2870	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera tricarinata*	KY084289	KY218773	AEF
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera trichophora*	KY081778		J
Epidendroideae	Epidendreae	Pleurothallidinae	*Acianthera wilsonii*	KY081776		FJ
Epidendroideae	Cymbidieae	Stanhopeinae	*Acineta chrysantha*		KF660281	FK
Epidendroideae	Cymbidieae	Stanhopeinae	*Acineta superba*	AF239379	KF660298	FG
Epidendroideae	Epidendreae	Laeliinae	*Acrorchis roseola*	AY174761	AY396086	F
Epidendroideae	Vandeae	Angraecinae	*Aerangis biloba*	DQ091594	MK685526	M
Epidendroideae	Vandeae	Angraecinae	*Aerangis kotschyana*	DQ091598	MK685599	M
Epidendroideae	Cymbidieae	Zygopetalinae	*Aganisia cyanea*	AY870104	MT518206	CEG
Epidendroideae	Cymbidieae	Zygopetalinae	*Aganisia fimbriata*	AY870105		CEG
Epidendroideae	Epidendreae	Laeliinae	*Alamania punicea*	AF260177	AF263783	K
Orchidoideae	Cranichideae	Cranichidinae	*Altensteinia fimbriata*	FJ473311	EF065583	EFGH
Orchidoideae	Cranichideae	Cranichidinae	*Altensteinia virescens*	FJ473310		FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis abbreviata*		JN589954	K
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis adenochila*	JQ306490		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis anfracta*	KY084291	KY218777	G
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis angustilabia*		AF302647	AEFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis aquinoi*	MN332331		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis aristulata*	JQ306338	#TFS115	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis attenuata*	MN332333	#MB642	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis barbulata*	KC425726		ABCEFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis bleyensis*	MN332334	#ALVTB3669	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis bolsanelloi*	JQ306342		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis brevipes*	MN332335		ABEF
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis burzlaffiana*	KC425727	KC425857	H
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis carvalhoi*	MN332336	#ALVTB2859	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis casualis*	KY988821	KY988638	FK

Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis caudatipetala*	MN332384	MN332559	EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis corticicola*	MN332338	#ALVTB3321	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis cuspidata*	KF747835		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis dalessandroi*	MN332339		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis deborana*	MN332340		EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis dryadum*	MN332341	#ALVTB2904	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis duplooyi*	KF747836		K
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis fastigiata*	MN332342		E
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis ferdinandiana*	MN332343		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis flammea*	#ALVTB3625	#ALVTB3625	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis fractiflexa*	KC425728		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis funerea*	KY988807	KY988627	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis gerthatschbachii*	MN332345	MN332524	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis graveolens*	MN332346	#ALVTB3502	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis grayumii*	KC425730	KP012494	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis guarujaensis*	MN332347		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis heloisae*	MN332385		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis imberbis*	MN332386		E
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis johnsonii*	MN332349	#ALVTB3271	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis kautskyi*	JQ306340		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis laciniata*	MN332350	#ALVTB3355	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis lewisiae*	KC425733	KC425858	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis linearifolia*	AF262869	AF265473	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis liparanges*	MN332348	#ALVTB2855	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis lobiserrata*	MN332353		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis luteola*	MN332354	#ALVTB3352	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis microphyta*	AF262894	MW375124	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis modesta*	MN332356		A

Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis muscoidea*	MN332357		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis nanifolia*	KC425736		E
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis nectarifera*	JQ306458		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis obovate*	KF747797	MN332534	ACDEFGHJ
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis ourobranquensis*	JQ306459		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis pabstii*	KC425737	KC425859	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis pachyphyta*	MN332359	MN332535	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis paranapiacabensis*	MN332360		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis peroupavae*	KF747837	MK306408	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis petropolitana*	MN332362		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis piratiningana*	JQ306344	#ALVTB3399	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis pubipetala*	JQ306460		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis pusilla*	MN332364	#ALVTB3529	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis rabei*	MN332365	KC425860	EG
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis radialis*	JQ306345		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis recurvipetala*	MN332366		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis sertularioides*	AF262871	MN332544	JK
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis tigridens*	MN332370	#ECS945	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis vitorinoi*	MN332371	#CAR124	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Anathallis welteri*	MN332372	MN332547	A
Epidendroideae	Collabieae	-	*Ancistrochilus rothschildianus*	AF521061	EU490675	M
Epidendroideae	Epidendreae	Pleurothallidinae	*Andinia dalstroemii*	KP012339	KR709284	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Andinia longiserpens*	KP012356	KP012521	EF
Epidendroideae	Vandeae	Angraecinae	*Angraecopsis gracillima*	MF980241	MW435910	M
Epidendroideae	Vandeae	Angraecinae	*Angraecopsis ischnopus*	MW435877	MW435911	M
Epidendroideae	Vandeae	Angraecinae	*Angraecum conchiferum*	DQ091748	DQ091414	M
Epidendroideae	Vandeae	Angraecinae	*Angraecum distichum*	DQ091567	KX060068	M
Epidendroideae	Cymbidieae	Eulophiinae	*Ansellia africana*	KF318915	KT750199	M

Apostasioideae	-	-	*Apostasia shenzhenica*	KX345131	KX345134	N
Epidendroideae	Epidendreae	Laeliinae	*Arpophyllum giganteum*	AF266742	AF263625	FJKL
Epidendroideae	Epidendreae	Laeliinae	*Arpophyllum spicatum*	AY008487		K
Epidendroideae	Epidendreae	Laeliinae	*Artorima erubescens*	AF260178	AY425798	K
Epidendroideae	Cymbidieae	Oncidiinae	*Aspasia epidendroides*	AF350521	EU214307	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Aspasia lunata*	FJ565252	FJ563860	AE
Epidendroideae	Cymbidieae	Oncidiinae	*Aspasia principissa*	FJ565440	FJ564934	F
Epidendroideae	Cymbidieae	Oncidiinae	*Aspasia silvana*	FJ565299	FJ564793	A
Orchidoideae	Cranichideae	Spiranthinae	*Aulosepalum oestlundii*	AM884874	AM884242	K
Orchidoideae	Cranichideae	Spiranthinae	*Aulosepalum tenuiflorum*	AJ539491	AM884249	K
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella australis*	KX686530	MF669949	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella circinate*	MK294776	MK258028	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella cogniauxiana*	AF262813		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella crassifolia*	KX686532	KX686521	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella cucullata*	AF262815	KX686522	EFGH
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella dolichorhiza*	EF079370	EF079328	FGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella dusenii*	KX686533	KX686523	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella gardneri*	JQ306335		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella miersii*	AF262816		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella orbicularis*	AF262814		EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella prorepens*	MK642621	JN589956	FJK
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella spiritusanctensis*	KX686536	KX686524	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Barbosella trilobata*	KX686537	KX686525	A
Epidendroideae	Epidendreae	Laeliinae	*Barkeria barkeriola*	FJ238540	FJ238553	K
Epidendroideae	Epidendreae	Laeliinae	*Barkeria lindleyana*		FJ238555	FK
Epidendroideae	Epidendreae	Laeliinae	*Barkeria obovata*	FJ238543	FJ238557	FK
Orchidoideae	Cranichideae	Cranichidinae	*Baskervilla colombiana*	AM419791	EU214310	EFGK
Orchidoideae	Cranichideae	Cranichidinae	*Baskervilla paranaensis*	MN946471	MN946485	A

Epidendroideae	Cymbidieae	Zygopetalinae	*Batemannia colleyi*	AF239343		E
Epidendroideae	Cymbidieae	Zygopetalinae	*Batemannia lepida*	AY870089		E
Orchidoideae	Cranichideae	Spiranthinae	*Beloglottis costaricensis*	AJ539492		EFKL
Orchidoideae	Cranichideae	Spiranthinae	*Beloglottis Mexicana*	MF465011	LT600869	FK
Epidendroideae	Cymbidieae	Zygopetalinae	*Benzingia caudata*	AY870027		E
Epidendroideae	Cymbidieae	Zygopetalinae	*Benzingia cornuta*	AY870026		G
Epidendroideae	Cymbidieae	Zygopetalinae	*Benzingia estradae*	AY870029		F
Epidendroideae	Cymbidieae	Zygopetalinae	*Benzingia hajekii*	AY870028		H
Epidendroideae	Cymbidieae	Zygopetalinae	*Benzingia hirtzii*	AY870030		F
Epidendroideae	Cymbidieae	Zygopetalinae	*Benzingia reichenbachiana*	AF239325	EU214311	F
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria atropurpurea*	AF239336		A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria aureofulva*	MZ736804	MZ334595	A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria calcarata*	MZ736806	MZ334596	A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria harrisoniae*	MZ268388	EF065567	A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria inodora*	MZ736808	DQ210744	A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria leucorrhoda*	MZ736813	MZ334598	A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria longicornis*	MZ268390	MZ334599	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria mellicolor*	AY063420		A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria parthonii*	AY063422		A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria stefanae*	MZ268391	MZ334600	A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria tetragona*	AF239335	DQ210751	A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria tyrianthina*	MZ736816	MZ334601	A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria venezuelana*	AY063418	MZ334603	E
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria vitellina*	AY063427		A
Epidendroideae	Cymbidieae	Maxillariinae	*Bifrenaria wittigii*	AY063417		A
Orchidoideae	Cranichideae	Chloraeinae	*Bipinnula fimbriata*	JQ045521	GQ917044	I
Orchidoideae	Cranichideae	Chloraeinae	*Bipinnula montana*	JQ045522	JQ045545	D
Orchidoideae	Cranichideae	Chloraeinae	*Bipinnula penicillate*	FR832134		ADE

Orchidoideae	Cranichideae	Chloraeinae	*Bipinnula volkmannii*	FR832099		I
Epidendroideae	Epidendreae	Bletiinae	*Bletia antillana*		KU054359	J
Epidendroideae	Epidendreae	Bletiinae	*Bletia campanulate*	DQ445818	KU054360	EFK
Epidendroideae	Epidendreae	Bletiinae	*Bletia catenulate*	AY008462	AY121718	ABCDEF
Epidendroideae	Epidendreae	Bletiinae	*Bletia corallicola*		AF263627	JL
Epidendroideae	Epidendreae	Bletiinae	*Bletia hamiltoniana*		AY121721	J
Epidendroideae	Epidendreae	Bletiinae	*Bletia lilacina*	DQ445822	KU054363	K
Epidendroideae	Epidendreae	Bletiinae	*Bletia macristhmochila*	DQ445823	KU054364	K
Epidendroideae	Epidendreae	Bletiinae	*Bletia meridana*		KU054365	KL
Epidendroideae	Epidendreae	Bletiinae	*Bletia Mexicana*	FJ427911	FJ427795	KL
Epidendroideae	Epidendreae	Bletiinae	*Bletia mixtecana*	KX241469		K
Epidendroideae	Epidendreae	Bletiinae	*Bletia parkinsonii*	DQ445825	AF263628	K
Epidendroideae	Epidendreae	Bletiinae	*Bletia parva*	FJ427934	MK726084	KL
Epidendroideae	Epidendreae	Bletiinae	*Bletia purpurea*		AY121719	EFGJKL
Epidendroideae	Epidendreae	Bletiinae	*Bletia roezlii*		KU054369	K
Epidendroideae	Epidendreae	Bletiinae	*Bletia stenophylla*	DQ445830		EFG
Epidendroideae	Epidendreae	Bletiinae	*Bletia urbana*	DQ445831	KU054370	K
Epidendroideae	Epidendreae	Bletiinae	*Bletia wrightii*		KU054358	J
Orchidoideae	Orchideae	Orchidinae	*Bonatea cassidea*	DQ522059	DQ522085	M
Orchidoideae	Orchideae	Orchidinae	*Bonatea speciosa*	MT500586	MT533490	M
Epidendroideae	Epidendreae	Pleurothallidinae	*Brachionidium ecuadorense*	MK294779		EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Brachionidium jesupiae*	MK294778		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Brachionidium restrepioides*	MN332375	KX686526	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Brachionidium valerioi*	AF291098	AF265488	FK
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele bracteosa*	KX421957	KX422008	AD
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele camporum*	KX421958	KX422009	AD
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele chlorops*		MG755131	E
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele cyclochila*	MF464957	MG755103	ABD

Orchidoideae	Cranichideae	Spiranthinae	*Brachystele dilatate*	JQ045526	JQ045529	AD
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele guayanensis*	MG460367	MG460434	CEFK
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele subfiliformis*	KX421964	KX422015	A
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele unilateralis*	KX421966	KX422017	HJ
Orchidoideae	Cranichideae	Spiranthinae	*Brachystele widgrenii*	KX421968	KX422019	A
Epidendroideae	Cymbidieae	Stanhopeinae	*Braemia vittate*	AF239380	MT518263	EF
Epidendroideae	Epidendreae	Laeliinae	*Brassavola ceboletta*		MT518266	BCDE
Epidendroideae	Epidendreae	Laeliinae	*Brassavola cucullate*		AF263819	FK
Epidendroideae	Epidendreae	Laeliinae	*Brassavola martiana*	AF260220	AF263821	CE
Epidendroideae	Epidendreae	Laeliinae	*Brassavola nodosa*	AF260219	AF263820	FKL
Epidendroideae	Epidendreae	Laeliinae	*Brassavola subulifolia*	AY008592		BJ
Epidendroideae	Epidendreae	Laeliinae	*Brassavola tuberculata*		AF263818	ABCDE
Epidendroideae	Cymbidieae	Oncidiinae	*Brassia caudata*	AF350523	EU214506	EFGJKL
Epidendroideae	Cymbidieae	Oncidiinae	*Brassia forgetiana*	FJ565642	FJ565134	EFGH
Epidendroideae	Epidendreae	Laeliinae	*Broughtonia lindenii*	AY008570	AY396096	J
Orchidoideae	Orchideae	Brownleeinae	*Brownleea macroceras*	MT500599	DQ414995	M
Orchidoideae	Orchideae	Brownleeinae	*Brownleea parviflora*	DQ414851	DQ414994	M
Orchidoideae	Cranichideae	Spiranthinae	*Buchtienia ecuadorensis*	MF464938	MG755107	E
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum adiamantinum*	GQ339691		AC
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum atropurpureum*	GQ339706	#SL12	A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum bidentatum*	GQ339701		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum boudetianum*	GQ339723	#MLK	A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum bracteolatum*	GQ339686		EK
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum camposportoi*	GQ339721		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum cantagallense*	GQ339722	#ECS976	A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum carassense*	GQ339717	#ELFM227	AC
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum chloroglossum*	GQ339694		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum ciluliae*	GQ339698		C

Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum epiphytum*	GQ339693	MN737573	AC
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum exaltatum*	GQ339714	MN604054	ABCE
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum filifolium*	GQ339699		AC
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum gladiatum*	GQ339718		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum glutinosum*	GQ339707	#INV	A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum granulosum*		MN604055	A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum hoehnei*	GQ339700		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum insectiferum*	GQ339692		AC
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum kautskyi*	GQ339705	#ECS1074	A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum longiflorum*	MK164473	MK178057	M
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum malachadenia*	GQ339708	#MB606	A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum manarae*	GQ339704		B
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum melloi*	GQ339719		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum mentosum*	GQ339690	MN604056	B
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum meridense*	GQ339712		ABEFG
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum micranthum*	GQ339697	#WSM1172	A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum micropetaliforme*	EF195922		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum mucronifolium*	GQ339695		AC
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum nagelii*	GQ339720		K
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum napellii*	GQ339711	MN618703	ABC
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum nummularia*	KY966464	KY966756	M
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum perii*	GQ862815		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum pitengoense*	KC581944		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum plumosum*	GQ339702	MN580547	ABCE
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum regnellii*	GQ339710	MN604057	A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum rupicola*	GQ339696		AC
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum setigerum*	GQ339689		E
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum steyermarkii*	GQ339688	MN604058	FG

Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum teimosense*	GQ339703		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum tripetalum*	GQ339716		ACE
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum uhlgabrielianum*	KC581945		A
Epidendroideae	Malaxideae	Dendrobiinae	*Bulbophyllum weddellii*	GQ339713	MN604059	ABC
Epidendroideae	Collabieae	-	*Calanthe calanthoides*	AF521063	MK215649	FJK
Epidendroideae	Collabieae	-	*Calanthe sylvatica*	KF560488	KF673818	M
Epidendroideae	Arethuseae	Arethusinae	*Calopogon tuberosus*	AF273366	MN877200	JKL
Epidendroideae	Vandeae	Angraecinae	*Calyptrochilum christyanum*	DQ091668	MK685508	M
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum brachycarpum*		KY510543	A
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum brenesii*	DQ091563	KY510549	F
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum calostachyum*		KY510556	A
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum crassirhizum*		KY510548	ABC
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum densiflorum*		KY510542	AD
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum fasciola*	AF506294	KY510559	CEFHJK
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum grisebachii*		KY510558	ADE
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum huebneri*		KY510565	E
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum jamaicense*	AF506299	AF506348	J
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum kuntzei*		KY510571	CEF
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum labiakii*		KY510534	A
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum lansbergii*	AF506297	AF506345	EF
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum mattogrossense*		KY510566	CEF
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum micranthum*	AY147219	KJ472358	ABCEFGJK
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum minutum*	MH237188		E
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum neglectum*		KY510546	ACDE
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum ornithorrhynchum*		KY510536	A
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum pachyrrhizum*		KY510553	ABCEFJKL
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum panamense*		KY510573	EF
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum pauloense*		KY510541	A

Epidendroideae	Vandeae	Angraecinae	*Campylocentrum pernambucense*		KY510537	A
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum poeppigii*		KY510563	EFJK
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum robustum*	DQ091565	KY510547	AB
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum schiedei*	AF506304	EU214315	FK
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum sellowii*		KY510535	AC
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum serranum*		KY510557	A
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum spannagelii*		KY510540	A
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum tenellum*		KY510562	F
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum tyrridion*	AF506305	DQ091322	FK
Epidendroideae	Vandeae	Angraecinae	*Campylocentrum ulei*	AF506306	KY510555	A
Epidendroideae	Cymbidieae	Oncidiinae	*Capanemia adelaidae*	MK302267	MK302273	A
Epidendroideae	Cymbidieae	Oncidiinae	*Capanemia gehrtii*	MK302268	MK302274	A
Epidendroideae	Cymbidieae	Oncidiinae	*Capanemia micromera*	MK302269		ACDE
Epidendroideae	Cymbidieae	Oncidiinae	*Capanemia superflua*	FJ565195	FJ563840	AD
Epidendroideae	Cymbidieae	Oncidiinae	*Capanemia theresae*	MK302271	MK302277	A
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum barbatum*	MF987482		ABCE
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum bertioguense*	KU295252		A
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum bicolor*	MF987483		F
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum blackii*	KU295253		B
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum boyi*	MF987484		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum callosum*	KU295254		G
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum cernuum*	KU295255		A
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum ciliatum*	KU295256		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum collare*	KT768384		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum complanatum*	KU295257		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum denticulatum*	KU295258		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum discolor*	KU295259		ABE
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum expansum*	KU295260	AF263637	F

Epidendroideae	Cymbidieae	Catasetinae	*Catasetum fimbriatum*	KU295261		ACDE
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum galeritum*	KU295262		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum gladiatorium*	KU295263		C
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum gnomus*	KU295264		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum hopkinsonianum*	KU295265		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum integerrimum*		MT518333	FK
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum juruenense*	KT768385		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum lanciferum*	KU295266		BC
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum luridum*	KU295267	MT518335	AB
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum macrocarpum*	KT768386		ABCE
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum maculatum*	MF987486		FK
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum meeae*	KT768387		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum ochraceum*	MF987487		EF
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum ornithoides*	MF987488		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum osakadianum*	KU295268		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum osculatum*	MF987489		CE
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum pendulum*	MW591557		K
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum pileatum*	KU295269		CEF
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum planiceps*		EF079266	EF
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum purum*	KU295270		A
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum rodigasianum*	KU295271		A
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum rooseveltianum*	KU295272		CE
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum saccatum*	KU295273		ABCEF
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum sanguineum*	KU295274		EF
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum socco*	#TFS253	#TFS253	A
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum spitzii*	KU295275		CE
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum stenoglossum*	KU295276		E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum tabulare*	MW591558	MW597435	F

Epidendroideae	Cymbidieae	Catasetinae	*Catasetum tuberculatum*	MH767004	MH748997	E
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum uncatum*	MH766997	MH748997	A
Epidendroideae	Cymbidieae	Catasetinae	*Catasetum viridiflavum*	KU295277	MH748996	F
Epidendroideae	Epidendreae	Laeliinae	*Cattleya aclandiae*	AF260207	GQ248091	B
Epidendroideae	Epidendreae	Laeliinae	*Cattleya alaorii*	AF260195	EU139993	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya alvaroana*	AY008658	EU139994	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya amethystoglossa*	AY008610	EU139957	AB
Epidendroideae	Epidendreae	Laeliinae	*Cattleya angereri*	AY008652		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya araguaiensis*		AF263817	C
Epidendroideae	Epidendreae	Laeliinae	*Cattleya bicalhoi*	AY008633	EU140004	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya bicolor*	AY008627	EU139960	AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya blumenscheinii*	AY008654		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya bradei*	AY008673	EU139996	AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya briegeri*	AY008674	EU139998	AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya caulescens*	AY008656	EU139999	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya cernua*	AF260200	AF263803	ACDE
Epidendroideae	Epidendreae	Laeliinae	*Cattleya cinnabarina*	AY008657		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya coccinea*	AF260201	AF263804	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya colnagoi*	FJ200183		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya conceicionensis*	FJ200196		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya crispa*	AY008640	EU140002	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya crispate*	AY008665	KP168671	AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya diamantinensis*	FJ200187		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya dormaniana*	AY008608		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya dowiana*	AF260210	AF263638	FKL
Epidendroideae	Epidendreae	Laeliinae	*Cattleya elongata*	AY008619	EU139964	B
Epidendroideae	Epidendreae	Laeliinae	*Cattleya endsfeldzii*	FJ200190	EU140005	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya esalqueana*	AF260198	EU140006	AC

Epidendroideae	Epidendreae	Laeliinae	*Cattleya flavasulina*	FJ200186	EU140007	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya forbesii*	AY429394	AY396102	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya fournieri*	FJ200185		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya ghillanyi*	AY008677		AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya gloedeniana*	AY008666		K
Epidendroideae	Epidendreae	Laeliinae	*Cattleya grandis*	AY008637	#APF4100	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya granulosa*	AY008620	EU139966	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya guttata*	AY008609	EU139967	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya harpophylla*	AF260199	AF263802	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya harrisoniana*	AY008615	EU139968	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya hoehnei*	AY008660		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya intermedia*	AF260204	AF263807	AD
Epidendroideae	Epidendreae	Laeliinae	*Cattleya itambana*	AY008678	EU140010	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya jenmanii*	AY008604	EU139971	EF
Epidendroideae	Epidendreae	Laeliinae	*Cattleya jongheana*	AY008632		AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya kautskyana*	FJ200188		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya kerrii*	AY008613	EU139972	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya kettieana*	AY008664		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya kleberi*	FJ200194		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya liliputana*		KP202881	AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya lobata*	AY008639	EU140012	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya loddigesii*	KY006866	EU139975	AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya longipes*	AY008676		AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya luetzelburgii*	AY008653	EU139995	B
Epidendroideae	Epidendreae	Laeliinae	*Cattleya lundii*	AY008645	EU140013	ACE
Epidendroideae	Epidendreae	Laeliinae	*Cattleya luteola*	AY008605	EU139977	E
Epidendroideae	Epidendreae	Laeliinae	*Cattleya mantiqueirae*	AY008647	EU140014	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya maxima*	AY008630	AY008460	EFGK

Epidendroideae	Epidendreae	Laeliinae	*Cattleya mirandae*	FJ200193		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya mossiae*	AY008596	MT518349	EFL
Epidendroideae	Epidendreae	Laeliinae	*Cattleya neokautskyi*	AY008651	EU140011	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya nobilior*		GQ248092	CE
Epidendroideae	Epidendreae	Laeliinae	*Cattleya pabstii*	FJ200184		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya perrinii*	AY008642	#APF2075	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya pfisteri*	AY008662	EU140015	B
Epidendroideae	Epidendreae	Laeliinae	*Cattleya porphyroglossa*	JN600951	EU139980	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya praestans*	AY008634		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya pumila*	AF260196	EU140016	AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya purpurata*	AY008641	AF263797	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya reginae*	AY008668		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya rupestris*	AF260197	AF263801	ABC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya sanguiloba*	AY008669	EU140017	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya schilleriana*	AY008614	EU139982	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya schofieldiana*	AY008623	EU139983	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya schroederae*	AY008601	EU139984	FG
Epidendroideae	Epidendreae	Laeliinae	*Cattleya sincorana*	AY008635	EU140018	B
Epidendroideae	Epidendreae	Laeliinae	*Cattleya tenebrosa*	AY008638	EU140019	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya tenuis*	AY008622	EU139985	B
Epidendroideae	Epidendreae	Laeliinae	*Cattleya tereticaulis*	AY008670		C
Epidendroideae	Epidendreae	Laeliinae	*Cattleya tigrine*	AY008611	EF065586	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya vandenbergii*	AY008671		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya velutina*	AY008618	EU139988	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya verboonenii*	FJ200192		A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya violacea*	AF260206	AF263809	ACEF
Epidendroideae	Epidendreae	Laeliinae	*Cattleya virens*	AY008636	EU140020	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya viridiflora*	FJ200195		A

Epidendroideae	Epidendreae	Laeliinae	*Cattleya walkeriana*	KY006871		AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya warneri*	AY008598	EU139991	A
Epidendroideae	Epidendreae	Laeliinae	*Cattleya wittigiana*	AF260202	AF263805	AC
Epidendroideae	Epidendreae	Laeliinae	*Cattleya xanthina*	AY008643	EU140022	A
Epidendroideae	Epidendreae	Laeliinae	*Caularthron bicornutum*	AY008518	MF669950	EF
Epidendroideae	Epidendreae	Laeliinae	*Caularthron bilamellatum*	AF260173	AF263780	EFK
Orchidoideae	Orchideae	Orchidinae	*Centrostigma occultans*	MT500664	MT533569	M
Epidendroideae	Cymbidieae	Zygopetalinae	*Chaubardia heteroclita*		MT518357	EF
Epidendroideae	Cymbidieae	Zygopetalinae	*Chaubardia klugii*	AY870072		EFH
Epidendroideae	Cymbidieae	Zygopetalinae	*Chaubardiella pacuarensis*	AY870046		F
Epidendroideae	Cymbidieae	Zygopetalinae	*Chaubardiella tigrina*	AY870045		EF
Orchidoideae	Cranichideae	Chloraeinae	*Chloraea crispa*	FR832109	JQ045528	I
Orchidoideae	Cranichideae	Chloraeinae	*Chloraea multiflora*	FR832119	JQ045537	I
Epidendroideae	Cymbidieae	Zygopetalinae	*Chondrorhyncha rosea*	AY870013		EF
Epidendroideae	Cymbidieae	Zygopetalinae	*Chondroscaphe bicolor*	AY870067	EU214316	F
Epidendroideae	Cymbidieae	Zygopetalinae	*Chondroscaphe eburnea*	AY870014		F
Epidendroideae	Epidendreae	Bletiinae	*Chysis bractescens*	EF079363	EF079351	K
Epidendroideae	Cymbidieae	Oncidiinae	*Chytroglossa aurata*	FJ565241	FJ564753	A
Epidendroideae	Cymbidieae	Oncidiinae	*Chytroglossa marileoniae*	KX687828	FJ565112	A
Epidendroideae	Cymbidieae	Oncidiinae	*Chytroglossa paulensis*	KX687829		A
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea dependens*	MH766965	MH748999	A
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea fuscolutea*	KM458419	KF660291	A
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea longiracemosa*	KM458417	KM458440	A
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea nasuta*	KM458418	KM458441	A
Epidendroideae	Cymbidieae	Stanhopeinae	*Cirrhaea seidelii*	KM458421	KF660272	A
Epidendroideae	Cymbidieae	Oncidiinae	*Cischweinfia dasyandra*	FJ565633	FJ565125	F
Epidendroideae	Cymbidieae	Oncidiinae	*Cischweinfia pusilla*	FJ565638	FJ565130	F
Vanilloideae	Pogonieae	-	*Cleistes aphylla*	EU498138		AC

Vanilloideae	Pogonieae	-	*Cleistes bella*	EU498140		AC
Vanilloideae	Pogonieae	-	*Cleistes cipoana*	EU498142		A
Vanilloideae	Pogonieae	-	*Cleistes exilis*	EU498144		B
Vanilloideae	Pogonieae	-	*Cleistes itatiaiae*	EU498148		A
Vanilloideae	Pogonieae	-	*Cleistes libonii*	EU498150		A
Vanilloideae	Pogonieae	-	*Cleistes paranaensis*	EU498152		ABCE
Vanilloideae	Pogonieae	-	*Cleistes pusilla*	EU498153		AC
Vanilloideae	Pogonieae	-	*Cleistes ramboi*	EU498154		ACD
Vanilloideae	Pogonieae	-	*Cleistes rodriguesii*	EU498146		A
Vanilloideae	Pogonieae	-	*Cleistes speciosa*	EU498151		ABCE
Vanilloideae	Pogonieae	-	*Cleistes tenuis*	EU498155		ACEF
Vanilloideae	Pogonieae	-	*Cleistes uliginosa*	EU498157		AC
Epidendroideae	Cymbidieae	Catasetinae	*Clowesia rosea*	MW591568	MW597434	K
Epidendroideae	Cymbidieae	Catasetinae	*Clowesia russelliana*	MW591563	MW597429	K
Orchidoideae	Cranichideae	Spiranthinae	*Coccineorchis cernua*	AJ539502	EU214153	EFG
Orchidoideae	Cranichideae	Spiranthinae	*Coccineorchis standleyi*	FN996949	LT600868	FK
Epidendroideae	Cymbidieae	Zygopetalinae	*Cochleanthes aromatica*	AY870063	MT518363	FK
Epidendroideae	Cymbidieae	Zygopetalinae	*Cochleanthes flabelliformis*	AY870064		FJK
Orchidoideae	Codonorchideae	-	*Codonorchis lessonii*	AF348005	DQ414993	D
Epidendroideae	Epidendreae	Calypsoinae	*Coelia macrostachya*	AY008472	AY121743	K
Epidendroideae	Epidendreae	Calypsoinae	*Coelia triptera*	AF260151	AF263643	K
Epidendroideae	Cymbidieae	Coeliopsidinae	*Coeliopsis hyacinthosma*	AF239344	EU214154	F
Epidendroideae	Cymbidieae	Oncidiinae	*Comparettia barkeri*	FJ565342	FJ564832	ACE
Epidendroideae	Cymbidieae	Oncidiinae	*Comparettia bennettii*	FJ565250	FJ564760	F
Epidendroideae	Cymbidieae	Oncidiinae	*Comparettia falcata*	FJ565601	FJ565090	EFGJK
Epidendroideae	Cymbidieae	Oncidiinae	*Comparettia micrantha*	FJ565461	FJ563963	EFG
Epidendroideae	Epidendreae	Laeliinae	*Constantia cipoensis*		AF263796	AC
Epidendroideae	Epidendreae	Laeliinae	*Constantia microscopica*	AY008499		AC

Epidendroideae	Epidendreae	Laeliinae	*Constantia rupestris*	#DA	#DA	A
Epidendroideae	Epidendreae	Calypsoinae	*Corallorhiza striata*	JF319692	JX087681	KL
Epidendroideae	Epidendreae	Calypsoinae	*Corallorhiza wisteriana*	EU391327	KM390020	KL
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes elegantium*	AF239360		F
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes horichiana*		EU214155	F
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes leucocorys*		MT518373	EF
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes macrantha*	AF239359	KF660261	EF
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes speciosa*	KM458408	EU214156	ABEFK
Epidendroideae	Cymbidieae	Stanhopeinae	*Coryanthes verrucolineata*		KF660259	E
Epidendroideae	Tropidieae	-	*Corymborkis corymbis*	MH596711		M
Orchidoideae	Cranichideae	Spiranthinae	*Cotylolabium lutzii*	HG425360	HG425363	A
Orchidoideae	Cranichideae	Cranichidinae	*Cranichis apiculata*	AM419784	AM900819	K
Orchidoideae	Cranichideae	Cranichidinae	*Cranichis ciliata*	FJ473317	AM900811	EFGHK
Orchidoideae	Cranichideae	Cranichidinae	*Cranichis cochleata*	AM419782	AM900817	K
Orchidoideae	Cranichideae	Cranichidinae	*Cranichis diphylla*	AM419778	MW498845	EFGJK
Orchidoideae	Cranichideae	Cranichidinae	*Cranichis engelii*	FJ473316	AM900814	FG
Orchidoideae	Cranichideae	Cranichidinae	*Cranichis revoluta*	AM419783	AM900818	K
Orchidoideae	Cranichideae	Cranichidinae	*Cranichis sylvatica*	AM419781	AM900816	FK
Epidendroideae	Cymbidieae	Zygopetalinae	*Cryptarrhena lunata*	AF239324		EFJK
Epidendroideae	Cymbidieae	Oncidiinae	*Cuitlauzina convallarioides*		EF079219	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Cuitlauzina egertonii*	FJ565263	FJ563871	FK
Epidendroideae	Cymbidieae	Catasetinae	*Cyanaeorchis arundinae*	KF771816	KF771820	ACDE
Epidendroideae	Cymbidieae	Catasetinae	*Cyanaeorchis minor*	KF771818	KF771822	AC
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon apricus*	MG460371	MG460438	ADE
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon calophyllus*	MG460373	MG460440	A
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon carinianus*	KX421931		A
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon comosus*	HE575509	EU214158	FK
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon congestus*	MG460376	MG460443	ACDE

Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon cranichoides*	MF464990		EFGJKL
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon dressleri*	MF464998		F
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon elatus*	MF464996	MG755112	ABDEFGHJKL
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon elegans*	KX421934		ACDE
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon epiphyticus*	AJ539499		F
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon eugenii*	KX421935		A
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon hennisianus*	HE575511		EF
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon inaequilaterus*	MF464991	MG755114	F
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon lindleyanus*	EF079165	EF079289	EF
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon longibracteatus*		MN597436	A
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon luteoalbus*	HE575512		K
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon multiflorus*		#ECS1009	A
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon obliquus*	MF465000		JK
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon olivaceus*	MF464989	MG755117	EF
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon ovalifolius*	MF464999	MG755118	EFG
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon polyaden*	MG460378	MG460432	A
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon saccatus*	MF465001	MG755119	K
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon truncatus*	MG460380	MG460446	A
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon variegatus*	KX421936	KX421986	A
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon violaceus*		MG755122	K
Orchidoideae	Cranichideae	Spiranthinae	*Cyclopogon warmingii*	KX421938	KX421987	AC
Epidendroideae	Cymbidieae	Catasetinae	*Cycnoches egertonianum*	KT768396	EU214159	FK
Epidendroideae	Cymbidieae	Catasetinae	*Cycnoches loddigesii*	KT768402		EF
Orchidoideae	Orchideae	Orchidinae	*Cynorkis anacamptoides*	MT500608	MT533513	M
Orchidoideae	Orchideae	Orchidinae	*Cynorkis kassneriana*	MT500653	MT533555	M
Cypripedioideae	-	-	*Cypripedium dickinsonianum*	JQ660885	JQ660909	K
Cypripedioideae	-	-	*Cypripedium irapeanum*	FR720328	JQ182207	K
Cypripedioideae	-	-	*Cypripedium molle*	FR720327	JQ182208	K

Epidendroideae	Cymbidieae	Oncidiinae	*Cyrtochiloides ochmatochila*	AF432946	AF433009	EFGK
Epidendroideae	Cymbidieae	Oncidiinae	*Cyrtochiloides panduriformis*	AF432948	AF433010	F
Epidendroideae	Cymbidieae	Oncidiinae	*Cyrtochilum macranthum*	EF079405	FJ564785	EFGH
Epidendroideae	Cymbidieae	Oncidiinae	*Cyrtochilum myanthum*	FJ565485	FJ564969	EFGH
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium aliciae*	EU877156		BC
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium andersonii*	AF470490	AF470460	ABCEF
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium flavum*		KF660297	A
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium longibulbosum*		KF660285	E
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium macrobulbon*		LN609766	FK
Epidendroideae	Cymbidieae	Cyrtopodiinae	*Cyrtopodium punctatum*	AF239412	KT750200	ABDEFJKL
Epidendroideae	Cymbidieae	Zygopetalinae	*Daiotyla albicans*	AY870016		F
Epidendroideae	Cymbidieae	Zygopetalinae	*Daiotyla crassa*	AY870017		F
Orchidoideae	Cranichideae	Spiranthinae	*Deiregyne falcata*	FN641871	LT613645	K
Orchidoideae	Cranichideae	Spiranthinae	*Deiregyne pseudopyramidalis*	FN641872	LT613646	K
Epidendroideae	Vandeae	Angraecinae	*Dendrophylax barrettiae*	AF506308	AF506353	J
Epidendroideae	Vandeae	Angraecinae	*Dendrophylax filiformis*	AF506296	AF506344	JL
Epidendroideae	Vandeae	Angraecinae	*Dendrophylax porrectus*	JN176101	JN176103	JKL
Epidendroideae	Vandeae	Angraecinae	*Diaphananthe fragrantissima*	DQ091618	MK685656	M
Epidendroideae	Vandeae	Angraecinae	*Diaphananthe sarcophylla*	DQ091621		M
Epidendroideae	Triphoreae	Diceratostelinae	*Diceratostele gabonensis*	KM598426		M
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea ancoraelabia*	EU123550	EU123614	EF
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea calyculata*		EF079244	AEFGH
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea campanulata*	AY870079		EF
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea cryptarrhena*	EU123556	EU123620	F
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea eburnea*	EU123564	EU123627	FK
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea eligulata*	EU123561	EU123625	F
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea glauca*	EU123566	EU123629	FJK
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea hystricina*	EU123570	EU123633	EFGJK

Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea longa*	EU123575	EU123638	FG
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea morrisii*	EU123577	EU123640	EFGJK
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea oxyglossa*	EU123583	EU123647	F
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea panamensis*	EU123584	EU123648	ABEFGK
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea pendula*		EU123651	ABEFGJK
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea similis*		EU214331	K
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea trichocarpa*	EU123605	EU123668	FJK
Epidendroideae	Cymbidieae	Zygopetalinae	*Dichaea trulla*	EU123607	EU123670	AEFGK
Orchidoideae	Cranichideae	Spiranthinae	*Dichromanthus cinnabarinus*	AJ539486	AM902110	K
Orchidoideae	Cranichideae	Spiranthinae	*Dichromanthus yucundaa*	FN996950	LT600886	K
Epidendroideae	Epidendreae	Pleurothallidinae	*Dilomilis montana*	AF260147	AF263765	J
Epidendroideae	Epidendreae	Laeliinae	*Dimerandra emarginata*	AF260179	AY425795	ABEFGK
Epidendroideae	Epidendreae	Laeliinae	*Dinema polybulbon*	AY429398	AF263769	JK
Epidendroideae	Epidendreae	Pleurothallidinae	*Diodonopsis erinacea*	AF262788	EU214336	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Diodonopsis pygmaea*	MK294782	MK258030	F
Orchidoideae	Orchideae	Disinae	*Disa barbata*	DQ414937	DQ415080	M
Orchidoideae	Orchideae	Disinae	*Disa ochrostachya*	DQ414966	DQ415109	M
Orchidoideae	Cranichideae	Discyphinae	*Discyphus scopulariae*	LK391732	LK391735	ABEF
Orchidoideae	Orchideae	Brownleeinae	*Disperis capensis*	MT500601	DQ414999	M
Orchidoideae	Orchideae	Brownleeinae	*Disperis dicerochila*	DQ414853	DQ414996	M
Epidendroideae	Epidendreae	Laeliinae	*Domingoa gemma*	AY008563		K
Epidendroideae	Epidendreae	Laeliinae	*Domingoa nodosa*	AY008565	AY425794	J
Epidendroideae	Epidendreae	Laeliinae	*Domingoa purpurea*	AF266743	MF349938	K
Epidendroideae	Epidendreae	Pleurothallidinae	*Draconanthes aberrans*	KY988810	KY988630	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Dracula erythrochaete*	AF262763	EU214337	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Dracula immunda*	MK294784	MK258032	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Dresslerella hirsutissima*	AF262902		EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Dresslerella hispida*	KY988815	KP012428	FK

Epidendroideae	Cymbidieae	Catasetinae	*Dressleria dilecta*	AF239411	EU214339	K
Epidendroideae	Cymbidieae	Catasetinae	*Dressleria helleri*		KF660264	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella albicans*	KC425742	KC425863	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella aviceps*	JQ306381		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella cristata*		MK258034	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella dressleri*		MT518435	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella fuchsii*	KY988820	KY988636	K
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella guatemalensis*	KC425743		FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella hirtzii*	EF079367	EF079327	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella kautskyi*	JQ306380		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella lilliputiana*	MN332380	MN332556	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella odontostele*		JQ771574	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella simula*	AF262825	AF265453	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella susanae*	JQ306486		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Dryadella yupanki*	KC425748	KP012498	E
Vanilloideae	Pogonieae	-	*Duckeella adolphii*	AF151007	FR832756	EF
Epidendroideae	Cymbidieae	Zygopetalinae	*Echinorhyncha litensis*	AY870039		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Echinosepala aspasicensis*	KP012468	AF302645	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Echinosepala lappiformis*	MT556803	MT571342	FK
Epidendroideae	Sobralieae	-	*Elleanthus aurantiacus*	EU490664	EU490683	EFGK
Epidendroideae	Sobralieae	-	*Elleanthus bifarius*	HM854593	HQ328999	F
Epidendroideae	Sobralieae	-	*Elleanthus brasiliensis*	MZ153093	MZ170071	ACE
Epidendroideae	Sobralieae	-	*Elleanthus capitatus*	HM854580	HQ328986	EFGJK
Epidendroideae	Sobralieae	-	*Elleanthus caravata*	KJ472411	EF079358	AEG
Epidendroideae	Sobralieae	-	*Elleanthus caricoides*	EU490665	EU490684	FKL
Epidendroideae	Sobralieae	-	*Elleanthus conifer*	EU490666	EU490685	EFG
Epidendroideae	Sobralieae	-	*Elleanthus crinipes*	MZ153094		AE
Epidendroideae	Sobralieae	-	*Elleanthus discolor*	KF612981	KF700334	EFK

Epidendroideae	Sobralieae	-	*Elleanthus hymenophorus*		MH733925	FK
Epidendroideae	Sobralieae	-	*Elleanthus lancifolius*	EU490667	EU490687	EFG
Epidendroideae	Sobralieae	-	*Elleanthus lateralis*	HM854590	HQ328996	EFG
Epidendroideae	Sobralieae	-	*Elleanthus myrosmatis*	HM854578		EFGH
Epidendroideae	Sobralieae	-	*Elleanthus poiformis*	EU490669	EU490689	FK
Epidendroideae	Sobralieae	-	*Elleanthus tricallosus*	EU490670	EU490690	F
Epidendroideae	Cymbidieae	Oncidiinae	*Eloyella thienii*	DQ315820	DQ315888	F
Orchidoideae	Cranichideae	Spiranthinae	*Eltroplectris calcarata*	KX421912	KX421970	ABEJ
Orchidoideae	Cranichideae	Spiranthinae	*Eltroplectris schlechteriana*	MF464942	MG755124	A
Orchidoideae	Cranichideae	Spiranthinae	*Eltroplectris triloba*	MG460381	MG460447	ABCD
Epidendroideae	Cymbidieae	Stanhopeinae	*Embreea herrenhusana*		KF660256	F
Epidendroideae	Cymbidieae	Stanhopeinae	*Embreea rodigasiana*	AF239358	KF660255	F
Epidendroideae	Epidendreae	Laeliinae	*Encyclia advena*	KT825409		A
Epidendroideae	Epidendreae	Laeliinae	*Encyclia alata*	KP057161	MF350003	FGKL
Epidendroideae	Epidendreae	Laeliinae	*Encyclia alboxanthina*	KT825412		ABC
Epidendroideae	Epidendreae	Laeliinae	*Encyclia andrichii*	KT825465		ABC
Epidendroideae	Epidendreae	Laeliinae	*Encyclia angustiloba*	KM385565	MT518439	EF
Epidendroideae	Epidendreae	Laeliinae	*Encyclia argentinensis*	KP057202		ACDE
Epidendroideae	Epidendreae	Laeliinae	*Encyclia aspera*	KM385600	MT518440	EF
Epidendroideae	Epidendreae	Laeliinae	*Encyclia atropurpurea*		EF079318	J
Epidendroideae	Epidendreae	Laeliinae	*Encyclia bipapularis*	KM385575		J
Epidendroideae	Epidendreae	Laeliinae	*Encyclia bocourtii*	KM385574		J
Epidendroideae	Epidendreae	Laeliinae	*Encyclia bohnkiana*	KT825417		AB
Epidendroideae	Epidendreae	Laeliinae	*Encyclia bracteata*	KT825418		A
Epidendroideae	Epidendreae	Laeliinae	*Encyclia bractescens*	KM385555	AY396112	K
Epidendroideae	Epidendreae	Laeliinae	*Encyclia bragancae*	KT825447		A
Epidendroideae	Epidendreae	Laeliinae	*Encyclia chapadensis*	KT825424		C
Epidendroideae	Epidendreae	Laeliinae	*Encyclia chloroleuca*	KM385604		AEFKL

Epidendroideae	Epidendreae	Laeliinae	*Encyclia conchaechila*	KT825426		CE
Epidendroideae	Epidendreae	Laeliinae	*Encyclia cordigera*	KT825486	AY396114	EFGKL
Epidendroideae	Epidendreae	Laeliinae	*Encyclia correllii*	KT825437		J
Epidendroideae	Epidendreae	Laeliinae	*Encyclia cyperifolia*	AY008534		CEF
Epidendroideae	Epidendreae	Laeliinae	*Encyclia dichroma*	AY008530	AY396117	A
Epidendroideae	Epidendreae	Laeliinae	*Encyclia diurna*	AY429402	AY396118	BEFGJ
Epidendroideae	Epidendreae	Laeliinae	*Encyclia duveenii*	KT825431		C
Epidendroideae	Epidendreae	Laeliinae	*Encyclia enriquearcilae*	MT859154		K
Epidendroideae	Epidendreae	Laeliinae	*Encyclia fowliei*	KT825433		A
Epidendroideae	Epidendreae	Laeliinae	*Encyclia gallopavina*	KT825434		A
Epidendroideae	Epidendreae	Laeliinae	*Encyclia garciae-esquivelii*	KM385608		F
Epidendroideae	Epidendreae	Laeliinae	*Encyclia granitica*	KT825428		E
Epidendroideae	Epidendreae	Laeliinae	*Encyclia guatemalensis*		EU490691	K
Epidendroideae	Epidendreae	Laeliinae	*Encyclia jenischiana*	KT825435		AB
Epidendroideae	Epidendreae	Laeliinae	*Encyclia leucantha*	KM385567		EF
Epidendroideae	Epidendreae	Laeliinae	*Encyclia lopezii*	KM385610		F
Epidendroideae	Epidendreae	Laeliinae	*Encyclia mapuerae*	KT825474		CE
Epidendroideae	Epidendreae	Laeliinae	*Encyclia microtos*	KT825448		E
Epidendroideae	Epidendreae	Laeliinae	*Encyclia mooreana*	KT825449		FK
Epidendroideae	Epidendreae	Laeliinae	*Encyclia naranjapatensis*	KP057184		G
Epidendroideae	Epidendreae	Laeliinae	*Encyclia nematocaulon*	KM385576		J
Epidendroideae	Epidendreae	Laeliinae	*Encyclia oliveirana*	KT825453		AC
Epidendroideae	Epidendreae	Laeliinae	*Encyclia oncidioides*	AF260184	AF263788	ABCDEFHK
Epidendroideae	Epidendreae	Laeliinae	*Encyclia osmantha*	KT825455		ABC
Epidendroideae	Epidendreae	Laeliinae	*Encyclia papillosa*	KM385586		K
Epidendroideae	Epidendreae	Laeliinae	*Encyclia patens*	KM385597		AC
Epidendroideae	Epidendreae	Laeliinae	*Encyclia pauciflora*	KT825458		F
Epidendroideae	Epidendreae	Laeliinae	*Encyclia peraltensis*	KP057191		FK

Epidendroideae	Epidendreae	Laeliinae	*Encyclia randii*	AY429405	AY396121	E
Epidendroideae	Epidendreae	Laeliinae	*Encyclia remotiflora*	KM385592		F
Epidendroideae	Epidendreae	Laeliinae	*Encyclia rufa*	KT825463		J
Epidendroideae	Epidendreae	Laeliinae	*Encyclia seidelii*	KT825467		C
Epidendroideae	Epidendreae	Laeliinae	*Encyclia spiritusanctensis*	KT825471		A
Epidendroideae	Epidendreae	Laeliinae	*Encyclia thienii*	KT825475		GL
Epidendroideae	Epidendreae	Laeliinae	*Encyclia thrombodes*	KT825459		E
Epidendroideae	Epidendreae	Laeliinae	*Encyclia tuerckheimii*	KP057200		K
Epidendroideae	Epidendreae	Laeliinae	*Encyclia unaensis*	KT825477		A
Epidendroideae	Epidendreae	Laeliinae	*Encyclia viridiflora*	KT825420		G
Epidendroideae	Epidendreae	Laeliinae	*Encyclia xerophytica*	KT825422		E
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum acunae*	EU554350	KM495148	FJK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum alieniferum*	KM495109	KM495110	F
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum althausenii*	MT248125	MT274075	EF
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum amapense*	MT248131	MT274081	E
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum anatipedium*	MT248132	MT274076	B
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum anceps*	EU554345		ABCEFJKL
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum angustilobum*	AY008511		EFJK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum armeniacum*	AF260165	AF263748	ABCE
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum avicula*	AF260169	AF263778	ABCDE
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum barbeyanum*		KM495143	F
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum bisulcatum*		KM495158	F
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum buenaventurae*	KM495119		F
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum calanthum*	MH218753		EFGH
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum caldense*		#WSM1189	A
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum campestre*	AF260174	MF669951	ABCE
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum capricornu*	AY008509		EF
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum cardiochilum*		FJ238563	FK

Epidendroideae	Epidendreae	Laeliinae	*Epidendrum cardiophorum*	EU554331		FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum centropetalum*	AF260175	AF263782	FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum chondrochilum*		MW498892	EFG
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum ciliare*	AY008503		EFGJKL
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum cinnabarinum*	MH218760	MH218774	AB
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum cochlidium*	MH218749	MW498931	EFG
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum coronatum*	KM495125	KM495126	ACEFGK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum criniferum*	AY008510		EFK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum cristatum*	FJ238552		ABCEFK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum denticulatum*	MF769385		ABCE
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum difforme*		MT518445	ABCEFGJKL
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum diffusum*		FJ238565	JKL
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum flammeum*	MH218763		B
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum flexuosum*	MH218761	EU214346	ABCEFGK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum fulgens*	MH218755	MH218776	A
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum garciae*		MT274077	A
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum ibaguense*	MH218758	MH218772	BCDEFGHKL
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum ilense*	EU554332	MT518448	F
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum incomptum*	KM495136	KM495137	FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum latilabre*	MT248127	MT274073	A
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum laucheanum*		JQ771563	FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum macrocarpum*	MH218762	MH218773	ABEFG
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum martianum*	MF769397		AC
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum mathewsii*	AY008516		DEH
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum medusae*	EF079382	EF079313	EF
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum montis-narae*		KM495150	FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum myodes*		KM495144	F
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum nocturnum*	AY008514	KM495141	ABCEFGJKL

Epidendroideae	Epidendreae	Laeliinae	*Epidendrum oerstedii*		KM495153	FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum orchidiflorum*	MH218756	MH218764	ABCEF
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum paniculatum*	EU554337		ACDEFGHK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum parkinsonianum*		FJ238566	FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum pessoae*	MT248126	MT274083	A
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum phragmites*		KM495140	FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum phyllocharis*	KM495122		F
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum polyanthum*	EU554347		FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum proligerum*	MT248118	MT274072	A
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum pseudepidendrum*	EU554346	EU214167	F
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum pseudodifforme*		MT274080	AC
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum puniceoluteum*	MH218752	MH218775	A
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum purpurascens*	EU554349		EFK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum quisayanum*		MW498960	F
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum radicans*		MH218771	FKL
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum ramosum*	KJ472392	KJ472347	ABEFGJK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum raniferum*		FJ238567	AFGHK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum repens*	EU554340		EFGJK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum rhopalostele*	KC165027	KF679543	E
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum rigidum*	EU554351		ABCDEFGJKL
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum robustum*	MH218744	MH218779	A
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum sanchezii*	MT248119	MT274078	B
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum schlechterianum*	AF260172	AF263779	EFHKL
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum sculptum*	KM495111	KM495112	EFGKL
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum secundum*	MH218750	MH218767	ABCDEFGHJ
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum spathatum*		MT518447	FG
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum stamfordianum*		KM495138	FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum tandapianum*		MW498923	FG

Epidendroideae	Epidendreae	Laeliinae	*Epidendrum trialatum*		KM495159	FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum tridactylum*	MH218745	MH218777	ABCE
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum veroscriptum*	AY008508		FK
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum vesicatum*	MH218742	MH218778	AC
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum vulgoamparoanum*	KM495128	KM495129	F
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum wrightii*	EU554341		J
Epidendroideae	Epidendreae	Laeliinae	*Epidendrum xanthinum*	MH218746	MH218769	AEFG
Epidendroideae	Neottieae	-	*Epipactis gigantea*	MF963894	MH590350	KL
Epidendroideae	Nervilieae	Epipogiinae	*Epipogium roseum*	EU711232		M
Vanilloideae	Vanilleae	-	*Epistephium parviflorum*	FJ425828		DEF
Vanilloideae	Vanilleae	-	*Epistephium subrepens*	FJ425837		EF
Vanilloideae	Vanilleae	-	*Epistephium williamsii*	FJ425836		ABCE
Epidendroideae	Cymbidieae	Eriopsidinae	*Eriopsis biloba*	DQ210374	EU490693	EFK
Epidendroideae	Cymbidieae	Eriopsidinae	*Eriopsis rutidobulbon*	AF239410		EF
Epidendroideae	Cymbidieae	Oncidiinae	*Erycina crista-galli*	FJ565449	FJ563956	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Erycina echinata*	AF350537	AF350616	K
Epidendroideae	Cymbidieae	Oncidiinae	*Erycina glossomystax*	FJ565587	FJ565074	EFG
Epidendroideae	Cymbidieae	Oncidiinae	*Erycina hyalinobulbon*	AF350536	AF350615	K
Epidendroideae	Cymbidieae	Oncidiinae	*Erycina pumilio*	FJ565554	FJ565039	EFGK
Epidendroideae	Cymbidieae	Oncidiinae	*Erycina pusilla*	FJ565542	FJ565025	ABCDEFGK
Epidendroideae	Cymbidieae	Oncidiinae	*Erycina zamorensis*	FJ565462	FJ564948	EF
Orchidoideae	Cranichideae	Spiranthinae	*Espinhassoa glaziovii*	MG460385	MG460450	AC
Epidendroideae	Cymbidieae	Eulophiinae	*Eulophia acutilabra*	KF318954	KF358103	M
Epidendroideae	Cymbidieae	Eulophiinae	*Eulophia alta*	EU877157		ABCEFJKLM
Epidendroideae	Cymbidieae	Eulophiinae	*Eulophia callichroma*	KF318903	KF358058	M
Epidendroideae	Cymbidieae	Eulophiinae	*Eulophia ecristata*		MH552183	JL
Epidendroideae	Cymbidieae	Eulophiinae	*Eulophia longisepala*	KF318918	KF358086	M
Epidendroideae	Cymbidieae	Eulophiinae	*Eulophia petersii*	KF318897	KF358067	M

Epidendroideae	Cymbidieae	Eulophiinae	*Eulophia ruwenzoriensis*	KF318894	KF358072	ACD
Epidendroideae	Cymbidieae	Zygopetalinae	*Euryblema anatonum*	AY870032		F
Epidendroideae	Cymbidieae	Zygopetalinae	*Euryblema andreae*	AY870047	EF079237	F
Epidendroideae	Vandeae	Angraecinae	*Eurychone galeandrae*	DQ091614	MK685555	M
Epidendroideae	Vandeae	Angraecinae	*Eurychone rothschildiana*	DQ091615	MK685593	M
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles actinosophila*	MG460382	MG460448	ABC
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles ananassocomos*	AJ539497		EJK
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles auriculata*	FN556161		FGK
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles cornu-bovis*	FN556162		F
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles cotyledon*	EF079172	EF079294	ABDEFG
Orchidoideae	Cranichideae	Spiranthinae	*Eurystyles lorenzii*	MG243403	#ECS932	A
Epidendroideae	Cymbidieae	Oncidiinae	*Fernandezia crystallina*	FJ565590	FJ565077	EFGH
Epidendroideae	Cymbidieae	Oncidiinae	*Fernandezia sanguinea*	FJ565526	FJ564944	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Frondaria caulescens*	AF262914		EFG
Orchidoideae	Cranichideae	Spiranthinae	*Funkiella hyemalis*	AJ539495		K
Orchidoideae	Cranichideae	Spiranthinae	*Funkiella valerioi*	MF465009	MG755128	FK
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra batemanii*	EU877139		FK
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra beyrichii*	EU877151		ABCDEFHJ
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra blanchetii*	KU295283		CE
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra devoniana*	EU877142	KF660268	E
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra dives*		EU214171	E
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra junceaoides*	EU877145		A
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra minax*	KU295284		E
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra montana*	EU877152		ABCE
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra paraguayensis*	EU877153		ACDE
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra stangeana*	KU295285		ACE
Epidendroideae	Cymbidieae	Catasetinae	*Galeandra styllomisantha*	EU877154		ACDEF
Orchidoideae	Cranichideae	Cranichidinae	*Galeoglossum thysanochilum*	AM419775	AM900810	K

Orchidoideae	Cranichideae	Cranichidinae	*Galeoglossum tubulosum*	AJ539510	AJ543938	K
Epidendroideae	Cymbidieae	Zygopetalinae	*Galeottia burkei*	AY870087		E
Epidendroideae	Cymbidieae	Zygopetalinae	*Galeottia ciliata*	AY870088		ACE
Epidendroideae	Cymbidieae	Zygopetalinae	*Galeottia fimbriata*	AY870091		F
Epidendroideae	Cymbidieae	Zygopetalinae	*Galeottia grandiflora*		AY869993	FK
Orchidoideae	Cranichideae	Galeottiellinae	*Galeottiella sarcoglossa*	AJ539518		K
Orchidoideae	Cranichideae	Chloraeinae	*Gavilea australis*	JQ045516	JQ045543	I
Orchidoideae	Cranichideae	Chloraeinae	*Gavilea litoralis*	JQ045468	GQ917022	I
Orchidoideae	Cranichideae	Chloraeinae	*Gavilea longibracteata*	JQ045502	JQ045533	I
Orchidoideae	Cranichideae	Chloraeinae	*Gavilea odoratissima*	JQ045495	GQ917024	D
Orchidoideae	Cranichideae	Chloraeinae	*Gavilea venosa*	JQ045472	JQ045542	D
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa barbaceniae*	FJ565420	FJ564911	AC
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa barbata*	FJ565431	FJ564924	AB
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa chrysostoma*	FJ565408		A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa ciliata*	FJ565217	FJ564730	ABD
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa cogniauxiana*	FJ565409	FJ564900	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa colorata*	FJ565242	FJ564754	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa concolor*	FJ565323	FJ564816	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa cornigera*	FJ565324	FJ564817	AD
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa crispa*	FJ565415	FJ564906	ACD
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa cuneata*		FJ564898	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa dasytyle*	AF350551	AF350630	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa echinata*	FJ565406	FJ564897	L
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa eleutherosepala*	FJ565203	FJ564717	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa flexuosa*	FJ565546	FJ565141	ABCDE
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa forbesii*	FJ565667	FJ565160	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa gardneri*	FJ565670	FJ565163	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa glaziovii*	FJ565433	FJ564926	A

Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa gomezoides*	AF350553	AF350632	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa gracilis*	FJ565411	FJ564902	AC
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa handroi*		FJ564928	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa hookeri*	FJ565427	FJ564920	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa hydrophila*	FJ565419	FJ564910	ABCDE
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa imperatoris-maximiliani*	FJ565207	FJ564720	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa kautskyi*	FJ565423	FJ564914	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa laxiflora*		FJ564899	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa lietzei*	FJ565625	FJ565117	AC
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa longipes*	FJ565386	FJ564882	AD
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa macronyx*	FJ565199		A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa macropetala*	FJ565424	FJ564915	ACDE
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa maculosa*		FJ564921	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa montana*	FJ565413		A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa pirarensis*	FJ565418		EF
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa planifolia*	EF079401	EF079196	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa praetexta*	FJ565412	FJ564903	AB
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa pubes*	FJ565190	FJ563836	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa radicans*	FJ565624	FJ565116	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa ranifera*	FJ565200	FJ564714	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa recurva*	FJ565435	FJ564929	ACD
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa riograndensis*	#DCI604		A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa sarcodes*	FJ565422	FJ564913	AL
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa sessilis*	FJ565434	FJ564927	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa silvana*	FJ565659	FJ565151	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa spiloptera*	FJ565428		AC
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa truncata*	FJ565407		A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa varicosa*	FJ565432	FJ564925	ABCDE

Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa venusta*		FJ564850	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa viperina*	FJ565347	FJ564841	DE
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa warmingii*	FJ565226	FJ564739	ABCE
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa welteri*	FJ565416	FJ564907	A
Epidendroideae	Cymbidieae	Oncidiinae	*Gomesa widgrenii*	FJ565658	FJ565150	A
Orchidoideae	Cranichideae	Cranichidinae	*Gomphichis adnata*	AM419769	AM900804	EF
Orchidoideae	Cranichideae	Cranichidinae	*Gomphichis bogotensis*	AJ539513	AJ543941	FG
Orchidoideae	Cranichideae	Cranichidinae	*Gomphichis caucana*	AM419770	AM900805	FG
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora armeniaca*	AF239386	EU214355	F
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora bufonia*		#TFS245	A
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora galeata*	MH766976	MH749005	K
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora gibba*		MT518467	FG
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora leucochila*		MT518468	FK
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora pardina*		MT518468	E
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora portentosa*	AF239389	KF660279	F
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora scaphephorus*		MT518473	EF
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora seideliana*		KF660277	K
Epidendroideae	Cymbidieae	Stanhopeinae	*Gongora sphaerica*	AF239388	KF660269	F
Orchidoideae	Cranichideae	Goodyerinae	*Goodyera major*	MT271808	MT265040	FK
Orchidoideae	Cranichideae	Goodyerinae	*Goodyera striata*	MZ269117	MZ269107	FK
Epidendroideae	Epidendreae	Calypsoinae	*Govenia capitata*	KX755390	KX755404	K
Epidendroideae	Epidendreae	Calypsoinae	*Govenia liliacea*	AF521056	AY121723	FK
Epidendroideae	Epidendreae	Calypsoinae	*Govenia sodiroi*		EU490695	F
Epidendroideae	Epidendreae	Calypsoinae	*Govenia superba*	KX755391	KX755405	K
Epidendroideae	Epidendreae	Calypsoinae	*Govenia tingens*		MW498869	DEFG
Epidendroideae	Epidendreae	Calypsoinae	*Govenia utriculata*	LC176600		ACDEFJKL
Epidendroideae	Cymbidieae	Oncidiinae	*Grandiphyllum auricula*	FJ565456	FJ564947	A
Epidendroideae	Cymbidieae	Oncidiinae	*Grandiphyllum divaricatum*	FJ565455	FJ563958	AD

Epidendroideae	Cymbidieae	Oncidiinae	*Grandiphyllum hians*	FJ565202	FJ564799	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Gravendeelia chamaelepanthes*	MK306362	MK258063	EFG
Orchidoideae	Cranichideae	Spiranthinae	*Greenwoodiella micrantha*		LT600875	K
Orchidoideae	Cranichideae	Spiranthinae	*Greenwoodiella wercklei*		LT600882	JK
Epidendroideae	Cymbidieae	Catasetinae	*Grobya amherstiae*	EU877158		A
Epidendroideae	Cymbidieae	Catasetinae	*Grobya cipoensis*	KU295286		A
Epidendroideae	Cymbidieae	Catasetinae	*Grobya fascifera*	KU295287	#JK63	A
Epidendroideae	Cymbidieae	Catasetinae	*Grobya galeata*	AF470487	AF470457	A
Epidendroideae	Epidendreae	Laeliinae	*Guarianthe skinneri*	AY008587	EU214145	FK
Orchidoideae	Orchideae	Orchidinae	*Habenaria achalensis*	HM777526	HM777794	ACD
Orchidoideae	Orchideae	Orchidinae	*Habenaria alata*		HF560586	DEFGJKL
Orchidoideae	Orchideae	Orchidinae	*Habenaria alpestris*	HM777688	HM777890	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria amambayensis*		HM777825	ABCDE
Orchidoideae	Orchideae	Orchidinae	*Habenaria anisitsii*	HM777668	HM777920	CDE
Orchidoideae	Orchideae	Orchidinae	*Habenaria araneiflora*	HM777527	HM777795	ACD
Orchidoideae	Orchideae	Orchidinae	*Habenaria aranifera*	MT582210	HM777819	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria armata*	HM777677	HM777931	ABCEF
Orchidoideae	Orchideae	Orchidinae	*Habenaria australis*	HM777724	HM777988	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria ayangannensis*	HM777706		AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria balansae*	HM777682	HM777884	ACE
Orchidoideae	Orchideae	Orchidinae	*Habenaria bicornis*	KF998087	HM777895	FJ
Orchidoideae	Orchideae	Orchidinae	*Habenaria brachydactyla*	KX784176	KX784171	C
Orchidoideae	Orchideae	Orchidinae	*Habenaria brachyphyton*	HM777557	HM777797	AE
Orchidoideae	Orchideae	Orchidinae	*Habenaria bractescens*	HM777615	HM777839	ABCDFK
Orchidoideae	Orchideae	Orchidinae	*Habenaria brevidens*	HM777535	HM777903	ACE
Orchidoideae	Orchideae	Orchidinae	*Habenaria brevilabiata*		HF560589	K
Orchidoideae	Orchideae	Orchidinae	*Habenaria caldensis*	HM777645	HM777881	ABCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria calicis*		HF560590	K

Orchidoideae	Orchideae	Orchidinae	*Habenaria campylogyna*	HM777581	HM777879	ABC
Orchidoideae	Orchideae	Orchidinae	*Habenaria canastrensis*	HM777726	HM777941	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria cardiostigmatica*	HM777575	HM778018	C
Orchidoideae	Orchideae	Orchidinae	*Habenaria ciliatisepala*	HM777565	HM777998	ABC
Orchidoideae	Orchideae	Orchidinae	*Habenaria clavata*	DQ522074	DQ522093	M
Orchidoideae	Orchideae	Orchidinae	*Habenaria clypeata*		HF560591	FK
Orchidoideae	Orchideae	Orchidinae	*Habenaria coxipoensis*	HM777536	HM777905	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria crucifera*	HM777574	HM778014	ABC
Orchidoideae	Orchideae	Orchidinae	*Habenaria cruegeri*	HM777660	HM777951	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria cryptophila*	HM777582	HM777870	ABCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria culicina*	HM777571	HM778012	ACE
Orchidoideae	Orchideae	Orchidinae	*Habenaria cultellifolia*	HM777675	HM777923	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria culveri*	MT500656		M
Orchidoideae	Orchideae	Orchidinae	*Habenaria curti-bradei*	HM777667	HM777918	ABCDEFGK
Orchidoideae	Orchideae	Orchidinae	*Habenaria curvilabra*	HM777598	HM777860	ACE
Orchidoideae	Orchideae	Orchidinae	*Habenaria depressifolia*	HM777601	HM777868	BCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria distans*	HM777630	HM777871	FJKL
Orchidoideae	Orchideae	Orchidinae	*Habenaria dutrae*	KJ021339	KJ021387	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria edwallii*	HM777564	HM777803	ABCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria egleriana*	HM777694		C
Orchidoideae	Orchideae	Orchidinae	*Habenaria ekmaniana*	KJ021340	KJ021383	ACDE
Orchidoideae	Orchideae	Orchidinae	*Habenaria espinhacensis*	KT831441	KT831446	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria eustachya*		HF560594	FJK
Orchidoideae	Orchideae	Orchidinae	*Habenaria exaltata*	HM777621	HM777829	ADE
Orchidoideae	Orchideae	Orchidinae	*Habenaria floribunda*		MH551798	EFJKL
Orchidoideae	Orchideae	Orchidinae	*Habenaria fluminensis*	HM777659	HM777945	ABC
Orchidoideae	Orchideae	Orchidinae	*Habenaria glaucophylla*	HM777631	HM777875	ABC
Orchidoideae	Orchideae	Orchidinae	*Habenaria glazioviana*	HM777545	HM777849	ACE

Orchidoideae	Orchideae	Orchidinae	*Habenaria gollmeri*	MW567127	MW675875	EFG
Orchidoideae	Orchideae	Orchidinae	*Habenaria gonzaleztamayoi*		HF560597	K
Orchidoideae	Orchideae	Orchidinae	*Habenaria gourlieana*	HM777612	HM777844	ABCDE
Orchidoideae	Orchideae	Orchidinae	*Habenaria gracilisegmenta*	MK926588	MK919206	E
Orchidoideae	Orchideae	Orchidinae	*Habenaria guadalajarana*		HF560598	K
Orchidoideae	Orchideae	Orchidinae	*Habenaria guilleminii*	HM777539	HM777900	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria gustavo-edwallii*	HM777529	HM777793	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria hamata*	HM777586	HM777865	ABCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria henscheniana*	HM777622	HM777827	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria heptadactyla*	HM777653	HM777956	CDEF
Orchidoideae	Orchideae	Orchidinae	*Habenaria heringeri*	HM777602	HM777915	C
Orchidoideae	Orchideae	Orchidinae	*Habenaria hexaptera*	HM777537	HM777908	ABCDE
Orchidoideae	Orchideae	Orchidinae	*Habenaria hieronymi*	HM777524	HM777924	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria hippocrepica*	HM777698	HM777946	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria imbricata*	HM777650	HM777927	ABCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria irwiniana*	HM777642	HM777932	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria itaculumia*	HM777723	HM777976	AE
Orchidoideae	Orchideae	Orchidinae	*Habenaria itatiayae*	HM777663	HM777894	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria jaguariahyvae*	HM777669	HM777919	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria johannensis*	HM777609	HM777841	ABCDE
Orchidoideae	Orchideae	Orchidinae	*Habenaria josephensis*	HM777596	HM777854	ABCD
Orchidoideae	Orchideae	Orchidinae	*Habenaria juruenensis*	HM777531	HM777897	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria kleinii*	KC257469	KC257477	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria laevigata*	MT500591	MT533496	M
Orchidoideae	Orchideae	Orchidinae	*Habenaria lavrensis*	HM777710	HM777938	ABC
Orchidoideae	Orchideae	Orchidinae	*Habenaria leprieurii*	HM777657	HM777955	ABCDEF
Orchidoideae	Orchideae	Orchidinae	*Habenaria leptoceras*	HM777597	HM777855	ABE
Orchidoideae	Orchideae	Orchidinae	*Habenaria leucosantha*	HM777568	HM777790	AC

Orchidoideae	Orchideae	Orchidinae	*Habenaria lithophila*	MT500589	MT533493	M
Orchidoideae	Orchideae	Orchidinae	*Habenaria longicauda*	HM777608	HM777843	ACEF
Orchidoideae	Orchideae	Orchidinae	*Habenaria ludibundiciliata*	HM777638	HM778006	CE
Orchidoideae	Orchideae	Orchidinae	*Habenaria macilenta*	HM777606	HM777811	ACE
Orchidoideae	Orchideae	Orchidinae	*Habenaria macrandra*	MK413693	MK413698	M
Orchidoideae	Orchideae	Orchidinae	*Habenaria macroceratitis*	MT500663	EU214358	FJKL
Orchidoideae	Orchideae	Orchidinae	*Habenaria macronectar*	HM777614	HM777834	ADE
Orchidoideae	Orchideae	Orchidinae	*Habenaria magdalenensis*	HM777595	HM777858	AB
Orchidoideae	Orchideae	Orchidinae	*Habenaria magniscutata*	HM777641	HM777880	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria megapotamensis*	KJ021347	KJ021386	AD
Orchidoideae	Orchideae	Orchidinae	*Habenaria mello-barretoi*	HM777685	HM777886	C
Orchidoideae	Orchideae	Orchidinae	*Habenaria melvillei*	HM777611	HM777840	ACE
Orchidoideae	Orchideae	Orchidinae	*Habenaria monorrhiza*	MT582232	HF560604	EFGJK
Orchidoideae	Orchideae	Orchidinae	*Habenaria montevidensis*	HM777619	HM777826	ADE
Orchidoideae	Orchideae	Orchidinae	*Habenaria montis-wilhelminae*	HM777714	HM777957	ACE
Orchidoideae	Orchideae	Orchidinae	*Habenaria mystacina*	HM777728	HM777970	ABC
Orchidoideae	Orchideae	Orchidinae	*Habenaria nasuta*	HM777716	HM777959	ACE
Orchidoideae	Orchideae	Orchidinae	*Habenaria nemorosa*	HM777634	HM777872	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria nuda*	HM777718	HM777981	ABCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria obtusa*	HM777587	HM777862	ABCDEFG
Orchidoideae	Orchideae	Orchidinae	*Habenaria omissa*	MH557864	MH557867	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria orchiocalcar*	HM777662	HM777914	CE
Orchidoideae	Orchideae	Orchidinae	*Habenaria pabstii*	HM777666	HM777912	C
Orchidoideae	Orchideae	Orchidinae	*Habenaria pansarinii*	HM777521	KX784169	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria paranaensis*	HM777528	HM777796	ACD
Orchidoideae	Orchideae	Orchidinae	*Habenaria parviflora*	HM777560	HM777799	ABCDE
Orchidoideae	Orchideae	Orchidinae	*Habenaria paulensis*	HM777556	HM777798	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria paulistana*	HM777610	HM777838	A

Orchidoideae	Orchideae	Orchidinae	*Habenaria pentadactyla*	KJ021350	KJ021382	D
Orchidoideae	Orchideae	Orchidinae	*Habenaria petalodes*	HM777583	HM777861	ABCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria petitiana*	MT500613	MT533518	M
Orchidoideae	Orchideae	Orchidinae	*Habenaria pleiophylla*	HM777594	HM777857	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria praestans*	MT500605	MT533510	M
Orchidoideae	Orchideae	Orchidinae	*Habenaria pratensis*	HM777546	HM777847	ABCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria psammophila*	HM777550	HM778000	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria pseudociliosa*	MT500654	MT533556	M
Orchidoideae	Orchideae	Orchidinae	*Habenaria pseudoculicina*	HM777707	HM777943	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria pseudoglaucophylla*	HM777590	HM777852	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria pseudohamata*	HM777593	HM777856	AB
Orchidoideae	Orchideae	Orchidinae	*Habenaria pubidactyla*	HM777702	HM777972	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria pungens*	HM777570	HM778011	CD
Orchidoideae	Orchideae	Orchidinae	*Habenaria quadriferricola*	HM777699	HM777947	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria quinqueseta*	MT582230	HF560605	FJKL
Orchidoideae	Orchideae	Orchidinae	*Habenaria reflexicalcar*	HM777700	HM777948	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria regnellii*	HM777603	KJ021391	ACDE
Orchidoideae	Orchideae	Orchidinae	*Habenaria repens*	MT582217	MT623301	ABCDEFGJKL
Orchidoideae	Orchideae	Orchidinae	*Habenaria rodeiensis*	HM777577	HM777995	ABCDEFK
Orchidoideae	Orchideae	Orchidinae	*Habenaria rolfeana*	HM777730	HM777977	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria roraimensis*	HM777676	HM777925	E
Orchidoideae	Orchideae	Orchidinae	*Habenaria rotundiloba*	HM777717	HM778017	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria rupicola*	HM777534	HM777910	ABCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria schenckii*	HM777580	HM777869	BE
Orchidoideae	Orchideae	Orchidinae	*Habenaria secunda*	HM777525	HM777791	ADE
Orchidoideae	Orchideae	Orchidinae	*Habenaria secundiflora*	HM777636	HM778005	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria setacea*	HM777731		ABC
Orchidoideae	Orchideae	Orchidinae	*Habenaria seticauda*	HM777584	HM777864	EF

Orchidoideae	Orchideae	Orchidinae	*Habenaria sobraliana*	HM777704	HM777990	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria spanophytica*	HM777576	HM778016	ABC
Orchidoideae	Orchideae	Orchidinae	*Habenaria spathulifera*	MT582233	HM777851	CE
Orchidoideae	Orchideae	Orchidinae	*Habenaria sprucei*	KC257470	KC257479	BCE
Orchidoideae	Orchideae	Orchidinae	*Habenaria strictissima*		HF560607	FKL
Orchidoideae	Orchideae	Orchidinae	*Habenaria subauriculata*		HF560608	K
Orchidoideae	Orchideae	Orchidinae	*Habenaria subfiliformis*	HM777572	HM778009	ACE
Orchidoideae	Orchideae	Orchidinae	*Habenaria subviridis*	HM777680	HM777930	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria tamanduensis*	HM777600		AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria tridactylites*	MK413695	MK413700	M
Orchidoideae	Orchideae	Orchidinae	*Habenaria tridens*	DQ522080	DQ522101	M
Orchidoideae	Orchideae	Orchidinae	*Habenaria trifida*	HM777672	HM777917	ABCDEFGK
Orchidoideae	Orchideae	Orchidinae	*Habenaria ulei*	MW567130	MW675880	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria umbraticola*	HM777605	HM777874	A
Orchidoideae	Orchideae	Orchidinae	*Habenaria urbaniana*	HM777658	HM777944	AC
Orchidoideae	Orchideae	Orchidinae	*Habenaria warmingii*	HM777616	HM777821	ABCE
Epidendroideae	Epidendreae	Laeliinae	*Hagsatera brachycolumna*	AY008515	AY396088	K
Orchidoideae	Cranichideae	Spiranthinae	*Hapalorchis lineata*	KX421911		ABDEFJK
Epidendroideae	Epidendreae	Ponerinae	*Helleriella guerrerensis*	AF260142	AF263761	K
Orchidoideae	Cranichideae	Goodyerinae	*Hetaeria heterosepala*	MT271810	MT265042	M
Epidendroideae	Cymbidieae	Oncidiinae	*Hintonella mexicana*	FJ565447	FJ564940	K
Epidendroideae	Cymbidieae	Oncidiinae	*Hofmeisterella eumicroscopica*	DQ315823	FJ565091	EFG
Orchidoideae	Orchideae	Orchidinae	*Holothrix condensata*	MK801534	MK732085	M
Orchidoideae	Orchideae	Orchidinae	*Holothrix orthoceras*	MF695605	MF741996	M
Epidendroideae	Epidendreae	Laeliinae	*Homalopetalum joinvillense*	KF951036	#WSM1192	A
Epidendroideae	Epidendreae	Laeliinae	*Homalopetalum kienastii*		AY396095	K
Epidendroideae	Epidendreae	Laeliinae	*Homalopetalum pachyphyllum*	AF260155	AF263770	K
Epidendroideae	Epidendreae	Laeliinae	*Homalopetalum pumilio*	AY008524	AY396089	FK

Epidendroideae	Epidendreae	Laeliinae	*Homalopetalum pumilum*	AY008523		K
Epidendroideae	Cymbidieae	Stanhopeinae	*Houlletia brocklehurstiana*	#Passos	KF660273	A
Epidendroideae	Cymbidieae	Stanhopeinae	*Houlletia odoratissima*		KF660257	CEFG
Epidendroideae	Cymbidieae	Stanhopeinae	*Houlletia sanderi*	AF239371	EF065562	EFG
Epidendroideae	Cymbidieae	Stanhopeinae	*Houlletia tigrina*	AF239370		K
Epidendroideae	Cymbidieae	Stanhopeinae	*Houlletia wallisii*	AF239369		EFG
Epidendroideae	Cymbidieae	Zygopetalinae	*Huntleya gustavi*	AY870076		F
Epidendroideae	Cymbidieae	Zygopetalinae	*Huntleya wallisii*	AY870074		FG
Epidendroideae	Cymbidieae	Maxillariinae	*Ida fimbriata*		KF660287	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Ida lata*	MH767003	MH749016	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Ionopsis minutiflora*	FJ565467	FJ564952	F
Epidendroideae	Cymbidieae	Oncidiinae	*Ionopsis satyrioides*	FJ565328	FJ564821	EFGJK
Epidendroideae	Cymbidieae	Oncidiinae	*Ionopsis utricularioides*	FJ565557	FJ565042	ABCDEFGJKL
Epidendroideae	Epidendreae	Laeliinae	*Isabelia pulchella*	AF260163	MH748942	A
Epidendroideae	Epidendreae	Laeliinae	*Isabelia violacea*	AF260168		AC
Epidendroideae	Epidendreae	Laeliinae	*Isabelia virginalis*	AF260161	AF263747	A
Epidendroideae	Epidendreae	Ponerinae	*Isochilus carnosiflorus*	MF349090		FK
Epidendroideae	Epidendreae	Ponerinae	*Isochilus chiriquensis*	AF260143	AY368412	FK
Epidendroideae	Epidendreae	Ponerinae	*Isochilus linearis*	AY008480	AY121725	ABCDEFGHJKL
Epidendroideae	Cymbidieae	Zygopetalinae	*Ixyophora viridisepala*	AY870041		EF
Epidendroideae	Epidendreae	Laeliinae	*Jacquiniella globosa*	AY008520	EF065588	ABEFGJK
Epidendroideae	Epidendreae	Laeliinae	*Jacquiniella standleyi*		EU214361	F
Epidendroideae	Epidendreae	Laeliinae	*Jacquiniella teretifolia*	KT825481	AY396087	EFGJK
Epidendroideae	Cymbidieae	Zygopetalinae	*Kefersteinia costaricensis*		EU214498	FK
Epidendroideae	Cymbidieae	Zygopetalinae	*Kefersteinia excentrica*	AY870033	EU214364	F
Epidendroideae	Cymbidieae	Zygopetalinae	*Kefersteinia microcharis*	AY870036	EU214366	K
Epidendroideae	Cymbidieae	Zygopetalinae	*Kefersteinia parvilabris*		EU214367	F
Epidendroideae	Cymbidieae	Zygopetalinae	*Kefersteinia pellita*		MT518486	EF

Epidendroideae	Cymbidieae	Stanhopeinae	*Kegeliella atropilosa*	AF239363	EF079232	K
Epidendroideae	Cymbidieae	Stanhopeinae	*Kegeliella kupperi*	AF239364	AF263666	FK
Orchidoideae	Cranichideae	Spiranthinae	*Kionophyton sawyeri*		LT600873	K
Orchidoideae	Cranichideae	Spiranthinae	*Kionophyton seminuda*	MF465022	MG755129	K
Epidendroideae	Cymbidieae	Zygopetalinae	*Koellensteinia eburnea*	AY870103		ACE
Epidendroideae	Cymbidieae	Zygopetalinae	*Koellensteinia florida*	AF239327		A
Epidendroideae	Cymbidieae	Zygopetalinae	*Koellensteinia graminea*	AY870102	AY870003	AEF
Epidendroideae	Epidendreae	Laeliinae	*Laelia anceps*	AF260191	AF263794	K
Epidendroideae	Epidendreae	Laeliinae	*Laelia elata*	KU232396		GH
Epidendroideae	Epidendreae	Laeliinae	*Laelia lueddemannii*	KR816319	EU214482	F
Epidendroideae	Epidendreae	Laeliinae	*Laelia lyonsii*	AF260222	AF263823	J
Epidendroideae	Epidendreae	Laeliinae	*Laelia marginata*	AY008571		ABCEFG
Epidendroideae	Epidendreae	Laeliinae	*Laelia rubescens*	AY008575	AY396098	FK
Epidendroideae	Epidendreae	Laeliinae	*Laelia speciosa*	AF260188	AF263792	K
Epidendroideae	Epidendreae	Laeliinae	*Laelia splendida*	AY008573	AY396105	F
Epidendroideae	Epidendreae	Laeliinae	*Laelia undulata*	AF260223	AF263749	EFGL
Orchidoideae	Cranichideae	Spiranthinae	*Lankesterella ceracifolia*	FN556164	MN597434	AD
Orchidoideae	Cranichideae	Spiranthinae	*Lankesterella gnomus*	EF079173	EF065581	A
Orchidoideae	Cranichideae	Spiranthinae	*Lankesterella orthantha*		EU395449	EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Lepanthes gargantua*	KY988856	KY988672	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Lepanthes helicocephala*	MN332387	MN332560	EG
Epidendroideae	Epidendreae	Pleurothallidinae	*Lepanthopsis acetabulum*	KX810328		EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Lepanthopsis acuminata*	KX810329		FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Lepanthopsis apoda*	KF747841	MK306411	EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Lepanthopsis astrophora*	AF262893	AF265487	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Lepanthopsis bennettii*	KX810332		H
Epidendroideae	Epidendreae	Pleurothallidinae	*Lepanthopsis floripecten*	KY988897	MK306413	AEFK
Epidendroideae	Epidendreae	Laeliinae	*Leptotes bicolor*	EF079383	EF079319	A

Epidendroideae	Epidendreae	Laeliinae	*Leptotes bohnkiana*		MT518491	A
Epidendroideae	Epidendreae	Laeliinae	*Leptotes cf. tenuis*	AY008562		A
Epidendroideae	Epidendreae	Laeliinae	*Leptotes unicolor*	#MB612	#MB612	A
Epidendroideae	Malaxideae	Malaxidinae	*Liparis nervosa*	AY907092	MN641753	ABCDEFGJKLM
Epidendroideae	Cymbidieae	Oncidiinae	*Lockhartia acuta*	FJ565175	FJ564694	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Lockhartia amoena*	FJ565166	FJ564686	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Lockhartia lunifera*	MH762936	MH748889	ACE
Epidendroideae	Cymbidieae	Oncidiinae	*Lockhartia micrantha*	FJ565172	FJ564691	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Lockhartia oerstedii*	FJ565174	FJ564693	FJK
Epidendroideae	Cymbidieae	Oncidiinae	*Lockhartia parthenocomos*	FJ565176	FJ564695	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Lockhartia parthenoglossa*	FJ565178	FJ564698	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Lockhartia serra*		FJ564697	G
Epidendroideae	Cymbidieae	Oncidiinae	*Lockhartia tenuiflora*		MT518505	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Lockhartia verrucosa*	FJ565179		FK
Epidendroideae	Epidendreae	Laeliinae	*Loefgrenianthus blanche-amesiae*	AF260183	AF263787	A
Epidendroideae	Cymbidieae	Maxillariinae	*Lycaste aromatica*	MH762937	MH748890	K
Epidendroideae	Cymbidieae	Maxillariinae	*Lycaste macrophylla*	KY745868	MG490284	EFGK
Epidendroideae	Cymbidieae	Coeliopsidinae	*Lycomormium fiskei*	AF239345	MT518520	EF
Epidendroideae	Cymbidieae	Coeliopsidinae	*Lycomormium squalidum*		AY368414	E
Orchidoideae	Cranichideae	Spiranthinae	*Lyroglossa grisebachii*	KX421913	KX421971	ACEF
Epidendroideae	Cymbidieae	Oncidiinae	*Macradenia brassavolae*	FJ565220	FJ563854	EFK
Epidendroideae	Cymbidieae	Oncidiinae	*Macradenia rubescens*	FJ565345	FJ564839	E
Epidendroideae	Cymbidieae	Oncidiinae	*Macradenia tridentata*	FJ565405	FJ564896	E
Epidendroideae	Cymbidieae	Oncidiinae	*Macroclinium aurorae*	FJ565626	FJ565118	H
Epidendroideae	Cymbidieae	Oncidiinae	*Macroclinium bicolor*	AF350550	AF350629	K
Epidendroideae	Cymbidieae	Oncidiinae	*Macroclinium dalstroemii*	FJ565585	FJ565072	F
Epidendroideae	Cymbidieae	Oncidiinae	*Macroclinium robustum*	FJ565344	FJ563935	F
Epidendroideae	Cymbidieae	Oncidiinae	*Macroclinium xiphophorus*	JN189789		F

Epidendroideae	Epidendreae	Pleurothallidinae	*Madisonia articulata*	MW166880	MW166886	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Madisonia bradei*	MN332404	MN332575	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Madisonia brasilica*	MW166882	MW166888	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Madisonia carrisii*	MW166884	MW166891	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Madisonia ianthina*		MW166893	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Madisonia kerrii*	MN332389	MN332562	E
Epidendroideae	Epidendreae	Pleurothallidinae	*Madisonia spiculifera*	MW166881		EFJ
Epidendroideae	Epidendreae	Pleurothallidinae	*Madisonia vandenbergii*	JQ306441		A
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis brachyrrhynchos*		HG970143	FK
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis brachystachys*	AY907110	AY907176	KL
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis cipoensis*		HG970148	ABC
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis excavata*		EU214382	ABCDEFGHK
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis hagsateri*		HG970145	K
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis histionantha*		EU214383	ADFGK
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis jaraguae*	#DCI156	#DCI156	A
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis lepanthiflora*		HG970151	K
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis maxonii*		HG970152	K
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis molotensis*		HG970153	K
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis moritzii*		HG970154	EFG
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis parthoni*		HG970155	ADEFGK
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis rosilloi*		HG970156	K
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis spicata*	AY907124	AY907191	JL
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis unifolia*	MG216353	MK520300	FJKL
Epidendroideae	Malaxideae	Malaxidinae	*Malaxis weberbaueriana*		KU748127	M
Orchidoideae	Cranichideae	Manniellinae	*Manniella cypripedioides*	AJ539516	AJ543943	M
Orchidoideae	Cranichideae	Manniellinae	*Manniella gustavi*	AJ539517	AJ543944	M
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia amabilis*	DQ923793		EH
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia amplexa*		MT518522	EH

Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia ayabacana*		MT518525	DEFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia bicolor*		AF265447	H
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia caudata*	MK294798	MK258041	FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia chontalensis*	DQ923767		FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia civilis*	DQ923770		H
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia coccinea*	AF262789	KP205432	FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia coriacea*	AF262781		FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia curtipes*	MN551418	MN577725	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia datura*	DQ923761		H
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia descendens*		MT518528	EH
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia discoidea*	DQ923759	#CAR151	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia echo*	DQ923760		H
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia garciae*		MT518532	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia hartmanii*		MT518533	E
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia infracta*	AF262785		ABC
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia kuhniorum*	DQ923784		E
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia kyphonantha*	AF262780		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia mooreana*	DQ923769		FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia picturata*	AF262775	MN615397	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia pinocchio*	AF262778	AF265445	G
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia platyglossa*	DQ923779		FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia rubeola*	AF262791		EH
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia smallmaniana*	KY988907	KY988723	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Masdevallia venezuelana*	AF262782		F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria acostae*	DQ210034	DQ210603	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria acuminata*	DQ210408	DQ210895	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria acutifolia*	DQ210168		EFGJK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria adendrobium*	DQ210214	EU214389	FGJ

Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria alba*	DQ209984	EU214392	CEFGJK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria alpestris*	DQ210414	DQ210901	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria alticola*	DQ210399	DQ210886	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria angustissima*	DQ210054	DQ209901	EFK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria arbuscula*	DQ210357	DQ210853	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria auyantepuiensis*	DQ210331	DQ210830	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria barbosae*	DQ210150	DQ210682	AB
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria bicallosa*	DQ210478	DQ210960	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria bolivarensis*	DQ210341	DQ210838	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria brachybulbon*		DQ210773	EFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria bradei*	DQ210149	DQ210681	AEFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria bradeorum*	DQ210443	DQ210987	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria brasiliensis*	DQ210155	DQ210687	AE
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria brevilabia*	DQ210046	DQ209893	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria caespitifica*	DQ210035	DQ209883	EFK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria canarina*	GU177873	KF660293	H
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria candida*	DQ210189		A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria cassapensis*	DQ924401	DQ210768	EFGHK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria chacoensis*	DQ210278	DQ210785	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria chrysantha*	DQ210113	DQ210644	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria colemanii*	DQ209989	DQ209865	E
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria conduplicata*	DQ209991	DQ209889	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria confuse*	DQ210001	DQ210994	EFJK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria crassifolia*	DQ209986	DQ209862	EFJK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria crocea*	DQ210103	DQ210810	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria ctenostachys*	DQ210098	DQ210899	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria cucullata*	DQ924398	DQ210753	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria cymbidioides*	DQ209987	DQ209863	G

Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria densa*	DQ210290	DQ209867	K
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria densifolia*	DQ210253	DQ210767	EFGH
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria desvauxiana*	DQ210206	DQ210736	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria dichotoma*	DQ210441	DQ210926	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria discolor*	KJ472401	DQ210711	AEFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria diuturna*	DQ210473	DQ210813	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria divaricata*	DQ210378	DQ210869	E
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria echinophyta*	DQ210197	DQ210765	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria ecuadorensis*	DQ210259	DQ210771	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria egertoniana*	DQ210184	DQ210740	FKL
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria encyclioides*	DQ209983	DQ209861	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria endresii*	DQ210010	DQ210586	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria equitans*	KX822792	KX822788	DEFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria erikae*		EF079248	H
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria ferdinandiana*	DQ210129	DQ210660	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria flava*	DQ210460	DQ210944	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria friedrichsthalii*	DQ210210	DQ210676	EFK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria fritzii*	DQ210497	DQ209969	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria graminifolia*	DQ924412		EFGH
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria grisebachiana*	DQ210542	DQ211017	J
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria gualaquizensis*	DQ461796		EH
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria guareimensis*	DQ210565	DQ211040	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria hematoglossa*		DQ209903	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria horichii*	DQ210462	DQ210946	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria huancabambae*		DQ209957	EFH
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria humilis*	DQ210154	DQ210686	AC
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria imbricata*	MZ736830	DQ210828	ABFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria inaequisepala*	DQ210407	DQ210823	EFG

Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria jacquelineana*	DQ210268	DQ210778	FGH
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria jenischiana*	DQ210111	DQ210642	AEF
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria johannis*	MZ736836	DQ210679	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria johannyae*	DQ210423	DQ210776	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria kautskyi*	DQ210115	DQ210646	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria lepidota*	DQ210363	DQ210857	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria leucaimata*	DQ210107	DQ210638	ABE
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria lineolata*	MT358290	MH748892	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria longibracteata*	DQ210353	DQ210850	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria longicaulis*	DQ210510	DQ210991	EFGJ
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria longicolumna*	DQ210495	DQ210978	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria longipes*	DQ210413	DQ210620	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria longipetala*	DQ210078	DQ211038	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria longipetiolata*	DQ210229	DQ209935	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria lueri*	DQ210003	DQ210581	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria lutescens*	DQ210226	DQ209931	CEFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria maleolens*	DQ210525	DQ209856	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria mapiriensis*	DQ210571	DQ211046	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria marginata*	DQ210156	DQ210718	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria matthewsii*	DQ924394		EFGH
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria meleagris*	DQ210038	DQ209886	K
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria meridensis*	DQ210037	DQ210780	EFGJ
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria miniate*	DQ210062	DQ209908	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria monantha*	MZ268395	MZ334604	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria moralesii*	KP323292	KP278255	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria multifoliata*	DQ210534	DQ211009	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria nardoides*	DQ210335	DQ210833	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria nasuta*	DQ210241	DQ210699	AEFGKL

Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria neglecta*	DQ210045	DQ209892	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria neowiedii*	DQ924409	DQ209952	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria nicaraguensis*		DQ210604	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria notylioglossa*	MZ736842	KP278305	ABCEFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria novoae*	DQ210321	DQ210820	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria obtuse*	DQ210110	DQ210641	AEF
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria oreocharis*	DQ210004	DQ210929	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pacholskii*	DQ210355	DQ210851	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pachyacron*	DQ210021	DQ210593	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pachyphylla*	DQ210285	DQ209879	AE
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria paleata*	DQ210424	DQ210911	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria paranaensis*	DQ210162	DQ210672	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria parviflora*	KJ472397	EU214407	ABEFGJKL
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria patens*	DQ210505	DQ210772	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pauciflora*	DQ210093	DQ209955	AEFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pendens*	MZ736839	DQ210677	AEG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pendula*	DQ210405	DQ210892	AEFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria perryae*	DQ210275	DQ209944	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria phoenicanthera*	MZ736820	DQ210812	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria picta*	OM925901	OM925902	AB
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pittieri*	DQ210060	DQ209907	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria porphyrostele*	MZ736822	DQ210691	AD
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria porrecta*	DQ210291	DQ210948	EFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria proboscidea*	DQ209979	DQ209857	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria procurrens*	DQ924399		EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pseudoneglecta*	DQ210007	DQ209874	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pudica*	KP323283	KP278319	J
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pulla*	DQ210381	DQ210872	EFG

Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria pumila*	DQ210083	DQ209912	ACE
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria reichenheimiana*	DQ210463	DQ209900	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria repens*	DQ210070	DQ210613	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria rigida*		DQ210635	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria ringens*	DQ210005	DQ210583	EFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria ruberrima*	DQ924402		FG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria rufescens*	KJ472410	KP278263	AEFGJK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria sanantonioensis*	KP323287	KP278299	G
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria santanae*	DQ210526	DQ209973	EK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria scalariformis*	DQ210023	DQ210595	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria schunkeana*	DQ210300	DQ210799	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria scorpioidea*	DQ210058	DQ209905	EFK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria setigera*	DQ210143	DQ210674	AEFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria shepheardii*		MT518560	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria Silvana*	DQ210516	DQ210997	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria soulangeana*	DQ210014	DQ210587	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria splendens*	KJ472383	KJ472376	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria suarezorum*	DQ210523		E
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria suaveolens*	DQ210482	DQ210964	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria subrepens*	DQ210153	DQ210640	ABCEFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria subulata*	DQ210121	DQ210650	ACE
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria superflua*	DQ461800	DQ210689	EG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria tagianarae*	KP323330	KP278259	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria tenuibulba*	KP323291	KP278276	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria tigrine*	DQ210085	DQ210625	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria tubercularis*	DQ210446	DQ210931	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria turbinata*	DQ210183	DQ210713	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria tutae*	DQ210071	DQ210614	F

Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria ubatubana*	MZ736827	DQ210690	A
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria uncata*	KP323320	KP278312	EFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria valenzuelana*	DQ210172	DQ210702	AEFGJK
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria villosa*	DQ210202	DQ209963	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria violaceopunctata*	KJ472387	DQ210678	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria virguncula*	DQ210264	DQ210983	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria vittariifolia*	DQ210102	DQ209921	F
Epidendroideae	Cymbidieae	Maxillariinae	*Maxillaria witsenioides*	DQ210247	DQ209937	EFG
Epidendroideae	Epidendreae	Laeliinae	*Meiracyllium gemma*	AF260153	AF263767	K
Epidendroideae	Epidendreae	Laeliinae	*Meiracyllium trinasutum*	AY008500	AF263670	K
Orchidoideae	Cranichideae	Spiranthinae	*Mesadenella cuspidata*	EF079175	EF079296	ABCDE
Orchidoideae	Cranichideae	Spiranthinae	*Mesadenella petenensis*	AJ539503		K
Orchidoideae	Cranichideae	Spiranthinae	*Mesadenus polyanthus*	AM778175	AM902109	JK
Orchidoideae	Cranichideae	Spiranthinae	*Mesadenus tenuissimus*	MK309835	MK310240	K
Cypripedioideae	-	-	*Mexipedium xerophyticum*	FR720330	JN181455	K
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus argenteus*	MN946458	MN946474	ABCD
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus arietinus*	MN946472	MN946486	AE
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus austrobrasiliensis*	MN946473	MN946487	A
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus bidentiferus*	MN946459	MN946475	A
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus caraguatatubensis*	MN946460	#ECS943	A
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus commelinoides*	MN946461	#TFS266	A
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus confusus*	MT271798	MT265032	EF
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus crispifolius*	MT271811	MT265043	FG
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus erythrodoides*	MT271815	MT265047	FG
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus fimbrillaris*	MN946462	MN946476	A
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus juruenensis*	MN946463	MN946477	ACEFG
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus kuczynskii*	MN946465	MN946479	AD
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus longicornu*	MN946466	MN946480	AC

Orchidoideae	Cranichideae	Goodyerinae	*Microchilus lunifer*	MT271816	MT265048	FK
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus malmei*	MN946467	MN946481	A
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus metallescens*	MN946468	MN946482	AC
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus mystacinus*	MN946469	MN946483	AE
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus platensis*	MT271799	MT265033	A
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus pumilus*	MN946470	MN946484	E
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus roseus*	MT271802	MT265036	ABEF
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus secundus*	MT271813	MT265045	FK
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus simplex*	FJ473328		E
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus sparreorum*	MT271817	MT265049	F
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus tridax*		FR832762	FK
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus utriculatus*	MT271803	MT265037	F
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus venustus*	MT271800	MT265034	EFGJKL
Orchidoideae	Cranichideae	Goodyerinae	*Microchilus vesicifer*	MT271818	MT265050	FK
Epidendroideae	Epidendreae	Laeliinae	*Microepidendrum subulatifolium*	AY429416	AY396137	K
Orchidoideae	Cranichideae	Spiranthinae	*Microthelys nutantiflora*		MG755126	FK
Orchidoideae	Cranichideae	Spiranthinae	*Microthelys rubrocalosa*	MF465010	MG755127	KL
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia candida*	AF350517	AF350596	A
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia clowesii*		MT518565	A
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia flavescens*	FJ565256	FJ563862	ABCD
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia phymatochila*	FJ565222	FJ563856	A
Epidendroideae	Cymbidieae	Oncidiinae	*Miltonia regnellii*	AF239395	MT518568	A
Epidendroideae	Triphoreae	Triphorinae	*Monophyllorchis maculata*	KM598427	EF065603	F
Epidendroideae	Cymbidieae	Catasetinae	*Mormodes buccinator*	KU295289		EFGK
Epidendroideae	Cymbidieae	Catasetinae	*Mormodes horichii*	MH767002	MH749007	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Muscarella aristata*	KC425842		EFGJ
Epidendroideae	Epidendreae	Pleurothallidinae	*Muscarella cabellensis*	KF747792	KP012396	EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Muscarella macroblepharis*	KC425805		FG

Epidendroideae	Epidendreae	Pleurothallidinae	*Muscarella mucronata*	KC425850		J
Epidendroideae	Epidendreae	Pleurothallidinae	*Muscarella segregatifolia*	KC425822		FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus affinis*	MT556804	MT571346	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus congestus*	MT556811	MT571354	EFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus exasperatus*	JQ306343	EU214414	ABEFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus lonchophyllus*	MN332390	MK642625	AC
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus monophyllus*	MT556827		EFGH
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus punctatus*	AF262885	AF265479	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus reymondii*		MT571338	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus ruschii*	MK642623	MK642627	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus scandens*	KY988921	KP012443	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus seidelii*	JQ306350	#MB630	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Myoxanthus serripetalus*	AF262883		EG
Epidendroideae	Epidendreae	Laeliinae	*Myrmecophila tibicinis*	AY429392	AY396099	FK
Orchidoideae	Cranichideae	Cranichidinae	*Myrosmodes cochlearis*	FJ473330		F
Orchidoideae	Cranichideae	Cranichidinae	*Myrosmodes nubigena*	FJ473332		EFGH
Orchidoideae	Cranichideae	Cranichidinae	*Myrosmodes paludosa*	FJ473333		DEFGH
Epidendroideae	Vandeae	Aeridinae	*Mystacidium gracile*	MF980228	MG250221	M
Epidendroideae	Vandeae	Aeridinae	*Mystacidium pusillum*	MF980233	MG250224	M
Epidendroideae	Epidendreae	Ponerinae	*Nemaconia glomerata*	AY008485		K
Epidendroideae	Epidendreae	Ponerinae	*Nemaconia striata*	KY239236	KY239496	FGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Neocogniauxia hexaptera*	AF260148	AF263766	J
Epidendroideae	Epidendreae	Pleurothallidinae	*Neocogniauxia monophylla*	AY008474		J
Epidendroideae	Cymbidieae	Zygopetalinae	*Neogardneria murrayana*	AY870096		A
Epidendroideae	Cymbidieae	Maxillariinae	*Neomoorea wallisii*	DQ210216	DQ210743	F
Epidendroideae	Nervilieae	Nerviliinae	*Nervilia crociformis*	MG452033	MG452067	M
Epidendroideae	Nervilieae	Nerviliinae	*Nervilia shirensis*	AF521066		M
Epidendroideae	Epidendreae	Laeliinae	*Nidema boothii*	AY008522	AY396081	FK

Epidendroideae	Cymbidieae	Oncidiinae	*Nohawilliamsia pirarensis*	FJ565418		EF
Orchidoideae	Cranichideae	Spiranthinae	*Nothostele acianthiformis*	FN868838		C
Epidendroideae	Cymbidieae	Oncidiinae	*Notylia albida*	FJ565613	FJ565105	F
Epidendroideae	Cymbidieae	Oncidiinae	*Notylia barkeri*	AF350545	AF350624	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Notylia buchtienii*	FJ565343	FJ563934	E
Epidendroideae	Cymbidieae	Oncidiinae	*Notylia ecuadorensis*	FJ565477	FJ564961	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Notylia incurva*	JN189790		FG
Epidendroideae	Cymbidieae	Oncidiinae	*Notylia pittieri*	FJ565181	FJ564701	F
Epidendroideae	Cymbidieae	Oncidiinae	*Notylia venezuelana*	EF079397	EF079193	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria alexandri*			A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria anceps*	#TFS324	#TFS324	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria costaricensis*	KY988925	KY988733	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria decumbens*	#TFS287	#TFS287	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria diaphana*			A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria fimbriata*			A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria gracilis*	MN332392	AF265484	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria grandiflora*	MN332393	MN332564	ACEF
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria juncifolia*	MK294812	#ECS922	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria linearifolia*			A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria lithophila*	AF262912		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria palmyrabellae*			A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria pusilla*	#TFS294	#TFS294	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria rotundiglossa*			A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria stellaris*			A
Epidendroideae	Epidendreae	Pleurothallidinae	*Octomeria tricolor*			A
Orchidoideae	Cranichideae	Spiranthinae	*Odontorrhynchus chilensis*	AF348047		J
Epidendroideae	Epidendreae	Laeliinae	*Oestlundia cyanocolumna*	AY429418	AY396139	K
Epidendroideae	Epidendreae	Laeliinae	*Oestlundia distantiflora*	AY429387	AY425803	K

Epidendroideae	Epidendreae	Laeliinae	*Oestlundia luteorosea*	AY429414	AY396135	K
Epidendroideae	Cymbidieae	Oncidiinae	*Oliveriana brevilabia*	FJ565321	FJ564814	EFG
Epidendroideae	Cymbidieae	Oncidiinae	*Oliveriana ecuadorensis*	FJ565404		F
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium altissimum*	FJ565295	FJ563914	JKL
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium aurarium*		FJ564846	DEH
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium baueri*	FJ565534	FJ565017	AEFG
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium cheirophorum*	AF350828		FK
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium cultratum*	FJ565533	FJ565016	EFGH
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium dactyliferum*	FJ565246	FJ564757	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium ensatum*	AF350829	FJ563919	FJKL
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium fuscatum*	FJ565205	FJ563921	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium gramineum*	FJ565500	FJ564984	EFG
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium hastatum*	AF350812	FJ564787	K
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium heteranthum*	FJ565537	FJ565020	EFGH
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium hintonii*	FJ565547	FJ565030	K
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium incurvum*	AF350823		K
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium isthmi*	FJ565296	FJ565026	FL
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium lineoligerum*			FGHK
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium maculatum*	AF350806	FJ563917	K
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium ornithorhynchum*	AF239400	MT518589	FGK
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium parviflorum*		EU214418	FG
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium poikilostalix*	AF350832	AF350651	FGK
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium reflexum*	JQ319730	FJ564735	K
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium schroederianum*	FJ565443	FJ564937	F
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium stenoglossum*	FJ565201	FJ563844	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Oncidium toachicum*	AF350826	FJ563852	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Ophidion carrilloi*	MK294817	MK258045	G
Epidendroideae	Epidendreae	Pleurothallidinae	*Ophidion pleurothallopsis*	KC425746	KP012495	EF

Epidendroideae	Epidendreae	Pleurothallidinae	*Opilionanthe manningii*	MK306372	MK306415	H
Epidendroideae	Epidendreae	Laeliinae	*Orleanesia mineirosensis*	MF669946	MF669955	C
Epidendroideae	Epidendreae	Laeliinae	*Orleanesia pleurostachys*		AY425800	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Ornithocephalus bicornis*	FJ565564	FJ565049	EFGK
Epidendroideae	Cymbidieae	Oncidiinae	*Ornithocephalus caveroi*	KX687830		EH
Epidendroideae	Cymbidieae	Oncidiinae	*Ornithocephalus ciliatus*		FJ565046	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Ornithocephalus cujeticola*	KX687832		E
Epidendroideae	Cymbidieae	Oncidiinae	*Ornithocephalus gladiatus*	MZ575596	MW256499	BEFGK
Epidendroideae	Cymbidieae	Oncidiinae	*Ornithocephalus kruegeri*	DQ315826		EF
Epidendroideae	Cymbidieae	Oncidiinae	*Ornithocephalus myrticola*	DQ315827	FJ564834	AC
Epidendroideae	Cymbidieae	Oncidiinae	*Ornithocephalus polyodon*	FJ565565	FJ565050	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Ornithocephalus suarezii*	FJ565560	FJ565045	E
Epidendroideae	Cymbidieae	Oncidiinae	*Otoglossum candelabrum*	FJ565610	FJ565100	EFG
Epidendroideae	Cymbidieae	Oncidiinae	*Otoglossum globuliferum*	FJ565373	FJ565119	EFG
Epidendroideae	Cymbidieae	Zygopetalinae	*Pabstia jugosa*	AY870098		A
Epidendroideae	Cymbidieae	Zygopetalinae	*Pabstia viridis*	AY870090		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella arcuata*	MN551423	MN577730	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella aryter*	JF934816	JF934876	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella aurantiaca*	JQ306357		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella biriricensis*	JQ306463	#ALVTB3371	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella bradei*	MN551426		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella calcarata*	MN551427	MN577734	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella calimanii*	MN551428	MN577735	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella carinifera*	MN551429	MN577736	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella castellensis*	JQ306484		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella colorata*	MN551431	MN577738	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella conceicionensis*	JQ306470	MN577739	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella crassicaulis*	MN551432	MN577740	A

Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella decurva*	MN551434	MN577742	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella determannii*	MN551435	MN577743	EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella ephemera*	MN551437	MN577745	AE
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella eunapolitana*	MN551438	MN577746	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella fasciata*	MN551440	MN577748	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella fragae*	MN551441	MN577749	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella fusca*	MN551442	MN577750	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella ghillanyi*	MN551443	MN577751	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella gracilicaulis*	MN551444	MN577752	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella juquitibensis*	MN551446	MN577754	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella leucopyramis*	MN551447	MN577755	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella lineolata*	MN551448	MN577756	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella lingua*	MN551449	MN577757	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella lueriana*	MN551450	MN577758	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella matinhensis*	MN551451	MN577759	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella mirabilis*	MN332394	MN332565	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella miragliae*	MN551452	MN577760	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella muricatifolia*	MN551453	MN577761	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella nymphalis*	MN551454	MN577762	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella pellifeloidis*	JQ306476	#RMP06	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella piraquarensis*	MN551455	MN577763	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella pristeoglossa*	MN551456		AC
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella pseudotrifida*	MN551457	MN577765	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella punctatifolia*	MN551458	MN577766	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella purpurea*	MN551459	MN577767	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella quadridentata*	MN551424	MN577731	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella quasi*	MN551460	MN577768	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella recurviloba*	MN551461	MN577769	A

Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella rhombilabia*	JQ306488	MN577770	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella ribeironensis*	LT574825		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella rubrolineata*	MN551462	MN577771	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella rupicola*	MN551463	MN577772	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella ruschii*	MN551464		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella seriata*	JQ306464	KJ472337	ADE
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella sordida*	MN551465	MN577774	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella teschiana*	JQ306480		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella tricolor*	JQ306429		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella trifida*	MN551466	MN577775	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella tripterantha*	MN551467	MN577776	ACEFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella truncicola*	JQ306391		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella uniflora*	JQ306469		ABCEF
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella varellae*	MN551468	MN577777	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella verboonenii*	MN551469	MN577778	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella versicolor*	MN551470	MN577779	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella villosisepala*	MN551471	MN577780	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella wacketii*	MN551472	MN577781	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella wawraeana*	JQ306408		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pabstiella yauaperyensis*	MN332395	MN332566	CE
Orchidoideae	Orchideae	Disinae	*Pachites appressus*	KX673557	KX673562	M
Orchidoideae	Orchideae	Disinae	*Pachites bodkinii*	MT500610	MT533515	M
Epidendroideae	Neottieae	-	*Palmorchis powellii*		EU490697	F
Epidendroideae	Neottieae	-	*Palmorchis trilobulata*	KM598431		F
Epidendroideae	Cymbidieae	Stanhopeinae	*Paphinia cristata*	EU441207	KF660271	EF
Epidendroideae	Cymbidieae	Stanhopeinae	*Paphinia herrerae*		MT518598	FG
Epidendroideae	Cymbidieae	Stanhopeinae	*Paphinia neudeckeri*	AF239375		FG
Epidendroideae	Cymbidieae	Zygopetalinae	*Paradisanthus bahiensis*	AY870107	AY870008	A

Orchidoideae	Cranichideae	Spiranthinae	*Pelexia adnata*	AJ539501		EFKLM
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia bonariensis*	MF464958	MG755132	ACD
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia congesta*	MF464966	MG755133	L
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia ekmanii*	KX421945	KX421994	ACD
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia funckiana*	MF464967	MG755139	FL
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia goninensis*	MF464964	MG755136	AE
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia gutturosa*	MF464962	MG755137	K
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia hirta*	MF464960	MG755138	EFG
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia incurvidens*	KX421946		A
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia laminata*	KX421948	#JK37	A
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia lindmanii*	MF464963	MG755141	A
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia macropoda*	KX421954	KX422005	A
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia maculata*	MF464969	MG755142	EF
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia minarum*	MG738360	MG755143	B
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia novofriburgensis*	KX421953	KX422004	ACE
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia obliqua*		MG755116	FK
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia oestrifera*	KX421949	KX421998	ABCE
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia olivacea*	MF464970	MG755144	FL
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia orobanchoides*	MG460387	MG460452	ACE
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia orthosepala*	KX421950	MG755145	ABCE
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia paludosa*		KX422001	D
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia parva*	KX421952	KX422002	A
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia pterygantha*	KX421943	KX421992	ACE
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia sancta*		KX421972	A
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia ventricosa*	MG460389	MG460454	ABCD
Orchidoideae	Cranichideae	Spiranthinae	*Pelexia weberbaueri*	EF079169	EU395448	E
Epidendroideae	Epidendreae	Pleurothallidinae	*Pendusalpinx dependens*	JQ306456		EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Pendusalpinx patula*	MK294843	MK258066	EF

Epidendroideae	Epidendreae	Pleurothallidinae	*Pendusalpinx vasquezii*	MK306377		H
Epidendroideae	Cymbidieae	Coeliopsidinae	*Peristeria cerina*	MH766996	MH749011	E
Epidendroideae	Cymbidieae	Coeliopsidinae	*Peristeria elata*	MF349114	MF349960	FG
Epidendroideae	Cymbidieae	Zygopetalinae	*Pescatoria cerina*	AY870051	EU214423	F
Epidendroideae	Cymbidieae	Zygopetalinae	*Pescatoria lehmannii*	AF239326	EF079240	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Phloeophila nummularia*		KP012380	AF
Epidendroideae	Epidendreae	Pleurothallidinae	*Phloeophila pelecaniceps*	AF262810	AF265450	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Phloeophila peperomioides*	AF275690	AF291103	FK
Cypripedioideae	-	-	*Phragmipedium besseae*	JQ660884	JQ660908	F
Cypripedioideae	-	-	*Phragmipedium boissierianum*	AY643424	MT518668	EF
Cypripedioideae	-	-	*Phragmipedium caricinum*	AY918822	AY918830	E
Cypripedioideae	-	-	*Phragmipedium caudatum*	AY643429		EFGK
Cypripedioideae	-	-	*Phragmipedium fischeri*		MT518671	G
Cypripedioideae	-	-	*Phragmipedium hirtzii*		MT518672	F
Cypripedioideae	-	-	*Phragmipedium humboldtii*	FR720329	JQ182195	FK
Cypripedioideae	-	-	*Phragmipedium klotzschianum*	MF785383		E
Cypripedioideae	-	-	*Phragmipedium kovachii*	AY918818	AY918826	E
Cypripedioideae	-	-	*Phragmipedium lindenii*	AY643430		FG
Cypripedioideae	-	-	*Phragmipedium lindleyanum*	EF156164	JN181453	E
Cypripedioideae	-	-	*Phragmipedium longifolium*	AY918823	AY557204	EFG
Cypripedioideae	-	-	*Phragmipedium pearcei*	AY918824		EG
Cypripedioideae	-	-	*Phragmipedium sargentianum*	AY643427	MT518677	A
Cypripedioideae	-	-	*Phragmipedium schlimii*	JQ929360	EU490702	FG
Cypripedioideae	-	-	*Phragmipedium warszewiczianum*	Z78512	AJ581442	FG
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium aquinoi*	KT709687	KR709308	A
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium delicatulum*	KT709688	KR709309	A
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium falcifolium*	DQ315834	FJ563942	A
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium geiselii*	KT709684	KR709315	A

Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium hysteranthum*	KT709690	KT728405	A
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium mellobarretoi*	KT709692	KR709311	A
Epidendroideae	Cymbidieae	Oncidiinae	*Phymatidium microphyllum*	KT709695	KT728406	A
Orchidoideae	Cranichideae	Spiranthinae	*Physogyne gonzalezii*	LT600855	LT600872	K
Orchidoideae	Orchideae	Orchidinae	*Platycoryne buchananiana*	MT500587	MT533491	M
Orchidoideae	Orchideae	Orchidinae	*Platycoryne crocea*	MT500614	MT533519	M
Epidendroideae	Cymbidieae	Oncidiinae	*Platyrhiza quadricolor*	KX687840	MZ575610	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Platystele acicularis*	KF747778	KP012383	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Platystele aurea*	KC425762		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Platystele caudatisepala*	KP012492	KP012385	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Platystele lancilabris*	KP012493	KP012386	EFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Platystele misera*	AF262823	AF265470	EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Platystele ovatilabia*	KC425753		FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Platystele oxyglossa*	MN332397	MN332568	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Platystele schmidtchenii*	KF747786	MT518689	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Platystele stenostachya*	KC425757	EF079326	EFGKL
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis bowmanni*	MN551425	MN577732	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis discoidea*	JQ306401	KJ472364	EFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis fantastica*	KC425761		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis gomezii*	MN551475	MN577785	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis gratiosa*	KY988942	KY988750	FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis inornata*	KY988944	KY988752	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis loranthophylla*	MN332399		DEFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis nuda*	AF262874		EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis quadrifida*	JF934819	EU214429	FJK
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis racemiflora*		AY396076	FJKL
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis restrepioides*	JF934825	JF934856	FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis ruscifolia*	AF262836		ABEFGJKL

Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis scoparum*	KY988952	KY988759	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis sijmii*	JQ995335		H
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis silverstonei*	KY988953	KY988761	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis talpinaria*	AF262840		EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallis xanthochlora*	MK294824		EFGH
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallopsis microptera*	KY988958	KY988765	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Pleurothallopsis reichenbachiana*	KY988959	KY988766	K
Epidendroideae	Vandeae	Angraecinae	*Podangis dactyloceras*	DQ091628	DQ091385	M
Epidendroideae	Vandeae	Angraecinae	*Podangis rhipsalisocia*	DQ091629	MK685566	M
Epidendroideae	Cymbidieae	Stanhopeinae	*Polycycnis aurita*	AF239372		F
Epidendroideae	Cymbidieae	Stanhopeinae	*Polycycnis escobariana*		MH749012	E
Epidendroideae	Cymbidieae	Stanhopeinae	*Polycycnis lepida*	AF239373		F
Epidendroideae	Cymbidieae	Stanhopeinae	*Polycycnis muscifera*		EU214431	EFK
Epidendroideae	Vandeae	Polystachyinae	*Polystachya albescens*	KF672219	KF672259	M
Epidendroideae	Vandeae	Polystachyinae	*Polystachya concreta*	JN114696	JN004592	ABCDEFGJKLM
Epidendroideae	Vandeae	Polystachyinae	*Polystachya dolichophylla*	GU556646	GQ145128	M
Epidendroideae	Vandeae	Polystachyinae	*Polystachya foliosa*	GU556690	GQ145135	ABCDEFGJK
Epidendroideae	Vandeae	Polystachyinae	*Polystachya golungensis*	GU556655	GQ145142	M
Epidendroideae	Vandeae	Polystachyinae	*Polystachya modesta*	DQ091562	OK930075	M
Epidendroideae	Vandeae	Polystachyinae	*Polystachya odorata*	GU556664	GQ145164	M
Epidendroideae	Vandeae	Polystachyinae	*Polystachya paniculata*	HM018551	HM018558	M
Epidendroideae	Vandeae	Polystachyinae	*Polystachya pinicola*	GU556668	GQ145174	E
Epidendroideae	Vandeae	Polystachyinae	*Polystachya seticaulis*	GU556671	GQ145186	M
Epidendroideae	Epidendreae	Ponerinae	*Ponera exilis*	AF260144	AF263763	K
Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva brittoniae*	AM419787	AM900822	JKL
Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva elata*	AM419792	AM900824	G
Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva ephippium*	AM419789		FK
Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva fertilis*	AJ000137		EFG

Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva formosa*	AM419793	AM900828	FK
Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva mandonii*	JQ045487	GQ917039	CDEH
Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva mexicana*	AM419790	AM900825	JK
Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva racemosa*	AJ539508	EU214184	EFGJKL
Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva triloba*	AM419788	AM900823	K
Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva trilobata*	AM901013	AM901011	K
Orchidoideae	Cranichideae	Cranichidinae	*Ponthieva tuerckheimii*	AM419794		FK
Orchidoideae	Cranichideae	Cranichidinae	*Porphyrostachys parviflora*	FJ473338		H
Orchidoideae	Cranichideae	Cranichidinae	*Porphyrostachys pilifera*	FJ473339	AJ543942	EFGH
Epidendroideae	Epidendreae	Pleurothallidinae	*Porroglossum eduardi*	MK294826	MK258053	FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Porroglossum oversteegenianum*	KY988963		FG
Orchidoideae	Cranichideae	Cranichidinae	*Prescottia cordifolia*	AM419772	AM900807	F
Orchidoideae	Cranichideae	Cranichidinae	*Prescottia oligantha*	FJ473342		ABCDEFGJKL
Orchidoideae	Cranichideae	Cranichidinae	*Prescottia petiolaris*	AM419771	AM900806	EF
Orchidoideae	Cranichideae	Cranichidinae	*Prescottia plantaginifolia*	AJ539511	AJ543939	ABC
Orchidoideae	Cranichideae	Cranichidinae	*Prescottia stachyodes*	AM419773	MN597433	ABCEFGJKL
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea ovatiloba*	AY870100	AY368428	A
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea riograndensis*		MT518729	A
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea rollissonii*	#WSM1193	MT362766	A
Epidendroideae	Cymbidieae	Zygopetalinae	*Promenaea xanthina*	AY870099		A
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea abbreviata*	AF260181	EU214434	FK
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea aemula*	AY008544	AY396125	ABCEFG
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea allemanii*	AY008535		A
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea boothiana*		MT518731	JKL
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea calamaria*	AY008539		ABEK
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea campylostalix*		EU214435	F
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea chacaoensis*		EU214436	FK
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea chimborazoensis*		AY396123	F

Epidendroideae	Epidendreae	Laeliinae	*Prosthechea cochleata*	AY008545	AY396126	EFJKL
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea fausta*	AY008536		A
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea fragrans*	AY429408	AY396124	ABEFGJK
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea lambda*	AY008542		G
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea livida*	KM385613		FGK
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea ochracea*	AY429412	AY396133	FK
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea pseudopygmaea*	AY429409	AY396128	FK
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea pygmaea*		AY396127	ABEFJK
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea squalida*	AY008537		K
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea suzanensis*	AY008538		A
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea varicosa*	KM385614		FK
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea venezuelana*	AY008540		EF
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea vespa*		#EC590	ABCEFGHJKL
Epidendroideae	Epidendreae	Laeliinae	*Prosthechea widgrenii*	AY008543		ACE
Orchidoideae	Cranichideae	Cranichidinae	*Pseudocentrum sylvicola*		MW498858	EFG
Orchidoideae	Cranichideae	Spiranthinae	*Pseudogoodyera wrightii*	LT600854	LT600871	JK
Epidendroideae	Epidendreae	Laeliinae	*Pseudolaelia canaanensis*	AF260167	AF263746	A
Epidendroideae	Epidendreae	Laeliinae	*Pseudolaelia cipoensis*	AY008491		A
Epidendroideae	Epidendreae	Laeliinae	*Pseudolaelia citrina*	AY008493		A
Epidendroideae	Epidendreae	Laeliinae	*Pseudolaelia dutrae*	AY008494		A
Epidendroideae	Epidendreae	Laeliinae	*Pseudolaelia geraensis*	AY008495		A
Epidendroideae	Epidendreae	Laeliinae	*Pseudolaelia vellozicola*	AY008490	AY121748	AC
Epidendroideae	Epidendreae	Laeliinae	*Psychilis krugii*	AF260157	AF263772	J
Epidendroideae	Epidendreae	Laeliinae	*Psychilis macconnelliae*	AY008568	AY396091	J
Epidendroideae	Cymbidieae	Oncidiinae	*Psychopsiella limminghei*	FJ565459	FJ563961	A
Epidendroideae	Cymbidieae	Oncidiinae	*Psychopsis krameriana*		MT518733	F
Epidendroideae	Cymbidieae	Oncidiinae	*Psychopsis papilio*	AF239405		FGL
Epidendroideae	Cymbidieae	Oncidiinae	*Psychopsis sanderae*	FJ565198	FJ564712	E

Orchidoideae	Cranichideae	Cranichidinae	*Pterichis galeata*	AM419796	AM900831	EFGH
Orchidoideae	Cranichideae	Cranichidinae	*Pterichis triloba*	FJ473346	AM900830	EFGH
Orchidoideae	Cranichideae	Spiranthinae	*Pteroglossa acalcarata*		MF179018	H
Orchidoideae	Cranichideae	Spiranthinae	*Pteroglossa euphlebia*	MF464945	MG755149	A
Orchidoideae	Cranichideae	Spiranthinae	*Pteroglossa glazioviana*	MF464944	MF179017	A
Orchidoideae	Cranichideae	Spiranthinae	*Pteroglossa macrantha*	MF464943	MF179016	ACD
Orchidoideae	Cranichideae	Spiranthinae	*Pteroglossa roseoalba*	FN868839	EF065578	ABCDFHK
Epidendroideae	Cymbidieae	Oncidiinae	*Pterostemma antioquiense*	FJ565396	FJ563948	F
Epidendroideae	Cymbidieae	Oncidiinae	*Pterostemma benzingii*	FJ565612	FJ565102	EF
Orchidoideae	Orchideae	Coryciinae	*Pterygodium caffrum*	HQ438195	HQ438199	M
Orchidoideae	Orchideae	Coryciinae	*Pterygodium vermiferum*	HQ438198	HQ438202	M
Orchidoideae	Cranichideae	Spiranthinae	*Quechua glabrescens*	HE575516	HE575503	E
Epidendroideae	Epidendreae	Laeliinae	*Quisqueya ekmanii*	AY008567		J
Epidendroideae	Cymbidieae	Oncidiinae	*Rauhiella seehaweri*	MZ575597	MW256501	A
Epidendroideae	Cymbidieae	Oncidiinae	*Rauhiella silvana*	KX687842		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Restrepia chocoensis*	MK294828	MK258055	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Restrepia elegans*	MN332401	MN332572	EFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Restrepia muscifera*	AF262908	EU214438	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Restrepiella ophiocephala*	AF262909	AY396075	K
Epidendroideae	Epidendreae	Pleurothallidinae	*Restrepiella ovatipetala*	MK679810	MK679811	A
Epidendroideae	Vandeae	Angraecinae	*Rhipidoglossum millarii*	DQ091579	MK685651	M
Epidendroideae	Vandeae	Angraecinae	*Rhipidoglossum pulchellum*	MF980240	MK685570	M
Epidendroideae	Epidendreae	Laeliinae	*Rhyncholaelia digbyana*	AF260221	AF263822	K
Epidendroideae	Epidendreae	Laeliinae	*Rhyncholaelia glauca*	AY008584	AY396101	K
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia arevaloi*	FJ565331		ABEFG
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia batemanii*	FJ565491	FJ564975	E
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia bracteata*		FJ564813	ABEFG
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia chasei*	FJ565470		F

Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia decora*		EF079199	ABCE
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia delcastilloi*	AF350543		EH
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia lanceolata*	MF785358	AF350621	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia leeana*	FJ565544	FJ565027	F
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia lehmannii*	FJ565555	FJ565040	F
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia pulchra*	FJ565476	FJ564960	FG
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia satipoana*	AF350544		E
Epidendroideae	Cymbidieae	Oncidiinae	*Rodriguezia venusta*	FJ565318	#MMR	A
Orchidoideae	Orchideae	Orchidinae	*Roeperocharis wentzeliana*	MT500678	MT533583	M
Epidendroideae	Cymbidieae	Oncidiinae	*Rossioglossum ampliatum*	EF065706	FJ563834	EFK
Epidendroideae	Cymbidieae	Oncidiinae	*Rossioglossum beloglossum*	FJ565228	FJ564740	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Rossioglossum schlieperianum*	FJ565191	FJ563837	FK
Epidendroideae	Cymbidieae	Maxillariinae	*Rudolfiella aurantiaca*	MZ268398	MZ334608	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Rudolfiella floribunda*	DQ210394	DQ210881	EF
Orchidoideae	Cranichideae	Spiranthinae	*Sacoila hassleri*	MG460391	MG460458	ABCDE
Orchidoideae	Cranichideae	Spiranthinae	*Sacoila lanceolata*	MG460392	MG460459	ABCDEFGJKL
Epidendroideae	Cymbidieae	Oncidiinae	*Sanderella riograndensis*	MK302266	MK302272	A
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis acaulis*	KJ472390	KJ472359	ABCDEFK
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis biflora*	MG460394	MG518229	AC
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis curvisepala*	MF464974	MG755155	ABCE
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis fasciculata*	MF464978	MG755156	ABC
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis grandiflora*	MF464973	MG755157	ABDEFK
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis homalogastra*	MG460395	MG460461	ACE
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis lobata*	MF464981	MG755158	K
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis neglecta*		EF079292	EF
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis pauciflora*	MF464985	MG755154	K
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis portillae*	EF079167		F
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis riocontensis*	MF464977	MG755160	B

Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis sceptrodes*	MF464975	MG755162	K
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis schwackei*	KX421918	MG460462	ABC
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis smithii*	MF464982	MG755165	FK
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis uliginosa*	KX421921	MG460463	ACE
Orchidoideae	Cranichideae	Spiranthinae	*Sarcoglottis ventricosa*	MF464972	#ECS956	A
Orchidoideae	Orchideae	Orchidinae	*Satyrium cristatum*	AY704986	EF612552	M
Orchidoideae	Orchideae	Orchidinae	*Satyrium orbiculare*	AY704993	EF612578	M
Orchidoideae	Cranichideae	Spiranthinae	*Sauroglossum andinum*		MW498872	DF
Orchidoideae	Cranichideae	Spiranthinae	*Sauroglossum aurantiacum*	KR608069	KR608068	E
Orchidoideae	Cranichideae	Spiranthinae	*Sauroglossum corymbosum*	MF464953	MG755168	E
Orchidoideae	Cranichideae	Spiranthinae	*Sauroglossum elatum*	KX421916	HG425365	ACD
Epidendroideae	Epidendreae	Pleurothallidinae	*Scaphosepalum breve*	MH762940	MT362768	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Scaphosepalum gibberosum*	AF262817	AF265458	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Scaphosepalum ursinum*	EF079365	EF079325	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Scaphosepalum verrucosum*	KC425767	KP012505	EFG
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis aurea*		EU214517	F
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis bidentata*	AF260162	AF263774	EFGK
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis boliviensis*	AY008553	EU214447	EFGK
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis confusa*	AY174755	EU214449	FK
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis crurigera*		AF263785	FK
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis cuniculata*	AY008551	AY396084	F
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis fusiformis*	KJ472400	EU214455	ABEFG
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis graminifolia*	AY008556		EFGK
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis imbricata*	AY008549	AY396083	EFK
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis lindeniana*	AY008558	EU214463	EFK
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis livida*	AY174717		ABCEFK
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis modesta*	AY174756		ABEFJ
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis prolifera*	AY174719	JQ588561	ABCEFGKL

Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis punctulata*	AF260182	EU214528	EFGH
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis reflexa*	AY174753		AEF
Epidendroideae	Epidendreae	Laeliinae	*Scaphyglottis stellata*	AY174734	EU214477	EFG
Orchidoideae	Cranichideae	Spiranthinae	*Schiedeella llaveana*	KU752295	KU752270	K
Orchidoideae	Cranichideae	Spiranthinae	*Schiedeella nagelii*	MK309837	MK310242	K
Orchidoideae	Cranichideae	Spiranthinae	*Schiedeella saltensis*	FN641867		K
Orchidoideae	Cranichideae	Spiranthinae	*Schiedeella tenella*	MK309838	MK310243	L
Orchidoideae	Cranichideae	Spiranthinae	*Schiedeella williamsiana*	MK309839	MK310244	K
Epidendroideae	Cymbidieae	Stanhopeinae	*Schlimia alpina*		KF660274	FG
Epidendroideae	Cymbidieae	Stanhopeinae	*Schlimia stevensonii*	AF239367		G
Epidendroideae	Cymbidieae	Oncidiinae	*Schunkea vierlingii*	FJ565340	FJ563933	A
Epidendroideae	Cymbidieae	Maxillariinae	*Scuticaria hadwenii*	MZ268399	MZ334609	A
Epidendroideae	Cymbidieae	Maxillariinae	*Scuticaria salesiana*	DQ210385	DQ210875	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Scuticaria steelei*	MZ268400	MZ334610	EF
Epidendroideae	Cymbidieae	Maxillariinae	*Scuticaria strictifolia*	MZ736845		A
Epidendroideae	Cymbidieae	Oncidiinae	*Seegeriella pinifolia*	EF079398	EF079189	E
Cypripedioideae	-	-	*Selenipedium aequinoctiale*	JF825977	JN181456	F
Cypripedioideae	-	-	*Selenipedium chica*		AY368381	EF
Epidendroideae	Cymbidieae	Stanhopeinae	*Sievekingia suavis*	KM458410	KM458428	FK
Orchidoideae	Cranichideae	Spiranthinae	*Skeptrostachys balanophorostachya*	KF548544	KF548546	ACD
Orchidoideae	Cranichideae	Spiranthinae	*Skeptrostachys congestiflora*	MF464950	MG755169	AB
Orchidoideae	Cranichideae	Spiranthinae	*Skeptrostachys gigantea*	MF464951		C
Orchidoideae	Cranichideae	Spiranthinae	*Skeptrostachys paraguayensis*	MF464949	MG755170	AD
Epidendroideae	Sobralieae	-	*Sobralia abadiorum*	HM854663		E
Epidendroideae	Sobralieae	-	*Sobralia candida*	HM854650	HQ329057	AEFG
Epidendroideae	Sobralieae	-	*Sobralia cobanensis*	KF612993	KF700347	K
Epidendroideae	Sobralieae	-	*Sobralia crocea*	EU490672	KF700342	EFG
Epidendroideae	Sobralieae	-	*Sobralia decora*	KF612994	KF700348	EFK

Epidendroideae	Sobralieae	-	*Sobralia ecuadorana*	KF612987	MW498866	FG
Epidendroideae	Sobralieae	-	*Sobralia fimbriata*	HM854631	HQ329056	EF
Epidendroideae	Sobralieae	-	*Sobralia fragrans*	KF612997	EU214486	EFGK
Epidendroideae	Sobralieae	-	*Sobralia gloriosa*	MG008688		EFG
Epidendroideae	Sobralieae	-	*Sobralia klotzscheana*	HM854643	HQ329049	EFG
Epidendroideae	Sobralieae	-	*Sobralia lancea*	KT923844	KT428837	F
Epidendroideae	Sobralieae	-	*Sobralia macrantha*	HM854639	OL690167	FK
Epidendroideae	Sobralieae	-	*Sobralia macrophylla*	KT923840	KT428833	EFG
Epidendroideae	Sobralieae	-	*Sobralia mucronata*	KF612996	KF700350	FK
Epidendroideae	Sobralieae	-	*Sobralia portillae*	HM854627	HQ329033	G
Epidendroideae	Sobralieae	-	*Sobralia powellii*	HM854654	HQ329061	FK
Epidendroideae	Sobralieae	-	*Sobralia rosea*	KT923827	KT428821	EFG
Epidendroideae	Sobralieae	-	*Sobralia sessilis*	MW628177	MZ170070	ABCEF
Epidendroideae	Sobralieae	-	*Sobralia violacea*	KT923831	KT428825	EFG
Epidendroideae	Sobralieae	-	*Sobralia virginalis*	KF612983	KT428829	EF
Epidendroideae	Sobralieae	-	*Sobralia warszewiczii*	KT923838	KT428831	FK
Epidendroideae	Sobralieae	-	*Sobralia wilsoniana*	KT923837	KT428830	FK
Epidendroideae	Sobralieae	-	*Sobralia withneri*	KT923839	KT428832	E
Epidendroideae	Sobralieae	-	*Sobralia yauaperyensis*	HM854621	HQ329027	DEFG
Epidendroideae	Vandeae	Angraecinae	*Solenangis clavata*	DQ091666	DQ091409	M
Epidendroideae	Vandeae	Angraecinae	*Solenangis scandens*	MW435899	MK722038	M
Epidendroideae	Cymbidieae	Oncidiinae	*Solenidium lunatum*	FJ565359	FJ563940	E
Epidendroideae	Cymbidieae	Oncidiinae	*Solenidium portillae*	FJ565472	FJ564956	G
Orchidoideae	Cranichideae	Spiranthinae	*Sotoa confusa*	FN641865	HE575506	K
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia acanthodes*	KF747842		E
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia acrisepala*	KC425768		FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia barbosana*	#WSM1310	#WSM1310	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia brighamii*	KC425773	KY988772	FGJK

Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia costaricensis*	AF262862		EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia gracillima*	KC425793		FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia grobyi*	AF262860		ABDEFGHJKL
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia marginalis*	MN551478		ABCD
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia morganii*	KF747817	KP012415	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia recula*	KF747823	KP012416	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia subpicta*	JQ306389	#DCI365	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia trichyphis*	KC425854		J
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia viridiflora*		#ALVTB3693	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Specklinia wrightii*	KC425855	MG755173	J
Orchidoideae	Cranichideae	Spiranthinae	*Spiranthes graminea*	MG738361	MG755173	K
Orchidoideae	Cranichideae	Spiranthinae	*Spiranthes nebulorum*	HE575517		K
Orchidoideae	Cranichideae	Spiranthinae	*Spiranthes torta*	KM262393		FJKL
Orchidoideae	Cranichideae	Spiranthinae	*Spiranthes vernalis*	EU384872	EU490711	JKL
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea anfracta*	AF239354	MT518785	EF
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea candida*		MT518787	E
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea ecornuta*	AF239349		FK
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea frymirei*		MT518795	FG
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea gibbosa*		MT518796	FGK
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea insignis*		KM458431	A
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea intermedia*	MH766975	MT518800	K
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea jenischiana*	FJ565637	FJ565129	FH
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea lietzei*		MT518804	AD
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea nicaraguensis*		MT518805	K
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea nigripes*	MH766968	MH749014	E
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea posadae*		MT518811	G
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea saccata*	AF239351	EU214196	G
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea saccata*	AF239351	EU214196	K

Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea wardii*	AF239350	EU214490	FK
Epidendroideae	Cymbidieae	Stanhopeinae	*Stanhopea warszewicziana*		MT518827	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis adrianae*	JQ995340	MT518831	G
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis alajuelensis*	JF934810	JF934870	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis allenii*	JQ995342	KY988780	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis alta*	JF934804	JF934865	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis antillensis*	JF934818		J
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis aprica*	MN332407		ABCEFJK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis argentata*	KJ472398	KJ472345	AEFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis atroviolacea*	AF262879		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis atwoodii*	JQ995343	KY988781	K
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis aurea*	MN332328	MN332508	EFGH
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis bivalvis*		MT518833	G
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis carnosilabia*	JF934807	EU214425	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis carnosula*	JQ306412		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis carpinterae*	JF934796	JF934857	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis chlorantha*		#MLK192	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis ciliaris*	AF262927	MN332580	EFK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis cobanensis*	JQ995344		K
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis conochila*	KY988976	KY988783	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis convallaria*	JF934791	JF934851	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis cylindrata*	JQ995345	KY988784	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis cylindrica*	MF349139	MF349928	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis deregularis*	JF934771	MN332553	ABEFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis despectans*	JF934761	JF934831	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis dimidia*	KY988977	KY988785	EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis dracontea*		EU214426	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis dressleri*	JF934759	JF934829	F

Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis eublepharis*	MN551479	MN577789	FGH
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis ferrelliae*	JQ995347	KY988786	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis galeata*	JQ995348	KY988787	FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis gelida*	JF934780	JF934844	EFGJK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis gemma*	AF262880		FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis gigantea*	AF262843	AF265461	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis glomerosa*	JQ995349		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis glossula*	JF934766		FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis grandiflora*	MN332410	MN332581	AEFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis gunningiana*	MN551445	MN577753	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis harlingii*	AF262846	AF265465	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis immersa*	AF262828	EU214427	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis intermedia*	JQ306502		ACE
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis kareniae*	JF934769	JF934834	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis kefersteiniana*	JQ995350		EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis lanata*	AF262881		FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis lankesteri*	JQ995353	KY988788	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis lennartii*	JF934777	JF934841	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis listerophora*	JF934785	JF934846	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis megachlamys*	JF934806	JF934867	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis microchila*	JF934757	JF934827	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis montis-mortensis*	KC425741		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis montserratii*	JQ306493	MW375125	ABCE
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis morae*	JF934768		K
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis multirostris*	JQ995354	KY988789	J
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis mystax*	AF262876	JF934855	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis nexipous*	JQ995356	MK258061	FGH
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis ornata*	JF934756		K

Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis pachyglossa*	JQ995359	KC425865	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis papaquerensis*	JQ306416		ADE
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis papillifera*	JF934811	JF934871	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis pardipes*	JF934765		FGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis parvula*	JQ306420		FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis pauciflora*	JQ306422		ACF
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis peliochyla*	JQ306417		A
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis pidax*	KY988979		F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis pilosa*	AF262831	AF265467	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis piperina*		MW498847	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis platystylis*	JQ995360		FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis poasensis*	JF934774	JF934838	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis pulchella*	JF934772	JF934836	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis pusilla*		MW498967	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis rodrigoi*	AF262829	AF265460	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis rubens*	FR837533	FR837536	K
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis rufobrunnea*	JF934754		K
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis ruprechtiana*	MN332412	MN332583	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis sclerophylla*	MN332368	MN332543	ABCEFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis segoviensis*	AF262866	KY988790	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis superbiens*	JF934750		EFGHK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis tenuissima*	JF934752		K
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis velaticaulis*	AF262847	AF302646	EFHJ
Epidendroideae	Epidendreae	Pleurothallidinae	*Stelis wercklei*	KY988982		FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Stellamaris pergrata*	MK306383	MK306421	F
Epidendroideae	Cymbidieae	Zygopetalinae	*Stenia bismarckii*	AY870019	EF079241	EF
Epidendroideae	Cymbidieae	Zygopetalinae	*Stenia calceolaris*	AY870018		F
Epidendroideae	Cymbidieae	Zygopetalinae	*Stenia pallida*	AY870021		AEFG

Epidendroideae	Cymbidieae	Zygopetalinae	*Stenia saccata*	AY870024		F
Orchidoideae	Orchideae	Orchidinae	*Stenoglottis fimbriata*	MN240681	MT533495	M
Orchidoideae	Orchideae	Orchidinae	*Stenoglottis macloughlinii*	MT500650	MT533553	M
Orchidoideae	Cranichideae	Cranichidinae	*Stenoptera acuta*	FJ473355		CDE
Orchidoideae	Cranichideae	Cranichidinae	*Stenoptera ecuadorana*	FJ473359	AJ543940	G
Orchidoideae	Cranichideae	Cranichidinae	*Stenoptera peruviana*	AF348066		EF
Orchidoideae	Cranichideae	Spiranthinae	*Stenorrhynchos speciosum*	FJ473356	HG425364	EFGHJK
Orchidoideae	Cranichideae	Spiranthinae	*Stenorrhynchos vaginatum*	FJ473358	MF179015	EFG
Epidendroideae	Cymbidieae	Zygopetalinae	*Stenotyla lendyana*	AY870062		F
Epidendroideae	Cymbidieae	Zygopetalinae	*Stenotyla picta*	AY870060		F
Epidendroideae	Cymbidieae	Oncidiinae	*Sutrina garayi*	FJ565338	FJ564828	H
Orchidoideae	Cranichideae	Spiranthinae	*Svenkoeltzia congestiflora*	AJ539493	AJ543921	K
Epidendroideae	Cymbidieae	Oncidiinae	*Systeloglossum acuminatum*	AF350528	MT518842	F
Epidendroideae	Cymbidieae	Oncidiinae	*Systeloglossum bennettii*	FJ565214	FJ564728	E
Epidendroideae	Malaxideae	Malaxidinae	*Tamayorkis porphyrea*	AY907115	AY907182	KL
Epidendroideae	Cymbidieae	Oncidiinae	*Telipogon barbozae*	DQ315838	DQ315897	K
Epidendroideae	Cymbidieae	Oncidiinae	*Telipogon bullpenensis*	DQ315840	DQ315898	F
Epidendroideae	Cymbidieae	Oncidiinae	*Telipogon monteverdensis*	DQ315842	DQ315900	F
Epidendroideae	Cymbidieae	Oncidiinae	*Telipogon pogonostalix*	AF239392	AF350590	EFG
Epidendroideae	Cymbidieae	Oncidiinae	*Telipogon smaragdinus*	DQ315844	FJ565034	F
Epidendroideae	Cymbidieae	Oncidiinae	*Telipogon venustus*	FJ565183	FJ564703	EFG
Epidendroideae	Epidendreae	Laeliinae	*Tetramicra elegans*	AY008566	AY396094	EJ
Orchidoideae	Cranichideae	Spiranthinae	*Thelyschista ghillanyi*	MF464937	MG755181	B
Epidendroideae	Cymbidieae	Oncidiinae	*Thysanoglossa jordanensis*	MZ575598	EF079224	A
Epidendroideae	Cymbidieae	Oncidiinae	*Thysanoglossa organensis*	KX687843		AC
Epidendroideae	Cymbidieae	Stanhopeinae	*Trevoria glumacea*	MH766987	MH749017	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum ascendens*	JQ319732	EU214320	FK
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum bicallosum*	FJ565208	FJ564721	K

Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum carthagenense*	FJ565632	FJ565124	EFGKL
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum cebolleta*	FJ565669	FJ565162	ABCDEFJK
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum cepula*		FJ565157	ABCE
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum cymbiglossum*	FJ565596	FJ565085	F
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum flavovirens*	JQ319734	FJ564711	K
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum hoegei*	JQ319746		K
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum jonesianum*		AF350653	AD
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum lacerum*		FJ565138	F
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum lanceanum*	AF350577	EF079283	EF
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum longicalcaratum*		FJ565007	GH
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum maculatum*	FJ565326		EFGHJK
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum morenoi*	FJ565441	FJ564935	ACE
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum nanum*	FJ565629	FJ565121	CEF
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum panduratum*	FJ565209	FJ564722	E
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum pfavii*	AF239401		F
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum pulchrum*	FJ565469	FJ564954	EFG
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum pumilum*	FJ565655	FJ565147	ABCDE
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum splendidum*	AF350576		K
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum stramineum*	FJ565348	FJ564842	K
Epidendroideae	Cymbidieae	Oncidiinae	*Trichocentrum tigrinum*	FJ565192	EU490713	E
Epidendroideae	Cymbidieae	Oncidiinae	*Trichoceros antennifer*	DQ315883	FJ564953	EFGH
Epidendroideae	Cymbidieae	Oncidiinae	*Trichoceros muralis*	FJ565468	FJ563966	F
Epidendroideae	Cymbidieae	Oncidiinae	*Trichopilia brevis*	EF079413	EF079229	GH
Epidendroideae	Cymbidieae	Oncidiinae	*Trichopilia fragrans*	FJ565568	FJ565053	EFHJ
Epidendroideae	Cymbidieae	Oncidiinae	*Trichopilia laxa*	FJ565225	FJ564737	EFG
Epidendroideae	Cymbidieae	Oncidiinae	*Trichopilia sanguinolenta*	AF350580	AF350659	F
Epidendroideae	Cymbidieae	Oncidiinae	*Trichopilia subulata*	AF350578	AF350657	EFJK
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx arbuscula*	KY988983	KY988791	EFG

Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx blaisdellii*	MK306385	MK306423	FGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx cedralensis*		KY988793	EFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx ciliaris*	MK294841	MK258064	KL
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx dirhamphis*	MK306399	MK306437	FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx dura*	MK306400	MK306438	EFGJK
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx escobarii*	KX844978		G
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx fruticosa*	KY988986	KY988794	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx intricata*	MK294842	MK258065	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx memor*	MK306388	MK306426	EFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx minutipetala*	MK306390	MK306428	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx montana*	MN551480	MN577790	A
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx notosibirica*	MK306401	MK306439	EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx orbicularis*	KY988989	KY988797	EFGK
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx pseudolepanthes*	MK306379	MK306417	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx pusilla*	KY988990	KY988798	EFG
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx rotundata*	MK306395	MK306442	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Trichosalpinx todziae*	MK306406	MK306444	FK
Epidendroideae	Vandeae	Angraecinae	*Tridactyle filifolia*	DQ091641	MK685654	M
Epidendroideae	Vandeae	Angraecinae	*Tridactyle scottellii*	DQ091642	MK685464	M
Epidendroideae	Triphoreae	Triphorinae	*Triphora trianthophoros*	MG215795	MK520780	KL
Epidendroideae	Epidendreae	Pleurothallidinae	*Trisetella triglochin*	EF079368	EF065592	EFG
Epidendroideae	Cymbidieae	Oncidiinae	*Trizeuxis falcata*	FJ565213	FJ563850	ABEFG
Epidendroideae	Tropidieae	-	*Tropidia polystachya*	EU490674	EU490714	EFJK
Epidendroideae	Gastrodieae	-	*Uleiorchis prataensis*	KF918852		A
Epidendroideae	Gastrodieae	-	*Uleiorchis ulei*	KF918853		AEFK
Vanilloideae	Vanillae	-	*Vanilla africana*	MW829667	MW828231	M
Vanilloideae	Vanillae	-	*Vanilla barbellata*	FJ425835		JL
Vanilloideae	Vanillae	-	*Vanilla chamissonis*	MW829674	MW828238	ABCDE

Vanilloideae	Vanillae	-	*Vanilla claviculata*	MN902007		J
Vanilloideae	Vanillae	-	*Vanilla columbiana*	MN902002		EF
Vanilloideae	Vanillae	-	*Vanilla crenulata*	MW829675	MW828240	M
Vanilloideae	Vanillae	-	*Vanilla cribbiana*	MN902009	MW828241	K
Vanilloideae	Vanillae	-	*Vanilla dilloniana*	MW829678	MW828242	JL
Vanilloideae	Vanillae	-	*Vanilla dressleri*	MN902012		F
Vanilloideae	Vanillae	-	*Vanilla edwallii*	EU498165		ACD
Vanilloideae	Vanillae	-	*Vanilla hartii*	MN902015		FK
Vanilloideae	Vanillae	-	*Vanilla helleri*	MN902018		FK
Vanilloideae	Vanillae	-	*Vanilla imperialis*	MW829685	MW828250	M
Vanilloideae	Vanillae	-	*Vanilla inodora*	MN902021		FJK
Vanilloideae	Vanillae	-	*Vanilla insignis*	MN902023	KX239521	K
Vanilloideae	Vanillae	-	*Vanilla mexicana*	MW829691	MW828256	AEFJKL
Vanilloideae	Vanillae	-	*Vanilla odorata*	MN902031	MW828257	ADEFGK
Vanilloideae	Vanillae	-	*Vanilla palmarum*	MW829689	MW828253	ABCE
Vanilloideae	Vanillae	-	*Vanilla phaeantha*	MN902034	MW828234	ABCFJK
Vanilloideae	Vanillae	-	*Vanilla planifolia*	MN902040	KJ566306	ABCEFGJKLM
Vanilloideae	Vanillae	-	*Vanilla polylepis*	MW829699	MW828265	M
Vanilloideae	Vanillae	-	*Vanilla pompona*	MN902055	MF197310	ABCEFKL
Vanilloideae	Vanillae	-	*Vanilla trigonocarpa*	MN902065		EG
Epidendroideae	Cymbidieae	Stanhopeinae	*Vasqueziella boliviana*	AF239377		E
Orchidoideae	Cranichideae	Spiranthinae	*Veyretia hassleri*	KX421939	KX421988	ACDE
Orchidoideae	Cranichideae	Spiranthinae	*Veyretia rupicola*	MF465003	MG755182	ABC
Orchidoideae	Cranichideae	Spiranthinae	*Veyretia sagittata*	MG460397	MG460464	A
Orchidoideae	Cranichideae	Spiranthinae	*Veyretia simplex*	KX421942	KX421991	ABCE
Orchidoideae	Cranichideae	Spiranthinae	*Veyretia sincorensis*	MF465005	MG755183	B
Epidendroideae	Cymbidieae	Oncidiinae	*Vitekorchis excavata*	FJ565604	FJ565094	EFGH
Epidendroideae	Cymbidieae	Oncidiinae	*Vitekorchis lucasiana*	FJ565573	FJ565060	H

Epidendroideae	Cymbidieae	Zygopetalinae	*Warczewiczella amazonica*		MT518860	EF
Epidendroideae	Cymbidieae	Zygopetalinae	*Warczewiczella guianensis*	AY870056	KJ472344	E
Epidendroideae	Cymbidieae	Oncidiinae	*Warmingia eugenii*	FJ565196	FJ563841	A
Epidendroideae	Cymbidieae	Oncidiinae	*Warmingia zamorana*	FJ565369	FJ563944	EGK
Epidendroideae	Cymbidieae	Zygopetalinae	*Warrea warreana*	AF239321	EU123675	AEFG
Epidendroideae	Wullschlaegelieae	-	*Wullschlaegelia aphylla*	KM598429	AY368434	ABCEFJK
Epidendroideae	Xerorchideae	-	*Xerorchis amazonica*	KM598434	AF263688	CE
Epidendroideae	Cymbidieae	Maxillariinae	*Xylobium colleyi*	MZ736848	DQ210745	AEF
Epidendroideae	Cymbidieae	Maxillariinae	*Xylobium elongatum*		EU214495	EFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Xylobium foveatum*		MZ334611	CEFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Xylobium leontoglossum*	DQ210254	DQ209939	EFG
Epidendroideae	Cymbidieae	Maxillariinae	*Xylobium pallidiflorum*	AF239338	MT518862	EFGK
Epidendroideae	Cymbidieae	Maxillariinae	*Xylobium squalens*	EF079427	EF079255	AEFG
Epidendroideae	Cymbidieae	Maxillariinae	*Xylobium subpulchrum*	DQ210218	MT518864	E
Epidendroideae	Cymbidieae	Maxillariinae	*Xylobium variegatum*	MZ736849	MZ334612	ABDEFGH
Epidendroideae	Cymbidieae	Maxillariinae	*Xylobium zarumense*	AF239339	MT518865	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion atropurpureum*	JQ306415		AEFGJ
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion dayanum*	AF262895	AF265452	EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion endresianum*	KY988994	KY988802	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion gracilentum*	KY988995	MK306446	FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion griffin*	MN332414		EF
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion hirtzii*	MK306361	MK258068	G
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion hypodiscus*	KY988997	MK306447	FG
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion lappaceum*	MN332415	KY988803	G
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion oblongifolium*	KY988999		EH
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion serpentinum*	AF262899	MT518867	F
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion williamsii*	MN332416		FK
Epidendroideae	Epidendreae	Pleurothallidinae	*Zootrophion ximenae*	KY989001	KY988805	G

Epidendroideae	Cymbidieae	Zygopetalinae	*Zygopetalum brachypetalum*		MT518868	A
Epidendroideae	Cymbidieae	Zygopetalinae	*Zygopetalum maculatum*	AY870097	AY869998	ABCE
Epidendroideae	Cymbidieae	Zygopetalinae	*Zygopetalum maxillare*		EF079242	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates aderaldoana*	MZ575599	MW256502	B
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates alleniana*	MZ575600	MW256503	AC
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates apiculata*	MZ575601	FJ565111	F
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates bradei*	KX687844	MW256504	AB
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates cornuta*	KX687845	KR709313	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates dasyrhiza*	KT709686	KR709314	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates densiflora*	MZ575602	MW256506	E
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates grandiflora*	AF350508	AY368405	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates greeniana*	MZ575593	MW256497	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates greeniana*	#CAR694	#CAR69	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates kuhlmannii*	KX687847	MW256507	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates lunata*	DQ315887	FJ564835	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates multiflora*	MZ575604	MW256508	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates nectarifera*	MZ575605		H
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates nunes-limae*	MZ575594	#MLK274	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates obliqua*	DQ315818	FJ564838	F
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates ovatipetala*	MZ575607		A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates pellucida*	DQ315819	FJ565103	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates pustulata*	MZ575608	MW256510	A
Epidendroideae	Cymbidieae	Oncidiinae	*Zygostates tripollinica*		MZ575609	A

CAPÍTULO 2

Estudos filogenômicos em Pleurothallidinae (Orchidaceae)

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Abstract

We present the first comparative plastome study of Pleurothallidinae with analyses of structural and molecular characteristics and identification of the ten most-variable regions to be incorporated in future phylogenetic studies. We sequenced complete plastomes of eight species in the subtribe and compared phylogenetic results of these to parallel analyses of their nuclear ribosomal DNA operon (26S, 18S, and 5.8S plus associated spacers) and partial mitochondrial genome sequences (29–38 genes and partial introns). These plastomes have the typical quadripartite structure for which gene content is similar to those of other orchids, with variation only in the composition of the *ndh* genes. The independent loss of *ndh* genes had an impact on which genes border the inverted repeats and thus the size of the small single-copy region, leading to variation in overall plastome length. Analyses of 68 coding sequences indicated the same pattern of codon usage as in other orchids, and 13 protein-coding genes under positive selection were detected. Also, we identified 62 polymorphic microsatellite loci and ten highly variable regions, for which we designed primers. Phylogenomic analyses showed that the top ten mutational hotspots represent well the phylogenetic relationships found with whole plastome sequences. However, strongly supported incongruence was observed among plastid, nuclear ribosomal DNA operon, and mitochondrial DNA trees, indicating possible occurrence of incomplete lineage sorting and/or introgressive hybridization. Despite the incongruence, the mtDNA tree retrieved some clades found in other analyses. These results, together with performance in recent studies, support a future role for mitochondrial markers in Pleurothallidinae phylogenetics.

Introduction

Neotropical Pleurothallidinae (Epidendreae, Epidendroideae) are the largest orchid subtribe, comprising more than 5,000 accepted species in 44 genera [1,2]. These are mostly epiphytes and can occupy almost all habitat types from North America (Florida) and the Caribbean through southern South America (Argentina) [3], although most pleurothallid species have narrow endemic distributions, and, therefore, many are considered endangered (e.g. [4]).

Previously, circumscriptions of Pleurothallidinae genera were based on morphological characters, and so was the inference of evolutionary relationships: Luer [5] classified them into informal groups or "affinities", relying on anther position and presence/absence of the annulus (a ring-like abscission zone on leaves). However, the first reclassification of Pleurothallidinae based on molecular evidence [6] highlighted several problems at generic and infrageneric levels (e.g. the polyphyletic "supergenus" *Pleurothallis* R.Br.), but some of the taxonomic changes that followed [7] were contested by Luer [8] due to the lack of morphological correlates, sampling problems, and the relatively low numbers of molecular markers used (i.e. often just nuclear ribosomal internal transcribed spacer, nrITS, plastid *matK* gene, and *trnL-trnF* intron/intergenic spacer).

This taxonomic controversy inspired more phylogenetic studies in the subtribe, mostly focused on specific genera and based almost only on nrITS (e.g. [9-17]). These studies initiated another round of reclassification in Pleurothallidinae [18], in which phylogenetic positions and generic classification were reassessed, providing a good framework for future studies. Karreman's proposal [18] recognized nine genera affinities, but due to a large number of species and infrageneric categories in the subtribe, some relationships remained inconclusive because the compiled phylogenetic trees did not sample and fully resolve all

Pleurothallidinae clades. Thus, some nomenclatural instability in the subtribe has continued and greatly affects regulations on international trade and conservation efforts that depend on Red Lists and population genetic studies.

In addition to nrITS, plastid genomes (plastomes) have been a source of good markers for Orchidaceae at various taxonomic levels [19]. In Pleurothallidinae, the *matK* gene and *trnK* −UUU intron are the main plastid markers used in combination with nrITS, but they are insufficiently variable to generate well resolved relationships for many genera. More recent molecular studies in the subtribe have used a wider number of plastid DNA markers (i.e. *ycf1* [20], *matK*, *psbD-trnT*, *rps16-trnQ*, *trnH-psbA*, and *trnS-trnG* intergenic spacers [21]) in combination with nrITS, which improved tree resolution and support. However, the general utility of plastid DNA markers for the subtribe is still under-investigated, particularly which are the most variable and informative.

The advent of next-generation sequencing (NGS) has made plastome sequencing faster and more accessible [22], and they have become the main source of phylogenetic information for angiosperms [19,23]. In Orchidaceae, plastome sequences have been compared among genera and species to find the most-variable regions, termed mutational hotspots [24-29]. Hence, comparative analyses of complete plastome sequences of Pleurothallidinae can indicate better molecular markers, but thus far only three plastomes of the subtribe are publicly available. Only the overall structure of these plastomes was analyzed and compared so far [30], with no analysis of which regions were more variable.

With this in view, we performed the first plastome study for Pleurothallidinae to identify mutational hotspots for use in future phylogenetic and population studies. We sequenced eight Pleurothallidinae plastomes and included two of those previously published in our analyses. We analyzed genome size and structure, gene content and order, and inverted

repeats borders. We also compared codon usage and frequency and detected protein-coding genes under positive selection. In addition, we identified polymorphic microsatellite loci and the ten most-variable regions, for which we designed primers. Finally, we used a maximum likelihood phylogenetic approach to evaluate and compare relationships of pleurothallid genera [18] based on these plastomes, nuclear ribosomal DNA operons, mitochondrial data, and combined analyses.

Materials And Methods

Species sampling

We included eight Pleurothallidinae species from individuals cultivated in the greenhouse of the Botany Department of Universidade Federal do Paraná (UFPR), Brazil. Fresh leaves were collected from these individuals for DNA extraction and NGS, and the vouchers were deposited at the UFPR herbarium (UPCB) [31]. We also used the plastome sequence of *Anathallis obovata* (Lindl.) Pridgeon & MW.Chase (MH979332), which was previously published by us [30], and obtained from GenBank the plastome sequence of *Masdevallia picturata* Rchb.f. (KJ566305), totaling ten species from subtribe Pleurothallidinae, representing seven of the nine generic affinity groups proposed by Karremans [18]. We also downloaded from GenBank the plastome sequences of two Laeliinae species to serve as the outgroup, according to the most recent classification of Orchidaceae [2]. Voucher and GenBank accession numbers of all species sampled are provided in Table S1.

DNA extraction and NGS

We followed a plastid-enrichment procedure using 2 g of leaf tissue according to Sakaguchi *et al.* [32] and then extracted genomic DNA following the Doyle & Doyle [33] protocol, with reagent scaling to 2 mL microtubes and increasing the incubation time to 2−4 hours at 60ºC. DNA was purified with DNA Clean and Concentrator kit (Zymo Research, Orange, CA) and sequenced on an Illumina MiSeq® using DNA Nextera XT Sample Prep kit (Illumina™) and MiSeq Reagent Kit V2 (Illumina™).

Genome assembly

The paired-end reads obtained from Illumina MiSeq sequencing (2 Í 250 bp) were trimmed at 0.05 error probability limit and discarded when below 50 bp long with the CLC Genomics Workbench 8.0 (CLC Bio, Qiagen). Reads were then used in genome assembly with a mixed guided and *de novo* approach, performed in both CLC Genomics Workbench and Geneious Prime 2020.0.5 (Biomatters Ltd.). In the latter, we generated contigs from a *de novo* assembly of the reads using the MIRA 4.0 plugin, with the most accurate settings. In CLC Genomics Workbench, we mapped the reads in the complete genome sequence of *Anathallis obovata* (MH979332) using the default configuration and then generated a consensus sequence that was gapped in low-coverage areas (≤ 5Í). These gaps were manually filled using the contigs, editing the former consensus sequence into a new one. The reads were mapped into the new consensus sequence with CLC Genomics Workbench, and the entire map was visually inspected to check for mismatches and assembly errors, which were manually corrected using the contigs. Sequencing information for each sample is available in S2 Table.

Genome annotation and graphical representations

Gene, coding sequence (CDS), ribosomal DNA (rDNA), and transport RNA (tRNA) annotations were imported from the complete plastome sequence of *Anathallis obovata* [30] in Geneious Prime. All annotations were manually verified and edited against those of the *Dendrobium officinale* Kimura & Migo (KC771275) and *Masdevallia picturata* (KJ566305) reference genomes. The IRs were identified and annotated using the Find Repeats tool of Geneious Prime and verified through REPuter online version (http://bibiserv.cebitec.uni-bielefeld.de/reputer). All sequences were submitted to GenBank through Geneious Prime. The .gb files of Pleurothallidinae plastomes were uploaded to Organellar Genome DRAW v1.1 [34] to make the genome maps and to IRscope [35] to produce the graphical representation of IR/LSC and IR/SSC junctions.

Mitochondrial and nuclear sequences

From the sequencing output of the eight species sequenced here plus that of *Anathallis obovata* sequenced by us previously [30], we recovered the complete sequence of the nuclear ribosomal DNA (nrDNA) operon (26S, 18.S, and 5.8S plus the associated spacers, ITS1 and ITS2) and parts of the mitochondrial genome (S2 Table). We mapped the raw reads to the nuclear ribosomal DNA sequence of *Phalaenopsis japonica* (Rchb.f.) Kocyan & Schuit. (MN221419) and the complete mitochondrial genome of *Allium cepa* L. (NC_030100.1) with Geneious Prime, using BBmap, with the highest sensitivity and Kmer length = 8. Also, in Geneious Prime, we annotated the nrDNA operon based on *Acianthera luteola* (Lindl.) Pridgeon & M.W. Chase (KX495754) and using BLAST. For mitochondrial DNA (mtDNA), we extracted only regions with coverage depth ≥ 8Í as consensus sequences and imported CDSs, rDNAs, and tRNAs annotations from the reference sequence (NC_030100.1), which

were then verified manually (S3 Table). Consensus sequences without annotations were excluded from the analyses and GenBank submission.

Sequence alignments

All alignments were made in Geneious Prime. We performed a Mauve alignment of the ten complete Pleurothallidinae plastomes with the progressiveMauve algorithm [36] to compare their general structure. For all subsequent analyses, we removed one of IRs from the plastome sequences to avoid overrepresentation. All alignments were made using MAFFT v.7.450 [37] with the FFT-NS-2 algorithm.

Codon usage and molecular evolution analyses

Codon usage and molecular evolution analyses were performed in the R software environment (https://www.r-project.org/). For the codon usage analysis, we extracted all complete CDS annotations from each of the ten Pleurothallidinae plastomes using Geneious Prime tools. Relative synonymous codon usage (RSCU) and codon frequencies were calculated for each CDS set using the SeqinR package [38]. For the molecular evolution analysis, we extracted and aligned separately all CDSs in common to the ten Pleurothallidinae plastomes in Geneious Prime. This analysis consisted of the application of Tajima's D neutrality test [39], from pegas package [40], in each CDS alignment. All codes and datasets used are available in S1 File.

Simple sequence repeats (SSRs)

Plastid SSRs were identified for the ten Pleurothallidinae plastomes through MISA-web online program [41], using the following search minimum parameters: ten repetitions for

mononucleotide motifs, five repetitions for dinucleotide motifs, and three repetitions for tri-, tetra-, penta-, and hexanucleotide motifs. All SSRs were manually annotated to the sequences, which were then aligned (S2 File). We designed primers for polymorphic SSRs present in at least seven plastomes using Geneious Prime, with the following characteristics: 18−27 bp in length, guanine-cytosine (GC) content between 20−80%, melting temperature (Tm) of 57−63ºC with a maximum variation of 1ºC between primer pairs, and product sizes between 100−500 bp.

Sequence variability and indels events

We aligned the ten Pleurothallidinae plastome sequences and then extracted all introns and intergenic spacers (IGSs) with 150 bp minimum length using Geneious Prime tools. We also extracted molecular markers that have been commonly used in Orchidaceae phylogenetics, such as the *trnH-psbA* intergenic spacer, the *matK* CDS, and the 3' portion of *ycf1* CDS [19,42]. All aligned sequences were uploaded to DnaSP v.6 software [43] to obtain the total number of variable sites and insertions/deletions (indels). These data were used to calculate the sequence variability (SV) *sensu* Shaw *et al.* [44] but considering indels as events instead of sites to reduce homoplasy in these alignments [45]. Therefore, we used the following equation (1) to calculate SV, where l = total length in bp, m = total number of mutations, and i = number of indels events.

$$SV = \frac{m+i}{l+m+i} \times 100 \qquad (1)$$

The ten sequences with the highest SV were selected as potential molecular markers for Pleurothalldinae. We designed primers for these sequences in Geneious Prime with the following characteristics: 18−27 bp in length, GC content between 20−80%, 57−63ºC Tm,

maximum variation of 2ºC annealing temperature between primer pairs, and product size between 100−1,000 bp.

We also extracted the IR, LSC, and SSC regions of each Pleurothallidinae plastome using Geneious Prime tools and performed multiple and pairwise alignments using *Masdevallia picturata* as the reference. Back in DnaSP, we computed the number of indels events per region and each plastome.

Phylogenetic analyses

All phylogenetic analyses were performed with maximum likelihood (ML) using IQ-tree v.1.6.11 [46], with 1,000 ultra-fast bootstrap replicates and *-bnni* strategy to reduce the risk of overestimation [47–49]. The best nucleotide substitution model was set for each dataset under the AIC criterion using ModelFinder [50], implemented on IQ-tree. The resulting trees were visualized and edited using Figtree v.1.4.1 (*http://tree.bio.ed.ac.uk*) and CorelDRAW X8 (*https://www.coreldraw.com/*). We analyzed and compared the following aligned datasets including the twelve Epidendreae samples: complete plastome sequences (one IR), plastid CDSs, plastid non-coding sequences, and top ten plastid mutational hotspots. We also analyzed, compared, and combined the following datasets including nine Pleurothallidinae samples (excluding *Masdevallia picturata*): complete plastome sequences (one IR), mtDNA, and nrDNA operon. For partitioned datasets, we first defined the best substitution model for each partition before combining them using Geneious Prime tools. Bootstrap percentages (BP) above 95 were considered strongly supported [51]. We submitted to TreeBASE the Epidendreae complete plastome dataset and the Pleurothallidinae combined dataset (http://purl.org/phylo/treebase/phylows/study/TB2:S28628).

Results and Discussion

The overall characteristics of the plastomes analyzed are summarized in Table 1 and those of the mitochondrial DNA in Table 2. Pleurothallidinae plastomes varied from 148,246 to 157,905 bp in length, with *Acianthera recurva* (Lindl.) Pridgeon & M.W.Chase the shortest and *Myoxanthus exasperatus* (Lindl.) Luer the longest. GC content varied little (36.9−37.1%). They all possess the typical quadripartite structure of most angiosperms plastomes: LSC of 83,694−85,605 bp and SSC of 10,573−18,444 bp, interspersed by two IRs of 25,242−27,020 bp (S1 Fig) [52].

Table 1. General characteristics of Pleurothallidinae plastomes analyzed.

Taxon	Length (bp)	LSC (bp)	SSC (bp)	IR (bp)	%GC
Acianthera recurva	148,246	84,871	10,573	26,401	37.0
Anathallis microphyta	154,558	84,597	15,993	26,984	37.0
Anathallis obovata	155,515	86,694	17,923	26,949	37.1
Dryadella lilliputiana	156,807	84,943	17,992	26,936	37.1
Masdevallia picturata	156,045	84,948	18,029	26,534	36.9
Myoxanthus exasperatus	157,905	85,605	18,260	27,020	37.1
Octomeria grandiflora	155,284	84,916	17,874	26,247	36.9
Pabstiella mirabilis	150,317	83,699	16,134	25,242	37.1
Stelis grandiflora	157,535	85,205	18,444	26,943	36.9
Stelis montserratii	157,479	85,147	18,366	26,983	36.9

Table 2. General characteristics of mtDNA dataset for Pleurothallidinae.

Taxon	Total length (bp)	%GC	# genes	# CDSs	# tRNAs	# rDNAs

Acianthera recurva	62,237	48.3	38	26	9	3
Anathallis microphyta	32,417	46.5	32	25	4	3
Anathallis obovata	46,959	47.0	33	25	5	3
Dryadella lilliputiana	83,225	47.2	36	25	8	3
Myoxanthus exasperatus	61,363	47.4	37	26	8	3
Octomeria grandiflora	63,381	48.2	33	25	6	2
Pabstiella mirabilis	43,635	48.4	29	25	1	3
Stelis grandiflora	49,861	47.4	34	25	6	3
Stelis montserratii	73,468	47.4	38	26	9	3

Gene composition is similar among the Pleurothallidinae plastomes analyzed: 102 genes are shared, being 68 CDSs, 4 rDNAs, and 30 tRNAs (S4 Table), and a variable set of *ndh* genes (S2 Fig). Of the 11 *ndh* genes, only *ndhB*, *ndhD*, and *ndhH* are present in all plastomes, but those with complete reading frames include only *Myoxanthus exasperatus*, *Octomeria grandiflora* Lindl., *Stelis grandiflora* Lindl., and *S. montserratii* (Porsch) Karremans. The *Masdevallia picturata* and *Octomeria grandiflora* plastomes are the only ones that have all 11 *ndh* genes intact, whereas *Acianthera recurva* has the fewest of these genes, only five, none with complete CDSs. Despite the variation observed in *ndh* gene content, the Mauve alignment showed no inversions or other rearrangements (S3 Fig). Complete losses and pseudogenization of *ndh* genes are common in Orchidaceae and have occurred independently [53-58]. These events have been linked to IR/SSC border instability and IR expansion [54,57,58], which we observed for the IR borders among these Pleurothallidinae plastomes (Fig 1). The IRa/SSC junction (JSA) is located within the *ycf1* gene, producing a partial copy of this gene in IRb, but there are three types of IRb/SSC junctions (JSB) in Pleurothallidinae that can be classified into types I, II, and III *sensu* Luo *et al.* [25]. Type I occurs in *Anathallis obovata*, *Dryadella lilliputiana* (Cogn.) Luer, and

Pabstiella mirabilis and is characterized by the presence of *ndhF* in the SSC without overlapping the JSB. Type II was the most common and detected in *Anathallis microphyta*, *Masdevallia picturata*, *Myoxanthus exasperatus*, *Octomeria grandiflora*, *Stelis grandiflora*, and *S. montserratii*, in which *ndhF* overlaps the JSB. Finally, type III, *ndhF* deletion, was found only in *Acianthera recurva*.

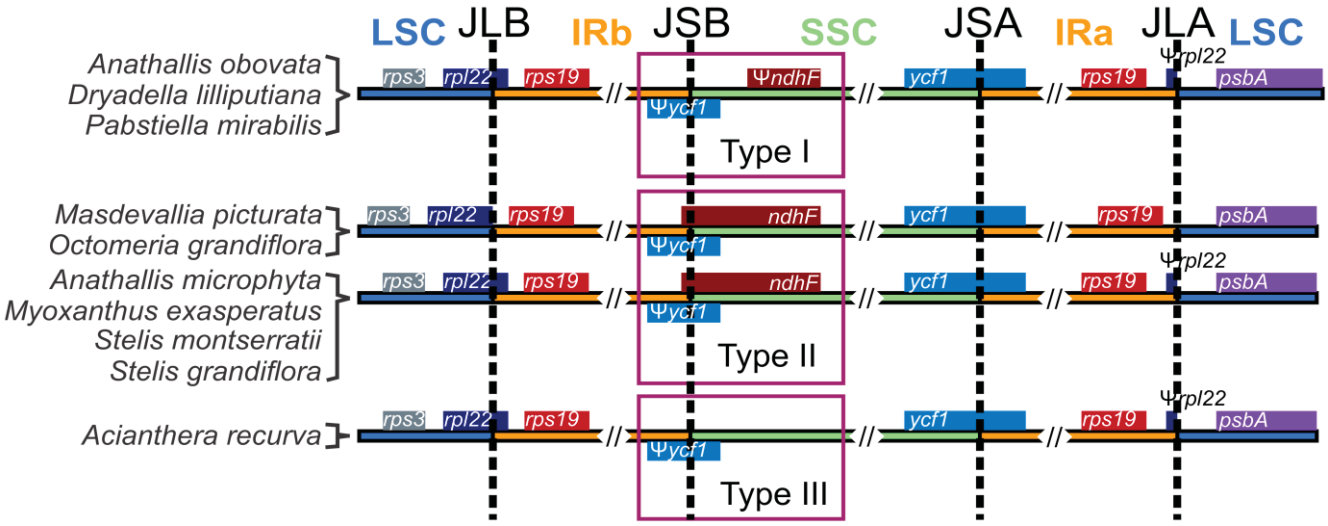


Fig 1. Inverted repeats (IRs) borders of the ten Pleurothallidinae plastomes analyzed. IRs/SSC junction types *sensu* Luo *et al.* [25].

We also observed a significant reduction of the *ycf1* partial copy in *Pabstiella mirabilis* due to a 1,000 bp shift of the gene into the SSC. Size reduction of *ycf1* in IRs was highlighted as one possible outcome of IRs/SSC junction instability promoted by deletion/retention of *ndh* genes, especially *ndhF* [54]. *Pabstiella mirabilis* has only 15 bp of *ndhF*, but other Pleurothallidinae with this gene missing or pseudogenized did not suffer alterations in *ycf1* size at the IRs. Thus, IR/SSC junction instability appears to have many attributes not exclusively dependent on the *ndh* gene content. The specific complement of *ndh* genes in *P. mirabilis* could have produced some IR reduction, but this was too small to alter gene content.

The LSC/IRb junction (JLB) varied among Pleurothallidinae as well. In *Octomeria grandiflora* and *Masdevallia picturata*, the JLB is situated in the *rpl22-rps19* IGS and *rps19* gene, respectively, producing a partial copy of the *rps19* gene at IRa in this case (Fig 1). However, in the other Pleurothallidinae, the JLB is located in the *rpl22* gene, producing a partial copy of this gene in IRa (Fig 1). We believe that retention of complete CDSs of all 11 *ndh* genes in *Masdevallia picturata* and *Octomeria grandiflora* may have caused a slight IR expansion, thus generating the variation observed in JLB position in these two plastomes relative to the others. Despite this, all ten plastomes have the *trnH*-GUG and *rps19* genes in both IRs, even though *rps19* is truncated in the IRa of *Masdevallia picturata*, which is the type III JLB, conserved among monocots [59].

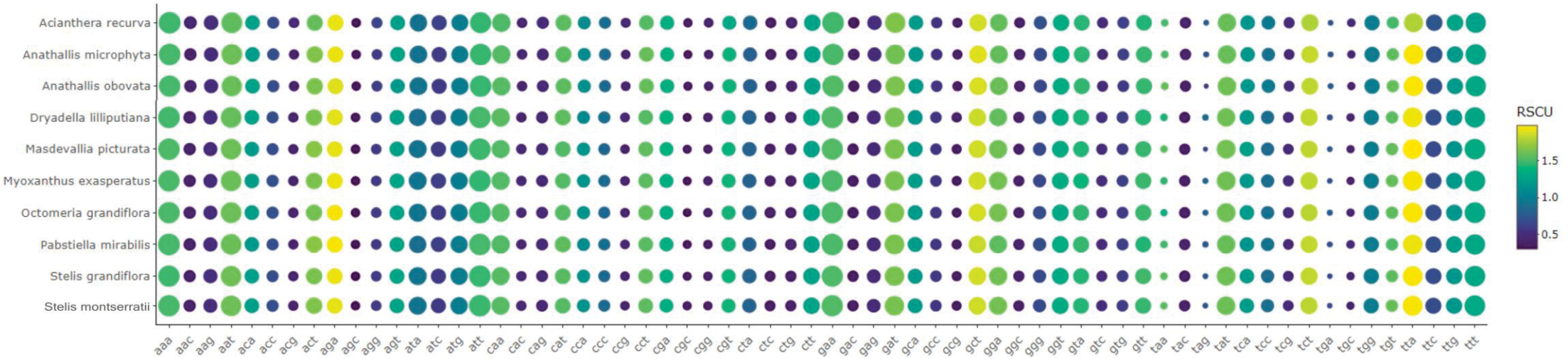
IR expansion/retraction is considered one of the main causes of length variation in angiosperm plastomes [60-62]. However, the first study in *Dendrobium* Sw. showed a major contribution of the LSC to plastome total size variation due to the presence of large number of indels in this region [27]. This same large LSC contribution was also observed in Pleurothallidinae: of the 2,417 indel events, 1,899 (78.57%) are in the LSC, 384 (15.89%) in the SSC, and 134 (5.54%) in the IR (S5 Table). Nonetheless, when we analyzed indels events in each plastome, we found no correlation between the number of LSC indels and genome size ($R = -0.52$, $p = 0.16$), but we observed such a correlation with indels in the IR ($R = -0.69$, $p = 0.04$). We also found a correlation between genome size and LSC size ($R = 0.70$, $p = 0.04$), SSC size ($R = 0.93$, $p < 0.01$), and *ndh* CDSs ($R = 0.68$, $p = 0.05$). SSC size, in turn, is sensitive to *ndh* gene content ($R = 0.66$, $p = 0.05$) and their CDSs ($R = 0.77$, $p = 0.01$). Correlation plots are presented in S4 Fig. These results contradict, in part, the findings of Niu *et al.* [27] but also show that plastome size is affected by a combination of factors, for which the relative importance varies among clades. For Pleurothallidinae plastomes, which have few

generic differences, indels in the most conservative region, the IR, have a greater impact on length than LSC indels, despite their predominance in the latter. Also, the sizes of LSC and SSC contribute unequally to Pleurothallidinae genome size because both varied more than the IR, but SSC size varied the most: about four times the range observed for LSC and IR (7,871 bp, against 1,906 bp of LSC and 1,778 bp of IR). In addition, seven of the 11 *ndh* genes are located in SSC, so it is not surprising that *ndh* gene composition greatly influences the length of this region and, consequently, plastome size because it is the main distinctive feature among Pleurothallidinae genomes. This influence of *ndh* gene deletion/retention on the SSC size has been widely reported in the literature [53,54,63,64], but the importance of this region for orchid plastome size variation has only been observed for Pleurothallidinae and *Bulbophyllum* Thouars [29] thus far.

Protein-coding genes

We observed that relative codon frequencies are similar among Pleurothallidinae (Fig 2, S6 Table). The most common were *AAA* (lysine) in *Acianthera recurva*, *Anathallis microphyta*, and *Pabstiella mirabilis*, *GAA* (glutamate) in *Dryadella lilliputiana*, and *ATT* (isoleucine) in the remaining species, whereas *TGC* (cysteine) was the rarest after stop codons. Among amino acids, leucine was the most frequent, and cysteine the least, similar to that observed in *Bulbophyllum* plastomes [29]. *ATG* (methionine) was the main start codon, but there is *GTG* in *rps19*, *ACG* in *ndhD* and *rps2*, *CTG* in *ndhC* (just *Dryadella lilliputiana*), and *ATT* in *matK*, except in *Pabstiella mirabilis*, which has an alternative start codon [65]. For relative synonymous codon usage, we identified a preference for codons that end in A/T (AT_3) instead of G/C (GC_3), a bias also observed for other angiosperms, including *Bulbophyllum*, and likely correlated with the high AT content of plastomes [29,66–68].

Fig 2. Heatmap of relative synonymous codon usage (RSCU) and codon relative frequency observed for Pleurothallidinae CDSs. The lowest frequency is indicated by purple and highest yellow. Relative frequencies are proportional to circle sizes.



To assess selection in protein-coding genes, we applied Tajima's D test in the 68 CDSs shared among Pleurothallidinae. The results indicated that 13 genes are under positive selection: *accD*, *atpB*, *petB*, *psbB*, *psbT*, *rbcL*, *rpl22*, *rpl32*, *rpl33*, *rpoC1*, *rps18*, *ycf1*, and *ycf2* (S7 Table). These genes have point mutations (SNPs), alignment gaps, and size variation. One of the most informative markers for land plants, *ycf1* is the second largest gene in the plastome and has been suggested as a potential DNA barcode [42]. The *accD*, *rbcL*, *rpl22*, *rpl32*, *rpoC1*, and *ycf2* genes also appear to be under positive selection in other Orchidaceae, perhaps related to their adaptative capacities [29,68,69].

Microsatellites (SSRs)

Simple sequence repeats (SSRs), also known as short tandem sequences or microsatellites, are 1−6 bp repeats common in all genomes [70,71]. We identified 1,290 SSRs in Pleurothallidinae, of which 170 (13%) are unique and varied 113−143 per species (S8 Table). They were most common in the LSC (71%) and IGSs (55.6%) and least abundant in the IR (13.5%) and introns (16.2%). This distribution is as expected: the LSC is the largest region [22], and IGSs are the most common and variable plastome category [22,72]. This is similar to what was found in *Bulbophyllum* [29] and *Dendrobium* [27] plastomes. Mono- and trinucleotide repeats are the most common and hexanucleotides the rarest, the latter absent in some species (S8 Table). As for other Orchidaceae [27,29,68,73], A/T repeats predominate, followed by AAG/CTT. Most trinucleotide microsatellites were found in CDSs and the IR, the latter possessing nearly all of these. Indeed, tri- and hexanucleotide SSRs were previously reported to be more frequent in CDSs than any other plastome category [74], undoubtedly due to maintenance of protein function [74,75].

Plastid microsatellites are excellent tools for genotyping, genetic mapping, and population studies [76-78]. Therefore, we designed 54 primers that cover 62 polymorphic SSR loci present in at least seven Pleurothallidinae (S9 Table). These repeats consist of 17 polyTs (10−19x), nine polyAs (10−19x), three di- (4−23x), 31 tri- (3−10x), one tetra- (3x), and one pentanucleotide repeat (3−4x). We hope that providing this set of microsatellite primers will encourage more population and species delimitation studies in Pleurothallidinae.

Mutation hotspots

We analyzed levels of variation in 104 sequences more than 150 bp long, comprising IGSs, introns, and two CDSs (S10 Table). The most variable sequences (higher SV) are IGSs that have low GC content (Fig 3). This inverse relation between SV and %GC was expected and previously reported in *Bulbophyllum* and *Dendrobium*, as AT-rich sequences have higher mutation rates [27,29,68]. Seven of the ten sequences with highest SV found (*ndhF-rpl32, psbB-psbT, psbK-psbI, rpl16-rps3, rpl32-trnL, trnR-atpA,* and *trnS-trnG*) were previously identified in various other orchid clades [24,26-29,64,68], but we identify here for the first time in orchids the following: *petN-psbM*, *psbI-trnS*, and *trnW-trnP*. Most phylogenetic studies in Pleurothallidinae have used nrITS, sometimes combined with the *trnK*^{UUU} intron or *matK* (*e.g.* [6,14]). Other markers such as *ycf1* and *trnH-psbA* were included more recently [20,21]. These all have SV below 25%, in contrast with 29.63−41.67% for the ten hotspots (S10 Table). Therefore, we designed subtribe-specific primers for the top ten to assist future phylogenetic analyses in Pleurothallidinae (S11 Table).

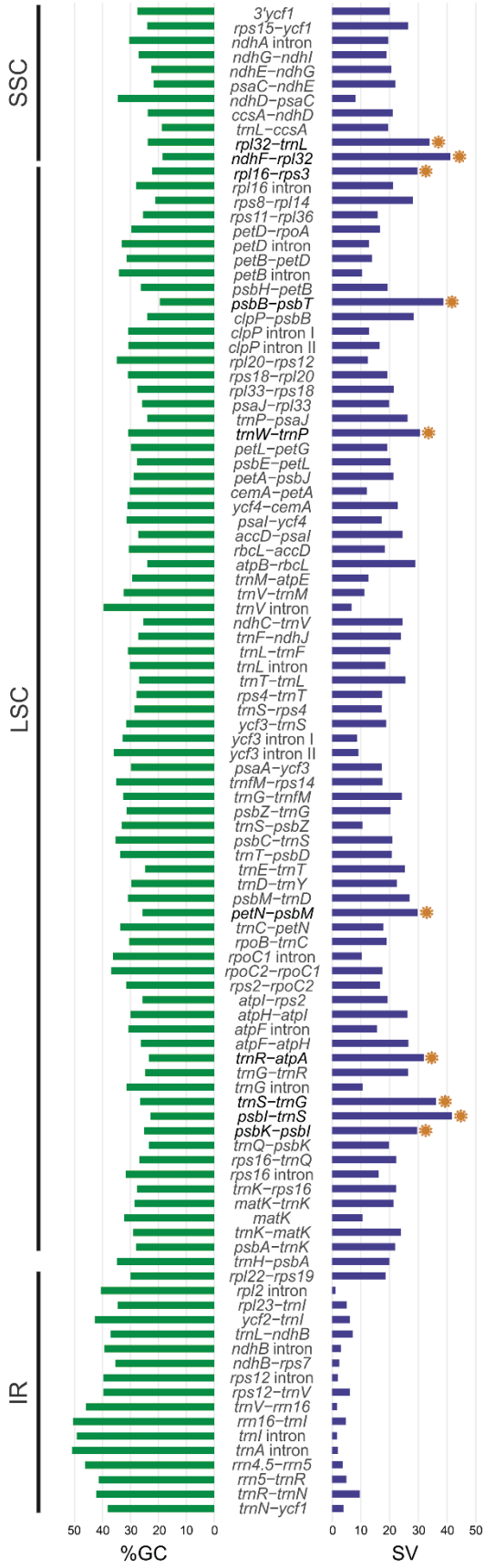


Fig 3. Graph of sequence variability (SV) and %GC for 104 Pleurothallidinae plastid sequences. The ten most-variable sequences are highlighted.

Phylogenomics

The aligned matrix of Epidendreae plastome sequences consisted of 142,507 bp, ~10% of which are variable and of these 41.47% are potentially parsimony-informative (PIC). As expected, non-coding regions had more variable characters (13.69%) and proportionally fewer PICs, whereas protein-coding loci are more conservative (Table 3) [79]. Tree topology based on plastid hotspots was the same as plastid non-coding DNA (NC-DNA) analysis (Fig 4, S5 Fig). When comparing ML trees from the plastome datasets, the only disagreement was the position of *Masdevallia picturata*, but not with strong support (Fig. 4).

Table 3. Number of sequences, length, nucleotide variation, and best substitution model for each dataset and partitions.

Dataset	# sequences	Length (bp)	Variable characters	PIC	Best model (AIC)
Whole plastomes	12	142,507	14,003 (09.82%)	5,807 (41.47%)	GTR+F+R2
	9	139,059	11,045 (07.94%)	3,330 (30.15%)	GTR+F+R2
Coding sequences	12	58,979	3,672 (06.22%)	1,596 (43.46%)	GTR+F+R2
Non-coding sequences	12	76,868	10,526 (13.69%)	3,971 (37.72%)	TIM+F+R2
Hotspots	12	6,656	1,676 (25.18%)	717 (42.78%)	Partitioned
ndhF-rpl32	12	1,146	370 (32.28%)	135 (36.48%)	TVM+F+G4
petN-psbM	12	1,042	231 (22.17%)	102 (44.15%)	TIM+F+G4
psbB-psbT	12	611	170 (27.82%)	66 (38.82%)	K3Pu+F+G4
psbI-trnSGCU	12	165	45 (27.27%)	21 (46.67%)	GTR+F
psbK-psbI	12	617	127 (20.58%)	54 (42.52%)	TVM+F+G4
rpl16-rps3	12	199	48 (24.12%)	25 (52.08%)	TVM+F+I
rpl32-trnLUAG	12	988	260 (26.31%)	116 (44.61%)	TVM+F+R2
trnRUCU-atpA	12	231	59 (25.54%)	25 (42.37%)	K3Pu+F+G4
trnSGCU-trnGUCC	12	1,456	319 (21.91%)	147 (46.08%)	K3Pu+F+G4
trnWCCA-trnPUGG	12	201	47 (23.38%)	26 (55.32%)	K3Pu+F+R3
mtDNA	9	94,117	6,048 (06.43%)	899 (14.86%)	TVM+F+I
nrDNA operon	9	5,865	335 (05.71%)	152 (45.37%)	GTR+F+R2
Combined*	9	239,041	17,506 (07.32%)	4,381 (25.68%)	Partitioned

PIC = parsimony-informative characters. *Plastome + mtDNA + nrDNA operon.

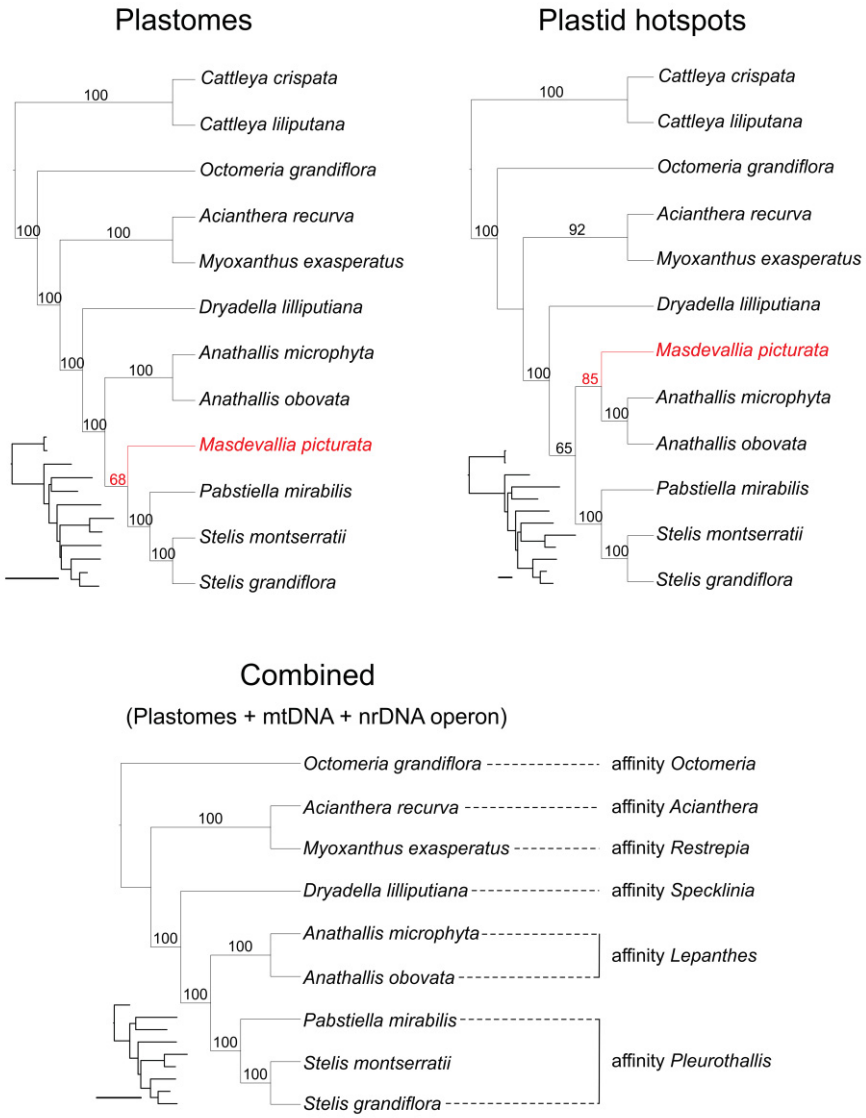


Fig 4. Maximum likelihood trees based on complete plastomes (one IR), plastid hotspots, and combined analyses (plastomes (one IR) + mtDNA + nrDNA operon). Numbers on branches are the bootstrap percentages; a tree with proportional branch lengths is on the left of each tree, which bars represent 0.02 nucleotide substitutions per site.

Based on our results (Fig 4), *Octomeria grandiflora* (*Octomeria* affinity sensu Karremans [18]) is sister to the rest of the sampled subtribe, followed next by the clade of *Acianthera recurva* (*Acianthera* affinity) and *Myoxanthus exasperatus* (*Restrepia* affinity). Then *Dryadella lilliputiana* (*Specklinia* affinity) is sister to the last two clades. The first is composed of *Anathallis microphyta* and *A. obovata* (*Lepanthes* affinity), and the second by

Pabstiella mirabilis sister to *Stelis grandiflora* and *S. montserratii* (*Pleurothallis* affinity). *Masdevallia picturata* (*Masdevallia* affinity) is sister to the *Pleurothallis* affinity clade in whole plastome and CDS analyses, and sister to the *Lepanthes* affinity clade in NC-DNA and hotspots analyses, with higher support in the latter.

Comparing this topology with Karremans' proposal [18], the positions of the *Octomeria*, *Restrepia,* and *Acianthera* affinities in this order agree. However, the *Masdevallia* and *Specklinia* affinities were not positioned accordingly. The classification of Pleurothallidinae genera into affinities is a compilation of phylogenetic results based almost exclusively on nrITS data, so this disagreement may be due to genomic incongruence. In agreement, the nuclear ribosomal DNA (nrDNA) operon analysis recovered the *Specklinia+Pleurothallis* relationship (S6 Fig). The mtDNA analysis, on the other hand, recovered only the *Lepanthes* and *Acianthera+Myoxanthus* clades, with the former sister of the rest (S6 Fig). It must be noted that such a sparse sample of genera does not constitute a robust evaluation of Karremans' ideas of relationships, and our aim was to describe and compare the large amount of molecular data presented here.

Plastid molecular markers are widely used in phylogenetic studies of land plants due to their abundance in cells and easy amplification/sequencing [19,80,81]. The nuclear ribosomal internal transcribed spacers (nrITS) have poorer sequencing success than plastid markers, but they hold the majority of nrDNA operon molecular variability and have great discriminant power at the species level for most angiosperms [19,82]. Hence, plastid markers are often combined with nrITS, specially in orchid phylogenetic studies (e.g. [6,14,21,25,83,84]). Highly supported discordance between plastid and nuclear trees is uncommon in Orchidaceae but has been detected in Epidendroideae [55], especially in Catasetinae [85] and here in Pleurothallidinae. Such cytonuclear discordance can be due to

divergence in evolutionary history between nuclear and plastid genomes and is usually attributed to introgression, incomplete lineage sorting, and hybridization [85-88]. Determining the causes of the observed cytoplasmic discordance is beyond our scope due to limited sampling, but these newly sequenced plastomes are a good starting point for future investigations on this subject in the Pleurothallidinae.

Mitochondrial molecular markers were not considered as potential plant DNA barcodes due to their low substitution rates [19,89,90]. Complete mitochondrial genome sequences are also difficult to assemble in plants because their overall structure is not as conserved as those of plastomes and contains horizontally inherited nuclear and plastid sequences [91]. Still, some mitochondrial markers have been analyzed in the past for use in orchid analyses [92], such as *nad1* and *cox1* introns [93,94], but their low variability compared to plastid markers discouraged their use. More recently, several mitochondrial CDSs were included in a phylogenomic study in the family [95], which produced a highly supported tree with some incongruence with the plastid analysis. Our mtDNA analysis included mostly CDSs and partial introns and also produced a well-supported tree, but it significantly diverged from the plastid and nuclear results (S6 Fig). It is noteworthy that there is no orchid complete mitochondrial genome available, so we recovered the mtDNA from raw reads based on a reference sequence that is phylogenetically distant from Pleurothallidinae. In addition, sequencing for each species varied in read number, length, and quality, which directly impacted mtDNA length and content (Table 2). We believe that these two main factors generated high sequence heterogeneity among species that might have influenced the results, so they must be interpreted with care. Despite the odd topology, the mtDNA tree retrieved the *Lepanthes* affinity and *Acianthera+Myoxanthus* clades found in other analyses. Also, a high-throughput analysis for the *Lepanthes horrida* Rchb.f. species complex revealed

that some mitochondrial markers were among the ten best performing markers [96], supporting a future role in Pleurothallidinae phylogenetics.

When the three datasets were combined (plastome, nrDNA operon, and mtDNA), we got the same topology as the plastome analysis with higher bootstrap percentages (Fig 4). In fact, applying standard methods to concatenated multigene data often improves tree resolution and support in phylogenetic estimates (e.g. as seen in Pleurothallidinae [21,96]). Simulation-based studies have shown that phylogenetic accuracy increases as more genes are included to the dataset [97,98]. With this in view, we hope that the molecular markers highlighted here as plastid hotspots will be used in future phylogenetic studies in Pleurothallidinae in conjunction with nrITS, mtDNA, and, if possible, with morphological and ecological data as well, so that more robust phylogenetic trees are produced.

Conclusions

The eight new plastomes of Pleurothallidinae sequenced here greatly increased orchid subtribal representation in GenBank. Their overall structure and codon usage are conserved, and gene content is similar, with variation only in the *ndh* gene composition. Protein-coding genes under positive selection were detected, and a complete set of primers were provided for microsatellites and the top ten most-variable markers, thus increasing molecular resources available to future evolutionary research in the subtribe at various scales, from genes to species. In particular, the top ten markers are more variable than any plastid markers previously used in Pleurothallidinae phylogenetics, and their tree topology is similar to that obtained with whole plastomes, reinforcing their potential as suitable molecular markers for the subtribe. However, strongly supported incongruence among plastid, nuclear ribosomal DNA, and mtDNA topologies suggests putative divergence in the evolutionary histories of

these genomes, a topic that needs future investigation. The well-supported mitochondrial tree, together with the performance in recent studies, suggests that the inclusion of mitochondrial markers in phylogenetic studies of Pleurothallidinae could be useful. The combined analysis of the three genomes, in addition to improving the support, could be expected to circumvent partly the problems associated with individual analyses.

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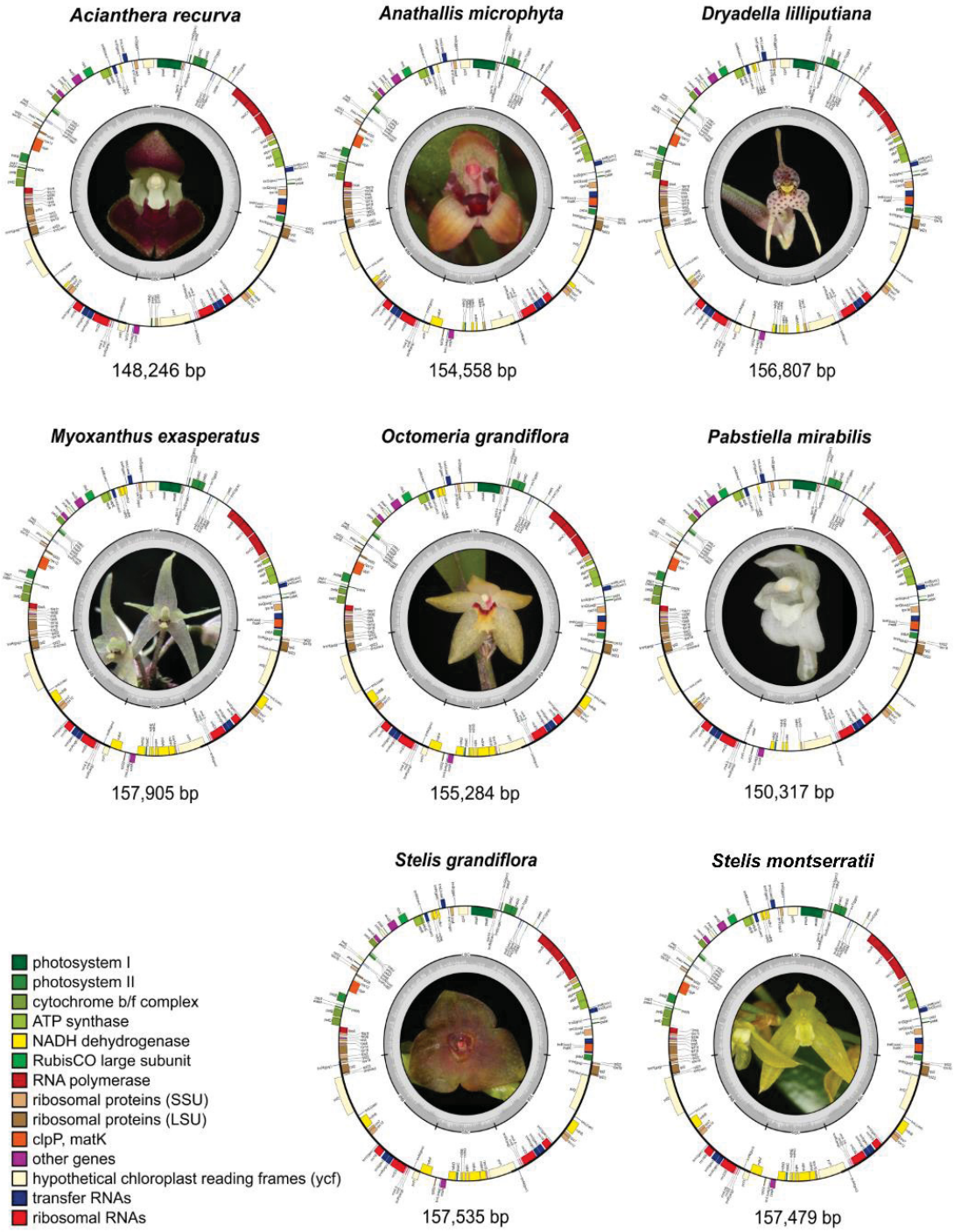
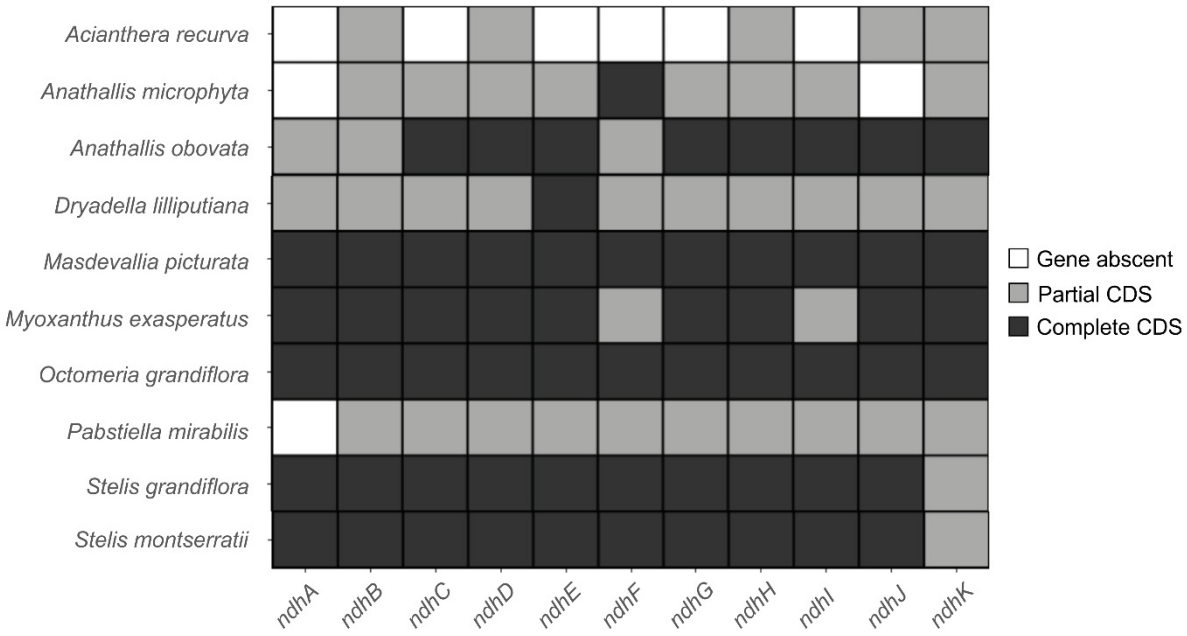
Supporting Information

S1 Fig. Genetic maps of the Pleurothallidinae plastomes sequenced. Genes are represented by rectangles, for which functions are identified by colors as shown in the legend. Genes placed inside the circle are transcribed clockwise, and those outside the circle are transcribed counter-clockwise. The gray inner circle is the GC content graph. Images of the sequenced species were taken by Eric C. Smidt except Marcelo Rodrigues for *Myoxanthus exasperatus*. https://doi.org/10.1371/journal.pone.0256126.s001

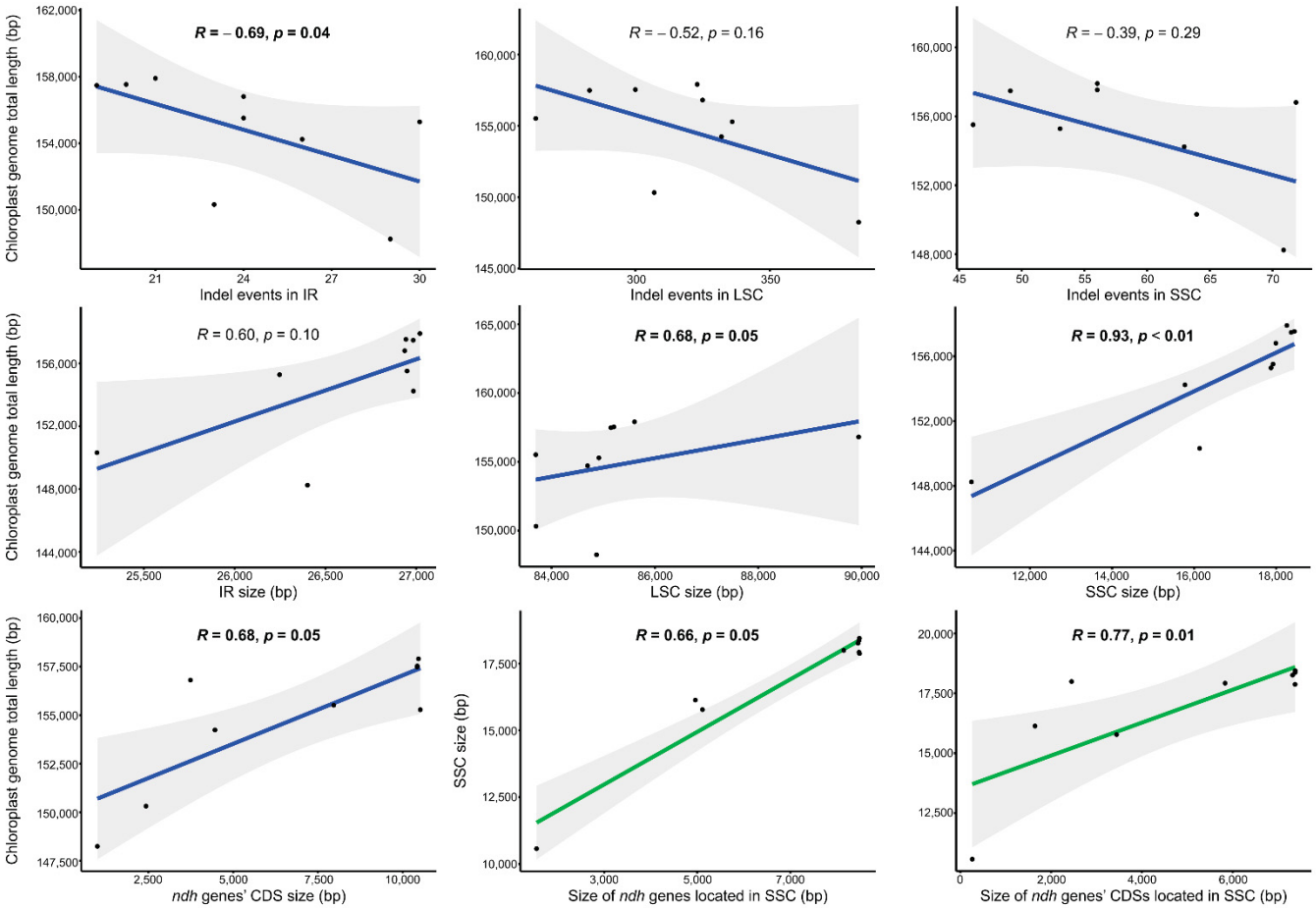


S2 Fig. Graph of *ndh* gene content of the ten Pleurothallidinae plastomes analyzed. White squares = complete gene losses, light-grey squares = truncated reading frames (pseudogenes), and dark-grey squares = complete CDSs. https://doi.org/10.1371/journal.pone.0256126.s002

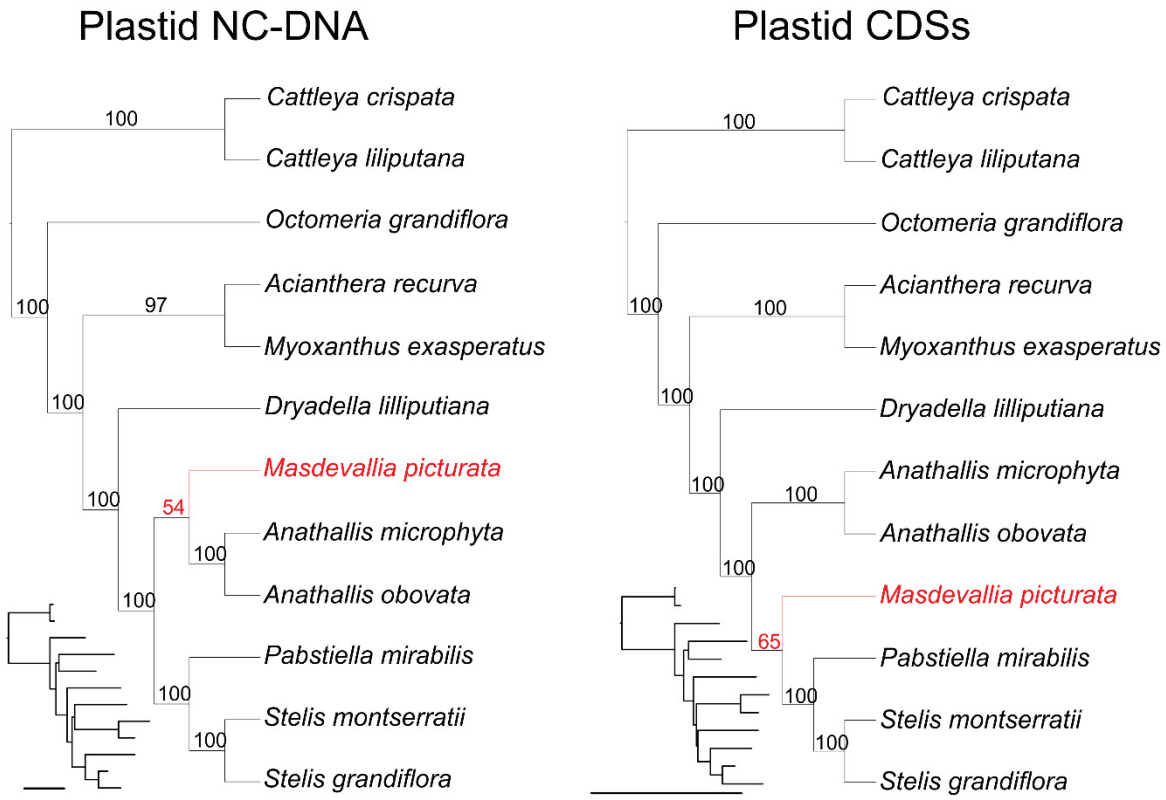


S3 Fig. Mauve alignment of the ten Pleurothallidinae plastomes analyzed. https://doi.org/10.1371/journal.pone.0256126.s003

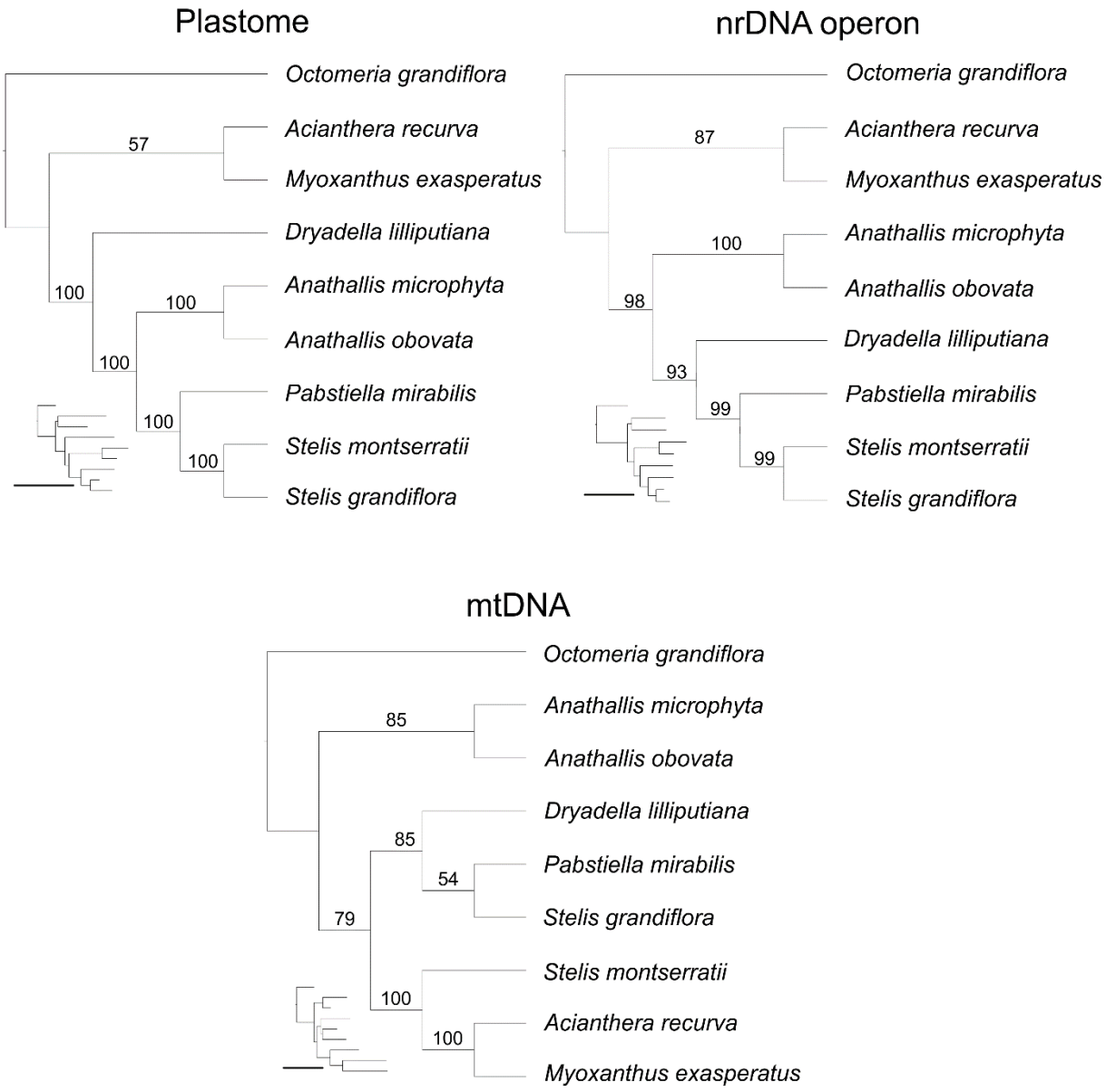
S4 Fig. Correlation plots. https://doi.org/10.1371/journal.pone.0256126.s004



S5 Fig. Maximum likelihood trees based on Epidendrae plastid CDS and non-coding DNA (NC-DNA). Numbers on branches are the bootstrap percentages; a tree with proportional branch lengths is on the left of each tree, which bars represent 0.02 nucleotide substitutions per site. https://doi.org/10.1371/journal.pone.0256126.s005



S6 Fig. Maximum likelihood trees based on Pleurothallidinae plastomes (one IR), nuclear ribosomal DNA operon, and mitochondrial DNA. Numbers on branches refer to bootstrap percentages; a tree with proportional branch lengths is on the left of each tree, which bars represent 0.02 nucleotide substitutions per site. https://doi.org/10.1371/journal.pone.0256126.s006



S1 Table. Taxonomic information, voucher, and GenBank accession numbers of all sequences used. Accessions in boldface are sequences generated in this study. All vouchers provided are deposited at UPCB herbarium. https://doi.org/10.1371/journal.pone.0256126.s007

Subtribe	Affinity	Taxon	Voucher	GenBank accession (plastome)	GenBank accession (nrDNA)	GenBank accession (mtDNA)
Laeliinae	-	*Cattleya crispata* (Thunb.) Van den Berg	unvouchered	KP168671	-	-
Laeliinae	-	*Cattleya liliputana* (Pabst) Van den Berg	unvouchered	KP202881	-	-
Pleurothallidinae	*Acianthera*	*Acianthera recurva* (Lindl.) Pridgeon & M.W. Chase	D.C. Imig 500 (UPCB)	**MW375123**	**MW364931**	**MW562896–MW562941**
Pleurothallidinae	*Lepanthes*	*Anathallis microphyta* (Barb. Rodr.) C.O.Azevedo & Van den Berg	M.C. Santos 25 (UPCB)	**MW375124**	**MW364932**	**MW562942–MW563001**
Pleurothallidinae	*Lepanthes*	*Anathallis obovata* (Lindl.) Pridgeon & M.W. Chase	M.C. Santos 22 (UPCB)	MH979332	**MW364933**	**MW563002–MW563053**
Pleurothallidinae	*Masdevallia*	*Masdevallia picturata* Rchb. f.	unvouchered	KJ566305	-	-
Pleurothallidinae	*Octomeria*	*Octomeria grandiflora* Lindl.	D.C. Imig 503 (UPCB)	**MW375128**	**MW364937**	**MW563178–MW563221**
Pleurothallidinae	*Pleurothallis*	*Pabstiella mirabilis* (Schltr.) Brieger & Senghas	A.L.V. Toscano de Brito 3287 (UPCB)	**MW375130**	**MW364938**	**MW563222–MW563270**
Pleurothallidinae	*Pleurothallis*	*Stelis grandiflora* Lindl.	M.E. Engels 1600 (UPCB)	**MW375129**	**MW364939**	**MW563271–MW563320**
Pleurothallidinae	*Pleurothallis*	*Stelis montserratii* (Porsch) Karremans	D.C. Imig 410 (UPCB)	**MW375125**	**MW364934**	**MW563054–MW563091**
Pleurothallidinae	*Restrepia*	*Myoxanthus exasperatus* (Lindl.) Luer	T.F. Santos 326 (UPCB)	**MW375127**	**MW364936**	**MW563137–MW563177**
Pleurothallidinae	*Specklinia*	*Dryadella lilliputiana* (Cogn.) Luer	D.C. Imig 469 (UPCB)	**MW375126**	**MW364935**	**MW563092–MW563136**

S2 Table. NGS information of the eight plastomes sequenced and the mtDNA and nuclear ribosomal DNA recovered. *See Mauad *et al.* [30].
https://doi.org/10.1371/journal.pone.0256126.s008

Taxon	# raw reads	Raw reads mean length (bp)	# post-trim reads	Post-trim reads mean length (bp)	# reads mapped to plastomes	Plastome mean coverage (x)	# raw reads mapped to mitochondrion	mtDNA mean coverage (x)	# raw reads mapped to nrDNA operon	nrDNA operon mean coverage (x)
Acianthera recurva	614,726	179.22	604,109	179.38	57,687 (09.56%)	68.3	34,916 (05.68%)	112.1	976 (00.16%)	23.9
Anathallis microphyta	1,331,958	127.44	1,221,040	130.71	266,857 (22.72%)	195.3	110,533 (08.30%)	35.5	4,472 (00.33%)	65.1
Anathallis obovata	1,378,972	*	*	*	*	*	75,501 (05.47%)	30.5	3,207 (00.23%)	59.6
Dryadella lilliputiana	1,284,838	159.42	1,239,756	161.73	230,188 (18.58%)	241.2	112,230 (08.73%)	62.4	4,647 (00.36%)	95.4
Myoxanthus exasperatus	898,306	130.75	839,586	134.70	189,429 (22.64%)	163.7	92,521 (10.30%)	71.2	3,745 (00.41%)	58.9
Octomeria grandiflora	1,142,910	167.76	1,095,295	171.23	121,474 (11.11%)	133.5	53,065 (04.64%)	29.0	2,630 (00.23%)	52.7
Pabstiella mirabilis	1,231,612	171.72	1,195,781	172.83	60,445 (05.10%)	182.9	40,170 (03.26%)	24.0	6,036 (00.49%)	135.4
Stelis grandiflora	1,120,894	138.39	1,046,794	143.58	150,757 (14.42%)	135.7	62,856 (05.61%)	27.0	2,689 (00.24%)	47.7
Stelis montserratii	826,542	188.57	816,984	187.57	116,542 (14.29%)	131.8	56,799 (06.87%)	57.8	683 (00.08%)	16.6

S3 Table. Gene content of the mitochondrial DNA recovered from raw reads. *Genes with introns. https://doi.org/10.1371/journal.pone.0256126.s009

Gene groups	Gene names
Ribosomal RNA	*5S*, *18S*, *26S*
Transport RNA	*trnE* –UUC, *trnK* –UUU, *trnL* –UAA, *trnM* –CAU, *trnQ* –UUG, *trnR* –GCG, *trnY* –AUA, *trnY* –GUA
Ribosome small subunit	*rps12*
Maturase	*matR*
Apocytochrome b	*cob*
Cytochrome c biosynthesis	*ccmB*, *ccmC*, *ccmFc**, *ccmFN1*, *ccmFN2*
Cytochrome c oxidase subunits	*cox1, cox2**, *cox3*
ATP synthase subunits	*atp1*, *atp4*, *atp6*, *atp8*, *atp9*
NADH dehydrogenase subunits	*nad1**, *nad2**, *nad3*, *nad4**, *nad4L*, *nad5**, *nad6*, *nad7**, *nad9*
Transport membrane protein	*mttb*

S4 Table. Gene content of the Pleurothallidinae genomes analyzed. [a]Genes with introns, [b]duplicated genes (in IRs), [c]partially duplicated genes, *pseudogenes. https://doi.org/10.1371/journal.pone.0256126.s010

Gene groups	Gene names
Ribosomal RNA	*rrn4.5*[b]; *rrn5*[b]; *rrn16*[b]; *rrn23*[b]
Transport RNA	*trnA* –UGC[ab]; *trnC* –GCA; *trnD* –GUC; *trnE* –UUC; *trnF* –GAA; *trnfM* –CAU; *trnG* –GCC; *trnG* –UCC[a]; *trnH* –GUG[b]; *trnI* –CAU[b]; *trnI* –GAU[ab]; *trnK* –UUU[a]; *trnL* –CAA[b]; *trnL* –UAA[a]; *trnL* –UAG; *trnM* –CAU; *trnN* –GUU[b]; *trnP* –UGG; *trnQ* –UUG; *trnR* –ACG[b]; *trnR* –UCU; *trnS* –GCU; *trnS* –GGA; *trnS* –UGA; *trnT* –GGU; *trnT* –UGU; *trnV* –GAC[b]; *trnV* –UAC[a]; *trnW* –CCA; *trnY* –GUA
Ribosome small subunit	*rps2*; *rps3*; *rps4*; *rps7*[b]; *rps8*; *rps11*; *rps12*[ab]; *rps14*; *rps15*; *rps16*[a]; *rps18*; *rps19*[b]
Ribosome large subunit	*rpl2*[ab]; *rpl14*; *rpl16*[a]; *rpl20*; *rpl22*; *rpl23*[b]; *rpl32*; *rpl33*; *rpl36*
RNA-polimerase	*rpoA*; *rpoB*; *rpoC1*[a]; *rpoC2*
Translation initiation factor	*infA*
Maturase	*matK*
Photosystem I (PSI) subunits	*psaA*; *psaB*; *psaC*; *psaI*; *psaJ*; *ycf3*[a]; *ycf4*
Photosystem II (PSII) subunits	*psbA*; *psbB*; *psbC*; *psbD*; *psbE*; *psbF*; *psbH*; *psbI*; *psbJ*; *psbK*; *psbL*; *psbM*; *psbN*; *psbT*; *psbZ*
Cytochrome *b*$_6$*f* subunits	*petA*; *petB*[a]; *petD*[a]; *petG*; *petL*; *petN*
ATP synthase subunits	*atpA*; *atpB*; *atpE*; *atpF*; *atpH*; *atpI*
NADH dehydrogenase subunits*	*ndhA*[a]; *ndhB*[ab]; *ndhC*; *ndhD*; *ndhE*; *ndhF*; *ndhG*; *ndhH*; *ndhI*; *ndhJ*; *ndhK*
Rubisco	*rbcL*
Chloroplast envelope membrane protein	*cemA*
Acetyl-CoA carboxylase beta subunit	*accD*
Cytochrome c biogenesis protein	*ccsA*
Clp protease subunit	*clpP*[a]
TIC complex component	*ycf1*[c]
Unknown function	*ycf2*[b]

S5 Table. Number of insertion/deletion events by genomic region in each Pleurothallidinae plastome. The plastome of *Madevallia picturata* was the reference for all indels. https://doi.org/10.1371/journal.pone.0256126.s011

Dataset	**IR**	**LSC**	**SSC**	**Total**
Pleurothallidinae	134	1,899	384	2,417
Acianthera recurva	29	383	71	483
Anathallis microphyta	26	330	62	418
Anathallis obovata	24	263	46	333
Dryadella lilliputiana	24	325	72	421
Myoxanthus exasperatus	21	323	56	400
Octomeria grandiflora	30	336	53	419
Pabstiella mirabilis	23	307	64	394
Stelis grandiflora	20	300	56	376
Stelis montserratii	19	283	49	351

S6 Table. Relative frequency (RF) and relative synonymous codon usage (RSCU) of all 64 codons and their respective amino-acids (AA) in each Pleurothallidinae plastome analyzed. Species names were abbreviated as follows: ACIRE = *Acianthera recurva*, ANAMI = *Anathallis microphyta*, ANAOB = *A. obovata*, DRYLI = *Dryadella lilliputiana*, MASPI = *Masdevallia infracta*, MYOEX = *Myoxanthus exasperatus*, OCTGR = *Octomeria grandiflora*, PABMI = *Pabstiella mirabilis*, STEGR = *Stelis grandiflora*, and STEMO = *Stelis montserratii*. https://doi.org/10.1371/journal.pone.0256126.s012

AA	Codon	ACIRE		ANAMI		ANAOB		DRYLI		MASPI		MYOEX		OCTGR		PABMI		STEGR		STEMO	
		RF	RSCU	RF	RSCU	RF	RSCU	RF	RSCU	RF	RF	RSCU	RSCU	RF	RSCU	RF	RSCU	RF	RSCU	RF	RSCU
Ala	GCA	1.63	1.21	1.61	1.19	1.65	1.20	1.59	1.19	1.65	1.64	1.22	1.22	1.64	1.22	1.61	1.21	1.65	1.22	1.63	1.21
	GCC	0.73	0.54	0.73	0.54	0.76	0.55	0.74	0.56	0.75	0.75	0.56	0.55	0.75	0.56	0.75	0.56	0.76	0.56	0.76	0.57
	GCG	0.49	0.37	0.50	0.37	0.50	0.36	0.54	0.40	0.49	0.47	0.35	0.36	0.47	0.35	0.47	0.35	0.50	0.37	0.48	0.35
	GCT	2.51	1.87	2.57	1.90	2.58	1.88	2.48	1.85	2.51	2.49	1.86	1.86	2.50	1.86	2.50	1.87	2.50	1.84	2.52	1.86
Arg	AGA	1.97	1.90	1.93	1.92	1.92	1.89	1.95	1.90	1.86	1.88	1.91	1.91	1.91	1.92	1.94	1.95	2.01	1.95	1.89	1.93
	AGG	0.64	0.62	0.59	0.59	0.62	0.61	0.63	0.62	0.57	0.58	0.59	0.59	0.58	0.59	0.59	0.59	0.59	0.58	0.58	0.59
	CGA	1.42	1.37	1.37	1.37	1.38	1.36	1.42	1.38	1.34	1.34	1.36	1.37	1.34	1.35	1.34	1.35	1.39	1.36	1.32	1.34
	CGC	0.36	0.35	0.33	0.33	0.34	0.34	0.32	0.32	0.34	0.35	0.35	0.35	0.33	0.33	0.31	0.32	0.34	0.33	0.34	0.35
	CGG	0.39	0.37	0.40	0.40	0.40	0.39	0.40	0.39	0.37	0.37	0.37	0.38	0.39	0.40	0.38	0.38	0.38	0.37	0.38	0.39
	CGT	1.44	1.39	1.39	1.38	1.41	1.39	1.41	1.37	1.36	1.38	1.40	1.39	1.39	1.40	1.39	1.40	1.44	1.40	1.37	1.40
Asn	AAC	1.01	0.42	0.93	0.39	0.92	0.41	0.98	0.41	0.92	0.91	0.39	0.40	0.92	0.40	0.93	0.39	0.94	0.40	0.90	0.39
	AAT	3.77	1.58	3.79	1.60	3.60	1.59	3.76	1.59	3.73	3.73	1.60	1.60	3.71	1.60	3.77	1.60	3.76	1.60	3.72	1.61
Asp	GAC	0.71	0.34	0.76	0.38	0.69	0.35	0.73	0.36	0.71	0.72	0.36	0.35	0.72	0.36	0.70	0.35	0.72	0.35	0.71	0.36
	GAT	3.40	1.65	3.27	1.62	3.30	1.65	3.30	1.63	3.29	3.26	1.64	1.64	3.27	1.64	3.27	1.65	3.36	1.64	3.26	1.64
Cys	TGC	0.27	0.47	0.25	0.43	0.24	0.41	0.25	0.44	0.24	0.24	0.41	0.41	0.24	0.41	0.25	0.43	0.28	0.48	0.25	0.43
	TGT	0.87	1.53	0.90	1.57	0.92	1.58	0.90	1.56	0.92	0.93	1.59	1.58	0.93	1.58	0.93	1.57	0.90	1.52	0.91	1.57
Gln	CAA	2.89	1.55	2.77	1.53	2.80	1.54	2.87	1.55	2.72	2.75	1.54	1.53	2.74	1.53	2.70	1.53	2.83	1.53	2.73	1.54
	CAG	0.84	0.45	0.84	0.46	0.83	0.46	0.83	0.45	0.83	0.81	0.46	0.47	0.83	0.47	0.82	0.47	0.87	0.47	0.81	0.45
Glu	GAA	4.30	1.51	4.09	1.50	4.14	1.52	4.24	1.52	4.08	4.07	1.53	1.53	4.04	1.51	4.10	1.51	4.20	1.52	4.05	1.52
	GAG	1.37	0.48	1.34	0.49	1.28	0.47	1.32	0.47	1.26	1.26	0.47	0.47	1.31	0.49	1.32	0.49	1.33	0.48	1.27	0.48
Gly	GGA	2.62	1.57	2.68	1.58	2.72	1.60	2.63	1.57	2.74	2.77	1.62	1.61	2.76	1.62	2.76	1.63	2.64	1.57	2.76	1.62
	GGC	0.68	0.40	0.68	0.40	0.68	0.40	0.66	0.39	0.65	0.64	0.37	0.38	0.65	0.38	0.63	0.37	0.69	0.41	0.66	0.39
	GGG	1.13	0.68	1.15	0.67	1.13	0.67	1.16	0.69	1.14	1.15	0.67	0.67	1.12	0.66	1.15	0.68	1.16	0.69	1.14	0.67
	GGT	2.25	1.34	2.28	1.34	2.27	1.33	2.23	1.33	2.24	2.26	1.32	1.32	2.26	1.33	2.21	1.31	2.24	1.33	2.24	1.32
His	CAC	0.54	0.43	0.55	0.44	0.54	0.44	0.53	0.43	0.56	0.54	0.45	0.47	0.54	0.46	0.53	0.45	0.54	0.43	0.54	0.45
	CAT	1.98	1.57	1.93	1.55	1.92	1.56	1.94	1.57	1.80	1.83	1.54	1.52	1.82	1.54	1.81	1.54	1.97	1.57	1.85	1.54

Ile	**ATA**	2.56	0.92	2.64	0.93	2.67	0.94	2.53	0.90	2.70	2.72	0.94	0.93	2.70	0.94	2.71	0.94	2.46	0.89	2.72	0.94
	ATC	1.64	0.59	1.68	0.59	1.67	0.59	1.66	0.59	1.69	1.67	0.58	0.58	1.73	0.60	1.69	0.59	1.69	0.61	1.68	0.58
	ATT	4.12	1.48	4.15	1.47	4.17	1.47	4.18	1.50	4.27	4.25	1.47	1.48	4.17	1.45	4.23	1.47	4.13	1.50	4.22	1.47
Leu	**CTA**	1.45	0.85	1.38	0.80	1.41	0.81	1.41	0.81	1.44	1.44	0.82	0.82	1.42	0.81	1.44	0.82	1.38	0.81	1.47	0.84
	CTC	0.61	0.36	0.65	0.38	0.66	0.38	0.65	0.37	0.66	0.64	0.37	0.38	0.67	0.38	0.68	0.39	0.62	0.36	0.65	0.37
	CTG	0.68	0.40	0.67	0.39	0.68	0.39	0.69	0.40	0.71	0.67	0.38	0.40	0.67	0.39	0.66	0.37	0.72	0.42	0.69	0.40
	CTT	2.09	1.24	2.16	1.25	2.15	1.24	2.25	1.30	2.18	2.23	1.27	1.25	2.23	1.27	2.23	1.28	2.11	1.24	2.23	1.27
	TTA	3.19	1.89	3.36	1.96	3.40	1.96	3.34	1.93	3.47	3.42	1.95	1.98	3.41	1.95	3.43	1.96	3.28	1.92	3.44	1.96
	TTG	2.11	1.25	2.07	1.21	2.08	1.20	2.04	1.18	2.03	2.08	1.19	1.16	2.08	1.19	2.06	1.17	2.09	1.23	2.06	1.17

S7 Table. Results of Tajima's neutrality test (D) for the 68 CDSs common to the 10 Pleurothallidinae plastomes analyzed. D > 0 = purifying selection, and D < 0 = positive selection. Significant results ($p \leq 0.05$) were highlighted in bold. *Tajima's D test was not computed due to the lack of variable sites. https://doi.org/10.1371/journal.pone.0256126.s013

CDS	*D*	*P* value	CDS	*D*	*P* value
accD	**-4.36**	**< 0.01**	***psbM***	-1.03	0.30
atpA	-1.49	0.13	***psbN***	-1.40	0.16
atpB	**-2.61**	**0.01**	***psbT***	**-3.55**	**< 0.01**
atpE	-0.89	0.37	***psbZ***	-0.67	0.50
atpF	-1.18	0.24	***rbcL***	**-2.32**	**0.02**
atpH	-0.96	0.34	***rpl2***	-1.01	0.31
atpI	-1.51	0.13	***rpl14***	-0.83	0.40
ccsA	-1.60	0.11	***rpl16***	-0.38	0.70
cemA	-1.28	0.20	***rpl20***	-1.41	0.16
clpP	-1.02	0.30	***rpl22***	**-2.03**	**0.04**
infA	-0.03	0.98	***rpl23***	-1.40	0.16
matK	-1.26	0.21	***rpl32***	**-1.96**	**0.05**
petA	-1.17	0.24	***rpl33***	**-1.95**	**0.05**
petB	**-3.49**	**< 0.01**	***rpl36***	-1.40	0.16
petD	-1.27	0.20	***rpoA***	-1.35	0.17
petG	-1.56	0.12	***rpoB***	-1.57	0.11
petL	-1.40	0.16	***rpoC1***	**-2.20**	**0.03**
petN	-0.69	0.49	***rpoC2***	-1.44	0.15
psaA	-1.58	0.11	***rps2***	-1.68	0.09
psaB	-1.28	0.20	***rps3***	-1.43	0.15
psaC	-1.84	0.06	***rps4***	-1.65	0.10
psaI	-0.63	0.53	***rps7****	-	-
psaJ	1.13	0.26	***rps8***	-1.65	0.10
psbA	-1.23	0.22	***rps11***	-1.50	0.13
psbB	**-1.91**	**0.05**	***rps12***	-1.11	0.26
psbC	-0.70	0.48	***rps14***	-1.01	0.31
psbD	-1.15	0.25	***rps15***	-1.80	0.07
psbE	-1.74	0.08	***rps16***	-1.38	0.70
psbF	-1.39	0.16	***rps18***	**-3.58**	**< 0.01**
psbH	-1.59	0.11	***rps19***	-1.39	0.16
psbI	0.01	0.99	***ycf1***	**-3.22**	**< 0.01**
psbJ	-1.40	0.16	***ycf2***	**-2.19**	**0.03**
psbK	-1.75	0.08	***ycf3***	-0.85	0.39
psbL	-1.11	0.26	***yfc4***	-1.80	0.07

S8 Table. Characterization, distribution, and frequency of microsatellites (SSRs) in the Pleurothallidinae plastomes analyzed. https://doi.org/10.1371/journal.pone.0256126.s014

Plastome	SSRs count	SSRs by repeat unit size						SSRs by location			SSRs by region		
		Mono	Di	Tri	Tetra	Penta	Hexa	Exons	IGSs	Introns	IR	LSC	SSC
Acianthera recurva	116	33	10	58	9	6	0	34	64	18	22	87	7
Anathallis microphyta	135	59	7	57	8	1	3	44	68	23	13	98	25
Anathallis obovata	134	62	5	57	8	1	1	41	73	20	17	94	23
Dryadella lilliputiana	143	65	4	62	9	2	1	41	84	18	18	96	29
Masdevallia picturata	131	51	8	61	11	0	0	44	69	18	17	92	22
Myoxanthus exasperatus	122	46	8	57	7	3	1	38	70	14	19	86	17
Octomeria grandiflora	127	56	6	57	5	2	1	40	72	15	18	90	19
Pabstiella mirabilis	113	41	9	54	6	3	0	40	62	12	16	80	17
Stelis grandiflora	133	62	5	54	10	2	0	41	76	16	16	95	22
Stelis montserratii	136	63	8	54	9	2	0	41	80	15	18	98	20
Total	1,290	538	70	571	82	22	7	363	718	209	174	916	200

S9 Table. List of the 62 polymorphic microsatellites present in at least seven Pleurothallidinae plastomes, including anticipated size, primers, melting temperatures, and location. SSR type in brackets with repetition frequency following. Loci amplified by the same primer separated by semicolons. Slanting bars (/) indicate polymorphism in repeat units. Tm = primer melting temperature. https://doi.org/10.1371/journal.pone.0256126.s015

Primer name	Product size (bp)	Location	Region	SSR type	Primer sequence (5'–3')	Tm (°C)	% GC
Pleuro_SSR1	341	*psbA-trnK* IGS	LSC	(T) × 10–17	F - TTGCAGAAGCGACCCCATAG R - CGACTAGTTCCGGGTTCGAG	60.1 59.9	55.0 60.0
Pleuro_SSR2	422	*psbK-psbI* IGS	LSC	(A) × 10–15; (ATCTT) × 3–4	F - AGGGAAGGAGGACGATGATCT R - GGATTACGCCCCGGATCATT	59.8 60.0	52.4 55.0
Pleuro_SSR3	442	*atpH-atpI* IGS	LSC	(TAC) × 3	F - CAAGCCCTACAGCCAATCCA R - AGCCCACTGCATTATAGATGGA	60.0 59.0	55.0 45.0
Pleuro_SSR4	421	*atpI-rps2* IGS	LSC	(TTC) × 3	F - TGTTGGCCTACTTCTACACCTG R - GCAATTTGTGAGGGCCGTTC	59.7 60.4	50.0 55.0
Pleuro_SSR5	365	*rps2-rpoC2* IGS	LSC	(T) × 10–16	F - GCCCTTATTGCTGCTGATGC R - CTGGTAGAAGGTTCCGTCGG	60.0 59.8	55.0 60.0
Pleuro_SSR6	226	*rpoC1* intron	LSC	(TCC) × 3	F - TCATATTCGCTTGCGCTTGC R - CCCCGGCTCTGACATGTATC	60.0 60.0	50.0 60.0
Pleuro_SSR7	296	*trnC-petN* IGS	LSC	(T) × 10–15	F - GGCTCTGAGTGCTGTTCCTT R - TTAAAGCAGCCCAAGCGAGA	60.0 60.0	55.0 50.0
Pleuro_SSR8	457	*petN-psbM* IGS	LSC	(TTA) × 3	F - TATGGGGAAGGAGTGGGCTT R - GAATTGCAAGCCCAACTGCT	60.3 59.7	55.0 50.0
Pleuro_SSR9	498	*trnE-trnT* IGS	LSC	(AGT) × 3–4 / (GTA) × 3	F - TGAGCTATCCCATACTCCCAT R - CCACTGAGTTAAAAGGGCCCT	57.4 59.9	47.6 52.4
Pleuro_SSR10	110	*trnT-psbD* IGS	LSC	(A) × 10–15; (ATT) / (TTA) × 3	F - TCTTCGTTTTTCAGCGGGGA R - ACGGGGAAGACTCCTCCTAA	59.9 59.3	50.0 55.0
Pleuro_SSR11	370	*psaA* CDS	LSC	(TTG) × 3	F - ACGGGAACTGCGAGCAAATA R - ACATCTGAACTGGGCATGCA	60.0 60.0	50.0 50.0
Pleuro_SSR12	498	*psaA-ycf3* IGS	LSC	(T) × 10–15	F - TGCCAAAGCATTTCCCAGGA R - GATTCGGAAATTGCGGAGGC	60.2 60.0	50.0 55.0
Pleuro_SSR13	134	*ycf3* intron I	LSC	(AAG) / (AAT) × 3	F - ATACGGCTCCTCCCTTCTGT R - AACCTCTTGTGGGAAGGCTG	60.0 59.9	55.0 55.0
Pleuro_SSR14	349	*trnT-trnL* IGS	LSC	(A) × 10–15	F - GGGCGGGGATATAAGAGCAA R - TGCCTTTCCTCCTCCTTCAT	59.3 58.3	55.0 50.0
Pleuro_SSR15	361	*trnT-trnL* IGS	LSC	(AGG) × 3; (AT) × 5–6	F - AGAATGAATATCGACCGTTCCACT	59.9	41.7

					R - AGCGTCTACCAATTTCGCCA	60.0	50.0
Pleuro_SSR16	419	*trnL-trnF* IGS	LSC	(T) × 10−13	F - ATCGTGAGGGTTCAAGTCCC R - TTCCCGTGCATCATCCTAGC	59.4 59.9	55.0 55.0
Pleuro_SSR17	476	*ndhC-trnV* IGS	LSC	(A) × 11−15	F - TGTGATGTGTAGACATAGCATGC R - CGGTTCGAGTCCGTATAGCC	58.9 60.0	43.5 60.0
Pleuro_SSR18	517	*atpB-rbcL* IGS	LSC	(TA) × 4−8	F - TACTGTCAAGAGAGGGGGCC R - GCGCAACCCAATCTTCGTTT	60.6 60.0	60.0 50.0
Pleuro_SSR19	430	*accD* CDS	LSC	(TAT) × 3−4	F - ACCGGTGGGAGTGAAGAAAC R - AACGAAGATAACTATCAATGCAACT	59.9 57.2	55.0 32.0
Pleuro_SSR20	454	*accD-psaI* IGS	LSC	(A) × 10−19	F - TGGAAGTATATCACTAGCTTCAGTT R - TGAAAAACGGGGGTTTTCGC	57.3 59.9	36.0 50.0
Pleuro_SSR21	450	*accD-psaI* IGS	LSC	(AGA) × 3	F - ACCCCCGTTTTTCACTAGGA R - AAGAAGCCATTGCGATTGCC	58.6 59.8	50.0 50.0
Pleuro_SSR22	242	*ycf4-cemA* IGS	LSC	(TAA) × 3−5 / (AAT) × 3	F - CTTGCGCGTACCCATTGAAG R - AAGAATGAAGCTGGACGCCA	59.9 60.0	55.0 50.0
Pleuro_SSR23	500	*petA-psbJ* IGS	LSC	(T) × 10−19	F - GTTTCGGCTGAAAAGCGGAT R - AAGAACTCAGCGGGGTAAGG	59.5 59.4	50.0 55.0
Pleuro_SSR24	388	*petL-trnW* IGS	LSC	(CCT) × 3	F - CGCGTCAATTGCCAATTCCT R - GGGTCTCCAAAACCCGATGT	59.8 60.0	50.0 55.0
Pleuro_SSR25	431	*trnP-psaJ* IGS	LSC	(AAG) × 3	F - AGCTGCGCTACATCCCTTTT R - CACAGGTGCCGTTGAGAGAT	60.0 60.0	50.0 55.0
Pleuro_SSR26	327	*psaJ-rpl33* IGS	LSC	(A) × 11−18	F - ATCTCTCAACGGCACCTGTG R - CGCGCTCCTAGACTGAATCC	60.0 60.3	55.0 60.0
Pleuro_SSR27	461	*rps18-rpl20* IGS	LSC	(AAT) × 10; (CTA) × 3	F - TTTCGTAGGCGTTTACCCCC R - GGAGAATGGACTCCGGGAAG	60.0 59.5	55.0 60.0
Pleuro_SSR28	500	*rpl20-rps12* IGS	LSC	(T) × 10−11	F - CACCGGAGCCTCTTCTTTCA R - TGCGACTCGTTCAGTTCAGA	59.7 59.3	55.0 50.0
Pleuro_SSR29	476	*clpP* CDS; intron I	LSC	(ATAA) × 3; (T) × 10−13	F - GGTATTACCCATCCGCCTGG R - TTCGGACAAATCTTCCCCCG	60.0 60.0	60.0 55.0
Pleuro_SSR30	413	*clpP* intron I	LSC	(T) × 10−12	F - CGGGGGAAGATTTGTCCGAA R - ATCCAGGCTCCGTTCAGAGA	60.0 60.3	55.0 55.0
Pleuro_SSR31	433	*clpP-psbB* IGS	LSC	(TAT) × 3; (AT) × 6−23 / (TA) × 5−17	F - TGGAAACGTAACAATGGTTTTATTG R - GACTGATCCGATCGATCCCG	57.1 59.8	32.0 60.0
Pleuro_SSR32	585	*psbB-psbT* IGS	LSC	(T) × 11−16	F - GCGCCAGAACCTTGTTCAGA R - GCTTCCACACCTATTCATTTTGGA	60.9 59.5	55.0 41.7

Pleuro_SSR33	206	*petD* intron	LSC	(T) × 11−19	F - ACAGGCTCCGTAAGATCCCT R - GATCAGGGTCGATGCAGAGG	60.0 60.0	55.0 60.0
Pleuro_SSR34	456	*rpoA* CDS	LSC	(TCT) × 3−4	F - GTGCTTCTGTAGAGTGCCCA R - TCTATGCCTGTTCGAAATGCG	59.7 59.1	55.0 47.6
Pleuro_SSR35	308	*rpl36-infA* IGS	LSC	(T) × 10−19	F - ATAATTCGACCCCGCCTACG R - TCCGGCGCAGTTTTATACGT	59.7 60.1	55.0 50.0
Pleuro_SSR36	294	*rpl36-infA* IGS	LSC	(T) × 10−17	F - TGTCCCTACCCATGACGAAC R - TTTTGGTGCAATTGCTCGGG	59.1 60.0	55.0 50.0
Pleuro_SSR37	422	*rpl14-rpl16* IGS	LSC	(CTT) × 3−4 / (TCT) × 3	F - TGAGCTCCACTGTTATCCGC R - TATGCACGTCGTGGTGGAAA	59.8 60.0	55.0 50.0
Pleuro_SSR38	347	*rpl16* intron	LSC	(CTT) × 3−4 / (TCT) × 3	F - GCTTAGGCCTGAACTCTGCA R - GGCAGTGTTATCAAGCATCAACA	60.0 59.8	55.0 43.5
Pleuro_SSR39	481	*ycf2* CDS	IR	(CTT) × 3	F - TGCGTTGAGAAAGGGCAGAT R - ACTCACTAGAGGCTCGGGAA	60.0 59.7	50.0 55.0
Pleuro_SSR40	293	*ycf2* CDS	IR	(TGA) × 3	F - AACCCTTTTCGCTCCGCTTA R - TGGGTCTATTTTCGGCGTCA	60.0 59.4	50.0 50.0
Pleuro_SSR41	410	*ycf2* CDS	IR	(CTT) × 3	F - TGACGCCGAAAATAGACCCA R - TGCTACAAGATCTCGCGCAT	59.4 59.9	50.0 50.0
Pleuro_SSR42	353	*ycf2* CDS	IR	(GAA) × 3	F - ATGCGCGAGATCTTGTAGCA R - CGATCCGGCAGAACAACTCA	59.9 60.4	50.0 55.0
Pleuro_SSR43	500	*rps12-trnV* IGS	IR	(CTT) × 3	F - CCTCATACGGCTCCTCGTTC R - CCCCTCGCTCGATGAGAAAA	60.0 59.8	60.0 55.0
Pleuro_SSR44	375	*rps12-trnV* IGS	IR	(TCC) × 3	F - TTCTCATCGAGCGAGGGGTA R - CCCTTACGCAATCGATCGGA	60.1 60.0	55.0 55.0
Pleuro_SSR45	432	*rps12-trnV* IGS	IR	(T) × 10−13	F – TTGGCGCAAGAATAAGGGGT R - TGACTTCCACCACGTCAAGG	60.0 59.9	50.0 55.0
Pleuro_SSR46	281	*ycf1* CDS	IR	(CAA) × 3	F – ACCAAGTTCCACGTTAGCCA R - TAGTGACAATAGGCGACGGC	59.5 59.9	50.0 55.0
Pleuro_SSR47	398	*ndhF* CDS	SSC	(CAA) × 3	F – GGTCGTGTGAACCAAAAGCC R - CGTCGTATGTGGGCTTTCCT	60.0 60.1	55.0 55.0
Pleuro_SSR48	290	*rpl32-ccsA* IGS	SSC	(TTA) × 3−6 / (ATT) × 3	F – ACCCCGACTGAGAACGAAAC R - TGCTTCCTAAGAGCAGCGTG	60.0 60.4	55.0 55.0
Pleuro_SSR49	260	*ndhE-ndhG* IGS	SSC	(A) × 10−14	F – TGCTTCGGCTTGTGATCAGT R - AGGTGCAATTACTATGGCTCGT	60.0 59.8	50.0 45.5
Pleuro_SSR50	405	*ycf1* CDS	SSC	(T) × 10−11	F – TGACTCATAAATGAATTCGCTGCA	59.4	37.5

					R - ATCTTCCCTGTCCCAAGCAT	58.7	50.0
Pleuro_SSR51	405	*ycf1* CDS	SSC	(A) × 10	F – AACGGACGATTCGCGAAGAA R - GTCTGGGGAAAGGAAGCGAA	60.4 60.0	50.0 55.0
Pleuro_SSR52	422	*ycf1* CDS	SSC	(TTA) × 3	F – CCTCATCCCACTCAGTAATTTGGA R - AGGATCTATGCGCGCTCAAA	60.1 59.9	45.8 50.0
Pleuro_SSR53	464	*ycf1* CDS	SSC	(T) × 12−14; (TCA) × 3	F – CCTCTTCTCCCAATTCTCCCA R - TGAGAGATCCCCTAGTCTGGA	58.8 58.5	52.4 52.4
Pleuro_SSR54	300	*ycf1* CDS	SSC	(T) × 10−11; (A) × 12	F – GGATTCGACTTCTCAATTCATTGT R - CTTTTCTTTTCGATTATAAACGATGGA	57.6 57.0	37.5 29.6

S10 Table. Nucleotide sequences of Pleurothallidinae with more than 150 bp in the alignment sorted by sequence variability (SV), including their location in the plastome, length, and guanine-cytosine content (GC). In total, 104 sequences were analyzed, comprising intergenic spacers (IGS), introns, and popular molecular markers for Orchidaceae such as the *trnH-psbA* IGS, the *matK* CDS, and the 3' portion of *ycf1* CDSs. IGS = inter-genic spacer, CDS = protein-coding sequence. https://doi.org/10.1371/journal.pone.0256126.s016

Sequence name	SV (%)	Location	Region	Length (bp)	GC (%)
psbI-trnS^{GCU}	41.67	IGS	LSC	158	22.8
ndhF-rpl32	41.19	IGS	SSC	1149	18.5
psbB-psbT	38.76	IGS	LSC	610	19.5
trnS^{GCU}-trnG^{UCC}	36.19	IGS	LSC	1334	26.5
rpl32-trnL^{UAG}	33.88	IGS	SSC	996	23.8
trnR^{UCU}-atpA	31.94	IGS	LSC	224	23.4
trnW^{CCA}-trnP^{UGG}	30.61	IGS	LSC	200	30.8
petN-psbM	29.78	IGS	LSC	1034	25.6
rpl16-rps3	29.68	IGS	LSC	192	22.2
psbK-psbI	29.63	IGS	LSC	611	25.1
atpB-rbcL	29.04	IGS	LSC	1319	23.9
clpP-psbB	28.38	IGS	LSC	1111	24.0
rps8-rpl14	28.13	IGS	LSC	265	21.1
psbM-trnD^{GUC}	26.95	IGS	LSC	1370	30.9
atpF-atpH	26.58	IGS	LSC	183	26.3
rps15-ycf1	26.53	IGS	SSC	459	24.0
trnG^{UCC}-trnR^{UCU}	26.50	IGS	LSC	166	24.7
trnP^{UGG}-psaJ	26.29	IGS	LSC	497	23.9
atpH-atpI	26.27	IGS	LSC	809	30.0
trnT^{UGU}-trnL^{UAA}	25.50	IGS	LSC	734	26.9
trnE^{UUC}-trnT^{GGU}	25.32	IGS	LSC	854	24.7
accD-psaI	24.54	IGS	LSC	887	27.2
ndhC-trnV^{UAC}	24.51	IGS	LSC	830	25.4
trnG^{GCC}-trnfM^{CAU}	24.34	IGS	LSC	215	32.6
trnF^{GAA}-ndhJ	24.00	IGS	LSC	191	27.2
trnK^{UUU}-matK	23.95	intron	LSC	311	29.0
ycf4-cemA	22.84	IGS	LSC	832	31.1
trnD^{GUC}-trnY^{GUA}	22.53	IGS	LSC	403	29.6
rps16-trnQ^{UUG}	22.39	IGS	LSC	479	26.8
trnK^{UUU}-rps16	22.33	IGS	LSC	605	27.6
psaC-ndhE	22.03	IGS	SSC	610	21.7
psbA-trnK^{UUU}	21.93	IGS	LSC	275	28.0
rpl33-rps18	21.47	IGS	LSC	214	27.5
matK- trnK^{UUU}	21.36	intron	LSC	1305	28.5
petA-psbJ	21.35	IGS	LSC	1163	28.8
rpl16	21.23	intron	LSC	1484	27.9
ccsA-ndhD	21.09	IGS	SSC	297	23.8
psbC-trnS^{UGA}	21.01	IGS	LSC	150	35.3
trnT^{GGU}-psbD	20.77	IGS	LSC	1006	33.7
ndhE-ndhG	20.65	IGS	SSC	161	22.5
psbE-petL	20.39	IGS	LSC	1320	27.6
psbZ-trnG^{GCC}	20.31	IGS	LSC	328	31.3
trnL^{UAA}-trnF^{GAA}	20.24	IGS	LSC	441	30.9
***ycf1* (3' portion)**	20.05	CDS	SSC	4541	27.5

trnH*^{GUG}*-psbA	19.94	IGS	IR/LSC	820	34.8
psaJ-rpl33	19.90	IGS	LSC	710	25.8
trnQ*^{UUG}*-psbK	19.85	IGS	LSC	390	23.4
ndhA	19.59	intron	SSC	1181	30.4
trnL*^{UAG}*-ccsA	19.49	IGS	SSC	160	18.7
atpI-rps2	19.35	IGS	LSC	309	25.6
psbH-petB	19.35	IGS	LSC	226	26.3
rps18-rpl20	19.25	IGS	LSC	274	30.9
petL-petG	19.17	IGS	LSC	192	29.8
***rpoB-trnC*^{GCA}**	18.97	IGS	LSC	1537	30.4
ndhG-ndhI	18.92	IGS	SSC	246	27.0
***ycf3-trnS*^{GGA}**	18.83	IGS	LSC	620	31.5
rpl22-rps19	18.60	IGS	IR	270	30.0
***trnL*^{UAA}**	18.56	intron	LSC	827	30.2
rbcL-accD	18.33	IGS	LSC	922	30.6
trnC*^{GCA}*-petN	17.81	IGS	LSC	875	33.6
rpoC2-rpoC1	17.51	IGS	LSC	205	36.9
trnfM*^{CAU}*-rps14	17.50	IGS	LSC	172	35.1
***rps4-trnT*^{UGU}**	17.42	IGS	LSC	365	27.8
psaA-ycf3	17.35	IGS	LSC	668	29.8
trnS*^{GGA}*-rps4	17.26	IGS	LSC	400	28.6
psaI-ycf4	17.26	IGS	LSC	435	31.3
petD-rpoA	16.67	IGS	LSC	191	29.7
rps2-rpoC2	16.67	IGS	LSC	238	31.5
***clpP* II**	16.57	intron	LSC	1068	30.7
rps16	16.20	intron	LSC	983	31.7
rps11-rpl36	15.85	IGS	LSC	197	25.5
atpF	15.70	intron	LSC	999	30.7
petB-petD	13.89	IGS	LSC	197	31.3
***clpP* I**	12.88	intron	LSC	716	30.8
petD	12.81	intron	LSC	949	33.1
trnM*^{CAU}*-atpE	12.70	IGS	LSC	198	29.4
rpl20-rps12	12.45	IGS	LSC	838	34.9
cemA-petA	12.14	IGS	LSC	255	30.3
***trnV*^{UAC}*-trnM*^{CAU}**	11.30	IGS	LSC	178	32.4
***trnG*^{UCC}**	10.68	intron	LSC	709	31.4
matK	10.58	CDS	LSC	1542	32.2
trnS*^{UGA}*-psbZ	10.57	IGS	LSC	233	33.1
petB	10.47	intron	LSC	744	34.1
rpoC1	10.30	intron	LSC	791	36.3
***trnR*^{ACG}*-trnN*^{GUU}**	09.68	IGS	IR	585	42.2
***ycf3* II**	09.18	intron	LSC	734	36.0
***ycf3* I**	08.66	intron	LSC	814	32.8
ndhD-psaC	08.21	IGS	SSC	152	34.5
trnL*^{CAA}*-ndhB	07.20	IGS	IR	588	37.1
***trnV*^{UAC}**	06.84	intron	LSC	589	39.6
***ycf2-trnI*^{CAU}**	06.25	IGS	IR	999	42.7
***rps12-trnV*^{GAC}**	06.23	IGS	IR	2005	39.7
***rpl23-trnI*^{CAU}**	05.16	IGS	IR	165	34.6
***rrn5-trnR*^{ACG}**	05.00	IGS	IR	247	41.3
***rrn16-trnI*^{GAU}**	04.76	IGS	IR	294	50.6

trnN^{GUU}-ycf1	04.04	IGS	IR	357	38.1
rrn4.5-rrn5	03.70	IGS	IR	217	46.3
ndhB	03.07	intron	IR	705	39.3
ndhB-rps7	02.52	IGS	IR	341	35.4
rps12	02.01	intron	IR	547	39.7
trnA^{UGC}	01.99	intron	IR	809	50.9
trnI^{GAU}	01.71	intron	IR	939	49.2
trnV^{GAC}-rrn16	01.71	IGS	IR	243	45.9
rpl2	01.20	intron	IR	665	40.6

S11 Table. Primers for the ten most variable regions for Pleurothallidinae. SV = sequence variability, Tm = primer melting temperature. *Primers previously published but with mismatches in Pleurothallidinae. For these cases, subtribe-specific primers for the same regions are provided. https://doi.org/10.1371/journal.pone.0256126.s017

Sequence	SV	Region	Primer sequence (5'−3')	Tm (ºC)	%GC	Product size (bp)
ndhF-rpl32	41.19	SSC	ndhF* – CCAATATCCCTTYYTTTTCCAA [79] rpl32R* – CCAATATCCCTTYYTTTTCCAA [79]	60.0 60.0	52.4 50.0	-
			Pleuro_ndhF-F – AGGAAAGCCCACATACGACG Pleuro_rpl32-R – ACTTTTTGACTGTCCGGTGGA	60.1 59.8	55.0 47.6	1068
petN-psbM	29.78	LSC	Pleuro_petN-F – TCTCGCTTGGGCTGCTTTAA Pleuro_psbM-R – GCGCTTATTGCTACTACGCTG	60.0 59.8	50.0 52.4	973
psbB-psbT	38.76	LSC	Pleuro_psbB-F – TGCTACGTTTGCTTTGCTCT Pleuro_psbT-R – GGGGGCTCATTACTTCAATGGA	58.4 60.1	45.0 50.0	800
psbI-trnS^{GCU}	41.67	LSC	Pleuro_psbI-F – AATGATCCGGGGCGTAATCC Pleuro_trnS(GCU)-R – ATGGGGAGAGATGGCTGAGT	60.0 60.0	55.0 55.0	266
psbK-psbI	29.63	LSC	psbK – TTAGCCTTTGTTTGGCAAG [80] psbI* – AGAGTTTGAGAGTAAGCAT [80]	54.1 50.7	42.1 36.8	-
			Pleuro_psbI-R – GGATTACGCCCCGGATCATT	60.0	55.0	699
rpl16-rps3	29.68	LSC	Pleuro_rpl16-F – AACGAGTCACACACTGAGCA Pleuro_rps3-R – TGCACGTGTCGAATGGATCA	59.5 60.0	50.0 50.0	337
rpl32-trnL^{UAG}	33.88	SSC	rpl32-F – CAGTTCCAAAAAAACGTACTTC [79] trnL_UAG – CTGCTTCCTAAGAGCAGCGT [79]	54.5 60.1	36.4 55.0	-
trnR^{UCU}-atpA	31.94	LSC	Pleuro_trnR(UCU)-F – AATGAAGGGCGTCCATTGTCT Pleuro_atpA-R – GCTGGAATCAGGCCTGCTAT	60.0 59.9	47.6 55.0	700
trnS^{GCU}-trnG^{UCC}	36.19	LSC	trnS* – AGATAGGGATTCGAACCCTCG [79] trnG* – GTAGCGGGAATCGAACCCGCATC [79]	58.8 65.8	52.4 60.9	-
			Pleuro_trnS(GCU)-F – ACGCTTTAGTCCACTCAGCC Pleuro_trnG(UCC)-R – AGCCGAGGGTTCTAGTAAACC	60.0 59.2	55.0 52.4	1336
trnW^{CCA}-trnP^{UGG}	30.61	LSC	Pleuro_trnW(CCA)-F – ATTTGAACCTACGACATCGGGT Pleuro_trnP(UGG-R – GCTTGGTAGCGCGTTTGTTT	59.8 60.3	45.5 50.0	300

S1 File. Codes and datasets used in R analyses. https://doi.org/10.1371/journal.pone.0256126.s018

S2 File. Misa-web results for all ten Pleurothallidinae plastomes analyzed.
https://doi.org/10.1371/journal.pone.0256126.s019

S3 File. Alignment matrices of Epidendrae (complete plastomes with one IR) and Pleurothallidinae (complete plastomes with one IR, mtDNA, and nrDNA). https://doi.org/10.1371/journal.pone.0256126.s020

CAPÍTULO 3

Filogeografia de *Barbosella miersii* (Orchidaceae, Pleurothallidinae), espécie endêmica da Floresta Atlântica brasileira

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ABSTRACT

Orchids developed diverse complex interactions with their environment, being especially susceptible to habitat loss worldwide. Few population studies were conducted in the Atlantic Forest, one of the leading biodiversity hotspots in endemic species that underwent severe deforestation since pre-columbian times. Therefore, we conducted phylogeographic analyses and species distribution modelling (SDM) on *Barbosella miersii*, a rare, epiphyte orchid endemic to the Atlantic Forest, to infer possible historical and ecological drivers of its restricted distribution, and to evaluate its conservation status. We found that the populations originated during the Pleistocene and are highly structured, presenting a marked North-to-South differentiation in haplotype composition and genetic diversity. The SDMs with and without vegetation cover are complementary and identified suitable areas outside the Atlantic Forest where other species of *Barbosella* occur. We conclude that the lower genetic variability of the Southern populations and the pattern of early population expansion followed by recent bottlenecks support refugia hypotheses. Further, the endemism of *B. miersii* is due to limited seed dispersal and forest discontinuity. The species relies on dense, continuous forests to settle new individuals, maintain gene flow between distant populations, and endure climate change through the stability of below-canopy microclimate. We consider *B. miersii* an endangered species.

ADDITIONAL KEY-WORDS: conservation genetics; orchids; population genetics; species distribution modelling; tropical rainforests.

INTRODUCTION

Endemism, the phenomenon in which taxa are distributed in determined areas, represents a basic pattern of species geographic distributions: few are cosmopolitan, while most are confined to restricted regions (Good, 1974, Kruckeberg & Rabinowitz, 1985, Gaston, 2000, Morrone, 2008). Both historical and ecological factors drive the restriction of species to determined areas. Historical events such as dispersal, vicariance, speciation, and extinction are invoked to explain the current geographic distribution of the species (Ronquist, 1997, Gaston, 2000). On the other hand, species' dispersal capacity and tolerance to environmental variables, as well as biological interactions and resource availability are ecological explanations for the present limits of endemic taxa (Hutchinson, 1978, Kruckeberg & Rabinowitz, 1985, Nekola & White, 1999, Soberón & Nakamura, 2009, Birand *et al.*, 2012). Time is also important to explain endemism, as species can be restricted due to biogeographical factors (e.g., barriers to dispersal or extensive extinctions in the past wider distribution) or simply because they have not had enough time to disperse further (Stebbins, 1974, Morrone, 2008).

Areas that are exceptionally rich in endemic species and are undergoing habitat loss are of great concern for the world's biodiversity conservation (Myers, 1988, Tilman *et al.*, 1994, Ginsberg, 1999, Brooks *et al.*, 2002, Hanski, 2011). Regions with high levels of endemism harbour more species than expected by chance (Lamoreaux *et al.*, 2006), as the 25 conservation hotspots contain ca. 44% of all species of vascular plants and 35% of all species of vertebrates in only 1.4% of the Earth's land surface (Myers *et al.*, 2000). One of the leading hotspots is the Atlantic Forest (AF), an emblematic tropical forest in the world: contains 1–8% of all plant and animal species (Silva & Casteleti, 2003) and 2–3% of all narrow endemic vascular plants and vertebrates (Myers *et al.*, 2000). At the same time, the AF is severely

threatened and fragmented by historic unsustainable land use, being reduced to ca. 12% of its pre-columbian extent (Oliveira-Filho & Fontes, 2000).

Orchids are important representatives of the epiphytic flora of the AF (Freitas *et al.*, 2016), and ca. 68% of the species in the region are endemic (BFG, 2015). This is intriguing because orchids are known to be excellent colonisers due to their stunning variety of vegetative forms and pollination strategies (Dressler, 1993, Givnish *et al.*, 2015). Moreover, a single fruit can produce up to six million dust-like seeds that are potentially wind-dispersed over long distances (Arditti & Ghani, 2000). Yet, the species are often found in small, overdispersed populations (Tremblay *et al.*, 2005), which makes them more susceptible to local extinctions (Hartley & Kunin, 2003). Habitat loss and climate change are threatening orchids worldwide (Cribb *et al.*, 2003, Fay, 2018, Barman & Devadas, 2013). However, few studies were conducted on the AF orchid species, so the knowledge about the historical drivers of their limited distribution and their conservation status remains limited. Genetic population studies in four *Cattleya* Lindl. species showed a strong genetic structure among the populations and possible isolation by distance (Pinheiro *et al.*, 2012, Rodrigues *et al.*, 2015, Fajardo *et al.*, 2017), while the contrary was found in *Gomesa hookeri* (Rolfe) M.W.Chase & N.H.Williams (Alcantara, Semir & Solferini, 2006) and *Octomeria grandiflora* Lindl. (Barbosa *et al.*, 2013). These findings follow global patterns of genetic differentiation in the family (Forrest *et al.*, 2004) and show that the Orchidaceae is a large and heterogenous group, which developed complex interactions with pollinators and specific environmental requirements (Loveless & Hamrick, 1984, Dressler, 1993, Rudall & Bateman, 2002). Therefore, species-by-species approaches are still needed before general conservation decisions can be made in the AF endemics.

Phylogeography is a powerful tool to infer historical patterns that shaped the current distribution of species through the relation between population genetic structure and biogeography (Avise *et al.*, 1987, Avise, 2000). Distribution modelling, on the other hand, is useful in identifying the potential distribution of species based on the environmental conditions found in their known occurrences (Guisan & Zimmerman, 2000, Peterson, 2001, Pearce & Boyce, 2006, Soberón & Nakamura, 2009). Further, species distribution models can be projected under paleo and future environmental conditions, allowing inferences about both the paleodistribution and future suitable areas of occurrence (e.g., Kolanowska, 2013, Kolanowska & Konowalik, 2014, Naczk & Kolanowska, 2015, Kolanowska *et al.*, 2017, Han *et al.*, 2022). Therefore, a combined interpretation of the phylogeography and distribution modelling can be valuable for the understanding of species endemism and conservation status.

Barbosella miersii Schltr. (Figure 1) is a very small, epiphytic orchid from the subtribe Pleurothallidinae that is endemic to the AF. The species is located in Southeast to South Brazil, in the states of Espírito Santo, Rio de Janeiro, São Paulo, Paraná, and Santa Catarina (Smidt, 2023). According to the regionalisation of Eastern Brazil (Reginato & Michelangeli, 2020), the area of occurrence of *B. miersii* includes the Southern Atlantic Forest (SAF) and the Northern Atlantic Forest (NAF), although it does not reach the NAF sub-bioregion 3, comprising the area further North from the Rio Doce. The species produces tiny solitary flowers, the smallest among the Brazilian *Barbosella*, which are translucent, yellowish-green to yellowish-pink, with ovate and minutely papillose sepals, petals, and lip (Luer, 2000). Little is known about the reproductive biology of *B. miersii*. In the Pleurothallidinae, pollination is deceitful, and the documented pollinators are unrelated Diptera: Ceratopogonidae (*Trichosalpinx* Luer - Bogarín *et al.*, 2018), Drosophilidae (*Dracula* Luer – Endara, Grimaldi & Roy, 2010, Policha *et al.*, 2016; *Specklinia* Lindl. -

Karremans *et al.*, 2015), Mycetophilidae (*Pleurothallis* R.Br - Duque-Buitrago *et al.*, 2014), Phoridae (*Acianthera* Scheidw. - Pansarin *et al.*, 2016), and Sciaridae (*Lepanthes* Sw. - Blanco & Barboza, 2005; *Octomeria* R.Br. - Barbosa *et al.*, 2009).

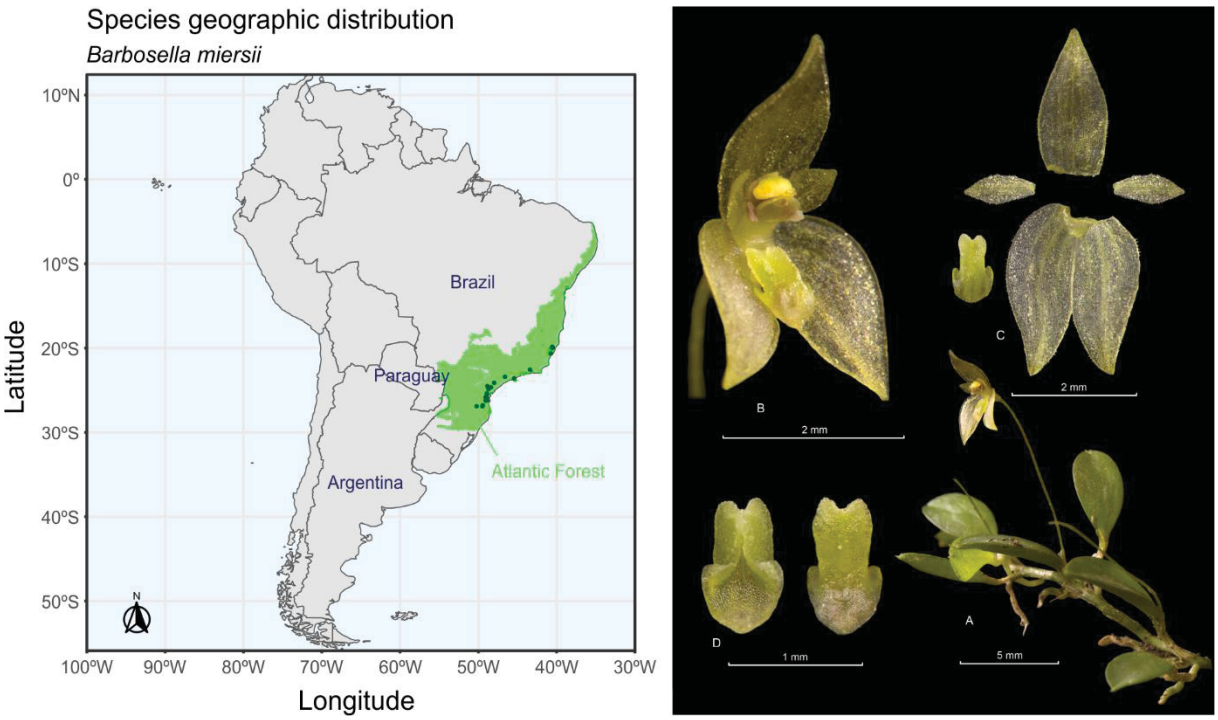

Figure 1: On the left-hand side, the map of the geographic distribution of *Barbosella miersii* shows the entire range of the Atlantic Forest and all known occurrence points of the species represented by dark green dots. On the right-hand side, photos of a representative of the species depict **(A)** the habit, **(B)** the flower, **(C)** the flower parts in detail, and **(D)** the lip in abaxial (left) and adaxial (right) views. Photos taken by Nicolás Gutiérrez Morales.

Given all the above, we aim to understand the narrow endemism of *Barbosella miersii* and, therefore, contribute to the growing knowledge about the evolutionary history and conservation of orchids from the AF. We performed phylogeographic analyses on populations distributed throughout the entire geographic range known for the species. We analysed and compared the sequence variability of two non-coding chloroplast DNA and one non-coding nuclear DNA to evaluate the genetic structure and gene flow among the populations. We also developed a distribution model to identify the potential distribution of *B. miersii* and infer the

environmental requirements of the species. Finally, we projected the distribution model under six paleo scenarios and four future scenarios to evaluate the species' paleodistribution and conservation status, respectively.

MATERIAL AND METHODS

Specimens sampling

Barbosella miersii is found in small populations of no more than ten individuals, often far from each other, in dense tropical forest sites with a lot of shade and humidity, and also in high altitudes of c.a. 900 m (Bolson, 2018). We sampled 32 individuals from 11 populations distributed across the entire geographic range known for the species (Figure 2). Populations ranged from one to seven individuals and were named with a three-letter code according to their geographic location (Table 1).

Table 1: Population codes, sample sizes, and geographical locations.

Pop. code	Sample size	Bioregion	Location
BEN	7	Southern Atlantic Forest	Santa Catarina. Benedito Novo
JOI	2	Southern Atlantic Forest	Santa Catarina. Joinville
ADR	4	Southern Atlantic Forest	Paraná. Adrianópolis. Parque Estadual das Lauráceas
MOR	2	Southern Atlantic Forest	Paraná. Morretes
NHG	5	Southern Atlantic Forest	Paraná. São José dos Pinhais. Reserva Particular do Patrimônio Natural Nhandara Guaricana
CAN	2	Southern Atlantic Forest	São Paulo. Serra da Cantareira
CAR	1	Southern Atlantic Forest	São Paulo. Caraguatatuba
ITA	1	Northern Atlantic Forest	Rio de Janeiro. Itatiaia. Parque Nacional do Itatiaia
NFR	2	Northern Atlantic Forest	Rio de Janeiro. Nova Friburgo. Macaé de Cima
TER	4	Northern Atlantic Forest	Rio de Janeiro. Teresópolis. Parque Nacional da Serra dos Órgãos
ALC	2	Northern Atlantic Forest	Espírito Santo. Alfredo Chaves. Road to São Bento de Urânia.

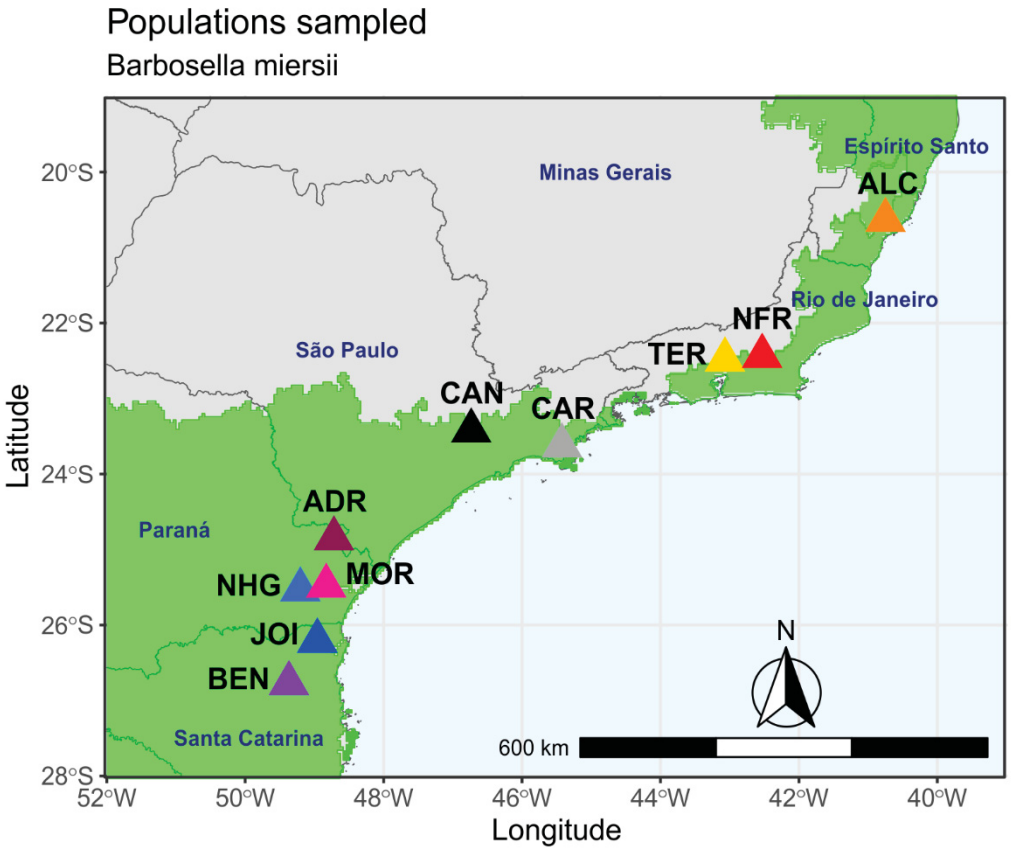

Figure 2: Map of population localities, indicated by coloured triangles. The SAF and the NAF bioregions are depicted in greenish colours.

DNA amplification and sequencing

All DNA samples were available at Laboratório de Sistemática e Ecologia Molecular de Plantas of the Universidade Federal do Paraná, stored at -80ºC. Five samples from different populations and bioregions were selected for the screening tests. We tested the nuclear ribosomal internal transcribed spacer (ITS) and six of the ten mutational hotspots identified for the Pleurothallidinae (Mauad *et al.*, 2021). We also tested the *psbD-trnT*^{GCU} intergenic spacer based on empiric evidence of its ease of amplification and sequencing for other Pleurothallidinae (Smidt *et al.*, 2021). We analysed amplification success, sequencing success, and sequence variation of each region (Supplementary Material 1). Sequence

variation was measured as the percentage of polymorphic sites (only single nucleotide substitutions were considered). According to these criteria, we selected the ITS and two plastid regions: the *psbI-trnS*^{GCU} and the *rpl32-trnL*^{UAG}. It is noteworthy that the intergenic spacers *psbD-trnT*^{GCU} and *trnS*^{GCU}*-trnG*^{UCC} were not chosen despite being variable because both have poly-A sequences at the 3'-end and the middle, respectively, which have caused unspecific pairing in PCRs and truncated sequencing.

We used QIAGEN TopTaq™ Master Mix Kit for all screening tests and most PCRs. We followed the manufacturer's instructions and added 20 ng DNA and 0.2 mM of each primer for 20 µL PCRs. We used Invitrogen™ Platinum™ Taq DNA Polymerase when targeting the ITS region and added 0.2 mM dNTPs, 0.08 mg/mL BSA, 0.08% DMSO, and 1 M betaine to the reactions. The thermocycler program was set as follows: one cycle of 1 min at 94ºC, 40 cycles of 30 s at 94 °C, 40 s of the annealing temperature (Table 2) and 40 s at 72 °C, and one cycle of 5 min at 72 °C. Amplification success was verified through horizontal electrophoresis using 1% agarose gel and 1x GelRed® Nucleic Acid Gel Stain (Biotium). PCR products were purified using 10% polyethylene glycol and 80% ethanol (Paithankar & Prasad, 1991), and sequenced using the Applied Biosystems 3500xl Genetic Analyzer (Life Technologies).

The obtained reads were trimmed at low confidence ends (0.05 error probability limit per base) and then were de novo assembled using Geneious Prime 2020.0.5 (Biomatters Ltd.). Disagreements within contigs were inspected manually, considering both the electropherogram and confidence level to determine the correct base call before generating the consensus sequences. We considered nuclear contigs as heterozygotes when we could not determine the correct base call during disagreements. The consensus sequences were aligned using MAFFT and annotated based on the *Myoxanthus exasperatus* (Lindl.) Luer complete

plastome (MW375127) and ITS (MW364936) sequences (Mauad *et al.*, 2021). Due to sampling differences between the DNA regions, we aligned and analysed only the 29 individuals that were sequenced for all three regions that were chosen (i.e., ITS, *psbI-trnS*^{GCU}, and *rpl32-trnL*^{UAG}; Supplementary Material 2). We analysed nuclear and plastid datasets separately due to differences in ploidy.

Phylogeographic analyses

Given that the populations are small, we regrouped the individuals into five populations based on geographic proximity for the analyses: SC (BEN + JOI), PR (ADR + MOR + NHG), SP (CAN + CAR), RJ (NFR + TER), and ALC. We identified the nuclear haplotypes and genotypes with PHASE (Garrick *et al.*, 2010), and used DnaSP v.6 (Rozas *et al.*, 2017) to test for recombination in the nuclear sequences. We also used DnaSP to identify the plastid haplotypes and to generate the input files for other softwares.

We used rmaverick v.1.1.0 (Verity & Nichols, 2016), implemented on R v.4.2.2 (R Core Team, 2022; Posit Team, 2023), to analyse the genetic structure of our data because it estimates the evidence for every number of genetic clusters (K) and also compares the evolutionary models through a Bayesian method called generalised thermodynamic integration (GTI). We set the analyses as follows: 1–5 K, 200,000 burnin, 500,000 samples, 50 rungs and the no-admixture model. We did not test the admixture model because our datasets do not have recombination sites (recombinant sites in the nuclear alignment were removed). The best value of K was chosen based on the highest log-likelihood and highest posterior probability values.

Network v.10.2.0.0 (*fluxus-engineering.com*) was used to obtain the phylogenetic relationships among haplotypes through Median Joining calculations (Bandelt *et al.*, 1999),

which are graphically represented by a network. Arlequin v.3.5.2.2 (Excoffier & Lischer, 2010) was used to perform Tajima's D (Tajima, 1989a) and Fu's F (Fu, 1996) neutrality tests and to obtain the molecular diversity indices for each population. With Arlequin, we also generated the pairwise genetic distances (FST) matrix among the populations, which was used in the analyses of molecular variance (AMOVA - Excoffier *et al.*, 1992) and the Mantel (1967) test. We performed AMOVA between the bioregions and among the genetic clusters found with rmaverick, and also among populations within these groups. For the Mantel test, used to identify isolation by geographic distance, we obtained the pairwise geographic distance matrix among the populations on R using the package gear v.0.3.4 (French, 2020). Because the geographic distances are calculated based on geographic coordinates, we used the midpoint coordinates for the merged populations (SC, PR, SP, and RJ).

We performed a Gaussian Markov random field (GMRF) Bayesian Skyride Plot (Minin, Bloomquist & Suchard, 2008) to see how the effective size of populations changed over time. We used BEAST v.1.10.4 (Suchard *et al.*, 2018) software package to set the parameters and to run the analysis, and Tracer v.1.7.2 (Rambaut *et al.*, 2018) to check parameters' convergence (Effective Sample Size ≥ 300) and to generate the plot. We searched for the best substitution model for each alignment with jModelTest2 (Guindon & Gascuel, 2003, Darriba *et al.*, 2012) through CIPRES Science Gateway (Miller *et al.*, 2015). The substitution models used were: GTR (*psbI-trnS*), GTR+I+Gamma (*rpl32-trnL*), and TN93 (ITS). We considered an uncorrelated relaxed lognormal molecular clock model because we do not have prior information about the substitution rate of *B. miersii* or closely-related species. In addition, we set the molecular clock using a uniform distribution to consider a wider range of possible substitution rates. For the ITS dataset, the initial value was 0.005 (lower bound = 0.00005, upper bound = 0.01), as in Pérez-Escobar *et al.* (2021), which

analysed hundreds of nuclear genes in Orchidaceae. For the plastid dataset, the initial value was 0.001 (lower bound = 0.00001, upper bound = 0.0025), because Angiosperm plastid genomes evolve approximately 5 times slower than nuclear genomes (Drouin, Daoud & Xia, 2008). To calibrate the tree, we used the previously estimated crown age of *B. miersii* (Bolson, 2018) using a normal distribution, with mean = 1.19 million years and standard deviation = 0.5. Markov chain Monte Carlo (MCMC) ran for 50,000,000 generations, the trees and parameters were sampled every 1,000 generations, and burnin was set to 10%. Based on the resulting GMRF Bayesian Skyride Plot, we performed molecular dating analyses to estimate the divergence times among haplotypes using the same parameters described above but assuming a logistic expansion growth coalescent tree model, in which the growth rate decreases over time (Griffiths & Tavare, 1994).

Species Distribution Modelling

We performed species distribution modelling (SDM) to evaluate the potential distribution of *B. miersii* under the present environmental conditions and to find which variables contribute the most to the current geographic distribution of the species. We also made projections for paleo and future scenarios to infer past environmental dynamics that contributed to the current species' endemism and to evaluate possible impacts of climate change on the populations, respectively. We employed a maximum entropy algorithm through MaxEnt v.3.3 (Phillips, Anderson & Schapire, 2006), implemented on R. The current distribution information for *B. miersii* was obtained from Global Biodiversity Information Facility (GBIF; https://www.gbif.org/) and speciesLink (https://specieslink.net/col/), including all occurrence data from the year 2000 until the present to reduce uncertainty, given

the lack of coordinates and precise information in older records. After removing duplicate records within 2.5 arc-min (ca. 5 km), we obtained 29 presence records. Due to the few occurrences of *B. miersii*, we created pseudo-absences by randomly sampling another 29 points within the AF where the species was not collected to act as the background data for the model, so we expect the model to be less restrictive regarding the potential distribution of the species.

We downloaded all 19 bioclimatic variables at 2.5 arc-min resolution under current (1950–2000) and future (2041–2060) conditions from WorldClim v.2.1 (Fick & Hijmans, 2017). The same 19 bioclimatic variables were downloaded for two paleo scenarios from PaleoClim (Brown *et al.*, 2018), which were the Last Glacial Maximum (LGM, ca. 21 kya; Karger *et al.*, 2021) and Last Interglacial (LIG, ca. 130 kya; Otto-Bliesner *et al.*, 2006). To reduce the number of future climate projections, we performed a cluster analysis using a smaller set of nine bioclimatic variables, which were selected based on their relative contribution to the current distribution of *B. miersii* after a pairwise correlation test ($r \geq 0.8$). The best number of clusters (k) from 1–12 was obtained by silhouette analysis (Rousseeuw 1987). The best value was $k = 4$ (Supplementary Material 3), so we chose one projection per cluster totalling four projections in the future: ACCESS-ESM1-5, CanESM5-CanOE, INM-CM4-8, and MRI-ESM2-0, which were the ones closest to the clusters' centroid. We also considered two future scenarios based on the Shared Socio-economic Pathways (SSPs): ssp245 (the medium part of the range of plausible future pathways) and ssp585 (the high end of plausible future pathways).

To improve the model under present conditions, we performed another SDM with the addition of other environmental variables that might be relevant for the species' distribution, which were vegetation cover and cloud cover. Vegetation cover because this species is an

epiphyte, so the presence of tree species is fundamental for its settlement, and cloud cover improves the prediction of species distributions with reduced spatial autocorrelation (Wilson & Jetz, 2016). Moreover, cloud cover can be a good proxy for reduced available solar irradiance (Wilson & Jetz, 2016), and *B. miersii* is found in shady habitats (Bolson, 2018). Three layers of vegetation cover ("Evergreen Broadleaf Trees", "Deciduous Broadleaf Trees", and "Mixed/Other Trees") and four layers of cloud cover ("Inter-annual variability (SD)", "Intra-Annual variability (SD)", "Seasonality concentration", and "Seasonality theta") were downloaded at 0.5 arc-min resolution from EarthEnv (https://www.earthenv.org/). We transformed the resolution of EarthEnv variables to 2.5 arc-min using the elevation layer from WordlClim on R by applying the function "resample". As there are no interpolations of these variables for paleo and future scenarios, we did not project this SDM but compared the results obtained with only the bioclimatic variables.

MaxEnt ran in 25 replicates, each one randomly sampling 75% of occurrences and pseudo-absences to train the model. Model performance was assessed using the area under the curve (AUC), selecting models with AUC > 0.5 (Swets, 1988). The relative importance of each environmental variable was measured using MaxEnt jackknife analysis. We used the value of maximum sensitivity plus specificity (maxSSS) as a threshold to obtain the maps of presence/absence because it is a very robust threshold for all types of data, especially for presence-only data (Liu, Newell & White, 2016). Therefore, all continuous values of adequability equal to or higher than the maxSSS were set to 1 (high probability of presence), and all values lower than the maxSSS were set to 0 (high probability of absence). All maps were generated on R using ggplot2 (Wickham, 2016).

RESULTS

We generated three datasets, of which two are intergenic spacers from the plastid genome and one is the nuclear ribosomal operon ITS, composed of the internal transcribed spacers 1 and 2 interspersed with the 5.8S gene. The *psbI-trnS*^{GCU} dataset has 136 base pairs in length and five polymorphic sites, all of which are transversions and are parsimony-informative. The *rpl32-trnL*^{UAG} dataset has 716 base pairs in length and 16 polymorphic sites, of which 12 are transversions and four are transitions, and 11 are parsimony-informative. We found three insertions/deletions (indels): one 34 bp long on sites 72–105 in the sequences from the NAF, one 24 bp long on sites 429–452 in the individual TER02, and one on site 533 in the sequences from the SAF. We considered the two large indels as a unique indel event. The ITS dataset has 621 base pairs in length and six polymorphic sites, of which four are transitions and two are transversions, and five are parsimony-informative. We detected one recombination event on sites 51 and 162, which were excluded before the analyses.

The arrangement of individuals in genetic clusters slightly differed between the datasets (Fig. 3). For the plastid data, the most probable value of K was three, clustering the populations PR and SC in one cluster, the population SP in a second cluster, and the populations from the NAF in the third. The second-best value was K = 2, in which all individuals from the SAF stayed in the same cluster. The most probable clustering scheme for the nuclear data was K = 2, with all populations from the SAF in one cluster and all populations from the NAF in the other. When considering K = 3, the second-best value of K, the individuals MOR02, TER01, TER02, and TER04 form one cluster, the individuals ALC01, ALC02, NFR01, NFR02, and TER03 form a second cluster, and the remaining species the third. This clustering scheme does not segregate the individuals concerning the

bioregions, populations (populations PR and RJ belong to more than one cluster), or haplotypes (H3 belongs to more than one cluster).

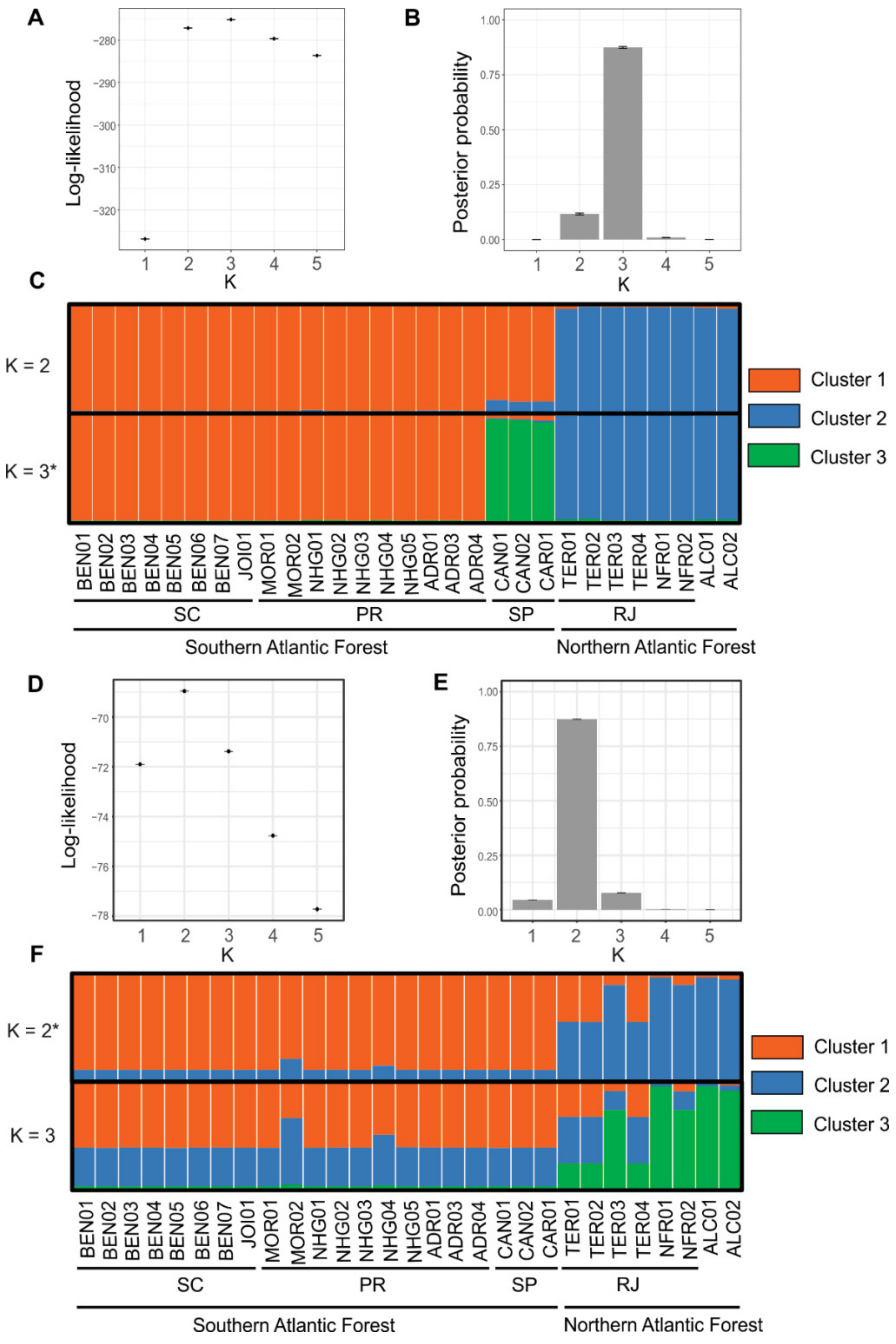

Figure 3: Genetic structure results obtained with rmaverick, including **(A–C)** the results for the plastid dataset (*psbI-trnS*^{GCU} and *rpl32-trnL*^{UAG} combined), and **(D–F)** the results for the nuclear dataset (ITS). **(A, D)** Log-likelihood of each value of K. **(B, E)** Posterior probability of each value of K. **(C, F)** Q-matrix for K = 2 and K = 3 showing the probabilities of each individual to belong to each cluster, represented by bars. * = best value of K.

We identified 13 haplotypes in the plastid dataset, with haplotype H5 the most frequent and haplotypes H3, H4, H6, H7, H8, H10, H12 and H13 the least, with only one individual each (Table 2). The haplotype network has a furcating tree pattern (Figure 4). The closest haplotypes are separated by one mutational step, while the farthest ones (H11 to H13) are distanced by 14 mutational steps. We identified five haplotypes in the nuclear dataset, with haplotype H1 being the most frequent and haplotype H5 the least (Table 3). The haplotypes are combined into seven genotypes, of which five are homozygotes for H1, H2, H3, and H4, and three are heterozygotes as follows: (H1, H3), (H1, H5), and (H2, H3). The genotype (H1, H1) is the most frequent, found in 19 individuals, followed by genotype (H1, H3) found in three individuals, genotypes (H2, H2) and (H3, H3) found in two individuals, and the three remaining are found in one individual each. The haplotype network has a star-like pattern (Figure 4). The closest haplotypes are distanced from each other by one mutational step, and the farthest ones (H2 to H4/H5) are separated by three mutational steps.

Table 2: Haplotype sequences and frequencies for the plastid dataset (*psbI-trnS*^{GCU} and *rpl32-trnL*^{UAG} combined), ordered from the most frequent to the least. Hap. = haplotype name, Freq. = haplotype frequency. Column numbers refer to site positions in the original alignments. Dots represent agreements to the reference sequence (most frequent) and dashes represent gaps.

Hap.	*psbI-trnS*^{GCU} sites					*rpl32-trnL*^{UAG} sites																		Freq.	Individuals
	51	71	81	96	135	25	47	57	59	72	187	211	300	355	429	478	533	606	645	659	665	706	707	711	
H5	T	T	A	A	C	C	G	T	G	A	T	G	G	C	-	G	-	C	G	G	A	T	C	A	8	BEN01–04, BEN06–07, JOI01, NHG03
H2	.	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	T	C	.	.	A	.	5	ADR04, BEN05, MOR01–02, NHG05
H9	.	.	C	.	G	.	.	G	T	-	.	.	.	.	.	.	A	.	.	C	.	G	A	C	4	NFR01, NFR02, TER03, TER04
H1	.	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	.	.	A	.	2	ADR01, ADR03
H11	.	G	.	.	.	.	.	.	.	.	C	.	.	.	.	.	.	.	T	C	.	.	A		2	NHG02, NHG04
H3	.	.	C	.	.	.	.	G	T	-	.	.	.	.	.	T	A	T	.	C	.	.	A	C	1	ALC01
H4	.	.	C	.	.	.	.	G	T	-	.	.	.	.	.	T	A	.	.	C	.	.	A	C	1	ALC02
H6	G	.	.	.	.	A	A	G	T	.	.	.	.	G	.	.	.	.	.	C	.	.	A	.	1	CAN01
H7	G	.	.	.	.	.	A	G	T	.	C	.	.	G	.	.	.	.	.	C	.	.	A	.	1	CAN02
H8	G	.	.	.	.	.	A	G	T	.	.	.	.	G	.	.	.	.	.	C	.	.	A	.	1	CAR01
H10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C	.	.	A		1	NHG01
H12	.	.	C	.	.	.	.	G	T	-	.	.	C	.	.	.	A	.	.	C	.	.	A	C	1	TER01
H13	.	.	C	C	.	.	.	G	T	-	.	A	.	.	C	.	A	.	.	C	T	A	A	C	1	TER02

Table 3: Haplotype sequences and frequencies for the nuclear dataset (ITS1 + 5.8S gene + ITS2), ordered from the most frequent to the least. Column numbers refer to site positions in the original alignment. Dots represent agreements to the reference sequence (most frequent).

Hap	ITS1	5.8S	ITS2 sites					Freq.	Individuals
	36	363	547	591	617	619	620		
H1	T	C	C	A	G	T	T	42	ADR01, ADR03–04, BEN01–07, CAN01–02, CAR01, JOI01, MOR01, NHG01–05, TER01–02, TER04
H2	C	.	.	C	.	.	.	5	ALC01, ALC02, NFR01
H3	.	.	.	C	.	.	.	8	ALC02, NFR02, TER01, TER02, TER03, TER04
H4	.	.	T	.	.	.	.	2	MOR02
H5	.	T	.	.	.	.	.	1	NHG04

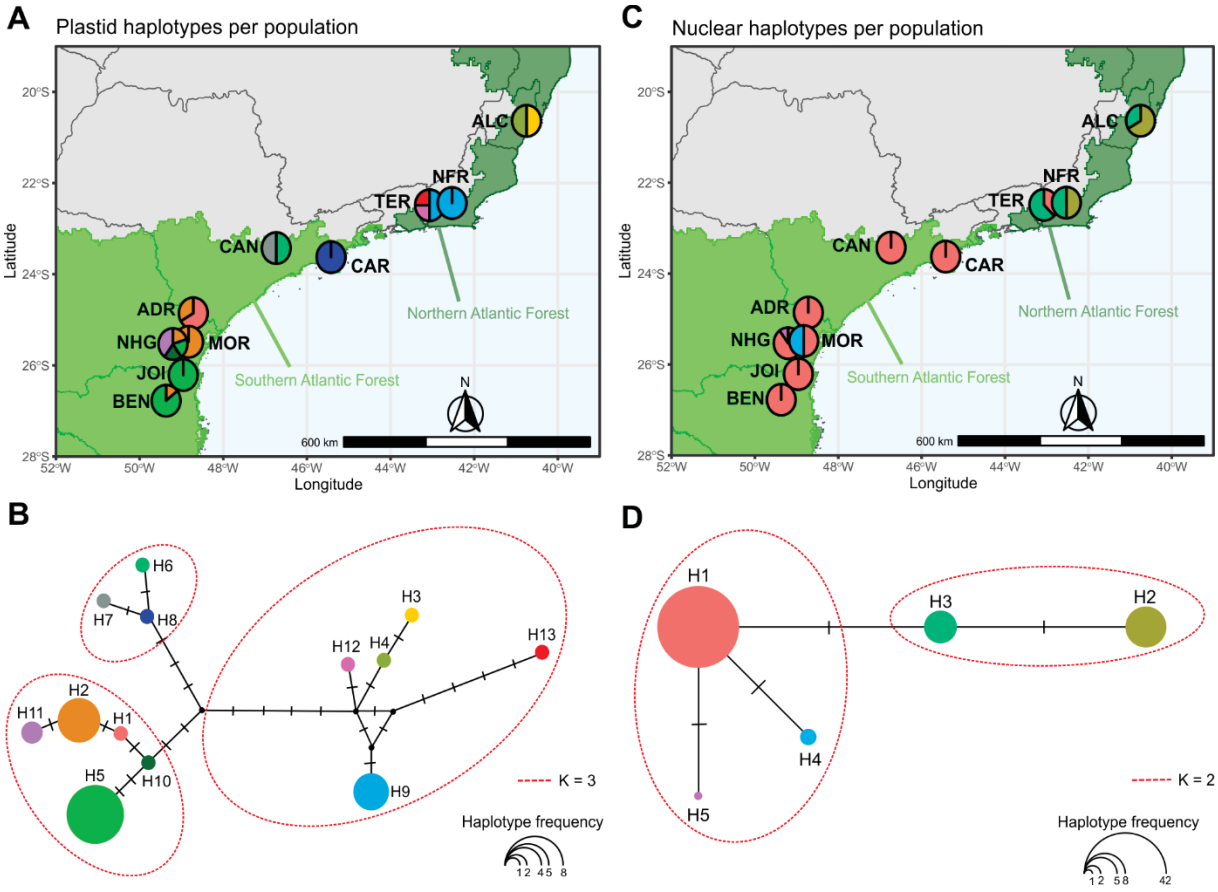

Figure 4: Geographic distribution and phylogenetic relationships of the **(A–B)** plastid and **(C–D)** nuclear haplotypes. **(A, C)** Haplotype maps. Pie charts represent the haplotype diversity of each population, with the slices corresponding to the frequency of a determined haplotype. **(B, D)** Haplotype networks. Circle sizes represent haplotype frequencies, sections on branches represent mutational steps, and small solid circles are median vectors. Haplotype colours match the pie charts on the map above. The red dashed-line circles illustrate the most probable clustering scheme (plastid: K = 3, nuclear: K = 2).

The plastid dataset has more overall nucleotide diversity ($\pi = 0.008$) and also more haplotype diversity (Hd = 0.89) than the nuclear dataset ($\pi = 0.001$, Hd = 0.45), as shown in Table 4. Considering each population separately, we found that the NAF populations (RJ and ALC) have the highest Hd and the population SC the lowest in both datasets. The only significant ($p < 0.05$) neutrality tests were Tajima's D for population SC on the plastid dataset and Fu's F for population PR on the nuclear dataset.

AMOVA results are shown in Table 5. For plastid data, most of the genetic variance is explained by the genetic clusters (K = 3, 63.17%) or by the bioregions (K = 2, 51.49%), and the genetic variance among populations is greater than within populations. The clusters/bioregions also accounted for most of the genetic variance in the nuclear data (68.01%), but variation within populations is greater than among populations. The mean value of population differentiation due to genetic structure (F_{ST}) was 0.76 (min.: 0.39, max.: 0.89) for plastid and 0.46 (min.: 0, max.: 0.95) for nuclear data (Supplementary Material 4). For both datasets, the Mantel test was significant ($p < 0.05$) and showed a strong positive correlation (plastid: $r = 0.66$, nuclear: $r = 0.82$) between genetic and geographic distances. The geographic structure explains 44% of the plastid genetic data and 67.23% of the nuclear genetic data.

Table 4: Molecular diversity indices estimated for each population and all individuals (Overall). π = nucleotide diversity, *h* = haplotype diversity, ΘHom = theta value estimated from the observed homozygosity, Θk = theta value estimated from the observed number of alleles, ΘS = theta value estimated from the observed number of segregating sites, Θπ = theta value estimated from the mean number of pairwise differences, D = Tajima's D, and F = Fu's F. Numbers in parenthesis are the standard deviation (s.d.) or the 95% confidence interval. Significant neutrality test results are in bold ($p < 0.05$).

Dataset	Indices	Overall	SC	PR	SP	RJ	ALC
Plastid	π	0.008 (+- 0.004)	0.001 (+-0.001)	0.002 (+-0.001)	0.002 (+- 0.002)	0.003 (+-0.002)	0.001 (+-0.002)
	Hd	0.887 (+-0.039)	0.250 (+-0.180)	0.822 (+-0.097)	1.000 (+-0.272)	0.600 (+-0.215)	1.000 (+-0.500)
	ΘHom	6.610 (s.d. 2.808)	0.248 (s.d. 0.238)	3.712 (s.d. 2.68)	NA	1.128 (s.d. 1.038)	NA
	Θk	8.482 (4.109 +- 17.261)	0.487 (0.109 +- 2.080)	3.301 (1.067 +- 10.048)	NA	1.696 (0.427 +- 6.599)	NA
	Θs	5.347 (s.d. 1.984)	1.543 (s.d. 0.960)	1.767 (s.d. 1.014)	1.333 (s.d. 1.098)	2.628 (s.d. 1.553)	1.000 (s.d. 1.000)
	Θπ	6.217 (s.d. 3.384)	1.000 (s.d. 0.852)	1.644 (s.d. 1.193)	1.333 (s.d. 1.370)	2.800 (s.d. 1.980)	1.000 (s.d. 1.414)
	D	-0.018 ($p = 0.554$)	**-1.535 ($p = 0.042$)**	-0.279 ($p = 0.448$)	0.000 ($p = 0.936$)	-0.351 ($p = 0.401$)	0.000 ($p = 1.000$)
	F	-0.908 ($p = 0.373$)	1.946 ($p = 0.801$)	-1.052 ($p = 0.160$)	-1.216 ($p = 0.072$)	1.672 ($p = 0.820$)	0.000 ($p = 0.250$)
ITS	π	0.001 (+- 0.001)	0.000 (+- 0.000)	0.001 (+- 0.001)	0.000 (+- 0.000)	0.001 (+- 0.001)	0.001 (+- 0.001)
	Hd	0.455 (+- 0.074)	0.000 (+- 0.000)	0.279 (+- 0.123)	0.000 (+- 0.000)	0.621 (+- 0.117)	0.500 (+- 0.265)
	ΘHom	0.623 (s.d. 0.186)	0.000 (s.d. 0.000)	0.288 (s.d. 0.176)	0.000 (s.d. 0.000)	1.236 (s.d. 0.637)	0.746 (s.d. 0.801)
	Θk	1.119 (0.426 +- 2.678)	0.000 (0.000 +- 0.000)	0.718 (0.207 +- 2.257)	0.000 (0.000 +- 0.000)	0.934 (0.260 +- 3.090)	0.879 (0.182 +- 4.268)
	Θs	0.864 (s.d. 0.475)	0.000 (s.d. 0.000)	0.564 (s.d. 0.420)	0.000 (s.d. 0.000)	0.662 (s.d. 0.501)	0.545 (s.d. 0.545)
	Θπ	0.616 (s.d. 0.548)	0.000 (s.d. 0.000)	0.289 (s.d. 0.357)	0.000 (s.d. 0.000)	0.712 (s.d. 0.645)	0.500 (s.d. 0.620)
	D	-0.630 ($p = 0.338$)	0.000 ($p = 1.000$)	-1.141 ($p = 0.171$)	0.000 ($p = 1.000$)	0.220 ($p = 0.694$)	-0.612 ($p = 0.379$)
	F	-1.299 ($p = 0.212$)	NA	**-1.206 ($p = 0.039$)**	NA	0.027 ($p = 0.380$)	0.172 ($p = 0.329$)

Table 5: AMOVA results for plastid and nuclear datasets. Significant values ($p < 0.05$) for the mean F_{ST} are in bold.

Dataset	Statistics	Among groups	Among populations	Within populations
Plastid, clusters (K = 3)	d.f.	2	2	24
	Sum of squares	55.32	12.169	19.733
	Variance components	2.98883	0.88528	0.82222
	% variation	63.17	19.09	17.73
	F_{ST}	0.63 ($p = 0.06$)	**0.82 ($p = 0.00$)**	**0.52 ($p = 0.00$)**
Plastid, bioregions (K = 2)	d.f.	1	3	24
	Sum of squares	39.814	27.487	19.733
	Variance components	2.55797	1.58739	0.82222
	% variation	51.49	31.95	16.55
	F_{ST}	0.51 ($p = 0.09$)	**0.83 ($p = 0.00$)**	**0.61 ($p = 0.00$)**
ITS, clusters/bioregions (K = 2)	d.f.	1	3	53
	Sum of squares	8.813	1.339	7.417
	Variance components	0.35945	0.02917	0.13994
	% variation	68.01	5.52	26.48
	F_{ST}	0.68 ($p = 0.10$)	**0.73 ($p = 0.05$)**	**0.17 ($p = 0.00$)**

The GMRF Bayesian Skyride plots showed that overall population sizes remained constant until ca. 1 Mya, when a slight increase in the effective population was observed in both datasets (Figure 5), being more pronounced in the plastid dataset. Near present, the populations stopped growing in the plastid dataset and started to shrink in the nuclear dataset. The effective population size varied from 2.5–35 individuals on the plastid dataset and 0.0025–60 on the nuclear dataset. The molecular dating analyses showed different median age estimates for the Most Recent Common Ancestor (MRCA) of haplotypes: 1.82 Mya (95% High Posterior Density Interval: 1.19 ± 2.5) from the plastid dataset and 1.02 Mya (95% HPD: 0.15 ± 1.94) from the nuclear dataset. In both analyses, the divergence between SAF and NAF populations/haplotypes occurred in the first cladogenesis event in de species, and the MRCA of haplotypes from the NAF (plastid: 1.09 Mya, nuclear: 0.34 Mya) is younger than the MRCA of haplotypes from the SAF (plastid: 1.47 Mya, nuclear: 0.53 Mya). Haplotype diversification occurred until ca. 200 kya in both datasets.

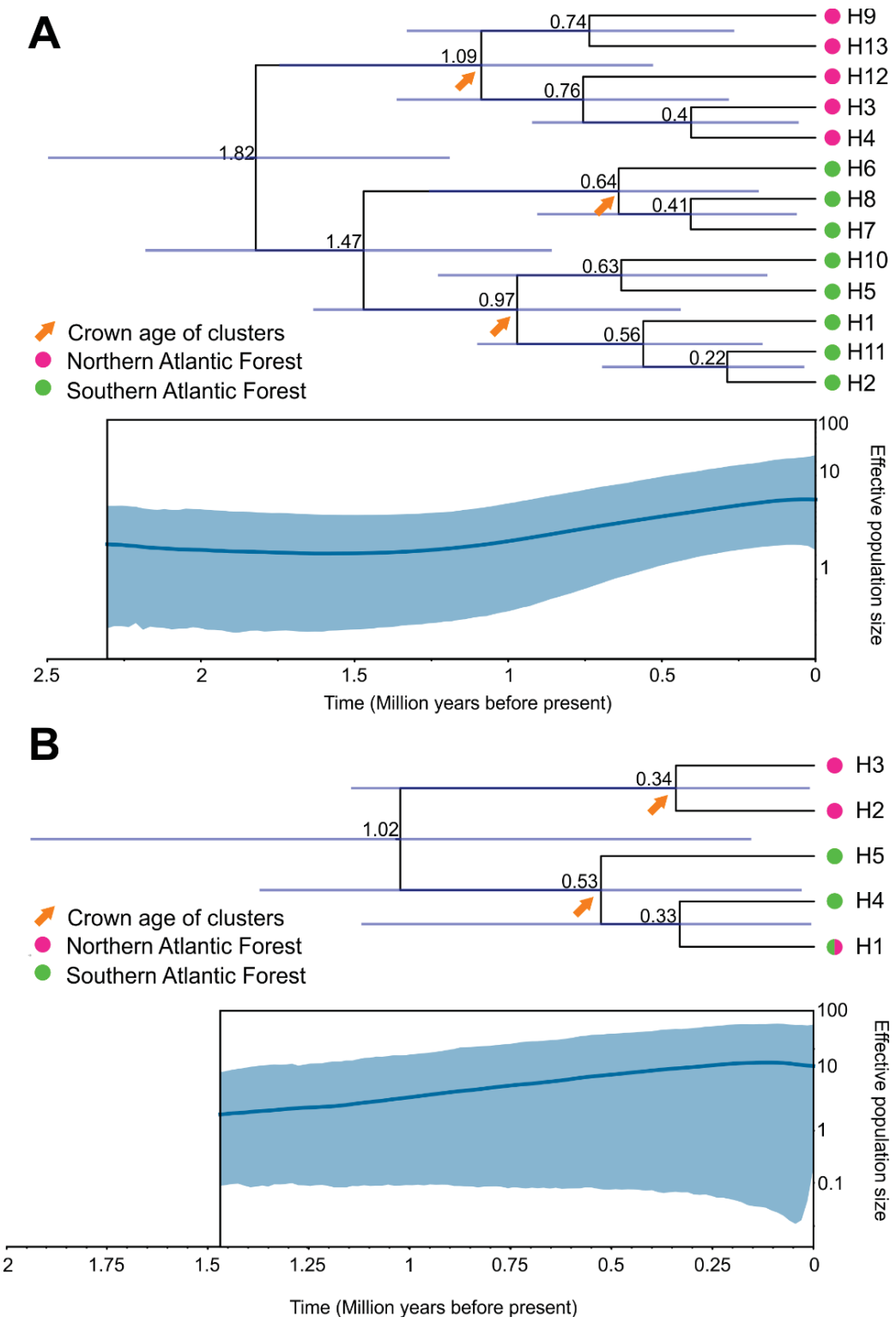

Figure 5: Results of Bayesian analyses of molecular dating and population size changes over time. In the Maximum Clade Credibility (MCC) trees of **(A)** plastid and **(B)** nuclear haplotypes, coloured circles on the tips represent the bioregion where the haplotype is found, and the orange arrows indicate the Most Recent Common Ancestor of haplotypes that belong to the same genetic cluster. Blue bars on nodes represent the 95% High Posterior Density interval of node age estimates. Numbers on nodes are de median age estimated for that node. In the GMRF Bayesian Skyride plots, below the MCC trees, the thick blue line is the mean effective population size and the light blue area is the confidence interval.

In the SDMs, AUC scores varied from 0.75–1 (mean = 0.93) for the model using all environmental variables and from 0.81–1 (mean = 0.94) for the model using only the bioclimatic variables. According to the MaxEnt jackknife tests of variable importance (Supplementary Material 5), the presence of evergreen trees contributed the most to the model (60.1%), followed by precipitation of the driest month (BIO14, 23.4%), temperature annual range (BIO7, 5.2%), mean temperature of the coldest quarter (BIO11, 4.8%), and mean temperature of the wettest quarter (BIO8, 3.3%). Considering only the bioclimatic variables, the most important ones for the model were: BIO11 (33.5%), BIO7 (29.6%), maximum temperature of the warmest month (BIO5, 26.7%), BIO14 (3.5%), and temperature seasonality (BIO4, 3.4%).

The SDM using environmental variables (hereafter called SDM_{26}) indicated high adequability values in the Eastern portion of the SAF, in the South-Western portion of the NAF sub-bioregion 1, and in the NAF sub-bioregion 2, where *B. miersii* occurs (Figure 6). The model also indicated high adequability values in areas where the species does not occur or have not been found yet, such as the mountains of Espinhaço and Mantiqueira, the NAF sub-bioregion 3, and the Southern portion of the SAF. Outside de AF, the SDM_{26} indicated high adequability values in the Amazon Forest, Andes Cordillera, Antilles, Central America, and in scattered areas of the Cerrado (Brazilian savanna). In contrast, the SDM using the bioclimatic variables (hereafter called SDM_{19}) indicated a large suitable area that includes the Atlantic Florest, the Cerrado and the Southern Amazon Forest (Figure 6). Outside this area the SDM_{19} indicated high adequability values in the Andes, Central America, Antilles, and in the Guiana Shield.

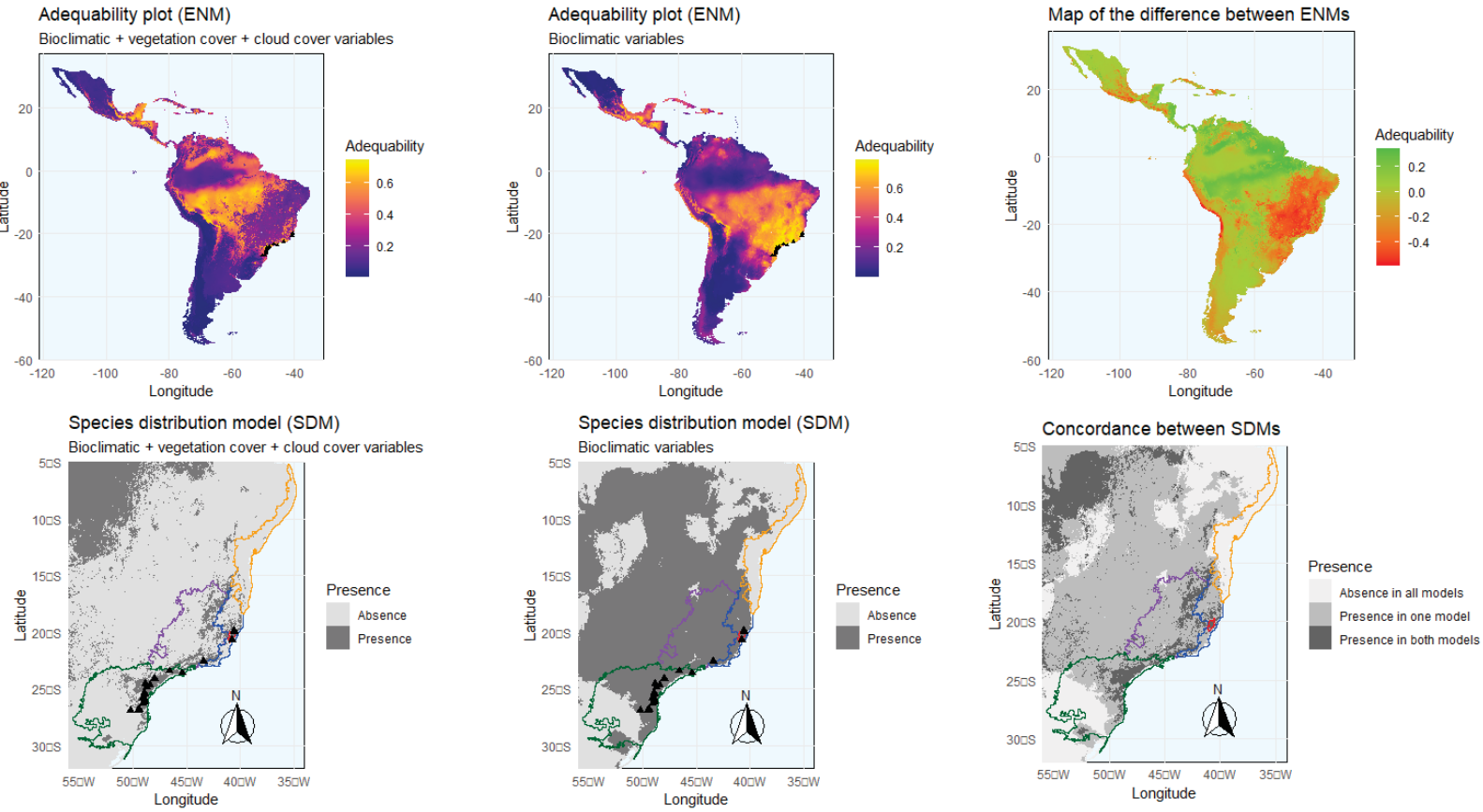

Figure 6: Species distribution models under present conditions. The occurrence points of *Barbosella miersii* are represented by black triangles. On the top row are the adequability plots of each model projected on the Neotropics and the difference between both models, where positive adequability values refer to higher values on the SDM_{26} (all environmental variables) and negative values refer to higher values on the SDM_{19} (bioclimatic variables). On the bottom row are the thresholded maps of each model and the models combined to visualise the areas where both models indicate a high probability of presence. The limits of some bioregions are shown: the SAF in green, the NAF sub-bioregion 1 in blue, the NAF sub-bioregion 2 in red, the NAF sub-bioregion 3 in orange, and the Espinhaço/Mantiqueira in purple.

The SDM_{19} projections for paleo scenarios (Figure 7) showed a pattern of expansion of *B. miersii* climatic niche in the AF during the LGM in comparison to the LIG. From the LGM until the present, the suitable areas above the Northern SAF continued to expand, but in the Southern SAF we observed retraction and fragmentation of the species' suitable area. The SDM_{19} projections for future scenarios (Figure 8), on the other hand, showed a pattern of retraction of the suitable areas above the Northern SAF, especially in the NAF sub-bioregion

1. The greatest difference between the projections for ssp245 and ssp585 is that was observed more fragmentation of the suitable areas in the latter.

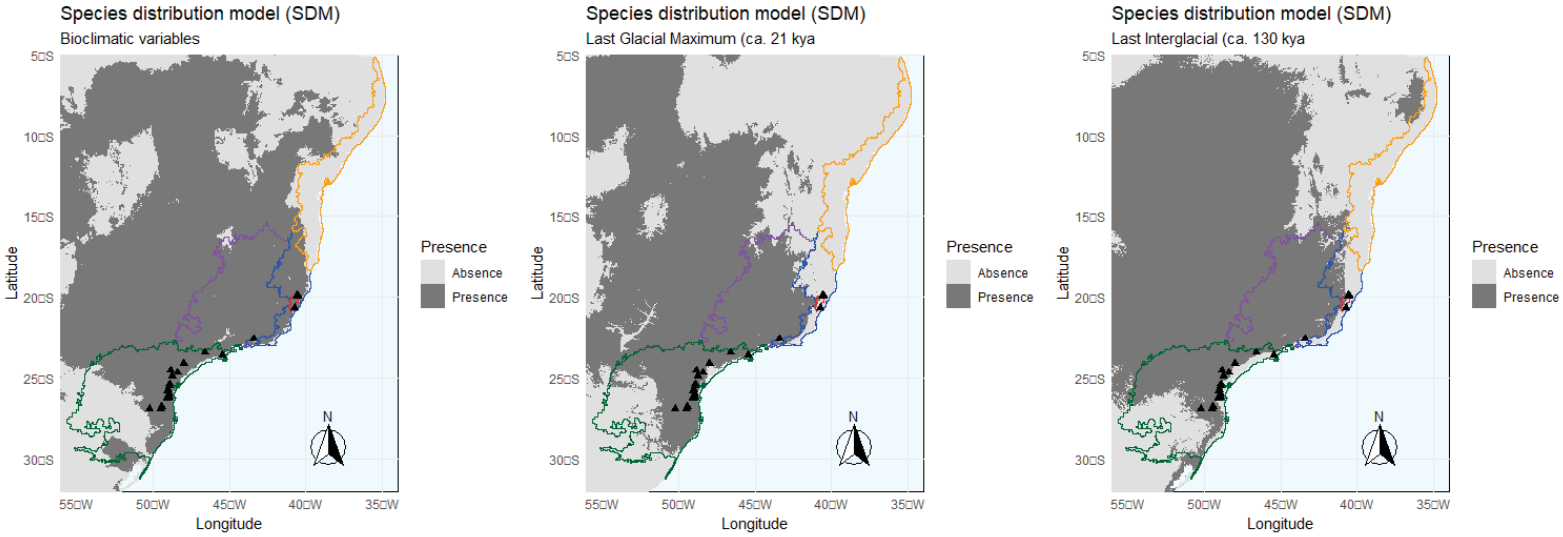

Figure 7: Species distribution models projected into paleo conditions. The SDM map under present conditions is displayed on the left-hand size for comparison. The occurrence points of *Barbosella miersii* are represented by black triangles. The limits of some bioregions are shown: the SAF in green, the NAF sub-bioregion 1 in blue, the NAF sub-bioregion 2 in red, the NAF sub-bioregion 3 in orange, and the Espinhaço/Mantiqueira in purple.

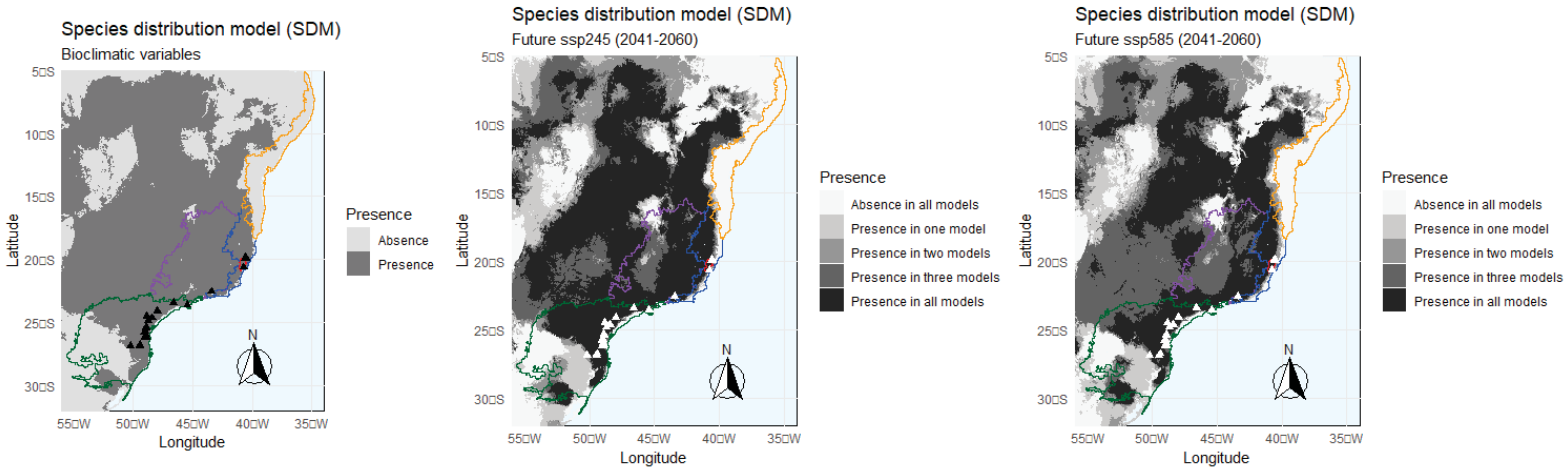

Figure 8: Species distribution models projected into future conditions considering the scenarios ssp245 and ssp585. The SDM map under present conditions is displayed on the left-hand size for comparison. Each future projection map is a combination of four projections: ACCESS-ESM1-5, CanESM5-CanOE, INM-CM4-8, and MRI-ESM2-0. The occurrence points of *Barbosella miersii* are represented by black or white triangles. The limits of some bioregions are shown: the SAF in green, the NAF sub-bioregion 1 in blue, the NAF sub-bioregion 2 in red, the NAF sub-bioregion 3 in orange, and the Espinhaço/Mantiqueira in purple.

DISCUSSION

Genetic structure and gene flow

Genetic structure is the non-random distribution of genotypes or haplotypes in space and time due to mutation, migration, selection, and drift combined (Felsenstein, 1976, Loveless & Hamrick, 1984). In plants, the genetic structure implies spatial structure (i.e., the distribution of individuals and populations in the geographic space) and is strongly determined by their reproductive systems and seed dispersal strategies (Allard, 1975, Endler, 1979, Loveless & Hamrick, 1984). We found that *B. miersii* has a strong genetic structure, presenting a significant positive correlation between genetic and geographic distances from the Mantel tests. We also observed a possible differentiation between SAF and NAF

populations evidenced by the genetic clusters' composition (Figure 3) and by the AMOVA results, in which the bioregions hold most of the genetic variation (Table 5). The Most Clade Credibility trees show that the divergence among haplotypes of these groups of populations was the first cladogenesis event in the species (Figure 4). Therefore, we argue that the observed differences between SAF and NAF populations can be due to an ancient vicariant event, either by barriers to dispersal or local extinctions, followed by environmental heterogeneity and differential selection pressures in the bioregions (Spieth, 1974, 1979, Hedrick, 2006).

We obtained different results regarding the genetic structure within the bioregions. With the plastid dataset, the SAF populations are subdivided into two clusters according to their geographic proximity: populations PR and SC, located in the southern portion of the bioregion, were not grouped with the northern population SP. Further, all population pairwise F_{ST} values are high (≥ 0.39). With the nuclear dataset, on the other hand, the genetic clusters correspond to the bioregions without subdivisions and, although population pairwise F_{ST} values are mostly high (≥ 0.3), we found low values (0–0.02) among the SAF populations. An $F_{ST} < 0.15$ indicates close genetic proximity between the populations; therefore, gene flow is expected to occur (Frankham, Ballou & Briscoe, 2002). One possible explanation of these results relies on the heritable information that each genome carries: the nuclear genome is biparentally inherited, while the chloroplast genome is maternally inherited in most angiosperms (Petit *et al.*, 2005). It means that nuclear DNA markers can track gene flow from both pollen and seeds, while plastid DNA markers retain genetic information only from the seeds (McCauley, 1995, Petit *et al.*, 2005). Therefore, we suggest that the stronger genetic structure observed with the plastid dataset is due to the limited seed dispersal in *B. miersii*, probably because the wind dispersal strategy is disadvantaged in dense tropical forests, where

the species inhabits. In fact, population genetic studies in *Octomeria* Lindl. (Barbosa *et al.*, 2013) and *Pleurothallis* R.Br (Borba *et al.*, 2001) species occurring in open vegetations showed low genetic structure. Moreover, direct observations of seed dispersal on terrestrial orchids (Jersáková & Malinová, 2007, Brzosko *et al.*, 2017) and on the epiphyte *Brassavola nodosa* (L.) Lindl. (Murren & Ellison, 1998) evidenced that most seeds are dispersed close to the mother plant, suggesting that long seed dispersal may occur occasionally on orchids. Regarding pollen transfer, gene flow might be occurring through pollination among SAF populations. Although the pollinator of *B. miersii* is not known, it is possibly a small dipteran like the pollinators documented for other species of the Pleurothallidinae. Hence, we argue that the flight capacity of the hypothesised pollinator might be limited, so we did not observe gene flow in the NAF probably due to the higher habitat fragmentation in this region, but this statement requires the identification of the pollinator and empirical tests for confirmation.

Another possible explanation for the different genetic structure results between nuclear and plastid DNA is that the ITS region is not variable enough to detect the genetic structure of the populations at a local scale. In fact, plastid markers perform best in identifying genetic structure than nuclear and mitochondrial markers in plants (Petit *et al.*, 2005). Furthermore, orchid populations often suffer from severe pollination limitation, mainly because of low frequency of visits from effective pollinators, which can be an important driver of diversification in the family by promoting population isolation and genetic drift (Tremblay *et al*., 2005). It means that, if the poorly-efficient pollinators promote genetic structure in orchids, and considering that the pollinator of *B. miersii* probably has low flight capacity due to its reduced body size, the weaker genetic structure observed in *B. miersii* with the nuclear dataset can be the result of a lower genetic variability of the ITS instead of a possible gene flow among Southern populations. Therefore, the genetic structure of *B. miersii*

populations was probably established by both short seed dispersal and pollination limitation, which resulted in the isolation by distance of the populations, rather than differences related to the bioregions.

Phylogeography

Our molecular dating analyses indicated that *B. miersii* originated ca. 1–1.8 million years ago (Figure 5), during the Pleistocene, which is in agreement with the literature (Bolson, 2018) and hence is congruent with the calibration node used. At that epoch, the Atlantic Forest was already distinguished from the Amazon Forest by the spread of open vegetation after global episodes of climate cooling and dryness during the Miocene Period (Prado & Gibbs, 1993, Flower & Kennett, 1994, Morley, 2000, Werneck *et al.*, 2011). The Pleistocene was a period of severe climatic fluctuations that provoked shifts in the species distributions (Colinvaux & De Oliveira, 2001, Antonelli *et al.*, 2018). Evidence from climate-based paleodistribution models and population genetic studies support the existence of climate-stable areas in the Atlantic Forest, called refugia, which maintained and also promoted biodiversity (Carnaval & Moritz, 2008, Carnaval *et al.*, 2014, Leite *et al.*, 2016). The region comprising the Central to Northern NAF bioregion was the largest refugia during the Pleistocene, while the SAF had smaller mountaintop refugia and underwent major turnover events (Carnaval *et al.*, 2014).

Phylogeographic studies in bromeliads (Palma-Silva *et al.*, 2009), vines (Lorenz-Lemke *et al.*, 2005), and trees (Stefenon *et al.*, 2019) found lower genetic variability in Southern populations, which is considered an evidence of Southern range expansions/colonisation events and bottlenecks during cooler periods of the Late Quaternary (Carvanal *et al.*, 2009). We observed the same pattern of higher genetic variability in the

Northern populations of *B. miersii* (Table 4), and the SDM projections showed that Southern suitable areas (i.e., located in the SAF) expanded during the LGM (Figure 7), meaning that both refugia and Southern glacial expansion hypotheses can be invoked to explain the current distribution of this species as well. Moreover, the GMRF Bayesian Skyride plots showed a pattern of slight population expansion, more pronounced in the plastid dataset, followed by bottlenecks ca. 200,000 years ago (Figure 5). The effective population size variation over time depicted in the GMFR Bayesian Skyride plots can also explain the differences observed in the haplotype networks. Because the plastid markers are more variable than the ITS, they can detect more recent genetic events. Hence, the plastid network has a furcating-tree pattern that is related to strong population differentiation and bottleneck, while the nuclear network has a star-like pattern that is related to population expansion.

It is noteworthy that the Southern population PR also presents high genetic variability, which is congruent with the existence of smaller refugia in the Paraná state that was suggested in other studies (Carnaval *et al.*, 2014; Stefenon *et al.*, 2019). Nonetheless, the putative origin of the species is unclear. The most parsimonious hypothesis is that the species originated in the NAF and expanded Southwards, where the Paraná refugia maintained the genetic diversity of the Southern populations while local extinctions occurred in areas experiencing intense turnover during climatic fluctuations. The most common haplotypes in both plastid (H1 and H5) and nuclear (H1) datasets are widespread in the Southern populations and are among the newest ones (Figure 5), reinforcing the hypothesis of a Northern origin followed by dispersal Southwards. However, the Most Recent Common Ancestor (MRCA) of the Southern haplotypes is older than the MRCA of the Northern haplotypes (Figure 5). We argue that it can be due to unsampled haplotypes. The plastid haplotype network has four median vectors, which represent extinct or unsampled haplotypes (Kong, Sánchez-Pacheco & Murphy, 2015):

one on the node between the haplotypes of the population SP and the remaining haplotypes from the SAF, and the other three form an unresolved triangle among haplotypes of the NAF. In fact, our sampling is biased toward Southern SAF: ca. 62% (18) of the individuals are from populations PR and SC, ca. 10% (3) are from population SP, and only ca. 28% (8) are from the NAF.

SDMs and conservation implications

We observed important differences between the SDMs. Basically, the inclusion of vegetation cover in the model caused a disjunction in the suitable area recovered with the bioclimatic variables that include the Cerrado. This finding suggests that *B. miersii* is endemic to the AF due to the lack of dense tropical forests in the Cerrado and due to the limited capacity of seed dispersal from within the dense forest, rather than be uncapable of survive in other environments. On the other hand, the areas where both models agree are likely to have unrecorded populations, which are the Atlantic Forest relicts in the Espinhaço and Mantiqueira Mountains (Figure 6). The median vectors in the plastid haplotype network (Figure 4) support the existence of populations in these areas. Therefore, it would be interesting to have field expeditions to the areas where both SDMs indicate high probability of presence of *B. miersii* to test whether our distribution models combined are powerful enough to predict the species' occurrence.

The SDMs indicated suitable areas outside the Atlantic Forest as well, such as the Andes, Central America, and the Antilles (Figure 6), where other species of *Barbosella* occur (Luer, 2000). This result can reflect a tendency of lineages to retain niche-related traits through speciation events (e.g., morphological traits and tolerance to certain climatic variables) called Phylogenetic Niche Conservatism (Tanlsey, 1904, Cooper, Jetz &

Freckleton, 2010). From all the above, we reinforce that *B. miersii* is restricted to the Atlantic Forest due to vegetation discontinuity and limited seed dispersal. The presence of continuous, dense vegetation is important for two main reasons: (1) tree trunks and branches are the main substrates for the species (and other epiphytes) to settle new individuals, and (2) dense forests have a distinct below-canopy microclimate (von Arx *et al.*, 2013). Trees offer protection from solar radiation and strong winds, lowering daily variation in air temperature and relative humidity below the canopy, and maintaining a colder and more humid environment in relation to comparable open vegetation (von Arx *et al.*, 2013). The finding that the maximum temperature of the warmest month (BIO5) greatly contributed for the SDM_{19} but not for SDM_{26} can be evidence of the influence of below-canopy microclimate in *B. miersii* distribution, as other bioclimatic variables were relevant for both models (i.e., BIO7, BIO11, and BIO14).

The ability of forests to maintain a stable below-canopy microclimate is not uniform and depends on several environmental and structural conditions, among which is the distance from the forest edge (Chen, Franklin & Spies, 1993; Heithecker & Halpern 2007, Meyer, Sisk & Covington, 2001, von Arx *et al.*, 2013). In fact, the "edge effect" is known to shape epiphytic community composition, as most light-demanding species are located near the edge, whereas more shaded and hygrophytic species, such as *B. miersii*, are found only at the forest interior (Zartman & Nascimento, 2006; Belinchón *et al.*, 2007, Hauck *et al.*, 2014). The largest fragment of the original forest is located in the Paraná state, South Brazil. The forest is protected against unsustainable use by law since 2006, but current law amendment proposals aim to weaken measures to combat deforestation. If such nocive proposals become approved, the Atlantic Forest will become even more fragmented (more "edgy") and consequently will lose the capacity of maintaining stable microclimates over time. Both SDMs projected into

future scenarios indicated retraction of suitable areas for *B. miersii* (Figure 8), especially in the Rio de Janeiro state (NAF sub-bioregion 1). These model projections raise concerns about the conservation of *B. miersii*, because the suitable areas that will be most affected by climate change according to the models are the most fragmented areas as well. On the other hand, the SAF region and the Espírito Santo highlands (NAF sub-bioregion 2) have great potential for receiving conservation measures to protect the species and likely other epiphytic orchids that rely on the AF microclimate.

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SUPPORTING INFORMATION

Supplementary Material 1: Screening tests on five individuals: ADR01, ALC02, BEN02, NHG05, and TER03. T = annealing temperature in ºC used in PCRs, L = average product size in base pairs, A = amplification success (%), S = sequencing success (%), and P = polymorphic sites (%).

Region	Primer sequences (5'–3')	T	L	A	S	P
psbI-trnS^{GCU}	Pleuro_psbI: AATGATCCGGGGCGTAATCC [2] Pleuro_trnS(GCU)-R: ATGGGGAGAGATGGCTGAGT [2]	53	136	100	100	3.7
rpl32-trnL^{UAG}	rpl32-F: CAGTTCCAAAAAAACGTACTTC [3] trnL_UAG: CTGCTTCCTAAGAGCAGCGT [3]	53	692	100	100	2.0
ITS	17SE: ACGAATTCATGGTCCGGTGAAGTGTTCG [1] 26SE: TAGAATTCCCCGGTTCGCTCGCCGTTAC [1]	51	628	100	100	0.8
psbB-psbT	Pleuro_psbB-F: TGCTACGTTTGCTTTGCTCT [2] Pleuro_psbT-R: GGGGGCTCATTACTTCAATGGA [2]	60	449	100	100	0.4
trnS^{GCU}-*trnG*^{UCC}	Pleuro_trnS(GCU)-F: ACGCTTTAGTCCACTCAGCC [2] Pleuro_trnG(UCC)-R: AGCCGAGGGTTCTAGTAAACC [2]	53	1256	60	67	0.4
psbD-trnT^{GGU}	psbD: CTCCGTARCCAGTCATCCATA [3] trnT(GGU)-R: CCCTTTTAACTCAGTGGTAG [3]	53	624	100	60	0
trnR^{UCU}-*atpA*	Pleuro_trnR(UCU)-F: AATGAAGGGCGTCCATTGTCT [2] Pleuro_atpA-R: GCTGGAATCAGGCCTGCTAT [2]	53	678	100	100	0
trnW^{CCA}-*trnP*^{UGG}	Pleuro_trnW(CCA)-F: ATTTGAACCTACGACATCGGGT [2] Pleuro_trnP(UGG)-R: GCTTGGTAGCGCGTTTGTTT [2]	53	93	100	100	0

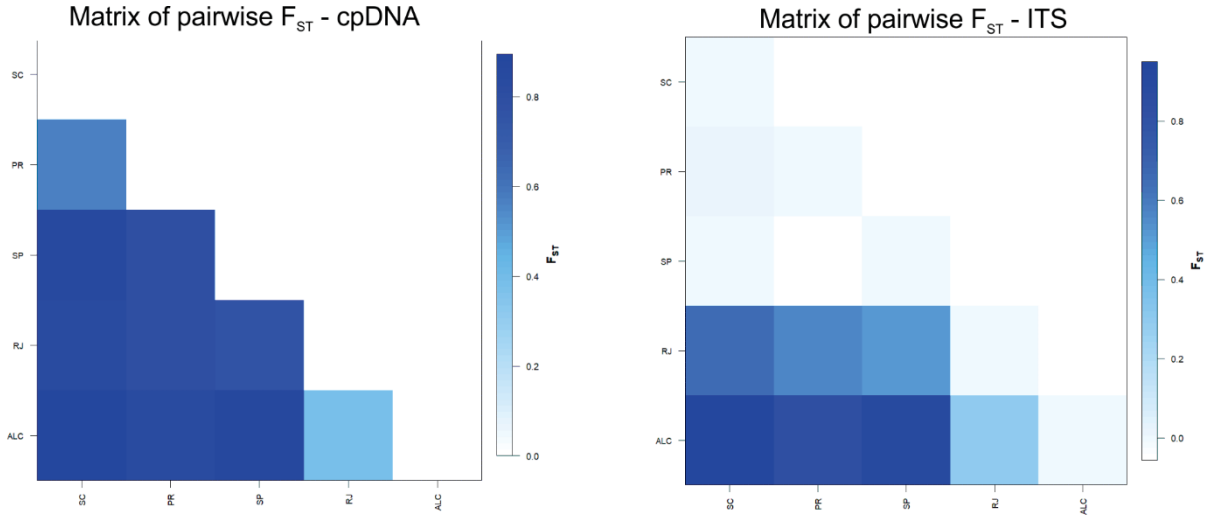
[1] Sun *et al.*, 1994; [2] Mauad *et al.*, 2021; [3] Shaw *et al.*, 2007.

Supplementary Material 2: Voucher and sequencing status of each sample. Samples marked with * were excluded from the analyses because we could not amplify them for all regions. Herbarium acronyms in parenthesis following Index Herbariorum (Thiers, 2016). OK = Sequence obtained and ready to be submitted to GenBank.

Sample	**Voucher**	**ITS**	***psbI-trnS*^{GCU}**	***rpl32-trnL*^{UAG}**
BEN01	M. Bolson 516 (UPCB)	OK	OK	OK
BEN02	M. Bolson 548 (UPCB)	OK	OK	OK
BEN03	M. Bolson 517 (UPCB)	OK	OK	OK
BEN04	M. Bolson 518 (UPCB)	OK	OK	OK
BEN05	M. Bolson 547 (UPCB)	OK	OK	OK
BEN06	M. Bolson 550 (UPCB)	OK	OK	OK
BEN07	M. Bolson 554 (UPCB)	OK	OK	OK
JOI01	M. Bolson 520 (UPCB)	OK	OK	OK
JOI02*	W.S. Mancinelli 906 (JOI)	-	OK	-
ADR01	M.E. Engels 667 (MBM)	OK	OK	OK
ADR02*	W.S. Mancinelli 1233 (JOI & UPCB)	-	OK	-
ADR03	M.L. Brotto 2163 (UPCB)	OK	OK	OK
ADR04	M.L. Brotto 2398 (UPCB)	OK	OK	OK
MOR01	M. Bolson 560 (UPCB)	OK	OK	OK
MOR02	M. Bolson 601 (UPCB)	OK	OK	OK
NHG01	A.V.S.R. Mauad 17 (UPCB)	OK	OK	OK
NHG02	M. Bolson 514 (UPCB)	OK	OK	OK
NHG03	M. Bolson 557 (UPCB)	OK	OK	OK
NHG04	M. Bolson 598 (UPCB)	OK	OK	OK
NHG05	M. Bolson 599 (UPCB)	OK	OK	OK
CAN01	L. Zandoná s.n., unvouchered	OK	OK	OK
CAN02	L. Zandoná s.n., unvouchered	OK	OK	OK
CAR01	M. Bolson 515 (UPCB)	OK	OK	OK
ITA01*	M. Bolson 555 (UPCB)	-	OK	-
NFR01	M. Bolson 615 (UPCB)	OK	OK	OK
NFR02	M. Bolson 616 (UPCB)	OK	OK	OK
TER01	M. Bolson 494 (UPCB)	OK	OK	OK
TER02	M. Bolson 496 (UPCB)	OK	OK	OK
TER03	M. Bolson 498 (UPCB)	OK	OK	OK
TER04	M. Bolson 507 (UPCB)	OK	OK	OK
ALC01	M. Bolson 645, unvouchered	OK	OK	OK
ALC02	M. Bolson 660 (UPCB)	OK	OK	OK

Supplementary Material 3: Cluster analysis to select the projections for the future, performed on the projections under the ssp245 scenario using the 9 bioclimatic variables that were strongly correlated ($r \geq 0.8$) to the current distribution of *Barbosella miersii*: BIO1, BIO4, BIO6, BIO9, BIO11, BIO15, and BIO19. Above, the silhouette analysis plot indicated the best number of clusters (k = 4). Below, the clusters for k = 4. The chosen models are in bold red.

Supplementary Material 4: Pairwise FST matrix among populations.



Supplementary Material 5: MaxEnt jackknife tests of variable importance performed on each species distribution model (SDM). Variables that did not contribute to any of the models were not shown.

Variable	SDM with all 26 environmental variables		SDM with the 19 bioclimatic variables	
	Contribution (%)	Permutation importance	Contribution (%)	Permutation importance
Evergreen trees	60.1	46	-	-
Precipitation of the driest month (BIO14)	23.4	38	3.5	7.5
Temperature annual range (BIO7)	5.2	0	29.6	51.5
Mean temperature of the coldest quarter (BIO11)	4.8	0	33.5	0
Mean temperature of the wettest quarter (BIO8)	3.3	8	1	32.8
Precipitation of the driest quarter (BIO17)	1.3	0	0	0
Mixed/other trees	1.1	6	-	-
Minimum temperature of the coldest month (BIO6)	0.4	0	0.8	6.8
Cloud cover intra-annual variation	0.3	0	-	-
Precipitation of the wettest quarter (BIO16)	0	2	1	3.7
Maximum temperature of the warmest month (BIO5)	0	0	26.7	4.5
Temperature seasonality (BIO4)	0	0	3.4	0
Mean diurnal temperature range (BIO2)	0	0	1.1	0
Mean temperature of the warmest quarter (BIO10)	0	0	0.3	0

CONSIDERAÇÕES FINAIS

Este estudo objetivou entender melhor a história evolutiva das orquídeas da Mata Atlântica em diferentes níveis hierárquicos. No primeiro capítulo, foram feitas análises biogeográficas a partir de uma amostragem sem precedentes das orquídeas da Mata Atlântica, o que foi possível graças ao grande volume de sequências de DNA e de registros de ocorrências disponibilizados em bancos de dados públicos. Essas análises foram complementares aos estudos biogeográficos já realizados na família e enfatizaram que a evolução de Orchidaceae na Mata Atlântica é bastante complexa e ocorreu de diferentes maneiras entre os vários grupos. Os resultados confirmaram a importância dos eventos geológicos do Paleogeno na diversificação de orquídeas, em especial o soerguimento dos Andes que, ao mesmo tempo em que causou inúmeras extinções em resposta às drásticas mudanças na paisagem que as montanhas provocaram, também propiciou o estabelecimento e diversificação de migrantes. A principal contribuição deste capítulo foi chamar a atenção para a importância das flutuações climáticas do Quaternário na diversificação rápida e recente das espécies, em especial das endêmicas da Mata Atlântica, sugerindo que estes eventos também devem tiveram seu impacto na mega-diversidade de orquídeas no mundo todo. Estudos futuros devem incluir representantes de outras regiões do planeta, em especial da Ásia e da Austrália, e fazer uso de dados de sequenciamento de nova geração para a obtenção de filogenias mais robustas e, consequentemente, para gerar reconstruções biogeográficas mais verossímeis e confiáveis. Além disso, análises de diversificação podem ser úteis na identificação de grupos “museu” e “berçário”, além de comparar a diversificação entre as diferentes biorregiões da Mata Atlântica.

O segundo e o terceiro capítulos consistiram em estudos mais restritos à subtribo Pleurothallidinae, a maior subtribo da família. O estudo filogenômico realizado no capítulo 2 era necessário para entender a variabilidade do genoma no grupo a nível de gêneros e afinidades (nomenclatura utilizada na literatura especializada na subtribo para nomear grandes clados), e teve como principal objetivo encontrar marcadores plastidiais mais variáveis para auxiliar estudos filogenéticos no grupo. Este estudo contribuiu muito positivamente nesse sentido, pois foi constatada a baixa variabilidade genética na subtribo, ao passo que os marcadores identificados são promissores para a obtenção de reconstruções filogenéticas mais robustas com baixo custo de sequenciamento. Além disso, a quantidade de genomas

plastidiais completos disponíveis em bancos de dados públicos mais do que dobrou, uma vez que antes só haviam três sequências de dois gêneros, e neste estudo foram produzidas mais oito sequências de sete gêneros diferentes.

Dois dos dez marcadores variáveis identificados no capítulo 2 foram utilizados na filogeografia de *Barbosella miersii*, realizada no capítulo 3, uma vez que apresentaram variabilidade genética suficiente a nível de indivíduo. Ao contrário de outros estudos populacionais realizados na subtribo em espécies de áreas abertas, este estudo indicou forte estrutura genética da espécie, sugerindo que o hábitat de floresta tropical densa pode estar atrapalhando a dispersão das sementes. Além disso, há diferenciação genética marcada Norte-Sul, e há indícios de que a espécie passou por eventos de expansão e *bottlenecks* recentes na região Sul que, juntamente com o padrão de diversidade genética, são congruentes com as hipóteses de expansões glaciais e de refúgios. Desta maneira, as populações provavelmente se originaram na biorregião Norte da Floresta Atlântica durante o Pleistoceno (ca. 1–2 milhões de anos atrás) e expandiram para a biorregião Sul. Ao longo das flutuações climáticas da época, as populações do Sul foram expandindo e se extinguindo, enquanto que as populações localizadas no micro-refúgio do Paraná e no refúgio ao Norte mantiveram a diversidade genética da espécie. Os modelos de distribuição mostraram que *B. miersii* é altamente dependente da presença de florestas densas e contínuas para sua distribuição, e por isto está fortemente ameaçada frente às mudanças climáticas e ao risco de desmatamento na região. Diante do exposto, este estudo reforçou que as orquídeas formam relações específicas com seu ambiente, mas que a distribuição restrita das espécies não se dá por baixas tolerâncias ambientais e sim por limitações na dispersão de sementes e características da paisagem. Estudos populacionais munidos de modelos de distribuição se mostraram ferramenta úteis no estudo de espécies raras e contribuem de maneira valiosa para o entendimento da distribuição restrita de espécies endêmicas.

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