Filogenia molecular do grupo Piptadenia (Leguminosae, Caesalpinioideae, Clado Mimosoide) e taxonomia do gênero *Piptadenia* Benth.

UNIVERSIDADE ESTADUAL DE FEIRA DE SANTANA DEPARTAMENTO DE CIÊNCIAS BIOLÓGICAS PROGRAMA DE PÓS-GRADUAÇÃO EM BOTÂNICA

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PÉTALA GOMES RIBEIRO

Tese apresentada ao Programa de Pós-Graduação em Botânica da Universidade Estadual de Feira de Santana como parte dos requisitos para a obtenção do título de *Doutora em Botânica*.

ORIENTADOR: PROF. DR. LUCIANO PAGANUCCI DE QUEIROZ (UEFS)

CO-ORIENTADORA: PROFª. DRA. MELISSA LUCKOW (CORNELL UNIVERSITY)

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(Bahia, abril de 2010)

“Se você olhar bem, verá que o mundo todo é um jardim!”

(O Jardim Secreto)

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Pensei que não fosse acabar, mas acho que consegui!!! Aprendi muuuuito, muuuito, muuuito! Eu sou uma antes da pós graduação e outra mulher bem mais madura, mais experiente, cheia de novidades, coisas que carrego em minha memória, de pessoas que conheci, do que li, do que vivi, objetos, livros, cheiros de gente, de lugares, de herbários,

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BIOGRAFIA

Pétala Gomes Ribeiro é filha de Dinalva Gomes Ribeiro, nascida em 24 de janeiro de 1986, em Salvador, Bahia, mudou-se para Feira de Santana ainda criança, onde iniciou e concluiu seu colegial. Cursou Licenciatura em Ciências Biológicas pela Universidade Estadual de Feira de Santana (UEFS-BA), recebendo o título de licenciada em outubro de 2009. Iniciou o bacharelado logo em seguida, mas não chegou a concluir por ter sido selecionada em dezembro do mesmo ano pelo Programa de Pós-graduação em Botanica – PPGBot da mesma instituição, tendo assim inicado o Mestrado em março de 2010 e concluído em abril de 2012. Após 6 meses afastada, voltou para a seleção pelo fluxo contínuo e iniciou o doutorado em janeiro de 2013 e concluiu em maio de 2017.

SUMÁRIO

APRESENTAÇÃO

Esta tese apresenta a sistemática de *Piptadenia s.s.* (Filogenia e revisão taxonômica). É composta por uma introdução geral, seguida de dois capítulos. O primeiro capítulo [*Lachesiodendron*, a new monospecific genus segregated from *Piptadenia* (Leguminosae, Caesalpinioideae, Mimosoid clade): evidence from morphology and molecules] está apresentado seguindo as normas de publicação da revista ***Taxon*** à qual foi submetido. O segundo capítulo [Phylogeny and taxonomic revision of *Piptadenia* (Leguminosae, Caesalpiniodea, Mimosoid clade)] está apresentado em língua inglesa também e com a formatação semelhante ao anterior, mas que será melhor trabalhado para a submissão a outra revista que ainda estamos a decidir.

Aspectos metodológicos

Obtenção de amostras: uma grande vantagem em fazer esse estudo é que boa parte das *Piptadenia* para o Brasil já haviam sido coletadas por alguns leguminólogos como *L.P. Queiroz*, *E.R. Souza*, *D. Cardoso,* bem como outros estudantes da UEFS e o material em sílica estava no banco de sílica da UEFS, tendo o material testemunho depositado na própria coleção do HUEFS. E também é um grupo bastante amostrado na maioria das coleções e nas que pude visitar sempre havia bastante material de *Piptadenia* para estudar.

Visita a herbários: as visitas aos herbários brasileiros foram realizadas de abril a julho de 2013. Fiz uma viagem somente de visitas a herbários, passando desde coleções mais regionais a grandes coleções históricas como a do Jardim Bot. do Rio de Janeiro. No total foram 68 herbários visitados, e pudemos pedir empréstimos da maioria das coleções para o HUEFS.

As visitas aos herbários europeus foram realizadas de agosto a novembro de 2013. Pude passar tres meses principalmente no K, já que fui no estágio do REFLORA e a maior parte do período foi dedicada a coleção do Royal Botanic Gardens, Kew. Foi possível analisar as coleções completas do herbário K, P, M, G, LE. O período de estágio revisando herbários europeus foi importante não só para ter uma maior quantidade materiais analisados, para obtenção de dados de distribuição geográfica das espécies, período fenológico de floração e frutificação, revisão dos tipos, que em sua maioria está depositada nos herbários europeus, bem como acessar a várias bibliografias nas bibliotecas das coleções, além de ilustrações botânicas e diários de campo, em especial a do Kew. Em 2014 fiz uma viagem pela Am. do sul extra Brasil para revisar as coleções de ANDES, BOG, COAH, COL, CUZ, MOL, QAP, QCA, QCEN, SMF, UDBC, USM. Em 2015 recebi o Rupert Barneby Award em NY, e pude revisar a coleção de NY, MO, ILL, F e US, tendo assim boa parte dos herbários com revisados e um banco de dados incluindo todas as espécies de *Piptadenia*. Lista dos herbários ao final do texto.

Avanços nos estudos taxonômicos

No Brasil, um dos avanços desses últimos 6 anos foi o projeto Reflora, que possibilitou a ida dos especialistas a uma das maiores coleções do mundo, na Inglaterra, Kew, e assim atualizar a identificação, para incorporação no acervo, Repatriamento das imagens com digitalização desses materiais para banco de dados mundial *on line*. Acesso a outros grandes bancos mundiais que compilam dados de diversos herbários, como JSTOR, TROPICOS, BOTANICOS é, sem dúvida um dos grandes avanços para estudos botânicos, principalmente em taxonomia. Pelo Reflora pude revisar não somente a coleção de *Piptadenia* do Kew, mas como a coleção geral dos legumes mimosoides. Também foi possível acessar as bibliotecas europeias, em especial a do Kew Gardens, com muitas obras raras. E graças ao Rupert Barneby Award pude revisar a coleção estudada por Barneby em NY, bem como tive acesso às grandes bibliotecas dessas instituições.

Estudos moleculares - Os estudos moleculares foram realizados em dois laboratórios: a parte de extração e os primeiros PCRs no Laboratório de Genética Vegetal (LGV/CEN-Embrapa, Brasília/DF), posteriormente, a maior parte das amplificações no Laboratório de Sistemática Molecular de Plantas (LAMOL/UEFS, Feira de Santana/BA) e por fim as reações de sequenciamento foram feitas no LGV. O tratamento das sequencias, incluindo conitgs, alinhamentos e analises foi feito na UEFS. Esse intercâmbio entre laboratórios foi de grande valia e a troca de experiências foi essencial para obtermos o maior número de sequencias boas.

É importante mencionar aqui que isso só foi possível graças ao projeto “Padrões de Diversidade de Leguminosas nos Biomas Brasileiros” do Sisbiota, coordenado por Dr. Luciano Paganucci de Queiroz, com várias instituições e pesquisadores colabaradores.

O Sisbiota viabilizou a rede de leguminosas e os trabalhos de sistemática moleculares em diferentes laboratórios. Ressalto ainda que o Sisbiota foi o principal responsável pelo financiamento das viagens de coletas de plantas e visitas aos herbários do mundo. Foi também o responsável pela viabilidade da realização deste trabalho em parceria com vários pesquisadores, em especial Marcelo Simon (Embrapa), Domingos Cardoso (UFBA), Élvia R. de Souza (UNEB).

RESUMO

Piptadenia Benth. inclui 23 táxons (22 espécies e uma variedade) de distribuição neotropical, apresentando seu centro de biodiversidade na região amazônica. Este estudo inclui uma abordagem filogenética e uma revisão taxonômica para as espécies do gênero *Piptadenia*. O estudo filogenético foi realizado a partir de sequências das regiões nucleares (ITS e ETS) e plastidiais (*trnL-F, trnD-T* e *matK/trnK*) analisados pelos critérios de Máxima Verossimilhança, Máxima Parcimônia e por Inferência Bayesiana. *Piptadenia*, como hipotetisado (e já mostrado anteriormente mesmo com amostragem baixa) é monofilético com a exclusão de *P. viridiflora*. A primeira parte da tese focou na inclusão de mais amostras de *P. viridiflora* na matriz usada na filogenia realizada anteriormente com espécies do grupo Piptadenia com ênfase em *Stryphnodendron*. Preenchemos as lacunas na matriz o tanto possível e incluímos múltiplos acesso de *P. viridiflora*. Em toda as análises, essa espécie sai em uma linhagem isolada de *Piptadenia* e irmão dos demais gêneros do grupo Piptadenia. Esse resultado é corroborado com dados morfológicos, incluído polínicos. Descrevemos então no capítulo 1 o gênero *Lachesiodendron* para acomodar *P. viridiflora* isolada das demais *Piptadenia*. A segunda etapa foi a filogenia e revisão taxonômica de *Piptadenia* s.s. Para cumprir essa etapa, nos estudos filogenéticos utilizamos a mesma matriz usada para *Lachesiodendron* e incluímos todas as espécies de *Piptadenia* exceto *P. imatacae*, a maioria representada por múltiplos acessos. A revisão taxonômica foi realizada através da análise de aproximadamente 10.000 espécimes, incluindo tipos, bem como materiais coletados e observados durante as expedições de campo. Nesse estudo, são propostas 13 lectotipificações, 4 novos sinônimos.

ABSTRACT

Piptadenia Benth. includes 23 taxa (22 species and one variety) of neotropical distribution, presenting its biodiversity center in the Amazon region. This study includes a phylogenetic approach and a taxonomic review for the species of the genus *Piptadenia*. The phylogenetic study was performed from the nuclear (ITS and ETS) and plastidial (trnL-F, trnD-T and matK / trnK) sequences analyzed by Maximum Likelihood, Maximum Parsimony and Bayesian Inference criteria. *Piptadenia*, as hypothesized (and previously shown even with low sampling) is monophyletic with the exclusion of *P. viridiflora*. The first part of the thesis focused on the inclusion of more samples of *P. viridiflora* in the matrix used in the previous phylogeny with species of the Piptadenia group with emphasis on *Stryphnodendron*. We fill in the gaps in the matrix as much as possible and include multiple accesses of *P. viridiflora*. In all the analyzes, this species appears in an isolated lineage of *Piptadenia* and sister of the other genera of the group Piptadenia. This result is corroborated with morphological data, including pollen. We describe in chapter 1 the genus *Lachesiodendron* to accommodate *P. viridiflora* isolated from the other *Piptadenia*. The second step was the phylogeny and review of *Piptadenia* s.s. To accomplish this step, in phylogenetic studies we use the same matrix used for *Lachesiodendron* and we included all species of *Piptadenia* except *P. imatacae,* most represented by multiple accesses. The taxonomic review was performed through the analysis of approximately 10,000 specimens, including types, as well as materials collected and observed during field expeditions. In this study, we propose 13 lectotipifications, 4 new synonyms.

INTRODUÇÃO GERAL

Família Leguminosae

Leguminosae é a terceira maior família de plantas com ca. 770 gêneros e 19.500 espécies e distribuição cosmopolita (LPWG 2017). Habita diversos tipos de ambientes e possui variados hábitos, desde ervas, lianas, arbustos a grandes árvores. Esse seu sucesso deve-se em parte à associação com bactérias fixadoras de Nitrogênio, em nódulos nas raízes, o que permite as leguminosas ocuparem solos pobres em Nitrogênio, o que ocorre em outras famílias, especialmente do clado fixador de Nitrogênio (Fabales, onde se inserem as Leguminosas, Rosales, Cucurbitales e Fagales), mas não tão eficiente como nessa família (Queiroz 2009).

A família tem grande importância econômica por incluir várias culturas como soja, feijão, ervilha, amendoim, que são produtos bastante utilizados na alimentação humana e animal. Plantas dessa família também são muito utilizadas como fornecedoras de madeira para construção, produtos farmacêuticos e medicinais, artesanato, essências para perfumes e tinturas, além de serem utilizadas na arborização de cidades, em paisagismo, para fabricação de papel, na indústria têxtil, como fornecedoras de fertilizantes e outros produtos químicos, sem contar também com sua utilização em rituais religiosos (Lewis *et al.*2005; Queiroz 2009).

Pode ser reconhecida pela combinação de caracteres como folhas alternas, compostas, com estípulas, flores pentâmeras, períginas ou hipóginas, diclamídeas, diplostêmones, ovário súpero unicarpelar, unilocular, com óvulos inseridos alternadamente em uma placenta marginal (Queiroz 2009). O nome Leguminosae se deve ao tipo de fruto mais típico das plantas da família, o legume. Entretanto, existe uma variação considerável de tipos de fruto dentre as Leguminosae, incluindo folículo, frutos indeiscentes, como legumes indeiscentes, legumes bacáceos, drupas, frutos alados ou sâmaras e frutos articulados, como lomento e craspédio (Queiroz 2009).

A classificação tradicional de Leguminosae reconhece 3 subfamílias: Caesalpinioideae, Mimosoideae e Papilionoideae (Lewis *et al.* 2005). Na nova classificação, as Leguminosas passam de três para seis subfamílias fortemente sustentadas como monofiléticas: Ceasalpiniodeae, Cercidoideae, Detarioideae, Dialioideae, Duparquetioideae e Papilionoideae (LPWG 2017). Nesta classificação, a subfamília Mimosoideae passa a ser representada pelo clado Mimosoid, aninhado na recircunscrita Caesalpinioideae. É neste clado Mimosoida que se encontra o gênero *Piptadenia*.

Baseada em Lima *et al.* (2012), Leguminosae é a família com maior riqueza no Brasil, com 211 gêneros (16 endêmicos) e 2750 espécies (1459 endêmicas), distribuídas por todas as regiões e domínios fitogeográficos. Dentre todas as angiospermas, Leguminosae se destaca com cerca de 8,6% do total da Flora do país (Lima *et al.*2012).

Clado Mimosoid (subfamília Caesalpinioideae)

O clado Mimosoid da sufamília Caesalpiniodeae ocorre nas regiões tropicais, subtropicais e temperadas, tendo como principais centros de diversidade a América tropical, a África e a Australásia (Elias 1981). Com base em caracteres florais, Polhill (1994) reconheceu cinco tribos: Parkieae, Mimozygantheae, Mimoseae, Acacieae e Ingae. Parkieae e Mimozygantheae são definidas pelo cálice com prefloração imbricativa (sépalas livres em Mimozygantheae e conatas em Parkieae), enquanto que as demais tribos possuem cálice com prefloração valvar. Mimoseae é definida pelo androceu isostêmone ou diplostêmone, enquanto Acacieae e Ingae possuem androceu polistêmone, sendo os estames livres em Acacieae e conatos em Ingae. Porém, nenhuma dessas tribos é sustentada como monofilética (LPWG 2013, 2017) e os gêneros de Parkieae foram transferidos para Mimoseae (Lewis *et al.* 2005). Atualmente, Caesalpinioideae inclui 148 gêneros e ca. 4400 espécies (incluindo o clado Mimosoid; LPWG 2017).

O grupo informal Piptadenia

Piptadenia Benth. abrangia originalmente (Bentham 1840) espécies atualmente classificadas em *Anadenanthera* Speg., *Goldmania* Rose ex Micheli, *Newtonia* Baill., *Parapiptadenia* Brenan, *Pityrocarpa* (Benth.) Britton & Rose e *Pseudopiptadenia* Rauschert, sendo, então, caracterizado pelos frutos achatados com valvas papiráceas ou cartáceas. Diferentemente dos outros gêneros de Mimosoideae, não apresenta frutos especializados. Bentham (1841) incluiu o gênero na tribo Piptadenieae, definida pela presença de glândulas nas anteras. Posteriormente, Bentham (1875) ampliou os limites da tribo para incluir também as espécies sem endosperma na semente.

Piptadenia foi dividido em três seções (Bentham 1840): *Eupiptadenia* (17 espécies), *Pityrocarpa* (4), ambos com inflorescências em espigas, e *Niopa* (4), com inflorescências em glomérulos, totalizando 25 espécies. Brenan (1955) propôs o desmembramento de *Piptadenia* em seis gêneros (Tabela 1), *Anadenanthera*, *Pseudopiptadenia* (como *Monochisma* Brenan), *Newtonia*, *Goldmania*, *Piptadenia* e *Pityrocarpa*, baseando-se principalmente em características morfológicas das sementes, no formato dos frutos e seu modo de deiscência. Ao gênero *Piptadenia* ficaram subordinadas as espécies com sementes aladas e sem endosperma (*Piptadenia pterosperma* Benth. e *Piptadenia rigida* Benth.); as espécies com sementes sem alas, com endosperma e de testa rígida foram transferidas para o gênero *Pityrocarpa*; três espécies americanas de *Piptadenia* (*Piptadenia nitida* Benth., *Piptadenia psilostachya* (DC.) Benth. e *Piptadenia suaveolens* Miq.) foram incluídas em *Newtonia* Baill.; e outras duas espécies (*P. inaequalis* Benth. e *P. leptostachya* Benth.) no gênero *Monochisma*, então descrito. Por ser um homônimo posterior de *Monochisma* Duby

(Briófita), *Monochisma* Brenan foi renomeado como *Pseudopiptadenia* por Rauschert (1982). As diferenças marcantes das espécies americanas de *Newtonia*, entre elas o pólen em políades, as flores sésseis e os frutos não revolutos, levaram Lewis & Lima (1991) a transferi-las para *Pseudopiptadenia*, restringindo *Newtonia* às espécies africanas.

Problemas de tipificação (Cowan & Brenan 1960) fizeram com que o nome *Pityrocarpa* fosse novamente sinonimizado a *Piptadenia* e as espécies com sementes aladas foram transferidas para um novo gênero, denominado *Parapiptadenia* Brenan (Brenan 1963). Em *Piptadenia* foram mantidas duas seções: *Piptadenia* e *Pityrocarpa*, embora nenhum táxon tenha sido formalmente incluído na seção *Pityrocarpa*. Estudos filogenéticos mostraram que a seção *Pityrocarpa* representa uma linhagem independente da seção *Piptadenia* (Jobson & Luckow 2007). Eles indicaram também que *Piptadenia viridiflora* (Kunth.) Benth. deveria ser segregada de modo a compor um novo gênero.

O grupo Piptadenia abrange atualmente doze gêneros: *Adenopodia, Anadenanthera, Microlobius, Mimosa, Parapiptadenia, Parkia, Piptadenia, Pityrocarpa, Pseudopiptadenia, Stryphnodendron* e o recém descrito *Lachesiodendron* (Ribeiro 2012; capítulo 1) com espécies ocorrendo na América do Sul e Central, parte do Velho Mundo, incluindo Madagascar.

Piptadenia (excluindo *Lachesiodendron*) está representado na América do Sul, com centros de diversidade na Amazônia, ocorrendo também na Mata Atlântica do Brasil, florestas secas do nordeste e leste do Brasil se estendendo a Venezuela, América Central e México, florestas secas subandinas no Peru, Equador e Bolívia, sudeste do Brasil, duas espécies amplamente distribuídas em florestas secas do México e América Central à Argentina (Lewis *et al.* 2005).

Tabela 1. Mudança histórica dos sistemas de classificação de *Piptadenia* e gêneros relacionados

"Piptadenia group"	**"Piptadenia group"**	**"Piptadenia group"**	**"Piptadenia group"**
Lewis & Elias 1981	Luckow *in* Lewis *et al.* 2005	AUTOR(ES) 2007	ESSE TRABALHO
***Anadenanthera* Speg.**	*Anadenanthera* Speg.	*Anadenanthera* Speg.	*Anadenanthera* Speg.
***Mimosa* L.**	*Mimosa* L.	*Mimosa* L.	*Mimosa* L.
***Schrankia* Willd.**			
***Shranckiastrum* Hassler**			
***Stryphnodendron* Mart.**	*Stryphnodendron* Mart.	*Stryphnodendron* Mart.	*Stryphnodendron* Mart.
***Goldmania* Rose ex Micheli**	*Microlobius* C.Presl	*Microlobius* C.Presl	*Microlobius* C.Presl
***Parapiptadenia* Brenan**	*Parapiptadenia* Brenan	*Parapiptadenia* Brenan	*Parapiptadenia* Brenan
***Monochisma* Brenan**	*Pseudopiptadenia* Rauschert	*Pseudopiptadenia* Rauschert	*Pseudopiptadenia* Rauschert
***Piptadenia* Benth.**	*Piptadenia* Benth.	*Piptadenia* Benth.	*Piptadenia* Benth.
			Lachesiodendron
		Pityrocarpa (Benth.) Britton & Rose	*Pityrocarpa* (Benth.) Britton & Rose
***Pseudoentada* Britton & Rose**	*Adenopodia* C.Presl	*Adenopodia* C.Presl	*Adenopodia* C.Presl
x	*Parkia* R.BR.	*Parkia* R.BR.	*Parkia* R.BR.

Piptadenia é distinto dos demais gêneros do grupo Piptadenia por uma combinação de caracteres que inclui o fruto do tipo legume, sementes em sua maioria não aladas e presença de acúleos seriados ou dispersos nos ramos. É um dos grupos pouco estudados e de posicionamento filogenético até então incerto dentre os demais gêneros do clado Mimosoid. Esse estudo irá contribuir para elucidar as relações filogenéticas somadas ao conhecimento da diversidade taxonômica dentro da família.

Algumas espécies de *Piptadenia* estavam mal delimitadas e apresentando semelhanças com espécies de outros grupos de "Mimoseae", uma vez que não havia estudos filogenéticos em "Mimoseae" com uma amostragem significativa de espécies de *Piptadenia* e gêneros relacionados.

Piptadenia s.l. (sendo 12 de *Piptadenia* s.s.), Jobson & Luckow (2007) mostraram que *Piptadenia* (*sensu* Brenan 1955) é um grupo polifilético. A baixa amostragem e a não inclusão de *Adenopodia* limita o alcance das conclusões e reforçou a necessidade de um trabalho intenso de coletas, visando ampliar a amostragem e resolver as relações no grupo *Piptadenia*.

Tendo em vista a problemática na taxonomia do gênero e a existência de táxons a serem descritos (Lewis *et al.* 2005), é evidente a necessidade de sua revisão. Sendo assim, realizamos a revisão do gênero combinando estudos de herbário e de campo e análise de dados moleculares a fim de esclarecer a sistemática e evolução de *Piptadenia* s.s., apresentada aqui.

OBJETIVOS

Diante da carência de estudos filogenéticos, das relações filogenéticas mal resolvidas no clado Mimosoid (LPWG 2017) e no grupo Piptadenia (Jobson & Luckow 2007, Simon et al. 2016), e da falta de uma revisão taxonômica das espécies de *Piptadenia*, esse estudo teve como objetivo:

1) Avaliar o monofiletismo de *Piptadena* Benth.;

2) Elucidar as relações filogenéticas entre as espécies de *Piptadenia* s.s.;

3) Resolver o posicionamento filogenético e a circunscrição taxonômica de *Piptadenia viridiflora*;

4) Revisar a taxonomia das espécies de *Piptadenia* s.s.

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Lista dos herbários consultados e suas respectivas instituições.

(acrônimos de acordo com Thiers 2015; * não em Thiers 2015).

ALCB – Universidade Federal da Bahia, Salvador, BA, Brasil;

B – Botanischer Garten und Botanisches Museum, Berlin-Dahlen, Alemanha;

BHCB – Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brasil;

BM – British Museum, Natural History Museum, Londres, Inglaterra;

BOTU – Universidade Estadual Paulista, Botucatu, SP, Brasil;

BR – Jardin Botanique National de Belgique, Bruxelas, Bélgica;

CEN – Centro Nacional de Pesquisa de Recursos Genéticos e Biotecnologia, Cenargen/Embrapa,

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CEPEC – Centro de Pesquisas do Cacau, Ceplac, Ilhéus, BA, Brasil;

CESJ – Universidade Federal de Juiz de Fora, Juiz de Fora, MG, Brasil;

CPAP – Centro de Pesquisas Agropecuárias do Pantanal, Embrapa, Corumbá, MS, Brasil;

CVRD – Reserva Florestal Vale do Rio Doce, Linhares, ES, Brasil;

E – Royal Botanic Gardens, Edimburgo, Escócia;

ESA – Escola Superior de Agricultura “Luiz de Queiroz”/USP, Piracicaba, SP, Brasil;

F – The Field Museum of Natural History, Chicago, Estados Unidos da América;

G – Conservatoire et Jardin Botaniques de la Ville de Genève, Genebra, Suíça;

GUA – FEEMA, Rio de Janeiro, RJ, Brasil;

HB – Herbarium Bradeanum, Rio de Janeiro, RJ, Brasil;

HEPH – Jardim Botânico de Brasília, Brasília, DF, Brasil;

HRB – Instituto Brasileiro de Geografia e Estatística/RADAMBRASIL, Salvador, BA, Brasil;

HRCB – Universidade Estadual de São Paulo/UNESP, Rio Claro, SP, Brasil;

HTO – Uiversidade Federal do Tocantins, Palmas, TO, Brasil;

HUEFS – Universidade Estadual de Feira de Santana, Feira de Santana, BA, Brasil;

HUFU – Universidade Federal de Uberlândia, Uberlândia, MG, Brasil;

IAC – Instituto Agronômico de Campinas, Campinas, SP, Brasil;

IAN – Centro de Pesquisa Agropecuária do Trópico Úmido, Embrapa Amazônia Oriental, Belém, PA,Brasil;

IBGE – Reserva Biológica do IBGE, Brasília, DF, Brasil;

INPA – Instituto Nacional de Pesquisa na Amazônia, Manaus, AM, Brasil;

IPA – Empresa de Pesquisas Agropecuárias, Embrapa, Recife, PE, Brasil;

K – Royal Botanic Garden, Kew, Richmond, Londres, Inglaterra;

M – Botanische Staatssammulung Herbarium, Munique, Alemanha;

MBM – Museu Botânico Municipal de Curitiba, Curitiba, PR, Brasil;

MG – Museu Paraense Emílio Göeldi, Belém, PA, Brasil;

MO – Missouri Botanical Garden, Saint-Louis, Estados Unidos da América;

NY – The New York Botanical Garden, Nova Iorque, Estados Unidos da América;

OUPR – Universidade Federal de Ouro Preto, Ouro Preto, MG, Brasil;

OXF – University of Oxford, Oxford, Inglaterra;

P – Museum d’Histoire Naturelle, Paris, França;

R – Museu Nacional, Rio de Janeiro, RJ, Brasil;

RB – Jardim Botânico do Rio de Janeiro, Rio de Janeiro, RJ, Brasil;

RFA – Universidade Federal do Rio de Janeiro, Rio de Janeiro, RJ, Brasil;

SP – Instituto de Botânica, São Paulo, SP, Brasil;

SPF – Universidade de São Paulo, São Paulo, SP, Brasil;

SPSF – Instituto Florestal de São Paulo, São Paulo, SP, Brasil;

U – Nationaal Herbarium Nederland, Utrecht, Holanda;

UB – Universidade Federal de Brasília, Brasília, DF, Brasil;

US – Smithsonian Institution, Washington D.C., Estados Unidos da América;

UEC – Universidade Estadual de Campinas, Campinas, SP, Brasil;

UFG – Uiversidade Federal de Goiás, Goiânia, GO, Brasil;

CGMS – Universidade Federal do Mato Grosso do Sul, Campo Grande, MS, Brasil;

VIC – Universidade Federal de Viçosa, Viçosa, MG, Brasil;

W – Naturhistorisches Museum Wien, Viena, Áustria;

WU – Universität Wien, Viena, Áustria.

CAPÍTULO 1

Lachesiodendron, a new monospecific genus segregated from *Piptadenia* (Leguminosae, Caesalpinioideae, Mimosoid clade): evidence from morphology and molecules

Artigo submetido à revista ***Taxon***

***Lachesiodendron*, a new monospecific genus segregated from *Piptadenia* (Leguminosae, Caesalpinioideae, Mimosoid clade): evidence from morphology and molecules**

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Abstract—The widest historical circumscription of the mimosoid legume genus *Piptadenia* (Caesalpinioideae: mimosoid clade) has once embraced morphologically disparate species that are currently ascribed to nine different genera. Previous molecular phylogenetic studies have tentatively shown that the neotropical dry forest *Piptadenia viridiflora* is not closely related to *Piptadenia* s.s. Here we expanded species sampling to build a more comprehensive phylogeny of the Piptadenia group and revised morphological evidence to define the phylogenetic relationship of *P. viridiflora*. Both morphology and molecular data confirm that *P. viridiflora* is an isolated lineage, thus warranting the description of the new monospecific genus *Lachesiodendron*. The new genus is diagnosed by the combination of nodal paired spines which have a stipular origin (*vs.* stipules not modified into spines in *Piptadenia* s.s.), prickles absent (*vs.* present), flowers in axillary spikes not grouped in compound inflorescences (*vs.* spikes grouped in compound pseudoracemes), flowers with a cylindrical corolla long exserted from the calyx (*vs.* corolla campanulate with petals free or slightly joined at the base), and long green stamens (*vs.* shorter and white or light-yellow stamens). In addition, *Lachesiodendron* has 8-celled polyads with a circumvolute exine, which further contrasts the new genus from the 12-celled polyads with a psilate exine in *Piptadenia* s.s.

***Keywords*—**Fabaceae; polen; phylogeny; taxonomy

INTRODUCTION

The systematics of mimosoid legume genera (Mimosoid clade, Caesalpinioideae; LPWG, 2017) is historically among the most challenging within the economically and ecologically important family Leguminosae. While traditional taxonomic circumscriptions within the mimosoids have been intrinsically problematic, advances in molecular phylogenetic studies have unveiled an apparently even more difficult scenario with the widespread non-monophyletic nature of traditionally-defined genera (Luckow & al., 2003; LPWG, 2013). This complex taxonomic history of the mimosoids probably resulted from the emphasis on morphological characters that are currently demonstrated to be highly homoplastic, as seen, for example, in the characters defining the genera *Acacia* Mill. (Lewis & al., 2005), *Pithecellobium* Mart., *Albizia* Durazz. (Barneby & Grimes, 1996), *Stryphnodendron* Mart. (Simon & al., 2016), *Calliandra* Benth. (Souza & al., 2013), as well as the neotropical genus *Piptadenia* Benth. (Jobson & Luckow, 2007) that is the focus of the current study.

Piptadenia was first described by Bentham (1840) so as to include species of tribe Piptadenieae with caducous anther glands and multi-seeded, dehiscent pods. Such a wide circumscription of *Piptadenia*, however, embraced a broad morphological variation in plant armament (either unarmed or presenting prickles or spines), inflorescence type (spikes or globose heads), fruit dehiscence (through both sutures or only by the ventral one) and marginal constriction (straight, regularly or irregularly constricted), seed margin (winged or not winged), and endosperm. Bentham (1840) divided the genus into three sections: sect. *Eupiptadenia* (17 species) and sect. *Pityrocarpa* (4), both with flowers grouped in spikes, and sect. *Niopa* (4) with globose heads.

Given such wide morphological variation, it is not surprising that the ever-increasing evidence from molecular phylogenetic analyses have now dismembered

Piptadenia in nine minor, yet mainly morphologically-coherent genera (Luckow, 2005; Jobson & Luckow, 2007): *Anadenanthera* Speg., *Indopiptadenia* Brenan, *Microlobius* C. Presl, *Newtonia* Baill., *Parapiptadenia* Brenan, *Piptadeniastrum* Brenan, *Pityrocarpa* (Benth.) Britton & Rose, *Pseudopiptadenia* Rauschert, and *Piptadenia*. These genera, together with *Adenopodia* C. Presl, *Mimosa* L., *Parkia* R.Br., and *Stryphnodendron* Mart. comprise the informal Piptadenia group of the tribe Mimoseae (Lewis & al., 2005), with the exception of Old World *Indopiptadenia*, *Newtonia* (Newtonia group) and *Piptadeniastrum* (Piptadeniastrum group).

The most densely-sampled molecular phylogenies so far with focus on the Piptadenia group (Jobson & Luckow, 2007; Simon & al., 2016) demonstrated the polyphyly of *Piptadenia* (*sensu* Luckow, 2005) by showing its species grouping into three independent clades. One of these clades was circumscribed as the re-established genus *Pityrocarpa* that lacks either prickles or spines and has fruits dehiscing along just one suture (Jobson & Luckow, 2007), narrowing the concept of *Piptadenia* (hereafter *Piptadenia* s.s.) to species that are armed with prickles or spines of stipular origin and have fruits dehiscing down both sutures.

Even after the removal of *Pityrocarpa*, the monophyly of the remaining *Piptadenia* species was considered doubtful because of the inclusion of *P. viridiflora* (Kunth) Benth., a species distantly related to the remaining species of *Piptadenia* s.s. The phylogenetic analyses of plastid data (*trnL* intron and *matK/trnK*) supported *P. viridiflora* as sister to *Anadenanthera* (Luckow & al., 2003) or left it as unresolved regarding other genera of the Piptadenia group (Jobson & Luckow, 2007). More recently, combined analyses of plastid (*matK/trnK*, *trnD-trnT*, *trnL-trnF*) and nuclear (nr-ITS) data resolved *P. viridiflora* as sister to a larger clade that brings together species of *Microlobius*, *Parapiptadenia*, *Pityrocarpa*, *Pseudopiptadenia*, and *Stryphnodendron* (Simon & al., 2016). The phylogenetic placement and generic identity of *P. viridiflora* thus deserve a further look in the light of a comprehensively-sampled phylogenetic framework. Furthermore, by exploring the morphological evolution in such a heterogenous collection of mimosoid genera will allow us to firmly place *P. viridiflora*, an ecologically important species in the neotropical seasonally dry forest and woodland (STDFW) biome (Pennington & al., 2009; Queiroz, 2009; Oliveira-Filho & al., 2013; DRYFLOR, 2016).

In addition to traditional macromorphological characters used to delimit taxa in the tribe Mimoseae (Lewis & Elias, 1981), pollen morphology also has proven to be useful in clarifying taxonomic boundaries. Pollen in species of the Piptadenia group are grouped in polyads (Guinet, 1981) that show a great variation in number of pollen grains per polyad, polyad shape, pollen wall surface, and aperture type (Guinet, 1969, 1981, 1990; Guinet & Caccavari, 1992; Sorsa, 1969; Caccavari, 2002). Palynological characters in the Piptadenia group show strong correlation with phylogeny (Simon & al., 2011) but limited sampling precludes its potential use to track obscure relationships or only-molecularly-defined clades within the tribe.

In this work, we tested the hypothesis, derived from previous phylogenetic studies, that *Piptadenia viridiflora* has an isolated position in the Piptadenia group and thus deserves status as a distinct genus. We carried out densely-sampled phylogenetic analyses of DNA sequences, filling-in the gaps of species sampling presented by Simon & al. (2016). Additionally, we explored the evolution of key macromorphological and palynological traits in the search for support of a new taxonomic position for *P. viridiflora*.

MATERIALS AND METHODS

Taxon Sampling and molecular data. — We use a multilocus phylogenetic approach to investigate the generic relationships within the Piptadenia group and the relationships of

Piptadenia viridiflora. Most of our data came from a large sampling of sequences from our previous work on the genus *Stryphnodendron* (Simon & al., 2016). Here we expanded the taxon sampling by including 23 new sequences of nuclear ITS (nrITS/5.8S) as well as plastid data from 11 sequences of *matK/trnK*, nine *trnL-trnF* intergenic spacer (including the *trnL*-intron), and 20 of the *trnD-trnT* spacer. In total, our sampling included 73 accessions of 50 species of the Piptadenia group and three outgroups. Of these, 21 accessions are from *Piptadenia* s.s., including nine different accessions that represent the geographic range and morphological diversity of *P. viridiflora* (see Appendix). Eleven genera of the Piptadenia group were sampled, with only the genus *Adenopodia* not included. Outgroups were selected from species of tribes Ingeae, Mimoseae, and Acacieae as guided by previous phylogenetic works (Hughes & al., 2003; Luckow & al., 2003; Jobson & Luckow, 2007; Kyalangalilwa & al., 2013; Simon & al., 2011, 2016; LPWG, 2017). Voucher information and GenBank accession numbers are provided in Appendix.

DNA Extraction, amplification and sequencing. — Total genomic DNA was extracted from silica gel-dried leaves using the 2× CTAB (cetyl trimethylammonium bromide) protocol of Doyle & Doyle (1987). For herbarium samples, DNA was extracted using the DNeasy Plant Mini Kits (Qiagen, Santa Clarita, California) and a better DNA quality was achieved using the sorbitol cleansing protocol (Souza & al., 2012).

Four DNA regions were selected for this study: *trnK*/*matK* (the *matK* gene and partial flanking *trnK* introns), *trnL-trnF* and *trnD-trnT* spacer from the plastid genome and the nuclear ribosomal Internal Transcribed Spacers (ITS1 and ITS2) and the intervening 5.8S region (nrITS/5.8S). Amplification of the *matK*/*trnK* locus was performed in two reactions with the set of primers *trnK*685F/1159R and *matK*1100L/*trnK*2R or in three reactions using the primers *trnK*685F/*matK*4LR, *matK*4La/*matK*1932R and *matK*1100L/*trnK*2R* (Hu & al., 2000; Wojciechowski & al., 2004). The amplification of the *trnD-trnT* region (Shaw & al., 2005) used primers *trnD*2, *trnE, trnT*, and *trnY* as described in Simon & al. (2011) or the internal primers *trnDti* and *trnDtiR* (Pennington, RBG–Edinburgh, unpublished data) in combination with the external primers *trnT* and *trnD*, respectively. The *trnL-trnF* region (including the *trnL* intron and the *trnL-trnF* intergenic spacer) was amplified in two reactions, using a combination of the universal primers “c” and “d”, and “e” and “f” (Taberlet & al., 1991), respectively. For the nrITS/5.8S region we used the ITS5p and ITS8p (Möller & Cronk, 1997), ITS1 and ITS4 (White & al., 1990) or 17SE and 26SE (Sun & al., 1994) primers.

Polymerase Chain Reactions (PCR) were performed using the TopTaq Master Mix Kit (QIAGEN GmbH, Hilden, Germany) according to the manufacturer’s protocol, with a final volume of 10-15 μL. For herbarium samples, PCR reactions also included 2 μL of TBT-PAR [trealose, bovine serum albumin (BSA), polysorbate-20 (Tween-20)] (Samarakoon & al., 2013). For the nrITS/5.8S amplification, DMSO (dimethyl sulfoxide; 2% of the preparation volume) and 1 M betaine were added in order to avoid secondary conformation. The amplification program used an initial denaturation at 94°C for 5 min., followed by 30–35 cycles of denaturation at 94°C for 1 min., annealing at 54-56°C (nrITS/5.8S) or 48-55°C (plastid loci) for 1 min., and elongation at 72°C for 2 min. and a final elongation step at 72°C for 5 min.

PCR products were purified using the QIAquick kit (Qiagen, Hilden, Germany), by enzymatic treatments with Exonuclease I and alkaline shrimp phosphatase (kit ExoSapIT, GE Healthcare, Buckinghamshire, UK) or using PEG 11% (Paithankar & Prasad, 1991). Sequencing reactions in both directions were performed with the same primers used for amplifications and the Big Dye Terminator kit version 3.1 (Applied Biosystems, Austin, Texas, USA). The products of sequencing were analysed in a sequencer 3130 XL Genetic

Analyzer (Applied Biosystems) at the Laboratório de Sistemática Molecular de Plantas (LAMOL) of the Universidade Estadual de Feira de Santana, Bahia, Brazil or at the Laboratório de Genética Vegetal (LGV/Cenargen - EMBRAPA), Brasília, Brazil.

Alignment and phylogenetic analyses. — Complementary strands were combined and base-calling verified with the Staden package (Staden & al., 2003). To avoid inconsistencies derived from automated multiple alignment, we have performed all alignments manually in SeaView version 4 (Gouy & al., 2010), using the similarity criterion of Kelchner (2000). The relatively high number of indels in the *matK* matrix was aligned by looking for homologies among amino acid translated sequences (Wojciechowski & al., 2004).

Putative incongruities between plastid and nuclear DNA markers were assessed by comparing clade parsimony bootstrap supports to identify clade conflict between the DNA partitions (Wiens, 1998). We did not find evidence of strong conflict between the individual data partitions (i.e., incongruent clades with bootstrap supports >80%) and thus they were assembled for nuclear (nrITS/5.8S; 61 taxa, 744 characters), plastid (*matk/trnK*, *trnD-trnT*, *trnL-F*; 73 taxa, 4609 characters), and combined (nuclear + plastid; 73 taxa, 5353 characters) datasets. We have avoided the parsimony-based partition homogeneity test (incongruence length difference test; Farris & al., 1994), because it has been proven to produce misleading results (Dolphin & al., 2000; Yoder & al., 2001; Barker & Lutzoni, 2002).

Maximum Parsimony (MP) analyses were carried out in PAUP* v.4.0b10 for Windows (Swofford, 2002) using Fitch parsimony (all characters unordered and equally weighted; Fitch, 1971). The search for the most parsimonious trees (MPTs) was carried out using a heuristic search, 1000 random taxon-addition, and tree bisection-reconnection (TBR) branch swapping, saving 15 trees per replicate. Trees saved in this first round were used as starting trees in a second search using the same parameters, but saving a maximum of 10,000 trees. Clade support was estimated with non-parametric bootstrapping (Felsenstein, 1985) with 2000 pseudoreplications, simple taxon-addition and TBR branch swapping, saving 15 trees per pseudoreplicate.

Maximum likelihood (ML) analyses were carried out using RAxML v.8 (Stamatakis, 2014) using GTRCAT evolutionary model and estimating gamma distribution and invariant sites during the run. Clade supports were assessed using 1000 rapid bootstrap replicates.

Bayesian analyses were carried out using MrBayes v.3.2.6 (Ronquist & Huelsenbeck, 2003, Ronquist & al., 2012) with uniform priors and a random starting tree. Best-fit substitution models were selected for each dataset using the Akaike information criterion implemented using MrModeltest v.2.3 (Nylander, 2004). GTR + Γ was selected for the *trnL-F* and *matK/trnK* partitions, GTR + I + Γ for *trnD-trnT*, ITS1 and ITS2, and K80 + Γ for the 5.8S region. Two separate runs of a Metropolis-coupled Markov Chain Monte Carlo (MCMC) permutation of parameters were each initiated with a random tree and eight simultaneous chains set at default temperatures (Ronquist & Huelsenbeck, 2003). Two simultaneous Monte Carlo Markov Chains (MCMC) were run for 10^7 generations sampling one tree each 10^3 generations. Convergence of runs was tested by inspecting whether the standard deviation of split frequencies of the runs was <0.01 and by using the effective sample sizes (ESS) >200 as calculated with Tracer v.1.5 (Rambaut & Drummond, 2007). We then used the MrBayes command “sumt” to summarize trees sampled from post burn-in generations into a 50% majority rule consensus tree that included posterior probabilities (PP) as branch support estimates.

Bayesian and ML analyses were run in the Cyber infrastructure for Phylogenetic Research (Cipres Science Gateway, Miller & al., 2010). MP strict consensus trees, ML trees and Bayesian 50% majority-rule consensus trees were visualized and partially edited in FigTree v. 1.4 (Rambaut, 2012).

Ancestral Reconstruction Analysis for Selected Morphological Characters. — Macromorphological characters were scored from herbarium specimens (ALCB, ANDES, ASE, BHCB, BOG, CEN, CEPEC, CGMS, COAH, COL, CVRD, CUZ, EAC, EBDA, F, FLOR, G, HAF, HAS, HST, HUCS, HUEFS, IAN, IBGE, ICN, ILL, INPA, IPA, JPB, K, LE, M, MAC, MBM, MBML, MG, MO, MOL, MUFAL, NY, OUPR, P, PACA, PEUFR, QAP, QCEN, R, RB, SLS, SMF, SP, SPF, TEPB, UB, UEC, UCE, UDBC, UFG, UFMA, UFMS, UFMT, UFRN, UFRP, US, USM, VIES; acronyms according to Thiers, 2015, continuously updated).

Pollen morphology data were gathered from literature (Table 1) and complemented with new data for *Piptadenia* s.s. [*P. adiantoides* (Spreng.) Macbr., *P. stipulacea* (Benth.) Ducke and *P. viridiflora* (Kunth.) Benth.], *Pseudopiptadenia* [*Ps. bahiana* G.P.Lewis & M.P.Lima, *Ps. brenanii* G.P.Lewis & M.P.Lima and *Ps. contorta* (DC.) G.P. Lewis & M.P. Lima], *Parapiptadenia* [*Pa. blanchetii* (Benth.) Vaz & M.P.Lima and *Pa. zehntnerii* (Harms) M.P.Lima & H.C.Lima], and *Pityrocarpa* [*Pt. moniliformis* (Benth.) Luckow & R.W.Jobson and *Pt. obliqua* subsp. *brasiliensis* (G.P.Lewis) Luckow & R.W.Jobson]. Polyads were gathered from dried specimens from the HUEFS herbarium (Table 1), were acetolysed following Erdtman (1960), and mounted in glycerine jelly. Photomicrographs (LM) were obtained with an Olympus BX 40F-3 microscope. Scanning Electromicrographs (SEM) were obtained from a LEO 1430 VP - Carl Zeiss Scanning Microscope. The morphological terminology for pollen followed Punt & al. (2007; http:/www.bio.uu.nl/palaeo/glossary/glos-lit.htm)

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Table 1. Ornamentation of exine and dispersion units comparison between *Lachesiodendron* and the phylogenetically closely related genera *Anadenanthera, Parapiptadenia, Piptadenia, Pityrocarpa and Pseudopiptadenia* of Piptadenia group.

Taxon	Dispersion unit/ distribution standard	Ornamentation	Voucher
Anadenanthera colubrina	Polyad (16 pollen grains)/ 8+8	Areolate	Lacerda, A. V. & Barbosa, F. M. 262 (HUEFS) Lacerda, A. V. & Barbosa, F. M. 268 (HUEFS) Melo, E.; França, F.; Gonçalves, J. M. 3744 (HUEFS) Melo, E. 6563 (HUEFS) Queiroz, L. P. de *et al.* 7194 (HUEFS) Ricardo, A. s.n. (HUEFS 35629)
Anadenanthera peregrina	Polyad (16 pollen grains)/ 8+8	Areolate	Colchester, M. E. M. & Lister, J. R. A. 2374 (HUEFS) Kinupp, V. F. 25794 (HUEFS) Pifano, D. S. & Pivari, M. O. D. 149 (HUEFS)
Parapiptadenia blanchetii	Polyad (16 pollen grains)/ nd*	Psilate	Grupo Pedra do Cavalo 1096 (HUEFS) Lemos, M. J. S. 56 (HUEFS) Melo, E.; França, F.; Correia, C. 1410 (HUEFS)
Parapiptadenia zehntneri	Polyad (16 pollen grains)/ nd*	Psilate	Bandeira, F. P. 82 (HUEFS) Conceição, A. A. *et al.* 2536 (HUEFS) Guedes, M. L. *et al.* 16085 (HUEFS)
Piptadenia adiantoides	Polyad (12 pollen grains)/ 6+6	Psilate	Lopes, M. M. M. & Gomes, L. C. J. 792 (HUEFS) Oliveira, R. P. *et al.* 599 (HUEFS) Pirani, J. R. *et al.* 5029 (HUEFS)
Piptadenia irwinii	Polyad (12 pollen grains)/ 6+6	Psilate	Jardim, J. G. *et al.* 3303 (HUEFS) Queiroz, L. P. de *et al.* 12652 (HUEFS) Queiroz, L. P. de *et al.* 12887 (HUEFS)

Taxon	Dispersion unit/ distribution standard	Ornamentation	Voucher
Piptadenia stipulacea	Polyad (16 pollen grains)/ 3+6+3	Areolate	Conceição, A. S. *et al.* 1168 (HUEFS) Fotius, G. 3988 (HUEFS) Melo, E. *et al.* 4711 (HUEFS)
Piptadenia viridiflora	Polyad (8 pollen grains)/ 4+4	circumvolute	Carvalho, A. M. de *et al.* 3953 (HUEFS) Queiroz, L. P. de *et al.* 7828 (HUEFS) Salino, A. & Stehmann, J. R. 3306 (HUEFS)
Pityrocarpa moniliformis	Polyad (8 pollen grains)/ 6+2	Psilate	Eiten, G. *et al.* 10840 (HUEFS) Ferreira, M. H. S. 17 (HUEFS) Melo, E.; França, F.; Silva, B. M. 7518 (HUEFS)
Pityrocarpa obliqua subsp. *Brasiliensis*	Polyad (16 pollen grains)/ nd*	Areolate	Carneiro-Torres, D. S. *et al.* 310 (HUEFS) Queiroz, L. P. de *et al.* 12903 (HUEFS) Silva-Castro, M. M. *et al.* 901 (HUEFS)
Pseudopiptadenia bahiana	Polyad (16 pollen grains)/ nd*	Psilate	Queiroz, L. P. de 9574 (HUEFS) Queiroz, L. P. de *et al.* 9970 (HUEFS) Queiroz, L. P. de *et al.* 9989 (HUEFS)
Pseudopiptadenia brenanii	Polyad (16 pollen grains)/ nd*	Psilate	Cardoso, D. & Conceição, A. A. 581 (HUEFS) Guedes, M. L. S. *et al.* 16722 (HUEFS); Neves, S. P. S. 263 (HUEFS).
Pseudopiptadenia contorta	Polyad (16 pollen grains)/ nd*	Psilate	Hatschbach, G. *et al.* 35398 (HUEFS) Queiroz, L. P. de & Nascimento, N. S. 4234 (HUEFS) Queiroz, L. P. de & Nascimento, N. S. 3700 (HUEFS)

nd*- not detected distribution standard

A total of 11 macromorphological and one pollen characters was assembled in a data matrix with Mesquite version 3.03 (Maddison & Maddison, 2015). All characters were optimized on a set of 1000 trees sampled from stationarity and their distribution examined on the 50% majority-rule consensus tree from the Bayesian analysis of the combined dataset with the unordered parsimony method implemented in Mesquite (Maddison & Maddison, 2015; Fig. S1).

RESULTS

Phylogenetic relationships. — The charateristics and results from maximum parsimony (MP), maximum likelihood (ML) and Bayesian analyses for the nuclear, plastid and combined datasets are presented in Table 2. The phylogenetic trees of individual nuclear and plastid sequences were poorly resolved and had mostly low support values (Figs. S2-S3). We thus present and discuss the results from the analyses of the combined dataset only (Fig. 1).

The monophyly of *Piptadenia* s.s. is highly supported in all analyses with the exclusion of *P. viridiflora* (PP 1, BS ML 100, BS MP 99; Fig. 1). The multiple accessions of *P. viridiflora* coalesced as monophyletic with high support (PP 1, BS ML 100, BS MP 100) and this *P. viridiflora* clade did not appear as sister to *Piptadenia* s.s. A large clade bringing together the genera *Microlobius*, *Parapiptadenia*, *Pityrocarpa*, *Pseudopiptadenia*, and *Stryphnodendron* (hereafter the MPPPS clade) was supported (PP 1, BS ML 96, BS MP 82) and *Piptadenia viridiflora* was resolved as sister to the MPPPS clade although highly supported only in Bayesian tree (PP 0.97, BS ML 53, BS MP <50). Within the MPPPS clade, the only genus supported as monophyletic is *Parapiptadenia*. *Pityrocarpa* is paraphyletic due to the nested position of *Pseudopiptadenia brenanii* (PP 1,BS ML 99, BS

Table 2. Features of the DNA data sets used in this study based on one of the most parsimonious trees from the combined parsimony analysis, and nucleotide substitution models selected for the Bayesian analyses. (bp = base pairs; CI = consistency index; RI = retention index;

Dataset	N	Length (bp)	Parsimony informative characters	Tree stattistics in MP analyses			
				Most Parsimonious trees	Tree length	CI	RI
ITS/5.8S	61	744	255	474	1543	43	57
matK	72	1882	160	9180	468	81	87
trnL-F	70	1191	129	10000	399	64	85
trnD-T	62	1536	123	845	335	84	90
ITS + *matK* + *trnL-F* + *trnD-T* combined	73	5353	668	5175	2784	58	75
Plastid	73	4609	413	10000	1218	80	87

MP 95) while the remaining accessions of *Pseudopiptadenia* formed a highly monophyletic lineage sister to the genus *Parapiptadenia*.

Pollen morphology. — Pollen data gathered for species of the Piptadenia group (*Anadenanthera* [2 species], *Parapiptadenia* [2], *Piptadenia* [3, including *Piptadenia viridiflora*], *Pityrocarpa* [2], and *Pseudopiptadenia* [3]) showed polyads with different number and type of pollen grains (8, 12 or 16-celled), small or medium size, acalymmate (i.e., in which the sexine of the individual grains do not merge to form a continuous sheath), isodiametrical with elliptical or spherical contour. Individual pollen grains are (3–) 4 (–5)-porate (apertures not seen in *Pityrocarpa obliqua*) with a rather thin (1–2 µm) and areolate or psilate exine in LM, with indistinct sexine and nexine. Eight-celled polyads were found in *Pityrocarpa moniliformis* and *Piptadenia viridiflora*. Polyads of *Piptadenia adiantoides*, *Piptadenia irwinii*, and *Piptadenia stipulacea* are 12-celled and those of *Parapiptadenia blanchetii*, *Parapiptadenia zehntneri*, *Pityrocarpa obliqua*, *Pseudopiptadenia bahiana*, *Pseudopiptadenia brenanii*, and *Pseudopiptadenia contorta* are 16-celled. *Piptadenia viridiflora* has 8-celled, ovoidal polyads arraged in two opposite tetrahedral tetrads (bitetrads) and a particular exine sculpture that appeared circumvolute, appearing as the surface of a human brain (Table 1; Fig. 2 -3).

Character reconstruction – Most characters reinforces the conclusion that *Piptadenia viridiflora* evolved from a lineage not directly related with *Piptadenia* s.s. Characters shared by these taxa were reconstructed as symplesiomorphies as it was the case of fruits dehiscing down both sutures with straight margins (Fig. S1 G–H) and lenticular, unwinged seeds provided with a pleurogram (Fig. S1 I–K). At least one character, the inflorescences arranged in axillary spikes, was reconstructed as a synapomorphy linking *P. viridiflora* and the MPPPS clade (Fig. S1 C). Other diagnostic features of *P. viridiflora* were reconstructed

Fig. 2. Photomicrographs of the polyads of selected species of the Piptadenia group. **A-B,** *Anadenanthera*. **A,** *Anadenanthera colubrina*; **B,** *A. peregrina*. **C-E,** *Parapiptadenia*. **C,** *Parapiptadenia blanchetii;* **D-E,** *P. zehntnerii*. **F-J,** *Piptadenia*. **F-G,** *Piptadenia adiantoides*; **H,** *P. irwinii*; **I,** *P. stipulacea*; **J,** *P. viridiflora*. **K-L,** *Pityrocarpa*. **K**, *Pityrocarpa moniliformis*; **L,** *P. obliqua* subsp. *brasiliensis*. **M-Q,** *Pseudopiptadenia*. **M-N,** *Pseudopiptadenia bahiana*; **O-P,** *Ps. brenanii*; **Q-R,** *P. contorta*. Scale: 10 µm.

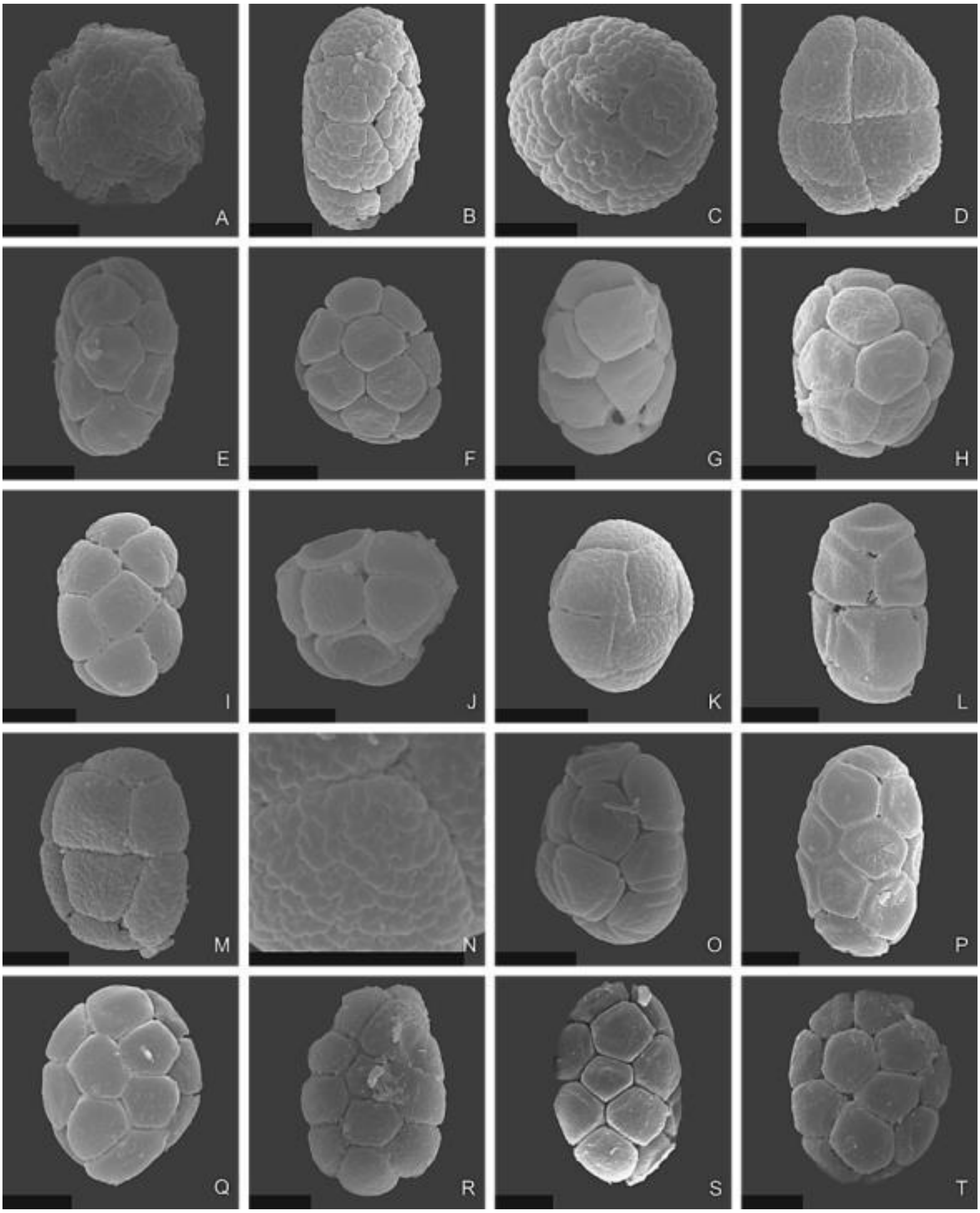

Fig. 3. Scanning Electron Micrographs of selected species of the Piptadenia group**. A-C**, Anadenanthera. **A,** *Anadenanthera colubrina var. cebil;* **B–C,** *A. colubrina var. colubrina*; **D,** *A. peregrina*. **E–H,** *Parapiptadenia*. **E–F,** *Parapiptadenia blanchetii*; **G-H,** *Pa. zehntnerii*. **I-N,** *Piptadenia*. **I-J,** *Piptadenia. irwinii*; **K,** *P. stipulacea*; **L–N,** *P. viridiflora*. **O,** *Pityrocarpa obliqua* subsp. *brasiliensis*. **P-Q,** *Pseudopiptadenia bahiana*. **R,** *P. brenanii*; **S-T,** *Ps. contorta*. Scale: 10 µm.

as homoplasies as it was the case of the stipules modified in nodal paired spines (Fig. S1 B) and the large flowers (> 10mm long) with petals highly fused into a cylindrical corolla (Fig. S1 E–F).

DISCUSSION

Our results agree with previous studies in not supporting the monophyly of the informal Piptadenia group (sensu Lewis & Elias, 1981) and in recovering the big MPPPS clade (Jobson & Luckow, 2007; Simon & al., 2016). The paraphyly of *Pityrocarpa* due to the nested position of *Pseudopiptadenia brenanii* (the Pityrocarpa clade in Fig. 1) was previously reported by Simon & al. (2016). *Pseudopiptadenia* was differentiated from *Piptadenia* s.l. (including *Pityrocarpa*) mostly by seeds flat, winged, and lacking pleurograms (Jobson & Luckow, 2007) but our results demonstrated that these characters are evolutionarily labile (Fig. S1 F–G) and a reappraisal of the limits of these genera should include a comprehensive species sampling in both genera.

Representatives of the remaining genera of the Piptadenia group, namely *Anadenanthera*, *Mimosa*, *Piptadenia* s.s., and *Parkia* (Luckow, 2005), are consistently recovered in a paraphyletic grade subtending the MPPPS clade, but relationships among these genera are not highly supported (Jobson & Luckow, 2007; Simon & al., 2011, 2016). *Anadenanthera* appears more closely related to *Parkia*, as previously reported (Simon & al., 2016; LPWG, 2017) and both genera share inflorescences in mostly globose heads (Lewis & Elias, 1981).

Piptadenia s.s. is not resolved as monophyletic because of the isolated position of *P. viridiflora* (Jobson & Luckow, 2007; Simon & al., 2011, 2016). The remaining species of *Piptadenia* s.s. cluster in a highly supported clade composed of trees or lianas with

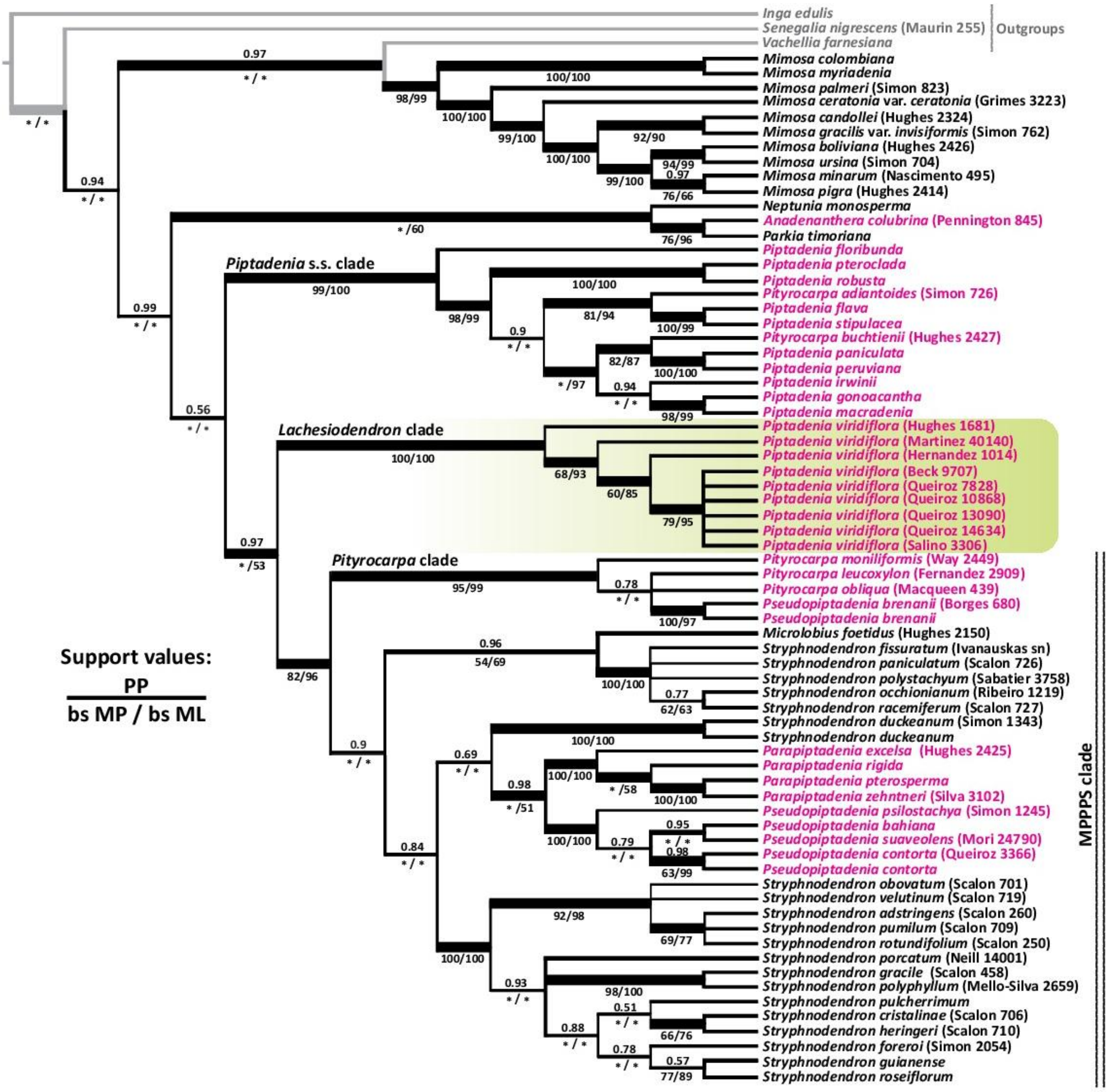

Fig. 1. Majority-rule consensus tree from the Bayesian analysis of the combined nuclear (ITS/5.8S) and plastid (*matK/trnK*, *trnD-trnT*, *trnL-trnF*) datasets of the Piptadenia group. Numbers above branches are posterior probabilities (PP < 0.98) and branches in bold have PP ≥ 0.98. Numbers below branches are bootstrap support (BS) values from the Maximum Parsimony (left) and Maximum Likelihood (right) analyses. Asterisk indicates BS < 50%.

branches armed with epidermal prickles, flowers grouped in elongate spikes and mostly unwinged seeds. We did not sample *P. latifolia* Benth., the type species of the genus (known only by the type material), but it is clearly related with this *Piptadenia* s.s. as indicated by the shared morphological features listed above. Futhermore, the strong morphological ties of *P. latifolia* with *P. adiantoides* (Spreng.) J.F. Macbr. suggest that these two could be conspecific.

Phylogenetic analyses of different molecular datasets had recovered *P. viridiflora*, although with low support, as sister to *Anadenanthera* (Luckow & al., 2003), to a clade comprised of the genera *Anadenanthera*, *Parkia*, and *Vachellia* Wight & Arn. (LPWG, 2017) or unresolved with respect to the other mimosoid legume lineages (Jobson & Luckow, 2007). However the more comphrenesive analyses reported here by sampling several accessions of *P. viridiflora* confirmed the isolated position of *P. viridiflora* as was already reported before using different plastid (*matK/trnK*, *trnL-trnF*, *trnD-trnT*) and nuclear (nrITS/5.8S) markers (Simon & al., 2011, 2016). The relationship of *P. viridiflora* as sister to the MPPPS clade is further morphologically coherent with the shared presence of geminate axillary spikes and the ovary long-stipitate, exserted from the corolla and terminating in a short style. This erratic grouping of *P. viridiflora* could result from unbalanced branch lengths subtending different lineages of the Piptadenia group: most clades are subtended by rather short branches while the *P. viridiflora* clade appears on a much longer stem branch. It is well documented that homoplastic mutations occurring on long branches could result in erroneous clustering irrespective of the phylogenetic method used (Bergsten, 2005; Qu & al., 2017). This variable phylogenetic resolution in mimosoid legumes could be attributed to substitution rate heterogeneity (Dugas & al., 2015; LPWG, 2017) rather than to poor taxon sampling (Hendy & Penny, 1989). The only genus of the Piptadenia group not sampled here was *Adenopodia* but a densely sampled *matK* phylogeny of the Leguminosae included accessions of this genus which appeared as monophyletic in a polytomy together with *Piptadenia* s.s. (excluding *P. viridiflora*) and

Mimosa. Whatever the underlying cause, *P. viridiflora* does not group with any other genus of the Piptadenia group and this phylogenetically isolated position is also supported by quite distinct morphological traits.

Piptadenia viridiflora has a unique combination of morphological characters that is not found in any other genus of the Piptadenia group. The distinctive paired spines derived from modified stipules (Luckow & al., 2003; Jobson & Luckow, 2007) is found only in remotely related genera of mimosoid legumes (e.g. *Prosopis* L., *Mimozyganthus* Burkart, and *Vachellia*; Luckow & al., 2003, 2007). *Piptadenia viridiflora* also has solitary or paired inflorescences in the leaf axils. This condition is commonly found in genera of the MPPPS clade (e.g., *Parapiptadenia*, *Pseudopiptadenia*, *Stryphnodendron*) but it is rarely found in *Piptadenia* s.s., in which the spikes are grouped in paniculate or pseudo-racemose secondary inflorescences. *Piptadenia viridiflora* flowers have a long cylindrical corolla with short lobes, long exserted from the calyx, there is no stemonozone, the ovary is exserted above the petals on a long stipe, and the style is shorter than the ovary (Jobson & Luckow, 2007). Such flower architecture is sharply distinct from the flowers of *Piptadenia* s.s. in which the ovary is rarely exserted above the petals and the style is long, the corolla has rather long lobes and is basally adnate to the filaments, forming a stemonozone (Jobson & Luckow, 2007; Simon & al., 2016).

Besides macromorphological traits, pollen morphology of *Piptadenia viridiflora* is also quite distinct. It presents 8-celled, acalymmate, ovoid polyads, in two opposite tetrahedral tetrads (bitetrads). Eight-celled polyads in the Piptadenia group are recorded in *Pityrocarpa moniliformis*, *Microlobius foetidus* and in species of *Mimosa*. However, the bitetrad arrangement of *P. viridiflora* polyads is observed only in species of *Mimosa* (Lima & al., 2008), quite distinct from *P. moniliformis* and *M. foetidus* that present the pollen grains arranged in six peripheral and two central cells. Additionally, the exine of *P.*

viridiflora has a quite distinct, circumvolute sculpture (appearing like the surface of a brain) that, to date, has not been found in any other taxon of the Piptadenia group.

Therefore, the strongly supported isolated position of *Piptadenia viridiflora* within the Piptadenia group as revealed by the combined molecular data, as well as the aforementioned morphological features, highlight its distinctiveness from any other genera of the mimosoid legumes. Such new evidence has led us to propose the new genus *Lachesiodendron* so as to place *P. viridiflora* within a phylogenetic framework.

TAXONOMY

Lachesiodendron P.G. Ribeiro, L.P. Queiroz & M. Luckow, **gen. nov.**—Type Species: *Lachesiodendron viridiflorum* (Kunth) P.G. Ribeiro, L.P. Queiroz & M. Luckow.

Lachesiodendron differs from the genus *Piptadenia* by the nodal stipules modified into paired spines (*vs.* prickly or rarely unarmed), inflorescences comprising 1–2 (3) axillary spikes, that are not grouped in compound inflorescences (*vs.* spikes grouped in pseudo-racemes or panicles), spikes wider, 20–22 mm diam. (*vs.* narrower, 3–12 mm diam.), corolla cylindrical, light green, long-exserted from the calyx (*vs.* corolla campanulate, slightly longer or 2× the calyx length), pollen in 8-celled polyads arranged in two opposite tetrads (*vs.* 12-celled polyads) and with a circumvolute exine (*vs.* a psilate exine).

Etymology.—The name *Lachesiodendron* derives from *Lachesis*, the generic name of the pit viper snake *Lachesis muta* (Linnaeus, 1766), with which it shares the same Brazilian vernacular name ‘surucucu’, probably because the paired, down-curved spines of *L. viridiflorum* resemble snake fangs.

Lachesiodendron viridiflorum (Kunth) P.G. Ribeiro, L.P. Queiroz & M. Luckow, **comb. nov.** *Acacia viridiflora* Kunth, Mimoses 81–83, pl. 25. 1821. *Piptadenia viridiflora* (Kunth) Benth., J. Bot. (Hooker) 4: 337. 1841. *Pityrocarpa viridiflora* (Kunth) Brenan, Kew Bull. 10: 177. 1955. Type: Peru, Cajamarca, "Crescit in Provincia Bracamorensi, prope San Felipe, alt. 980 hexapodorum", *Humboldt & Bonpland 3559* (holotype: P!; fragment of the holotype: SI!).

Acacia subtilifolia Kunth, Nov. Gen. Sp. (quarto ed.) 6: 268–269. 1823. *Piptadenia subtilifolia* (Kunth) Benth., J. Bot. (Hooker) 4 (31): 337. 1841. Type: Ecuador, "Crescit in ripa fluminis Chotoe, alt. 400 hex. (Regno Novo-Granatensi.)", *Humboldt & Bonpland 3644* (holotype: P!).

Piptadenia biuncifera Benth., J. Bot. (Hooker) 4: 337. 1841. Type: Brazil, Piauí, "Province Piauhy", *Gardner 2558* (lectotype: K-Benth., barcode K000090290!, designated here; isolectotype: K-Hook., barcode K000090289!).

Acacia ampeloclada Rusby, Mem. New York Bot. Gard. 7: 256. 1927. Type: Bolivia, La Paz, Espía. *Rusby 284* (holotype: NY!; isotypes: BKL, GH!, US!).

Piptadenia rubescens Pittier, Arb. Arbust.Venez. 6-8: 84. 1927. Type: Venezuela, Guárico, between Ortiz y El Sombrero, *Pittier 11361* (holotype: VEN; isotypes: GH!, NY!, US!).

Piptadenia speciosa Britton & Killip, Ann. New York Acad. Sci. 35: 155-156. 1936. Type: Colombia, "Barranquilla, Atlantico", *Elias 513* (holotype: US!; isotype: NY!).

Figs. 4–6.

Fig. 4. A-E, *Lachesiodendron viridiflorum*. **A,** branch with leaves and inflorescences and detail of a pair of spines seen from the front; **B,** branch detail with spines; **C,** Petitolar nectary and the nectary of the distal portion of the stalk rachilla; **D,** flower in anthesis plus the gynoecium showing the exserted ovary; **E,** flat legume and seed. (all from *Queiroz et al. 3366*- HUEFS). Drawn by Pétala Gomes Ribeiro.

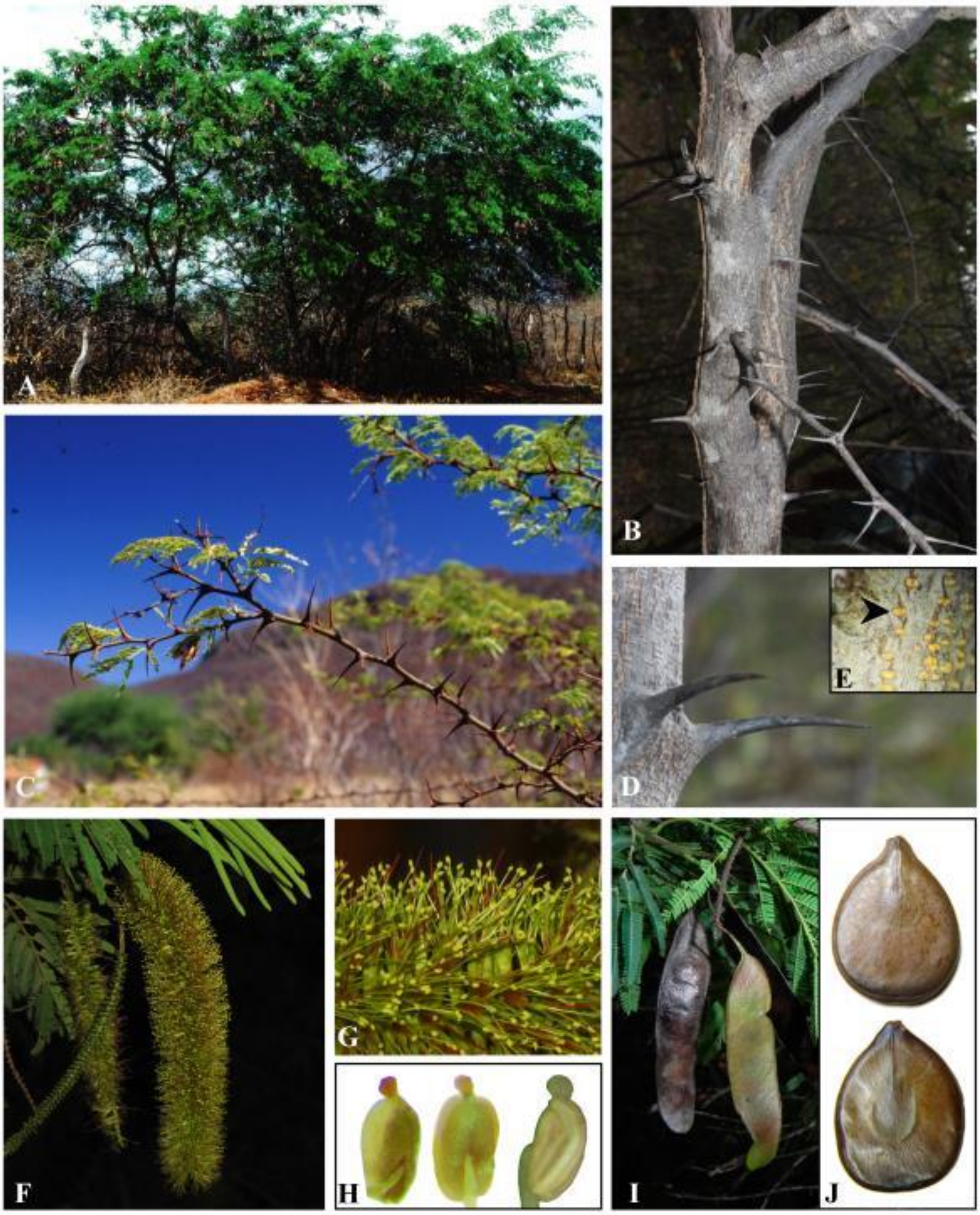

Fig. 5. A-J, General morphology of *Lachesiodendron viridiflorum*. **A,** habit; **B-D,** trunk and branch showing the nodal spines; **E,** close-up of branch surface showing lenticels; **F,** spicate inflorescence; **G,** close-up of flowers; **H,** detail of anther showing the gland; **I,** branch with fruits; **J,** seeds in two stages: immature first and mature the second one. Photographs **A-D; F-G** and **I** by Luciano Paganucci de Queiroz. **E**, **H** and **J** by Earl Chagas.

Fig. 6. Geographical distribution of *Lachesiodendron viridiflorum* in the Neotropics. Gray areas present the distribution of the Seasonally Dry Tropical Forests and Woodlands biome.

Tree (2) 3–20 m tall, usually forming multiple trunks from the base, rarely flowering as shrubs c. 1.5 m tall, bark greyish brown, rugose, branches with dark and smooth bark or only obscurely ridged, with numerous white or orange lenticels, puberulent to rarely glabrous, minute glands present near to the nodes. Prickles absent, spines (modified stipules) 3–10×2–4 mm, paired at branch nodes, slightly or, more commonly, strongly recurved, usually persisting on the trunks. Leaves spirally alternate, bipinnate; petiole 1.2–2 cm long, cylindrical, pulvinus 3–4 mm long; leaf rachis 6–11 cm long, slightly grooved, puberulent, interpinnal segments 8–12 mm long; nectary 1.5–2×1 mm, sessile, discoid, at the base of the petiole, additional smaller nectaries at the tip of the leaf rachis between the distal pinnae pair, and on the pinna rachilla between the proximal and distal pairs of leaflets; pinnae in 5–15 pairs per leaf, opposite or sub-opposite, basal pinnae 3.3–4.5 cm long, median pinnae 4–5.5 cm long, distal pinnae 4–5.6 cm long, the pinnae sub-equal in length, pinna rachilla puberulent, segments between leaflets 0.5–2 mm long; paraphyllidia absent; leaflets 20–50 pairs per pinna, 4–7×0.8–1.6 mm, linear, apex obtuse, base asymmetrical, oblique, sparsely pubescent on both surfaces, margins slightly ciliate, not revolute, midvein nearly centric, raised, secondary venation inconspicuous. Inflorescence a dense, 200–300-flowered cylindrical spike, solitary or 2–3-fasciculate pendent spikes in the leaf axils, 7.5–12 cm long, 2–2.2 cm wide (including the stamens), peduncle 8–21 mm long, densely puberulent, lacking involucrate bracts; floral bracts (at flower attachment) 0.5–1×0.3 mm, linear, spatulate, apex acute or rounded, carinate, persistent, pubescent; flower buds ellipsoid. Flowers 1–1.3 cm long (including the stamens), sessile, pentamerous; calyx 0.6–1.2 mm long, campanulate, 5-lobed, lobes 0.1-0.2 mm long, glabrous or sparsely pubescent; corolla 5–5.5 mm long, 5-lobed, , tube 3.6–4 mm long, lobes 1.1–1.6 mm long, erect, glabrous, cilyndrical; stamens 10, 10–12 mm long, yellowish green, free to the base, long-exserted from the corolla, anthers 0.26–0.32×0.12–0.18 mm long, versatile, with short-stipitate glands present and an enlarged connective; polyads elliptical, 8-celled, arranged in two opposite tetrads, acalymmate, exine circumvolute; ovary 0.8–1.3×0.25–0.5 mm, 8–12-ovulate, glabrous, exserted from the corolla by a 5–8 mm long stipe, style 3–3.2 mm long, stigma porate; stemozone absent. Fruit 8.2–13×1.9–3.2 cm (the stipe 12–20 mm long), straight, flattened, oblong-linear, apex mostly rounded, rarely acute, terminating in a 2–3 mm long beak, margins straight, not constricted between the seeds, dehiscent along both sutures, coriaceous, brownish tan coloured, smooth, coriaceous, transversely striate, glabrous, eglandular. Seeds 8–10×5.4–8 mm, uniseriate, oval to obovate, flattened; testa light brown, margin not winged, pleurogram present, U-shaped; endosperm absent.

Distribution and habitat. – Lachesiodendron viridiflorum is a tree typical of the neotropical seasonally dry forests and woodlands biome (SDTFW). It occurs disjunctly distributed in major SDTFW nuclei, including northeastern Brazilian Caatinga, northern Paraguay and the adjacent Brazilian Mato Grosso do Sul state, the Bolivian Chiquitano region, the Piedmont region in northwestern Argentina (Salta) and southern Bolivia, northwestern Peru (Piura and Cajamarca) and western Ecuador, the Caribbean coast of Colombia and Venezuela, southern Mexico (Campeche and Chiapas), and adjacent northern Nicaragua (Fig. 6). It is a common element of dry vegetation, mostly below 700m high but it can reach almost 2500m altitude in the Andean dry valleys of Bolivia and Argentina.

Phenology – South American populations of *L. viridiflorum* mostly found in flower from June to December and in fruits all over the year, although mostly from July to March. Mexican and Guatemalan specimens are found in flower from February to April and in fruit from October to April.

Vernacular names. – The commonest name in Brazil is surucucu but other local names are espinheiro, espinheiro-de-carcará, inhadê, jacurutu, jacaratu, jiquiri, jiquirizeiro, jucuri, juquiri, sumcuçu, pau-galheiro, zeanapé (Brazil), tepeguaje (Mexico), cari, cari-cari, khari (Bolivia), rabo-de-iguana (Colombia), espino-verde, yax-txix (Guatemala) and tiamo-güire (Venezuela).

Conservation. – According to IUCN criteria (IUCN, 2001) and the extent of occurrence and area of occupancy of the species as estimated using the GeoCAT software (Bachman & al., 2011), *L. viridiflorum* should be considered of Least Concern.

Taxonomy. – *Lachesiodendron viridiflorum* (and the genus *Lachesiodendron*) is easily recognized within its gographical range by the combination of paired down-curved nodal spines, flower spikes isolated or 2–3-fasciculate in leaf axils, flowers relatively large, 1–1.3 mm long, a cylindrical corolla that is long-exserted from the calyx and has short erect lobes, a long-stipitate ovary exserted from the corolla, and oblong pods with coriaceous and smooth valves. This set of characters readily distinguishes *Lachesiodendron* from *Piptadenia*, the genus in which it has been included previously. *Piptadenia* s.s. species have their branches armed with epidermal prickles, but have no modified stipules and, consequently, lack nodal spines; the floral spikes are arranged in paniculate or pseudo-racemose secondary inflorescences, flowers are smaller (1.5–6.2 mm long), the corolla with lobes usually longer than the tube, the ovary short-stipitate, and pods with undulate valves.

Lachesiodendron viridiflorum shares the fasciculate, axillary inflorescences and long-stipitate ovary with *Pityrocarpa*, another genus re-segregated from *Piptadenia* (Jobson & Luckow, 2007), but it readily differs by the nodal spines (*vs.* spines and prickles absent in *Pityrocarpa*) and by the pods with straight margins and coriaceous flat valves (*vs.* pods with their margins constricted between the seeds and with sub-woody and verrucose valves in *Pityrocarpa*).

SELECTED EXAMINED MATERIAL: ARGENTINA: Salta, José de San Martín, 47Km de Piriquenda, 7km de el Chorrito Morrone, *O. Deginani & Aliscioni 4090* (MBM, MO, SI*). BOLIVIA: Santa Cruz, Chiquitos, entre San José y Taperas, en bosque chaqueño, al lado del camino en un lugar poco hondo, *Wood & Soto 23418* (UNB, USZ); La Paz, Loaiza, between Miguillas and the summit of the road leading to La Plazuela, leguminous thorn scrub, *Dorr et al. 6930* (LPB, MO, NY); Depto. Potosí, Prov. José M. Lineares Lizarazu, valle de Dronkhota, *G. Torrico & C. Peca 299* (F, HNB); Depto. Chuqísaca, Prov. Cropeza, Sucre 23kms, Hacia Aiquile, *Beck St. G. 8890* (F, MO, UMSA*); Depto. Tarija, Prov. O'Connor, Entre Ríos 12-20kms, Hacia Villamontes, *Beck St. G. M. Liberman 9707* (MO, UMSA*); Depto. Beni, Prov. Vaca Diez, Tumi chucua a 20-25 km, De Riberalta al SE, Laguna Tumi Chucua, *M. Moraes 196* (HNB*, NY). BRAZIL: Alagoas, Água Branca, Área antropizada, *A. M. Miranda 6702* (EAC, HST, HUEFS); Bahia, Bom Jesus da Lapa, ca. 16 km na estrada de Bom Jesus da Lapa para Ibotirama, *A. M. Carvalho, T. S. Dos Santos, A. M. Amorim, S. C. Sant'ana & J. G. Jardim 3953* (CEPEC*, F, HUEFS, K, MO, NY, SP, NMNH, RB, US); Ceará, Aratuba, Balança, *J. R. Lima 271* (CEPEC, EAC, HUEFS, RB*); Distrito Federal, Brasília, Estrada Ibotirama - Lençóis (BR - 242), km 125, *L. Coradin 8527* (CEN); Mato Grosso, Cáceres, Rodovia MT 343, Estância Capão do Ipê, aproximadamente 12km da cidade de Cáceres na estrada para Porto Estrela, *M. A. Carniello, W. J. A. Cruz, A. O. Alves, R. Villa, G. S. Carvalho & M. F. Moraes 5153* (HPAN); Mato Grosso do Sul, Corumbá, Serra Santa Cruz, Sopé da Serra Santa Cruz, Planalto Residual do Urucum, Borda de Floresta Estacional Decidual, *R. R. Silva & J. S. Velásquez 1143* (CGMS, COR, CPAP, UEC*); Minas Gerais, Januária, Vale do rio Peruaçu, próximo ao Sítio Arqueológico do Caboclo, *A. Salino & J. R. Stehmann 3306* (BHCB*, ESA, HUEFS, NY, SPF); Paraíba, Areia, lugares altos, região de agreste, *J. C. de Moraes Vasconcelos 1158* (IPA*, NY); Pernanbuco, Buíque, Brejo de São José, *M. E. Alencar 2329* (HUEFS, TEPEB*); Piauí, Paulistana, Fazenda Poço de Areia, *D. P. Lima 13288* (IPA, HST*, HUCPE, HUEFS, PEUFR); Rio Grande do Norte, Mossoró, Distrito de Alagoinha, Fazenda Experimental Rafael Fernandes, *M. L. Silva & R. C. Oliveira 58* (MAC, MOSS, UB); Sergipe, Porto da Folha, Assentamento São Judas Tadeu, *B. A. L. Freitas 26* (ASE*, HUEFS). COLOMBIA: Depto. Del Magdalena, Valle del Rio Cesare (parte occidental), Llanuras subserofilicas de sabanaa abierta con "matas de monte" esparcidas, al oeste y sur de Los Venados, *A. Dugant 6298* (COL, HNC*, US); Depto. De Bolívar, entre Cartagena y Turbaco, *A. Dugant & R. Jaramillo 2837* (HNC*, US); Depto del Atlantico, alrededores de Galuçu y Burana, *A. Dugant & R. Jaramillo 3263* (HNC*, US); Depto. de Santander, entre Aratoca y la carretera a Piedecuesta, *C. Saravia, J. Hernández & R. M. Jaramillo 953* (HNC*); Ciénaga, Via Ciénaga a Fundación, km 30 SE, *H. Cuadros & Al. Gentry 3991* (MO*, US). ECUADOR: Regno, nova-granatensi, *H. Humboldt & Bonpland 3664* (N, P*). GUATEMALA: Huehuetenango, Jacaltenango, Village of Nueva Catarina, *J.J. Castillo & A. Castillo 1787* (MO). MEXICO: Chiapas, Mun. Frontera Comalapa En Jaboncillo, 75 km al SE de Comitánm, sobre la carretera a Motozintla Soto, *JC; Con D. Sutton R. Hampshire, R. Lira & A. Reyes 13489* (CAS, K, MBM, MEXU*); La Trinitaria, Along small dirt road to Boqueron and Ejido Mujica, W of Mex Hwy 190 at point 18 km SW of La Trinitaria, *D. E. Breedlove 42326* (NY*); La Concordia, Heavily wooded slope along the Río de la Concordia, W of La Concordia, *Chis, A. S. Ton 2437* (MO, NY*); PARAGUAY: Depto. Pte Hoyis Ruto, trosis choco camisio a Filadelfia, a 10 kms de Filadelfia, *I. Boswaldo & E. Zardissi 1286* (MO, UNA (Asunción). PERU: Flat land adjacent to a small stream crossing the road at this point, Between Bagua Grande and the Rio Marañon bridge, 118 east of Olmos, *P. C. Hutchinson Kenneth J.W 6767* (USM*, UC, MO); Cajamarca, Provincia bracamorensi, *H. Humboldt & Bonpland 3559* (N, P*). VENEZUELA: Edo. Guarico, Altagracia de Orituco-Tamanaco, *L. Aristeguieta 6060* (HNV*, MEL, NY); Capatárida, El Olivo, San José de Coque, Entre kms 400 y 401, Eio. *Falcón L.C. Guevara A. Costero, S. Serafin 2530* (F, MY*); Piar, Isla en el lago de Guri, (Sector Danto Machado), 20km al S de la Presa, *R. Leoni & G. A. Aymard Corredor 7759* (NY, PORT*).

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APPENDIX. Voucher information and GenBank accession numbers for DNA sequences used in this study.

Taxon	Voucher	Locality	ITS (61)	*trnK/matK*	trnD-T	trnL_F
OUTGROUPS						
Inga edulis Mart.	Queiroz 13797 (HUEFS)	Brazil, Bahia	JX870764	-	-	JX87088
	Murphy 352		-	AF523078	-	-
	Pennington 13282		-	-	JQ417383	-
Senegalia nigrescens (Oliv.) P.J.H. Hurter	Maurin 255		JQ265858	GQ872237	-	GQ872282
Vachellia farnesiana (L.) Wight & Arn.	Murphy sn		AF360728	-	-	-
	Entwisle 2708		-	AF523115	-	-
	Meimberg 101		-	-	-	AY574119
Neptunia monosperma F. Muell. ex Benth.	Krosnick 0050		AF458789	-	-	-
	Miller 185		-	EU812005	-	-
	Jackes sn		-	-	-	AF278495
Anadenanthera colubrina (Vell.) Brenan	Pennington 845 (E)	Bolivia	JQ910930	AF521813	INED*	AF278481
Microlobius foetidus (Jacq.) M. Sousa & G. Andrade	Hughes 2150 (FHO)	Mexico	KT364047	KT364172	FJ981976	KT363986
Mimosa boliviana Benth.	Hughes 2426 (FHO)	Bolivia	KT364049	KT364209	FJ982009	KT363987
Mimosa candollei R. Grether	Hughes 2324 (FHO)	Bolivia	KT364050	KT364211	FJ982020	KT363988
Mimosa ceratonia ceratonia	Grimes 3223 (NY)	Puerto Rico	KT364051	KT364208	JF694259	KT363989
Mimosa colombiana Britton & Killip	Torres 21343 (K)	Colombia	KT386295	-	FJ982027	-
	Davidse 15198 (NY)	Colombia	-	DQ790603	-	DQ784646
Mimosa gracilis invisiformis Barneby	Simon 762 (FHO)	Brazil	KT364053	KT364214	FJ982073	KT363990
Mimosa minarum Barneby	Nascimento 495 (HUEFS)	Brazil	KT364057	KT364215	FJ982120	KT363991
	AcevedoRodriguez 7483 (K)	Ecuador	KT364058	-	FJ982127	-

Mimosa myriadenia (Benth.) Benth.	Balsleu 10611 (NY)	Ecuador	-	DQ790605	-	DQ784648
	Simon 823 (MEXU)	Mexico	KT364059	KT364212	FJ982142	KT363993
Mimosa palmeri Rose	Hughes 2414 (FHO)	Bolivia	KT364060	KT364213	FJ982148	KT363994
Mimosa pigra L.	Simon 704 (FHO)	Brazil	KT364061	KT364210	FJ982217	KT363995
Mimosa ursina Mart.	Hughes 2425 (FHO)	Bolivia	KT364062	KT364160	FJ982235	KT363996
Parapiptadenia excelsa (Griseb.)Burkart	Ribeiro 902 (HUEFS)	Brazil	INED	-	INED	-
Parapiptadenia pterosperma (Benth.) Brenan	Tameirao 2458 (NY)	Brazil	-	DQ790608	-	DQ784651
	Marestoni 26	**	INED	-	-	-
Parapiptadenia rigida (Benth.) Brenan	Silva 1890 (NY)	Brazil	-	DQ790609	-	DQ784652
	Silva 3102 (CEN)	Brazil	KT364063	KT364161	KT364108	KT363997
Parapiptadenia zehntneri (Harms) M.P.Lima & H.C.Lima	Murphy 265		AF360729	-	-	AF195701
Parkia timoriana (DC.) Merr.	Ariati 47		-	AF523091	-	-
	Simon 726 (FHO)	Brazil	KT364064	KT364158	FJ982236	KT363998
Piptadenia adiantoides (Spreng.) Macbr.	Hughes 2427 (FHO)	Bolivia	-	DQ790614	FJ982237	KT386299
Piptadenia buchtienii	Elorsa 3697	**	INED	-	INED	-
Piptadenia flava (Spreng. ex DC.) Benth.	Salas 2415 (NY)	Mexico	-	DQ790617	-	DQ784660
	Mori 20836 (NY)	French Guiana	INED	DQ790619	INED	DQ784662
Piptadenia floribunda Kleinhoonte	Simon 735 (FHO)	Bolivia	KT364065	-	FJ982238	KT363999
Piptadenia gonoacantha (Mart.) J.F. Macbr.	Nee 36338 (NY)	Bolivia	-	DQ790620	-	-
	Queiroz 12887 (HUEFS)	**	INED	-	INED	-
Piptadenia irwinii G.P. Lewis	Queiroz 3500 (NY)	Brazil	-	DQ790621	-	DQ784664
	Simon 2252 (CEN)	Brazil	INED	-	INED	-
Piptadenia macradenia Benth.	Nee 48772(NY)	Bolivia	-	DQ790623	-	DQ784666
	Thomas 11101 (NY)	Brazil	-	DQ790626		DQ784669
Piptadenia paniculata	Queiroz 15328 (HUEFS)	**	-	-	INED	-

Piptadenia peruviana (J.F. Macbr.) Barneby	Nee 48865	**	INED	-	INED	-
	Nee 38898 (NY)	Bolivia	-	DQ790627	-	DQ784670
Piptadenia pteroclada Benth.	Neill 7201	**	INED	-	INED	-
	Prance 24672 (NY)	Peru	-	DQ790629	-	DQ784672
Piptadenia robusta Pittier	Nee 55004		INED	-	-	-
	Arroyo 850 (NY)	Bolivia	-	DQ790632	-	DQ784674
Piptadenia stipulacea (Benth.) Ducke	Nee 48894		-	-	INED	-
	Simon 702		KT386296	-	-	-
	Harley 18962		-	DQ790635	-	-
	Ribeiro 60		-	-	INED	-
	Queiroz 3115		-	-	-	DQ784675
	Hughes 1681 (FHO)	Mexico	KT364066	KT364173	FJ982241	KT364001
Piptadenia viridiflora (Kunth) Benth.	Beck 9707		INED	INED	INED	-
Piptadenia viridiflora (Kunth) Benth.	Hernandez 1014		INED	INED	-	-
Piptadenia viridiflora (Kunth) Benth.	Martinez 40140		INED	INED	INED	INED
Piptadenia viridiflora (Kunth) Benth.	Queiroz 7828 (HUEFS)	Brazil	INED	INED	INED	INED
Piptadenia viridiflora (Kunth) Benth.	Queiroz 10868 (HUEFS)	Brazil	INED	INED	INED	INED
Piptadenia viridiflora (Kunth) Benth.	Queiroz 13090 (HUEFS)	Brazil	INED	INED	INED	INED
Piptadenia viridiflora (Kunth) Benth.	Queiroz 14634 (HUEFS)	Brazil	INED	INED	INED	INED
Piptadenia viridiflora (Kunth) Benth.	Salino 3306 (HUEFS)	Brazil	INED	INED	-	INED
Piptadenia viridiflora (Kunth) Benth.	Fernandez 2909 (NY)	Venezuela	-	DQ790622	-	DQ784665
Pityrocarpa leucoxylon	Way SWM 2449 (K)	Brazil	KT364067	KT364162	FJ982242	KT364002
Pityrocarpa moniliformis (Benth.) Luckow & R.W.Jobson	Macqueen 439 (K)	Mexico	KT364068	KT364206	FJ982243	KT364003

Pityrocarpa obliqua subsp. *brasiliensis* (G.P.Lewis) Luckow & R.W.Jobson	Queiroz 15381 (HUEFS)	Brazil	INED	INED	-	INED
Pseudopiptadenia bahiana G.P. Lewis & M.P. Lima	Coradin 8580 (CEN)	Brazil	-	-	KT364110	-
	Borges 680 (SPF)	Brazil	KT364069	KT364163	KT364111	KT364004
Pseudopiptadenia brenanii G.P. Lewis & M.P. Lima	Queiroz 15585 (HUEFS)	Brazil	INED	-		-
	Sevilha 4287 (CEN)	Brazil	-	KT364216	KT364112	-
Pseudopiptadenia contorta (DC.) G.P. Lewis & M.P. Lima	Queiroz 15582 (HUEFS)	Brazil	INED	-	INED	-
	Queiroz 15507 (HUEFS)	Brazil	-	KT364155	KT364113	KT364005
	Queiroz 3366 (NY)	Brazil	-	-	-	DQ784676
	Simon 1245 (CEN)	Brazil	KT364070	KT364170	KT364114	KT364006
Pseudopiptadenia psilostachya (DC.) G. P. Lewis & M. P. Lima	Scalon 260 (ESA)	Brazil	KT364074	KT364188	KT364118	KT364007
Stryphnodendron adstringens (Mart.) Coville	Simon 1343 (CEN)	Brazil	KT364076	KT364166	KT364122	KT364014
Stryphnodendron duckeanum Occhioni	Simon 1606 (CEN)	Brazil	-	-	KT364123	KT364015
	Ivanauskas sn (ESA)	Brazil	KT364077	KT364175	KT364124	KT364016
Stryphnodendron fissuratum E.M.O. Martins	Simon 2054 (CEN)	Brazil	KT364078	KT364164	KT364125	KT364017
Stryphnodendron foreroi E.M.O. Martins	Scalon 458 (ESA)	Brazil	KT364080	KT364177	KT364127	KT364019
Stryphnodendron gracile Rizzini & Heringer	Scalon 728(ESA)	Brazil	INED	INED	INED	INED
Stryphnodendron guianense (Aubl.) Benth.	Scalon 701 (ESA)	Brazil	KT364082	KT364183	KT364131	KT364023
Stryphnodendron obovatum Benth.	Ribeiro 1219 (RB?)**	Brazil	INED	INED	INED	INED
Stryphnodendron occhionianum E.M.O. Martins	Scalon 726 (ESA)	Brazil	KT364085	KT364174	KT364134	KT364026
Stryphnodendron paniculatum Poepp.	Mello-Silva 2659 (SPF)	Brazil	KT364086	KT364184	KT364136	KT364028
Stryphnodendron polyphyllum Mart.	Queiroz 15487 (HUEFS)	Brazil	INED	KT364205	KT364151	KT364043
Stryphnodendron pulcherrimum (Willd.) Hochr.	Scalon 728 (ESA)	Brazil	KT364090	KT364193	KT364143	KT364035

Stryphnodendron roseiflorum (Ducke) Ducke	Scalon 250 (ESA)	Brazil	KT364095	KT364168	KT364148	KT364040
Stryphnodendron rotundifolium Mart.	Scalon 719 (ESA)	Brazil	KT364101	KT364187	KT364153	KT364045
Stryphnodendron velutinum						

Suplement

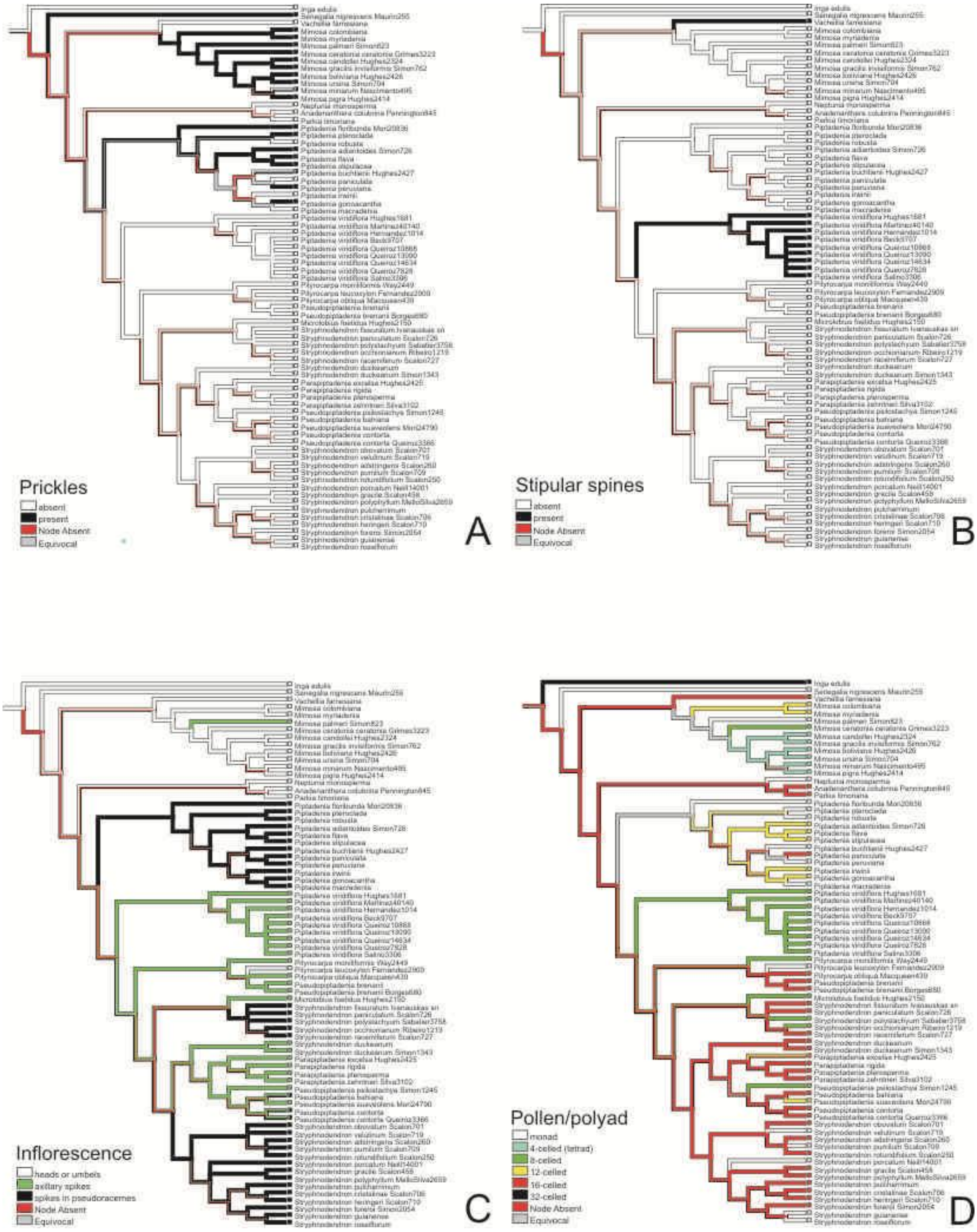


Fig. S1- A-D. Unordered parsimony ancestral reconstructions of morphological characters as optimized on 1000 trees sampled from stationarity and depicted on the 50% majority-rule consensus tree from the Bayesian analysis of the combined dataset.

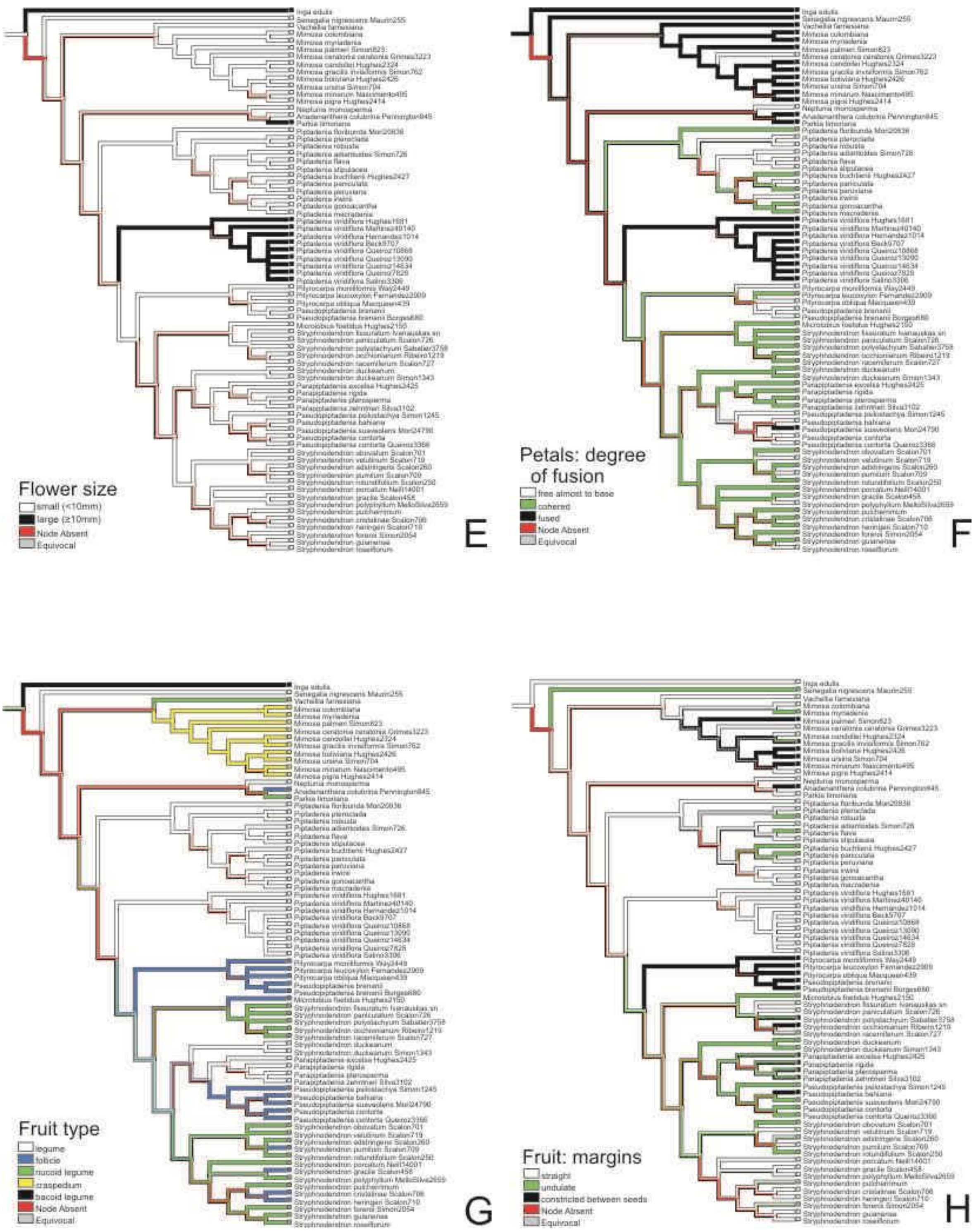


Fig. S1-E-H. Unordered parsimony ancestral reconstructions of morphological characters as optimized on 1000 trees sampled from stationarity and depicted on the 50% majority-rule consensus tree from the Bayesian analysis of the combined dataset.

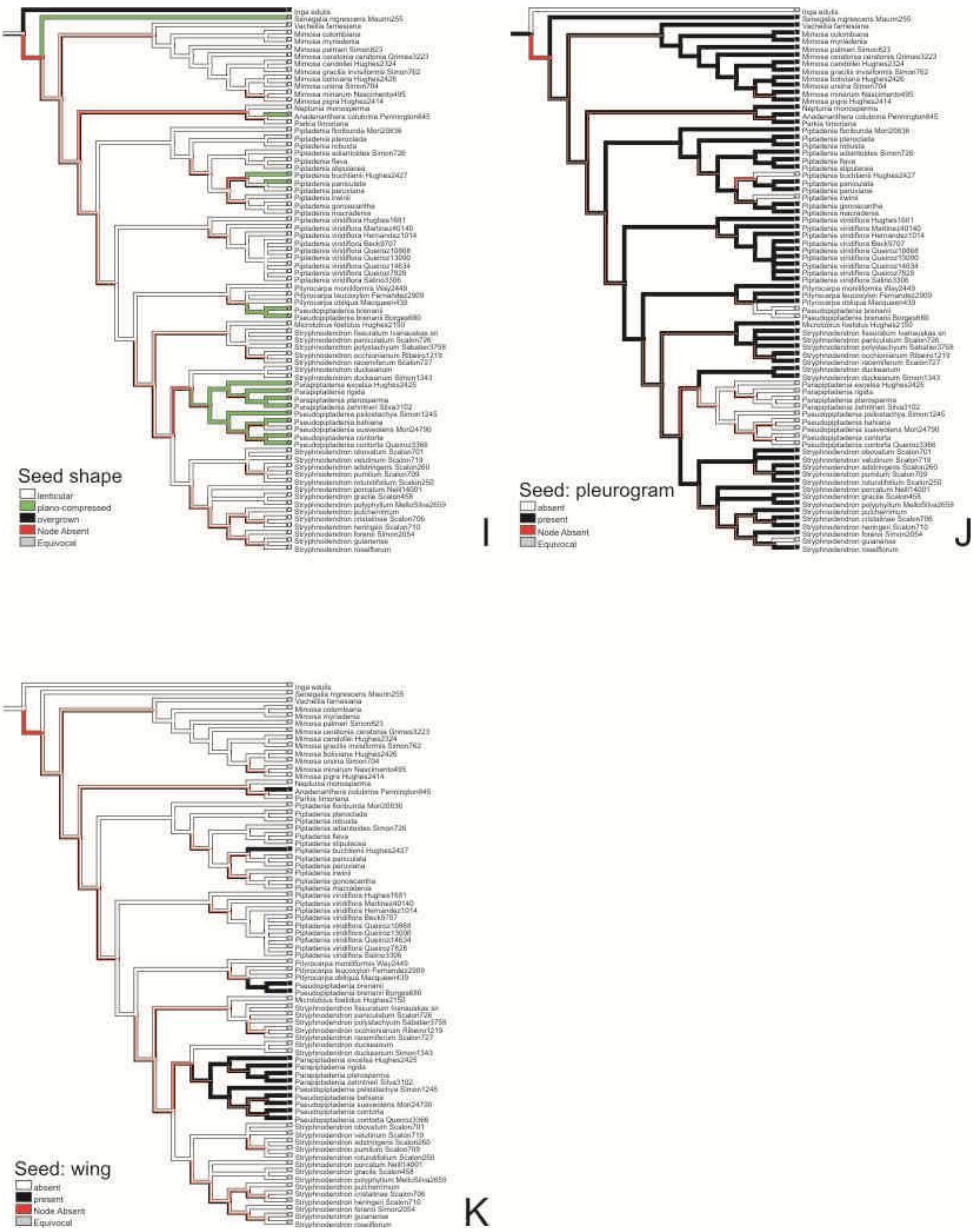


Fig. S1- I-K. Unordered parsimony ancestral reconstructions of morphological characters as optimized on 1000 trees sampled from stationarity and depicted on the 50% majority-rule consensus tree from the Bayesian analysis of the combined dataset.

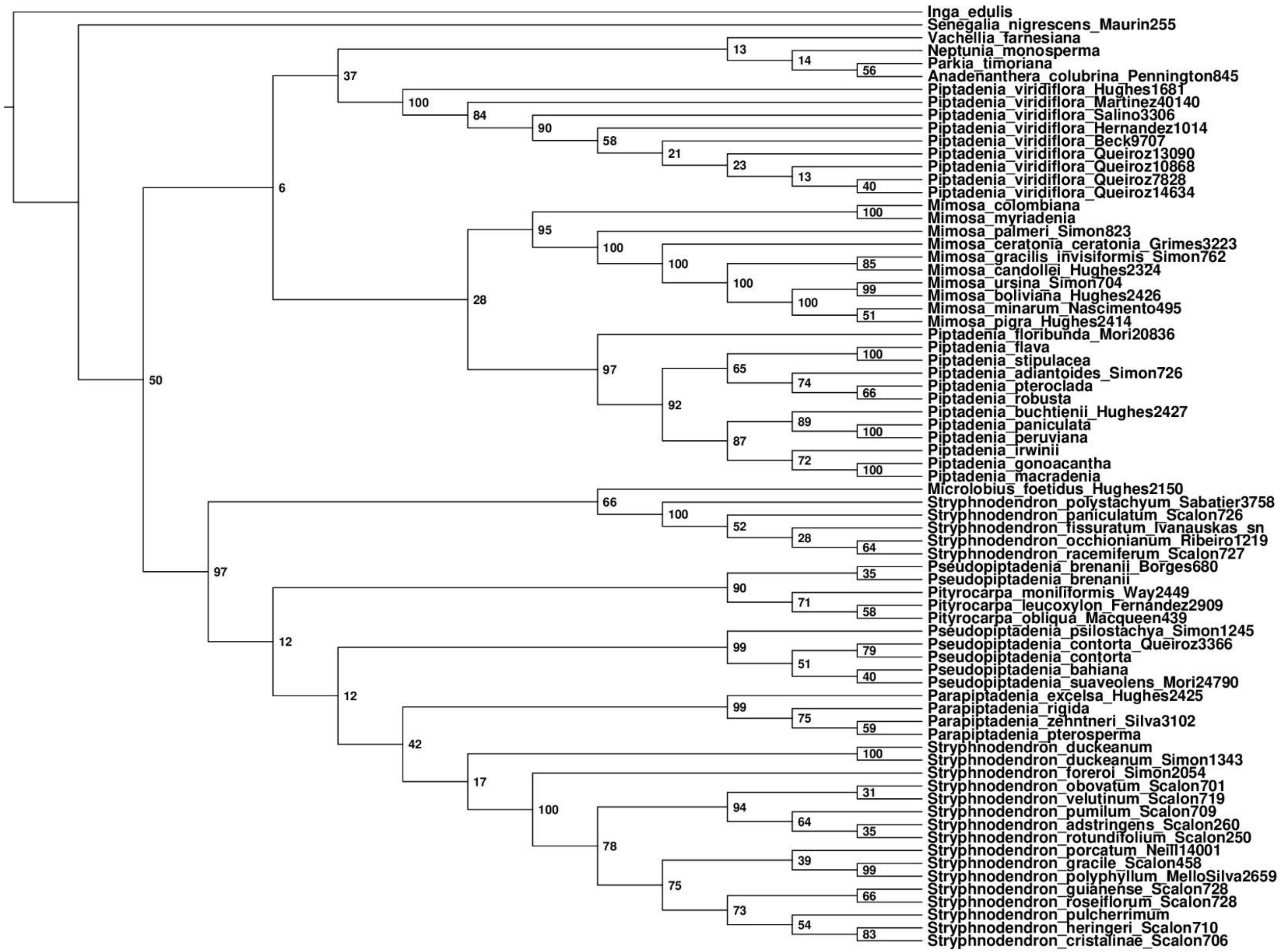


Fig. S2. Maximum likelihood tree from the combined plastid (*matK/trnK*, *trnD-trnT*, *trnL-trnF*) dataset of the Piptadenia group (Ln likelihood = -14699.162081). Numbers on the nodes are supporting values from 1000 bootstrap replications. Majority-rule consensus tree from the Bayesian analysis of the plastid (*matK/trnK*, *trnD-trnT*, *trnL-trnF*) datasets of the Piptadenia group.

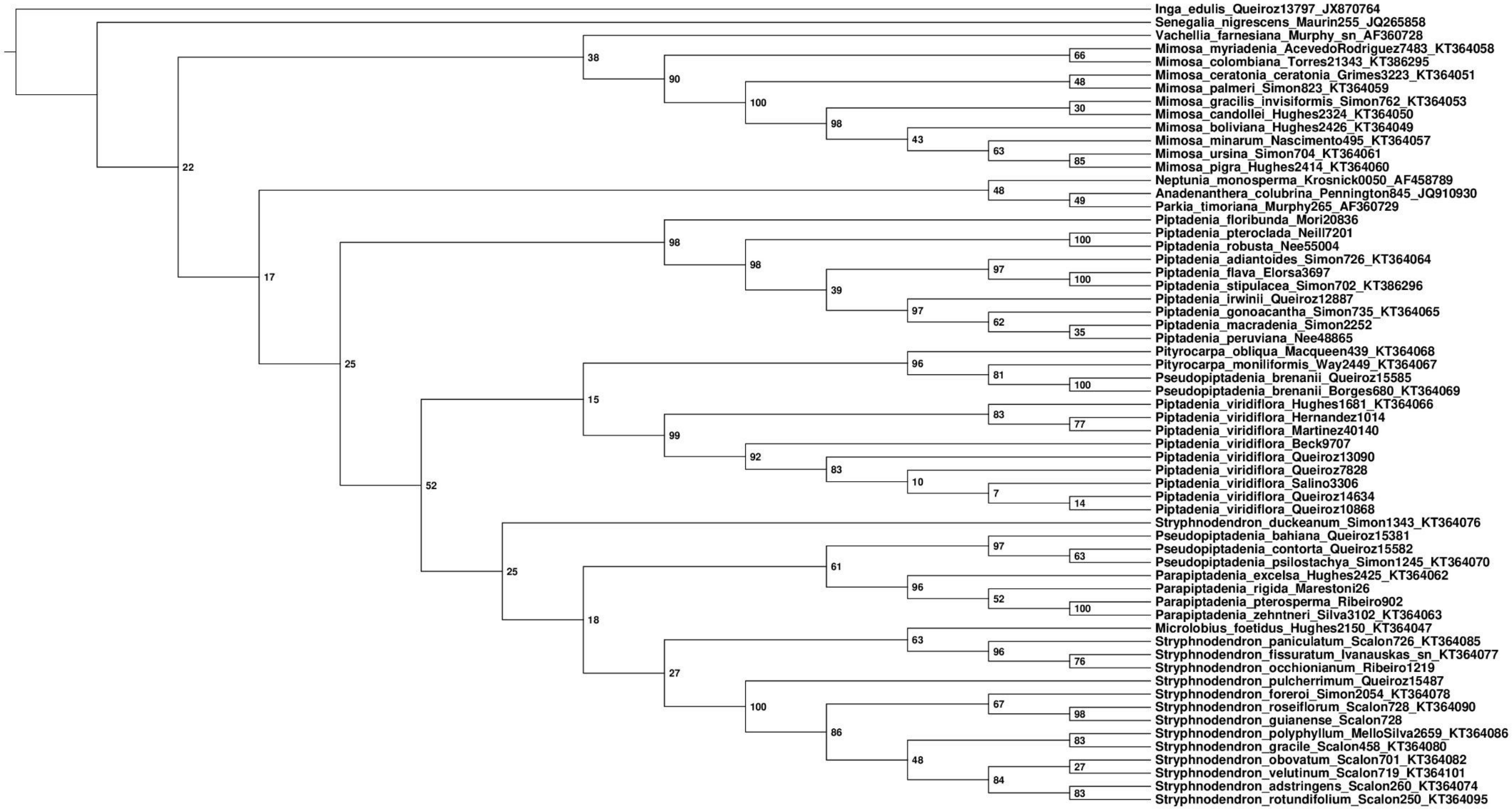
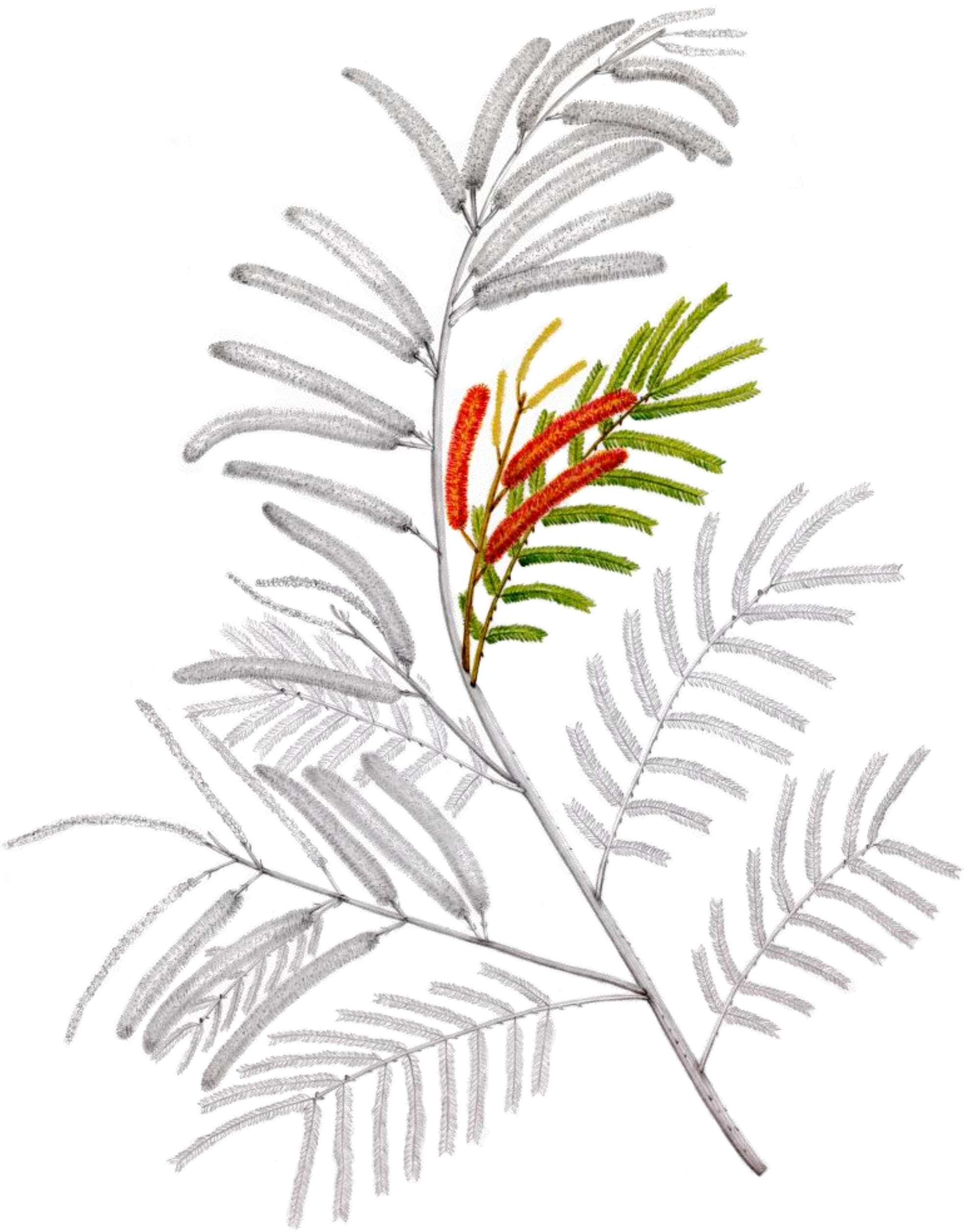


Fig. S3. Maximum likelihood tree from the ITS/5.8S dataset of the Piptadenia group (Ln likelihood = -7962.023151). Numbers on the nodes are supporting values from 1000 bootstrap replications.

CAPÍTULO 2

Phylogeny and taxonomic revision of *Piptadenia* Benth.

(Leguminosae, Caesalpinioideae, Mimosoid clade)



Phylogeny and taxonomic revision of *Piptadenia* Benth.

(Leguminosae, Caesalpinioideae, Mimosoid clade)

Abstract— A phylogeny and taxonomic revision for the genus *Piptadenia* (Leguminosae, Caesalpiniodeae - Mimosoid clade). The taxonomic revision of the *Piptadenia* species was based on ca. 10,000 herbarium specimens, including nomenclature types. Field trips and visits to herbaria were carried out. We present phylogenetic results based on molecular analysis of accessions for the ETS, ITS (nuclear), trnL-F, mat-k, trnD-t (plastids) regions. Parsimony, maximum likehood and bayesian analyzes of all data concurred in resolving to monophyletic *Piptadenia* s.s. We include multiple accesses of most of the species in the analyses, and most of them coalesce as monophyletic. We propose 4 new synonyms, lectotypes for 13 names were designated here. *Piptadenia* is characterized by a combination of characters that includes branches with aculeans, fruits of the type legume, seeds mostly non-winged, inflorescences in spikes, fasciculdes, pseudoracemo or racemes of panicula. *Piptadenia* is more diverse in the Amazon region, and the most common form of habit is liana.

***Keywords*—** molecular phylogenetics, Mimosae, morphology, Legumes, Systematics

Resumo – Filogenia e revisão taxonômica para o gênero *Piptadenia* (Leguminosae, Caesalpiniodeae - Mimosoid clade). A revisão taxonômica de *Piptadenia* foi baseada em ca. 10.000 espécimes de herbário, incluindo os tipos de nomenclatura. Foram realizadas visitas de campo e visitas a herbários. Apresentamos resultados filogenéticos baseados na análise molecular de acessos para as regiões ETS, ITS (nuclear), trnL-F, mat-k, trnD-t (plastids). A parcimônia, a maxima verossimilhança e análises bayesianas de todos os dados resolvem Piptadenia s.s. como monofilético. Incluímos múltiplos acessos de todas espécies nas análises, exceto *P. imatacae,* e a maioria deles se coalescem como monofilético. Propomos 4 novos sinônimos, lectotypes para 13 nomes foram designados aqui. *Piptadenia* é caracterizada por uma combinação de caracteres que inclui ramos com acúleos, frutos do tipo legume, sementes principalmente não-alada, inflorescências em espigas, fasciculos, pseudoracemo ou racemos de panicula. *Piptadenia* é mais diversa na região amazônica, e a forma mais comum de hábito é liana.

Palavras-chave: filogenia molecular, Mimosae, morfologia, Legumes, Sistemática

INTRODUCTION

Piptadenia Benth. in its current circumscription (Jobson & Luckow 2007) includes about 28 species (including 4 varieties) in South America, with main diversity center in the Amazonia, also occurring in the Atlantic Forest of Brazil (ca. 10 species), dry forests of northeastern Brazil extending to Venezuela (ca. 4 species, one extending to Central America and Mexico), sub-Andean forests in Peru, Ecuador and Bolivia (ca. 2 species), southeastern Brazil (ca. 4 species), two species widely distributed in dry forests From Mexico and Central America to Argentina (Lewis et al., 2005). The group is little studied and of historical taxonomic complex among the other genera of the Mimosoid Clade (LPWG 2017)

The genera of mimosoids legumes (Caesalpinioideae, Mimosoid clade; LPWG 2017) have a historically complex and challenging systematics among the Leguminosae. Traditionally defined genera have shown complex circumscriptions and molecular results show the generalized non monophyletic nature of several genera (Luckow et al., 2003; LPWG 2013).

Piptadenia was disbanded into ten smaller morphologically coherent genera (Luckow, 2005): *Anadenanthera* Speg., *Indopiptadenia* Brenan, *Lachesiodendron* Ribeiro, Luckow & L.P. Queiroz, *Microlobius* C.Presl, *Newtonia* Baill., *Parapiptadenia* Brenan, *Piptadeniastrum* Brenan, *Pityrocarpa* (Benth.) Britton & Rose and *Pseudopiptadenia* Rauschert, in addition to *Piptadenia*. These genera, along with *Adenopodia* C.Presl, *Mimosa* L., Parkia R.Br., and *Stryphnodendron* Mart. comprise the informal Piptadenia group of the Mimoseae tribe (sensu Luckow 2005) of the Mimosoid clade (LPWG 2017; Ribeiro et al 2017, Cap 1), with the exception of the Old World *Indopiptadenia*, *Newtonia* (group Newtonia) and *Piptadeniastrum* (Piptadeniastrum group).

Recently molecular phylogenies with focus on the Piptadenia group (Jobson & Luckow 2007; Simon et al. 2016) demonstrated the polyphyly of *Piptadenia* (sensu Luckow 2005), even with sparse sampling in *Piptadenia* s.s., by showing their species falling apart in independent clades. The last combined analyses of plastid (*matK/trnK*, *trnD-trnT*, *trnL-trnF*) and nuclear (nr-ITS) data resolved *P. viridiflora* in a isolated lineage, as sister to a larger clade that bring together species of *Microlobius*, *Parapiptadenia*, *Pityrocarpa*, *Pseudopiptadenia*, and *Stryphnodendron* (Simon et al. 2016, Ribeiro et al 2017, submited - capitulo 1). It was re-classified in its own new genus *Lachesiodendron*, additionally supported by the combination of morphological characters that include stipular spines, inflorescence, and different floral morphology (Jobson & Luckow 2007; Ribeiro et al 2017, Cap 1).

Despite the historical instability in the genus circumscription, relatively few species *of Piptadenia* were sampled in recent phylogenetic works on the mimosoids or the Piptadenia group. Luckow et al. (2000) included only *P. viridiflora* in a study of the mimosoids phylogeny but it is currently ascribed to the genus *Lachesiodendron*. Luckow et al. (2003) sampled 3 species: *P. viridiflora* (now *Lachesiodendron*), *P. moniliformis* and *P. obliqua* (these last two now classified in *Pityrocarpa*). Jobson & Luckow (2007) sampled 18 species of *Piptadenia* but only 12 belong to *Piptadenia* s.s. Simon et al (2016) included in their analyses the same *Piptadenia* samples used by Jobson & Luckow (2007). Ribeiro et al 2017 (submited, chapter 1) sampled the same species included in previous works (Jobson & Luckow 2007; Simon et al. 2016) but expanded the sampling of *P. viridiflora* to include multiple accessions. Therefore, there is no molecular phylogenetic study with a comprehensive sampling in *Piptadenia* s.s.

Given this taxonomic history with several genera being segregated following new views on morphological traits and, more recently, results of molecular phylogenies, *Piptadenia*, as currently circumscribed, is distinguished from the other genera of the group by a combination of characters that includes the fruit legume, mostly unwinged seeds and, generally, the presence of prickles in the branches. In order to clarify the systematics and evolution of *Piptadenia* s.s., we propose the revision of the genus combining herbarium and field studies and molecular data analyses. The objective thus aims (1) to test the monophyly of *Piptadenia* and (2) to investigate relationships among its species based on molecular phylogenetic analyses, and (3) to revise species limits and stabilize taxonomy at species level based on traditional taxonomic procedures.

MATERIAL AND METHODS

Taxon sampling and molecular data—We used a multilocus phylogenetic approach to investigate the generic relationships of *Piptadenia* within the Piptadenia group and of the species of *Piptadenia* within the genus. Part of our data came from a large sampling of sequences from our previous work that investigated the non-monophyly of *Piptadenia* [Ribeiro et al 2017 (submitted, CAPÍTULO 1); Simon et al. 2016].

Here we now expanded the taxon sampling by including 69 new sequences of nuclear rDNA ITS and 82 of the rDNA ETS as well as plastid data from 96 sequences of *matK/trnK*, 69 of *trnL-trnF* intergenic spacer (including *trnL* intron,), and 66 of *trnD-trnT* spacer.

Our sampling totaled 137 accessions of species of the Piptadenia group and 1 outgroups, of which 55 accessions are from *Piptadenia* s.s., including multiples accessions that are representative for the geographic range and morphological diversity of *Piptadenia* (see Table 1). All the 12 genera (including the new genus *Lachesiodendron*, CAPÍTULO 1) of the Piptadenia group were sampled. Outgroup were selected from specie of tribe Ingeae, as guided by previous phylogenetic works (Hughes et al. 2003; Luckow et al. 2003;

Table 1 Voucher information and GenBank accession numbers for DNA sequences used in this study

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
Lachesiodendron viridiflorum	Lachesiodendron viridiflorum_1	Piptadenia_viridiflora_Hughes1681_KT364066		Piptadenia_viridiflora_Hughes1681_KT364001	Piptadenia_viridiflora_Hughes1681_FJ982241	Piptadenia_viridiflora_Hughes1681_KT364173
	Lachesiodendron viridiflorum_2	Piptadenia_viridiflora_Martinez40140	Piptadenia_viridiflora_Martinez40140	Piptadenia_viridiflora_Martinez40140	Piptadenia_viridiflora_Martinez40140	Piptadenia_viridiflora_Martinez40140
	Lachesiodendron viridiflorum_3	Piptadenia_viridiflora_Hernandez1014	Piptadenia_viridiflora_Hernandez1014			Piptadenia_viridiflora_Hernandez1014
	Lachesiodendron viridiflorum_4	Piptadenia_viridiflora_Beck9707			Piptadenia_viridiflora_Beck9707	Piptadenia_viridiflora_Beck9707
	Lachesiodendron viridiflorum_5	Piptadenia_viridiflora_Queiroz7828	Piptadenia_viridiflora_Queiroz7828	Piptadenia_viridiflora_Queiroz7828	Piptadenia_viridiflora_Queiroz7828	Piptadenia_viridiflora_Queiroz7828
	Lachesiodendron viridiflorum_6	Piptadenia_viridiflora_Queiroz10868	Piptadenia_viridiflora_Queiroz10868	Piptadenia_viridiflora_Queiroz10868	Piptadenia_viridiflora_Queiroz10868	Piptadenia_viridiflora_Queiroz10868
	Lachesiodendron viridiflorum_7	Piptadenia_viridiflora_Queiroz13090	Piptadenia_viridiflora_Queiroz13090	Piptadenia_viridiflora_Queiroz13090	Piptadenia_viridiflora_Queiroz13090	Piptadenia_viridiflora_Queiroz13090
	Lachesiodendron viridiflorum_8	Piptadenia_viridiflora_Queiroz14634	Piptadenia_viridiflora_Queiroz14634	Piptadenia_viridiflora_Queiroz14634	Piptadenia_viridiflora_Queiroz14634	Piptadenia_viridiflora_Queiroz14634
	Lachesiodendron viridiflorum_9	Piptadenia_viridiflora_Salino3306	Piptadenia_viridiflora_Salino3306	Piptadenia_viridiflora_Salino3306		Piptadenia_viridiflora_Salino3306
Piptadenia adiantoides	Piptadenia_adiantoides_1	Piptadenia_adiantoides_Jardim1784	Piptadenia_adiantoides_Jardim1784	Piptadenia_adiantoides_Jardim1784	Piptadenia_adiantoides_Jardim1784	Piptadenia_adiantoides_Jardim1784_DQ790611
	Piptadenia_adiantoides_2	Piptadenia_adiantoides_Lombardi1295	Piptadenia_adiantoides_Lombardi1295	Piptadenia_adiantoides_Lombardi1295	Piptadenia_adiantoides_Lombardi1295	Piptadenia_adiantoides_Lombardi1295
	Piptadenia_adiantoides_3	Piptadenia_adiantoides_Queiroz15533	Piptadenia_adiantoides_Queiroz15533	Piptadenia_adiantoides_Queiroz15533	Piptadenia_adiantoides_Queiroz15533	Piptadenia_adiantoides_Queiroz15533
	Piptadenia_adiantoides_4	Piptadenia_adiantoides_Queiroz15506	Piptadenia_adiantoides_Queiroz15681	Piptadenia_adiantoides_Queiroz15506	Piptadenia_adiantoides_Queiroz15506	Piptadenia_adiantoides_Queiroz15506
	Piptadenia_adiantoides_5	Piptadenia_adiantoides_Simon726_KT364064	Piptadenia_adiantoides_Euquis1183	Piptadenia_adiantoides_Simon726_KT363998	Piptadenia_adiantoides_Simon726_FJ982236	Piptadenia_adiantoides_Simon726_KT364158
				Piptadenia_adiantoides_Lima2953_DQ784655		

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
Piptadenia affinis	**Piptadenia_affinis**	Piptadenia_afinis_Seger716	Piptadenia_affinis_Seger716	Piptadenia_affinis_Seger716	Piptadenia_affinis_Seger716	Piptadenia_affinis_Seger716
Piptadenia anolidurus	**Piptadenia_anolidurus**				Piptadenia_anolidurus_Santos169	
Piptadenia buchtienii	**Piptadenia_buchtienii_1**			Piptadenia_buchtienii_Hughes2427_KT386299	Piptadenia_buchtienii_Hughes2427_FJ982237	Piptadenia_buchtienii_Hughes2427_DQ790614
	Piptadenia_buchtienii_2			Piptadenia_buchtienii_Nee44558_DQ784656	Piptadenia_buchtienii_Nee34231	Piptadenia_buchtienii_Nee34231
				Piptadenia_buchtienii_Nee50497_DQ784657		Piptadenia_buchtienii_Beck12053
						Piptadenia_buchtienii_Dorr6926
Piptadenia cuzcoensis	**Piptadenia_cuzcoensis**	Piptadenia_cuzcoensis_Vargas18500	Piptadenia_cuzcoensis_Vargas18500		Piptadenia_cuzcoensis_Vargas18500	Piptadenia_cuzcoensis_Vargas18500
Piptadenia flava	**Piptadenia_flava_1**	Piptadenia_flava_Elorsa3697			Piptadenia_flava_Elorsa3697	Piptadenia_flava_Elorsa3697
	Piptadenia_flava_2			Piptadenia_flava_Lewis2334_DQ784659		Piptadenia_flava_Lewis_2334_DQ790616
				Piptadenia_flava_Roger17901	Piptadenia_flava_Roger17901	
				Piptadenia_flava_Salas2415_DQ784660		Piptadenia_flava_Salas2415_DQ790617
					Piptadenia_flava_Simpson7095	
Piptadenia floribunda	**Piptadenia_floribunda_1**	Piptadenia_floribunda_Granville13823	Piptadenia_floribunda_Granville13823	Piptadenia_floribunda_Granville13823	Piptadenia_floribunda_Granville13823	Piptadenia_floribunda_Granville13823_DQ790618
	Piptadenia_floribunda_2	Piptadenia_floribunda_JansenJacob1782	Piptadenia_floribunda_JansenJacob1782	Piptadenia_floribunda_JansenJacob1782		Piptadenia_floribunda_JansenJacob1782
	Piptadenia_floribunda_3	Piptadenia_floribunda_Mori20836	Piptadenia_floribunda_Mori20836	Piptadenia_floribunda_Mori20836	Piptadenia_floribunda_Mori20836	Piptadenia_floribunda_Mori20836
				Piptadenia_floribunda_Mori20836_DQ784662		Piptadenia_floribunda_Mori20836_DQ790619
Piptadenia laxipinna	**Piptadenia_fluvidulcis**					Piptadenia_fluvidulcis_Lombardi1209
Piptadenia gonoacantha	**Piptadenia_gonoacantha_1**	Piptadenia_gonoacantha_Fontes250	Piptadenia_gonoacantha_Fontes250	Piptadenia_gonoacantha_Fontes250	Piptadenia_gonoacantha_Fontes250	Piptadenia_gonoacantha_Fontes250

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
	Piptadenia_gonoacantha_2	Piptadenia_gonoacantha_Molina13224	Piptadenia_gonoacantha_Molina13224		Piptadenia_gonoacantha_Molina13224	Piptadenia_gonoacantha_Molina13224
	Piptadenia_gonoacantha_3	Piptadenia_gonoacantha_Queiroz14914	Piptadenia_gonoacantha_Queiroz14914		Piptadenia_gonoacantha_Queiroz14914	Piptadenia_gonoacantha_Queiroz14914
				Piptadenia_gonoacantha_Nee36338_DQ784663		Piptadenia_gonoacantha_Nee36338_DQ790620
	Piptadenia_gonoacantha_4	Piptadenia_gonoacantha_Simon735_KT364065		Piptadenia_gonoacantha_Simon735_KT363999	Piptadenia_gonoacantha_Simon735_FJ982238	Piptadenia_gonoacantha_Simon_735_DQ790620
						Piptadenia_gonoacantha_Vargas15432
Piptadenia irwinii					Piptadenia_irwinii_Conceicao1903	Piptadenia_irwinii_Conceicao1903
	Piptadenia_irwinii_1	Piptadenia_irwinii_Queiroz12887		Piptadenia_irwinii_Queiroz12887	Piptadenia_irwinii_Queiroz12887	Piptadenia_irwinii_Queiroz12887
	Piptadenia_irwinii_2				Piptadenia_irwinii_Irwin31171	Piptadenia_irwinii_Irwin31171
						Piptadenia_irwinii_Mori9501
Piptadenia killipii var. cacophylla	Piptadenia_cacaophylla_1	Piptadenia_killipii_cacaophylla_Ribeiro416	Piptadenia_killipii_cacaophylla_Ribeiro416	Piptadenia_killipii_cacaophylla_Ribeiro416	Piptadenia_killipii_Ribeiro416	Piptadenia_killipii_cacaophylla_Belem2331
	Piptadenia_cacaophylla_2	Piptadenia_killipii_cacaophylla_Ribeiro417	Piptadenia_killipii_cacaophylla_Ribeiro417	Piptadenia_killipii_cacaophylla_Ribeiro417	Piptadenia_killipii_cacaophylla_Ribeiro417	Piptadenia_killipii_cacaophylla_Ribeiro417
Piptadenia gonoacantha	Piptadenia_gonoacantha_1	Piptadenia_macradenia_Simon2252	Piptadenia_macradenia_Simon2252	Piptadenia_macradenia_Simon2252	Piptadenia_macradenia_Simon2252	Piptadenia_macradenia_Simon2252
	Piptadenia_macradenia_2		Piptadenia_macradenia_Vargas17328	Piptadenia_macradenia_Vargas17328		Piptadenia_macradenia_Vargas17328
			Piptadenia_macradenia_Cardoso2935	Piptadenia_macradenia_Nee48772_DQ784666		Piptadenia_macradenia_Nee48772_DQ790623
Piptadenia micracantha	Piptadenia_micracantha_1	Piptadenia_micracantha_Queiroz_15663	Piptadenia_micracantha_Queiroz15663	Piptadenia_micracantha_Queiroz15663	Piptadenia_micracantha_Queiroz_15663	Piptadenia_micracantha_Queiroz15663
	Piptadenia_micracantha_2	Piptadenia_micracantha_Ribeiro415	Piptadenia_micracantha_Ribeiro415	Piptadenia_micracantha_Ribeiro415	Piptadenia_micracantha_Ribeiro415	Piptadenia_micracantha_Ribeiro415
Piptadenia uaupensis	Piptadenia_minutiflora	Piptadenia_minutiflora_Ribeiro398	Piptadenia_minutiflora_Ribeiro398	Piptadenia_minutiflora_Leme6_DQ784667	Piptadenia_minutiflora_Ribeiro398	Piptadenia_minutiflora_Ribeiro398

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
						Piptadenia_minutiflora_Davidse5637
						Piptadenia_minutiflora_Ducke_sn_RB23251
Piptadenia paniculata				Piptadenia_paniculata_Brotto1527		Piptadenia_paniculata_Brotto1527
	Piptadenia_paniculata_2			Piptadenia_paniculata_Thomas11101_DQ784669		Piptadenia_paniculata_Thomas11101_DQ790626
	Piptadenia_paniculata_1		Piptadenia_paniculata_Brotto1527	Piptadenia_paniculata_Queiroz15328	Piptadenia_paniculata_Queiroz15328	Piptadenia_paniculata_Queiroz15328
				Piptadenia_paniculata_Jardim1221_DQ784668		Piptadenia_peruviana_Nee38898_DQ790627
Piptadenia peruviana	Piptadenia_peruviana_2		Piptadenia_peruviana_Nee38898	Piptadenia_peruviana_Nee38898_DQ784670	Piptadenia_peruviana_Nee38898	Piptadenia_peruviana_Nee38898
	Piptadenia_peruviana_1	Piptadenia_peruviana_Nee48865	Piptadenia_peruviana_Nee48865	Piptadenia_peruviana_Nee48865	Piptadenia_peruviana_Nee48865	Piptadenia_peruviana_Nee48865_DQ790628
	Piptadenia_peruviana_3		Piptadenia_peruviana_Nunes9966		Piptadenia_peruviana_Nunes9966	Piptadenia_peruviana_Nunes9966
			Piptadenia_peruviana_Pillip440			Piptadenia_peruviana_Pillip440
					Piptadenia_peruviana_Rodriguez1572	
Piptadenia pteroclada	Piptadenia_pteroclada_1	Piptadenia_pteroclada_Neill7201	Piptadenia_pteroclada_Neill7201	Piptadenia_pteroclada_Neill7201	Piptadenia_pteroclada_Neill7201	Piptadenia_pteroclada_Neill7201
	Piptadenia_pteroclada_2			Piptadenia_pteroclada_Prance24672_DQ784672	Piptadenia_pteroclada_Klug4386	Piptadenia_pteroclada_Prance_24672_DQ790630
				Piptadenia_pteroclada_Rimachi11560_DQ784673		Piptadenia_pteroclada_Prance24672_DQ790629
Piptadenia ramosissima	Piptadenia_ramosissima_1	Piptadenia_ramosissima_Queiroz15493	Piptadenia_ramosissima_Queiroz15493	Piptadenia_ramosissima_Queiroz15493	Piptadenia_ramosissima_Queiroz15493	Piptadenia_ramosissima_Queiroz15493

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
	Piptadenia_ramosissima_2	Piptadenia_ramosissima_Roque2838	Piptadenia_ramosissima_Roque2838	Piptadenia_ramosissima_Roque2838		Piptadenia_ramosissima_Roque2838
	Piptadenia_ramosissima_3	Piptadenia_ramosissima_Queiroz15373	Piptadenia_ramosissima_Queiroz15373	Piptadenia_ramosissima_Queiroz15373		Piptadenia_ramosissima_Queiroz15373
				Piptadenia_(irwinii)RAMOSISSIMA_Queiroz3500_DQ784664	Piptadenia_sp_ramosissima_Queiroz15326	Piptadenia_(irwinii)RAMOSISSIMA_Queiroz3500_DQ790621
Piptadenia robusta	Piptadenia_robusta_1	Piptadenia_robusta_Nee55004	Piptadenia_robusta_Nee55004	Piptadenia_robusta_Nee55004		Piptadenia_robusta_Nee55004
	Piptadenia_robusta_2	Piptadenia_robusta_Pittier8297	Piptadenia_robusta_Nee48894	Piptadenia_robusta_Nee48894	Piptadenia_robusta_Nee48894	Piptadenia_robusta_Nee48636
				Piptadenia_robusta_Arroyo850_DQ784674		Piptadenia_robusta_Arroyo_850_DQ790632
						Piptadenia_robusta_Arroyo850_DQ790632
Piptadenia santosii	Piptadenia_santosii		Piptadenia_santosii_Lombardi5044	Piptadenia_santosii_Lombardi5044	Piptadenia_santosii_Lombardi5044	Piptadenia_santosii_Lombardi5044
						Piptadenia_santosii_Santos2729
Piptadenia stipulacea	Piptadenia_stipulacea_1	Piptadenia_stipulacea_Ribeiro60	Piptadenia_stipulacea_Alencar2268	Piptadenia_stipulacea_Ribeiro60	Piptadenia_stipulacea_Ribeiro60	Piptadenia_stipulacea_Ribeiro60
	Piptadenia_stipulacea_2	Piptadenia_stipulacea_Simon702_KT386296	Piptadenia_stipulacea_Simon544	Piptadenia_stipulacea_Simon544		Piptadenia_stipulacea_Simon544
		Piptadenia_stipulacea_Alencar2268				Piptadenia_stipulacea_Alencar2268
				Piptadenia_stipulacea_Queiroz3115_DQ784675		Piptadenia_stipulacea_Queiroz_3115_DQ790634
						Piptadenia_stipulacea_Harley18962_DQ790635
Piptadenia trisperma	Piptadenia_trisperma					Piptadenia_trisperma_Lima2908
						Piptadenia_trisperma_Araujo8966
Piptadenia uaupensis						

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
Piptadenia uliginosa	Piptadenia_uliginosa		Piptadenia_uliginosa_Killip14453	Piptadenia_uliginosa_Killip14453	Piptadenia_uliginosa_Killip14453	Piptadenia_uliginosa_Killip14453
						Piptadenia_uliginosa_Dugand2754
EXCLUÍDA - PROV. PARAPIPTADENIA		Piptadenia_aff_boliviana_Antezone576	Piptadenia_aff_boliviana_Antezone576	Piptadenia_aff_boliviana_Antezone576	Piptadenia_sp_Scalon462_KT364109	Piptadenia_boliviana_Antezone576
EXCLUÍDA - PROV. PARAPIPTADENIA			Piptadenia_flava_Sarkinen2069		Piptadenia_flava_Sarkinen2069	Piptadenia_flava_Sarkinen2069
EXCLUÍDAS		Piptadenia_anolidurus_Flores1509	Piptadenia_irwinii_Mori9501	Piptadenia_minutiflora_Ribeiro398	Piptadenia_kilipii_HOLOTYPUS	Piptadenia_adiantoides_Lima4547
EXCLUÍDAS				Piptadenia_sp_Scalon462_KT364000		Piptadenia_sp_Scalon462_KT364196
EXCLUÍDAS					Piptadenia_uaupensis_Ducke1592	Piptadenia_peruviana_Nunes24037
EXCLUÍDAS						Piptadenia_uaupensis_Amand1421
EXCLUÍDAS						Piptadenia_affinis_Falkenber7522
Adenopodia patens	Adenopodia_patens					Adenopodia_patens_Sandoval_MS00343_KX302291
Adenopodia sclerata	Adenopodia_sclerata					Adenopodia_scelerata_Jongkind_10602_KX302292
Adenopodia spicata	Adenopodia_spicata					Adenopodia_spicata_Botha_25_JX517808
				Anadenanthera_colubrina_Hughes2308_KT363985		Anadenanthera_colubrina_Hughes2308_KT364207
Anadenanthera colubrina	Anadenanthera_colubrina_2	Anadenanthera_colubrina_Pennington845_JQ910930		Anadenanthera_colubrina_Pennington845_AF278481	Anadenanthera_colubrina_Pennington845	Anadenanthera_colubrina_Pennington845_AF521813
	Anadenanthera_colubrina_1	Anadenanthera_colubrina_Vargas15684	Anadenanthera_colubrina_Vargas15684	Anadenanthera_colubrina_Vargas15684	Anadenanthera_colubrina_Hughes2308_FJ981975	Anadenanthera_colubrina_Vargas15684

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
Inga edulis	Inga_edulis					Anadenanthera_colubrina_CANB_615636_AF523114
Microlobius foetidus	Microlobius_foetidus_1	Inga_edulis_Queiroz13797_JX870764		Inga_edulis_Queiroz13797_JX87088	Inga_edulis_Pennington13282_JQ417383	Inga_edulis_Murphy352_AF523078
	Microlobius_foetidus_2	Microlobius_foetidus_Almeida236	Microlobius_foetidus_Almeida236	Microlobius_foetidus_Almeida236	Microlobius_foetidus_Almeida236	Microlobius_foetidus_Almeida236
	Microlobius_foetidus_3	Microlobius_foetidus_Hughes2150_KT364047		Microlobius_foetidus_Hughes2150_KT363986	Microlobius_foetidus_Hughes2150_FJ981976	Microlobius_foetidus_Hughes2150_KT364172
		Microlobius_foetidus_Macqueen432_AF458783		Microlobius_foetidus_Macqueen432_AF278506		Microlobius_foetidus_Macqueen432_AF523095
						Mimosa_acutistipula_acutistipula_Simon_705_KX422258
						Mimosa_adenophylla_adenophylla_Santos_Silva_1188_KX422259
						Mimosa_arenosa_arenosa_Santos_Silva_978_KX422260
						Mimosa_artemisiana_Faria_138_KX422261
			Mimosa_sp_Mimadenia_Ribeiro608			Mimosa_bimucronata_Simon_301_KX422262
Mimosa boliviana	Mimosa_boliviana	Mimosa_boliviana_Hughes2426_KT364049		Mimosa_boliviana_Hughes2426_KT363987	Mimosa_boliviana_Hughes2426_FJ982009	Mimosa_boliviana_Hughes2426_KT364209
Mimosa candollei	Mimosa_candollei	Mimosa_candollei_Hughes2324_KT364050		Mimosa_candollei_Hughes2324_KT363988	Mimosa_candollei_Hughes2324_FJ982020	Mimosa_candollei_Hughes2324_KT364211
Mimosa ceratonia_ceratonia	Mimosa_ceratonia_ceratonia	Mimosa_ceratonia_ceratonia_Grimes3223_KT364051		Mimosa_ceratonia_ceratonia_Grimes3223_KT363989	Mimosa_ceratonia_ceratonia_Grimes3223_JF694259	Mimosa_ceratonia_ceratonia_Grimes3223_KT364208
Mimosa colombiana	Mimosa_colombiana	Mimosa_colombiana_Torres21343_KT386295		Mimosa_colombiana_Davidse15198_DQ784646	Mimosa_colombiana_Davidse15198_FJ982027	Mimosa_colombiana_Davidse15198_DQ790603
						Mimosa_gemmulata_gemmulata_Simon_690_KX422263

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
						Mimosa_glutinosa_Santos_Silva_862_KX422257
Mimosa gracilis_invisiformis	Mimosa_gracilis_invisiformis	Mimosa_gracilis_invisiformis_Simon762_KT364053		Mimosa_gracilis_invisiformis_Simon762_KT363990	Mimosa_gracilis_invisiformis_Simon762_FJ982073	Mimosa_gracilis_invisiformis_Simon762_KT364214
						Mimosa_grandidieri_Koenen_207_KX302338
						Mimosa_guilandinae_Nee_42700_DQ790604
						Mimosa_hexandra_Simon_711_KX422264
						Mimosa_incarum_Dexter_5865_KY045880
						Mimosa_lepidophora_Cardoso_1747_KX422255
						Mimosa_lewisii_Simon_696_KX422265
Mimosa minarum	Mimosa_minarum	Mimosa_minarum_Nascimento495_KT364057		Mimosa_minarum_Nascimento495_KT363991	Mimosa_minarum_Nascimento495_FJ982120	Mimosa_minarum_Nascimento_495_KT364215
						Mimosa_minarum_Nascimento495_KT364215
Mimosa myriadenia	Mimosa_myriadenia	Mimosa_myriadenia_AcevedoRodriguez7483_KT364058		Mimosa_myriadenia_Balsleu10611_DQ784648	Mimosa_myriadenia_AcevedoRodriguez7483_FJ982127	Mimosa_myriadena_Cardoso_3461_KY045939
						Mimosa_myriadenia_Balsleu10611_DQ790605
						Mimosa_ophthalmocentra_Santos_Silva_838_KX422266
Mimosa palmeri	Mimosa_palmeri	Mimosa_palmeri_Simon823_KT364059		Mimosa_palmeri_Simon823_KT363993	Mimosa_palmeri_Simon823_FJ982142	Mimosa_palmeri_Simon823_KT364212
Mimosa pigra	Mimosa_pigra	Mimosa_pigra_Hughes2414_KT364060		Mimosa_pigra_Hughes2414_KT363994	Mimosa_pigra_Hughes2414_FJ982148	Mimosa_pigra_Hughes2414_KT364213
						Mimosa_pilulifera_pilulifera_Dahmer_3_KX422267

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
						Mimosa_pseudosepiaria_Simon_712_KX422268
						Mimosa_pteridifolia_Simon_754_KX422269
						Mimosa_revoluta_Beck_14424_DQ790607
						Mimosa_scabrella_Simon_1404_KX422270
						Mimosa_schomburgkii_Simon_1662_KX422271
						Mimosa_sericantha_Simon_410_KX422272
						Mimosa_tenuiflora_Miller_533_AF274120
Mimosa ursina	Mimosa_ursina	Mimosa_ursina_Simon704_KT364061		Mimosa_ursina_Simon704_KT363995	Mimosa_ursina_Simon704_FJ982217	Mimosa_ursina_Simon_704_KT364210
						Mimosa_ursina_Simon704_KT364210
						Mimosa_verrucosa_Simon_706_KX422274
Parapiptadenia blanchetii	Parapiptadenia_blanchetii_1	Parapiptadenia_blanchetii_Queiroz15358	Parapiptadenia_blanchetii_Queiroz15358	Parapiptadenia_blanchetii_Queiroz15358	Parapiptadenia_blanchetii_Queiroz15358	Parapiptadenia_blanchetii_Queiroz15358
	Parapiptadenia_blanchetii_2	Parapiptadenia_blanchetii_Thomas12372	Parapiptadenia_blanchetii_Thomas12372	Parapiptadenia_blanchetii_Thomas12372		Parapiptadenia_blanchetii_Thomas12372
						Parapiptadenia_blanchetii_Queiroz15512
Parapiptadenia excelsa	Parapiptadenia_excelsa	Parapiptadenia_excelsa_Hughes2425_KT364062		Parapiptadenia_excelsa_Hughes2425_KT363996	Parapiptadenia_excelsa_Hughes2425_FJ982235	Parapiptadenia_excelsa_Hughes2425_KT364160
				Parapiptadenia_excelsa_Fortunato7669_DQ344569		
Parapiptadenia ilheusana	Parapiptadenia_ilheusana	Parapiptadenia_ilheusana_Neves1659	Parapiptadenia_ilheusana_Neves1659	Parapiptadenia_ilheusana_Neves1659	Parapiptadenia_ilheusana_Neves1659	Parapiptadenia_ilheusana_Neves_1659_KY046081
					Parapiptadenia_ilheusana_Santos4303	Parapiptadenia_ilheusana_Neves1659

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
Parapiptadenia pterosperma	**Parapiptadenia_pterosperma_1**	Parapiptadenia_pterosperma_Cardoso2359	Parapiptadenia_pterosperma_Cardoso2359	Parapiptadenia_pterosperma_Cardoso2359	Parapiptadenia_pterosperma_Cardoso2359	Parapiptadenia_pterosperma_Cardoso2359
	Parapiptadenia_pterosperma_2	Parapiptadenia_pterosperma_Ribeiro902		Parapiptadenia_pterosperma_Ribeiro902	Parapiptadenia_pterosperma_Ribeiro902	Parapiptadenia_pterosperma_Ribeiro902
				Parapiptadenia_pterosperma_Tameirao2458_DQ784651		Parapiptadenia_pterosperma_Tameirao2458_DQ790608
Parapiptadenia rigida	**Parapiptadenia_rigida_1**	Parapiptadenia_rigida_Marestoni26	Parapiptadenia_rigida_Marestoni26	Parapiptadenia_rigida_Marestoni26		Parapiptadenia_rigida_Marestoni26
	Parapiptadenia_rigida_2		Parapiptadenia_rigida_Santos559	Parapiptadenia_rigida_Santos559		Parapiptadenia_rigida_Santos559
				Parapiptadenia_rigida_Arambarri_sn_AF278505		Parapiptadenia_rigida_Silva1890_DQ790609
				Parapiptadenia_rigida_Silva1890_DQ784652		
Parapiptadenia zehntneri	**Parapiptadenia_zehntneri_1**	Parapiptadenia_zehntneri_Cotarelli2029	Parapiptadenia_zehntneri_Cotarelli2029	Parapiptadenia_zehntneri_Cotarelli2029		Parapiptadenia_zehntneri_Cotarelli2029
		Parapiptadenia_zehntneri_Queiroz7359		Parapiptadenia_zehntneri_Gomes155_DQ784653		
	Parapiptadenia_zehntneri_2	Parapiptadenia_zehntnerii_Queiroz10974	Parapiptadenia_zehntneri_Queiroz10974	Parapiptadenia_zehntneri_Queiroz10974		Parapiptadenia_zehntneri_Queiroz10974
		Parapiptadenia_zehntneri_Queiroz15692		Parapiptadenia_zehntneri_Queiroz15692		Parapiptadenia_zehntneri_Queiroz15692_KX302341
	Parapiptadenia_zehntneri_3	Parapiptadenia_zehntneri_Silva3102_KT364063	Parapiptadenia_zehntneri_Queiroz15692	Parapiptadenia_zehntneri_Silva3102_KT363997	Parapiptadenia_zehntneri_Silva3102_KT364108	Parapiptadenia_zehntneri_Silva3102_KT364161
Parkia discolor	**Parkia_discolor**					Parkia_discolor_Cardoso_2884_KX581232
Parkia multijuga	**Parkia_multijuga**					Parkia_multijuga_Klitgaard_697_EU362018
Parkia panurensis	**Parkia_panurensis**					Parkia_panurensis_Dexter_6998_KY046082
Parkia pendula	**Parkia_pendula**					Parkia_pendula_Neves_1698_KY046083

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
Parkia platycephala	Parkia_platycephala					Parkia_platycephala_Oliveira_225_KY045958
						Parkia_timoriana_Ariati_47_AF523091
Parkia timoriana	Parkia_timoriana	Parkia_timoriana_Murphy 265_AF360729		Parkia_timoriana_Murphy265_AF195701		Parkia_timoriana_Ariati47_AF523091
Parkia ulei	Parkia_ulei					Parkia_ulei_Neves_1998_KY046045
Parkia velutina	Parkia_velutina					Parkia_velutina_Dexter_6959_KY046084
Pityrocarpa leucoxylon	Pityrocarpa_leucoxylon			Pityrocarpa_leucoxylon_Fernandez2909_DQ784665		Pityrocarpa_leucoxylon_Fernandez2909_DQ790622
Pityrocarpa moniliformis	Pityrocarpa_moniliformis_1	Pityrocarpa_moniliformis_Melo7518	Pityrocarpa_moniliformis_Melo7518	Pityrocarpa_moniliformis_Melo7518	Pityrocarpa_moniliformis_Melo7518	Pityrocarpa_moniliformis_Melo7518
	Pityrocarpa_moniliformis_2	Pityrocarpa_moniliformis_Queiroz9084	Pityrocarpa_moniliformis_Queiroz9084	Pityrocarpa_moniliformis_Queiroz9084		Pityrocarpa_moniliformis_Queiroz9084
	Pityrocarpa_moniliformis_3	Pityrocarpa_moniliformis_Walter6658	Pityrocarpa_moniliformis_Walter6658	Pityrocarpa_moniliformis_Walter6658	Pityrocarpa_moniliformis_Way2449_FJ982242	Pityrocarpa_moniliformis_Way2449_KT364162
		Pityrocarpa_moniliformis_Way2449_KT364067		Pityrocarpa_moniliformis_Way2449_KT364002		
				Pityrocarpa_moniliformis_KewSeedCollection0049052_AF278496		
Pityrocarpa obliqua subs obliqua	Pityrocarpa_obliqua_obliqua_1	Pityrocarpa_obliqua_Delgadillo137	Pityrocarpa_obliqua_Delgadillo137	Pityrocarpa_obliqua_Delgadillo137		Pityrocarpa_obliqua_Delgadillo137
				Pityrocarpa_obliqua_obliqua_Ibassa5758		
	Pityrocarpa_obliqua_obliqua_2	Pityrocarpa_obliqua_Macqueen439_KT364068	Pityrocarpa_obliqua_obliqua_Ibassa5758	Pityrocarpa_obliqua_Macqueen439_KT364003	Pityrocarpa_obliqua_Macqueen439_FJ982243	Pityrocarpa_obliqua_Macqueen439_KT364206
Pityrocarpa obliqua subs brasiliensis	Pityrocarpa_obliqua_brasiliensis_1	Pityrocarpa_obliqua_brasiliensis_Queiroz12903		Pityrocarpa_obliqua_brasiliensis_Queiroz12903		Pityrocarpa_obliqua_brasiliensis_Queiroz12903

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
	Pityrocarpa_obliqua_brasiliensis_2	Pityrocarpa_obliqua_brasiliensis_Queiroz13003	Pityrocarpa_obliqua_brasiliensis_Queiroz13003	Pityrocarpa_obliqua_brasiliensis_Queiroz13003		Pityrocarpa_obliqua_brasiliensis_Queiroz13003
Pseudopiptadenia bahiana	Pseudopiptadenia_bahiana_1	Pseudopiptadenia_bahiana_Melo138	Pseudopiptadenia_bahiana_Melo138	Pseudopiptadenia_bahiana_Melo138	Pseudopiptadenia_bahiana_Melo138	Pseudopiptadenia_bahiana_Melo138
	Pseudopiptadenia_bahiana_2	Pseudopiptadenia_bahiana_Queiroz15381	Pseudopiptadenia_bahiana_Queiroz15381	Pseudopiptadenia_bahiana_Queiroz15381	Pseudopiptadenia_bahiana_Queiroz15381	Pseudopiptadenia_bahiana_Queiroz15381
	Pseudopiptadenia_bahiana_3	Pseudopiptadenia_bahiana_Queiroz15504	Pseudopiptadenia_bahiana_Queiroz15504	Pseudopiptadenia_bahiana_Queiroz15504	Pseudopiptadenia_bahiana_Queiroz15504	Pseudopiptadenia_bahiana_Queiroz15504
					Pseudopiptadenia_bahiana_Coradin8580_KT364110	
Pseudopiptadenia brenanii	Pseudopiptadenia_brenanii_1	Pseudopiptadenia_brenanii_Borges680_KT364069		Pseudopiptadenia_brenanii_Borges680_KT364004	Pseudopiptadenia_brenanii_Borges680_KT364111	
	Pseudopiptadenia_brenanii_2	Pseudopiptadenia_brenanii_Cardoso2807	Pseudopiptadenia_brenanii_Cardoso2807	Pseudopiptadenia_brenanii_Cardoso2807	Pseudopiptadenia_brenanii_Cardoso2807	Pseudopiptadenia_brenanii_Cardoso2807
	Pseudopiptadenia_brenanii_3	Pseudopiptadenia_brenanii_Harley56005	Pseudopiptadenia_brenanii_Harley56005	Pseudopiptadenia_brenanii_Harley56005	Pseudopiptadenia_brenanii_Queiroz15585	Pseudopiptadenia_brenanii_Harley56005
	Pseudopiptadenia_brenanii_4	Pseudopiptadenia_brenanii_Queiroz15585	Pseudopiptadenia_brenanii_Queiroz15585	Pseudopiptadenia_brenanii_Queiroz15585	Pseudopiptadenia_brenanii_Sevilha4287_KT364112	Pseudopiptadenia_brenanii_Queiroz15585
						Pseudopiptadenia_brenanii_Sevilha4287_KT364216
Pseudopiptadenia contorta	Pseudopiptadenia_contorta_1		Pseudopiptadenia_contorta_Pifano427	Pseudopiptadenia_contorta_Queiroz3366_DQ784676		Pseudopiptadenia_contorta_Pifano427
	Pseudopiptadenia_contorta_2	Pseudopiptadenia_contorta_Queiroz15582	Pseudopiptadenia_contorta_Queiroz15582	Pseudopiptadenia_contorta_Queiroz15582	Pseudopiptadenia_contorta_Queiroz15582	Pseudopiptadenia_contorta_Queiroz15582_KX302348
						Pseudopiptadenia_contorta_Queiroz3366_DQ790636
	Pseudopiptadenia_contorta_3			Pseudopiptadenia_contorta_Queiroz15507_KT364005	Pseudopiptadenia_contorta_Queiroz15507_KT364113	Pseudopiptadenia_contorta_Queiroz15507_KT364155
Pseudopiptadenia inaequalis	Pseudopiptadenia_inaequalis					Pseudopiptadenia_inaequalis_Foli6203
			Pseudopiptadenia_marliae_Farias39			Pseudopiptadenia_marliae_Farias39

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
Pseudopiptadenia spnovA_1	Pseudopiptadenia_spnovA_1	Pseudopiptadenia_marliae_Neves1675	Pseudopiptadenia_marliae_Neves1675	Pseudopiptadenia_marliae_Neves1675	Pseudopiptadenia_marliae_Neves1675	Pseudopiptadenia_marliae_Neves1675
Pseudopiptadenia spnovA_2	Pseudopiptadenia_spnovA_2	Pseudopiptadenia_marliae_Ribeiro351	Pseudopiptadenia_marliae_Ribeiro351	Pseudopiptadenia_marliae_Ribeiro351		Pseudopiptadenia_marliae_Ribeiro351
Pseudopiptadenia nitida	Pseudopiptadenia_nitida		Pseudopiptadenia_nitida_Queiroz12874			Pseudopiptadenia_nitida_Queiroz12874
Pseudopiptadenia psilostachya	Pseudopiptadenia_psilostachya	Pseudopiptadenia_psilostachya_Simon1245_KT364070		Pseudopiptadenia_psilostachya_Simon1245_KT364006	Pseudopiptadenia_psilostachya_Simon1245_KT364114	Pseudopiptadenia_psilostachya_Simon1245_KT364170
Pseudopiptadenia suaveolens	Pseudopiptadenia_suaveolens			Pseudopiptadenia_suaveolens_Mori24790_DQ784677		Pseudopiptadenia_suaveolens_Mori24790_DQ790637
Pityrocarpa spnvov	Pityrocarpa_spnvov		Pseudopiptadenia_unijuga_Demuner4917	Pseudopiptadenia_unijuga_Demuner4917	Pseudopiptadenia_unijuga_Demuner4917	Pseudopiptadenia_unijuga_Demuner4917
			Pseudopiptadenia_warmingii_Santos3060	Pseudopiptadenia_warmingii_Reitz5608	Pseudopiptadenia_warmingii_Santos3060	Pseudopiptadenia_warmingii_Reitz5608
						Pseudopiptadenia_warmingii_Santos3060
						Pseudopiptadenia_warmingii_Saraiva4
Senegalia nigrescens	Senegalia_nigrescens	Senegalia_nigrescens_Maurin255_JQ265858		Senegalia_nigrescens_Maurin255_GQ872282		Senegalia_nigrescens_Maurin255_GQ872237
Stryphnodendron adstringens	Stryphnodendron_adstringens	Stryphnodendron_adstringens_Scalon260_KT364074		Stryphnodendron_adstringens_Scalon260_KT364007	Stryphnodendron_adstringens_Scalon260_KT364118	Stryphnodendron_adstringens_Scalon260_KT364188
		Stryphnodendron_adstringens_Scalon263_KT364073		Stryphnodendron_adstringens_Scalon263_KT364009	Stryphnodendron_adstringens_Scalon263_KT364117	Stryphnodendron_adstringens_Scalon263_KT364165
		Stryphnodendron_adstringens_Scalon407_KT364071		Stryphnodendron_adstringens_Scalon407_KT364010	Stryphnodendron_adstringens_Scalon407_KT364115	Stryphnodendron_adstringens_Scalon407_KT364197
		Stryphnodendron_adstringens_Souza29702_KT364072		Stryphnodendron_adstringens_Souza29702_KT364008	Stryphnodendron_adstringens_Souza29702_KT364116	Stryphnodendron_adstringens_Souza29702_KT364198
				Stryphnodendron_coriaceum_Brito343_DQ784679	Stryphnodendron_coriaceum_Scalon716_KT364119	Stryphnodendron_coriaceum_Brito343_DQ790639

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
				Stryphnodendron_coriaceum_Scalon716_KT364011		Stryphnodendron_coriaceum_Scalon716_KT364199
Stryphnodendron coriaceum	Stryphnodendron_coriaceum	Stryphnodendron_coriaceum_Scalon718_KT364075		Stryphnodendron_coriaceum_Scalon718_KT364012	Stryphnodendron_coriaceum_Scalon718_KT364120	Stryphnodendron_coriaceum_Scalon718_KT364200
Stryphnodendron cristalinae	Stryphnodendron_cristalinae			Stryphnodendron_cristalinae_Scalon706_KT364013	Stryphnodendron_cristalinae_Scalon706_KT364121	Stryphnodendron_cristalinae_Scalon706_KT364189
Stryphnodendron duckeanum	Stryphnodendron_duckeanum_1	Stryphnodendron_duckeanum_Simon1343_KT364076		Stryphnodendron_duckeanum_Simon1343_KT364014	Stryphnodendron_duckeanum_Simon1343_KT364122	Stryphnodendron_duckeanum_Simon1343_KT364166
	Stryphnodendron_duckeanum_2			Stryphnodendron_duckeanum_Simon1606_KT364015	Stryphnodendron_duckeanum_Simon1606_KT364123	Stryphnodendron_duckeanum_Dionizia118_DQ790615
				Stryphnodendron_duckeanum_Dionizia118_DQ784658		
Stryphnodendron fissuratum	Stryphnodendron_fissuratum	Stryphnodendron_fissuratum_Ivanauskas_sn_KT364077		Stryphnodendron_fissuratum_Ivanauskas_sn_KT364016	Stryphnodendron_fissuratum_Ivanauskas_sn_KT364124	Stryphnodendron_fissuratum_Ivanauskas_sn_KT364175
				Stryphnodendron_fissuratum_Killeen1158_DQ784680		Stryphnodendron_fissuratum_Killeen1158_DQ790640
Stryphnodendron foreroi	Stryphnodendron_foreroi	Stryphnodendron_foreroi_Assis1143_KT364079		Stryphnodendron_foreroi_Assis1143_KT364018	Stryphnodendron_foreroi_Assis1143_KT364126	Stryphnodendron_foreroi_Assis1143_KT364201
		Stryphnodendron_foreroi_Simon2054_KT364078		Stryphnodendron_foreroi_Simon2054_KT364017	Stryphnodendron_foreroi_Simon2054_KT364125	Stryphnodendron_foreroi_Simon2054_KT364164
Stryphnodendron gracile	Stryphnodendron_gracile	Stryphnodendron_gracile_Scalon458_KT364080		Stryphnodendron_gracile_Scalon458_KT364019	Stryphnodendron_gracile_Scalon458_KT364127	Stryphnodendron_gracile_Scalon458_KT364177
		Stryphnodendron_guianense_Scalon728		Stryphnodendron_guianense_Scalon728	Stryphnodendron_guianense_Scalon728	Stryphnodendron_guianense_Scalon728
Stryphnodendron heringeri	Stryphnodendron_heringeri			Stryphnodendron_heringeri_Scalon710_KT364129	Stryphnodendron_heringeri_Scalon710_KT364129	Stryphnodendron_heringeri_Scalon710_KT364190
				Stryphnodendron_heringeri_Simon1110_K	Stryphnodendron_heringeri_Simon1110_KT36	Stryphnodendron_heringeri_Simon1110_KT364159

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
				T364020	4128	
Stryphnodendron occhionianum	**Stryphnodendron_obovatum**	Stryphnodendron_obovatum_Scalon701_KT364082		Stryphnodendron_obovatum_Scalon701_KT364023	Stryphnodendron_obovatum_Scalon701_KT364131	Stryphnodendron_obovatum_Scalon701_KT364183
		Stryphnodendron_obovatum_Scalon712_KT364081		Stryphnodendron_obovatum_Scalon712_KT364022	Stryphnodendron_obovatum_Scalon712_KT364130	Stryphnodendron_obovatum_Scalon712_KT364182
Stryphnodendron occhionianum	**Stryphnodendron_occhionianum**	Stryphnodendron_occhionianum_Ribeiro1219	Stryphnodendron_occhionianum_Ribeiro1219	Stryphnodendron_occhionianum_Ribeiro1219	Stryphnodendron_occhionianum_Ribeiro1219	Stryphnodendron_occhionianum_Ribeiro1219
		Stryphnodendron_occhionianum_Simon1597_KT364083		Stryphnodendron_occhionianum_Simon1597_KT364024	Stryphnodendron_occhionianum_Simon1597_KT364132	Stryphnodendron_occhionianum_Simon1597_KT364157
Stryphnodendron paniculatum	**Stryphnodendron_paniculatum**	Stryphnodendron_paniculatum_Scalon726_KT364085		Stryphnodendron_paniculatum_Scalon726_KT364026	Stryphnodendron_paniculatum_Scalon726_KT364134	Stryphnodendron_paniculatum_Scalon726_KT364174
		Stryphnodendron_paniculatum_Simon1058_KT364084		Stryphnodendron_paniculatum_Simon1058_KT364025	Stryphnodendron_paniculatum_Simon1058_KT364133	Stryphnodendron_paniculatum_Simon1058_KT364156
				Stryphnodendron_polyphyllum_Forzza3766_KT364027	Stryphnodendron_polyphyllum_Forzza3766_KT364135	Stryphnodendron_polyphyllum_Forzza3766_KT364174
Stryphnodendron polyphyllum	**Stryphnodendron_polyphyllum**	Stryphnodendron_polyphyllum_MelloSilva2659_KT364086		Stryphnodendron_polyphyllum_MelloSilva2659_KT364028	Stryphnodendron_polyphyllum_MelloSilva2659_KT364136	Stryphnodendron_polyphyllum_MelloSilva2659_KT364184
				Stryphnodendron_polyphyllum_Queiroz15673_KT364041	Stryphnodendron_polyphyllum_Queiroz15673_KT364149	Stryphnodendron_polyphyllum_Queiroz15673_KT364204
				Stryphnodendron_polystachyum_Sabatier3758_DQ784681		Stryphnodendron_polystachyum_Sabatier3758_DQ790641
				Stryphnodendron_porcatum_Neill14001_DQ784682		Stryphnodendron_porcatum_Neill14001_AY944564
Stryphnodendron pulcherrimum	**Stryphnodendron_pulcherrimum**	Stryphnodendron_pulcherrimum_Queiroz15487	Stryphnodendron_pulcherrimum_Queiroz15487	Stryphnodendron_pulcherrimum_Queiroz15482_KT364042	Stryphnodendron_pulcherrimum_Queiroz15482_KT364150	Stryphnodendron_pulcherrimum_Queiroz15482_KT364186
		Stryphnodendron_pulcherrimum_Scalon723_KT36408		Stryphnodendron_pulcherrimum_Queiroz	Stryphnodendron_pulcherrimum_Queiroz154	Stryphnodendron_pulcherrimum_Scalon723_KT364191

SPECIES	**NAME OF ACCESSION**	**ITS**	**ETS**	**trnLF**	**trnDT**	**matK**
		8		15487_KT364043	87_KT364151	
		Stryphnodendron_pulcherrimum_Scalon725_KT364089		Stryphnodendron_pulcherrimum_Scalon723_KT364031	Stryphnodendron_pulcherrimum_Scalon723_KT364139	Stryphnodendron_pulcherrimum_Scalon725_KT364192
		Stryphnodendron_pulcherrimum_Simon980_KT364087		Stryphnodendron_pulcherrimum_Scalon725_KT364032	Stryphnodendron_pulcherrimum_Scalon725_KT364140	Stryphnodendron_pulcherrimum_Simon980_KT364167
				Stryphnodendron_pulcherrimum_Simon980_KT364029	Stryphnodendron_pulcherrimum_Simon980_KT364137	Stryphnodendron_pulcherrimum_Souza30717_KT364203
				Stryphnodendron_pulcherrimum_Souza30717_KT364030	Stryphnodendron_pulcherrimum_Souza30717_KT364138	
				Stryphnodendron_pumilum_Scalon709_KT364141	Stryphnodendron_pumilum_Scalon709_KT364141	Stryphnodendron_pumilum_Scalon709_KT364178
				Stryphnodendron_racemiferum_Scalon727_KT364034	Stryphnodendron_racemiferum_Scalon727_KT364142	Stryphnodendron_racemiferum_Scalon727_KT364176
		Stryphnodendron_roseiflorum_Romao987_KT364091		Stryphnodendron_roseiflorum_Romao987_KT364036	Stryphnodendron_roseiflorum_Romao987_KT364144	Stryphnodendron_roseiflorum_Romao987_KT364179
Stryphnodendron roseiflorum	**Stryphnodendron_roseiflorum**	Stryphnodendron_roseiflorum_Scalon728_KT364090		Stryphnodendron_roseiflorum_Scalon728_KT364035	Stryphnodendron_roseiflorum_Scalon728_KT364143	Stryphnodendron_roseiflorum_Scalon728_KT364193
				Stryphnodendron_rotundifolium_Queiroz15523_KT364037	Stryphnodendron_rotundifolium_Queiroz15523_KT364145	Stryphnodendron_rotundifolium_Queiroz15523_KT364180
Stryphnodendron rotundifolium	**Stryphnodendron_rotundifolium**	Stryphnodendron_rotundifolium_Scalon250_KT364095		Stryphnodendron_rotundifolium_Scalon250_KT364040	Stryphnodendron_rotundifolium_Scalon250_KT364148	Stryphnodendron_rotundifolium_Scalon250
		Stryphnodendron_rotundifolium_Souza30040_KT364096		Stryphnodendron_rotundifolium_Souza30040_KT386300	Stryphnodendron_rotundifolium_Souza30040_KT386298	Stryphnodendron_rotundifolium_Souza30040_KT386297
						Stryphnodendron_rotundifolium_Walter_2913_DQ790643
		Stryphnodendron_rotundifolium_villosum_Scalon704_KT364092		Stryphnodendron_rotundifolium_villosum_Scalon704_KT36403	Stryphnodendron_rotundifolium_villosum_Scalon704_KT364146	Stryphnodendron_rotundifolium_villosum_Scalon704_KT364185

SPECIES	NAME OF ACCESSION	ITS	ETS	trnLF	trnDT	matK
				8		
		Stryphnodendron_rotundifolium_villosum_Scalon715_KT364094		Stryphnodendron_rotundifolium_villosum_Scalon715_KT364039	Stryphnodendron_rotundifolium_villosum_Scalon715_KT36414	Stryphnodendron_rotundifolium_villosum_Scalon715_KT364194
Stryphnodendron velutinum	**Stryphnodendron_velutinum**	Stryphnodendron_velutinum_Scalon719_KT364101		Stryphnodendron_velutinum_Scalon719_KT364045	Stryphnodendron_velutinum_Scalon719_KT364153	Stryphnodendron_velutinum_Scalon719_KT364187
		Stryphnodendron_velutinum_Scalon720_KT364102		Stryphnodendron_velutinum_Scalon720_KT364046	Stryphnodendron_velutinum_Scalon720_KT364154	Stryphnodendron_velutinum_Scalon720_KT364181
Vachellia farnesiana	**Vachellia_farnesiana**	Vachellia_farnesiana_Murphy_sn_AF360728		Vachellia_farnesiana_Meimberg101_AY574119		Vachellia_farnesiana_Entwisle2708_AF523115

Table 2 Voucher information and GenBank accession numbers for DNA sequences used in this study

Kyalangalilwa et al. 2013; Jobson and Luckow 2007; Simon et al. 2011, 2016; LPWG 2017). Voucher information and GenBank accession numbers are provided in the Table 1.

DNA Extraction, amplification and sequencing— For specimens from silica gel-dried leaves, the total genomic DNA was extracted using the 2× CTAB (cetyl trimethylammonium bromide) protocol of Doyle and Doyle (1987). For herbarium samples, DNA was extracted using the DNeasy Plant Mini Kit Kits (Qiagen, Santa Clarita, California), and for samples with difficulty extraction, to obtain a better DNA quality was better using the sorbitol cleansing protocol (Souza et al. 2012).

Five DNA regions were selected for this study: *trnK*/*matK* (the *matK* gene and partial flanking *trnK* introns), *trnL-trnF* (including *trnL* intron), *trnD-trnT* spacer from plastid genome, and the nuclear ribosomal Internal Transcribed Spacers (ITS1 and ITS2) and the intervening 5.8S region (nrITS/5.8S) and ribosomal nuclear ETS (partial 161 50 end of the 18S ribosomal RNA gene and part of the External 162 Transcribed Spacer).

To amplification of the *matK*/*trnK* locus (Table 2) was performed in two reactions with the set of primers *trnK*685F/1159R and *matK*1100L/t*rnK*2R or in three reactions with the set of primers *trnK*685F/*matK*4LR, *matK*4La/*matK*1932R and *matK*1100L/*trnK*2R* (Hu et al. 2000; Wojciechowski et al. 2004). The amplification of the *trnD-trnT* region (Shaw et al. 2005) used primers *trnD*2, *trnE*, *trnT*, and *trnY* as described in Simon et al. (2011) or by using the internal primers *trnDti* and *trnDtiR* (Pennington, RBG–Edinburgh, unpublished data) in combination with the external primers *trnT* and *trnD*, respectively. The *trnL-trnF* region (including the *trnL* intron and the *trnL-trnF* intergenic spacer) was amplified in two reactions, using a combination of the universal primers “c” and “d”, and “e” and “f” (Taberlet & al. 1991), respectively. For the nrITS/5.8S region we used the ITS5p and

Table 2. Sequence of the primers used for PCR amplification and sequencing, respective references and PCR conditions.

DNA region	Primer name	Primer Sequence 5'–3'	Reference	PCR Conditions					
				Pre-melting	Denaturation (I)	Primer Annealing (II)	Primer Extension (III)	Cycles (I + II + III)	Final Extension
ETS	18S-IGS	GAGACAAGCATATGACTACTGGCAGGATCAACCAG	Baldwin and Markos (1998)	94 °C (3 min)	94 °C (1 min)	55 °C (1 min)	72 °C (1.5 min)	30	72 °C (7 min)
	ETS-Dio	GCTTGTGCATCGAACGGTTGG	Qeiroz et al. (2015)						
ITS	17SE (F)	ACG AAT TCA TGG TCC GGT GAA GTG TTC G	Sun et al. (1994)	94 °C (3 min)	94 °C (1 min)	52 °C (40 s)	72 °C (2.5 min)	28	72 °C (7 min)
	26SE (R)	TAG AAT TCC CCG GTT CGC TCG CCG TTA C	Sun et al. (1994)						
	SSF	GTCGTAACAAGGTTTCCGTAG	Kollipara et al. (1997) modified	Following manufacturer's protocol for sequencing					
	LSR	GTTAGTTTCTTTTCCTCC	Kollipara et al. (1997)						
trnK/matK	matK685F	GTATCGCACTATGTATTATTTGA	Wojciechowski et al. (2004)	94 °C (3 min)	94 °C (40 s)	55 °C (45 s)	72 °C (1 min)	36	72 °C (7 min)
	matK4La	CCTTCGATACTGGGTGAAAGAT	Wojciechowski et al. (2004)						
	matK1100L	TTCAGTGGTACGGAGTCAAATG	Wojciechowski et al. (2004)						
	matK4R	CATCTTTCACCCAGTAGCGAAG	Hu et al. (2000)						
	matK1932R	CAGACCGGCTTACTAATGGG	Hu et al. (2000)						
	trnK2R	CCCGGAACTAGTCGGATG	Wojciechowski et al. (2004)						
trnL_F	trnL-C	CGAAATCGGTAGACGCTACG	Taberlet et al. 1991	94 °C (3 min)	94 °C (40 s)	55 °C (45 s)	72 °C (1 min)	36	72 °C (7 min)
	trnL-D	GGGGATAGAGGGACTTGAAC	Taberlet et al. 1991						
	trnL-E	GGTTCAAGTCCCTCTATCCC	Taberlet et al. 1991						
	trnL-F	ATTTGAACTGGTGACACGAG	Taberlet et al. 1991						
trnD-T	trnD	ACCAATTGAACTACAATCCC	Demesure et al. 1995	94 °C (3 min)	94 °C (40 s)	55 °C (45 s)	72 °C (1 min)	36	72 °C (7 min)
	trnT	CTACCACTGAGTTAAAAGGG	Demesure et al. 1995						
	trnE	AGGACATCTCTCTTTCAAGGAG	Shaw et al. 2005						
	trnY	CCGAGCTGGATTTGAACCA	Shaw et al. 2005						

ITS8p (Möller and Cronk 1997), ITS1 and ITS4 (White et al. 1990) or 17SE and 26SE (Sun et al. 1994) primers, and for ETS (Ariati et al. 2005, Baldwin & Markos 1998)

Polymerase Chain Reactions (PCR) was performed using the TopTaq Master Mix Kit (QIAGEN GmbH, Hilden, Germany) according to the manufacturer's protocol, for a final volume of 10-15 μL. For herbarium samples, PCR reactions also included 2 μL of TBT-PAR [trealose, bovine serum albumin (BSA), polysorbate-20 (Tween-20)] (Samarakoon et al. 2013). For the nrITS/5.8S amplification, DMSO (dimethyl sulfoxide; 2% of the preparation volume) and 1 M betaine were added in order to avoid secondary conformations. Program of PCR see table 2.

PCR products were purified using the QIAquick kit (Qiagen, Hilden, Germany), by enzymatic treatments with Exonuclease I and alkaline shrimp phosphatase (kit ExoSapIT, GE Healthcare, Buckinghamshire, UK) or using PEG 11% (Paithankar and Prasad 1991). Sequencing reactions in both directions were performed with the same primers used for amplifications and the Big Dye Terminator kit version 3.1 (Applied Biosystems, Austin, Texas, USA). The products of sequencing were analysed in a sequencer 3130 XL Genetic Analyzer (Applied Biosystems) at the Laboratório de Sistemática Molecular de Plantas (LAMOL) of the Universidade Estadual de Feira de Santana, Bahia, Brazil or at the Laboratório de Genética Vegetal (LGV/CEN- EMBRAPA), Brasília, Brazil.

Alignment and phylogenetic analyses—Complementary strands were combined and base-calling verified with the Staden package (Staden et al. 2003). We have performed all alignments manually in SeaView version 4 (Gouy et al. 2010), using the similarity criterion of Kelchner (2000) to avoid inconsistencies derived from automated multiple alignment. The relatively high number of indels in the *matK* matrix was aligned by in looking for homologies among amino acid translated sequences (Wojciechowski et al. 2004)

Incongruences between plastid and nuclear DNA markers were assessed by comparing clade parsimony bootstrap supports to identify clade conflict between the DNA partitions (Wiens, 1998). We did not find evidence of strong conflict between the individual data partitions (i.e., incongruent clades with bootstrap supports >80%) and thus they were assembled for nuclear (nrITS/5.8S; 125 taxa, 910 characters), plastid (*matk/trnK*, 243 taxa, 1969 characters; *trnD-trnT*, 134 taxa, 1629 character; *trnL-F*; 173 taxa, 1217 characters), and combined (nuclear + plastid; 130 taxa, 6216 characters) datasets (Table 3). We have avoided the parsimony-based partition homogeneity test (incongruence length difference test; Farris et al., 1994), because it has been proven to produce misleading results (Dolphin et al., 2000; Yoder et al., 2001; Barker and Lutzoni, 2002).

Maximum Parsimony (MP) analyses were carried out in PAUP* v.4.0b10 for Windows (Swofford 2002) using Fitch parsimony (all characters unordered and equally weighted; Fitch 1971). The search for the most parsimonious trees (MPTs) was carried out using a heuristic search, 1000 random taxon-addition, and tree bisection-reconnection (TBR) branch swapping, saving 15 trees per replicate. Trees saved in this first round were used as starting trees in a second search using the same parameters, but saving a maximum of 10,000 trees. Clade support was estimated with non-parametric bootstrapping (Felsenstein 1985) with 2000 pseudoreplications, simple taxon-addition and TBR branch swapping, saving 15 trees per pseudoreplicate.

Maximum likelihood (ML) analyses were carried out using RAxML v.8 (Stamatakis 2014) using GTRCAT evolutionary model and estimating gamma distribution

Table 3. Features of the DNA data sets used in this study based on one of the most parsimonious trees from the combined parsimony analysis, and nucleotide substitution models selected for the Bayesian analyses. (N = accessions; bp = base pairs; CI = consistency index; RI = retention index)

Dataset		N	Length (bp)	Parsimony informative characters	Tree stattistics in MP analyses			
	Bayesian model				Most Parsimonious trees (n)	Tree length	CI	RI
ITS/5.8S	GTR + I + Γ/ K80 + Γ for the 5.8S region.	125	910	294 (32.31%)	10000*	1827	0.3924	0.8108
ETS	GTR+I+ Γ	83	551	220 (39.93%)	24	874	0.4851	0.8506
matK	GTR + Γ	243	1969	356 (18.08%)	10000*	900	0.6700	0.9095
trnL-F	GTR + Γ	173	1217	194 (15.94%)	10000*	483	0.7495	0.9121
trnD-T	GTR + I + Γ	134	1629	178 (10.93%)	10000*	860	0.8744	0.9037
ITS + ETS + *matK* + *trnL-F* + *trnD-T*	Mixed	130	6216	1100 (17.70%)	10000*	4509	0.5844	0.8268

* maximum number of trees.

and invariant sites during the run. Clade supports were assessed using 1000 rapid bootstrap replicates.

Bayesian analyses were carried out using MrBayes v.3.2.6 (Ronquist and Huelsenbeck 2003, Ronquist et al. 2012) with uniform priors and a random starting tree. Best-fit substitution models were selected for each dataset using the Akaike information criterion implemented using MrModeltest v.2.3 (Nylander 2004; Table 3).Two separate runs of a Metropolis-coupled Markov Chain Monte Carlo (MCMC) permutation of parameters were each initiated with a random tree and eight simultaneous chains set at default temperatures (Ronquist and Huelsenbeck, 2003). Two simultaneous Monte Carlo Markov Chains (MCMC) were run for 10^7 generations sampling one tree each 10^3 generations. Convergence of runs was tested by inspecting whether the standard deviation of split frequencies of the runs was <0.01 and by using the effective sample sizes (ESS) >200 as calculated with Tracer v.1.5 (Rambaut and Drummond, 2007). We then used MrBayes command "sumt" to summarize trees sampled from post burn-in generations into a 50% majority rule consensus tree that included posterior probabilities (PP) as branch support estimates.

Bayesian and ML analyses were run in the Cyber infrastructure for Phylogenetic Research (Cipres Science Gateway, Miller at al. 2010). MP strict consensus trees, ML trees and Bayesian 50% majority-rule consensus trees were visualized and partially edited in FigTree v. 1.4 (Rambaut 2012).

Phylogenetic relationships – The charateristics and results from maximum parsimony (MP), maximum likelihood (ML) and Bayesian (IB) analyses for the nuclear, plastid and combined datasets are presented in Table 3. The phylogenetic trees of individual nuclear and plastid sequences were poorly resolved and had mostly low support values. We then will present and discuss the results from the analyses of the combined dataset showing the ML, MP and IB trees, but most of the discussion is based on the ML tree because it was better resolved (Figure 1-3).

Taxonomic Revision **–** Field expeditions were carried out between November 2014 and November 2015 covering several Brazilian regions, but focused on the Brazilian Amazonia, extending to the Peruvian and Colombian Amazonia. The plants collected were treated appropriately and incorporated into HUEFS herbarium collection.

The taxa studied were characterized morphologically based on field observations and analysis of dehydrated material from the herbaria. Approximately 10,000 exsicates were analysed from the following herbaria: ALCB, ANDES, ASE, BHCB, BOG, CEN, CEPEC, CGMS, COAH, COL, CVRD, CUZ, EAC, EBDA, F, FLOR, G, HAF, HAS, HST*, HUCS, HUEFS, IAN, IBGE, ICN, ILL, INPA, IPA, JPB, K, LE, M, MAC, MBM, MBML, MG, MO, MOL, MUFAL*, NY, OUPR, P, PACA, PEUFR, QAP, QCEN, R, RB, SLS, SMF, SP, SPF, TEPB, UB, UEC, UDBC, UFG, UFMA, UFMS, UFMT, UFP, UFRN, US, USM, VIES (acronyms according to Thiers 2015, continuously updated; *=not in Thiers 2015).

Nomenclature decisions were based on the International Code of Botanical Nomenclature (ICBN, MCNeil et al., 2006). Valid names of the species were defined through consult to the original protologues and material-type. The International Plant Name Index (IPNI 2011) was consulted to see the name of authors and abreviations. We adopted the Code recommendations of prioritizing the best material that agrees with the diagnosis (Art 9.2, note 2), and when it is possible to choose the material with evidence that was analysed by the author of publication. For the types indicated, it was chosen to display the barcode number of the samples, where available, in order to avoid ambiguities.

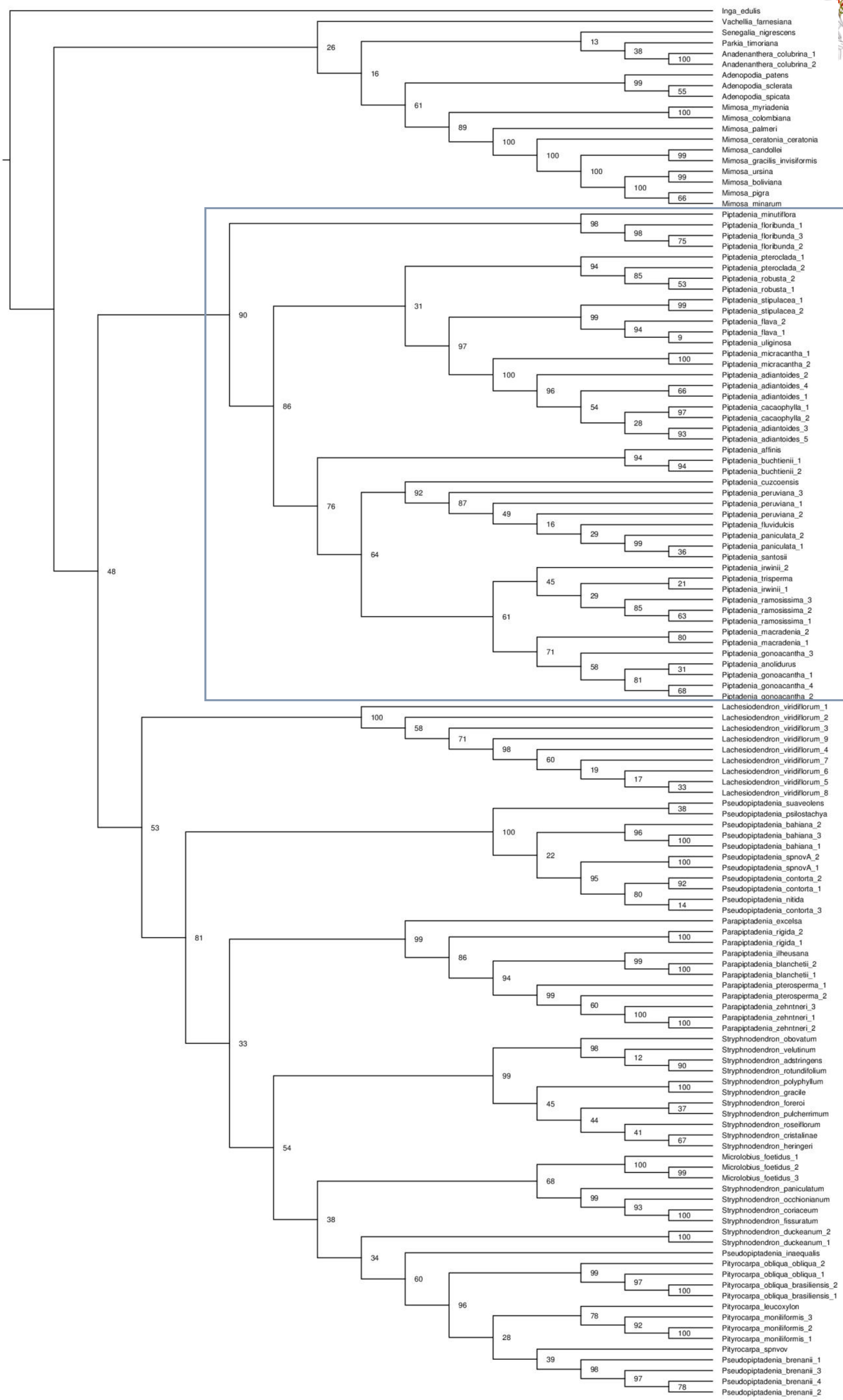


Fig 1.Maximum likelihood (ML) tree from the analysis of the combined nuclear (ITS/5.8S, ETS) and plastid (*matK/trnK*, *trnD-trnT*, *trnL-trnF*) datasets of the Piptadenia group.

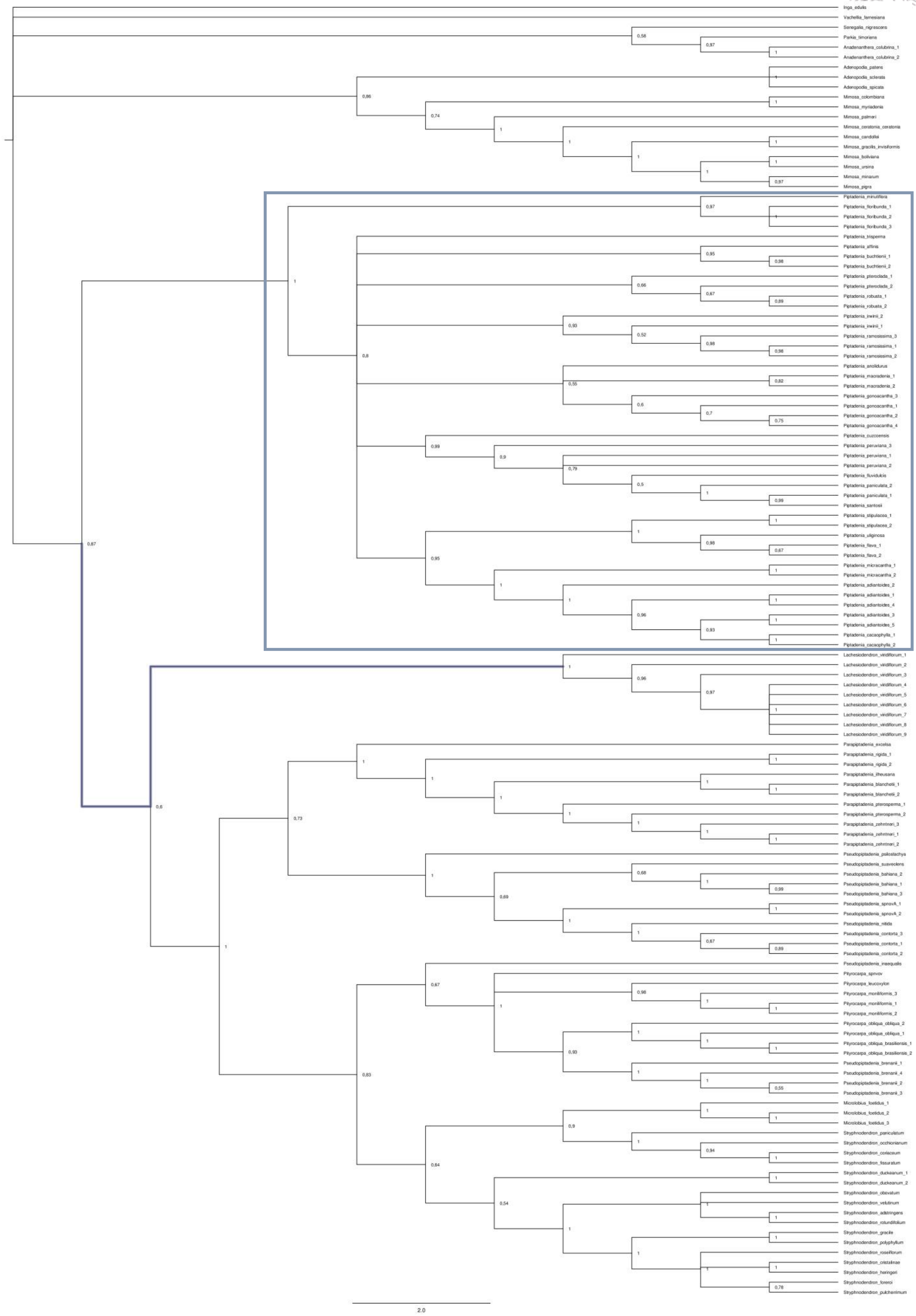


Fig 2 Majority-rule consensus tree from the Bayesian analysis of the combined nuclear (ITS/5.8S, ETS) and plastid (*matK/trnK*, *trnD-trnT*, *trnL-trnF*) datasets of the Piptadenia group.

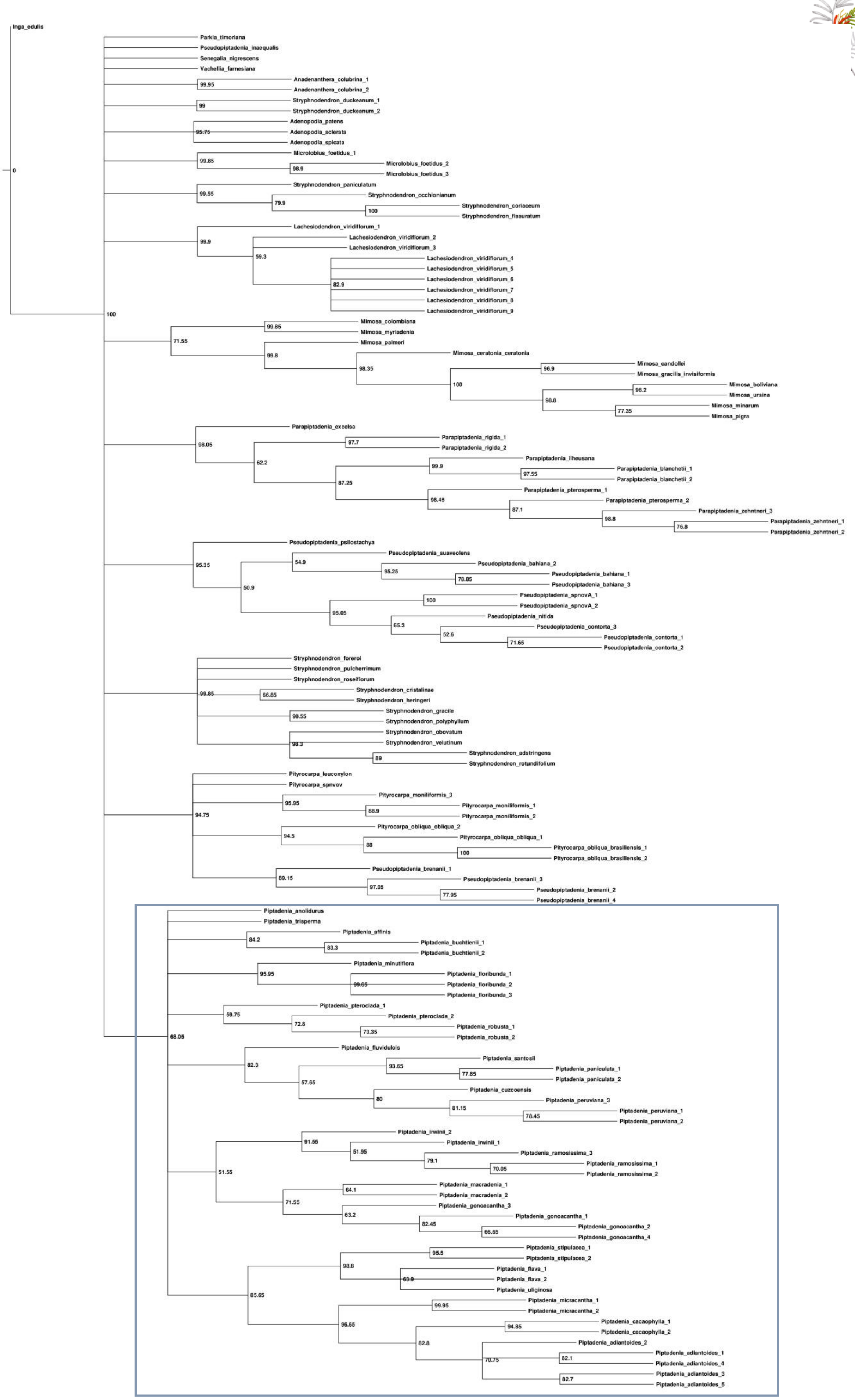


Fig 3 Maximum parsimony (MP) tree fot the analysis of the combined nuclear (ITS/5.8S, ETS) and plastid (*matK/trnK*, *trnD-trnT*, *trnL-trnF*) datasets of the Piptadenia group.

The terms *nomen novum* (*nom. nov*.), *nomen nudum* (*noom. nud*.), *nomen illegitimus* (*nom. illeg.*) followed articles 6, 14, 50, 52, 53 and 54 of the ICBN (McNeill et al., 2006)

Terminologies used for morphology were based on Font Quer (1953), Radford et al. (1974), Harris & Harris (1994).

Vernacular names, phenological data (flowering or fruiting), as well as data on vegetation, altitude and geographic coordinates were obtained from the labels of the studied materials. Neotropical biomes adopted to map species distribution followed Queiroz et al. (submitted; adapted from Olson et al. 2001).

The photographs of details of the general morphology of the species were obtained with a photographic camera coupled to the LEICA M60 stereomicroscope, from herbaria materials in the HUEFS or some loan materials to this collection.

The geographic distribution maps of the species were made based on the geographic coordinates obtained from the sheet labels, or for those missing data a search was made to the site (https://www.gps-coordinates.net/). The database was handled in ACCESS and processed in the ArcView GIS 3.2 program to produce distribution maps (ESRI 1999).

***Identification key* –**We prepared an identification key for *Piptadenia* species prioritizing vegetative data and calling attention to morphological details of extreme taxonomic importance for identification of these species, such as branches, foliar nectaries, and prickles. When possible we included geographic distribution data in the key.

RESULTS AND DISCUSSION

The monophyly of *Piptadenia* s.s. is highly supported in all analyses after the exclusion of *P. viridiflora* (PP 1, BS ML 90, BS MP 68; Fig 1-3; CAPÍTULO 1). The multiple accessions of some species individually coalesced as monophyletic and *Piptadenia* clade appear as sister to a large clade bringing together the genus *Lachesiodendron* and the major part of the species of Piptadenia group with the genera *Microlobius*, *Parapiptadenia*, *Pityrocarpa*, *Pseudopiptadenia*, and *Stryphnodendron*, named the MPPPS clade (Ribeiro et al 2017 submitted, CAPÍTULO 1) was supported (PP 1, BS ML 96, BS MP 82).

TAXONOMIC TREATMENT

In this review 23 taxons (including variety) of Piptadenia were recognized: *Piptadenia adiantoides* (Spreng.) J.F.Macbr, *Piptadenia affinis* Burkart, *Piptadenia anolidurus* Barneby, *Piptadenia buchtienii* Barneby, *Piptadenia cuzcoënsis* Barneby, *Piptadenia flava* (DC.) Benth, *Piptadenia floribunda* Kleinhoonte, *Piptadenia gonoacantha* (Mart.) J.F. Macbr, *Piptadenia imatacae* Barneby, *Piptadenia irwinii* G.P. Lewis, *Piptadenia killipii* J.F. Macbr., *Piptadenia killipii* J.F. Macbr. var *killipii, Piptadenia killipii* var. *cacaophila* G.P. Lewis, *Piptadenia laxipinna* Barroso, *Piptadenia micracantha* Benth., *Piptadenia paniculata* Benth., *Piptadenia peruviana* (Macbr.) Barneby, *Piptadenia pteroclada* Benth., *Piptadenia ramosissima* Benth., *Piptadenia robusta* Pittier, *Piptadenia santosii* Barneby ex G.P.Lewis, *Piptadenia trisperma* (Vell.) Benth., *Piptadenia uaupensis* Spruce ex. Benth., *Piptadenia uliginosa* Britton & Killip.

MORPHOLOGY

The most important morphological characters in the group taxonomy, the most used in the species differentiation in *Piptadenia* were listed below and the most relevant comments made about pattern and species exceptions. Morphological plates are presented to exemplify each character discussed.

HABIT - *Piptadenia* presents a variation in relation to habit (figure 10A, 25C), which includes species ranging from lianas, shrubs or trees of varying size (from 3 to 35 m tall). Small and medium tree species, such as *P. flava*, are most common. Less frequently, medium and large tree species can also be observed in the species reaching up to 35 m tall: *P. gonoacantha, P. paniculata, P. pteroclada* and *P. robusta*. Most species are lianas, like *P. santosii, P. affinis* and *P. trisperma.*

INDUMENTUM –Vegetatively, most species of *Piptadenia* are glabrous or sparsely pubescent, but some species appear densely pubescent in the branches with trichomes that can vary from white, yellowish to golden like in *P. cuzcoënsis*. Inflorescences axis and calyx vary from glabrous, sparsely to densely pubescent. Some species are easyly recognized by the densely pubescent perianth, as *P. santosii* (Fig. 54H). Ovary indumentum is very usefull for recognizing some species; it can vary from glabrous, with trichomes on apex of ovary, densely short pubescent like *P. uaupensis* or densely long pubescent like *P. adiantoides*. A type of indument present in all species of *Piptadenia* that has been observed by Barneby (1998) in other mimosoid legumes, as *Calliandra*, is amorphously pluricellular granular trichomes that can be present in the branches, inflorescences, even in the perianth or in the fruits, varying in the coloration of small orange to blackish dots; we are naming them as granular trichomes following Baneby's (1998) nomenclature.

PRICKLES – All known species of *Piptadenia* have epidermal prickles on the branches, distributed at the internodes, and in several species prickles could be present to the leaf petiole and rachis. Most species have recurved prickles scattered at the branches, but in some species such as *P. gonoacantha* (Fig. 27B), *P. pteroclada* (Fig. 47A) and *P. ramosissima* (Fig. 51A), prickles are erect and arranged on ribs at the branches, which are similar on color to the branch or may vary of tan, yellowish to gray. In too young branches these ribs are not yet formed and presents similarly the other species of the genus, except for the erect position of the prickles, but with maturation these prickles develop, become thicker and in older trunks, the appearance is compared to the alligator skin, from which comes the vernacular name "pau-jacare" (*P. gonoacantha*) or "pashaco-lagarto" (*P. pteroclada*).

Piptadenia trisperma is unique among the genus as the prickles are arranged in 2 paired nodal and plus one infranodal prickles, which in the more developed branches give a false impression of being thorns; they are even thicken in diameter, but do not form ribs, but they remain woody and even peel the suber pronounced on older branches. In *P. robusta* and *P. uliginosa* the prickles are present, but they are inconspicuous, presenting in scarce form in the herbarium samples.

For some species, infraspecific taxa that were based on the presence or absence of prickles (e.g., *P. gonoacantha* var *gonoacantha*, *P. gonoacantha* var. *inermis*, *P paniculata* var. *paniculata* and *P paniculata* var *aculeata*), but this condition is variable, since the same individual can present both conditions (branches unarmed or prickles), since it is possible to have a variation in the armament of the same plant, in more juvenile or senile branches, there is often no prickles present in younger branches, however, on the trunk of the same trees, these prickles are visible and woody (figure 25G).

STIPULES – *Piptadenia* species have stipules, which are mostly deciduous (or rarely persistents like occurring in *P. santosii,* figure 54A), and at the branches are only seen the scar of stipules after fall.

LEAVES – all *Piptadenia* species have alternat and bipinate leaves, distributed along the branches equally, with opposite pinnae and leaflets. The leaves present varying sizes, variable number of pinnae per leaf and leaflets per pinnae. The aspect of leaves presents varying from very delicate and thin as in *P. uliginosa* to coarser leaves and larger than 20 cm as in *P. pteroclada*. Despite variation, the number of pinnae pairs is of great importance in the delimitation of the species. Among the *Piptadenia* taxa two large groups can be recognized from the number of pinnae and then by the number and size of the leaflets. The leaflets present a morphological variation within the same species, but the species can also be diagnosed by the form, apex and base, indumentum and main vein. There are a group of species with large and few leaflets in the pinnae leaf, and these in turn with few pairs of leaflets per pinnae (e.g. *P. uaupensis*, *P. laxipinna*), while there is another group with many and small to medium size leaflets per pinnae (e.g. *P. gonoacantha*, *P. pteroclada*).

Some leaflets have trichomes forming a tuft at the abaxial base of leaflets (e.g. *P. adiantoides*, *P. irwinii*), or as domacia (*P. affinis*). Leaflets may have main vein central, subcentral position or even displaced towards the acroscopic margin.

The extrafloral nectary is one of the most diagnostic characters within the genus, and it is present in all species of *Piptadenia* and is one of the easiest characters to be noticed and recognized. Located from the proximal to the distal region of petiole, in the leaf rachis between the pairs of distal pinnae, and in the pinna between the distal leaflets. Extrafloral nectaries are present in several forms even in the same species. Most species have only one petiolar nectary (e.g. *P. santosii*, *P. paniculata*), to in 2 nectaries present (e.g. some specimens of *P. gonoacantha, P. flava*) until 4 contiguous nectaries (e.g. *P. uaupensis*). In the mostly of the species is located proximal to midle of the petiole, and can be: conical, cylindrical, short cylindrical, claviform, conical from elongate base; vulconic like (e.g. *P. adiantoides)*, discoid, sunken on petiole like *in P. laxipinna*, or cushion-shaped like in *P. uaupensis*. In *P. flava* and *P. gonoacantha* could have one or two petiolar nectaries with variable shape and size (figures 22D, 27C)

INFLORESCENCE – *Piptadenia* inflorescence units are always spikes, composed of a peduncle with 1-3 first-order bracts (prophiles sensu Scalon 2007) the axis of the inflorescence with the floral bracts that may be deciduous or persistent, and the sessile flowers (*P. affinis*), subsessiles (*P. adiantoides*) or pedicellate, like in *P. uliginosa*.They may be isolated or grouped in axillary fascicles (e.g. *P. irwinii* and *P. killipii*), or arranged pseudo-racemes with 1-4 spikes per node (e.g. *P. buchtienii, P. robusta*), or even in panicles with secondary branching (e.g. *P. paniculata*), or a unique case among the species of *Piptadenia* is that of *P. uliginosa* a panicle of racemes. figure 60F).

FLOWERS - *Piptadenia* flowers are small, ranging from 1.4–7 mm long. Floral bracts cover partially the flowers in the early stages of inflorescence development. The calyx varies in relation to the tube and the lobes length and in indumentum. The corolla of *Piptadenia* shows very similar shapes and variable indument, the lobes (petals) with a strongly mid vein is mostly erect (e.g. *P. buchtienii, P. micracantha*) or splitting to the base and curling to backward when mature (only *P. adiantoides*, figure 10B). The length of the corolla tube, varies with generally enclosed on calyx tube. The shape is campanulate, the indumentum glabrous or sparsely to densely pubescent.

The color of the periant is not very usefull taxonomic important character, since they are inconspicuous and there are not many notes on the labels of exsicates on these characters, however the filaments are conspicuous and its color are notably variable among some species, ranging from white, yellowish-cream, yellow (e.g. *P. flava*) to red-vinaceous (e.g. *P. robusta*). The androecium is made by 10 stamens with filaments 1.2 – 6.3 mm long, free or joined very close to the base. The anthers have a deciduous, sessile or stipitate globose gland (figures 22I, 24I). The gynoecium formed by ovary glabrous, short or long sparsely or densely pubescent, 8-14 ovulate, stipit terminal. Stemonozone mostly presente.

FRUITS – There is low variation in the fruits of species of *Piptadenia*. The fruits are stiptate with straight and slightly thickened margins. The valves can be undulate (e.g. *P. adiantoides*), flat (e.g. *P. gonoacantha*); papery or coriaceaous. The surface is mostly uniform, with granular trichomes commonly present mixed with sparse, short and adpress trichomes. Photos of fruit surfaces in Figure 5-6.

SEEDS – Seeds are usually obovate oblong ovaries, suborbicular; rigid testa and pleurogram when present in U-shaped, without endosperm (Figures 7-9). One of the characters currently used to distinguish *Piptadenia* from the other genera of the Piptadenia group, e.g. *Parapiptadenia* and *Psedopiptadenia*, is that seeds in *Piptadenia* are unwinged, and the other two genera present winged seeds. However, we are reporting for the first time that three species of *Piptadenia* (*P. affinis*, *P. buchtienii* and *P. trisperma*) have winged seeds, with very narrow circular wings (< 2.5 mm wide), similar to the observed in

Anadenanthera, *Parapiptadenia* and *Psedopiptadenia*. The species of *Piptadenia* with winged seeds lack pleurogram, a structure visible in unwinged seeds.

DISTRIBUTION – the genus *Piptadenia* has a wide distribution in the Neotropical Region, from southern Mexico and Guatemala to northern Argentina and Paraguay (Figure 4). The genus occurs in all major woody neotropical biomes, with a predilection to Rain Forests (both in Amazonia and Atlantic Forest domains), where it occurs 14 species. Species restricted to this Rain Forets biome includes *P. anolidurus, P. cuzcoensis, P. floribunda, P. uaupensis*, (in the Amazonia domain) and *P. affinis*, *P. micracantha, P. paniculata*, *P. ramosissima, P. santosii* (in the Atlantic Forest domain). Some rain forests species could occur in semideciduous or gallery forests within the Caatinga or Cerrado domains, as *P. adiantoides*, *P. gonoacantha* and *P. paniculata*.

Seven species occurs in the Seasonally Dry Tropical Forests and Woodlands biome (STDFW). *Piptadenia flava* occurs in most nuclei of neotropical SDTFW as in the Caatinga, Piemonte, Guajira and Mexican domains (Fig. 13B). However, most SDTFW species are restricted to one particular nucleus. In the Caatinga domain we find *P. irwinii* and *P. ramosissima*, in the Piedemonte nucleus *P. buchtienii*, and northwestern South America dry areas *P. uliginosa*.

No species of *Piptadenia* is found in typical savannah vegetation. Some species found in savannah biome as *P. flava* and *P. gonoacantha* in central Brazilian Cerrado domain, in fact occur in patches of SDTFW and gallery forests, respectively.

Nine species of *Piptadenia* are known only from Brazil: *P. adiantoides, P. affinis, P. irwinii, P. laxipinna, P. micracantha, P. paniculata, P. ramosissima, P. santosii* and *P. trisperma*. A total of 16 taxa of the genus occur in Brazil. Only 7 *Piptadenia* taxa do not present a known distribution in Brazil: *Piptadenia uliginosa* (Colombia); *P. buchtienii, P. robusta* (Bolivia, Panama, Venezuela); *P. killipii* var *killipii,* and *P. cuzcoënsis* (Peru); *P. peruviana* (Bolivia, Ecuador, Peru) and *P. imatacae* (Ecuador, Venezuela).

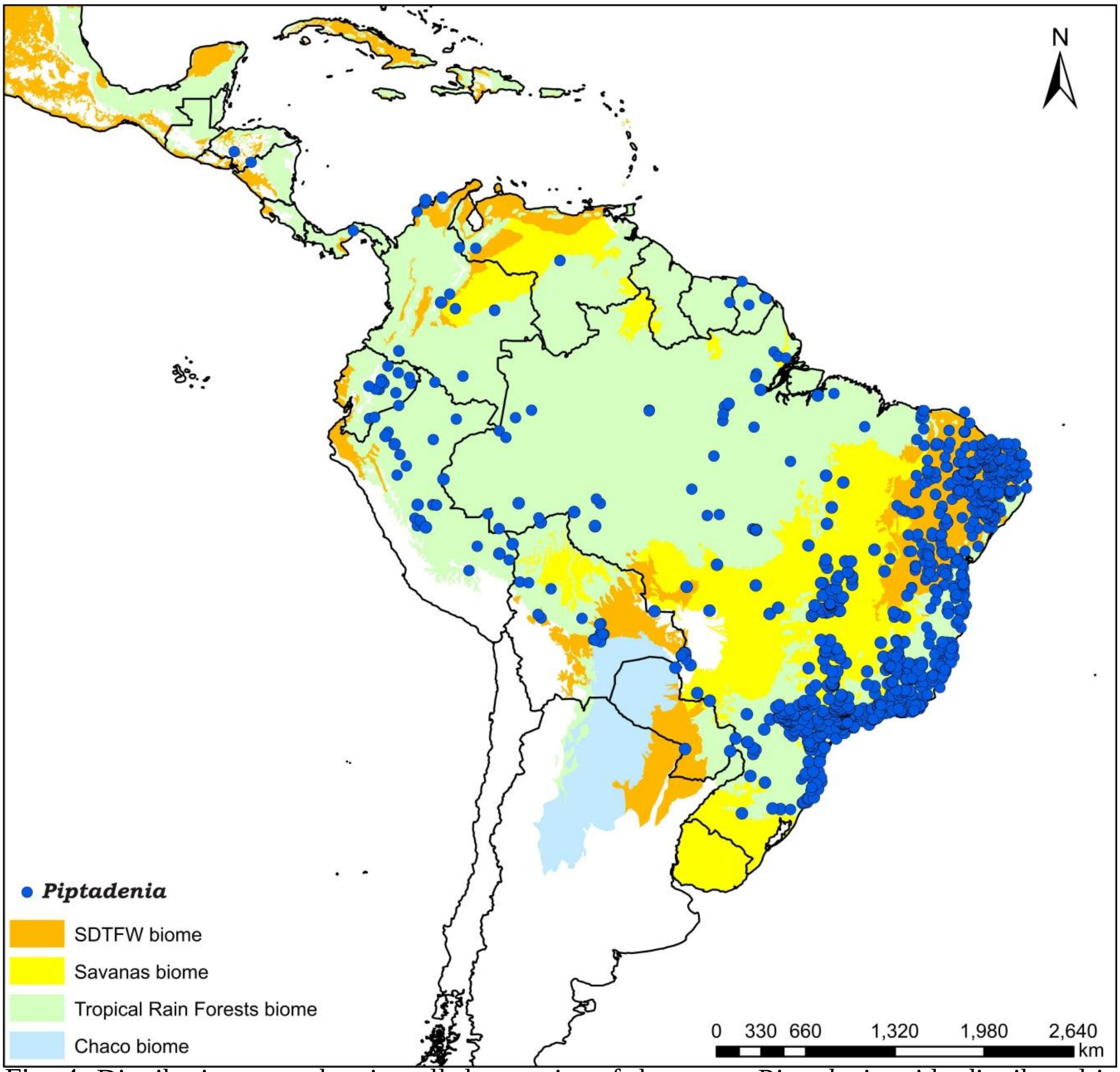


Fig. 4. Distribution map showing all the species of the genus *Piptadenia* wide distributed in the neotropical region

Fig. 5. **A-I.** Sufaces of fruits of *Piptadenia*. **A,** *P. adiantoides*; **B,** *P.affinis*; **C,** *P.buchtienii*; **D,** *P. flava*; **E,** *P. gonoacantha*; **F,** *P.imatacae*; **G,** *P. irwinii*; **H,** *P.killipii* var *killipii*; **I,** *P. laxipinna*.Pictures of Earl Chagas.

Fig. 6. **A-I.** Sufaces of fruits of *Piptadenia*. **A,** *P. micracantha*; **B,** *P.paniculata*; **C,** *P. peruviana*; **D,** *P. pteroclada*; **E,** *P. ramosissima*; **F,** *P. robusta*; **G,** *P. trisperma*; **H,** *P. uaupensis*; **I,** *P. uliginosa*. Pictures of Earl Chagas.

Fig. 7. **A-I.** Seed of *Piptadenia*. **A,** *P. adiantoides*-mature; **B,** *P.affinis*- imature; **C,** *P.affinis*-mature; **D,** *P.affinis*- wing; **E,** *P.buchtienii*-mature; **F,** *P. flava*- mature; **G,** *P. gonoacantha*-mature; **H,** *P.imatacae- imature*; **I,** *P. imatacae*;- mature. Pictures of Earl Chagas

Fig. 8. **A-I.** Seed of *Piptadenia*. **A,** *P. irwinii*-mature; **B,** *P.laxipinna*- mature; **C,** *P.micracantha*- imature; **D,** *P. micracantha* - mature; **E,** *P.paniculata*-mature; **F,** *P. peruviana*- imature; **G,** *P. pteroclada*- mature; **H,** *P.ramosissima- imature*; **I,** *P. ramosissima*- mature.

Fig. 9. **A-I.** Seed of *Piptadenia*. **A,** *P. robusta*-imature; **B,** *P. robusta*- mature; **C,** *P. trisperma*-mature; **D,** *P. uaupensis* - imature; **E,** *P. uaupensis* -mature; **F,** *P. uliginosa*- imature.

TAXONOMY

Piptadenia Bentham. Type Species: *Piptadenia latifolia* Benth.

Piptadenia Benth., in Hooker J. Bot. 2(11): 135. 1840. Lectotype, designated by Briton & Rose (1926): *Piptadenia latifolia* Benth. (= *Piptadenia adiantoides* (Spreng.) J.F.Macbr.).

Etymology—The name *Piptadenia* derives from "*pip*" (that falls) and "*adenia*" (gland), in reference to the caducuous anther glands.

Taxonomic Comments – *Piptadenia* was described by Bentham (1840) withou indication of Type species. Britton & Rose (1926) selected *Piptadenia latifolia* as lectotype, species described by Bentham (1841).

The concept of *Piptadenia* was based basicaly on morphlogy of fruit, but Britton & Rose selected a material *P. latifolia*, a species described withou fruit known. Burkart (1949), then, selected *P. rigida*, a complete material, but nowadays, *Piptadenia rigida* is belong to *Parapiptadenia* (combined in *Parapiptadenia rigida*). This way, the lectotype acept here is the selected proposed by Britton & Rose (1926)

Trees, shrubs or lianas, armed with erect or recurved "cat-claws" epidermal prickles dispersed on the branches or aligned on internodal ribs, occasionally present on lower surface of leaf petiole and rachis, rarely unarmed, sometimes with woody and thickened prickles on the trunk, these occasionally merging and forming a network of raised ribs like alligator skin; indumentum of plain, forwardly curved hairs, sometimes lacking, on the branches and main inflorescence axes glabrous to pubescents; glandulose trichomes . **Stipules** linear to triangulate, caducous. **Leaves** spirally alternate, petiolate, bipinnate, leaf rachis cylindrical, slightly grooved or not, lacking interpinnal seta; pinnae 1–14 pairs, opposite or sub-opposite, paraphyllidia absent or, rarely, presente 1-2; petiolar nectaries sessile or stipitate, discoid, cylindrical, oblong or conical, along the petiole but lacking between the first pair of pinnae, additional nectaries on the rachis, usually between the last pair of pinnae, and in the pinnae, between the distal pairs of leaflets; leaflets 1–60 pairs per pinnae, opposite, ovate to elliptic-oblong, apex rounded to obtuse or falcate, base asymmetric, oblique, margins straight, glabrous or with sparse trichomes on both sides, midvein centric to subcentric, obvious or inconspicuous, secundary venation inconspicuous or obvious. **Inflorescence** a densely 180–300-flowered spikes, mostly grouped in terminal, pseudoracemes or panicles, rarely isolated or paired in terminal leaf axils or slender racemes grouped in panicles (*P. uliginosa*); peduncle densely puberulent to glabrous; first-order bracts located at axis of spike, floral bracts (at flower attachment) oval-lanceolate or linear, elongate, concave, acuminate, hairy or pubescent, caducuous; flower buds ellipsoid. **Flowers** pentamerous, bisexual, sessile to subsessile; calyx 5-lobed, glabrous or sparsely pubescent, campanulate, lobes acute; corolla 5-lobed, petal strongly 1-nerved, glabrous or pubescent, tube included in the calyx or longer and exsert, lobes erect or rolled; stamens 10, filaments, slightly thickened at the base, white, cream to yellowish-green, green, yellowish-green or reddish-pink, anthers ellipsoid, versatile, connective gland present, spherical, globose, sessile, subsessile or stipitate, caducous; ovary 8–14- ovulate, glabrous or pubescent, stiptate, included or exserted from the corolla, stigma punctiform porate; stemonozone presente or absent; nectariferous disk absent. **Pollen** grouped in 12-celled polyads. **Fruit** a legume, inertly dehiscing through both margins, stipitate, in profile oblong or broad-linear, straight, apex rounded or acuminate, margins slightly thickened, straight,or slightly sinuous but do not constricting between the seeds; valves leathery, glabrous or pubescent and glandular, smooth to reticulate, light brwon or brownish-tan, flat-compressed or undulate between the seeds. **Seeds** uniseriate, biconvex, ovate to obovate, rarely winged (*P. affins, P. buchitienii and P. trisperma*), lacking pulpy aril; testa hard, bony, brown, pleurogram open, U-shaped; embryo with flat cotyledons; endosperm absent.

KEY FOR IDENTIFICATION OF PIPTADENIA SPECIES

1. Pinnae 1–5 pairs 2

1. Pinnae more than 5 pairs.. 10

2. Plants from northern and northwestern Amazonian South America in northern Brazil, Peru, Bolivia.. 3

2. Plants from eastern Brazil, barely reaching central and southwestern Brazil close to the border with Paraguay 6

3. Petiolar nectary sessile and claviform .... ***P. floribunbda***

3. Petiolar nectary sessile and shortly cylindrical..4

4. Petiolar nectary 1; individual spikes 9–13 mm wide; flowers 4.6–7 mm long; anther glands sessile..**15. *P. peruviana***

4. Petiolar nectaries 2–4; individual spikes 5–7 mm wide; flowers 2.2–3.1 mm long, pedicelled; anther glands stipitate 5

5. Pairs of pinnae per leaf 2, rarely 1, interfoliolar segment 2.5-3.5 mm long, ... **9. *P. imatacae***

5. Pairs of pinnae per leaf 3, rarely 4, interfoliolar segment 7-13 mm long................**21. *P. uaupensis***

6. Leaflets 15–30 mm long 7

6. Leaflets 35–80 mm long 8

7. Pinnae in 1, rarely 2 pairs; paraphyllidium 1, present at the proximal pinna; corolla 1.8–2 mm long with erect lobes; spike peduncles 3–5 mm long .... **10. *P. irwinii***

7. Pinnae in 3–5, rarely 2 pairs; paraphyllidia absent; corolla 3.2–5 mm long with revolute lobes; spike peduncles 9–18 mm long .... **1. *P. adiantoides***

8. Trees; leaflets 5–8 pairs per pinna; flowers shortly pedicelled, the pedicel 0.3–0.5 mm long; ovary shortly stipitate, the stipe 0.4–0.5 mm long................................ **14. *P. paniculata***

8. Lianas; leaflets 1–4 pairs per pinna; flowers sessile; ovary stipe 1.4–2 mm long 9

9. Young branches, leaflets, spike peduncle and rachis densely pubescent; petiole 2.5–3.2 cm long; pinnae 1–2 pairs; leaflets 1–2 pairs per pinna, apex oblique .... **12. *P. laxipinna***

9. Young branches, leaflets, spike peduncle and rachis glabrous or glabrescent; petiole larger, 5.2–7 cm long; leaflets 2–4 pairs per pinna, apex straight .... **19. *P. santosii***

10. Self-standing trees or shrubs.. 11

10. Lianas.. 16

11. Trunk and branches provided with suberous wings similar to an alligator skin 12

11. Trink and branches not winged 13

12. Petiolar nectary 0.5–4 mm long., ring shaped or conical; leaflets 4.5–7 × 0.8–1.2 mm; spikes 5.8–11 cm long .... **8. *P. gonoacantha***

12. Petiolar nectary 3.1–6.5 mm long., elliptical; leaflets 7–12 × 1.4–2.4 mm; spikes 12–22 cm long .... **16. *P. pteroclada***

13. Petiolar nectary crateriform, oblong; flower mostly cream colored, occasionally fading pink..14

13. Petiolar nectary oval to elliptic; flowers red to vinaceous, rarely white 15

14. Petiole 3–11 cm long; paraphyllidia absent; petiolar nectary 3–5 mm diam.; leaflets 23–31 pairs; individual spikes 40–62 × 6–7 mm .... **6. *P. flava***

14. Petiole 1–1.8 cm long; paraphyllidia 2; petiolar nectary 0.5–1 mm diam.; leaflets 6–14 pairs; individual spikes very small, 5–8 × 3 mm, in lax terminal panicles .... **22. *P. uliginosa***

15. Paraphyllidium present; leaflets 12–17 pairs; seeds winged .... **4. *P. buchtieni***

15. Paraphyllidium absent; leaflets 22–45 pairs; seeds unwinged .... **18. *P. robusta***

16. Prickles arranged in longitudinal series on branch ribs 17

16. Prickles scattered or randomly arranged on the branches 19

17. Trunk and branches provided with suberous wings .... **17. *P. ramosissima***

17. Trunk and branches unwinged 18

18. Leaflets 1–1.2 mm wide; spikes grouped in terminal or axillary pseudo-racemes; flowers 4.8–5 mm long, reddish-pink, rarely yellowish-cream .... **13. *P. micracantha***

18. Leaflets 1.5–2 mm wide; spikes 1–2-fascicled, axillary; flowers 3–3.2 mm long, cream-colored, sometimes fading pink .... **11. *P. killipii***

19. Northern, northwestern and western, mostly Amazonian South America, in northern Brazil, Venezuela, Colombia, Peru, Ecuador and Bolivia 20

19. Eastern Brazil barely extending to central and southwestern Brazil close to the Paraguay border 22

20. Leaflets 4–7 pairs, ≥ 15 mm long and 10–20 mm wide .... **15. *P. peruviana***

20. Leaflets 7–24 pairs, ≤ 14 mm long and 2.3–5.5 mm wide 21

21. Pinnae 4–9 pairs; paraphyllidia present .... **3. *P. anolidurus***

21. Pinnae 10–11 pairs; paraphyllidia absent .... **5. *P. cuzcoënsis***

22. Leaflets 15–26 × 6–17 mm, separate by 8–14 mm; flowers cream colored, sometimes fading pinkish, corolla lobes revolute; seeds unwinged .... **1. *P. adiantoides***

22. Leaflets 6–12 × 1.5–3.3 mm, separate by 2–4 mm; flowers reddish pink or vinaceous, corolla lobes erect; seeds winged 23

23. Paraphyllidia present; flowers 2.7–3.3 mm long; ovary subsessile (stipe 0.2–0.3 mm long); prickles scattered on the branch but in a usually regular presence of two nodals prickles and one infranodal .... **20. *P. trisperma***

23. Paraphyllidia absent; flowers 4.1–4.6 mm long; ovary stipitate (stipe 1–1.2 mm long); prickles serials on the branch, absent two nodals ando ne infranodal prickles............. **2. *P. affin***

1. ***Piptadenia adiantoides*** (Spreng.) J.F.Macbr., Contr. Gray Herb. 59: 17. 1919. ≡ *Acacia adiantoides* Spreng., Syst. Veg. 3: 146. 1826. ≡ *Pityrocarpa adiantoides* (Spreng.) Brenan, Kew Bull. 10 (2): 176. 1955. Type. BRAZIL. *Sello s.n.* (holotype: B, probably destroyed). Neotype:to be designated.

= *Mimosa fruticosa* Vell., Fl. Flum. 11: t. 6. 1831. ≡ *Piptadenia fruticosa* (Vell.) Angely, Fl. Analit. Fitogeogr. Sao Paulo 1: 235. 1965. Type: BRAZIL. Rio de Janeiro, 1783–1790, *J.M.C. Vellozo* (lectotype: iconograph in Vellozo 1831: tab. 6, **designated here**).

Piptadenia latifolia Benth., Hook. J. Bot. 4(30): 335. 1841. Type. BRAZIL. Rio de Janeiro, s.d., *J.B.E. Pohl 1449* (lectotype: W–2 sheets**, designated here**; isolectotypes: K–2 sheets [barcodes K000504665 and K000504667]!, NY [barcode NY00003218]!).

Piptadenia laxa Benth., in Hook. J. Bot. 4(30): 335. 1841. Type: BRAZIL. Rio de Janeiro, s.d., *J.B.E. Pohl 1453* (lectotype: W, **designated here**; isolectotype: NY [barcode NY00003220]!).

Piptadenia laxa var. *pubescens* Benth. Fl. Bras. 15(2): 274. 1876. Type: BRAZIL. Minas Gerais: “in sylvis ad Ant. Pereira et Bento Rodriguez villas”, s.d., *Martius s.n. (= Herb. Fl. Bras. 935)* (lectotype: M [barcode M0218765]!, **designated here**; isolectotype: M [barcode M0218766]!).

Figs. 5A, 7A; 10A-D; 11, 12A-I. Map Fig.13A.

Illustration in Bentham (1840; *Tabula LXXII*, V15 P2 t.72)

Liana or scandent shrub 2–16 m tall, with several trunks from the base, bark smooth, brown, profusely branched, entangled and forming dense mats at forest borders; branches

Fig.10.**A-D.** *Piptadenia adiantoides.* **A.** Habit liana, **B**. Detail of inflorescence showing flowers with filaments pink, **C**. Inflorescence showing flowers with filaments cream, **D**. Fruits matures. **E.** *Piptadenia cuzcoensis*. Leafs. Pictures A,C -D by Luciano P. de Queiroz; B by Cristiane Snak and E by Percy Nunez.

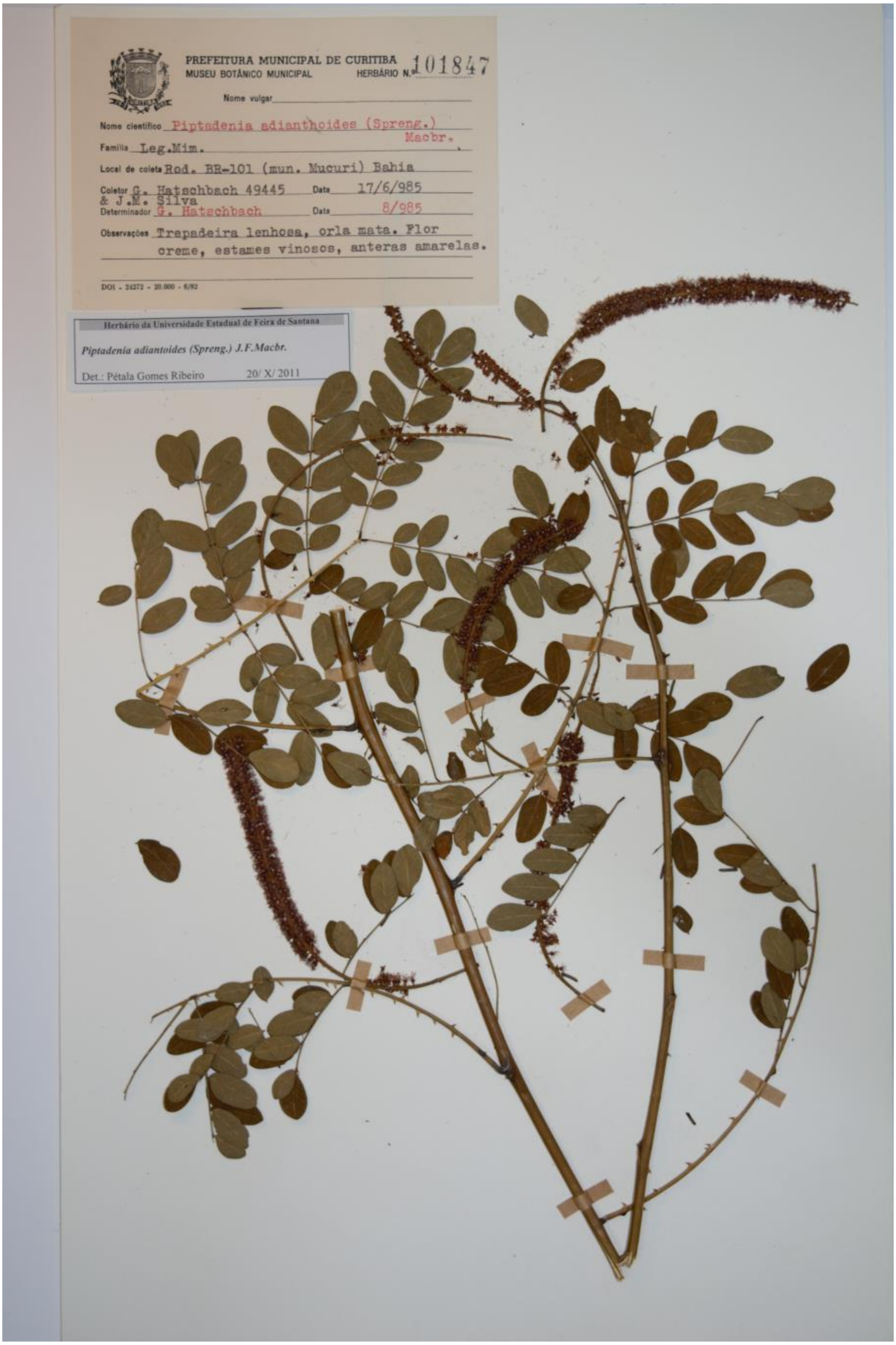


Fig.11. *Piptadenia adiantoides* G. Hatschbach 49445 (MBM)

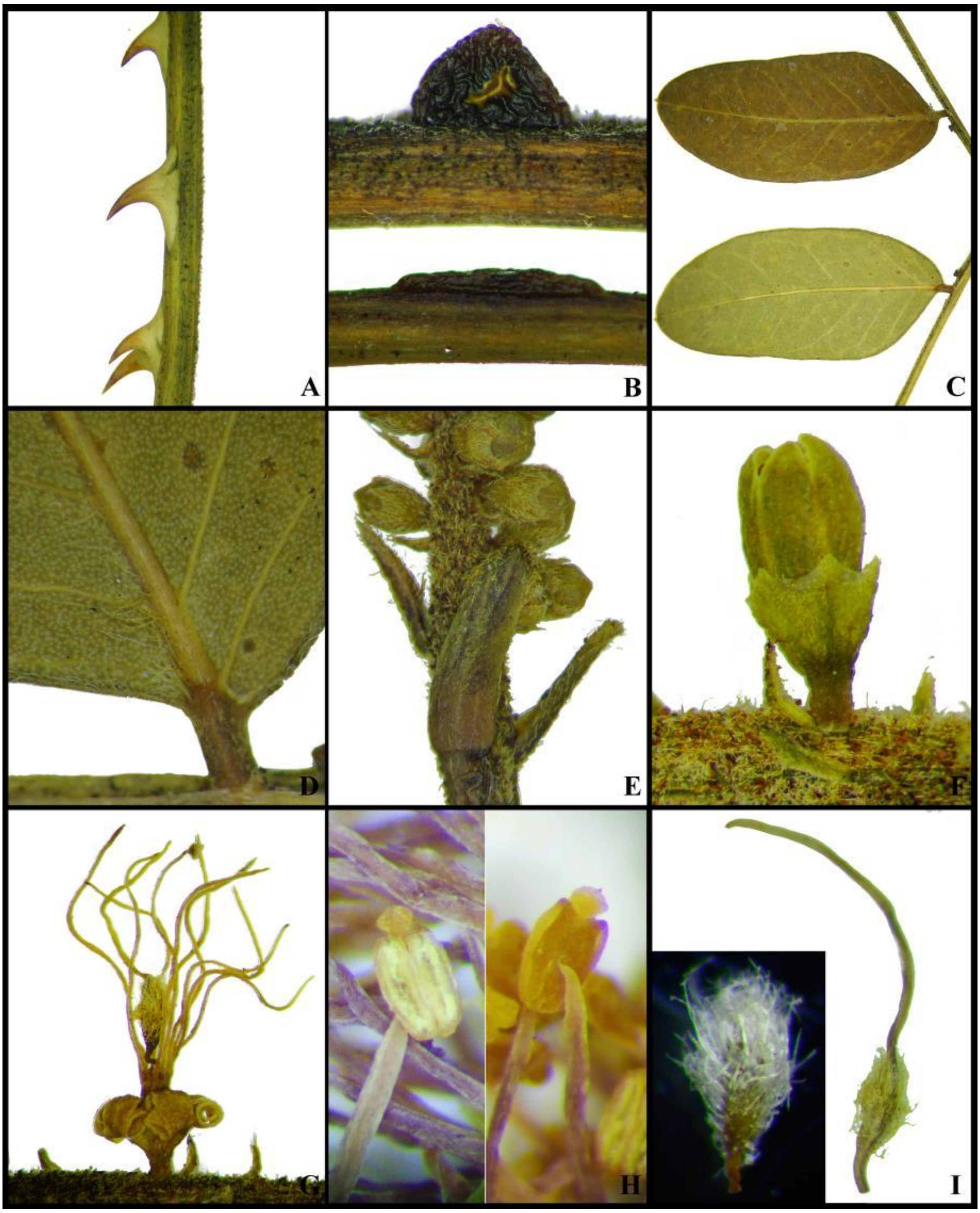


Fig.12.**A-I.** *Piptadenia adiantoides.* A. Prickles, B. Petiolar nectary, C. Leaflets on upper and lower surfaces, D. Base of leaflet show tuffing of trichomes, E. First order bract, F.Flower bud, G. Flower, H. Anthers showingthe gland on the top and I.Gynoecium showing ovary densely pubescent. Pictures by Earl Chagas.

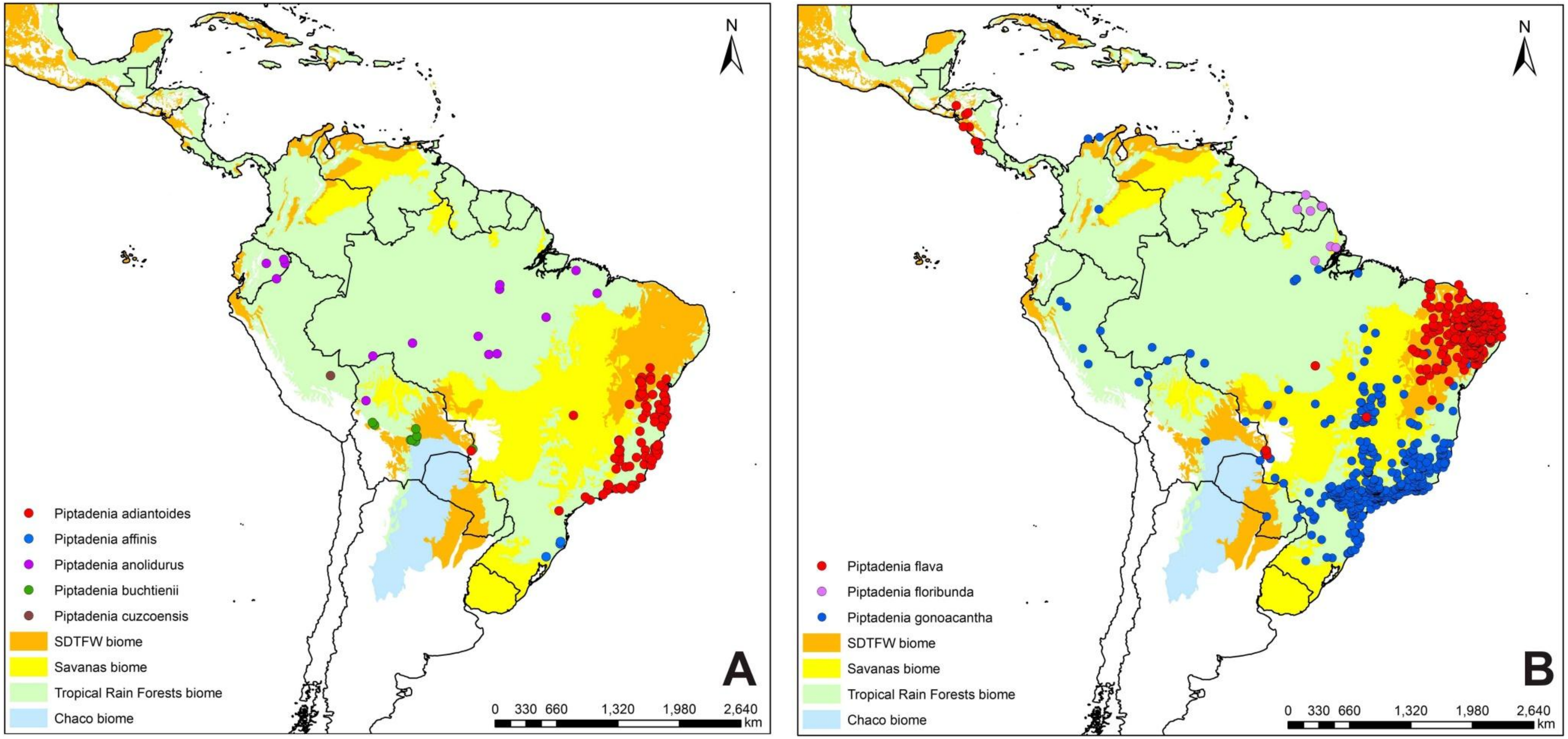


Fig.13. Distribution maps of *Piptadenia*. **A**. *P. adiantoides, P. affinis, P.anolidurus, P. buchtienii* and *P. cuzcoensis*. **B.** *P. flava, P. floribunda* and *P. gonoacantha*

reddish-brown or brown, not noticeably ridged, glabrous or sparsely pubescent with short white hairs, rarely with cream-coloured, inconspicuous, elliptic lenticels; prickles 2–3.5 × 1–4 mm, recurve, cream-coloured with apex orange to brownish, scattered on the branch, and minute in the leaf rachis and in the pinnae. **Stipules** 4–6 mm long, linear, caducous. **Petiole** 3–9.5 (11.5) cm long, rachis 3.5–11.1 (18) cm long, slightly grooved, puberulent, pulvinus 3–5 mm long, interpinnal segments (10) 16–45 mm long; pinnae (2) 3–5 pairs, proximal pinnae (2.5) 3–4.5 cm long, median pinnae 4–6.5 cm long, distal pinnae slightly longer (4.3) 5.8–7.3 (8.5) cm long, interfoliolar segments 8–12 (14) mm long; paraphyllidia absent; petiolar nectary 0.5–1.8 mm diam, sessile, conical or discoid, usually with margins raised like a volcane, vinaceous, located from the base to the middle of the petiole, additional and smaller nectaries in leaf rachis between the distal pair of pinnae and in the pinnae between the distal or all pairs of leaflets; leaflets 3–7 pairs per pinna, 15–26 (40) × 6–17 (27) mm, elliptic to obovate, apex rounded to acute, base acute, symmetrical, margins plane, ciliate, sparsely pubescent on both sides, rarely glabrous, trichomes larger on the lower surface and forming tufts at the base of the petiole, midvein central or subcentral, raised on the lower surface, secondary venation brochidodromous, smaller venation reticulate. **Inflorescences** mostly in terminal pseudoracemes or narrow few branched panicles fully exserted from foliage, with 2–3 spikes per node, rarely with expanded leaves and then with isolate or paired spikes at distal leaves axils; individual spikes 49–130 × 6–7 (9) mm, peduncle 9–18 mm long, the spike axis densely pubescent with short golden hairs; first-order bracts located at axis of spike, 1–3, triangular, 2–4 mm long, densely pubescent, deciduous; floral bracts 0.5–1 × ca. 0.3 mm, lanceolate, apex acute, pubescent, persistent; flower buds ellipsoid. **Flowers** 4.6–6.5 mm long, subsessile, pedicel 0.1–0.3 mm long; calyx 1.6–2 mm long, campanulate, glabrous to sparsely pubescent, tube 1.5–1.8 mm long, lobes 0.1–0.2 mm long, acute; corolla 3.2–5 mm long, campanulate, glabrous, tube 0.8–1.5 mm long, included in the calyx, lobes 1.5–2 mm long, splitting to the base and curling backward when mature; filaments 4.6–6.3 mm long, cream-coloured or greenish-yellow, rarely light pink, red to vinaceous, anther 0.3–0.5 × 0.2–0.25 mm long, anther gland sessile; ovary 0.8–1.1 mm long, densely pubescent, ca. 12–14–ovulated, stipe 1.4–2 mm long, style 2.6–3.1 mm long; stemonozone present. **Legume** 10.6–15.6 × 1.9–2.8 cm, stipe 8–20 mm long, broad linear, apex acuminate to rounded, margins slightly thickened; valves brown, papery, undulate, reticulate, glabrous, sometimes present mixed with tiny orange to blackish glands. **Seeds** 7– 11, 6–7 × 4–6 mm, ovoid; testa dark brown; pleurogram 2–3.5 mm diam.

Etymology— The name *adiantoides* derives from the similarity with the genus of fern *Adiantum* L.

Distribution and habitat – *Piptadenia adiantoides* is distributed in Northeast (Paraíba, Pernambuco, Bahia) and Southeast (Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro) Brazil. It occurs in Caatinga domain (deciduous and semidecidual seasonally dry forests) and Atlantic Forest domain (dense ombrophylous, dense montane forest and restinga), at altitudes of 0-1100 m.n.m. It is more commonly found in margins of rivers, riverine gallery forests, and semideciduous forests.

Phenology

Flowering in March and from May to August, and in December; Fruiting from May to December.

Common names – The commonest name is calumbi, but other local names are angico, arranha-gato, calombi, calumbi, calumbi-branco, calumbi-de-riacho, calumbi-preto, cega-olho, espinheiro-bravo, jucuri, mimosa, rapa-canela, unha-de-gato.

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***Taxonomy and relationships* –** Similar to *Piptadenia irwinii* by the overal appearance, but may be separated by the presence of leaves with (2) 3–7 pairs of pinas (*vs.* 1–2 pairs in *P. irwinii*), by the corolla with a short tube included in the calyx and revolute lobes (*vs.* corolla with exserted tube and straight lobes). When sterile, individuals with discoid flat nectary and up to three pairs of pinnae may be confused with *P. paniculata*, but the liana habit, obovate leaflets, with rounded or obtuse apex of *P. adiantoides* separates it from *P. paniculata*, which is a tree and presents leaflets ovate-oblong or lanceolate-ovate with obtuse or obliquely acute.

Piptadenia adiantoides is one of the species of the genus well collected and sampled in the Brazilian herbaria, where it is commonly identified by its sinonyms *P. fruticosa* or *P. laxa*. The habit is liana with trunks and branches prikly. It was observed broad morphological variation in the leaves, mainly in size of the leaflets, length of the interpinnal segment of the rachis and of the interfoliolar segments of the pinnae. These dimensions are usually much larger in individuals from Rio de Janeiro and São Paulo than from Brazilian Northeast region. It should also be noted that there is a variation in the size of leaflets and leaf axes in different phenological stages: flowering plants usually have less developed vegetative parts, and fruiting individuals tend to have larger leaflets, sometimes even with variation in leaflet texture, as well as variation in the indumentum, which in younger branches tend to be more puberulent than in more developed branches.

Another variation found was the color of the fillaments in the flowers, which vary from yellowish cream, the most common to light pink and becoming vinaceous when older, but in other inflorescences the flowers have remained cream in a darker tone.

The materials worked by Sprengel deposited in B, were not found. It is likely that they have been destroyed. Because the term used by Sprengel (1826) to describe *Acacia* *adiantoides* (= *Piptadenia adiantoides*) is not used, we need to choose a neotype for the basionym of this species.

Piptadenia fruticosa was initially proposed by Vellozo (1831), in "Flora fluminensis", under the name *Mimosa fruticosa*. The basionym proposed by Vellozo must be lectotipfyied, since there is no known material of the Vellozo deposited in collection. For this, we selected as lectotipo the original illustration. Bentham (1876), in "Flora brasiliensis", list *Acacia fruticosa* Mart. as synonymous with *Piptadenia fruticosa*. But, in fact, this combination in *Acacia* deals only with a manuscript name in exsicata, with no nomenclatural validity.

Piptadenia latifolia was described by Bentham (1841) based on several types of southeastern Brazil. We have here chosen the material *Pohl 1449* deposited in the W herbarium as lectotype.

Like *Piptadenia latifolia*, *P. laxa* was described by Bentham (1841) based on several types of Southeast Brazil. We have chosen here the material *Pohl 1453* deposited in the herbarium W as a lectotype. For *Piptadenia laxa var. pubescens*, Bentham (1876) did not explicitly indicate type in the work, but it indicated in the exsicatas. Among the analyzed syntypes, we propose *Martius s.n.* of the M herbarium (M barcode M0218765) as a lectotype.

Our results show the accessions of *P. adiantoides* grouping in a clade with *P. killipii* var. *cacaoplilla* (1PP / 96ML / 83MP; Figure 1), but internal relationships within this clade have low support.

Our results are different from what was found in previous results (Jobson & Luckow 2007, Simon et al 2016). In molecular studies including plastid data *trnL-F* and *matK* (Jobson & Luckow 2007), *P. adiantoides* in a clade formed by *P. pteroclada*, *P. ramosissima* and *P.*

robusta, and *P. adiantoides* is the only species that does not have the marginal veins developed in the leaflets within this clade. In our topology the affinity relation between the species *P. robusta* and *P. pteroclada* was recovered (see discussions on *P. pteroclada*), but does not include *P. ramosissima*. The relation justified by the presence of the marginal veins of the well developed leaflets.

Examined material: BRASIL: BRASIL: *J. Gardner 2833* (NHM); Rio Corumbá, Granja Samambaia, *E.P. Hering 8918* (NY); Estrado da Guanabara, Entre Mesa do Imperador e Alto da boa Vista, *P. A. Duarte 4741* (MO). BAHIA: Margem da Rodovia Una-Olivença, *R.P. Belém & R.S. Pinheiro 2368* (IPA); Rod. BR-101., *G. Hatschbach & J.M. Silva 49445* (MO); Serra do Sincorá, W. of Barra da Estiva, on the road to Jussiape, *R.M. Harley 20729* (NY); Margem da Rodovia Una-Olivença, *R.P. Belém & R.S. Pinheiro 2366* (IPA, NY); Margem da Rodovia Una-Olivença, *R.P. Belém 2368* (NY); Alcobaça, Teixeira de Freitas/Vale do Rio Alcobaça, *T.S. Santos 1625* (CEPEC); ALMADINA: Rod. Almadina/Ibitupã, entrada a ca. 5Km ao W da sede do município, Faz. Cruzeiro do Sul, Serra dos Sete Paus, ca.8Km da entrada, Área do Inventário Florestal e Fitossociologico, J.*G. Jardim 1221* (CEPEC, NY); AMARGOSA: Serra do Timbó, Mata do Centro Sapucaia, *D. Cardoso 1732* (CEPEC); Serra do Timbó, Mata do Centro Sapucaia, *J.L. Paixão 1235* (CEPEC, HUEFS); ANDARAÍ: Cerca de 13 km NE da entrada do Projeto Sempre-Viva, na estrada para Andaraí, *L.P. Queiroz 15531* (CEN); ARATACA: Serra das Lontras, ca. 7 km no ramal que liga o distrito de Itatinguí à Serra, Fazendas de Monteiro e Ciro, *M.M.M. Lopes 1443* (CEPEC, RB); BAIXA GRANDE: 5Km NW cidade, BA-052 (estr. do feijao), *L.P. Queiroz 3319* (CEPEC, FLOR, MBM, HUEFS); BARRA DA ESTIVA: 6 km ao N cidade, *G. Hatschbach 47888* (CEPEC, MBM); ca. 5 km Sul de Barra da Estiva, *L.P. Queiroz 9197* (HUEFS); Serra do Sincorá, 15-19 Km W of Barra da Estiva, on the road to Jussiape, *R.M. Harley 20729* (CEPEC, NY, RB); BELMONTE: Estr.

Belmonte/Itapebi, km 31, *H.S. Brito 97* (CEPEC, HRB, RB); Mata costeira, *R.P. Belém 2450* (CEPEC, IPA, NY, UNB, UB); Barrolândia, Estação Experimental "Gregório Bondar" CEPLAC, 48 km east of BR-101 on road to Belmonte, W.W. Thomas 9933 (CEPEC, RB, NY); BOM JESUS DA LAPA: *A. Lutz* s.n. (R); BONITO: Chapada Diamantina, Assentamento Piratini, margem da represa, *L.J. Alves 110* (ALCB); CACHOEIRA: Fazenda Paraíso (ex- favela), *L.P. Queiroz 9700* (HUEFS); CAMACAN: RPPN Serra Bonita, 9,7Km W de Camacan na estrada para Jacarecí, daí 6 Km SW na estrada para RPPN Serra Bonita e torre, Trilha das Cachoeiras, *A.M. Amorim 7458* (CEPEC, RB); RPPN Serra Bonita 9,7 km W de Camacan na estrada para Jacarecí, daí 6 km SW na estrada para RPPN e Torre da Embratel, beira da estrada, *M.M.M. Lopes 792* (HUEFS, NY, RB); CAMAMU: Estrada de barro para o Povoado de Barcelos do Sul, *A.M. Miranda & M.I. Silva 5070* (HUEFS, HST); CANAVIEIRAS: Rod. BR-101, próximo do trevo para Canavieiras, *G. Hatschbach G. Ribas & O.S. Carneiro 75192* (ICN, HCF, HUEFS, MBM*); ENCRUZILHADA: Margem do rio Pardo, *R.P. Belém 3595* (CEPEC, NY); FEIRA DE SANTANA: Pirelli, *M.V. Moraes 471* (HUEFS); IBICORA: Chapada Diamantina, Fazenda Ribeirao da Serra, margem da serra, margem do Rio Sincora, 2km a nordeste da sede, *L.A. Passos 304* (ALCB*); IGRAPIÚNA: Reserva Ecológica da Michelin, estrada para vila 8, *C. Snak, D.J.L. Sousa, & M.L. Souza 1043* (MBM); litotral sul, Rodotec- Comunidade Vargido, *L.O. Magalhães 20* (ALCB); ILHÉUS: km 10 da rodovia Ilhéus \Olivenca , Ramal à direita, L.*A.M. Silva & A.J. Ribeiro 517* (CEPEC*, HUEFS, HRB, K, MBM, NY, RB); Rodovia Uruçuca, Plantação de cacau, *R.P. Belém & A.M. Aguiar 1277* (CEPEC, IPA, UB); ITABERABA: Parte da ARIE pertencente a Itaberaba, Fazenda Bom Jardim, Estância Baleeiro, *L.P. Queiroz 9825* (HUEFS); ITABUNA: Rodovia Itabuna-Uruçuca, *R.P. Belém 1320* (CEPEC, IPA, K, UNB*, UB); Juçaré/ Plantação de cacau, *R.P. Belém 2291* (CEPEC, UB); Juçari, Plantação de cacau, *R.P. Belém & R.S. Pinheiro 1599* (IPA); Jucari, *R.P. Belém 2249* (CEPEC); Jucari, *R.P. Belém 2291* (CEPEC); Jucari, *R.P. Belém 2297* (CEPEC); Jucari, *R.P. Belém 2301* (CEPEC); Juçari, Plantação de cacau, *R.P. Belém & R.S. Pinheiro 2337* (IPA); ITACARÉ: Rodovia para Itacaré, entrada a ca. 1km da BR 101. Ramal que leva a fazenda de cacau, margeando o Rio de Contas, ca. 8km da entrada, *J.G. Jardim 1784* (CEPEC, MO, NY, RB); JACOBINA: *A. Fernandes s.n.* (EAC, NY); JEQUIÉ: Fazenda Brejo Novo, a 10,5 Km da Av. Otávio Mangabeira entrando pela Av. Exupério Miranda no Bairro do Mandacarú, *G.E.L. Macedo 2023* (HRB, HUESB, PEUFR, RB); Ca. 20km de Jequié a Contendas do Sincorá, *L.P. Queiroz 2154* (HUEFS, NY); JUSSARI: Serra do Teimoso, entrada da fazenda, *L.A.M. Silva 537* (HUEFS); Plantação de cacau, *R.P. Belém 2294* (CEPEC, UB); Plantação de cacau, *R.P. Belém 2297* (CEPEC, UB); Plantação de cacau, *R.P. Belém 2301* (CEPEC, NY); Plantação de cacau, *R.P. Belém 2337* (CEPEC, IPA, RB, NY, UNB, UB); LENÇÓIS: *M.L. Guedes et al. 3848* (MBM); Lençóis - Andaraí - estrada de baixo km 1, *G.P. Silva 3072* (CEPEC, HUEFS, NY, TEPB); Estrada de Lencóis-Seabra (BR-242) KM 20, *L. Coradin 8560* (CEN); Mata das Toalhas, Floresta estacional semi-decidual, desenvolvida em latossolo vermelho, *L.S. Funch 1112* (CEN, HUEFS); à margem do Rio São José no encontro com o rio Capivara de Lençóis-Ba, *M.P. Sena s.n.* (HUEFS); Beira da estrada, no pé do Morro do Pai Inácio, Direção Salvador-Palmeiras-Lençóis, 415 de Salvador, *M.S. Nunes 33* (HUEFS); Serra dos Lençóis - Shortly North of Lençóis, *R.M. Harley 22248* (CEPEC, HRB, NY, RB, UEC); Serra da Chapadinha, *R.P. Orlandi 636* (ALCB, CEPEC); Serra dos Lençóis - Shortly North of Lençóis, *R.M. Harley 22248* (CEPEC, HRB, NY, RB, UEC); LICÍNIO DE ALMEIDA: Rod. p/ Urandi, ca. 3,8Km da cidade, *J.G. Jardim 3303* (CEPEC); MARACÁS: Fazenda Tanquinho: ca. 20 km N de Maracás no ramal para a fazenda Santa Rita, na estrada para Planaltino, *L.P. Queiroz 3256* (ALCB, CEPEC, HUEFS); MORRO DO CHAPÉU: Distrito de Ventura, ca.

26 Km E de Morro do Chapéu na estrada para Mundo Novo, *L.P. Queiroz 13249* (HUEFS); MUCURI: Rod. BR-101, *G. Hatschbach & J.M. Silva 49445* (CEPEC, EAC, HEPH, MO, MBM); MUNDO NOVO: Fazenda Jequitibá, *P.A. Melo 78* (HUEFS); PALMEIRAS: Canoão de Lavrinhas, *E. Melo 3697* (HUEFS); PORTO SEGURO: Próximo a estrada, *D.A. Folli 1191* (CEN*, CVRD); Estrada para Santa Cruz Cabrália, *L.A.M. Silva 1187* (HUEFS); Ponta Grande, *P. A. Duarte 6673* (RB, UEC); ca. 22km do entroncamento da BR-367, BA-001, estrada para o Arraial da Ajuda, Entrada da Fazenda Santa Rita, *R.P. Oliveira 599* (HUEFS); RPPN Estação Veracruz (Cia. Veracel), Cerca de 15 km de Porto Seguro em direção a Eunápolis, Floresta de tabuleiro, Solo arenoso, *V.C. Souza 29980* (ESA); Parque Nacional de Monte Pascoal, along park road 1-2 Km. East of path to peak and visitor center, *W.W. Thomas 11562* (CEPEC, NY*, RB); POSTO DA MATA, Área de Aracruz, *M.L. Guedes 3525* (ALCB); RUY BARBOSA: Paraguaçu, margem do Rio Água Branca, *D.M. Loureiro 377* (ALCB*, CEPEC); Serra do Orobó, Fazenda Bom Jardim, *L.P. Queiroz 10649* (HUEFS); SALVADOR: Ondina, *D.R. Espinosa s.n.* (BAH*); Av. Centenário, *D.R. Jarbas s.n.- BAH 1456* (BAH); SANTA CRUZ CABRÁLIA: Estrada Eunapolis/Barrolandia, *J.C.A. Lima 141* (NY); Projeto Ceabra, *M.L. Guedes 3130* (ALCB); Área da ESPAB, *T.S. Santos 4280* (BAH, CEPEC, HRB, NY); SANTA TEREZINHA: ca. de 2km de Pedra Branca no caminho para a torre, L.*P. Queiroz 6309* (HUEFS); SÃO FÉLIX: Margem direita do rio Paraguaçu, *L.P. Queiroz 9581* (HUEFS); SERRA GRANDE: ca. 6 km N do entroncamento para Serra Grande na estrada Ilhéus - Itacaré, *L.P. Queiroz 9219* (HUEFS); TEIXEIRA DE FREITAS: Vale do Rio Alcobaça, margem da estrada, *T.S. Santos 1625* (CEPEC); UNA: Estrada de acesso à REBIO (Reserva Biológica de Una), Região da Mata Higrófila Sul Baiana (Bioma Mata Atlântica), *E. A. Gross 265 (CEN);* Estr. Ilheus/Una,+ - 35-40Km ao Sul Olivença, *G.P. Lewis & A.M. Carvalho 733* (CEPEC, K*, MBM, NY, RB); Reserva Biológica de Una,

lado W Rod. Una/São José, entrada ca. 26 km de Una para Vila Brasil, ca. 10 km da entrada, *J.G. Jardim 3033* (NY); Litoral Sul, Assentamento Vitorópolis, *L.J. Alves 403* (ALCB, CEPEC); Margem da Rodovia Una-Olivença, *R.P. Belém 2366* (CEPEC, IPA, NY, UB); Margem da Rodovia Uma-Olivença, mata costeira, *R.P. Belém 2368* (CEPEC, NY, UB); URUÇUCA: Distrito de Serra Grande, 7.3 km na estrada Sera Grande/Itacaré, Conjunto Fazenda Santa Cruz, *A.M. Amorim 649* (CEPEC, RB, NY); Estrada de acesso ao Parque Estadual Serra do Conduru, km 6,4. Região da Mata Higrófila Sul Baiana (Bioma Mata Atlântica)., -14.4775 -39.085555, *E. A. Gross 264* (CEN); Parque Estadual Serra do Condurú, Rodovia Serra Grande/Uruçuca, 9.4 km, Serra do Conduru vertente E, *J.G. Jardim 3003* (NY); ca. 5Km de Serra Grande, *L.P. Queiroz 13846* (HUEFS); Rodovia Urucuca-Ilhéus, Plantação de cacau, *R.S. Pinheiro 1256* (CEPEC); 7.4 km north of Serra Grande on road to Itacaré, Fazenda Lagoa do Conjunto Fazenda Santa Cruz, *W.W. Thomas 10922* (NY); VITÓRIA DA CONQUISTA: Estrada Brumado - Vitória da Conquista, km 125, *L. Coradin 8655* (CEN); 1 km south of BR 415, 14 km east of Vitória da Conquista, *W.W. Thomas 11101* (NY). DISTRITO FEDERAL: BRASÍLIA: Coleta feita no corrego Papuda, *E.P. Hering & J.E. Paulo 1183* (IBGE, MG*, MO, VIC, UEC); Floresta da Covanca, Jacarepagua, *J.N. Vieira s.n.* (NY); *sem coletor s.n.* (SPFW). ESPÍRITO SANTO: Comp. Vale do Rio Doce, *sem coletor s.n.*(BOTUW); ALTO RIO NOVO: Monte Carmelo - macega, *A.M. Assis 2089* (MBML); CASTELO: Parque Estadual do Forno Grande, *A.P. Fontana 5400* (MBML, NY, UPCB); Parque Estadual do Forno Grande, riacho pedregoso próximo à sede do parque, *R. Goldenberg 1416* (NY); CONCEIÇÃO DA BARRA: Rodovia WS-421, *G. Hatschbach, G. Ribas & O.S. Carneiro 75048* (FURB); Área 135 da Aracruz Celulose S.A., Restinga. Mata seca, *O.J. Pereira, J.M.L. Gomes & S. Pereira 3454* (VIES); GUARAPARI: Parque Estadual Paulo César Vinha, Restinga, Borda da Rodovia ES-060 próximo à Sede na área periodicamente inundada (mata), *P.L. Peterle,* *A.P. Chagas & S.S. Dutra 21* (VIES); Parque Estadual Paulo César Vinha, Restinga, Borda da Rodovia ES-060 com a formação florestal periodicamente inundada, *P.L. Peterle 54* (VIES); Parque Estadual Paulo César Vinha, Restinga, Borda da Rodovia ES-060 com a formação florestal inundável, *P.L. Peterle, A.P. Chagas & R.T. Valadares 59* (VIES); Fazenda do seu Atemar, entre a BR-101 e a rodovia do Sol, *R.G. Chacon & B. Dourado 854* (HEPH); IBIRAÇU: Estação Ecológica do Morro da Vargem. Floresta Atlântica, *H.Q.B. Fernandes, J.M.L. Gomes & Martins et al. 2926* (CEPEC, HUEFS, MBML*, UEC, UIES, VIES); ITAGUAÇU: Caparaó, *L. Kollmann 9927* (MBML); JAGUARÉ: Barra Seca, *G. Hupp 31* (HUEFS, MBML*); LINHARES: *C. Snak & C. Silva 1165* (CVRD); Pontal do Ipiranga, Restinga, Bordo da mata seca, *A.M. Assis, F. Passamani, F., G.H. Silva & R.L.D. Souza 21275* (VIES); Reserva Florestal de [illegible] Vale do Rio Doce, *G. Martinelli 1849* (NY); Reserva Florestal da CVRD. Est. Louro, ant. 351, km 2450, lado direito, *G.L. Farias 123* (NY); *G.L. Farias 273* (CVRD); *G.L. Farias 574* (CVRD); BR-101, km 120, Reserva da Cia. Vale do Rio Doce, Estrada da Gavea (X-32), prox. a Torre do Canto Grande, *H.C. de Lima 2953* (NY); Reserva Florestal do vale do Rio Doce, *J. Moitinelli 1849* (MG*, RB); Taxonomia de Campo USP, UNICAMP, ESAlq, *J.G. Rando 208* (CVRD, ESA); Reserva Florestal da Companhia vale do Rio Doce,Estrada do Flamengo, ca. 13km apos guarita , *L.P. Queiroz 2464* (CVRD, NY); Taxonomia de Campo USP, UNICAMP, ESAlq, *M.A.F. Pinho 611* (CVRD); Comboios, Restinga, Mata seca, *O.J. Pereira 3612* (VIES); Comboios, Restinga, Mata seca, *O.J. Pereira & J.M.L. Gomes 5105* (VIES); PEDRA AZUL: BR-262, *G. Hatschbach 47692* (CEPEC. EAC, MBM, UPCB); SANTA TERESA: Dois Pinheiros, *L. Kollmann 160* (MBML); Nova Lombardia, Reserva Biológica Augusto Ruschi, Trilha da Educação Ambiental, *R.R. Vervloet & E. Bausen 142* (HUEFS, MBML*); Reserva Biológica Augusto Ruschi - Nova Lombardia, *R.R. Vervloet 2478* (MBML); Penha, *W. Boone 33* (CEPEC,MBML); Penha, Propriedade do Tabajara, W.A. Hoffmann 175 (CEPEC, MBML); SÃO MATEUS: Guriri, *L.D. Thomaz 693* (VIES);Lajinha, Estrada Velha p/ Conceição da Barra, *M.C. Souza 532* (MBML); Lajinha, Estrada Velha para Conceição da Barra, lado esquerdo do Rio Cricaré, Restinga Pleistocênica, *M.C. Souza, M.P. Morim, L.F.T. Menezes, J. Iganci, & N.L. Nunes 532* (VIES);Ilha de Guriri, Restinga, *N.M. Andrade 168* (VIES); SERRA: Parque Ecológico da C.S.T., Área de Tabuleiro (Ipês), I.*W. Junior , M. Simonelli & J.M. Simões 199* (VIES); Bicanga, Tabuleiro, *O.J. Pereira, J.M.L. Gomes, I.W. Júnior & R. Schmidt 4526* (VIES);Bicanga, Tabuleiro, *O.J. Pereira & J.M.L. Gomes 4559* (VIES);Bacia Rio Jacaraípe, Dominio Floresta Ombrófla Densa de terras baixas. Tabuleiro, *O.J. Pereira 7707* (VIES); VILA VELHA: *B.M.T Wienberg s.n.* (R). GOIÁS: Province de Goyaz, *A.F.M. Glaziou 3732* (IAN, P*). MATO GROSSO DO SUL: CORUMBÁ: BR-262, Beira da estrada, *J.S. Silva & G. Shimzu s.n.* (COR). MINAS GERAIS: Estação Biológica de Caratinga (EBC), Fazenda Montes Claros, Beira da estrada para a linha da Cemig, a esquerda, subindo, *C.V. Mendonça 127* (NY); Instituto Ecol. Exp. Agrícola - C.N.E.PA, *E.P. Hering 3257* (IPA); Reduto, *E.P. Hering 3448* (NY); Ca. 1 km S of São Pedro do Suaçuí along Highway MG-3. Secondary growth along road, *G. Davidse, T.P. Ramamoorthy & D.M. Vital 11491* (MO); Margem da estrada Penha-Caeté, *G.M. Magalhães 5087* (BHCB*); Rio Piracicaba, min. Morro Agudo (SAMITRE), *H.C. Souza s.n.* (BHCB*); *H.S. Irwin s.n.*(R); Serra do Espinhaço, Cerrado, Steep rocky slopes with extensive outcrops, ca. 15km E. of Diamantina, *H.S. Irwin, S.F. Fonsêca, R. Souza, R. Reis dos Santos & J. Ramos 27971* (MO); Rio Piracicaba, Pilha de rejeito da mina, *M.A. Rollo s.n.* (SPF*); 5km do Camping Clube Iangará, *P.B. Moraes 6* (BHCB*); Parque Estadual do Rio Doce (PERD), Trilha de acesso à Lagoa Carioca, *R.L.C. Bortoluzzi 11* (VIC); Parque Estadual do Rio Doce (PERD), Trilha de acesso à Lagoa Carioca, *R.L.C. Bortoluzzi s.n.* (VIC); Esta. Biológica de Caratinga, *T.R. Andrade & L.V. Costa 149* (BHCB*); Caraça, Cruzeiro, *Tales s.n.* (BHCB*); Caraça, caminho de asfalto indo até o encontro dos rios, *W.M. Ferreira , J.Semir, S. Martins, S. Miotto, L.P de Queiroz, E.F. Martins, L.T Silveira & L.P.C Morellato 273* (SP*); AÇUCENA: Parque Estadual do rio corrente, *J.M. Fernandes & L.C. Siqueira 1439* (VIC); Serra do Espinhaço, Rio Jequití, ca. 25 km E. of Diamantina, *H.S. Irwin 27772* (NY); ARAPONGA: Entorno do Parque Estadual Serra do Brigadeiro, Fragmento da Lurdinha, Floresta Estacioal Semidecidual, *J.M. Fernandes 103* (VIC); Comunidade dos Lanas, *J.M. Fernandes & L.C. Siqueira 273* (VIC); Entorno do Parque Estadual Serra do Brigadeiro, Pousada Serra D'água, *L.C. Siqueira & J.M. Fernandes 733* (VIC); BARÃO DE COCAIS: Transição entre Mata Atlântica e Cerrado, *J.M.L. Gomes 2114* (VIES); BELO HORIZONTE: FZBBH/ Portaria 2, *J. Ordones et al. 1342* (BHZB); FZB-BH/ Portaria - Praça Nacional, *J. Ordones et al. 1458* (BHZB); Portaria - Praça Nacional, *J. Ordones s.n.* (VIC); Campus da UFMG, próximo a unidade administrativa II, *J. Pires s.n.* (BHCB*); Campus da UFMG, perto da prefeitura, J.*A. Lombardi 738* (BHCB*, NY); Campus da UFMG, próximo a Prefeitura, *J.A. Lombardi & L.G. Temponi 920* (BHCB*, NY); Campus, J.*A.O & J.M.P.S s.n.* (BHCB*); Campus da UFMG, *J.D.S. Las 90* (BHCB*); FZB/BH, *L.A. Echternach 914* (BHZB); Estação experimental, *M. Barreto 10179* (BHCB*); Carlos Prates, *M. Barreto 6453* (BHCB, SP*); Carlos Prates, *M. Barreto 6473* (BHCB*); Campus da UFMG, *T.S.M.G s.n.* (BHCB*); CAETÉ: Caeté, M. Barreto 6420 (BHCB*, SP*); CARANDAÍ: Carandahy, [illegible], *sem coletor 12646* (NY); CARATINGA: EBC, Montes Claros, *C.V. Mendonca Filho 127* (BHCB*); Est. Biol., *M.A. Lopes & P.M. Andrade 511* (BHCB*); EBC., *P.H.A. Pequeno & L.V. Costa 248* (BHCB*); Est. Biol., *P.M. Andrade & M.A. Lopes 166* (BHCB*); CATAS ALTAS: Caraça/ Buraco da Boiada, *J. Ordones 49* (BHZB); Caraça/ Tabões, *J. Ordones 920* (BHZB, VIC); Serra do Caraça, *R.C. Mota 733* (BHCB*); Reserva Particular do Santuário do Caraça, *T.M.A. Alves & M. Sobral 53* (BHCB*); CATUJI: Pontelete, *G.*

Hatschbach 46303 (MBM, NY); CONCEIÇÃO DO MATO DENTRO: Pousada Vale das Pedras, *L.H.Y. Kamino & L.M. Silva 1021* (BHCB*); Pousada Vale das Pedras, *L.H.Y. Kamino & L.M. Silva 1026* (BHCB*); DESCOBERTO: Reserva Biológica Represa do Grama, *R.C. Forzza 2202* (VIC); DIAMANTINA: Estrada de terra de Biribiri, Ponte da Barragem, *D.C. Zappi et al. 10624* (MO, VIC); Serra do Espinhaço, Ca. 15 km E. of Diamantina, *H.S. Irwin 27971* (MBM, NY); Gruta do Salitre, Estrada para Extração, 6,0 Km além do Córrego Pururuca ou Rio das Palhas, Afloramentos rochosos e carrasco com elementos de cerrado, *R.M. Silva 2549* (VIC); DIONÍSIO: Parque Estadual do Rio Doce (PERD), Trilha da Lagoa Águas Claras (Mombaça), *S.R.D.F.S Nunes et al. 70* (VIC); ITABIRA, Minas Cauê, *J.R. Stehmann 3076* (BHCB*, ESA, MBM, CESJ); Ipoema, Estrada para o Morro Redondo, *M.J.F. Barros s.n.* (VIC); ITABIRITO: Pico do Itabirito, W.A. Teixeira s.n. (BHCB*); JEQUITINHONHA: Margens do rio Jequitinhonha, *G. Hatschbach 50416* (EAC, MBM, UPCB); LAVRAS: *A.S. Kroger s.n.*(SPSF); MARIANA: Cibrão, *M.C.T.B. Messias 868* (VIC); Linha cátodica Sentido-Samarco, *S.M. Faria J.S. Silva & J.B. Santana 1758* (RB*); MARLIÉRIA: Parque estadual do Rio Doce, *J.A. Lombardi 1295* (BHCB*, NY); Parque Estadual do Rio Doce, Trilha da Lagoa Carioca, *R.L.C. Bortoluzzi 11* (PERD); Parque Estadual do Rio Doce, Trilha do Mombaça , *R.L.C. Bortoluzzi & L.A. Bovini 246* (PERD); Parque Estadual do Rio Doce, Estrada do Aníbal, *R.L.C. Bortoluzzi 630* (PERD, VIC); Parque Estadual do Rio Doce, Trilha da Lagoa Carioca, *R.L.C. Bortoluzzi, L.A. Bovini, D.M Braz, C. Okamo & R.M. Neto s.n.* (PERD); Parque Estadual do Rio Doce, Trilha da Lagoa Carioca, *S.R.D.F.S Nunes & A.G. Santos 127* (PERD, VIC); Parque Estadual do Rio Doce, Trilha da Lagoa Carioca, *S.R.D.F.S Nunes 188* (PERD, VIC); Parque Estadual do Rio Doce, Trilha do Turvo, *S.R.D.F.S Nunes, R.M. Perereira & W.Q. Santos 59* (PERD, VIC); Parque Estadual do Rio Doce, Trilha da Lagoa Águas Claras (Mumbaça), S.*R.D.F.S Nunes R.M. Perereira, W.Q. Santos & E.D.*

Almeida 70 (PERD); Parque Estadual do Rio Doce, Estrada portaria-área de camping, *S.R.D.F.S Nunes & R.M. Pereira 98* (PERD, VIC); OURO PRETO: Parque Estadual do Itacolomi (PEI), Estrada para a fazenda do Manso, *H.C. Lima 4069* (VIC); *J. Badini s.n.* (VIC); Parque Estadual do Itacolomi (PEI), Trilha da Alcan, L.*C.P. Lima S.C. Ferreira & M.E.F Araujo 300* (VIC); Parque Estadual do Itacolomi (PEI), Trilha da Alcan, *L.C.P. Lima S.C. Ferreira & M.E.F Araujo 310* (VIC); Parque Estadual do Itacolomi (PEI), Trilha da Alcan, *L.C.P. Lima S.C. Ferreira & M.E.F Araujo 360* (VIC); PEDRA AZUL: Pedra Azul, na região do Reservatório do Córrego Soberbo (COPASA), Área com cerrado e cerradão, *A. Salino & P.O. Moraes 4704* (BHCB*); Fazenda Bom Jardim, *I.R. Andrade s.n* (BHZB); Fazenda Bom Jardim, *R.D. Botelho s.n.*(BHZB); Pedra Azul, caminho do aeroporto, *Z.A. Trinta 826* (NY); RIO PIRACICABA: Pilha de rejeito da mina, *M.A. Rollo s.n.* (VIC); RIO VERMELHO: Cipó em regeneração de corte raso, Ensaio de Manejo Florestal, parcela D2, *M.S. Menandro 214* (CVRD); SANTA MARIA DO SALTO: *V. Terra, J.M. Fernandes & J.T. Miller 665* (VIC); SANTANA DO RIACHO: Serra do Cipó, Km 127 ao longo da rodovia Belo Horizonte - Conceição do Mato Dentro, Mata ciliar, na orla, *A. Furlan & J.R Pirani 6093* (SPF*, VIC); km 126 ao longo da rodovia Belo Horizonte-Conceição do Mato Dentro, *J. Semir & M. Sazima s.n.* (HUEFS, SP*, SPF*); Serra do Cipó, Rodovia Belo Horizonte - Conceição do Mato Dentro, Km 117 atual (antigo 124), Mata ciliar do Córrego Três Pontes, *J.R. Pirani et al. 5029* (VIC); Serra do Cipó, MG 010. Distrito de Serra do Cipó (antigo Cardeal Mota) - Conceição do Mato Dentro, 500 m após a ponte sobre o Córrego Três Pontes, Borda de mata junto à margem esquerda da estrada, *L.M. Borges 116* (VIC); SANTA BÁRBARA: Margem da estrada Penha-Caeté, *G.M. Magalhães 5087* (BHCB*); Caraça, caminho de asfalto indo até o encontro dos rios, *W.M. Ferreira, J.Semir, S. Martins, S. Miotto, L.P de Queiroz, E.F. Martins, L.T Silveira & L.P.C Morellato 273* (SP*); TEIXEIRAS: Estrada BR-120, Em direção à Ponte Nova, à

4 Km da ponte sobre o córrego Bom Jardim, *J.P. Fontella & M.R.R Vidal 1032* (VIC); VIÇOSA: Herbário Botânico UFV/Viçosa, *S. Matoso s.n.* (FUNED-POL). *PARAÍBA: J.C. Moraes s.n. IPA-13099* (IPA); AREIA: Capoeira, senhor Fernando Leal, lugares altos, *sem coletor s.n.*(EAN); Capoeira em terrenos altos e frescos, *sem coletor s.n.*(EAN); Capoeiras, *J.C. Moraes 1788* (MBM, SPSF). PARANÁ: ADRIANÓPOLIS: Estrada Velha da Ribeira, km 27, *J.M. Silva, J. Cordeiro & C.B. Poliquesi 1408* (BHCB*, MBM*); Tatupeva, *J.M. Silva & G.C. Vasconcellos 6410* (HUCP); CERRO AZUL: Boi Perdido, rodovia Cerro Azul para Tunas do Paraná, *E. Barbosa & E.F. Costa 1269* (ALCB, MBM*); Estrada Tunas - Morro Grande, *G. Hatschbach 3043* (UPCB); Boi Perdido, *G. Hatschbach 33716* (MBM*); Estrada Tunas-Morro Grande, *G. Hatschbach s.n.* (MBM*); Along road to Rio Branco do Sul, *L.R. Landrum 4064* (NY); MORRETES: Colônia Floresta, *G. Hatschbach 21324* (BOTU, K, MBM*, NY, TEPB, UEC); RIO BRANCO DO SUL: Quabrada Funda, *G. Hatschbach 24070* (INPA). RIO DE JANEIRO: Silva Jardim, Reserva Biológica de Poço das Antas, Trilha para a Fazenda Portuense, próximo a entrada do cajueiro, *H.C. Lima 4547* (MO); Silva Jardim, Reserva Biológica Poço das Antas, Estrada do Aristides, Após a 2a porteira, *H.C. Lima 4922* (MO); Ibicuiba, estrada para Engenho Grande, *J.A. Lombardi 6183* (MO); Serra de Friburgo para Teresopolis, *P. A. Duarte 9575* (NY); Campos dos Goytacases, Ibitioca, Morro do Itaoca, *R.C. Forzza 5122* (NY); ARARUAMA: Ibicunha, *sem coletor 6183* (SPSF); Ibicuiba, estrada para o engenho grande, *H.C. Lima, C.F. de Sá, H.G. Dantas & R.D. Ribeiro 6183* (F, HUEFS, MO, MBM, NY, SP*); CAMPO GRANDE: Serra do Mandanha, *H.C. Lima 300* (SP*); ITAGUAÍ: Inst. Ecologia, km 47 da antiga Rio-S. Paulo, *E.P. Hering 3260* (NY); ITATIAIA: Parque Nacional do Itatiaia, Caminho para o Lago Azul, *sem coletor 456* (CEPEC); Serra da Mantiqueira, Maciço do Itatiaia, Parque Nacional do Itatiaea, *I.S. Gottsberber 11-16471* (NY); Parque Nacional do Itataia, Próximo ao Centro de Recuperação de Itatiaia, na beira

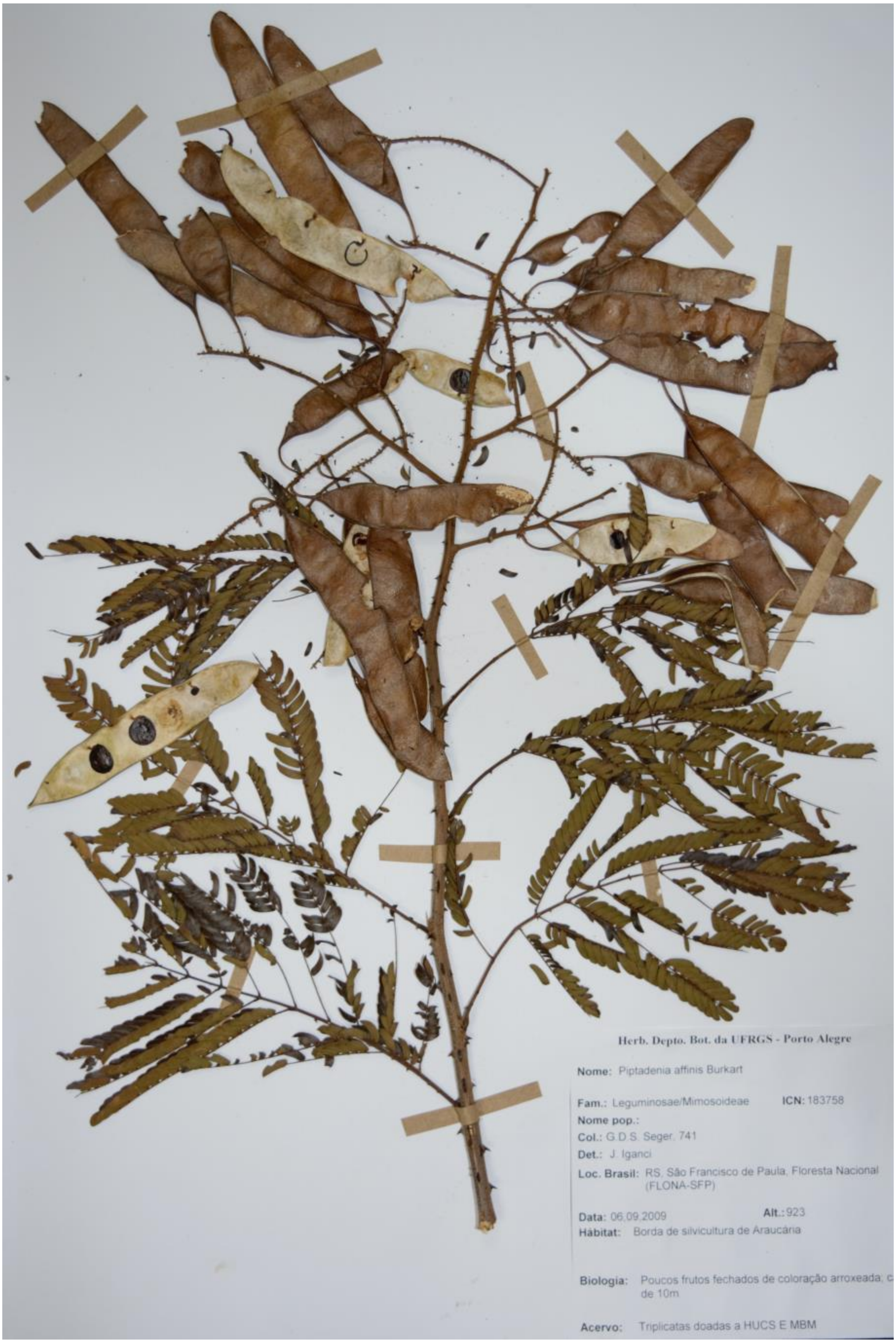
da estrada, *M.J.F. Barros 30* (NY); Lago Azul, *O.S. Melo 15* (NY); Maciço do Itatiaia, *I. Gottsberger 11 (*BOTU); MANGARATIBA: Barra Seca, *B.C. Kurtz s.n.* (HUEFS, RB*); NOVA FRIBURGO: Cascatinha do Pinel, *L.C. Siqueira 2213* (FCAB); *P.S.J. Capell s.n.* (FCAB); PARATI: Morro do corisquinho, *A.P.S. Ribeiro 31* (MBM); RIO BONITO: *P.P.H. Laclette s.n.*(R); Braçanã, *P.P.H. Laclette s.n.* (R); RIO DAS OSTRAS: Reserva Biológica União, eucaliptal nas proximidades da sede administrativa, *J.M.A. Braga & G.R Rabelo 6390* (RB*, UENF); Reserva Biológica, Última Porteira, Gasoduto, *J.M.A. Braga 6706* (MBM, NY); RIO DE JANEIRO: Parque Nacional da Tijuca, estrada para a Vista Chinesa, *H.C. Lima & G.M. Barroso 1627* (RB, SP*, HUEFS); Jacarepaguá, *J.G. Kahlmann 6153* (NY); Estrada Grajau-Jacarepaguá, *J.P.L. Sobrinho 507* (IPA); Tijuca, estr. Vista Chinesa, prox. Gávea Pequena, *J.P.L. Sobrinho 623* (SP*); Serra Carioca, estrada de Vista Chinesa, aos fundos do predio do Centro de Conservação da natureza, *J.P.P. Carauta 835* (NY); Jardim Botânico do Rio de Janeiro, Na encosta atrás do cactário, *R. Marquete, N. Marquente & R. Matheus 562* (IBGE, HRB, HUEFS*, RB, SP); SILVA JARDIM: Reserva Biológica de Poço das Antas, Trilha para fazenda Portuense, proximo a entrada do cajueiro, *H.C. Lima 4547* (CEPEC, RB*). SÃO PAULO: Cunha, perto de Campo Limpo, *J. Mattos 15331* (SP*); *L.E. Mello Filho s.n.* (R); In the forest close above the Benedictine Monastery at Santos, *W.J. Burchell 3049* (NY); CAMPINAS: Fazenda Santa Elisa, *K. Yamamoto 12599* (MBM); CAMPOS DO JORDÃO: Parque Estadual, Instituto Florestal, região do Ribeirão, *M.J. Robim 559* (HUEFS, MBM, SP*, SPSF); ILHABELA: *M.T.A.V.A. Campos 142* (ESA); *V.C. Souza et al. 1951* (ESA); SÃO JOSÉ BARREIRO: Serra da Bocaina, km 10, *C. Farney 691* (C, RB*); Nativo no alto da Serra da Bocaina, *P.E. Gibbs 4581* (MBM, NY); São José do Barreiro, *M.A. Glaziou s.n.*(R); SÃO JOSÉ DOS CAMPOS: Estrada Turvo, depois do Horto, *A.F. Silva L.C. Junior 1394* (VIC); SÃO PAULO: Chácara dos Morrinhos, No mato, na cerca, *D.B. Pickel 5193* (IPA, SPSF); 1, 5 km norte da cidade, *J. Mattos & N. Mattos 8919* (HAS, IAC, SP*, UEC); Capão Redondo, *R.J.F. Garcia s.n.*(SINBIOTA); UBATUBA: Estrada de Itamambuca, *sem coletor 1523* (SPSF); P.E.Serra do Mar, nucleo Picinguaba, *sem coletor 388* (SPSF).

2. ***Piptadenia affinis*** Burkart, *Fl. Il. Catarin.* 280-283, pl. 46-47. 1979. Type: Brasil, Santa Catarina, Lauro Muller, Rio do Meio, 16 Dec 1958, *Reitz & Klein 8037* (holotype: SI [barcode SI002428]; isotypes: B [barcode B_10_0244181], GH [barcode GH00064050], HBR, K [barcode K000504669]!, L [barcode L0019208]).

Figs. 5B, 7B-D, 14. 15A-I. Map Fig. 13A.

Illustration in Burkart (1979)

Liana; branches brown, noticeably ridged, sparsely pubescent with short yellow hairs, with cream-coloured, elliptic lenticels; prickles 1–4.5 × 2–5 mm, recurve, black to purple, internodals serials on the branch, in the leaf rachis and in the pinnae. **Stipules** 4–7 mm long, linear, persistens. **Petiole** 2.5–4.7 cm long, rachis 7–11.5 cm long, slightly grooved, puberulent, pulvinus 3–6 mm long, interpinnal segments 10–15 mm long; pinnae 6–9 pairs, proximal pinnae 3.5–4.3 cm long, median pinnae slightly longer 5–7.2 cm long, distal pinnae 4.2–5.6 cm long, interfoliolar segments 2–3 mm long; paraphyllidia absent; petiolar nectary 0.8–1.3 mm diam, sessile, discoid, reddish, located at the base of the petiole, additional and smaller nectaries in leaf rachis between the distal pair of pinnae and in the pinnae between the distal or all pairs of leaflets; leaflets 14–26 pairs per pina, 6.5–12 × 1.5–3.3 mm, oblong, subfalcate, apex mucronate acute, base acute, uniauriculate, discolor, asymmetrical, domacea present, margins plane, ciliate, glabrous on upper surface, sparsely pubescent on the lower surface, trichomes yellow, adpresse and forming tufts at the base of the leaflet, midvein subcentral, raised on the lower surface, secondary venation brochidodromous, smaller venation reticulate. **Inflorescences** mostly in terminal panicles, fully exserted from foliage, rarely with 1–2 axillary spikes per node; individual spikes 2.6–4 × 2.3–3 mm, peduncle 4–6 mm long, the spike axis densely pubescent with short golden hairs; first-order bracts located at axis of spike, 1–2, triangular, 3–4.5 mm long, densely



14. *Piptadenia affinis.* Segger 741 (ICN)

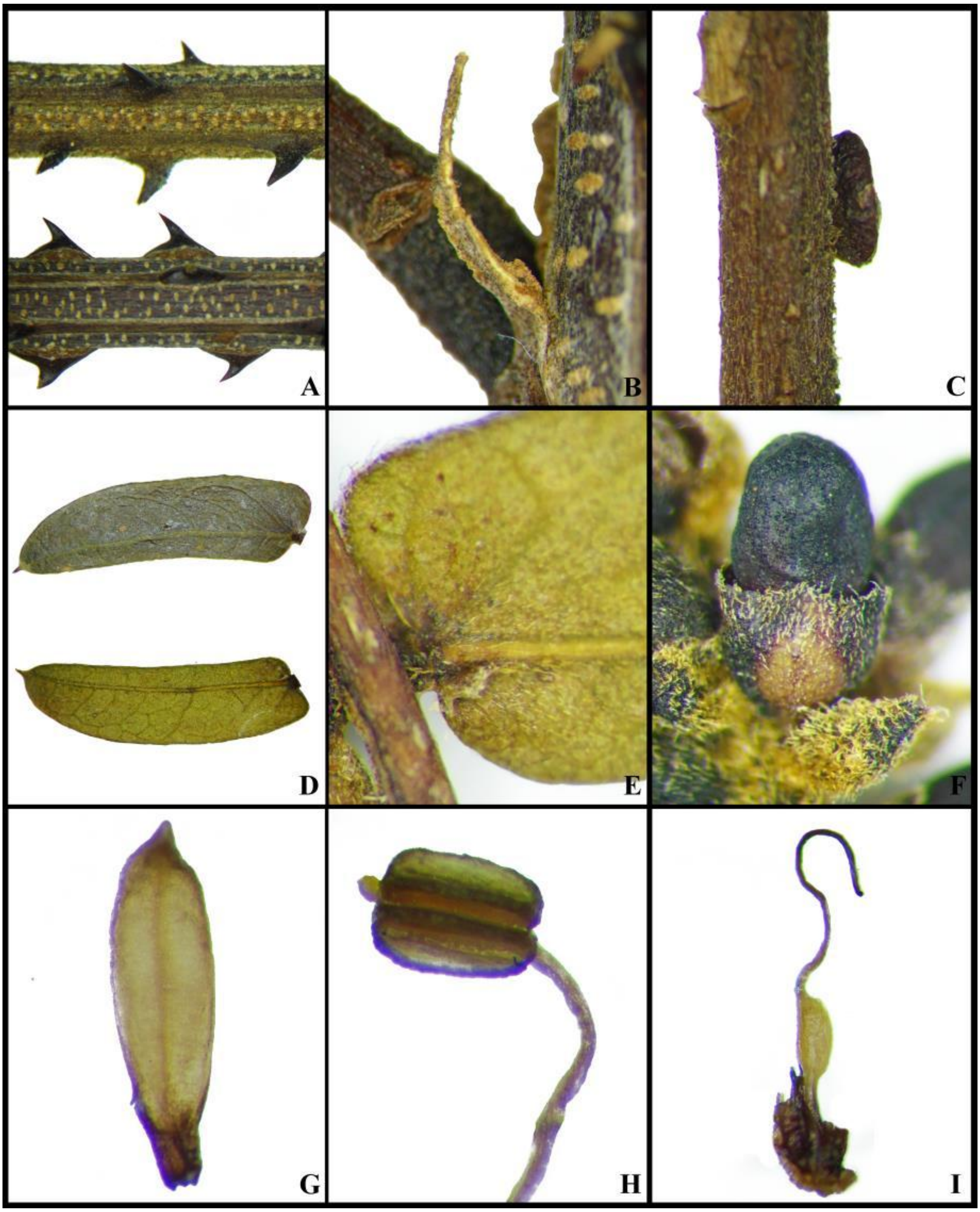


Fig.15.**A-I.** *Piptadenia affinis.* A. Prickles, B. Stipules, C. Petiolar nectary, D. Leaflets on upper and lower surfaces, E. Base of leaflet show domacea, F.Flower bud, G. Lobe of flower (petal), H. Anthers showingthe gland on the top and I.Gynoecium showing ovary glabrous. Pictures by Earl Chagas.

pubescent, persisten; floral bracts 0.5–1 × ca. 0.3 mm, lanceolate, apex acute, pubescent, persistent; flower buds ellipsoid. **Flowers** 4.1–4.6 mm long, sessile; calyx 1–1.2 mm long, campanulate, sparsely pubescent, tube 0.8–1 mm long, lobes 0.1–0.2 mm long, acute; corolla 2–2.5 mm long, campanulate, glabrous, tube short, 0.2–0.3 mm long, included in the calyx, lobes 0.8–2.2 mm long, strongly 1-nerved; filaments 4–4.5 mm long, red to vinaceous, anther 0.3–0.4 × 0.15–0.2 mm long, anther gland sessile, globose, early deciduous; ovary 0.7–0.8 mm long, glabrous to sparsely pubescent, 10–12-ovulated, stipe 1–1.2 mm long, style 1–1.5 mm long; stemonozone present. **Legume** 4.5–8.6 × 1.1–1.8 cm, stipe 8–16 mm long, straight, oblong-linear, apex rounded to shortly cuspidate, margins slightly thickened; valves light to dark brown, papery, flat to subtly undulating, transversally reticulate, glabrous. **Seeds** 5–6, 6–8 × 6–8 mm, transverse, oval-orbicular, flat, strongly compressed, provided with a circular, 0.5–1 mm wing; testa dark brown; pleurogram absent.

Etymology—The name *affinis* derives from the diagnosis when Burkart describes it as close to *Piptadenia gonoacantha*.

***Distribution and habitat* –** *Piptadenia affinis* occurs in southern Brazil (Rio Grande do Sul and Santa Catarina). It is found in the Atlantic Forest domain, in rain forests in mixed (Araucaria) forests borders, at 923 m a.s.l. elevations ("area of the rain forest of the atlantic slope" of the State of Santa Catarina, heliophytic and selective hygrophytes, very rare, especially in vegetation as capoeira, coppices or the edges of situated forests in moist soils”; Burkart 1979). A new occurrence was registered for FLONA (National Forest) of

Rio Grande do Sul, extending their occurrence towards South Brazil, presenting low abundance with eight individuals found (Seger & Hartz 2014).

Phenology

Flowering in December and February; Fruiting in February and September.

***Common names* –** Brazil: vamos-junto.

***Taxonomy* –** *Piptadenia affinis* was described by Burkart (1979) who differentiated it from *P. gonoacantha* by having curved prickles, wider leaflets, spikes shorter, red flowers, legumes lower and submarginal not fused funiculus (*vs.* prickles arranged on ribs on the branches, leaflets 5–7 × 0.8–1, spikes 5.8–6.2 × c. 7 mm, yellow flowers, legumes 11–13 × 2.5–2.8 mm). Besides those characters, we can easily differentiate these two species by the liana habit of *P. affinis* versus tree habit of *P. gonoacantha.*

Piptadenia affinis, *P. buchtienii* and *P. trisperma* are the only known species of *Piptadenia* with winged seeds. In the original description, Burkart (ano) does not reported this trait, although it is quite visible at illustration.

Burkart (1966) first used the name *Pityrocarpa affinis* Burkart on palynologycal studies, but there is no description of this species at the paper, only polen data. Hence, the name *Pityrocarpa affinis* Burkart is a *nomen nudum*.

Our molecular data show *P. affinis* sister to *P. buchtienii* (95PP / 94ML / 84MP). This result is also supported by the common sharing of the winged seeds, a trait salso found in *P. trisperma*, a species whose phyloegetic position was not resolved with high support. However, it is possible that winged seeds is homoplastic in *Piptadenia* as it is also found in species of *Anadenanthera*, *Parapiptadenia* and *Pseudopiptadenia*, probably emerging independently. *P. affinis* and *P. buchtienii* share some character like numbers of pinnae pairs (6–9 *P. affinis* vs 7–9 *P. buchtienii*); filaments size and color (4–4.5 mm long vs. 4–6 mm long, red to vinaceous in both).

This species was not included in previous phylogenetic works on the Piptadenia group (Jobson & Luckow 2007; Simon et al 2016).

Examined material – BRAZIL: RIO GRANDE DO SUL: SÃO FRANCISCO DE PAULA: Floresta Nacional, *G.D.S. Seger & G. Frainer716* (HUCS, ICN*); Floresta Nacional, *G.D.S. Seger 741* (HUCS, ICN*). SANTA CATARINA: LAURO MÜLLER: Rio do Meio, capoeira, *R. Reitz & R.M. Klein 8037* (GH, HERB, ICN, SPFW, US).

3. ***Piptadenia anolidurus*** Barneby, Brittonia 38: 222. 1986. Type. BRAZIL. Pará: Taperinha bei Santarém, "Rand des Sekundarwaldes der terra firme", 23 Jun 1927, *A. Ginzberger s.n.* (holotype: W–2 sheets = NY negative nº 11556; isotype: NY [barcode NY00842350] fragment ex W!).

Figs. 16, 17 A-E. Map Fig. 13A.

Illustration in Barneby (1986)

Liana, branches reddish-brown or brown; stems golden brown, puberulent with velvety hairs, older stems with horizontal lenticels; prickles 1–2 × 1–3 mm at the base, recurve, dark purple-brown, apex darker, widely scattered along the branch, in the leaf rachis and in the pinnae. **Stipules** 2–6 mm long, linear, puberulent, early deciduous. **Petiole** 3–5.5 (–11.5) cm long, rachis 5–13 cm long, slightly grooved, glabrous to lightly puberulent, pulvinus 3–8 mm long, interpinnal segments 10–23 mm long; pinnae 4–8 pairs, proximal pinnae 3.8–5 cm long, median pinnae 5.4–7.8 cm long, distal pinnae slightly longer 6–8.6 cm long, interfoliolar segments 8–16 mm long; paraphyllidia present 1, sometimes absent; petiolar nectary 1.7–5.2 mm long, sessile, sunken, fused to the petiole groove, elliptic, crateriform located at the base of the petiole, flat, additional nectaries raised, claviform, between most pairs of pinnae and in the pinnae between the distal or all pairs of leaflets; leaflets 11–20 pairs per pina, 5.5–13.5 (–18) × 2.3–3.5(–5.5) mm, oblong, slightly falcate, mucronate apex, base square-oblique, truncate on one side, margins not ciliate, subrevolute, short golden hairs on lower surface, some pubescence on upper surface as well, asymmetrical, midvein displaced towards acroscopic margin, raised on the lower surface, other venation pinnate reticulate, second venation obscure. **Inflorescences** mostly in terminal pseudo-racemose clusters, 1–3 per axil or node, leaves reduced terminally and appearing as panicles at the ends of branches, spike axis pubescent with golden hair;

16. *Piptadenia anolidurus.* Ubiratan 169 (NY).

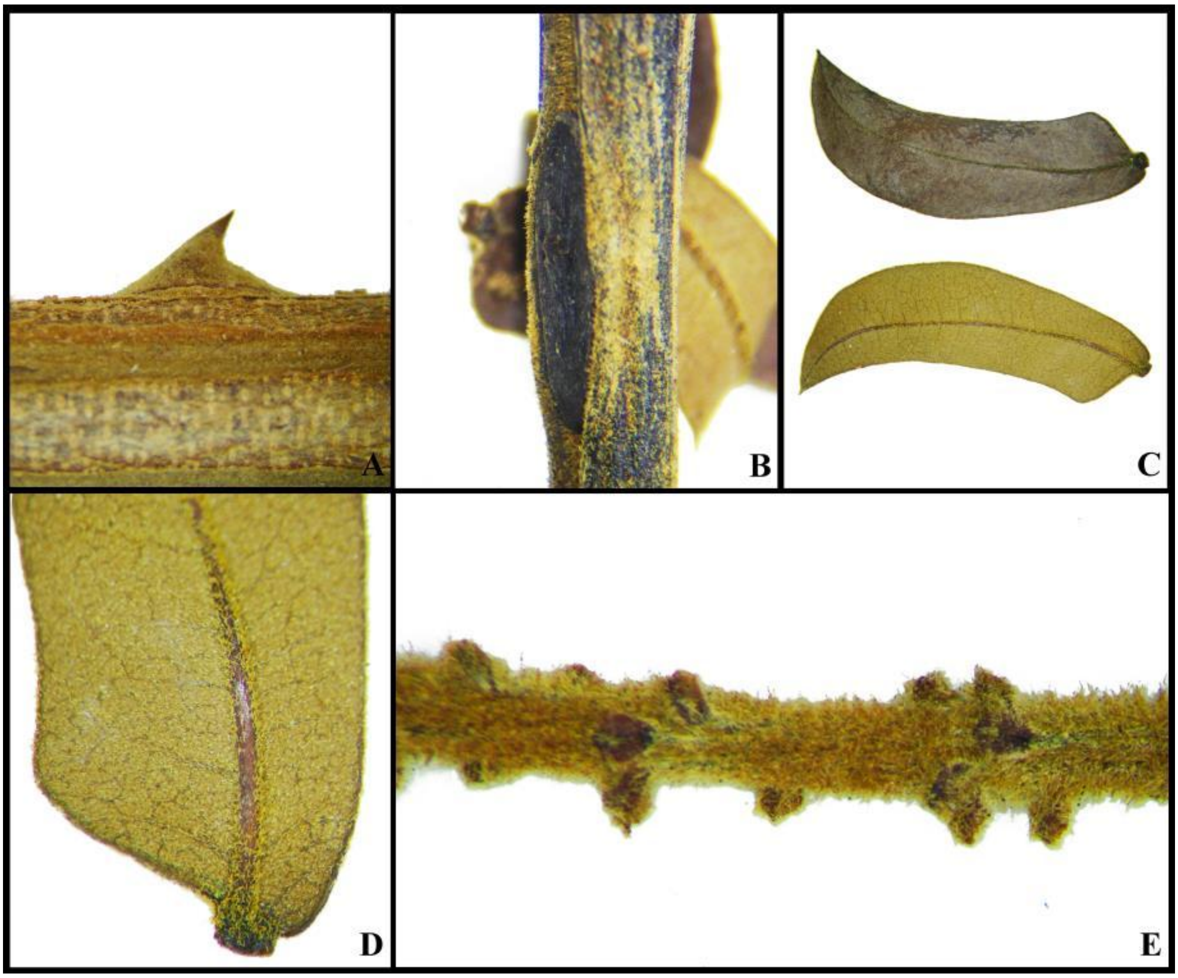


Fig.17.**A-E.** *Piptadenia anolidurus.* A. Prickles, B. Petiolar nectary, C. Leaflets on upper and lower surfaces, D. Base of leaflet, F.Axis of inflorescence showing persistents flower bracts. Pictures by Earl Chagas.

individual spikes 80–160 × 7–12 mm wide, peduncle 5–15 mm long, the spike axis densely puberulent with short golden hairs; first-order bracts 1–2, linear, 2–4 mm long, densely pubescent, early deciduous; floral bracts 0.4–0.8 × 0.15–0.3 mm, oval, carinate, apex rounded, pubescent, persistent; flower buds ellipsoid. **Flowers** 2.9–3.3 mm long, sessile; calyx 0.6–1.0 mm long, campanulate, puberulent, tube 0.4–0.9 mm long, lobes 0.1–0.2 mm long, acute; corolla 1.7–2 mm long, campanulate, glabrous, tube 0.3–0.6 mm long, included in the calyx, erect, pubescent outside, lobes 1.1–1.7 mm long, petals almost separate to base, not reflexed, strongly 1-nerved; filaments 2.8–3.2 mm long, white or cream-coloured, anther 0.3–0.4 × 0.15–0.2 mm long, anther gland sessile, globose, early deciduous; ovary 0.7–0.9 mm, densely pubescent, 12–14-ovulated, stipe 0.7–0.8 mm long, style 2.1–2.8 mm long; stemonozone present. **Legume** 12–23 × 25–35 cm, stipe 13–20 mm long, broad linear, apex acute, not beaked straight, flattened, margins slightly thickened; valves brown, coriaceous, undulate, transversely to irregularly striate, glabrous, eglandular. **Seeds** 8-10, 11–15 × 9–11 mm, oval to orbicular, strongly flattened, margin not winged, testa light to dark brown; pleurogram 3.3–4 mm.

Etymology—The name *anolidurus* [latim *anolis* = camaleao, lat. *durum* – hard] derives from vernacular name “rabo-de-camaleão in Brazil (hence the epithet), a name applied also to the other Amazonian mimosoids with prickles climbing stems and spicate flowers” (Barneby 1986).

***Distribution and habitat* –** Tropical rainforest and disturbed forest of the Amazonia domain, below 500 m a.s.l., in Bolivia, Ecuador, Peru and in northern Brazil (Pará).

Phenology **–** Flowering from August to March. Fruiting unknow.

Common names **–** Brazil: cari-cari (PA), rabo-de-camaleão (PA)

Taxonomy **–** Similar to *Piptadenia cuzcoënsis* by sharing the liana habit, but differing by presenting leaves with 4-8 pairs of pinnae (*vs.* 10-11 pairs in *P. cuzcoënsis*), individual spikes 80–160 × 7–12 mm (*vs.* 45–72 × 3.6–4 mm). In fact, the limits between these two species are very fragile, *P. cuzcoënsis*. is poorly sampled, with rare collections deposited in herbaria.

We recover it in a low supported clade together with *P. gonoacantha* and *P. macradenia* (=*P. gonoacantha*), but far removed from *P. cuzcoënsis* that is highly supported in a clade with *P. peruviana*, *P. laxipinna* and *P. paniculata*. However, as we only got sequence of the plastid *trnD-T* of this species, it is necessary include sequences of other markers toimprove phylogenetic inference. On previous works this species was not included.

Examined material **–** **Bolivia**. Brazil. Par : roadside on BR 163, Cuiaba-Santarem, km 890, 14 Feb 1977, J. H. Kirkbride & E. Lleras 2767 (NY); Marab , Serra dos Caraj s, 22 Mar 1984, A. S. L. de Silva et al 1964 (NY). **Ecuador**. Santiago-Zamora Taisha, 8 Feb 1962, *P. C. D. Cazalet & T. D. Pennington 7728* (NY); Prov. Napo: Parque Nacional Yasun¡, Pozo Petrolero Conoco Amo 1, 0º57'S, 76º13'W, D. Neill et al 8301 (NY). Peru. Loreto: Prov. Alto Amazonas, Andeas, Rio Pastaza, near Ecuador border, 76º28'W, 2º48'S, 14 Aug 1980, *A. Gentry et al 29673* (NY).BOLIVIA**:** Beni: Road from Carinavi-

San Borja, Serrania del Pilón Lajas, 450 m, 30 Oct 1989, *D.N.Smith & V.García 13793* (MO, NY); Santa Cruz: Parque Nacional Amboro, Queb rada Yapoje, 350 m, 12 Dec 1989, *M.Nee 38115* (MO). ECUADOR**:** Napo: Parque Nacional Yusuní, 250 m, 4-27 Jul 1993, *M.Aulestia 95* (MO); Aguarico, Reserva Etnica Huaorani, 250 m, 21-25 Oct 1993, *M.Aulestia & J.Audi 913* (MO); Aguarico, Reserva Etnica Huaorani, 247 m, 10-14 Nov 1993, *A. Dik 747* (MO); Cantón Orellana,Huashito, 20 km N of Coca, 250 m, 3-21 Non 1989, *E.Gudiño 174* (MO); Pastaza: Parroquia Curaray, 350 m, 4-19 Aug 1993, *M.Tirado & V.Zak 75* (MO). PERU**:** Amazonas: Huambisa, Valle de Río Santiago, 65 km N of Pinglo, 200 m, 31 Jun 1980, V.Huashikat 1894 (MO); Madre de Dios: Pampus del Heath, Tambopata, 200 m, 27 Feb 1990, A.Genmtry & P.Núñez 69682 (MO).

4-***Piptadenia buchtienii*** Barneby, *Brittonia* 38: 224-226. 1986. Type: Bolivia, La Paz, “prov. Nor Yungas, Millihuaya [± 16º20'S, 67º40'W], 1400 m, Dec 1917 (fl)”, *O. Buchtien 4180* (holotype NY!; isotypes HBG!, US!).

Figs. 5C, 7E, 18, 19A-F. Map Fig 13A.

Illustration in Barneby (1986)

Shrub or small tree 4–10 m tall, multiples trunks arising from the base; branches with shreddy, furrowed, red-brown bark on trunks, corky ridges on stems, a few scattered prickles along the ridges, disarticulating with age, branches brown, noticeably ridged, glabrous, with cream-coloured colored, elliptic lenticels; prickles 1–2 × 1–3 mm, recurve, light brown to dark brown to apex, scattered on the branches, in the leaf rachis and in the pinnae. **Stipules** 2–4.5 mm long, erect, linear, subulate, deciduous. **Petiole** 2–2.5 cm long, rachis 10–15 cm long, slightly grooved, with a terminal seta, puberulent, pulvinus 3–6 mm long, interpinnal segments 10–15 mm long; pinnae (3–)7–9 pairs, proximal pinnae 3.5–4.3 cm long, median pinnae slightly longer 5–7.2 cm long, distal pinnae 4.2–5.6 cm long, interfoliolar segments 3.5–5 mm long; paraphyllidia minute, deciduous; petiolar nectary 0.8–1.3 mm diam, sessile, crateriform, sunken, ellipitical, depressed, near the base of the petiole, additional and smaller nectaries in leaf rachis between the distal pair of pinnae and in the pinnae between the distal or all pairs of leaflets; leaflets 12–17 pairs per pina, 8.5–12 × 3–5 mm, oblong, opposite, apex mucronate, base rounded asymmetrical, ciliolate, midvein subcentric, venulosous on both surfaces, raised reticulate venation on both surface. **Inflorescences** mostly in terminal and axillary pseudoracemes, rarely with 1–2 spikes on the leaf axils, individual spikes 4–7 × 7–12 mm wide, peduncle 7–12 mm long, the spike axis densely puberulent with short white hairs throughout; first-order bracts 1–2, near the top of the peduncle, linear, 3–4.5 mm long, densely pubescent, early deciduoust;

18. *Piptadenia buchtienii.* Beck 8727 (NY)

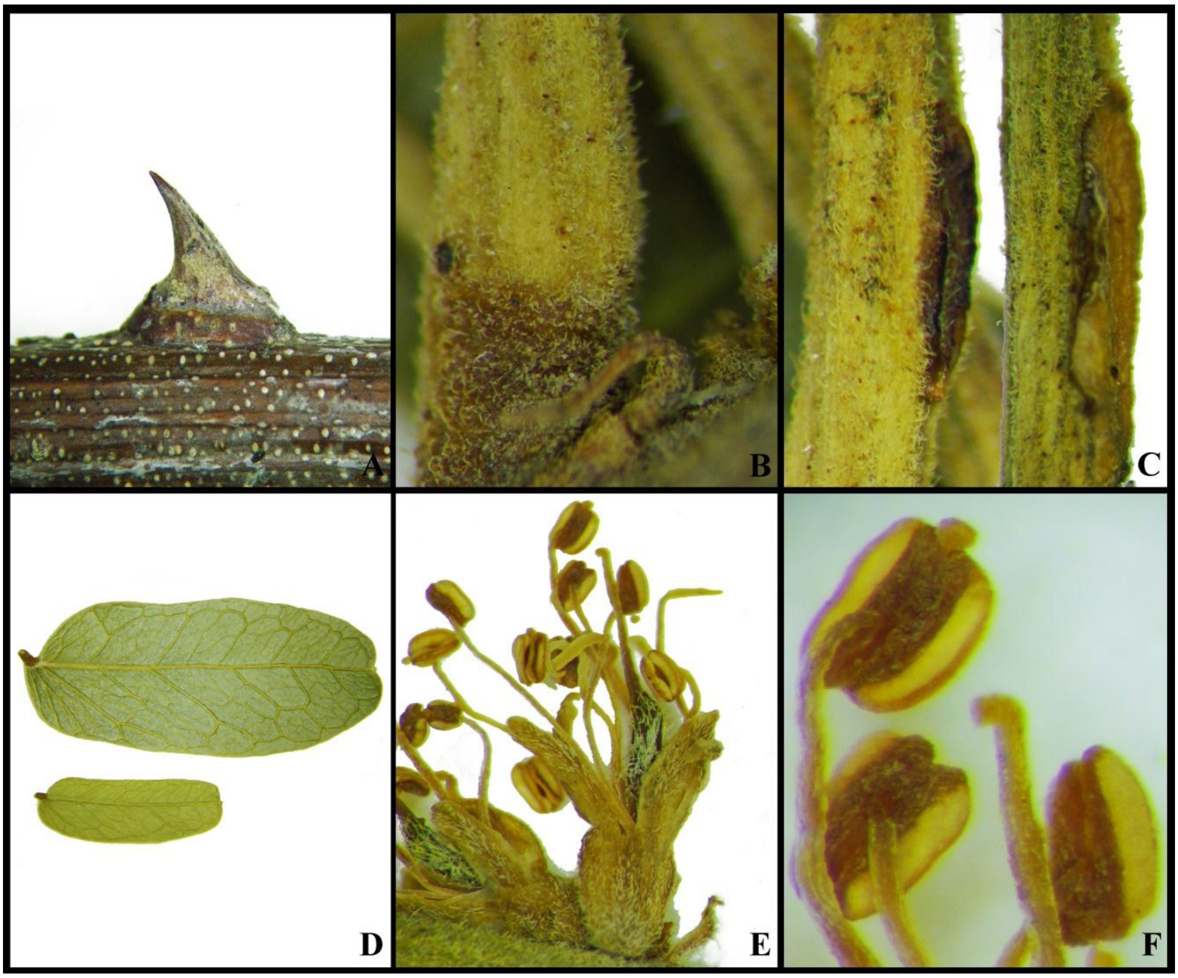


Fig.18.**A-I.** *Piptadenia buchtienii*. A. Prickles, B. Stipules, C. Petiolar nectary, D. Leaflets variation of size, E. Flower, F. Anthers showingthe gland on the top. Pictures by Earl Chagas.

floral bracts 0.3–0.7 × ca. 0.3 mm, sessile, carinate, apex acute, pubescent, deciduous; flower buds ellipsoid. **Flowers** 4.1–4.6 mm long, sessile; calyx 0.8–1.3 mm long, campanulate, puberulent, tube 0.8–1 mm long, lobes 0.1–0.2 mm long, acute,; corolla 1.8–2.4 mm long, campanulate, short tube 0.2–0.3 mm long, included in the calyx, lobes 0.8–2.2 mm long, strongly 1-nerved; filaments 4–6 mm long, red to vinaceous, anther 0.3–0.4 × 0.15–0.2 mm long, anther gland sessile, globose; ovary 0.7–0.8 mm long, sparsely pubescent, 10–12-ovulated, stipe 0.7–1.2 mm long, style 1–1.5 mm long; stemonozone absent. **Legume** 15–20 × 1.5–1.7 cm, stipe 8–16 mm long, broad-linear, apex obtuse, margins slightly thickened; valves brown or purplish-brown, but very light when dry on exsicates, stiffly papery, flat-compressed, transversally reticulate, glabrous, minute blackish glands. **Seeds** 5–6, 6–8 × 6–8 mm, oval-orbicular, flat, strongly compressed, provided with a circular,1.5–2.2 mm wing;; testa dark brown; pleurogram absent.

Etymology— Named in honor of Otto Buchtien, who collected the material selected as the type by Barneby.

***Distribution and habitat* –** In the Piedmonte nucleus of the SDTFW biome, in brushy edge of agricultural fields on sandy soil of subtropical deciduous forest of Bolivia, at 375-1600 m a.s.l. elevation.

Phenology

Flowering in December to February; Fruiting in August.

Common names **–** Not recorded.

Taxonomy **–** *Piptadenia buchtienii* was described by Barneby (1986) being compared to other sub-Andean members of the *Piptadenia* with leaflets of moderate size, erect petals, and very short monadelphous filaments from which it is differentiated by its elborately reticulate, not simply costate leaflets that retain a fresh green color when dried.

Piptadenia buchtienii was described for not fully mature fruits, and in the description it does not present dehiscence data of the fruit as well as seeds since they were not seen. We analyzed some sheets with mature legumes and we were able to describe the fruits and seeds. The winged seeds are only reported in three species of the *Piptadenia* (see discussion of *P. affinis*; Fig 7B-D). The wings are narrower than those found in *Parapiptadenia* and *Pseudopiptadenia*, and are comparable to the wing found in *Anadenanthera*, but the testa is much more membranous than the one present in *Anadenathera* (Morim 1985).

Our data show multiple accessions of *P. buchtienii* coalescing as monophyletic, and the both samples are sister of *P. affinis* (see discussion of *P. affinis*). Jobson & Luckow (2007) did not sample *P. affinis*, but they discuss that they hoped that based on morphological data, *P. buchtienii* would be close to *P. flava/P. stipulacea*, but this species emerges like sister group of the clade *P. paniculata* + *P. peruviana* (100 MP jacknife).

Examined material **– Bolivia**. Dept. La Paz: Prov. Inquisivi, below Cajuata, 16º49'S, 67º15'W, near Puente Alegre on the Rio Suri, *L. J Dorr & Lisa Barnett 6852* (NY), *L. J Dorr & Lisa Barnett 6856* (NY); Prov. Loaiza, between Miguillas and the summit of the road leading to La Plazuela, 16º28'S, 67º22'W, L. J. Dorr et al 6926 (NY); Prov. Sud Yungas, Chulumani, 67 km hacia Asunta, *St. G. Beck 8600* (NY); Prov. Nor Yungas, Coripata 12 kms hacia el sur, via Puente Villa, 1600 m, 31 Dec 1983, *St. G. Beck 8727* (MO, NY); Prov. Sud Yungas, Chulumani, 30 km hacia Asunta Colquechaca, embocdura del rio Solacama en el rio Tamampayo, *St. G. Beck 12133* (NY); Prov. Sud Yungas, Chulumani, 26 kms hacia Asunta, pasando Tajma, *St. G. Beck 12053* (NY). Dept. Santa Cruz: Prov. Andres Ibanez, Jardin Botanico de Santa Cruz, 12 km E of center of Santa Cruz, on road to Cotoca, 17º46'S, 63º04'W, *M. Nee 34231* (NY), *M. Nee 36918* (NY), 12 km E of Santa Cruz on road to Cotoca, 375 m, 3 Jan 1989*M. Nee 37510* (MO, NY); Mun. Andres Ibanez, "Monte Grande", road from Santa Cruz to Camiri, ca 4 km S of km 40, 17º05'S, 63º11'W, *M. Nee & M. Saldias P. 36404* (NY); Prov. Florida, canyon of Rio Bermejo, 4.5 km by road SE of Bermejo, 18º09'S, 63º36'W, *M. Nee 37073* (NY); Prov. Florida, canyon of Rio Pirai, near junction with Rio Bermejo, 18º11'S, 63º33'W, *M. Nee 37077* (NY); Canyon of Río Piral, junction with Río Bermejo, 800 m, 8 Dec 1988, *M.Nee 37077* (MO) Prov Cordillera, ca 21 km SE of Palmar del Oratorio, ca 14 km SE of Rio Chore-Chore (= Rio Pantano), 18º02'S, 63º01'W, *M. Nee 37643* (NY); Prov. Cordillera, 5 km N of YPFB Gas Plant on the Rio Grande, 1 km S of road "Brecha 5 1/2", 18º08'S, 62º56'W, *M. Nee 37920* (NY); Santa Cruz, Jardin Botanico, Av. Cotoca at km 12, *W. W. Thomas 5553* (NY); Santa Cruz: Km 40, Santa Cruz-Abapó, 470 m, 1 Sep 2001, *A.Fuentes, J.C.Catari & V.Salazar 1AF-49* (MO); 5.5 km S of Basilio on Santa Cruz-Camiri road, 500 m, 21 Jan 1994, *M.Nee 44558* (MO);Highway between Santa Cruz to Camiri, 525 m, 24 Dec 1997, *M.Nee 47519* (MO);6 km SW of police checkpoint, Santa Cruz-Samaipata road, 680 m, 30 Jan 1998, *M.Nee 48162* (MO).

5. ***Piptadenia cuzcoënsis*** Barneby, *Brittonia* 38: 222-226. 1986. Type: Peru, Cuzco, prov. Quispicanchis: “in monte, 610 m [illegible] a Fortaleza, 9 Dez 1966 (fl)”, *C. Vargas C. 18500* (holotype US 2702743!, isotypes CUZ!, NY!).

Figs. 10E, 20A-I. Map Fig 13A.

Illustration in Barneby (1986)

Liana or scandent shrub climbing to ca. 6 m tall, bark smooth, dark brown, branches brown, noticeably ridged, densely pubescent with short golden hairs, with rare cream-coloured, inconspicuous, elliptic lenticels; prickles 1–2.6 × 1–4 mm, recurve, cream-coloured with apex brownish, scattered on the branch, in the leaf rachis and in the pinnae. **Stipules** 4–6 mm long, linear, caducous. **Petiole** 2.8–3.2 cm long, rachis 8.5–11 cm long, slightly grooved, puberulent, pulvinus 3–5 mm long, interpinnal segments 16–45 mm long; pinnae 10–11 pairs, proximal pinnae 2.8–3.2 cm long, median pinnae 3.2–3.5 cm long, distal pinnae slightly longer 3.3–4.3 cm long, interfoliolar segments 1.8–2.5 mm long; paraphyllidia absent; petiolar nectary 3–4 mm long, sessile, sunked, fused to the petiole groove, elliptic, crateriform located at the base of the petiole, additional nectaries raised globose to claviform ones in leaf rachis between the several pinnae-pairs and smallers ones between the 1–3 distal pairs of leaflets; leaflets 17–24 pairs per pina, 7.5–9 × 2–2.3 mm, falcate, apex acutely triangular and apiculate, base cuneate, margins plane, ciliate, pubescent on both sides, trichomes larger on the lower surface, midvein subcentral, raised on the lower surface, secondary venation incospicuous. **Inflorescences** in a terminal pseudoracemes, with 2–5 spikes per node; individual spikes 45–72 × 3.6–4 mm, peduncle

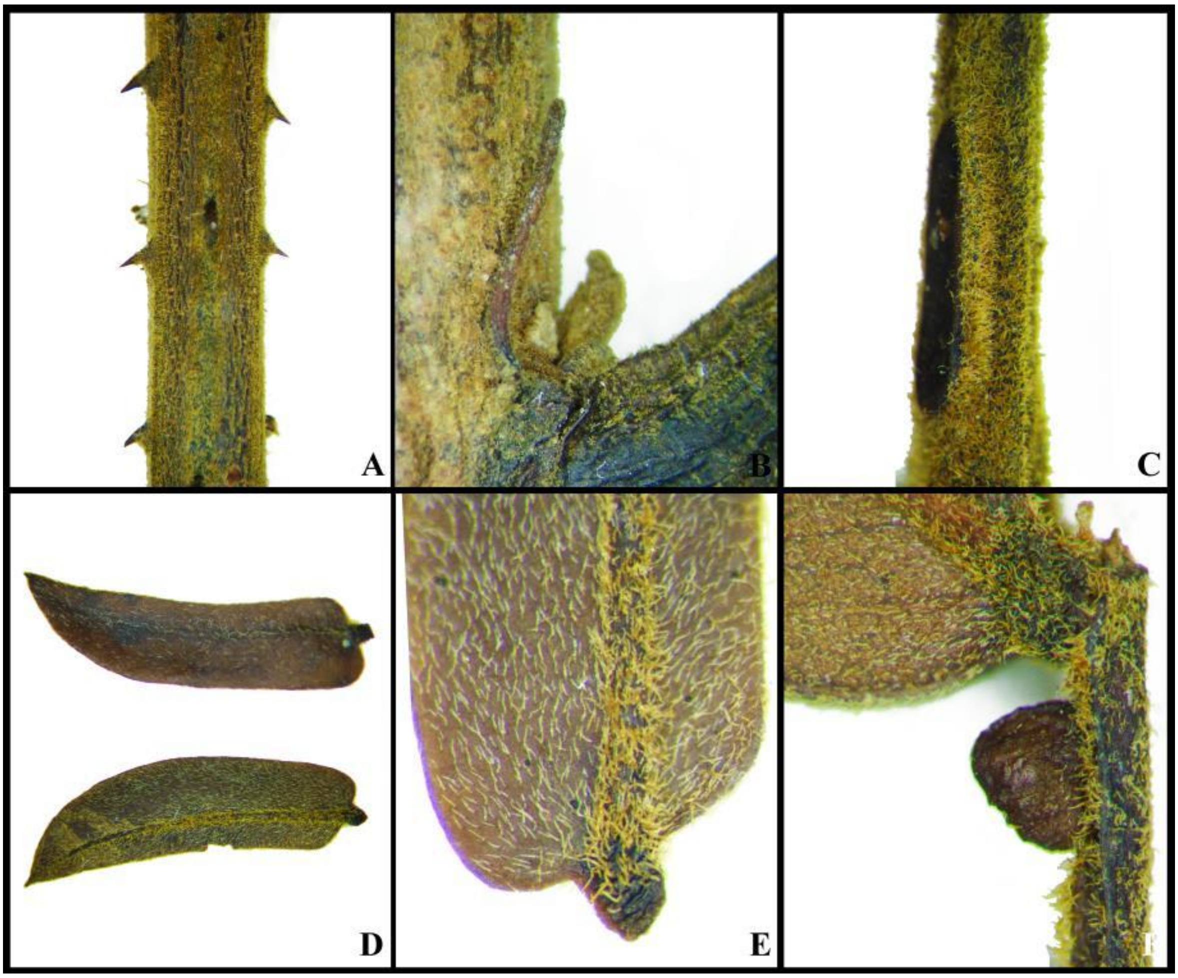


Fig.20.**A-I.** *Piptadenia cuzcoënsis.* A. Prickles, B. Stipules, C. Petiolar nectary, D. Leaflets on upper and lower surfaces, E. Base of leaflet, F.Nectary between leaflets. Pictures by Earl Chagas.

4.5–11 mm long, the spike axis densely pubescent with short golden hairs; first-order bracts located at axis of spike, 1–3, linear, 2–4 mm long, densely pubescent, deciduous; floral bracts 0.3–0.5 × ca 0.3 mm, ovate, apex acute, pubescent, persistent. **Flowers** 4.6–6.5 mm long, subsessile, pedicel 0.1–0.3 mm long; calyx 0.8–0.9 mm long, campanulate, densely gray puberulent dorsally, tube 0.7–0.8 mm long, lobes 0.1–0.2 mm long, deltate, acute; corolla 1.6–1.7 mm long, campanulate, glabrous, petals permanently erect, free to the base, oblanceolate, strongly 1-nerved; filaments 1.2–1.3 mm long, cream-coloured or white-yellowish, anther 0.3–0.35 × 0.15–0.2 mm wide, anther gland subsessile; ovary 0.8–1.1 mm long, pilosous, 12–14-ovulated, stipe ca.1 mm long, style 1–1.3 mm long; stemonozone present. **Fruit** unknown.

Etymology— The epithet *cuzcoënsis* derives from the type locality of this species, in Cuzco, Peru.

Distribution and habitat **–** *Piptadenia cuzcoënsis* occurs in the province Quispichance and Manu, Deptartment of Madre de Dios, Cuzco, Peru. It occurs in areas of forest at the Amazonia domain, between 350 and 610 m a.s.l.

Phenology

Flowering in December. Fruiting unknown

Common names **–** unknown.

Taxonomy **–** *Piptadenia cuzcoënsis* was described by Barneby (1986), who reported that it appears most closely related to *P. killipii,* for share liana habit, and by the general aspect of those species, but differs in minutely puberulent rather than villosous foliage, in lower leaflets of each pinna not degraded into linear-subulate paraphyllidia, and in densely puberulent flowers. In general appearence it also resembles *P. anolidurus* (see discussion on taxonomy of this specie).

P. cuzcoënsis present minutely puberulent foliage, no paraphilidya, densely puberulent flowers, leaflets 2-2.3 mm wide. It is known only form the type and another two collections. The fruits of *P. cuzcoënsis* are unknown.

Our results show *P. cuzcoënsis* in a clade (99 PP / 91ML / < 50MP) and sister to a subclade incuding *P. peruviana, P. laxipinna, P. paniculata* and *P. santosii* making a basal grade of Amazonian species subtending a low supported clade of Atlantic Forest species. The Maximum Parsimony results only recovery the clade *P. cuzcoënsis* + *P. peruviana* (80MP). This relationship is explained by the geographic distribution of these two species that occur in the Peruvian Amazon region.

Examined material: **PERU:** MANU**,** Parque Nacional Manu, Rio manu, Pakitsa Satation tachigali trail to 8km N of camp, *R.B. Foster 12789* (NY*).

6. ***Piptadenia flava*** (DC.) Benth., *Trans. Linn. Soc.* 30: 371. 1875. ≡ *Acacia flava* Spreng. ex DC., *Prodr*. 2: 469. 1825. ≡ *Pityrocarpa flava* (DC) Brenan, *Kew Bull.* 10: 176. 1955.

Type: Colombia: “in insula Sta. Martha”, *C.G. Bertero 1628* (holotype: G-DC!; isotype: M!).

= **synon. nov.** *Piptadenia communis* var. *stipulacea* Benth., *Fl. Bras.* (Mart.) 15: 279-280. 1876. ≡ *Piptadenia stipulacea* (Benth.) Ducke, *Arch. Jard. Bot. Rio de Janeiro* 5: 126. 1930. ≡ *Pityrocarpa stipulacea* (Benth.) Brenan, *Kew Bull.* 10: 177. 1955. Lectotype (**here designated**): Brazil, Ceará, Mundo Novo, “west from Barra do Jardim”, *G. Gardner 1943* (K!).

Piptadenia leptocarpa Rose, *Contr. U. S. Natl. Herb.* 1: 325-326. 1895. Type: Mexico, Colima: *E.J. Palmer 996* (holotype US!, isotypes: BM!, GH!, K!, NY!, US!, YU!)

Mimosa buceragenia B.L. Rob., *Proc. Amer. Acad. Arts* 43:23. 1907. Type: Mexico, Morelos: “valley near Treinte Station, 4000 ft., 26 Sep 1905”, *C.G. Pringle 10073* (holotype: GH!, isotypes: BM!, CM!, E!, F!, GOET!, HBG!, K!, M!, MEXU!, MIN!, MO!, PH!, S!, UC!, US!, VT!).

Mimosa carbonalis A. Molina, *Ceiba* 18: 102-104. 1974. Type: Honduras, Commayagua: “rocky pastures and moist thickets along stream, Támara Valley between Amarateca and Támara, 1000 m, 10 Oct 1969”, *Molina & Molina 24550* (holotype: F!; isotypes: EAP!, MO, NY!).

Figs. 5D, 7F, 21, 22–X, Map Fig 13B.

Shrub or tree 1.5–3 m tall, with several trunks from the base, bark smooth, brown, profusely branched; branches light-brown grayish, yellowish-cream, noticeably ridged,

Fig. 21. *Piptadenia flava.* Palmer 998 (MO)

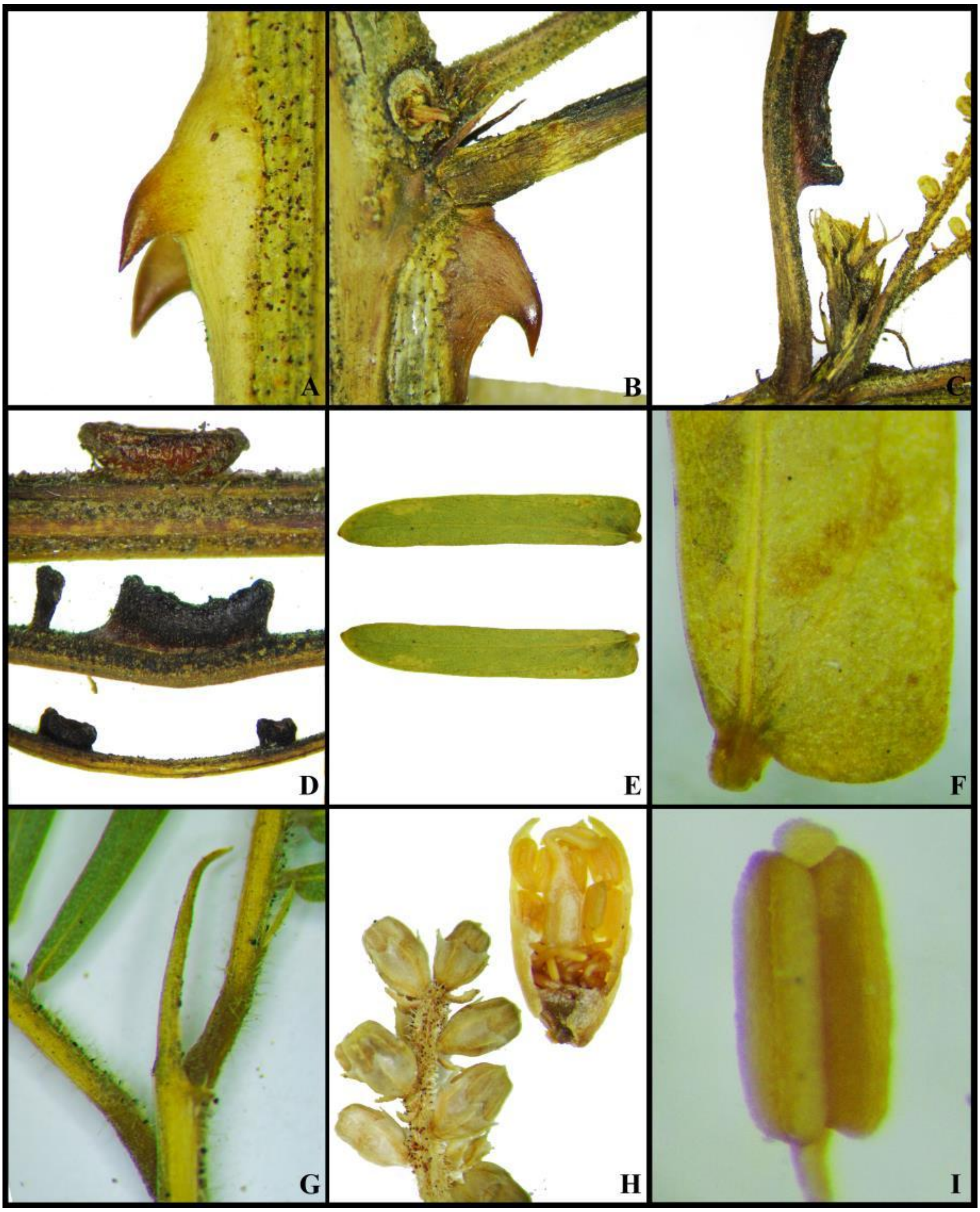


Fig.22.**A-I.** *Piptadenia flava.* A. Prickles, B. Stipules, C. Petiolar nectary and base of petiole, D.Petiolar nectary variations, E. Leaflets on upper and lower surfaces, F. Base of leaflet, G. Apex of leaf showing paraphylidia at base of pinnae, H. Flower buds and detail od bud open showinhg gynoecium and androecium, I. Anthers showingthe gland on the top. Pictures by Earl Chagas.

sparsely pubescent with short white hairs, rarely with cream-coloured, inconspicuous, elliptic lenticels; prickles 3–6 × 4–6 mm, recurve, cream-coloured with apex orange to brownish, dispersed on the branch, in the leaf rachis and in the pinnae. **Stipules** 3–5 mm long, linear, glabrous, caducous. **Petiole** 3–11cm long, rachis 2.4–8.6 cm long, cylindrical, slightly grooved, puberulent, pulvinus 2–3 mm length, interpinnal segments 6–15 mm long; pinnae (5–) 6–11 pairs, proximal pinnae slightly shorter, 2–3.2 cm long, median pinnae 4–5.1 cm long, distal pinnae 4–4.7 cm long, interfoliolar segments 0.5–1 mm long; paraphyllidia present; petiolar nectary 1-2, 3–5 × 1–2 mm diam, sessile, crateriform, oblong, vinaceous, margins strongly raised, 1(–2) located from the medial to the distal portion of the petiole, additional and smaller in the distal portion of the rachis, between the distal or penultimate pair of pinnae and in the pinnae between the distal pairs of leaflets; leaflets 23–31 pairs per pinna, 5–7 (–10) × 1–1.2 (–2) mm, linear, apex obtuse, base asymmetrical, margins plane, sparsely ciliate, mostly glabrous on both sides, rarely few hairs on lower base of the leaflet, midvein subcentral, raised on the lower surface, one or two additional veins from the pulvinus, smaller venation reticulate. **Inflorescences** solitary axillary, or terminal pseudoracemes grouped at the apex of the branches; individual spikes 40–62 × 6–7 mm wide, peduncle 6–8 mm long, the spike axis densely pubescent with white to yellowish short hairs; first-order bracts located at axis of spike, 1–3, linear, 2–4 mm long, densely pubescent, deciduous; floral bracts 1–1.1 × ca. 0.3 mm, lanceolate, apex acuminate, pubescent, persistent; flower buds ellipsoid. **Flowers** 4.6–6.5 mm long, subsessile, pedicel 0.05–0.15 mm long; calyx 1–1.2 mm long, campanulate, glabrous to sparsely pubescent and, tube 0.8–1 mm long, lobes 0.1–0.2 mm long, acute, rare trichomes at margins; corolla 2.6–3 mm long, campanulate, glabrous, tube 1–1.2 mm long, included in the calyx, lobes 1.6–2 mm long, erect, strongly 1-nerved; filaments 4.8–5.3 mm long, cream-coloured or greenish-yellow varying to pinkish-red, anther 0.2–0.4 × 0.15–0.25 mm long, anther gland shortly stipitate, ca.0.5 mm diam., globose, early deciduous; ovary 1.2–1.4 mm, glabrous, 10–12-ovulated, stipe 1–1.2 mm long, style 3–3.4 mm long; stemonozone present. **Legume** 9.5–11.5 × 1.8–2.1 cm, stipe 1–1.4 cm long, broad linear, flat-compressed, apex acuminate to rounded, margins slightly thickened; valves brown, papery, smoothly undulate, reticulated, glabrous. Seeds 8–10, 6–8 × 4–6 mm, ovoid; testa brown; pleurogram 1–2 mm diam.

Etymology—The latin name *flava* means pale yellow, light, blond; the name is due to the color of the most typical stamens in the inflorescences of the species, light yellow.

Distribution and habitat **–** *Piptadenia flava* occurs disjunctly in SDTFW nuclei across the neotropics, in the Caatinga of northeastern Brazil (Paraíba, Pernambuco, Bahia), in the Piedemonte of northestern Argentina (Salta) and southeastern Bolivia, in northwestern South America in Colombia and Venezuela, and in southern Mexico (Chiapas? Oaxaca?) and adjacent Guatemala. It is a typical element of decidual and semidecidual forests but it could be found in restinga, at altitudes of 0-1100 m a.s.l.

Phenology

Flowering in March, from May to August, and in December; Fruiting from May to December.

Common names **–** Calumbi-de-lagoa, calumbi, calumbi-vermelho, jurema-branca, jurema-preta, espinheiro, espinheiro-branco, unha-de-gato (Brazil) and zarza (Mexico).

Taxonomy **–**

After a careful analysis and a detailed study of the materials present in the herbaria under the name *P. flava* and *P. stipulacea*, we conclude they should be synonymized. There is an overlap of characters, and the justification for them to be considered different species is the geographical distribution. Lewis (1991) comments that *P. stipulacea* is barely distinct from the widely dispersed *P. flava* (known from NW South America northwards into Mexico) and *P. stipulacea* restricted to the caatinga vegetation NE Brazil. Lewis (1991) had pointed out the need for further study of these taxa.

We had studied several specimens from herbaria in an attempt to separate individuals with similar vegetative or floral pattern, but all the characters overlap. Due this fact, we are synonimizing here *P. stipulacae* in *P. flava*.

Piptadenia flava occurs then in most nuclei of neotropical SDTFW as in the Caatinga, Piemonte, Guajira and Mexican domains This pattern of distribution is similar to found in *Lachesiodendron*, recently segregated from *Piptadenia* (Ribeiro et al, submited).

Our molecular date show *P. flava* and *P. stipulacea* (= *P. flava*) on same clade (1PP / 99ML / 98 MP, Figura 1), with a sample of *P. uligonosa* included. Samples of *P. flava* and *P. sipulacea* coalesce in geographical clades but they do not make a clade because of the nested position of *P. uliginosa*, a SDTFW from northwestern South America. In maximum parsimony analysis, the accessions of *P. flava* appear in a polytomy with *P. uliginosa* and this clade is a sister group of *P. stipulacea*. However, in IB and ML *P. uliginosa* was recovered as sister of *P. flava* and this clade sister group of *P. stipulacea*. These three species are very similar in vegetative characers but differs mainly by the inflorescence of panicle of racemes, unique in of *P. uliginosa* (vs. solitary axillary or terminal pseudoracemes grouped at the apex of the branches of *P. flava*).

Piptadenia flava was recovery as sister of *P. stipulacea* in previous studies (100 MP jackknife in Jobson & Luckow 2007; 100 PP / 100 MP in Simon et al 2016) and the species *P. uliginosa* was not included. Jobson & Luckow (2007) reported that *P. flava* e *P. stipulacea* differs primarily in the distribution pattern rather than in any morphological characters.

Examined material – Central America, MEXICO, Michoacan: 4 km N of El Devanador, Temazcal-Huetamo, 7 Sep 1978, *J.C.Soto N. 980* (MO); Oaxaca: 11 km ENE of Tololapam, Talacolula, 1100 m, 25 Oct 1977, *M.Sousa & O.Téllez 8566* (ILL); 3 km W of San Jose de Gracia, Tlacolula, 800 m, 25 Oct 1977, *M.Sousa & O.Téllez 8575* (ILL); 4 km W of Salina Cruz, Tehuantepec, 20 m, 27 Oct 1977, *M.Sousa & O.Téllez 8639* (ILL); Laguna de los Bajos de Chila, Juquila, 30 m, 21 Dec 1977, *M.Sousa, O.Téllez, A.S.Magallanes & R.Gurether 8416* (ILL). NICARAGUA, Boaco, 4 km S of Boaquito, 200m, 21 Oct 1982, *P.P.Moreno 18044* (MO); Santa Cruz, Km 63 to Rama, 160-200 m, 15 Nov 1092, *P.P.Moreno 18634* (MO); Leon: 20 km S of Leon, 80 m, 18 Jan 1983, *A.Grijalva 2218* (MO); Managua, W of Laguna de Jiloa, 250 m, 18 Nov 1980, J*.C.Sandino 287* (MO).

South America: BRAZIL, Bahia, Banzaê, área indígena Kiriri, Baixa da Cangalha, 10°40'47''S, 38°39'47''W, 18 ago. 2002 (bot. e fr.), *L.M. Pacheco & C.V. Santos 5* (HUEFS). Barro Alto: Comunidade de Lagoa Funda, Fazenda Lagoa Branca, 11°45'12''S, 41°50'8''W, 8 abr. 2002 (bot. e fl.), *T.S. Nunes et al. 920* (HUEFS, MBM, SPF); *i.b.*, 11 abr. 2001 (bot. fl. e fr), *T.S. Nunes et al. 304* (HUEFS). Boa Vista do Tupim: ca. 3 Km após a balsa para a travessia do Rio Paraguaçu para João Amaro, na estrada para Boa Vista do Tupim, 27 abr. 1994 (bot. e fl.), *L.P. Queiroz & N.S. Nascimento 3883* (ALCB, CEPEC, HUEFS, IPA, MBM, NY). Bom Jesus da Lapa: Basin of the Upper São Francisco River 28 Km SE of Bom Jesus da Lapa, on the Caetité road, 13°23'S, 43°13'W, 16 abr. 1980 (fl. e fr.), *R.M. Harley et al. 21420* (CEPEC, IPA, RB, NY, UEC); Arredores, 17 jun. 1986 (bot. e fl.), *G. Hatschbach et al. 50468* (CEPEC, MBM). Brotos de Macaúbas: estrada Ibotirama-Lençóis (BR-242) Km 80, 12º16'S, 42º42'W, 9 set. 1992 (fr.), *L. Coradin et al. 8525* (CEN, HUEFS); em direção a Ipupiara, a 3km, 11°59'0"S, 42°37'0"W, 25 jan. 2001 (bot.), *M.L. Guedes et al. 7935* (HUEFS); caminho para o Barreiro, 12°15'32"S, 42º31'47"W, 10 abr. 2001 (bot. e fl.), *T.S. Nunes et al. 277* (HUEFS). Caém: Piemonte da Diamantina, Assentamento Engano, Piabas, 11°07'50"S, 40°10'11"W, 5 ago. 2001 (fr.), *M.L. Guedes et al. 9082* (ALCB, CEPEC, MBM). Campo Alegre de Lourdes: ca. 36 km da cidade e a 2 Km do povoado limite com banco do Brasil, estrada para de Pitomba, 9°29'25"S, 43°12'3"W, 29 abr. 2001 (fl. e fr.), *E.P. Heringer et al. 54378* (CEPEC, HRB, HUEFS, RB); estrada de Tuiuiu e Pitomba, 15 km de Campo Alegre de Lourdes, 9°29'37"S, 43°11'21"W, 17 abr. 2004 (bot., fl. e fr.), *J.G. Carvalho-Sobrinho et al. 224* (HUEFS). Campo Formoso: estrada Alagoinhas-Água Preta Km 3, 26 jun. 1983 (fr.), *L. Coradin et al. 6037* (CEN, CEPEC). Canudos: Estação Biológica de Canudos (Biodiversitas), 9°56'34"S, 38°59'19"W, 27 jun. 2002 (bot. e fl.), *L.P. Queiroz et al. 7229* (HUEFS); Estação Biológica de Canudos, 10°1'0"S, 39°9'0"W, 24 abr. 2003 (bot. e fl.), *F.H.M. Silva et al. 391* (HUEFS, HUESB); Reserva Biologica de Canudos, 9°56'34"S, 38°59'17"W, jan. 2002 (bot. e fl.), *M.S. Castro & C.M. Pigozzo s.n. - ALCB 66364* (ALCB, HRB). Casa Nova: Fazenda Lagoa Nova, 23 mar. 1973 (bot. e fl.), *F.B. Ramalho 167* (HST, RB, PEUFR); 70 km de Casa Nova na estrada, 9°17'55"S,41°35'21"W, 28 dez. 2001 (fr.), *T.S. Nunes et al.. 697* (HUEFS); s.l., 9º37'29"S, 41º52'23"W, 29 fev. 2008 (bot., fl. e fr.), *C. Correia et al. 420* (HUEFS). Chorrochó: Parque, 8º55'37"S, 39º4'57"W, 11 out. 2009 (fr.), *E. Melo et al. 6606* (HUEFS). Curaçá: Serra Canabrava, encostas rochosas, 9°15'34"S, 39°39'45"W, 13 mar. 2011 (bot.e fl.), *E. Melo et al. 9368* (HUEFS). Gentio do Ouro: 16 km from Gentio do Ouro NW along road to São Inácio, 11°24'S, 42°40'W, 23 fev. 1977 (bot. e fl.), *R.M. Harley 18962* (CEPEC, IPA, RB, NY); ca. 3 Km E de Gentio do Ouro na estrada pra Mirorós, 17 jun. 1994 (fr.), *L.P. Queiroz & N.S. Nascimento 3972* (HUEFS); estrada Gentio do Ouro - Xique-Xique, 11°11'0"S, 42°44'0"W, 22 fev. 2011 (bot.), *E.R. Souza et al. 608* (HUEFS); BA 210, sentido Glória -Rodelas, ca. 3,5 Km do Centro Administrativo José Messias, 9°13'53"S, 38°24'29"W, 7 jun. 2007 (bot. e fl.), *A.S. Conceição et al. 983* (HUEFS); Serra de Itaparica, 9°6'20"S, 38°19'5"W, 18 jul. 2007 (bot. e fl.), *A.S. Conceição et al. 1129* (HUEFS, HUNEB); BA-210 sentido Glória-Rodelas, ca. de 4 Km do Centro Administrativo José Messias, 9°13'53"S, 38°24'29"W, 8 jun. 2007 (bot. e fl.), *R.A. Silva et al. 1854* (HUEFS, HUNEB); BA- 210 sentido Glória-Rodelas, ca. de 3,5 Km do Centro Administrativo José Messias, 9°13'53"S, 38°24'29"W, 8 set. 2007 (bot. fl. e fr), *A.S. Conceição et al. 1168* (HUEFS, HUNEB); Serra de Itaparica, 9°6'35"S, 38°9'30"W, 10 jun. 2007 (bot. e fl.), *M.V.V. Romão et al. 1* (HUEFS, HUNEB); Brejo do Burgo, caminho da serrota, 3 jul. 1995 (bot.), *F.P. Bandeira 237* (HUEFS); Serrota, 9°20'S, 38°29'W, 1 set. 2006 (bot., fl. E fr.), *S. Leal 22* (HUEFS). Ibipeba: 52 km da cidade de Ibipeba, 11°17'S, 42°12'W, 2 mar. 2006 (bot. e fl.), *A.C. Melo 20* (HUEFS); 52 Km da cidade de Ibipeba, 11°17'S, 42°12'W, 30 mar. 2006 (bot. e fl.), *A.C.Melo 28* (HUEFS). Ipirá: 29 Km na estrada que liga Ipirá a Itaberaba, 12°20'S, 39°57'W, 13 jun. 1980 (fl.), *J.E.M. Brazão 227* (CEPEC, HRB, RB); Fazenda Tanque do Sítio- Ipirá, 3 out. 1984 (bot. e fl.), *E.L.P.G. Oliveira 677* (HUEFS). Irecê: Estação Experimental da EPABA em Central, 18 fev. 1981 (bot., fl. e fr.), *B.C. Bastos 76* (ALCB, IBGE); bambuí de capoeira na beira de área cultivada, 11°20'S, 41°54'W, 18 jan. 1984 (fr.), *G. Fotius 3681* (HSTA, HUEFS, IPA); Localidade de Central, ca. 7 km de Central a Uibaí, 28 abr. 1999 (fr.), *A.M. Amorim et al. 3017* (CEPEC, SP); Xique-Xique, Empreendimento Brasil"2000" do empreendedor- TOC agrícola SA , 10º40'S, 42º41'W, 17 jun. 2000 (fr.), *M.L. Guedes et al. 7244* (ALCB); ao longo da estrada Irecê -Xique-Xique, 10°57'06"S, 42°43'08"W, 9 mar. 2006 (bot. e fl.), *M.F. Simon et al. 702* (FHO, HUEFS). Itaberaba: sl., mai. 1972 (bot. e fl.), *G.C.P. Pinto 1331* (HUEFS). Jacobina: rodovia Jacobina-Umburanas, km 2, 11°09'S, 40°34'W, 20 set. 1992 (fr.), *L. Coradin & G.P. Silva 8689* (CEN, HUEFS, RB); Bairro do Mutirão, morro atrás do bairro, estrada para Morro do Chapéu, 11°9'12"S, 40°33'22"W, 7 jun. 2001 (bot. fl.), *M.E.R. Junqueira et al. 36* (HUEFS). Jaguarari, rodovia Juazeiro-Senhor do Bonfim (BR-407) Km 100, 10°19'S, 40°10'W, 25 jun. 1983 (Fr.), *L. Coradin et al. 6014* (CEN, CEPEC); crista quartzítica, 10°6'1"S, 40°13'45"W, 30 jul. 2005 (fr.), *D.S. Carneiro-Torres et al. 419* (HUEFS); rodovia Juazeiro-Senhor do Bonfim (BR-407) Km 100, 10°19'S, 40°10'W, 25 jun. 1983 (bot., fl. e fr.), *L. Coradin et al. 6012* (CEN, CEPEC, UB, RB); Parque, 9º20'37"S, 40º13'38"W, 1 mai. 2009 (bot.e fl.), *E. Melo et al. 6172* (HUEFS); rodovia Juazeiro-Senhor do Bonfim (BR- 407) Km 100, 10º19'S, 40º10'W, 25 jun. 1989 (fr.), *L. Coradin et al. 3012* (CEN, RB); Flamengo, Serra das Umburanas, 10°6'21"S, 40°13'43"W, 30 jul. 2005 (fr.), *T.S. Nunes et al. 1269* (HUEFS). Jeremoabo: Povoado Casinhas, Roça de Sr. Zé Lino, 10°15'0"S, 38°23'54"W, 1 ago. 2010 (bot. e fl.), *T.B. Gomes 92* (HUEFS); estrada entre Jeremoabo e Canudos, 10°4'7"S, 38°28'21"W, 27 jun. 2007 (bot. e fl.), *R.M. Santos et al. 1655* (HUEFS); Muro, 10°1'14"S, 38°25'59"W, 18 out. 2009 (bot. e fl.), *E. Melo et al. 6730* (ALCB, HUEFS); ca. 23 km E de Canudos na estrada para Jeremoabo (BR-235), 26 ago. 1996 (fl.), *L.P. Queiroz & N.S. Nascimento 4642* (CEPEC, ESA, HUEFS, MBM). Juazeiro: km 4 caminho Olho D'água - Rio Salitre, 9°56'S, 40°37', 25 abr. 1985 (bot. e fl.), *G. Fotius 3988* (HSTA, HUEFS); Serra do Mulato, 9°44'40"S, 40°40'39"W, 26 mar. 2000 (bot. e fl.), *G. Cavalcanti et al. 49* (ALCB, CEN, CEPEC, HUEFS, SPF); Serra do Mulato, 9°44'40"S, 40°40'39"W, 27 mar. 2000 (bot. e fr.), *N.G. Jesus et al. 892* (ALCB, HUEFS). Maracás: 26 km na estrada Maracás/Tamburi, 20 abr. 1983 (bot., fl. e fr.), *A.M. Carvalho et al. 1863* (CEPEC). Marcionílio Souza: ca. 6,2 km E de Marcionílio Souza na entrada para Iaçu, 12°57'53"S, 40°29'17"W, 25 jan. 2000 (bot. e fl.), *L.P. Queiroz 5703* (CEN, HUEFS, UB). Mirorós: ca. 52 km da cidade de Ibipeba, 11°17'S, 42°12'W, 4 abr. 2006 (bot. e fl.), *A.C. Melo 33* (HUEFS). Morro do Chapéu: Lages, 11°29'52"S, 41°19'50"W, 7 mar. 2003 (bot., fl. e fr.), *L.P. Queiroz et al. 7636* (CEPEC, HUEFS, RB); Fazenda São João Brejões, Rio Salitre, 11°15'29"S, 41°5'42"W, 14 abr. 2007 (bot. e fl.), *E. Melo et al. 4711* (HUEFS); Lajedo Bordado, 11°15'30"S, 41°5'41"W, 14 abr. 2007 (est.), *D. Rocha et al. 322* (HUEFS); *i.b.* 14 abr. 2007 (bot. e fl.), *D. Rocha et al. 343* (HUEFS); ca. 2 km da comunidade Gruta dos Brejões, 11°05'3"S, 40°24'19"W, 4 mai. 2007 (fr.), *D. Cardoso & R.M. Santos 1807* (HUEFS); Piemonte da Diamantina, Lajes, 11º33'S, 41º09'W, 3 abr. 2004 (bot. e fl.), *M.L. Guedes et al. 10972* (ALCB, CEPEC); Chapada Diamantina, rodovia BA-052, Km 289, 8 set. 1990 (fr.), *H.C. Lima et al. 3910* (CEPEC); Lagedo do Bordado, 11°15'32"S, 41°5'40"W, 19 mai. 2007 (bot. e fl.), *C.A. Bastos et al. 29* (CEPEC, HUEFS); Baixa da Serra do Tarreco, 15 mai. 1957 (bot. e fl.), *R.P. Lordelo 380* (ALCB); Lagedo Bordado, 11°15'28"S, 41°9'40"W, 5 mai. 2007 (bot. e fl.), *J.M. Gonçalves et al. 167* (HUEFS); ca. 2 km da comunidade Gruta dos Brejões, 11°0'53"S, 40°24'19"W, 4 mai. 2007 (bot. e fl.), *D. Cardoso & R.M. Santos 1810* (HUEFS). Olindina: s.l., 25 jul. 1977 (bot. e fl.), *A. Fernandes 3885* (EAC, RB). Oliveira dosBrejinhos: rodovia Oliveira dos Brejinhos a Macaúbas, BR-122, Km 8, 17 jun. 1986 (bot. e fl.), *G. Hatschbach et al. 65091* (MBM). Paulo Afonso: 62 km saindo do km 28 da BR 110, 9°39'S, 38°27'W, 21 set. 2008 (est.), *A.A. Conceição et al. 3030* (HUEFS); Estação Ecológica Raso da Catarina, estrada da Várzea com acesso à 3º casa da ESEC , 9°33'7"S, 38°30'46"W, 30 jan. 2006 (fr.), *A.M. Amorim et al. 5542* (CEPEC, HUEFS); Raso da Catarina, Cachimbo, 9°39'12"S, 38°32'14"W, 10 ago. 2005 (est.), *E.B. Miranda et al. 830* (HUEFS); Estação ecológica do

Raso da Catarina , 19 jun. 1981 (bot. e fl.), *M.L. Guedes 273* (ALCB); Raso da Catarina, Cachimbo, 9°39'12"S, 38°32'14"W, 10 ago. 2005 (bot., fl. e fr.), *E.B. Miranda et al. 827* (HUEFS); Estacao ecológica do Raso da Catarina, 24 jun. 1982 (bot. e fl.), *L.P. Queiroz 310 & M.L. Guedes 428 310* (ALCB, HUEFS). Pilão Arcado: 1 km depois da ponte sobre o riacho de Lage, 30 km de Remanso na estrada para Pilão Arcado, 9°45'32"S, 42°17'53"W, 28 abr. 2001 (fl. e fr.), *L.P. Queiroz et al.. 6595* (ALCB, HRB, HUEFS, UB). Remanso: ca. 9 km E de Remanso na estrada para Casa Nova. 9°33'47"S, 42°2'31"W, 3 jul. 2003 (fr.), *L.P. Queiroz et al. 7864* (HUEFS); Aterro do Terminal Pesqueiro da Barragem da Hidroelétrica de Sobradinho/Novo Remanso, 9°37'S, 42°05'W, 22 jun. 1983 (bot., fl. e fr.), *L. Coradin et al. 5936* (CEN, CEPEC, UB); Campo Alegre de Lourdes, a 1 km da cidade, 9°35'38"S, 42°54'50"W, 2 mar. 2000 (bot.), *L. Passos et al. 405* (ALCB, CEN, HUEFS, SPF); saída de Remanso a Pilão Arcado, 9°44'17"S, 42°23'49"W, 28 fev. 2000 (bot. e fl.), *L. Passos et al. 390* (ALCB, CEN, HUEFS, SPF). Riachão do Jacuípe: Serrote Branco, 9°42'1"S, 40°23'20"W, 26 mar. 2000 (bot., fl.e fr.), *M.R. Fonseca at. 1314* (ALCB, CEN, HUEFS). Santo Antonio: s.l., 8 mar. 1910 (fr.), *Lofgren 181* (R). Santa Brígida: BR-116, 9°41'48"S, 38°13'54"W, 23 ago. 2005 (bot. e fl.), *D.S. Carneiro-Torres et al. 494* (HUEFS). Santa Terezinha: ca. 2 km S de Santa Terezinha, entre Santa Terezinha e o entroncamento para Pedra Branca, 11 abr. 1994 (bot. e fl.), *L.P. Queiroz & N.S. Nascimento 3813* (ALCB, CEPEC, HRB, HUEFS, IPA, MBM). São Gabriel: após a entrada da cidade , 11-12,35, 41º54'16"W, 17 abr. 2008 (bot., fl. e fr.), *J.F.B. Pastore & R.M. Harley 2597* (CEN, HUEFS); Fazenda Boa Sorte, 11°2'S, 41°9'W, 31 mar. 2009 (bot. e fl.), *R.F. Machado et al. 51* (HUEFS). Saúde: ca. 11 km S de Saúde, a 23 km N da BR 324, 11º01'S, 40º24'W, 23 ago. 1993 (fr), *L.P. Queiroz & N.S. Nascimento 3567* (CEPEC, HUEFS, MBM, RB). Seabra: ca. 3km S de Lagoa do Chure na estrada para Seabra (Seabra-Lagoa Boa Vista), 12º19'48"S, 41º46'11"W, 22 jun. 1993 (fr.), *L.P. Queiroz & N.S.*

Nascimento 3370 (CEPEC, HUEFS). Senhor do Bonfim: Carrapichel, 10°22'47"S, 40°9'23"W, 29 jul. 2005 (fr.), *P.D. Carvalho et al. 137* (HUEFS); Carrapichel, 10°22'47"S, 40°9'23"W, 29 jul. 2005 (bot. e fr.), *P.D. Carvalho et al. 229* (HUEFS). Serra Dourada: estr. para Gameleira da Lapa via Proj. Agrop., 12º39'S, 43º43'W, 22 mar. 1984 (bot. e fl.), *M.M. Fernandes & J.E.R. Collares 11* (HRB, RB). Serrolândia: s.l., 20 ago. 1980 (fr.), *W. Fonseca 251* (ALCB, CEPEC, HRB, RB). Tucano: ca. 6 Km S de Tucano, na BR-116, 11º01'S, 38°48'W, 23 mar. 1993 (bot., fl. e fr.), *L.P. Queiroz & T.S.N. Sena 3115* (ALCB, CEPEC, HUEFS, MBM, NY, UB). Umburanas: Distrito de Delfino, Fazenda Boa Esperança , 10º30'19"S, 41º19'51"W, 24 mai. 2008 (bot. e fl.), *E. Melo et al. 5767*(HUEFS); Serra do Curral Feio, entrando para W, a ca. 20 km S de Delfino na estrada para Umburanas, 10°22'S, 41°19'W, 10 abr. 1999 (bot. e fl.), *L.P. Queiroz et al. 5257* (CEPEC, MBM, HUEFS, SP, SPF).s.m. BR-4, 60Km N da divisa Minas-Bahia, 25 jun. 1965 (bot. e fl.), *R.P. Belém 1212* (CEPEC, UB). Paraíba, Maturéis, Pico do Jabre, 800 m, 30 Oct 1997, *F.Agra & Sr. Paulo* (MO). COLOMBIA: Bolivar, Isla de Barú, between Santa Ana and Playa Mojana, 25 Aug 1986, *H.Cuadros V. & A.H.Gentry 3059* (ILL, MO). ECUADOR, El Oro, Huaquillas-Arenillas road, Km 18, 1 May 1980, *G.Harling & L.Andersson 18823* (MO); 10 km SW of Santa Rosa, 18 Jan 1989, *C.D.Johnson 45231-89* (ILL, MO). PERU, Tumbes, entre Pocitos y Uña de gato, 25 Apr 1955, *R.Ferreyra 10652* (MO); Cuesta de Animas entre Zarritos y Casitas, 320-350 m, 28 May 1957, *R.Ferreyra 12247* (MO); Entre Puerto Pizarro y El Bendito, 16 May 1965, *R.Ferreyra 16229* (MO); Entre "El Caucho" y Campo verde, 370 m, 21 Jun 1989, *C.Diaz, T.Pennington & C.Reynel 3212* (MO). VENEZUELA, Nueva Esparta, Isla de Margarita, Santa Ana, 23 Mar 1985, *J.A.Steyermark, J.Hoyos & B,Holst 130986* (MO); Sucre, 26 km SE of Cumaná, 7 Aug 1984, *C.D.Johnson 3448-84* (ILL, MO).

7. ***Piptadenia floribunda*** Kleinhoonte, *Recueil Trav. Bot. Néerl*. 30: 168. 1933. *Adenopodia floribunda* (Kleinhoonte) Brenan, *Kew Bull*. 41: 83. 1986. Type: Surinam, Brownsberg, *Herb. Boschwezen 3186* (holotype: U!, isotype: K!).

Figs. 23, 24A-I. Map Fig. 13B.

Climbing shrub 2–16 m tall; branches cream-coloured or brownish, noticeably ridged, glabrous or minutely brownish puberulous, lenticels absent; prickles 2.5–3 × 3–4 mm, recurve, cream-coloured with apex orange to brownish, scattered on the branch, in the leaf rachis and in the pinnae. **Stipules** 4–5 mm long, linear, caducous. **Petiole** 3.5–6.5 cm long, rachis 2.6–4 cm long (smaller then petiole), slightly grooved, puberulent, pulvinus 4–5 mm long, interpinnal segments 2.6–4 mm long; pinnae 2 pairs, proximal pinnae 3–4 cm long, distal pinnae longer 5.1–9.5 cm long, interfoliolar segments 1.2–1.6 mm long; paraphyllidia absent; petiolar nectary 1.5–2 mm diam, claviform, cream-coloured, located at the base of the petiole, additional and slightly smaller nectaries in leaf rachis between the distal pair of pinnae and in the pinnae between all the pairs of leaflets; leaflets 3–4 pairs per pinna, 2.5–7 × 1.5–5 mm, elliptic to obovate, abruptly narrowed to an apex acutely apiculate, base rounded to broadely cuneate, slightly asymmetrical, margins plane, not ciliate, glabrous to minutely pubescent on upper surface, apressed-pubescent on lower surface, trichomes larger on the lower surface, midvein central or subcentral, raised on the lower surface, secondary venation brochidodromous, smaller venation reticulate. **Inflorescences** a terminal panicles with 1–5 spikes per node, fully exserted from foliage; individual spikes 20–45 × 4–5 mm, peduncle 5–20 mm long, the spike axis densely puberulent with golden hairs; first-order bracts not seen, probably very early deciduous; floral bracts 0.3–0.5 × ca. 0.2 mm, lanceolate, apex acute, pubescent, persistent. **Flowers**

Fig. 23. *Piptadenia floribunda.* Jansen-Jacobs 1782 (NY).

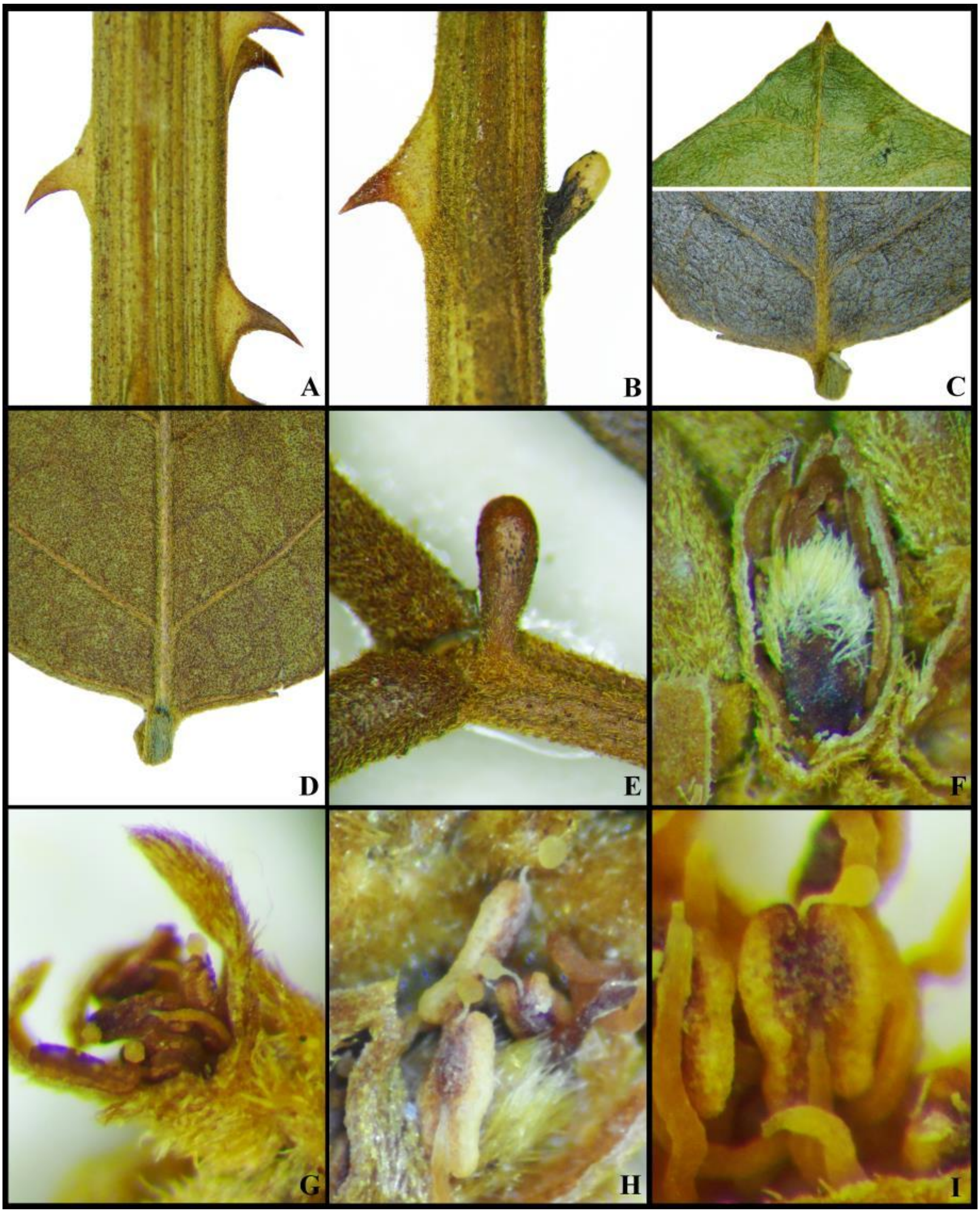


Fig.24.**A-I.** *Piptadenia floribunda.* A. Prickles, B. Prickles and petiolar nectary, C. Apex and base of leaflet, D. Base of leaflet on lower surfaces, E. Petiolar nectary, F.Flower bud opened showing densely puscent ovary, G. Anthers showing glands on the top, H. Anthers showing the stipitat gland on the top and I. Anthers showing the stipitat gland on the top. Pictures by Earl Chagas.

0.2–0.25 mm long, sessile; calyx 0.5–0.7 mm long, campanulate, densely pubescent, tube 0.3–0.5 mm long, lobes 0.2–0.25 mm long, acute; corolla 3.2–5 mm long, campanulate, densely pubescent, tube 0.25–0.35 mm long, included in the calyx, lobes 1.5–1.75 mm long, erect, strongly 1–nerved; filaments 2–2.5 mm long, white, fading yellow, anther 0.2–0.3 × 0.15–0.2 mm wide, anther gland stiptate, 1.3-2.1 mm long; ovary 0.7–0.8 mm long, pubescent on the apex, 8–10-ovulated, subsessile, style 1.2–1.8 mm long; stemonozone present. **Legume** 9.5–11.6 × 2–2.6 cm (imature), stipe 1.5–2.2 cm long, broad linear, apex rounded, margins slightly thickened; valves light brown, papery, undulate, reticulate, glabrous, with sparse granular trichomes. **Seeds** 8–11, (imatures), ovoid; testa dark brown; pleurogram minute on imature seed.

***Distribution and habitat* –** *Piptadenia floribunda* occurs in French Guyana, and in the state of Para (Brazil), in the Amazonia domain, at 500-700 m a.s.l.

Phenology – Flowering in March, from May to August, and in December; Fruiting from May to December.

Common names – unkonown.

***Taxonomy* –** Our studies recovery a morphologically and geographically supported clade (97 PP / 98 ML / 95 MP), whereas multiple accessions of *P. floribunda* coalesce and form clade sister to *P. uaupensis*. This results is similar to the found by Jobson & Luckow (2007) whereas this clade is recovered by 91 BS (MP jacknife).

P. floribunda and *P. uaupensis* share the leaves with two pairs of pinnae (*P. uaupensis* rarely has 1 pair), leaflets in until 4 pairs by pinnae (3-4 in *P. floribunda,* 2-4 in *P. uaupensis*), and similar range of size of leflets (*P. floribunda* 2.5-7 × 1.5-5 cm *vs. P. uaupensis* 3-9.5 × 1.5-6.2 cm). A marked difference between these two species is the petiolar nectary that is claviform in *P. floribunda* and shortly cylindrical in *P. uaupensis.*

Examined material – BRAZIL: AMAPÁ: West bank of Rio Falsino, aprox. 10 km, upstream from confluence with rio Araguari and about 8 hours upstream from boat from Porto Grande, Inventory site, *J.F. Pruski 3308* (HAMAB, NY). MACAPÁ: 154 km NW of Porto Grande on the highway "Perimetral Norte” (BR210), Fazenda Sucupira, *B.V. Rabelo 3097* (NY). PARÁ: Almeirim, Mt. Dourado Estação Ecológica do Jari (SEMA), *M.J. Pires & N. Silva 1475* (Herbarium. FRENCH GUIANA: *B. Bordenave s.n.* (P); *J.J. Granville & F. Crozier s.n.* (P); Kaw Mts, Trésor Reserve Roadside, Near eastern border Trésor Reserve, *M.J.J. Jacobs, R. Vonk & Pineau 1782* (NY, U*); Mantagnes de Kaw, Camp, Caiman, *S.C. s.n.* (NY); Mana, route d'Awala, pk 2,5, *J.J. Granville & F. Crozier 13823* (CAY*, NY, P); Saul, La Fumee west, between entrance and first hill, Non-flooded moist forest , *S. Mori & N. Ishikawa s.n.* (NY*). SURINAME: Lely, Lely mountains, 175 kms of Paramibo, *S. Mori & A. Bolten s.n.* (NY*).

8. Piptadenia gonoacantha (Mart.) J.F. Macbr., *Contr. Gray. Herb.* n.s. 59: 17. 1919. ≡ *Acacia gonoacantha* Mart., *Fl. Bras.* 20, 2 Beiblatt: 109. 1837. ≡ *Pityrocarpa gonoacantha* (Mart.) Brenan, *Kew Bull.* 2: 176. 1955. Type: Brazil, Rio de Janeiro: "In valle Laranjeiras prope Rio de Janeiro, feb.1834, *Luschnath in Mart. Herb. Fl. Brasil. 147* (holotype: BR!, isotype: M!).

Piptadenia communis Benth., Hooker J. Bot. 4: 337. 1842. Lectotype (**designated here**): Brazil, *Pohl 1207* (lectotype W, isolectotype NY!).

Piptadenia gonoacantha (Martius) Macbride var. *inermis* Burkart, *Fl. Ill. Catar.* 279. 1979. Type: Brazil, Santa Catarina: Jacinto Machado, Sanga da Arela, mata, 200 m, 4 Sep 1959, *Reitz & Klein 9044* (holotype: SI; isotype: HBR).

= **synon. nov.** *Piptadenia macradenia* Benth., Hooker J. Bot. 4: 335. 1842. Lectotype (**designated here**): Brazil, *Pohl 1422* (lectotype W, isolectotypes K!).

Figs. 5E, 7G, 25A-C, 26, 27A-I.Map. Fig.13B.

Illustration in Burkart (1969)

Tree 3–20 m tall, branches brownish-tan, greyish-cream, noticeably ridged, glabrous or pubescents with elliptical cream-coloured lenticels; prickles 3–8 mm long on young branches, erect, varying to cream-coloured with apex orange to brownish, uniformly grayish-cream, arranged in longitudinal series on branch ribs and in the leaf rachis, merging in the older branches to defining suberous stem wings. **Stipules** 3–5 mm long, linear, caducous. **Petiole** 0.8-3 mm long, rachis 10.2-12.1 cm long, cylindrical, slightly grooved, puberulent, pulvinus 3-4 mm long; interpinnal segments 8-12 mm long; pinnae 7-14 pairs, proximal pinnae 3-4.2 cm long, median pinnae slightly larger 4.8-5.5 cm long,

Fig. 25.**A-C.** *Piptadenia gonoacantha.* **A.** Trunk, **B**. Leaf and galls, **C**. Tree. **D-F.** *Piptadenia micracantha*. **D**. Inflorescences. **E**. Detail of petole showing the nectary. **F.** Detail of inflorescence showing filaments pink**. G-I**. *Piptadenia paniculata.* **G**. Trunk. **H**. Base of petiole showing the petiolar nectary. **I**. Pinnae apex. Pictures **A-C** by Pétala G. Ribeiro, **D-I** by Luciano P. de Queiroz.

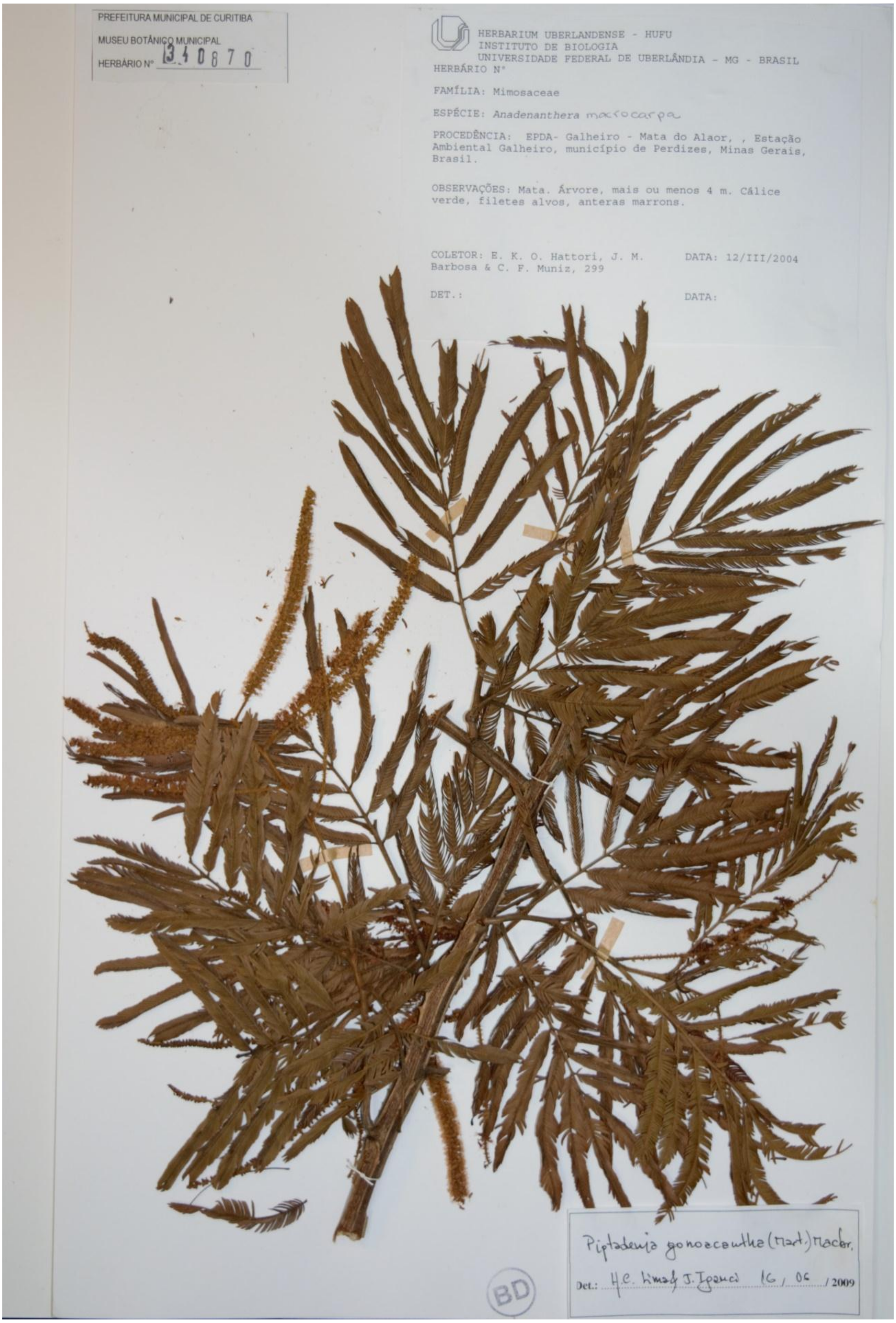


Fig.26. *Piptadenia gonoacantha.* Hatori 299 (MBM).

Fig.27.**A-I.** *Piptadenia gonoacantha.* A. Galls, B. Prickles in a rib, C. Petiolar nectary variations, D. Pinnae apex, E.Leaflets on upper and lower surfaces, F.Flower an bud, G. Anthers showingthe gland on the top, H. Corolla and ovary almost glabrous, I. Flower showing ovary pubescent. Pictures by Earl Chagas.

distal pinnae slightly longer 35-55 cm long, interfoliolar segments 0.5-1.2 mm long; paraphyllidia absent; petiolar nectary 1 (2), 0.5-1.6 mm diam., sessile, ring-shaped or conical, located from the middle to the apex of the petiole, additional and smaller nectaries in the leaf rachis between the 1-2 distal pair of pinnae and in the pinnae between the distal pairs of leaflets; leaflets 27-60 pairs per pina, 4.5-7 × 0.8-1.2 mm, linear, falcate, apex falcate, base truncated, asymmetrical, margins plane, ciliate, glabrous to pubescent on both sides, midvein displaced towards acroscopic margin, raised on the lower surface, secondary venation reticulate. **Inflorescences** in terminal pseudoracemes or axillary with 1–3 spikes per node, individual spikes 58-110 × 6-13 mm, peduncle 3-7 mm long, the spike axis densely pilosous with white hairs; first-order bracts 1-2 at the apex of the peduncule, linear, 1.5-3 mm long, pubescent, deciduous, floral bracts 0,3-1,0 × 0,3 mm, lanceolate, apex acuminate, pubescent. **Flowers** 3–3.5 mm long, sessile; calyx 0.5–0.7 mm long, campanulate, glabrous to pubescent, tube 0.4–0.6 mm long, lobes 0.1–0.2 mm long,; corolla 2–2,2 mm long, cylindrical to campanulate, glabrous to pubescent, tube 0.6–0.8 mm long, include in the calyx, lobes 1,3–1,5 mm long, erect; filaments 3–3.5 mm long, white, yellowish-cream, rarely light pink, anther 0.25–0.4 × 0.2–0.25 mm long, anther gland shortly stiptate, globose; ovary 0.8–1 mm long, glabrous to pubescent, 12–14-ovulated, stipe 1.4–2 mm long, style 1.3–2 mm long; stemonozone present. **Legume** 11–20× 1.7–3 cm wide, stipe 1–1.8 cm, broad linear, apex obtuse, margins slightly thickened; valves brown, coriaceous, slightly undulate, almost flat, reticulated, glabrous. **Seeds** 9–12, 7–8 × 6–7 mm, ovoid to suborbicular; testa light brown, pleurogram present, 3–4 mm diam.

Etymology—The name *gonoacantha* derives from *greg*. *gonia* = angule and *acantha* = prickle, ceference to the aculeus on the edges of the branches and trunk. (Burkart)

Distribution and habitat – *Piptadenia gonoacantha* occurs in Nordeste (Bahia), centro-oeste (xxx), Sudeste (Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro) e Sul (Paraná, Santa Catarina) from Brazil, at altitudes of 315-545 (bellow 1200m) ms.n.m Habitat: subtropical semi-deciduous forest, forested slopes, galley forests, cut-over forests, and disturbed áreas.

Phenology

Flowering from January to May; Fruiting from May to December.

Flowering Jan-May.

Common names –jacaré, pau-jacaré, arranha-gato, aripuanã, cambuí, farinha-seca, jurema-branca (all in Brazil, the first two being the most common).

Taxonomy –

Piptadenia gonoacantha presentes the prickles erect and arranged on ribs at the branches, this way, the trunk presente a broad reticulum of suberous wings, resulting from the fusion of aculeus, from which derives its vernacular name of pau-jacaré (“allgator wood”), used mainly in the southeastern region of Brazil. It is very common to find galls in the leaves in this species (Figures 25B, 27A).

We are considering *P macradenia* as a synonym of *P. gonoacantha*, because the morphological characters used to distinguish the two species are very similar, differting only in pubescence of the perianth and ovary [pubescente (Fig. 27I) on *P. macradenia* vs glabrous (Fig. 27H) on *P. gonoacantha*] and the size of petiolar nectary (2x larger on *P. macradenia*). Due those character that overlap between the two species, besides having similar geographic distribution, we are synonymizing here.

Our molecular data results recovery multiples accessions of *P. gonoacantha* in the same clade as *P. macradenia* (59PP / 73ML / 71MP), but with very low support to make any phylogenetic inference. Sample of *P. anolidurus* appears together in the politomy with the other accessions of *P. gonoacantha* and *P. macradenia.*

In previous phylogenetic works on the Piptadenia group the topology recovery tha clade *P. gonoacantha* + *P. macradenia* (99 BS MP jacknife, in Jobson & Luckow 2007; and 100PP / 96MP, in Simon et al 2016). Jobson & Luckow justified the relationship because they are very similar morphologically, except for the pubescent periant in *P.macradenia* pubescenth and in *P. gonoacantha* glabrous.

Due to this previous results (Jobson & Luckow 2007; Simon et al 2016), we choise to analyze several samples of the both species and we can report that those characters used to distinguish both species are quite variable among all the studied individuals, therefore, here synonimized.

Examined material – **BOLIVIA: Abuná**, Ibañez, 9.7 km (by road) N of Urubó bridge over the Río Piraí, W of Río Piraí, 21 Apr. 2007, *M.H. Nee 55117* (COL, MO). **Andres Ibanez**, Along valley of Rio Salado (also Quebrada Salada), 7.4-8 km NW of turnoff at Taruma from highway from Santa Cruz to Samaipata, 22 Jan. 1998, *M.H. Nee 48077* (MEL, MO). **Ayopaya**, Rio Altamachi, 19 May 2004, *E. Fernández 3776* (MO). **Beni**, Inmediaciones del Parque Nacional Noel Kempff Mercado, a 24 km al W de la comunidad de San José de Campamento, sobre el camino hacia el empalme hacia Piso Firme, 5 May

1996, *R.V. Guillén et al. 4294* (MO); Parque Nacional Noel Kempff Mercado, 23 Mar. 1994, *A. Jardim et al. 462* (MO); Campamento Cerro Pelao, 5 km del aserradero sobre el camino a El Empalme, 29 Mar. 1994, *M.P. Saldias et al. 3704* (MO); *M.P. Saldias et al. 3725* (MO); Cerca de 1 km al NW de Santa Rosa de la Roca, en el camino a Piso Firme, 22 Jun. 1993, *M.P. Saldias et al. 2660* (MO); Vaca Diez, Riberalta, at junction of Rio Madre de Dios and Rio Beni, 14 Aug. 1985, *M.H. Nee 31332* (INPA, MO). **Chiquitos**, Camino a Roboré, 70-72 km al E de Roboré, Localidad Los Naranjos, Bosque bajo, Suelos arenosos rojizos,. 27 Jan. 1995, *B.C. Mostacedo et al. 2653* (MO); Cerro de Santiago near Santiago, 17 May 1991, *A.H. Gentry et al. 74056* (MO). **Franz Tamayo**, Area Natural de Manejo Integrado Madidi, comunidad Virgen del Rosario, arroyo Yarimita, 24 Apr. 2012, *E. Mosqueira et al. 9B* (MO); 14 Mar. 2005, *J. Uzquiano 86* (MO); 24 Apr. 2012 L. Quispe et al. 93 (MO); 24 Apr. 2012, *L. Quispe et al. 155* (MO); 24 Apr. 2012, *L. Quispe et al. 156* (MO); 24 Apr. 2012, *L. Quispe et al. 164* (MO); Chaquimayo-Tuichi trail ca 20 km NW of Apolo, disturbed dry forest along Río Machariapo, 12 Jun. 1990, *A.H. Gentry & R.B. Foster 71143* (MO); Madidi, Azariamas, Resina, 10 Jun. 2005, *A.M. Araujo 1924* (MO); **Franz Tamayo**, Parque Nacional Madidi, Azariamas, Resina, 10 Jun. 2005, *A.M. Araujo et al. 1902* (MO); Mojos, Muspay, al lado del rio Mojos, 9 Jul. 2005, *A.F. Fuentes et al. 9634* (MO); NW de Apolo, senda Azariamas-San Fermin, 31 May 2006, *I. Loza et al. 194* (MO); NW de Apolo, Bosque andino semideciduo del sector de Yarimita, 12 Mar. 2005, *D. Choque A. 130* (MO); 15 Mar. 2005, *L. Cayola 1586* (MO). **Ichilo**, Along highway from Buena Vista to San Carlos, 5 km SE of San Carlos, 7 kn WM of Buena Vista, 1 Mar. 1998, *M.H. Nee 48549* (MEL, NY, SP). **Larecaja**, Guanay, *H.H. Rusby 1306* (MO); *H.H. Rusby 1307* (MO); *H.H. Rusby 1308* (MO); Apr. 1892, *M. Bang 1361* (MO). **Mamoré**, Ballivian, Rio Beni, above confluence with Rio Quiqibey, 3.5 hr upstream from Rurrenavaque, 23 May 1990, *D.C. Daly 6600* (MO). **Nor Yungas**, 5.5 km below Coroico towards Yolosa, 1.4 km above Yolosa, 16 May 1985, *J.C. Solomon 13725* (MBM, MO, NY). **Ñuflo de Chaves**, Ca. 12 km NE from Concepcion, S16° 14' 19.3" W59° 37' 08", 28 Feb. 2003, *L. Quispe et al. 1471* (MO); San Ramón, Puquio Sur-Ladera Norte, 23 Feb. 1991, *R.C. Quevedo 440* (MO). **Pelechuco**, Area Natural de Manejo Integrado Apolobamba, Marumpampa, al frente pasando el rio Camata, 21 Apr. 2005, *A.F. Fuentes et al. 7082* (MO); antes de Marumpampa, 20 Apr. 2005, *A.F. Fuentes 7039* (MO); Quita Calzon-Camata, 11 Sep. 2004, *L. Cayola 1356* (MO). **Santa Cruz**, Comunidad de Salvatierra, 20 km N de Urubichá, 12 Jun. 2003, *M.G. Toledo 1759* (MO); cuenca del Rio Pirai, 1 km al NE de la union de los rios Pirai y Bermejo, *M.H. Nee & M.P. Saldias 36338* (MO); **Santa Cruz**, Parque Amboró, Rio Colorado, Nueva Palestina a 34 km al E de la Ciudad de Santa Cruz, 3 Mar. 1990, *R.C. Quevedo 47* (MO); 7.3 km from Santa Cruz-Samaipata highway leaving at Tarumá on dirt road along Río Salado and oil pipeline, 27 Mar. 1998, *M.H. Nee 48772* (NY).

BRAZIL: Sem estado, *F. Sellow 25* (MEL); *F. Sellow 5307* (MEL); *F. Sellow 879* (MEL); *F. Sellow s.n.* (HBG); *F. Sellow s.n.* (MPU); *J.B.E. Pohl 1396* (NY, US); *P. Clausen 2090* (MO); *P. Claussen s.n.* (MEL); 1840, *P. Claussen s.n.* (MPU); 1 Dec. 1933, *L. Riedel 1798* (NY); 17 Sep. 1958, *R. Schnell s.n.* (P); **Acre**, Plácido de Castro, BR-364 Highway to Guajará, km 80 left side, 28 Apr. 1995, *L.C.L. Meneses Filho 1* (NY); Sena Madureira, Vicinity of Sena Madureira, 24 Sep. 1968, *G.T. Prance 7580* (NY). **Amazonas**, Estrada do Munguba, km 12, 6 Nov. 1979, *M. Hopkins 5193* (INPA). **Bahia**, *J.S. Blanchet 3684* (MO); Barreiras, 12 Mar. 1979, *G.G. Hatschbach 42108* (ESA) Campo Formoso, Brejão da Caatinga, 4 Sep. 1981, *G.C.P. Pinto 32181* (NY); Coribe Ca, 5 Km S em estrada de terra que cruza pequeno ramal que sai a 5.1 km E de Ponto d'água, a 24,4 Km S de São Félix do Coribe na estrada para Coribe, 11 Apr. 2007, *L.P. Queiroz 12796* (HUEFS); Jaguarari, Rodovia Juazeiro - Senhor do Bonfim (BR-407), km 100, *L. Coradin 6012*

(CEN); *L. Coradin 6014* (CEN); Potiraguá, Rod. que liga a BR 101 com Itapetinga, ca. 15 Km de Itaibé, Faz. Idependência, 18 Aug. 2006, *J.L. Paixão 1053* (CEPEC, HUEFS, HUESC); Vitória da Conquista, Coletada na estrada para Itapetininga na mata de altitude a cerca de 13km, 2 Aug. 1998, *E.R. Salviani & H. Lorenzi 192* (HPL). **Ceará**, Mulungu, Camará, 12 Jul. 2004, *A.S.F. Castro 1505* (EAC). **Distrito Federal**, Brasília, 4 Aug. 1972, *O.D.T. Pinho s.n.* (HEPH); Área de inundação da barragem do São Bartolomeu, barra do córrego Papuda, 5 Jun. 1979, *E.P. Heringer 1523* (MO, NY); Área de Proteção Ambiental de Cafuringa, Fazenda Dois Irmãos, Mata margem direita do Córrego Ladim, 26 Mar. 1993, *B.A.S. Pereira & D. Alvarenga 2498* (UEC); Asa Norte, quadra 415, 17 Mar. 2006, *M.F. Simon et al. 735* (UB); Bacia do Rio São Bartolomeu, 1 Jun. 1981, *E.P. Heringer 7000* (NY); 17 Mar. 1981 *E.P. Heringer 6483* (NY); 22 Jan. 1981, *E.P. Heringer et al. 6032* (UEC); Brazlândia, 15 Apr. 2010, *W. Alkimim 127* (HEPH, UB); Coletada nos fundos do Congresso, 1 Aug. 1979, *E.P. Heringer 18443* (CEN, ESA, SP, UEC, UPCB); Eixo Monumental Norte, 28 Dec. 2007, *C.E.B. Proença 3449* (UB); Escola de Agricultura, Km 47, 20 Dec. 1951, *E.P. Heringer 2781* (UB); 25 Dec. 1951, *E.P. Heringer 2781* (UB); Escola Fazendária, 5 Jan. 1980, *E.P. Heringer 17642* (UB); Escola Fazendária, Margem direita da estrada DF-11, 13 Jan. 1981, *E.P. Heringer et al. 5962* (UEC); Escola Fazendária, mata seca cultivada em cerrado, 5 Jan. 1980, *E.P. Heringer 17642* (MO); Estação Ecológica do Jardim Botânico de Brasília, 1 Jun. 2010, *F.B. Passos 217* (HEPH, SPF); Próximo ao T-2, 20 Jun. 1996, *M.G.G. Nóbrega 468* (HEPH, MBM); Estação Florestal da Cabeça de Veado, Ca. de 20 km. a SE de Brasília. Borda de mata de galeria. 21 Jan. 1983, *G. Reis 2* (UEC); Fazenda Sucupira, 8 Jun. 1995, *M.C. Assis 225* (CEN, HUEFS, NY, TEPB); em mata a beira do córrego próximo ao Alojamento, 19 Apr. 1995, *M.C. Assis 215* (CEN, HUEFS, NY); Horto Florestal, 1936, *C.A. Lage 82430* (MO); Inst. de Ecol. e Exp. Agr. CNEPA, 6 Nov. 1953, E.*P. Heringer 3207* (IPA); 25 Nov. 1953, *E.P.*

Heringer 3207 (IPA); Jardim Botânico de Brasília, 20km de Brasília, 16 Sep. 1993, A.E. Ramos 90B (HEPH); beira da estrada para CAESB, 27 Jun. 1993, A.*E. Ramos 542* (HEPH, UEC); Águas do Cerrado, 7 Apr. 1994, *M. Boaventura 106* (HEPH); 5 Mar. 2012, *V.F. Paiva & M. Oliveira 811* (FURB, HEPH); Perto da Cantina, 26 Feb. 1997, *M.G.G. Nóbrega 720* (HEPH); Margem da estrada próximo ao morro da Pedreira, 30 May 2015, J.*E.Q. Faria & M.R.V. Zanatta 4578* (UB); Parque Municipal do Gama, 21 Mar. 1966, *H.S. Irwin et al. 14158* (MO, NY, SP, UB); Parque Nacional de Brasília, trilha Cristal Água, Parada do Cristal, 29 Jun. 1905, *M.B.S Campos & A.M. Carvalho s.n.* (HDJF); 21 Sep. 2007, *M.B.S Campos & A.M. Carvalho 57* (HUEFS, UB); Parque Olhos d'Água, *A.P. Silva 152* (CEN); 5 Feb. 2004, *I.M.X. Oliveira Filho 48* (UB); *I.M.X. Oliveira Filho 49* (HUEFS, UB); 19 Aug. 2003, *I.M.X. Oliveira Filho 1* (UB); Fazenda Sucupira, Borda da mata de galeria, próxima ao bambuzal, *C.G. Fontes 168* (CEN, HUEFS, UB); Iate Clube de Brasília, *G.P. Silva 4305* (CEN); Parque Nacional de Brasília, 4 Mar. 2008, *C.G. Fontes 250* (CEN, HUEFS); entrada da trilha da capivara, *B.R. Teixeira 63* (CEN); próximo da estrada, *B. R. Teixeira 151* (CEN); Parque Olhos D'água, *M.F. Simon 1819* (CEN, HUFU); próximo ao T-2, 7 Apr. 1994, *M. Boaventura 107* (HEPH); *M. Boaventura 108* (HEPH); Picada R-3, 1978, *E.P. Heringer 317* (MO); Reserva Ecológica do IBGE, 16 Apr. 1984, *B.A.S. Pereira 963* (UEC); Matar ciliar do córrego Roncados entre as chácaras 2 e 3, 17 Aug. 1989, *M.L.M. Azevedo & E.C. Lopes 292* (UEC); Picada R-3, 5 Jan. 1978, *E.P. Heringer 317* (NY); RA-XVI (Lago Sul) em frente ao restaurante da Recor, 7 Jun. 2006, *F.C.A. Oliveira & M.L. Fonseca 1243* (UB); Rio São Bartolomeu, Jul. 1987, *R.C. Mendonça 851* (UB); Sobradinho, Country Club, 28 Jul. 1965, *R. Martin 468* (UB); FERCAL, 28 May 1987, *P.C.M. Ramos CIPLAN74* (UB). **Espírito Santo**, Águia Branca, Águas Claras, Zequinha, 15 Aug. 2007, *R.R. Vervloet 3206* (MBML); Mata do Assentamento 16 de abril, 25 Jul. 2006, *L.F.S. Magnago 1093* (HUEFS, MBML); Santa

Luzia, Prop. Ciro Ferreira, 4 Jul. 2007, *R.R. Vervloet 2807* (MBML); Cachoeiro de Itapemirim, R.F. Bananal do Norte, 19 Mar. 1996, *G. Acácio 286* (VIES); Cariacica, Estrada para São Paulo de Biriricas, 20 Dec. 1991, J.*M.L. Gomes 1691* (HUEFS, VIES); Castelo, Caxixa, 17 Oct. 1985, *G.G. Hatschbach & F.J. Zelma 49892* (CEPEC, MBM, NY, UPCB); Colatina, Alto Moacir, Pedra do Cruzeiro, 17 Apr. 2006, *L.F.S. Magnago 764* (MBML); Cascatinha do Pancas,16 Jul. 2008, *A.M. Assis 1743* (HUEFS, MBML); *A.M. Assis 1744* (HUEFS, MBML); São João Grande, 16 Oct. 2008, *A.M. Assis 1830* (MBML); São Salvador,16 Jul. 2008, *A.M. Assis 1751* (HUEFS, MBML); Conceição da Barra, Floresta Nacional do Rio Preto, Floresta de Tabuleiro em regeneração após fogo, 21 Nov. 2010, *M. Ribeiro 374* (VIES); Domingos Martins, Rio Jucu, 662 m, 25 Jan. 2001, *O.J. Pereira 6832* (HUEFS, VIES); Guaçuí, Floresta do Rosal, A 19,4km da sede de Guaçui, 26 Aug. 2010, *R.A. Curto et al. 137* (VIES); Guarapari, 27 May 1994, *S.V. Dutra s.n.* (HUEFS, VIES); Linhares, João Neiva, 23 Feb. 1991, *D.A. Folli 1287* (CVRD, HUEFS); Marilândia, Alto Liberdade,19 Apr. 2006, *L.F.S. Magnago 948* (MBML); Nova Venécia, Área de Proteção Ambiental da Pedra do Elefante, 18 Jul. 2008, *A.M. Amorim 7546* (MBML); Serra de Baixo, 25 Apr. 2008, *A.M. Assis 1495* (HUEFS, MBML); Pinheiros, Reserva Biológica do Córrego do Veado, 9 Jul. 2010, *I.S. Broggio et al. 25* (VIES); Santa Leopoldina, Alto Luxemburgo, 16 Apr. 2008, *A.P. Fontana 5013* (HUEFS, MBML); Fazenda Caioaba, 9 Aug. 2006, *L.F.S. Magnago 1270* (HUEFS, MBML); Suiça, 13 Apr. 2008, M. Simonelli 1552 (HUEFS, MBML); Santa Teresa, Cruzeirinho, 16 Jul. 2003, *A.M. Assis 954* (MBML); Parque do Museu de Biologia Mello Leitão, 24 Aug. 1995, *G.C. Vallandro 166* (CEPEC, MBML); São Gabriel da Palha, Jardim Vitória, 2 May 2008, *A.M. Assis 1594* (HUEFS, MBML); São Roque do Canaã, Misterioso, 24 Dec. 2003, *R.R. Vervloet 2570* (MBML); Serra, 4 Feb. 1986, *O.J. Pereira 1410* (HUEFS, VIES); Vitória, Parque Municipal da Fonte Grande, 5 Feb. 2004, *M.L. Dan 3* (HUEFS, VIES). **Goiás**, Alexânia, 7 Oct. 1963, *E.P. Heringer 9498* (NY); Alto Paraíso de Goiás, Estrada Alto Paraíso/São João da Aliança, Km 12 da estrada Alto Paraíso/São João da Aliança, 29 Apr. 1996, *B.A.S. Pereira & D. Alvarenga 3044* (NY, UB, UEC); Anápolis, Campus UEG, 6 Dec. 2006, *P.C.M. Ramos & B.S. Araújo s.n.* (HUEG); 11 Jan. 2007, *P.C.M. Ramos & B.S. Araújo s.n.* (HUEG); 15 Oct. 2005, *P.C.M. Ramos & B.S. Araújo s.n.* (HUEG); 24 Mar. 2006, *P.C.M. Ramos & B.S. Araújo s.n.* (HUEG); Rodovia Anápolis-Goiânia, 8 Jun. 1969, *E.P. Heringer 11850* (NY); Carlópolis, Embrapa-Unidade Regional de Pesquisa Florestal (CEN), unidade regional de Pesquisa Florestal centro-Sul, 6 Jan. 1985, *P.E.R. Carvalho 238* (SPSF, UEC); Catalão, Serra do Facão, margem direira Rio S.Marcos, 2 Feb. 2003, *A.E.H. Salles et al. 2563* (HEPH); 19 Aug. 2007, *A.A. Arantes SF138* (HUFU); 26 Aug. 2007, *A.A. Arantes SF138* (HUFU); Corumbaíba, margem esquerda do Rio Corumbá, 300 m a montante da Alternativa 4, *S.P.C. Silva 290* (CEN); 26 Apr. 2008, *A.S. Siqueira SF994* (HUFU); Cristalina, *A.A. Santos 1251* (CEN); Formosa, 30 May 1999, *N. Pais s.n.* (HUEFS); 35km NW of Formosa, 18 Apr. 1966, *J.W. Grear Junior 14962* (UB); Goianápolis, Parque Estadual Altamiro de Moura Pacheco-PEAMP, 31 Aug. 2005, *B.A.S. Pereira 3499* (UB); Goiânia, Parque Estadual Altamiro de Moura Pacheco-PEAMP, 13 Apr. 2005, *M.L. Fonsêca et al. 5819* (UB); Guarani de Goiás, Fazenda Forquilha, 5 Mar. 2001, *M.L. Fonsêca et al. 2421* (UEC); Iaciara, Fazenda Sabonete, 17 Oct. 2001, *M.L. Fonsêca et al. 2924* (UEC); Luziânia, 26 Feb. 1975, *E.P. Heringer 14434* (UB); AHE Corumbá IV, margem esquerda do rio Corumbá, *M.C. Silva 89* (CEN); Minaçu, cerca de 200 m antes do portão de entrada da obra á jusante da barragem, *G.P. Silva 4798* (CEN); Montes Claros de Goiás, Votorantim, May 2007, *M.S. Mendes & G.S. Neves 167* (BHCB); Nerópolis, Parque Estadual Altamiro de Moura Pacheco, 29 Mar. 2005, *M.L. Fonsêca et al. 5692* (UB, UEC); Niquelândia, 1 km após a Mina da Companhia de Níquel Tocantins (CNT), 12 Apr. 1996, *R.C. Mendonça 2427* (NY); Niquelândia, Km 23 ao 31 estrada de terra a direita da mina de Niquel, 23 Mar. 1995, *M.L. Fonsêca 197* (NY); Pirenópolis, 20 Nov. 1976, *E.P. Heringer 16253* (UB); 4 May 1995, *J.M. Felfili 316* (UB); São Domingos, Fazenda Flor do Ermo, *A.C. Sevilha 4178* (CEN); *A.C. Sevilha 1928* (CEN); São João da Aliança, Serra Geral do Paraná, 3 km by road of São João da Aliança, 1040 m, 23 Mar. 1973, *W.R. Anderson et al. 7784* (SPF, UB, UEC); São João da Aliança, ca. 3km S of São João da Aliança, 14 Mar. 1971, *H.S. Irwin et al. 31732* (MBM, MO, NY, UB); Silvânia, margem direita do rio Antas (próximo à ponte de madeira), *G.P. Silva 7358* (CEN); margem esquerda do ribeirão São Roque, próximo a foz, *G.P. Silva 7691* (CEN); *G.P. Silva 7718* (CEN); Simolândia, Clube da polícia militar, 23 Aug. 2014, *F.P.R. Jesus 376* (HEPH). **Mato Grosso**, 18 Sep. 2001, *E.A. Silveira 1738* (HCF); Barão de Melgaço, Vila São Pedro de Joselândia, Sep. 2003, *G.B.S. Pinto s.n.* (UPCB); Campinápolis, 1 Sep. 1982, *M. Haridasan 74* (UB); Belterra, Santarém, ao longo da Rodovia BR-163 Santarém-Cuiabá no Km 135, 8 Oct. 1975, *M. Barbosa & Erly s.n.* (UB); Tangará da Serra, fragmento Florestal Dona Lolita, 28 Jul. 2011, *C.A. Silva 312* (TANG). **Mato Grosso do Sul**, 15 Nov. 1958, *H.S. Irwin et al. 2098* (F, NY, VIC, US); Antônio João, 15 Mar. 1985, *G.G. Hatschbach et al. 49075* (INPA, MBM, (NY); Corumbá, BR-262, Beira da estrada, 13 Mar. 2011, *J.S. Silva & G.H. Shimizu 927* (CEN, UEC); Estrada para a mineração Corumbaense, 13 Mar. 2001, *G.A. Damasceno Junior 2223* (UEC); Reserva Acurizal (Ecotropica), Serra do Amolar, borda oeste do Pantanal, 18 Sep. 2001, *A. Pott 9445* (CGMS); Serra São Domingos, Planalto Residual do Urucum, 26 Apr. 2004, *R.R. Silva & J.S. Velasquez 895* (UEC); Jardim, Rodovia BR-262, Km 552, 500 m a oeste do Rio Caracol e da Fazenda Margarida, entre Jardim e Porto Murtinho, 4 Sep. 2003, *A. Pott 11433* (CGMS); Ladário, 16 Apr. 1994, *V.J. Pott et al. 2257* (CPAP); 27 Feb. 2004, *R.R. Silva & M.V. Silva 747* (UEC); Fazenda São Marcelo, Morro Sta Cruz, 30 Jan. 2001, *G.A. Damasceno Junior et al. 2151* (UEC); Fazenda Vale do Paraíso, Morro Sta Cruz, 16 Jul.

2001, *G.A. Damasceno Junior 2465* (UEC); Terras, 30 May 1989, *M.P. Silva et al. 27* (CPAP); *M.P. Silva et al. 28* (CPAP); *M.P. Silva et al. 29* (CPAP). **Minas Gerais**, Araguari, Capim Branco I-Funil I, 2 Mar. 2007, *P.O. Rosa 457* (HUFU); 25 Feb. 2005 *G.M. Araújo s.n.* (HUFU); Capim Branco II, 24 May 2005, *G.M. Araújo s.n.* (HUFU); Funil I. 13 Apr. 2005 G.M. Araújo s.n. (HUFU); 7 Jul. 2005, *A.S. Siqueira s.n.* (HUFU); Araponga, Comunidade dos Lanas, 5 Oct. 2005, *J.M. Fernandes & L.C. Siqueira 75* (VIC); Comunidade São Joaquim, 5 Sep. 2005, *J.M. Fernandes 6* (VIC); Parque Estadual Serra do Brigadeiro (PESB), Estrada em direção à Portaria Fervedouro, lado esquerdo, 27 Aug. 2012, *L.C. Siqueira & R.H. Sousa 706* (VIC); Araxá, Arboreto CBMM, 19 Nov. 2010, J.*R. Stehmann & M. Augsten 6136* (BHCB); Belo Horizonte, Campus da UFMG, 3 Jan. 1983, *G.W.A. Fernandes & E. Tameirão-Neto s.n.* (BHCB); Estação Ecológica da UFMG, 29 Aug. 1990, *E. Tameirão-Neto s.n.* (BHCB); Estação Experimental, 22 May 1942, *T. Barbosa s.n.* (BHCB, MBM); FZB/BH, 11 May 2005, *V.M. Santos et al. s.n.* (BHZB); Próximo à Ecolojinha, 3 Jan. 2001, *X.C. Ferreira s.n.* (BHZB); Trilha do Lobo, 16 Jan. 2008, *J. Ordones et al. 1341* (BHZB, VIC); margem represa da Pampulha, 30 Nov. 1982, *T.S.M. Grandi & R.C.F. Carvalho 112* (BHCB); Museu de História Natural e Jardim Botânico UFMG, Coletada na mata do piptadenial, próximo ao campo de futebol, 9 May 2007, *D.F. Felix 59* (BHCB); Parque Estadual Serra Verde, Trilha do Pica-pau, 2012, *A. P. Santana 14* (BHCB); Represa da Pampulha, 1957, *L.R. Rennó s.n.* (BHCB); Boa Esperança, Fazenda Caxambu, estrada Boa Esperança, 29 Jul. 2006, A.R. Silva 15 (HCF); Brumadinho, Inhotim, Borda de mata semidecídua da trilha da caixa d'água, 19 Mar. 2008, *N.F.O. Mota & P.L. Viana 219* (BHCB, CESJ); 29 Apr. 2008, *F.M. Rodrigues & J.G. Oliveira 287* (BHCB); Caparaó, Alto Caparaó, margem do rio Caparaó, 3 Jan. 1998, *J.M.A. Braga 4702* (HUEFS); Capitão Enéas, Faz. Bom Sucesso, 17 Feb. 1991, *G.G. Hatschbach et al. 55216* (CEPEC, MBM, NY); Carandaí, Pedra do Sino Hotel Fazenda, BR-040, KM 6, trilha da mata atrás do hotel, 1 May 2005, *N.F.O. Mota & P.L. Viana 220* (BHCB); Caratinga, Beira da estrada Caratinga-Ipanema, 25 Apr. 1994, *C.V. Mendonça 279* (BHCB, SPF); Estação Biológica de Caratinga, estrada leme, 24 May 1984, *P.M. Andrade et al. 222* (BHCB, FUEL, NY, UEC); Fazenda Montes Claros, 18 Mar. 1994, *C.V. Mendonça 248* (BHCB); Conceição do Mato Dentro, entrada da MG-10 para córregos, 16 Jun. 2016, *J.E.Q. Faria 5997* (HUEFS); Santo Antônio do Cruzeiro, 2 Jul. 2008, *L.H.Y. Kamino & L.M. Silva 1032* (BHCB); Contagem, Córrego do Banguelo, sub-bacia do Córrego Bom Jesus, Bacia da Lagoa da Pampulha, 13 Jun. 2008, *P.A. Couto s.n.* (BHZB); Coronel Pacheco, Estação Experimental de Café, 8 Jan. 1939, *E.P. Heringer 33* (SP, SPF); Descoberto, Reserva Biológica da Represa do Grama, 7 May 2001, *R.M. Castro et al. 322* (CESJ, VIC); Reserva Biológica da Represa do Grama, 19 Nov. 2000, *L.D. Meireles et al. s.n.* (CESJ31512); 19 Nov. 2000, *L.D. Meireles et al. s.n.* (VIC); 21 Jul. 2001, *R.M. Castro 556* (CESJ); Serra do Relógio, RPPN Alto da Boa Vista, 9 Apr. 2010, *F.S. Souza et al. 930* (CESJ); Dionísio, Parque Estadual do Rio Doce (PERD), Trilha da Lagoa dos Patos, Mata do Mombaça, 15 Mar. 2001, *S.R.D.F.S. Nunes et al. 38* (PERD, VIC); 13 Apr. 2006, *P.B. Souza s.n.* (VIC); Divinópolis, Parque do Gafanhoto, 22 Apr. 2013, *F. Soares 49* (HUFSJ); Francisco Sá, Serra do Espinhaço, ca. 5 km N.E. of Francisco Sá, on road to Salinas, 13 Feb. 1969, *H.S. Irwin et al. 23201* (NY); *H.S. Irwin et al. 23212* (NY, UB); Itambé do Mato Dentro, Serra do Cipó, Cabeça de Boi, Estrada das Posses, a partir da casa de José Fernandes rumo à mata do Cachoeirão, Margem direita, Mata ciliar, 18 Dec. 2007, *L.M. Borges & M.F. Santos 284* (VIC); Itaperuna, Fazenda do Banco - Dona Emilia, 11 Jan. 1936, *H.L.M. Barreto 6446* (BHCB, SP); Juiz de Fora, Mata do Morro do Imperador, Oct. 1994, *M.L.G. Lisboa et al.* s.n. (CESJ27850); 5 Dec. 2001, *D.S. Pifano et al. 247* (CESJ, HUEFS); 5 May 2001, *D.S. Pifano et al. 5* (MBM); 7 Nov. 2001, *D.S. Pifano & M.O.D. Pivari 115* (CESJ, HUEFS); 11 Jan. 2002, *D.S. Pifano & A.S.M. Valente*

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(UEC); Jundiaí, Estação Experimental de Jundiaí., 12 Apr. 1994, *L.C. Bernacci et al. 60* (SP, UEC); 14 Mar. 1997, *S.L. Jung-Mendaçolli 613* (IAC); Leme, 21 Nov. 1964, *D. O. Norris 428* (NY); Limeira, Mata da Soc. A.F.B., Fazenda "Morro Azul", 12 May 1943, *M. Kuhlmann 711* (SP); Lorena, Horto florestal de Lorena, 25 Jun. 1942, *H.M. Bastos s.n.* (HUEFS); Loreto, *O. Vecchi 175* (SPSF); Mairiporã, Serra da Cantareira, 1 Sep. 1999, *L. Custodio & A. Custodio Filho 1005* (FUEL, SPSF); Manduri, Estação Experimental, 26 Jul. 1991, *D.F. Pereira et al. 114* (SP, SPSF); Mogi das Cruzes, 30 Aug. 2003, *N. Canova 1* (ESA); Mombuca, 2012, *D. Castillo 67* (ESA); Monte Alegre do Sul, Estação Experimental do IAC, 17 Jul. 1935, *R. Góes 7* (IAC); 16 Mar. 1995, *L.C. Bernacci et al. 1308* (SP, UEC); Nova Odessa, Instituto de Zootecnia, 29 Jun. 2015, *P. Orlandini et al. 38* (SPSF, UEC); Novo Horizonte, 20 Jul. 1994, *R.R. Rodrigues et al. 40* (ESA, SP, UEC, UB); Paranapanema, Estação Ecológica de Paranapanema, 28 Aug. 2007, *C.R. Lima et al. 39* (MBM, SPSF); Pardinho, 10 Apr. 2013, *A.A.S. Bertholdi 18* (BOTU); Paulo De Faria, Estação Ecológica de Paulo de Faria, 6 Apr. 1993, *V. Stranghetti 88* (UEC); 29 Mar. 1995, *V. Stranghetti 481* (UEC); Pedregulho, P.E.Furnas do Bom Jesus, 19 Jul. 1993, *E.E. Macedo & M.Bueno 149* (FUEL, SPSF); nucleo Sucupira, 12 Sep. 1996, *E.E. Macedo 197* (SPSF); Peruíbe, 8 Oct. 1996, *R.B. Aguiar 4* (BOTU); Pindamonhangaba, Fazenda São Sebastião do Ribeirão Grande, talhão 2, próximo ao córrego do convento, 7 Jul. 1997, *A.S. Nicolau & H.G. Sousa 2214* (SP); Pindorama, Estação Experimental Pindorama, 1 Nov. 1938, *B. Valentim s.n.* (IAC); 29 Nov. 1938, *B. Valentim s.n.* (IAC); Piracicaba, Fazenda Areião, 26 Mar. 1993, *K.D. Barreto et al. 175* (ESA, FUEL, MBM); Mata de Pedreira, 16 Sep. 1986, *E.L.M. Catharino 921* (IAC); 3 Aug. 1994, *K.D. Barreto et al. 2777* (ESA); 9 Aug. 1991, *N.M. Ivanauskas 78* (ESA); 12 Mar. 1993, *G.D. Fernandes & F.X. Vitti 95* (ESA); 13 Apr. 1993, *K.D. Barreto et al. 256* (ESA); 14 Sep. 1994, *A.C.A. Negrini 1* (ESA); 15 Mar. 1990, *E. Kampf 195* (ESA); 16 Sep. 1986, *E.L.M. Catharino 921* (ESA, SP); 19 Mar. 2002, *F.F. Mazine et al. 414* (ESA); 2012, *D. Castillo 34* (ESA); 2012, *D. Castillo 36* (ESA); 2012, *D. Castillo 65* (ESA); 2012, *D. Castillo 66* (ESA); Piratininga, Sítio Lagoa Azul, Mata em volta da represa, 7 Nov. 2011, *G.D. Colletta et al. 571* (ESA, HUEFS, UEC); Porto Feliz, 1997, *L.V.B. Bufo & P.C. Sabadim 95* (ESA, FUEL); L.*V.B. Bufo & P.C. Sabadim 97* (ESA); Fazenda Gramadinho, 4 Oct. 2008, *C.G. Menk s.n.* (LUSC); Floresta Ciliar do Ribeirão Avecuia, 1997, *L.V.B. Bufo & P.C. Sabadim 96* (BHCB, ESA, HUEFS, HUEM); Ribeirão Preto, Fazenda da Barra, 27 Jun. 2001, *O.K. Henriques & M. Sandrini 560* (ESA, IAC, UB); Rio Claro, 23 Nov. 1984, *A. Furlan 208* (HUEM, SP, UB); Fazenda São José, 24 Mar. 1983, *Pagano 491* (SP); Salesópolis, Bairro dos Freires, km 6, Usina-Parque de Salesópolis, encosta ao longo da Trilha da Cachoeira dos Freires, 11 Jul. 2007, *A.S. Nicolau & N.A.M. Deus 3328* (SP); Entorno da Barragem de Paraitinga, Mata do Gaúcho, 6 Jan. 2007, *Equipe FEPAF 111* (HUMC); São João da Boa Vista, ca. 5km do centro de São João da Boa Vista, 21 Mar. 1994, *A.B. Martins et al. 31509* (SP); São José dos Campos, Reserva Florestal Prof. Augusto Ruschi, Estrada Turvo, depois do Horto, 20 Mar. 1986, *A.F. Silva et al. 1395* (UEC, VIC); São Paulo, 19 Sep. 2000, *G.O. Romão & A.R. Duarte 173* (ESA); Horto Florestal, 1 Jan. 1940, *A. Rodrigues s.n.* (SPSF); 10 Jul. 1943, *A. Rodrigues s.n.* (SPSF); Jardim Botânico, 30 Jan. 1934, *O. Handro 30843* (NY, SP, UEC); Parque Estadual do Instituto Florestal, 20 Feb. 1986, *J.A. Pastore 152* (SPSF); 26 Dec. 1985, *J.A. Pastore 140* (SPSF); Parque Estadual do Jaraguá, 4 Jun. 2007, *F.M. Souza et al. 808* (SPSF); Serra da Cantareira, Chapada, *M. Koscinski 153* (SPSF); Bairro do Belém, 20 Nov. 1945, *W. Hoehne s.n.* (BHCB, SP, UEC); Bairro do Jabaquara, 26 May 1949, *W. Hoehne s.n.* (BHCB, SP); Belém, 26 Nov. 1945, *W. Hoehne s.n.* (HUEFS, SP, UEC); Butantã, 7 Jan. 1919, *A. Gehrt s.n.* (FUEL, SP); Chácara dos Morrinhos, 8 Feb. 1940, *B. Pickel 4527* (IPA, SP); Cidade Universitária "Armando de Salles Oliveira" – USP, 13 Dec. 1979, *L. Rossi 145* (HUEFS, SP); Butantã, 31 Jul. 1979, *L.*

Rossi 11 (HUEFS, SP); Canteiro entre a rua do Lago e Av. Lineu Prestes, ao lado da Biblioteca do Instituto de Química, 25 Apr. 2003, *F.B. Mendonça 256* (HUEFS); Horto Florestal, 19 Dec. 1942, *B. Pickel s.n.* (SPSF); Jabaquara, 15 Jun. 1949, *W. Hoehne s.n.* (UEC); 10 May 1949, *W. Hoehne s.n.* (HUEFS); 20 May 1949, *W. Hoehne s.n.* (MO, SPF, UEC); 15 Jun. 1949, *W. Hoehne s.n.* (HUEFS, SPF); Parque do Carmo, 10 Jan. 1986 J. Coelho s.n. (SPF); 9 Jan. 1986, *J. Coelho 771* (HUEFS); Parque Santo Dias, Trilha principal, 16 Nov. 1994, *R.J.F. Garcia 517* (HUEFS); Parque Siqueira Campos, 9 May 1974, *A.M.R. Cruz & M.C. Câmara s.n.* (SP); Parque Siqueira Campos, May 1974, *A.M.R. Cruz & M.C. Câmara s.n.* (SP); Tietê Instituto Agronômico, *L.C. Bernacci et al. 540* (SP, UEC); Universidade de São Paulo, 1 Jan. 1975, *V. Angyalossy & D. Natal s.n.* (SPF); Universidade de São Paulo, 1 Jan. 1993, *G.C.T. Ceccantini et al. 504* (SPF); São Roque, Mata de Câmara, 3 Dec. 1993, *E.C. Leite & R.R. Rodrigues 308* (ESA, UEC); São Vicente, Morro do Japú, 3 Mar. 1991, *F.S. Santos 24214* (UEC); 17 Mar. 1991, *F.S. Santos 24211* (LUSC, UEC); Parque Estadual Xixova-Japui, 22 Jun. 2001, *J.A. Pastore & C. Moura 1033* (FUEL, SPSF); Sumaré, Horto Florestal de Sumaré, 14 Oct. 2010, *A.R. Silva 112* (UEC); Tapiraí, Área da Cia. Votorantim, Estrada entre o alojamento da Barra e a portaria para Tapiraí, 30 Apr. 2013, *V.C. Souza & T.B. Flores 34904* (ESA); Reserva Particular da Votorantim (CBA), 15 Apr. 2014, *G.D. Colletta et al. 1412* (ESA); UHE da Barra, trilha da caixa d'água para vila de moradores, 26 Mar. 2013, *R.T. Polisel 1062* (ESA); Tarumã, Fazenda Berrante, Mata ciliar, 15 Apr. 1994, *G. Durigan 31668* (UEC); Ubatuba, 17 Apr. 1994, *A. Furlan et al. 1529* (SP, SPSF, UEC); Estrada de Ubatuba - Estação Experimental, 15 Feb. 1940, *A.C. Smith s.n.* (IAC); 22 Feb. 1940, *A.C. Smith s.n.* (IAC); Estrada do Puruba, 11 Nov. 1993, *A.L.M. Franco 29078* (UEC); Fazenda Capricórnio, Parcela J 10 Jan. 2007 B.A. Aranha 557 (UEC); estrada de Ubatuta, 15 Feb. 1940, *C. Smith s.n.* (SP); Parque Estadual da Serra do Mar, núcleo Picinguaba, 5 Jun. 1988, *J.E.L.S. Ribeiro 338*

(SPSF); 13 Jan. 1991, *F.C.P.Garcia 616* (SPSF); Fazenda Capricórnio, 28 Jan. 2007, *E. D. Silva 653* (PEUFR, UEC); Picinguaba, Estrada para a Casa da Farinha, 16 Jul. 2006, *E.D. Silva 330* (UEC); Picinguaba, Estrada para a Casa da Farinha, 30 Jan. 2007, *E.D. Silva 664* (UEC); Trilha do Camping Caracol, 6 Apr. 2007, *E.D. Silva 735* (UEC); Praia Vermelha do meio, 14 Nov. 1993, *M.I.M. Hernandez et al. 30113* (SP, UEC); Rodovia Ubatuba-Paraty, entrada para a Praia Barra Seca, Mar. 2010, *J.S. Silva et al. 843* (UEC); São Paulo Valinhos Área da Reforma Agrária, 16 Aug. 1994, *S.L. Jung-Mendaçolli et al. 584* (IAC, SP, SPF, UEC); São Paulo Valinhos Clube de Campo Valinhos, mata ciliar 6 Aug. 2009 A.C.M. Costa 189 (UEC); Valinhos, Estação Ecológica, borda de mata, 4 Jan. 2002, *J.R. Guillaumon s.n.* (FUEL, SPSF); Reserva Florestal de Valinhos, cerca de 25Km. SE ed Campinas, 16 Jun. 1977, *C.A. Joly 678* (UEC); Vinhedo, Condomínio Estância Marambaia, rua Guarujá, rua Guarujá, 4 Nov. 2001, *J.R. Guillaumon s.n.* (FUEL); 4 Dec. 2001, *J.R. Guillaumon s.n.* (FUEL, SPSF). **Sergipe**, Nossa Senhora da Glória Assentamento Cachoeirinha, Entrada na Fazenda de Zé Banquista, Antiga Fazenda Malhada Vermelha, 12 Dec. 2012, *A.P. Prata 3542* (ASE); Poço Verde, Assentamento Santa Maria da Laje, 23 Feb. 2010, *E.V.R. Ferreira 31* (HUFU); Porto da Folha, 9 Jul. 2014, *F.B. Gonçalves 254* (ASE). **Tocantins**, Arraias, Rodovia Campos Belos a Taguatinga, 5km S de Novo Alegre, 11 Feb. 1994, *G.G. Hatschbach et al. 60338* (ASU, CEPEC, CESJ, HUEFS, MBM, MO, NY, SPF, UB); Filadélfia, Mata da Balsa, margem esquerda do rio Tocantins, divisa da cidade de Barra do Ouro, *G.P. Silva 9827* (CEN); Formoso do Araguaia, 25km from the junction with the Brasília-Belém highway (BR153), 9 Nov. 1997, *J.A. Ratter 7956* (UB); Palmeirópolis, Balsa do Coronel, rio Mocambinho, *G.P. Silva 11676* (CEN); Paraíso do Tocantins, BR-153 km 449-Paraiso do Norte/Belém, 10 Apr. 1988, *L.A. Skorupa 403* (NY); Paraná, Canteiro de obras do UHE São Salvador, *G.P. Silva 10775* (CEN); Pedro Afonso, Bacia do Tocantins, Sub-bacia do rio Perdida, 28

Mar. 2010, *F.C.A. Oliveira et al. 1921* (HUTO, SPF, VIC). **COLOMBIA**: *H.H. Smith 304* (S); Atlántico, 1 Feb 1932, *H. Elias 121965* (COL); PNN Tayrona, Sector Palangana, Neguanje, 3 Oct 2013, *H. Cuadros 6446* (FMB); Serranía, Chamusa, Centro de Investigaciones Primatológicas La Macarena, 13 Feb 1994, *P. Stevenson 866* (MO). **PARAGUAI**: Cerca del Parque Nacional Cerro Corá, junto a Gas Ory, 9 Feb. 1982, *J.F. Casas & J. Molero 6125* (F, FMB, NY); Centurión, entre río Apa y Aquidabán, *K.A.G. Fiebrig s.n.* (E, G); *T. Morong 756* (BM). **PERU**: 1 km W of pilcopata on road to Paucartamobo, 1 Jul. 1978, *A.H. Gentry & A.A.N. Pinheiro 23653* (MG, MO, F); Distrito Echarate, Palma Real, 26 Mar. 2007, *I. Huamantupa 8609* (MO); Distrito El Cenepa, Comunidad de Mamayaque, 20 Aug. 1997, *R. Vásquez & E. Quiaco 24509* (MO); Ingola, Km 79 ca. F. Basada, *F. Chávez 339* (MO); Provincia e Quispicanchis, Inambari, Laderas, 11 May 1964, C.C. Vargas 15432 (MO); 14 May 1964; C.C. Vargas 15432 (MO); Puerto Maldonado, outskirts of city along road paralleling Rio Tambopata, Weedy roadside second growth, 7 Jun. 1986, A.H. Gentry & P.V. Núñez 54209 (MO); 13 May 1992, A.H. Gentry et al. 76582 (MO); Yamayakat, 29 Jan. 1996, N. Jaramillo & M. Jaramillo 984 (MO).

9. ***Piptadenia imatacae*** Barneby, *Brittonia* 38 (3): 227-228. 1986. Type: Venezuela, Bolivar: "em floresta primária perto de 500 m, Serrania de Imataca NE de Upata (ca 8 16'N, 62 13'W), 21 Mar 1966 (fl, jovem fr), " *FJ Breteler 5092* (holotype: US (2 sheets)!, isotypes NY!, US!).

Figs. 5F, 7H-I, 28, 29A-I. Map. Fig.30A.

Illustration in Barneby (1986)

Stout liana climbing to ca 30 m tall, bark smooth, branches dark brown, not noticeably ridged, sparsely pubescent with yellow trichomes, lenticels not seen; prickles 2–3.5 × 3–4 mm, recurve, brownish, scattered on the branch, in the leaf rachis and in the pinnae. **Stipules** 2–2.6 mm long, subulate, very early caduceus. **Petiole** 3–5 cm long, rachis 8–13 cm long, puberulent, pulvinus 3–4 mm long, interpinnal segments 1–3 cm long; pinnae 3 (4) pairs, proximal pinnae 4–5.1 cm long, median pinnae 5.3–6.2 cm long, distal pinnae slightly longer 6.5–7 cm long, interfoliolar segments 7–13 mm long; paraphyllidia absent; petiolar nectary 1 or often 2–3 (4) contiguous, 2–3 mm diam., margins raised 1–1.5 mm tall, cylindrical, cream-coloured, located at the base of the petiole, additional and smaller similar nectaries in leaf rachis between all the pair of pinnae and in the pinnae between all pairs of leaflets; leaflets 4–5 pairs per pina, 15–33 × 6–22 mm, obovate or oblong-obovate, apex mucronate, base rounded or cuneate, asymmetrical, margins plane, ciliate, sparsely pubescent on both sides, rarely glabrous, trichomes larger on the lower surface and forming tufts at the base of the petiole, midvein central, raised on the lower surface, secondary venation brochidodromous, smaller venation reticulate. **Inflorescences** a terminal pseudoraceme with 1-2 spikes per node; individual spikes 3.5–5 × 0.6–0.7 cm, peduncle 9–18 mm long, the spike axis densely pubescent with short golden hairs; first-

Fig.28. *Piptadenia imatacae.* Bruijin 1703 (US)

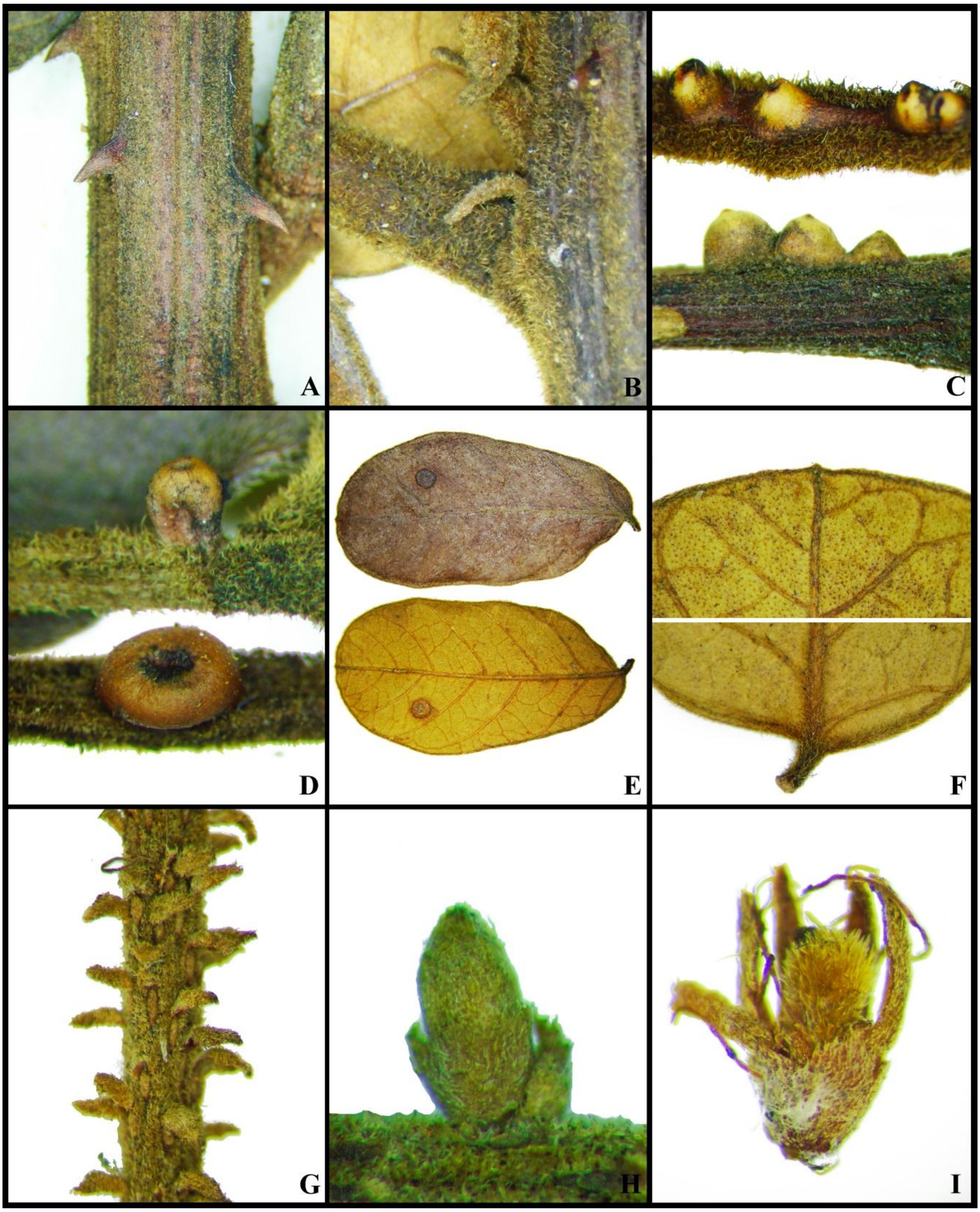

Fig.29.**A-I.** *Piptadenia imatacae.* A. Prickles, B. Stipules, C. Petiolar nectaries, D. Nectaries of pinnae variations, E. Leaflets on upper and lower surfaces, F. Apex and base of leaflet, G.Axis os inflorescence showing the flower bracts bud, H. Flower bud and bract, I. Flower opened to show a densely pubescent ovary. Pictures by Earl Chagas.

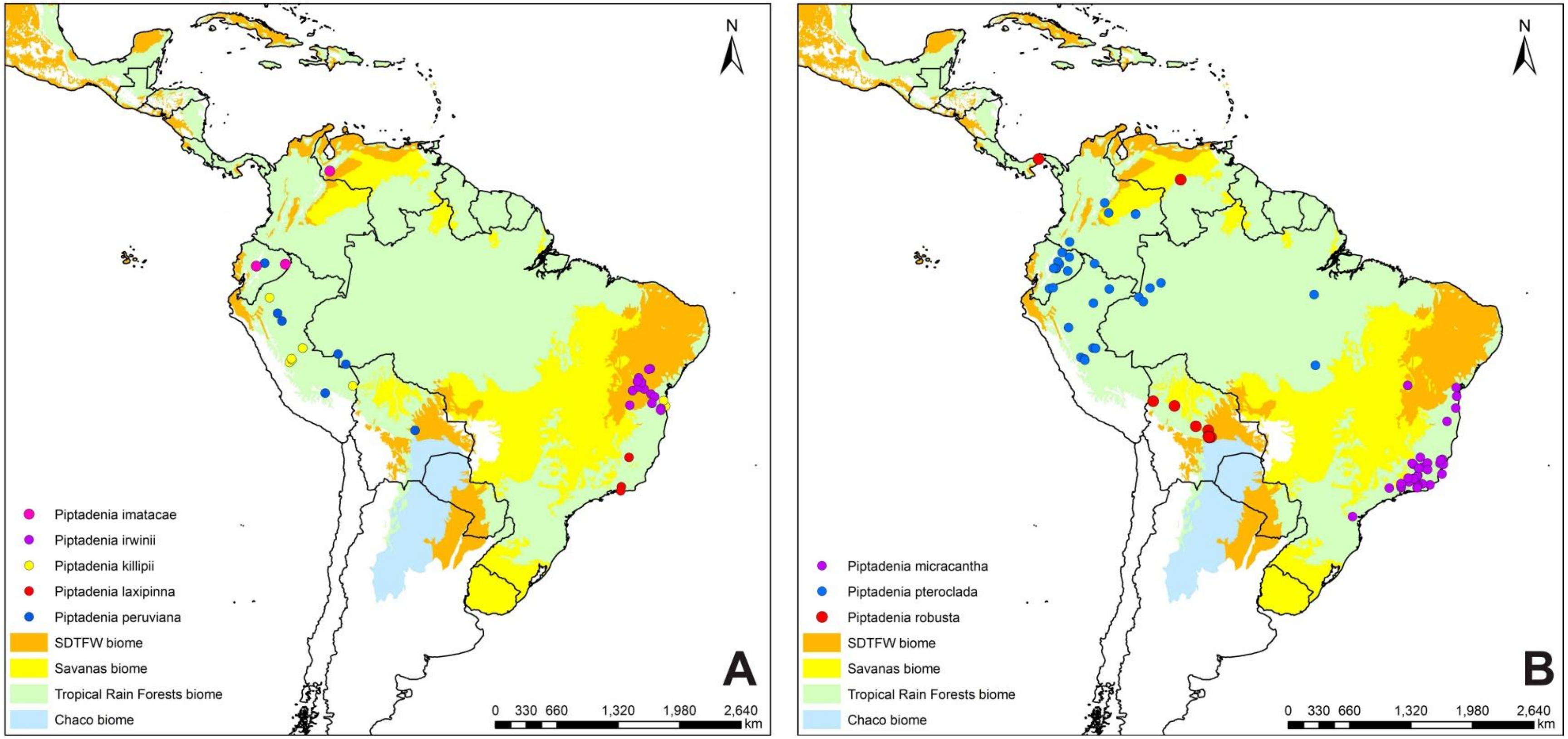

Fig.30 Distribution maps of *Piptadenia*. **A**. *P. imatacae, P. irwinii, P.killipii, P. laxipinna* and *P. peruviana.* **B.** *P. micracantha, P. pteroclada* and *P. robusta.*

order bracts 1–2, located at apex of the peduncule, linear, 2–3 mm long, densely tomentellous, persistent; floral bracts 0.5–0.9 × ca. 0.3 mm, lanceolate, apex acute, pubescent, persistent. Flowers 2.2–2.3 mm long, sessile; calyx 0.6–0.7 mm long, campanulate, densely tomentellous, tube 0.4–0.6 mm long, lobes 0.1–0.2 mm long, acute; corolla 1.7–1.9 mm long, campanulate, densely tomentellous, tube 0.5–0.7 mm long, included in the calyx, lobes 1–1.4 mm long, erect; filaments 2.2–2.3 mm long, cream-coloured or greenish-yellow, anther 0.25–0.45 × 0.2–0.25 mm long, anther gland stiptate, globose, early deciduous; ovary 0.7–1 mm long, densely pubescent, ca. 10–12-ovulated, stipe 0.6–0.8 mm long, style 1.6–2.1 mm long; stemonozone present. **Legume** 16–16 × 3–3.6 cm, stipe 8–12 mm long, broad linear, apex acuminate to rounded, margins slightly thickened; valves brown, papery, undulate, reticulate, yellowish suberect tricomes intermixed with sessile yellowish or reddish granulose trichomes. **Seeds** ca.12, immature; ovoid, testa light brown; pleurogram immature.

Etymology—Name derives from the locality of the type material: *Serranía de Imataca*, Bolivar, Venezuela.

***Distribution and habitat* –** *Piptadenia imatacae* occurs in the state of Bolivar (Venezuela) and in Ecuador, in wet forests of the Amazonia domain, at 500 m a.s.l..

***Phenology* –**Flowering and fruiting found on March.

***Common names* –** arespín (Venezuela)

***Taxonomy* –** Similar to *Piptadenia uaupensis* and *P. floribunda* by share large and few leaflets in the pinnae leaf, which may vary in number of pines in 2 pairs of pinnae on *P. floribunda*, 3 (rarely 4) on *P. imatacae*, and (rarely one) 2 pairs of pinnae on *P. uaupensis*.

Those species are easyly recognized by the densely pubescent periant, as *P. floribunda* (Fig. X-A), *P. imatacae (*Fig. X-A), *P. santosii* (Fig. X-A). *P. imatacae* and *P. floribunda* share the same kind of petiolar nectary (shortly cylindrical, usually 2-3 present), nevertheless *P. imatacae* leaflets are smaller usually15–33 × 6–22 mm (vs leaflets *P. uaupensis* 3–9.5 × 1.5–6.2 cm), beyond the inflorescence that is terminal pseudo-raceme on *P. imatacae* and terminal panicles on *P. uaupensis*.

Unfortunetaly we had not included samples of *P. imatacae*, even after several attempts of sequencing it.

Examined material – ECUADOR: Putumayo Canton, pozo petrolero Cuyabena 6, vegetación secundaria al lado del pozo, Bosque húmedo Tropical, 00º02'N 76º19'W (fl. bot. fr.), *E. Carlos & Ceron*; Reserva Etnica Huaorani. Carretera y oleoducto de Maxus, km 120. Plataforma del Pozo Ginta. Bosque humedo tropical, bosque primário, 01º02'S 76º09' W (fr.), *M. Aulestia & M.B. Loureiro*. VENEZUELA: Bolivar, Territorio Delta Amacuro., 8º4'N, 61º 71º16'W (fr.), *J. Bruijn.*

10- ***Piptadenia irwinii*** G.P. Lewis, *Kew Bull.* 46: 164-167. 1991. Type: Brazil, Bahia, Seabra: "ca. 28 km N of Seabra, road to Agua de Rega, 27 fev. 1971 (bot., fl. e fr.)", *H.S. Irwin et al. 31171* (holotype CEPEC! [photo HUEFS!]; isotypes K!, MBM!, NY!, UB!).

= **synon. nov.** *Piptadenia irwinii* G.P. Lewis var. *unijuga* G.P. Lewis, *Kew Bull.* 46: 166-167. 1991. Type Brazil, Bahia: Mori et al. 9501(holotype CEPEC! [photo HUEFS!]; isotype K!, NY!)

Figs. 5G, 8A, 31, 32A-I. Map. 29A.

Illustration in Lewis (1991)

Liana or scandent shrub 2.5–5 m tall, bark smooth; branches greyish-brown, not noticeably ridged, glabrous or sparsely pubescent with short white hairs, with cream-coloured, elliptic lenticels; prickles 1–2.5 × 1–3 mm, recurve, cream-coloured with apex orange to brownish, scattered on the branch, in the leaf rachis and in the pinnae. **Stipules** 1–2 mm long, oblong-lanceolate, caducous. **Petiole** 1–2.5 cm long, rachis 1.1–2.6 cm long, cylindrical, puberulent, pulvinus 2–3 mm long, interpinnal segments 11–21 mm long; pinnae 1 (2) pairs, proximal pinnae 4–4.6 cm long, distal pinnae slightly longer 4-5.7cm long, interfoliolar segments 4–15 mm long; paraphyllidium 1 at the proximal pinnae; petiolar nectary 0.5–2 mm diam, sessile, discoid, usually with margins raised, located from base to the apex of the petiole, additional and smaller nectaries in leaf rachis between the distal pair of pinnae and in the pinnae between the distal pairs of leaflets; leaflets 3–4 (5) pairs per pina, 20–30 × 8–18 mm wide, oblong to obovate, apex obtuse, base assymetrical or rounded, margins plane, not ciliate, upper surface mostly glabrous, sparsely pilosous, lower surface sparsely pubescent, rarely glabrous, midvein central, raised on the lower surface, secondary venation brochidodromous, smaller venation reticulate. **Inflorescences** axillary 1 or 2–3- fasciculated spikes, rarely terminal pseudoracemes; individual spikes 50–

Fig.31. *Piptadenia irwinii.* Irwin 31171 (MBM)

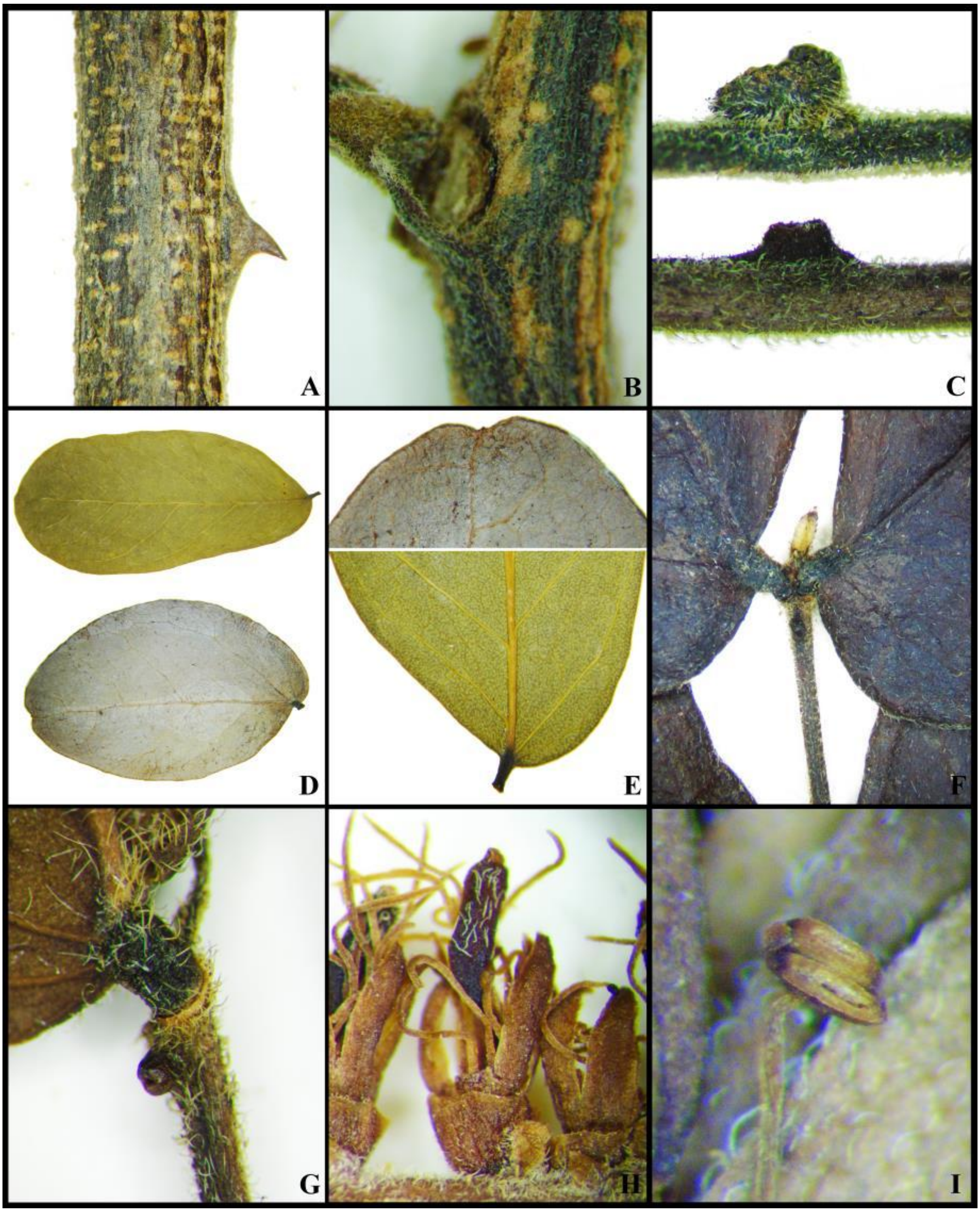

Fig.32.**A-I.** *Piptadenia irwiniii.* A. Prickles, B. Stipules, C. Petiolar nectary, D. Leaflets on upper and lower surfaces, E. Base of leaflet show domacea, F.Apex of leaf showing the last pair of pinnae and rachis extension, G.Nectary of pinnae between the leaflets, H. Flower opened shoing the sparsely pubescent ovary, I. Anthers showingthe gland on the top. Pictures by Earl Chagas.

61 × 6–7 mm, peduncle 3–5 mm long, the spike axis densely pubescent with short yellowish-white hairs; first-order bracts 1–2, located at axis of spike, linear, 2–2.5 mm long, densely pubescent, caducous; floral bracts 0.5–0.6 × ca. 0.3 mm, linear, apex rounded, pubescent, persistent; flower buds ellipsoid. Flowers 4.6–6.5 mm long, subsessile, pedicel 0.1–0.3 mm long; calyx 0.7–1 mm long, campanulate, glabrous to sparsely pubescent, tube 0.6–0.9 mm long, lobes ca. 0.1 mm long, acute; corolla 1.8–2 mm long, campanulate, glabrous, tube 0.7–0.8 mm long, included in the calyx, lobes 1.1–1 mm long, erect, 1-nerved; filaments 3–3.2 mm long, white, anther 0.3–0.5 × 0.2–0.25 mm long, shortly stiptate, globose, early deciduous; ovary 1.1–1.2 mm long, glabrousto sparsely pubescent, ca. 10–12-ovulated, stipe 1–1.2 mm long, style 1.6–2 mm long; stemonozone present. **Legume** 5.6–7.7 × 1.5–1.8 cm, stipe 8–12 mm long, broad linear, apex rounded, margins slightly thickened; valves brown, papery, slightly undulate, reticulate, glabrous. **Seeds** 7-8, imature, ovoid; testa dark brown, pleurogram present, 2–3.5 mm diam.

Etymology—Named “irwinii” honours Howard S. Irwin, who collected the type material.

Distribution and habitat – *Piptadenia irwinii* is endemic of the stste of Bahia, in northeastern Brazil, at 593-1000 m a.s.l. It occurs mostly in SDTFW biome of the Caatinga domain and in semideciduous forests of the Atlantic Forest domain.

Phenology - flowering and fruiting from February to April.

Common names – The common name not mentioned

***Taxonomy* –** Lewis (1991) recognized two varieties (var. *irwinii* and var. *unijuga*), based on the number of pinnae and of leaflets by pinnae. The analysis of a more specimens, together with analysis of the type-materials, showed that these characters are not constant and the two varieties are here synonymized.

Our results on molecular works recovery the clade including *P. irwinii* and *P. ramosissima*, although low supported in MP analysis (93 PP / * 45ML / 91 MP). However, with support not very good in the analyzes of Bayesian and maximum parsimony, and without support in maximum likelihood. In ML topology, *P. trisperma* appears without resolution in this clade. Both *P. irwinii* and *P. ramosissima* appear better supported in the individual trees, in which recovery of the clade *P. irwinii* + *P. ramosissima* (100 PP) in the analysis of ITS dataset. The individual trees of plastidial regions *trnL-F*, *trnD-T* and *matK* recovery the same clade. We were not able to sequence *P. irwinii* to ETS region. Both *P. ramosissima* and *P. irwinii* are similar in leaflet surface that have shining adaxial surface. Besides, they occur in sympatry in southeastern Bahia. In previous phylogenetic works on the Piptadenia group, *P. irwinii* is weakly supported as sister to *P. gonoacantha* + *P. macradenia* (56MP jacknife on Jobson & Luckow 2007; 96PP / 53MP on Simon et al 2016).

***Examined material* – BRAZIL, Bahia**, Estrada Jacobina-Itaitu, ca. de 22 km a partir da Sede do municipio, A.M. *Amorim 986* (NY); Estrada Maracás-Jequié., *D.S. Carneiro-Torres et al. 310* (HUESB); Mata das Toalhas, L.S. *Funch & R. Funch 1112* (CEN, HUESB); ca. 20 Km W de Palmeiras na BR 242, *L.P. Queiroz 12652* (HUEFS); Morro da Torre, *L.P. Queiroz 12887* (HUEFS); Fazenda Tanquinho, ca. 20 km N de Maracás no ramal para Fazenda Santa Rita, na estrada para Planaltino, *L.P. Queiroz & V.L.F. Fraga* 3256 (Herbarium); Paraguaçu, Assentamento Baixão, área de lote, *M.L. Guedes et al. 8307* (ALCB); km 2 a 4 da estrada que liga Poções (BR-116) ao povoado de Bom Jesus da Serra (ao W de Poções), (bot., fl. e fr.), *T.S. Santos et al. 9501* (CEPEC*, K, HUEFS, NY); 3.2 km west of BR101 on road to Jussari, *W.W. Thomas 10213* (NY); Lençóis, Mata das Toalhas, *L.S. Funch* (CEN, HUESB); Caturama, Caieiras, (est.), *A.A. Conceição 2007 2391* (CEPEC, HUEFS*); Jacobina, Serra Tombador, 10 Km, W C. Velho, esta 1 Km W BA-421 p/ Piritiba, entrando 14Km S BR-324, (fr.), *L.P. Queiroz & N.S. Nascimento* (CEPEC, HUEFS*, K, MBM, NY); Jequié, Morro da Torre, *L.P. Queiroz* (HUEFS); Jussari, RPPN Serra do Teimoso, (est.), *F.H.F. Nascimento* (HUEFS); Licínio de Almeida, Rod. para Urandi, ca. 3,8 km da cidade, 14º42'47"S (fr.), *Jardim, J.G.F. et al.* (ALCB, CEPEC*, HUEFS, NY, SPF); Paramirim, caminho Catuarama para Mateus, 13.29722(fr.), *A.A. Conceição 1903* (CEPEC, HUEFS*); Seabra, ca. 28 km N of Seabra, road to Agua de Rega, (bot., fl. e fr.), *Irwin, H.S. et al.* (HUEFS , K, MBM, MO, NY*, UB, US).

11. ***Piptadenia killipii*** J.F. Macbr., *Publ. Field Mus. Nat. Hist., Bot. Ser.* 13 (3/1): 103-104. 1943.Type: Peru, San Martin: “Juanjuí”, *Klug 4333* (holotype F, isotypes K!, MO! [photo HUEFS!], MBM!, NY!, UB!).

Figs. 5H, 33, 34, 35A-I. Map Fig. 30A.

Scandent shrub; branches light-brown, noticeably ridged, sparsely pubescent with short white hairs, with cream-coloured, inconspicuous, elliptic lenticels; prickles 2–3 × 3–4 mm, recurve, cream-coloured, arranged in longitudinal series on branch ribs, in the leaf rachis. **Stipules** not seen. **Petiole** 2.5–5 cm long, rachis 8.5–10 cm long, slightly grooved, puberulent, pulvinus 2–3 mm long, interpinnal segments 10–15 mm long; pinnae 7–9 pairs, proximal pinnae 2.2–3 cm long, median pinnae 4–5.2 cm long, distal pinnae slightly longer 4.6–5.5 cm long, interfoliolar segments 2-3 mm long; paraphyllidia presente 2; petiolar nectary 0.8–1.3 mm diam, sessile, conical, located at the base of the petiole, additional and smaller nectaries in leaf rachis between the 3–4 distal pairs of pinnae and in the pinnae between the 1–4 or all distal pairs of leaflets; leaflets 7–16 pairs per pinna, 5–7 × 1.5–2 mm, linear, apex acute, base obliquely cuneate, asymmetrical, margins plane, ciliate, pubescent on both sides, midvein displaced towards acroscopic margin, raised on the lower surface, secondary venation inconspicuous. **Inflorescences** of 1–2-fasciculated spikes per node; individual spikes 38–66 × 5- 6 mm, peduncle 5–10 mm long, the spike axis densely pubescent with short golden hairs; first-order bracts 1–2, at apex of the peduncule, linear, 2–3 mm long, densely pubescent, caducous; floral bracts ca. 0.7-0.75 × 0.2 mm, linear, apex acuminate, pubescent, persistent. **Flowers** 3–3.3 mm long, sessile, calyx 1–1.1 mm long, campanulate, pubescent, tube 0.8 –1.1 mm long, lobes 0.1–0.2 mm long, acute; corolla 1.8–2.2 mm long, campanulate, glabrous, tube 0.5–0.6 mm long, included in the calyx, lobes 1.3–1.7 mm long, erect, glabrous; filaments 3–3.2 mm long, cream-yellowish, anther 0.3–0.45 × 0.2–0.25 mm long, anther gland sessile; ovary ca. 0.8 mm long, densely

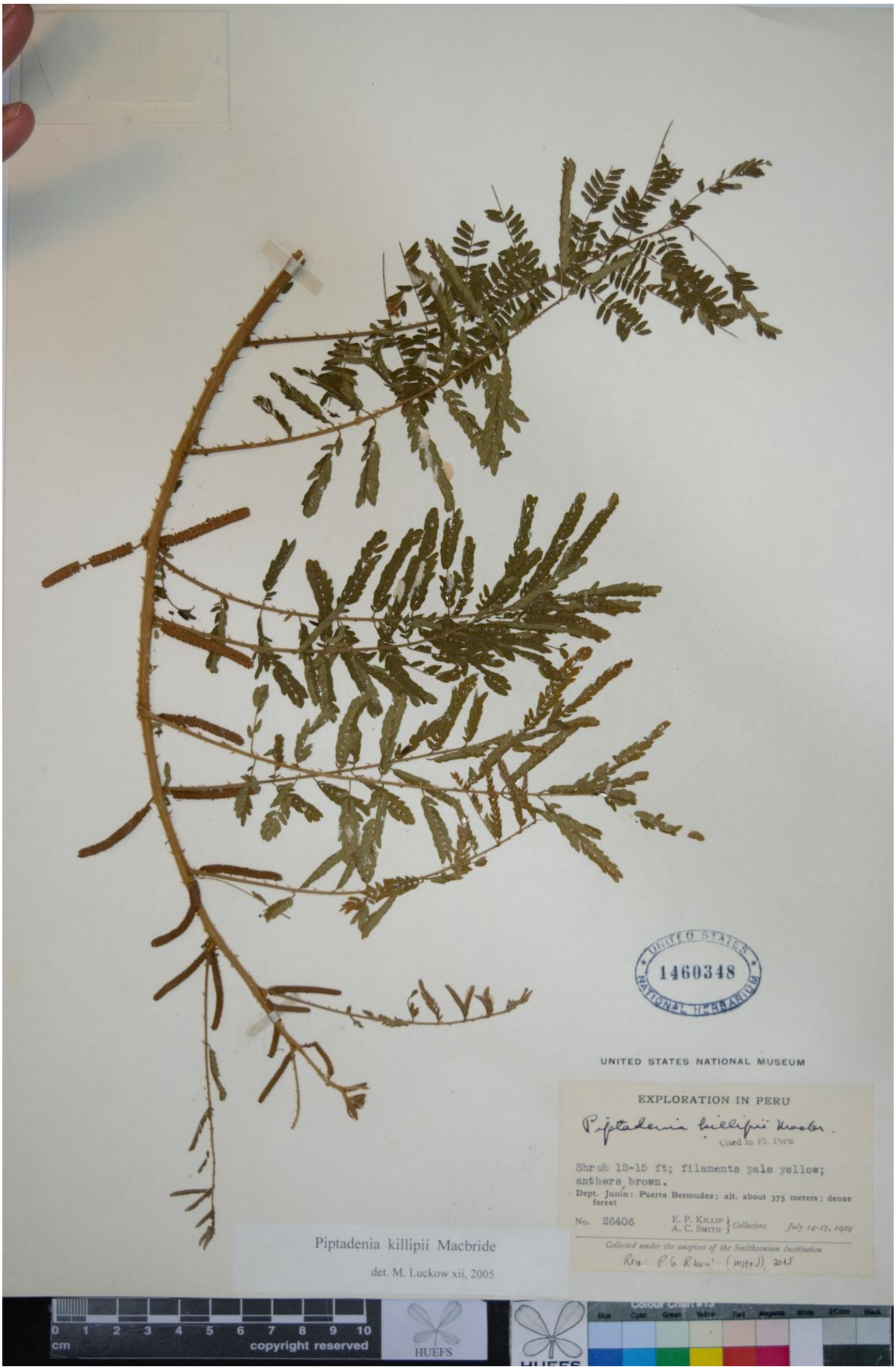

Fig.33. *Piptadenia killipii* var *killipii*. Killip 26406 (US)

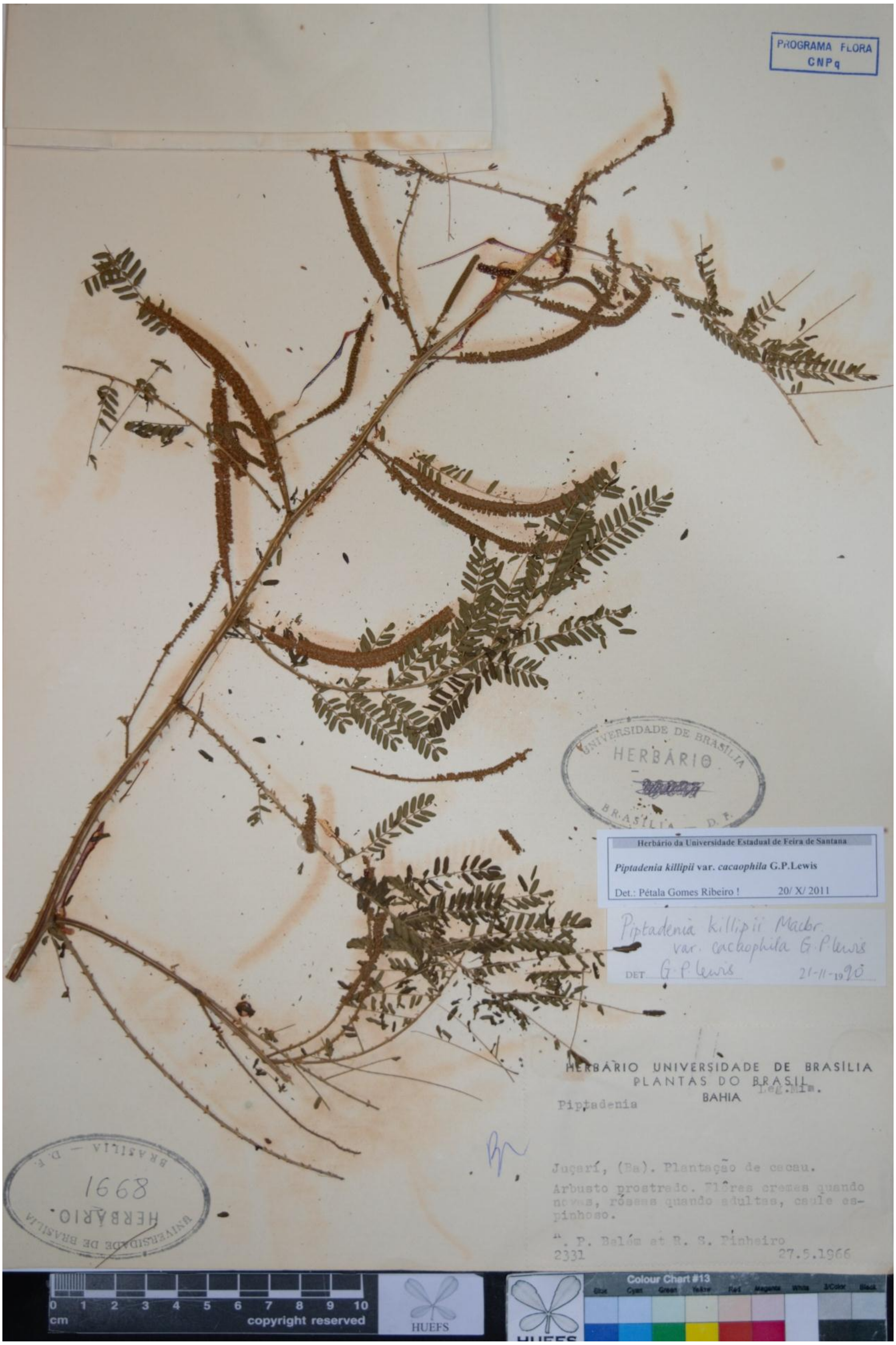

Fig.34. *Piptadenia killipii* var *cacaophila.* Belém 2334 (UB)

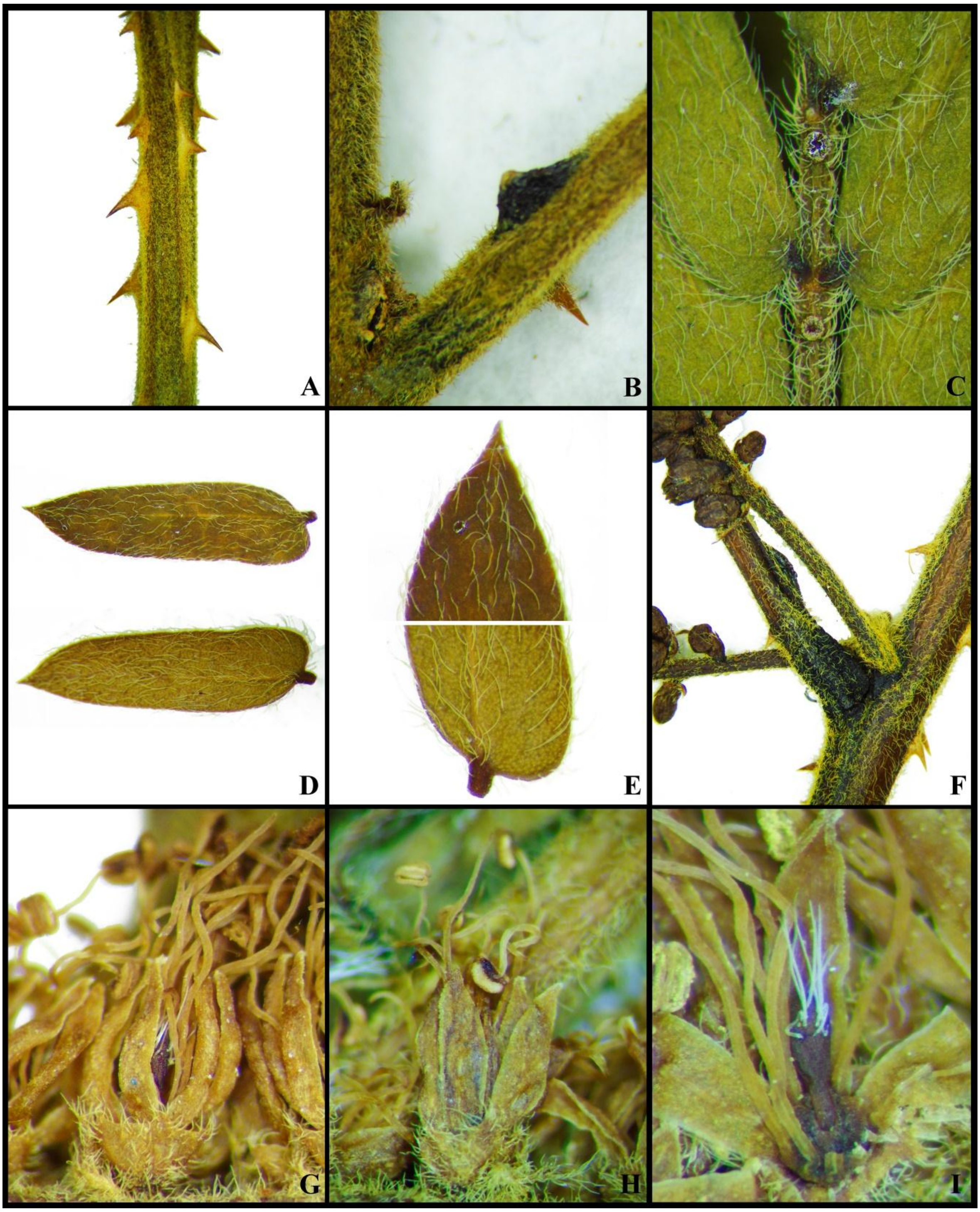

Fig.35.**A-I.** *Piptadenia killipii* var *killipii.* A. Prickles, B. Petiolar nectary, C. Pinnae showing base of leaflets and nectary, D. Base and apex of leaflet, F. Petiole of leaf showing nectary and anxilar inflorescences base, G Flowers, H. Flower, I. Flower opende showing sparsely pubescent ovay on the top. Pictures by Earl Chagas.

pubescent, 8-10-ovulated, stipe ca. 0.2 mm long, style 1.8–2 mm long; stemonozone present. **Legume** 7.6–9.5 × 1.4–1.7 cm long, stipe 8–1.2 cm long, broad linear, undulate, apex acute to shortly acuminate, margins slightly thickened; valves brown, papery, smoothly undulate, reticulated, glabrous. Seeds 8-12, 7.6–9.5 × 1.4–1.7 mm, ovoid; testa brown; pleurogram 1.6–2 mm diam.

Etymology—The name "killipi" honours the American botanist E.P. Killip.

Two varieties are recognized for this species. The morphological characteristics are very similar, but they occur in different areas, *P. killipi*

1. Petiolar nectary slightly stiptate, calyciform; present 2 paraphylidia, occurs on Bahia, Ilheus region .... 11b. var ***cacaophila***

1'. Petiolar nectary conical; present 1 rudmentary paraphylidium, occurs in Peru .... 11a. var ***ki***

11a. ***Piptadenia killipii*** J.F. Macbr. var ***killipii***

Diagnostic traits as presented in the above key.

Distribution and habitat – *Piptadenia killipii* var. *killipii* occurs in Peru.

Phenology

Flowering from May to June and fruiting from June to December.

Common names – unknown.

Taxonomy – This variety is barely differentiated from var *cacaophila* by the presence of one pair of paraphyllidia (*vs.* only one paraphyllidium in var. *cacaophila*), besides the wide geographical disjunction (Peru in var. *killipii* and eastern Brazil, Bahia, in var. *cacaophila*).

Unfortunately we were not able to get good quality DNA sample of this variety which were never included in any molecular phylogenetic study before.

Examined material: PERU: **Dept. of San Martin**, Juan Jui, Alto Río Huallaga, *Klug, G. 4333* (Herbarium); **Depto. Loreto**, prov. Ucayili, contamana, road to oriente (bot. Fl.) *M. Ferando & Leonel* (US); 45-46 km N of Cacazu on road to Iscozacin, *A. H. Gentry et al.* (MO); Near aviation field 2 km. northwest of Tarapoto, *C. M. Belshaw* (MO); Oxapampa, *D. N. Smith* 2083 (Botany); Iscozacin. Edge between pasture and river, *D. N. Smith* (MO); Panjil, (12 km air distance from Puerto Inca), Clearing near house: Low secondary forest edge, *D. N. Smith & R. B. Foster* (MO); Zwischen El Sacramento und Pucallpa, *Ellenberg H.* (Botany); **Dep. of San Martín,** Juan Jui, Alto Rio Huallaga, forest, 400-800 m. *G. Klug 4333 G. Klug 4333* (A, Botany, NY, Vascular Plants); Petro Peru, Estación Río Morona. Low secondary and primary rainforests, terra firma and flooded river banks, *W. H. Lewis et al.* (MO); East side of Río Huallaga. North and south of Shapaja 1-2 km. on grassy slopes of "slip soil", *C. M. Belshaw 3159* (bot. Fl., MO*, NY); **Department of University of California**, Bergeley. Near avaistation field 2 km. Northwest of Tarapoto, *C. M. Belshaw 3340* (bot. Fr., MO*, NY,), **Dept. Júnin**, Puerto Bermudez *E. P. Killip & A. C. Smith 26406* (bot. Fl., US). **Dpto. Tacache Nuevo.** Desembocadura del Rio Tocache. (fr.), *J. S. Vigo* (MO); Tourist Camp at Tambopata Reserve, Río Tambopata at mouth of Río D'Orbigny. Transect 10. (est.), *A. H. Gentry & K. Young 31986* (MO)

11b. ***Piptadenia killipii* var. *cacaophila*** G.P. Lewis, *Kew Bull.* 46: 166. 1991.Type: Brazil, Bahia, Jussari, "Plantação de Cacau, 27 mai 1966 (fl.)", *R.P. Belém & R.S. Pinheiro 2345* (holotype CEPEC!; isotype: IAN!, UB!).

Figs. 34. Map Fig. 30A.

Characters as presented in the above key.

Similar to *killipii* var *killipi* of who differentiates by minimal details like parafilidio, and the disjunta distribution

Etymology—The ephitet name "cacophila" refers to cacao plantation, place of occurrence of the type material.

Distribution and habitat – *Piptadenia killipii* var *cacaophilla* is know from few locality at Southern Bahia (Brazil), at the Quadra D of the CEPEC/CEPLAC and Serra do Teimoso, Jussari.

Phenology

Flowering from May to June; fruiting unknown.

Common names – Brazil: calumbi, calumbi-preto, calumbi-vermelho.

Taxonomy – *Piptadenia killipii* var *cacaophila* is known from two locality in southern Bahia. It was collected only in cocoa plantations in the south of Bahia. After two unsuccessful attempts to collect, it was found in the same locality of the type, probably the same plant. Lewis (1991) commented on the possibility of being an anthropogenic introduction in the cocoa region, since it was a practice of the farmers of the region to plant different species, including exotic, to shade the cacao trees. However, because it is a plant with many prickles, the farmers use to remove plants with these characteristics because, according to them, prickles can kill the cacao vegetation. On the excursions we made to the region we were able to see several dried and cut branches to the ground of plants with prickles.

On our molecular phylogenetic study, *Piptadenia killipii* var *cacaophilla* is related to *P. adiantoides* (see the discussion on *P. adiantoides*).

Examined material: BRAZIL: **Bahia**, Area do CEPEC (Centro de Pesquisas do cacau), km 22 da rodovia Ilhéus-Itabuna (BR-415). Quadra E, *Hage, J.L. & Santos, E .B. 660* (CEPEC, K); Area do CEPEC (Centro de Pesquisas do cacau), km 22 da rodovia Ilhéus-Itabuna (BR-415), quadra D. Plantação de cacau, *Hage, J.L. & Santos, E. B. 2082* (CEPEC, Herbarium, NY); Entrada 7,5 Km Rod. Jussari/Palmira. Faz. Teimoso 1,7 Km da entrada. RPPN Serra do Teimoso. Sede da Reserva. Parcela 4. Árvore 1147, *J. G. Jardim 3802* (CEPEC); Area do CEPEC (Centro de Pesquisas do Cacau), km 22 da Rodovia Ilhéus/Itabuna (BR-415). Quadra D. do CEPEC. Parque Zoobotanico, *J. L. Hage 2058* (CEPEC, NY); Ilhéus, Quadra D. do CEPEC. Parque Zoobotanico, *J. L. Hage* (CEPEC); Area do CEPEC (Centro de Pesquisas do Cacau), km 22 da Rodovia Ilhéus/Itabuna (BR-

415). Quadra D. Parque Zoobotanico, *J. L. Hage* (NYBG_BR); Jussarí, Plantação de cacau (bot. e fl.) *R. P. Belém & R. S. Pinheiro* (CEPEC, IPA, IAN K, NY, UB*); Entrada 7,5 Km Rod. Jussari/Palmira. Faz. Teimoso 1,7 Km da entrada. RPPN Serra do Teimoso. Sede da Reserva, Parcela 4, Árvore 1147, *J. G. Jardim* (CEPEC); Plantação de Cacau (bot. Fl.), *R. P. Belém & R. S. Pinheiro* (CEPEC, IPA, K, NY, UB*)

12. ***Piptadenia laxipinna*** Barroso, *Arch. Jard. Bot. Rio de Janeiro* 18: 125. 1965. Type: Brazil, Rio de Janeiro, Guanabara, “Jacarepaguá, Pau Ferro, (15.4.1959)”, *P. Duarte & E Pereira* 4742 (holotype RB!).

Figs. 5I, 8B, 36, 37, 38A-F. Map. 30A.

Liana or scandent shrub; branches cream to light-brown, not noticeably ridged, glabrous, lenticels not seen; prickles 2–4 × 3–5 mm, recurve, cream-coloured, scattered on the branch, in the leaf rachis and in the pinnae. **Stipules** ca. 6 mm long, linear, caducous. **Petiole** 5.2–7 cm long, rachis 4–6 cm long, glabrous, pulvinus 2–5 mm long, interpinnal segments 3.6–6 cm long; pinnae 2–4 pairs, proximal pinnae 1.6–7 cm long, median pinnae 1.8–7 cm long, distal pinnae slightly longer 3.3–7.8 cm long, interfoliolar segments 1–2 mm long; paraphyllidia absent; petiolar nectary 2–6 mm diam, sessile, discoid, sumken, located at the base of the petiole, additional and smaller shortly conical nectaries in leaf rachis between the distal pair of pinnae and in the pinnae between the distal or all pairs of leaflets; leaflets 2–4 pairs per pinna, 3.5–5.5 × 1.3–3.1 cm, oblique, falcate, apex acute, base rounded, oblique, asymmetrical, margins plane, not ciliate, glabrous on both sides, midvein displaced towards acroscopic margin, raised on both surfaces, secondary smaller venation brochidodromous, reticulate. **Inflorescences** terminal pseudoracemes, with 1–3 spikes per node; individual spikes 68–83 × 5–6 mm, peduncle 5–10 mm long, the spike axis densely pubescent with short white-yllowish hairs; first-order bracts located at axis of peduncle of spike, 1, lanceolate, 2–3 mm long, densely pubescent, early deciduous; floral bracts 0.3–0.5 × ca. 0.3 mm, triangulate, apex acute, pubescent, caducous. **Flowers** 2.9–3.1 mm long, sessile; calyx 0.5–0.6 mm long, campanulate, glabrous to covered of glandulose trichomes, tube 0.4–0.5 mm long, lobes 0.1–0.2 mm long, acute; corolla 1.7–1.9 mm long, campanulate, glabrous, tube 0.3–0.5 mm long, included in the calyx, lobes 1.4–1.6 mm long, erect; filaments 2.8–3 mm long, cream-coloured or greenish-yellow, anther 0.2–0.3 ×

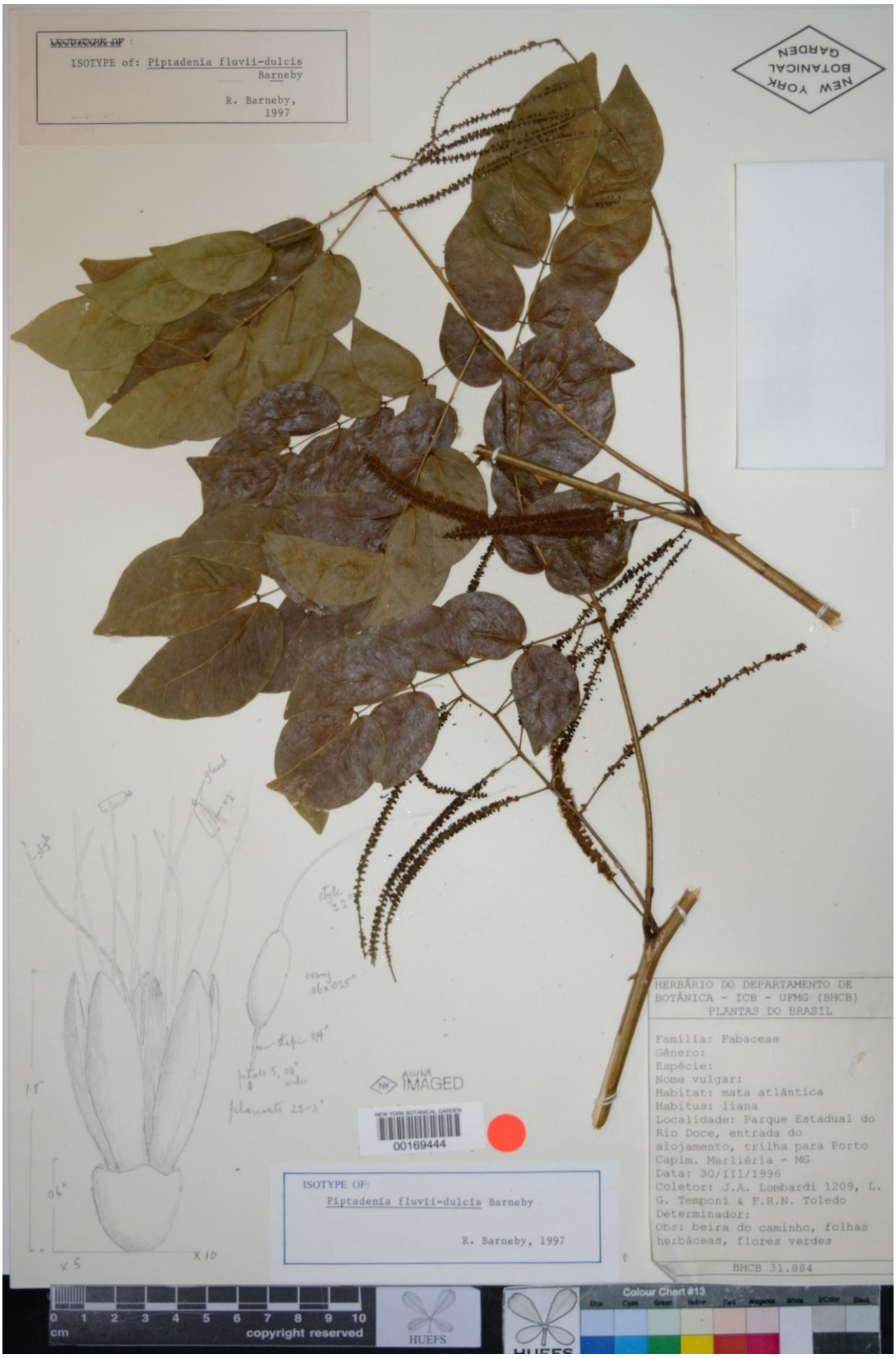

Fig.36. *Piptadenia laxipinna*.On the exsicate under name *Piptadenia fluvii-dulcis* Barneby by Barneby 1997. Lombardi 1209 (NY).

Fig.37. *Piptadenia laxipinna.* Duarte 5634 (RB)

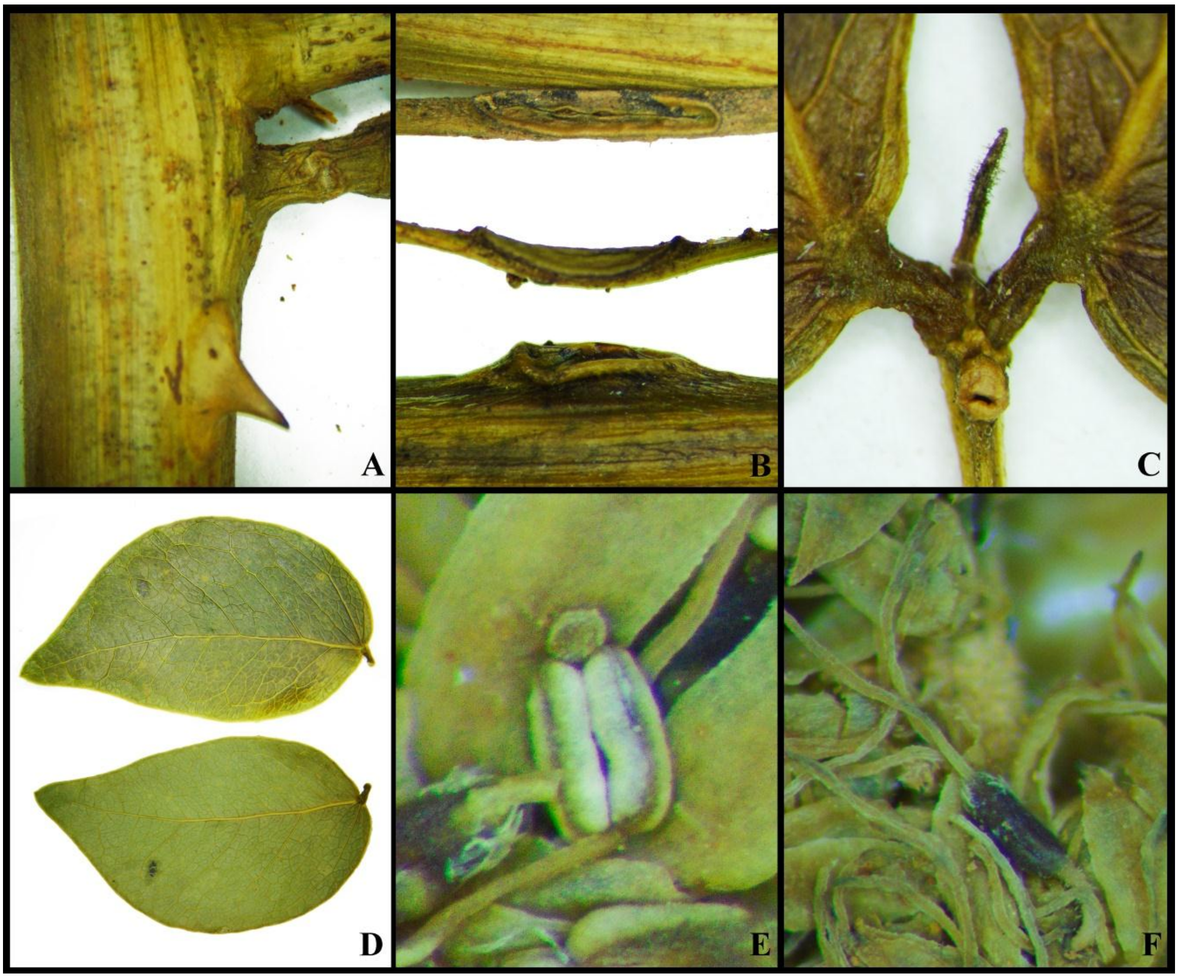

Fig.38.**A-F.** *Piptadenia laxipinna.* A. Prickles, B. Petiolar nectary variations, C. Apes of pinnae showing the nectary and rachis extension, D. Leaflets on upper and lower surfaces, E. Anthers showing the gland on the top and F.Gynoecium showing ovary almost glabrous. Pictures by Earl Chagas.

ca.0.2 mm long, anther gland sessile; ovary 0.6–0.75 mm long, glabrous to sparsely pubescent at apex, 8–12–ovulated, stipe 1.4–2 mm long, style 1.8–2.1 mm long; stemonozone present. **Legume** 14–16 × 3–3.2 cm, stipe 1.4–2 cm long, broad linear, apex rounded, margins slightly thickened; valves brown, coriaceous, undulate, reticulate, glabrous. **Seeds** 7– 8, 10–11 × 10–11 mm, suborbcular; testa dark brown; pleurogram ca. 4 mm diam.

Etymology—The name "laxipinna" derives from the remotely arranged pinnae at the leaf rachis.

Distribution and habitat **–** *Piptadenia laxipinna* occurs in Southeastern Brazil, in Minas Gerais and Rio de Janeiro states, in wet forests of the Atlantic Forest domain.

Phenology **–** Flowering in March; Fruiting July.

Common names **–** unknown.

Taxonomy **–** Similar to other species of *Piptadenia* with large leaflets and few pairs of pinnae (*P. uaupensis, P.* floribunda), but the oblique leaflet shape, apex falcate, acute, and base rounded, oblique and asymmetrical, as well as its arrangement in the pinna differ it form all species of *Piptadenia*.

The specimen *Lombardi et al 1209* (Figure 36), from Minas Gerais, was annotated as isotype of a new species named on NY duplicate as *Piptadenia fluvii-dulcis* by Barneby in

1997. However, after searching for this bibliography, I noticed that this material was selected, it may have been written and not published, keeping safe with the original Barneby manuscripts remaining archived, but they were never published despite being marked in as isotype on the exsicata. Analyzing the material I could to note that treats, in fact, of the same species of Dr. Graziela Barroso, therefore, if it were published its name would be synonymous to *P. laxipinna*. However, that name is not valid published, it is a *non published name.*

Our molecular phylogeny sampled this species for the first time. It recovered a clade (99PP / 92ML / 82MP) grouping *P. cuzcoënsis*, *P. peruviana*, *P. laxipinna*, *P paniculata* and *P. santosii*, all from tropical rain forests of Amazonia and Atlantic Forest. On ML tree, *P. cuzcoënsis* appears as sister of a large clade bringing together another species. All species of the clade sister to *P. cuzcoënsis* present leaves with large and few leaflets, and less than five pairs of pinnae.

Examined material: **BRAZIL**: Minas Gerais, Marliéria, Parque Estadual do Rio Doce, trilha do alojamento, trilha para Porto Capim; Rio de Janeiro, Duque de Caxias, Distrito de Xerém, Refibaria Duque de Caxias, (REDUC), proximidades da Barragem de Saracuruba, (fl.); antigo Estado da Guanabara. Jacarepaguá, Três Rios (fr.).

13. ***Piptadenia micracantha*** Benth., *Trans. Linn. Soc. London* 30(3): 369. 1875. Lectotype (**designated here**): Brazil, "Rio de Janeiro, Mandiocca", *Riedel 46* (K!).

Figs. 6A, 8C, 25D-F, draw of cover of this capitule, 39 A-I. Map 30B.

Scandent shrub, branches light-brown or brown, noticeably ridged, pubescent with short hairs, rarely with cream-coloured, inconspicuous, elliptic lenticels; prickles 1–3 × 2–3 mm, recurve, cream-coloured to brownish, arranged in longitudinal series on the branch and minute in the leaf rachis. **Stipules** 4–5 mm long, linear, pubescent, caducous. **Petiole** 2.4–3 cm long, rachis 5.5–7.8 cm long, slightly grooved, pubescent, pulvinus 2–3 mm long, interpinnal segments 8–13 mm long; pinnae 7–13 pairs, proximal pinnae 1–2.5 cm long, median pinnae 3–3.5 cm long, distal pinnae slightly longer 3.5–5.5 cm long, interfoliolar segments 13–32 mm long; paraphyllidia absent; petiolar nectaries 1–2 or absent, 2–2.6 mm diam, sessile, conical, located from base to middle of the petiole, additional and smaller nectaries in leaf rachis between the 1–2 distal pairs of pinnae and in the pinnae between the distal pairs of leaflets; leaflets 13–32 pairs per pina, 4-7 × 1-1,2 mm, linear, apex falcate, base asymmetrical, margins plane or revolute, ciliate, pubescent on both sides, rarely glabrous on upon surface, trichomes larger on the lower surface and forming tufts at the base of the petiole, midvein subcentral or displaced towards acroscopic margin, raised on the lower surface, secondary venation inconspicuous. **Inflorescences** in terminal pseudoracemes or axillary panicles, with 1–2 spikes per node; individual spikes 68–90 (140) × 7–8 mm, peduncle 10–15 mm long, the spike axis densely pubescent with short golden hairs; first-order bracts 1-3, located at axis of spike, linear, 3–4 mm long, densely pubescent, caducous; floral bracts 0,8-1,0 × ca. 0,3 mm, lanceolate, apex acute, pubescent, deciduous. **Flowers** 4.6–6.5 mm long, shortly pedicelate, pedicel 0.1–0.2 mm long; calyx

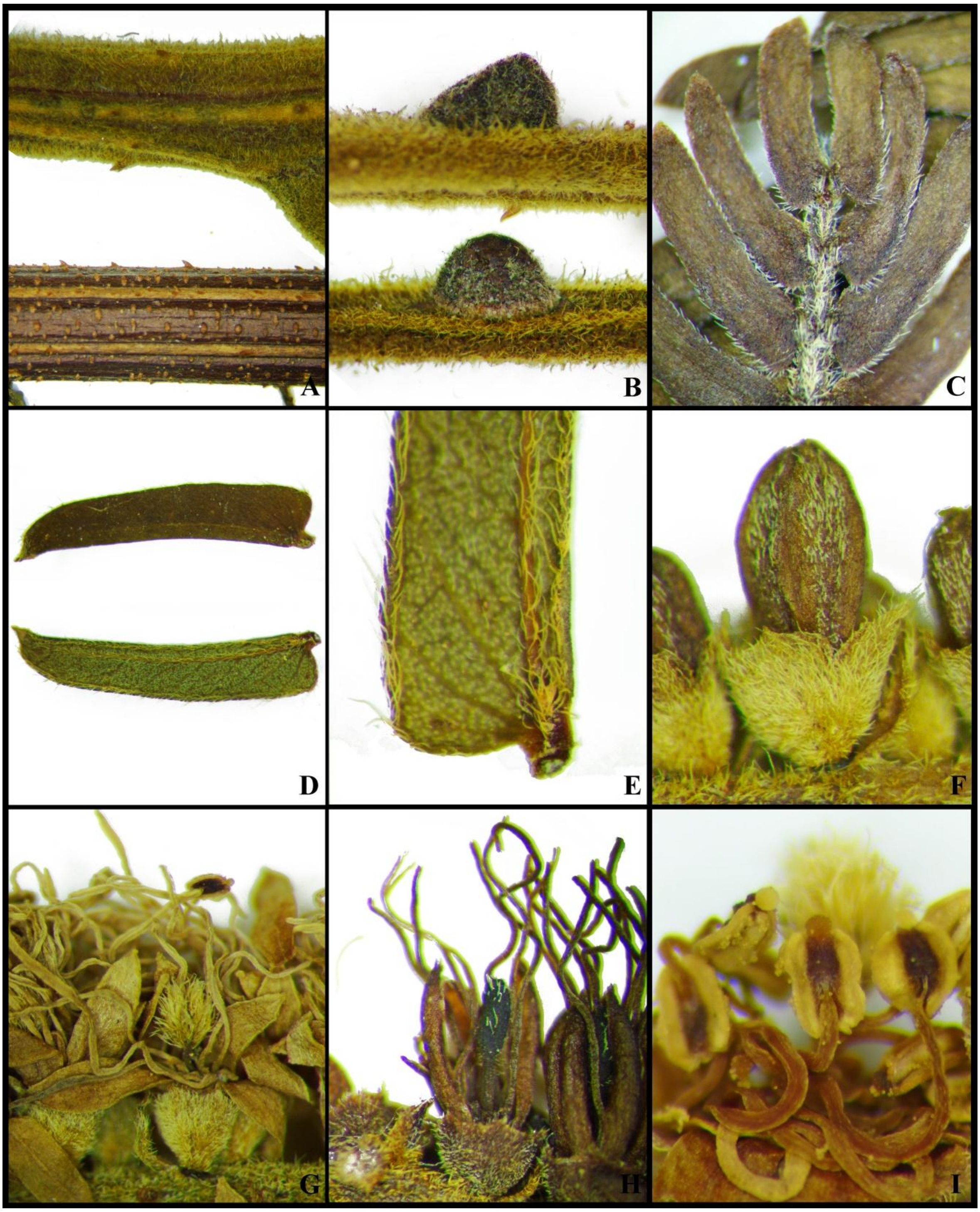

Fig.39.**A-I.** *Piptadenia micracantha.* A. Prickles, B. Petiolar nectary, C. Pinnae apex, D. Leaflets on upper and lower surfaces, E. Base of leaflet, F.Flower bud, G. Flower opened showing the pubescent ovary, H. Flower opened showing the ovary, I. Anthers showing the gland on the top. Pictures by Earl Chagas.

1–1.1 mm long, campanulate, pubescent, tube 0.8–0.9 mm long, lobes 0.1–0.2 mm long, acute; corolla 2.4–3 mm long, campanulate, glabrous, tube 0.5–0.6 mm long, included in the calyx, lobes 1.8–2.5 mm long, erect; filaments 4.8–5 mm long, yellowish-cream or reddish-pink, anther 0.2–0.4 × 0.2–0.25 mm long, anther gland sessile, globose, early caducous; ovary 0.8–1 mm long, densely pubescent or almost glabrous, 8–10-ovulated, stipe 1–1.2 mm long, style 1.6–2 mm long; stemonozone present. **Legume** 8–13 × 1.5–3.4 cm, stipe 6–1.2 mm long, broad linear, apex apiculate to rounded, margins slightly thickened; valves brown, papery, undulate, reticulate, glabrous, with blackish glanulose trichomes. **Seeds** 7–10, 6–8.5 × 5.4–7 mm, ovoid; testa dark brown, pleurogram 3–4mm long.

Etymology—The name “micracantha” probably derives from the presence of minute prickles on branches observed in this species.

Distribution and habitat **–** *Piptadenia micracantha* occurs in eastern Brazil, in the states of Bahia, Minas Gerais, Rio de Janeiro and dense São Paulo, in wet forests of the Atlantic Forest domain.

Phenology

Flowering in June and fruiting august.

Common names **–** Brazil: unknown

Taxonomy –

Morphologicaly It is similar to *P. killipii* by the serial arrangement of the prickles and general appearance (Lewis 1991), but it differs in the width of the leaflets (1-1.2 mm in *P. micracantha vs.* 1.8-2 mm in *P. killipii*) and by the corolla glabrous (*vs.* pubescent).

Our results show mutiples acessions of *P. micracantha* coalescing as monophyletic, and form a clade (1PP / 100ML / 96MP) sister to a clade bringing together *P. adiantoides* and *P. killipii* var *cacaophila.* All these species occurs are lianas with relatively small prickles on the branches and occur in sympatry in the Atlantic Forest.

Examined material: **BRASIL**: Bahia: Buerarama, Próximo a S. José, 1 Jun. 1967 (bot. e fl.), *J.P. Lanna 1445* (CEPEC, K, UB*); Castro Alves, Topo da serra da Jibóia, em torno da torre da televisão, 13º51'S, 39º28'W, 18 jun. 1993 (bot. e fl.), *L.P. De Queiroz & T.S.N. Sena 3239* (HUEFS*, K); Igrapiúna, Reserva Ecológica Michelin, Vila 5, ca. 5 Km SW do Centro de Pesquisa (CEB), -13.82 -39.203889, *L.P. de Queiroz 15663* (HUEFS); Santa Luzia, Entrada a Rod BR-101 e Betanha, (bot. Fl.), *G.G. Hatschbach et al*. 75194 (K, MBM*); Santo Antônio de Jesus, Serra da Jibóia, G.*G. Hatschbach et al. 75673* (MO); estrada para Gameleira da Lapa via Proj. Agrop., -12.764759729 -43.949607633, M. M. Fernandez 11 (NY); Distrito Federal, Brasília: (bot. Fl.), *E.P. Heringer 18085* (MBM, SP, UEC, HREI?*); Espírito Santo: Alegre, Oriente/ Paraíso, (fr.), D.R. *Couto 743* (HUEFS, MBML*); Colatina, Jequitibá (Torre 45/2 - LT 230 Kv Mascarenhas x Verona), 213° 40 (bot. Fl.), *A.M. Assis & K.F.O. Faria 1677* (HUEFS, MBML*); Domingos Martins, Panelas, Mata Atlântica., (bot. fl.), *J.M.L. Gomes 1872* (HUEFS, VIES*); Santa Teresa, Serra do Gelo, -19.973611 -40.7575, *A.M. Assis 912* (MBML); Vale do Canaã, -19.906111

-40.601944 (bot. fl.), *J.M. Vimercat 40* (CEPEC, MBML); Viana, Vale do Rio Jucu - BR 262, Mata perturbada à beira do rio, estrada ao lado esquerdo do braço norte do rio, (bot. fl.), R.*M. Silva & J.R. Pirani 811* (K, NY, SPF* VIC); Minas Gerais: Manhuaçu, (bot. fl.), *E.P. Heringer 18173* (HERBMG, HERI?*, K, LISJC MG, MO, UEC, US), *E.P. Heringer 3422* (UB); Juiz de Fora, -21.768240947 -43.350476964, *E.P. Heringer 3261* (NY), -21.768240947 -43.350476964, *E.P. Heringer 3262* (NY), Capoeira, *L. Krieger 1094* (VIC); *L. Krieger CESJ1094* (CESJ); *F.C. Hoehne* (HUEFS); Serra da Jibóia, *Hatschbach 75673* (MO); *Glaziou 8442* (Herbarium); Área de Proteção Ambiental de Macaé de Cima, estrada para Macaé de Cima, cerca de 2 km antes do Hotel Fazenda São João, próximo a plantação de Eucalipto, *H.C. de Lima 5020* (HUEFS); Cascata do Pinel, *J.C. Siqueira 2214* (FCAB); *J.G. Kuhlmann s.n.* (VIC); Ouro Preto, Parque Estadual do Itacolomi, *J.L. Silva et al. s.n.* (OUPR), Parque Estadual do Itacolomi (PEI), estrada para Fazenda do Manso, *J.L. Silva et al. s.n.* (VIC); Açucena, Parque Estadual do Rio Corrente, *J.M. Fernandes et al. 1440* (VIC); Araponga, Entorno do Parque Estadual Serra do Brigadeiro, Fragmento da Lurdinha. Floresta Estacional Semidecidual, J.*M. Fernandes 274* (VIC), Entorno do Parque Estadual Serra do Brigadeiro, SAF do Sr. João dos Santos, Floresta Estacioal Semidecidual, J.*M. Fernandes 285* (VIC), Entorno do Parque Estadual Serra do Brigadeiro, Fragmento da Lurdinha. Floresta Estacional Semidecidual, *J.M. Fernandes* 326 (VIC), Entorno do Parque Estadual Serra do Brigadeiro, Fragmento da Lurdinha. Floresta Estacioal Semidecidual, *J.M. Fernandes* 350 (VIC); Prov. Mand in collibus apricis, -22.656955956 -43.040756736, *L.Riedel* (NY); *L. Riedel 1798* (NY); -10.8339 -52.8731; *L. Riedel 2912* (Botany); Parque Nacional do Itatiaia. Trilha para os Três Picos, partindo do Hotel Repouso, -22.25 -44.583333, *L. Sylvestre 1103* (HUEFS); Parque Estadual do Itacolomi, próximo ao rio Mainarte, *L.C.P. Lima & J.C. Duelhi-Filho* 390 (OUPR, VIC); Parque Estadual do Itacolomi (PEI), Estrada do Cibrão, próximo ao rio Belchior, *L.C.P.*

Lima & J.C. Duelhi-Filho 390 (VIC); *M.C. Pinheiro* (R); *N.H.P. Yellan* (R); Serra Negra, Fazenda da Tiririca, N.L. *Abreu et al. 52* (CESJ); *R. Barneby* (NY); Ibitipoca, Estrada da entrada no Parque de Ibitipoca e Gruta da Bromelias, -21.714444 -43.905278, *R.D. Ribeiro 390* (CEPEC); Lima Duarte, Parque Estadual de Ibitipoca, entre o camping e centro de visitantes. Trilha atrás da casa da Polícia Florestal, *R.C. Forzza et al. 3287* (CESJ); Descoberto, Reserva Biológica da Represa do Grama, *R.M. Castro et al. 512* (CESJ); Riedel (P); [Mandacea], *Riedel 46* (Herbarium); Santa Maria do Salto, *V. Terra et al*. *664* (VIC); Viçosa, Agricultural College Lands. North slope of Barbabo, -20.761343 -42.868031, *Y.E.J. Mexia 4614* (NY, P, VIC), road to São Miguel, near São Miguel, on streamside, (bot. fl.), *Y. Mexia 4359* (IAN, K, MO, NY, VIC), E.S.A.V., *J.G. Kuhlmann s.n.* (VIC); *A. Löfgren & G. Edwall* 2470 (F_BOTANY_BR); -10.8339 -52.8731, *L. Riedel 2912* (F_BOTANY_BR); Est. Biol. de Caratinga, mata jaó, (fl. bot.), *P.M. Andrade & M.A. Lopes 331* (RB*); Marliéria, Parque Estadual do Rio Doce, entre a trilha do Vinhático e o laboratório, 19 (bot. Fl.), *J.A. Lombardi 2861* (BHCB*); São João Nepomuceno, Serra dos Núcleos, *A. Valente et al. 295* (BHCB, CESJ, MBM); Tombos, Fazenda Cachoeira, (bot. Fl.), *J.E. Oliveira 327* (BHCB, CESJ, ESA, HUEFS, UB); Rio de Janeiro: [This is not on the label: Prope Rio de Janeiro. Organ Mount. Protologue stated that the specific locality was not known], -22.5309 -43.0084, A.F.M. Glaziou 8448 (NYBG_BR); Itatiaia, Parque Nacional do Itatiaia. Abrigo 3., 22° 44 (bot. fl.), *A.F.N. Brandes et al. 3* (HUEFS, RB*); Estrada para o Hotel Simond após o Centro de visitantes, -22.448333 -44.610278, *A.F.N. Brandes 72* (HUEFS); Parque Nacional do Itatiaia. Trilha para os Três Picos, partindo do Hotel Repouso., -22.25 -44.583333, L. Sylvestre 1103 (HUEFS); Parque Nacional do Itatiaia. Último Adeus, (fr.), *M.P.M. Lima & M. Barros 463* (HUEFS, RB*); Caminho em direção ao abrigo Macieras., 22° 44 (fr.), *M.P.M. de Lima 322* (HUEFS, RB*); Macaé, Área de Proteção Ambiental de Macaé de Cima. Estrada para Macaé de

Cima, cerca de 2 km antes do Hotel Fazenda São João, próximo a plantação de Eucalipto, *H.C. de Lima 5020* (HUEFS); Magé, Prov. Mand in collibus apricis, -22.6531 -43.0406, *L. Riedel (NYBG_BR)*; Nova Friburgo, Macaé de Cima, proximidades do Sítio do Sr. Bob, (fr.), C.M.B. *Correia et al. 71* (HUEFS, K, RB*); Área de Proteção Ambiental de Macaé de Cima. Distrito de Macaé de Cima, estrada para o Hotel Fazenda São João, Km 6-8., 22 (bot. fl.), *H.C. de Lima et al. 3518* (HUEFS); Cascata do Pinel, *J.C. Siqueira 2214* (FCAB); Teresópolis, Parque Nacional da Serra dos Órgãos, (bot. fl.), *D. Otávio 295* (HUEFS, TB*); *N.H.P. Yellan* (R); São Paulo: São Bento, (fl.), *F.C. Hoehne s.n*. (HUEFS, SP*).

14-***Piptadenia paniculata*** Benth., in Hooker J. Bot. 4(31): 338. 1841. = *Pityrocarpa paniculata* (Benth.) Brenan, Kew Bull. 10:177. 1955. Type. BRAZIL. Rio de Janeiro, Tingua, s.d., *J.B.E. Pohl (= Schott) 1393* (lectotype: W–2 sheets [W0066968 and W0066968], **designated here**; isolectotype: K [barcode K000504654]!).

= *Piptadenia paniculata* var. *aculeata* Burkart, Fl. Il. Catarin. 273. 1979. Type. BRAZIL. Santa Catarina: Florianópolis, Ilha de Santan Catarina, Morro Costa da Lagoa, 17 Jan 1967, R.M. Klein 7097 (holotype: SI; isotypes: FLOR [barcode FLOR0006456], HBR [barcode HBR0037813]).

Figs. 6B, 8E, 25G-I, 40, 41. Map Fig. 42A.

Tree 6–20 m tall; branches brownish-tan, not noticeably ridged, sparsely pubescent with short white-yellowish hairs, with cream-coloured, inconspicuous, elliptic lenticels; prickles 3–4 × 2–3 mm, recurve, cream-coloured with apex orange to brownish, sparse, scattered on the branch, on the trunk wider and wood 15× 12 mm. **Stipules** 3–4 mm long, linear, caducous. **Petiole** 4.7–9.9 cm long, rachis 3.5–10.4 cm long, slightly grooved, pubescent, pulvinus 3–4 mm long, interpinnal segments 31–62 mm long; pinnae 2–3 pairs, proximal pinnae 3.3–9 cm long, median pinnae slightly longer 6.1–11.4 cm long, distal pinnae 6.5–10.5 cm long, interfoliolar segments 10–15 mm long; paraphyllidia absent; petiolar nectary 3–4 mm diam, sessile, discoid, located at the base of the petiole, additional and smaller nectaries in leaf rachis between the 1–2 distal pairs of pinnae and ring-shaped in the pinnae between the distal pairs of leaflets; leaflets 5–8 pairs per pinna, 3.4–4 × 1.5–1.7 cm, ovate-oblong or lanceolate-ovate, apex obtuse or oblique, base oblique, asymmetrical, margins plane, ciliate, glabrous or sparsely pubescent on the upper surface, sparsely or densely pubescent on the lower surface, midvein central, raised on the lower surface, secondary

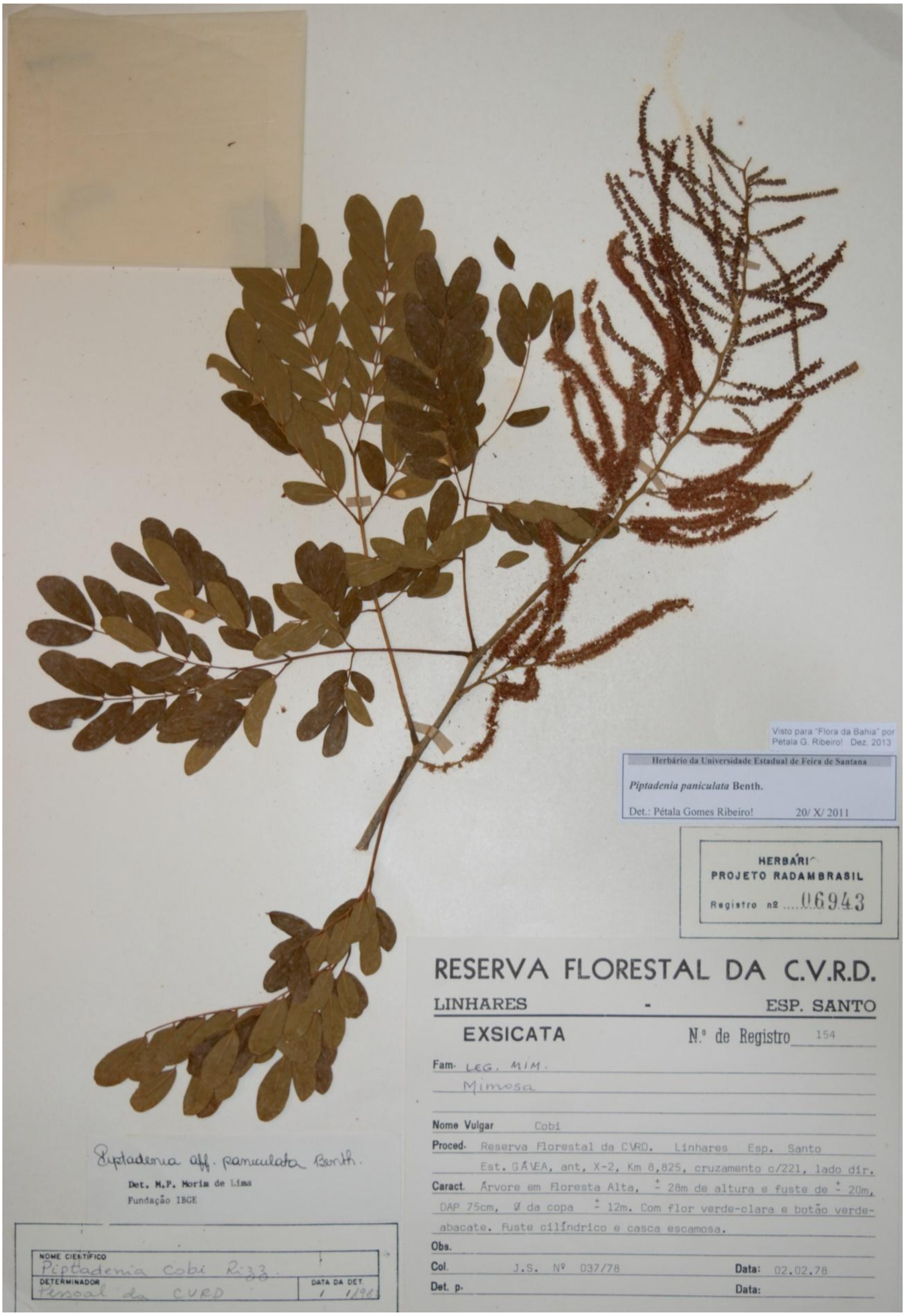

Fig.40. *Piptadenia paniculata.*

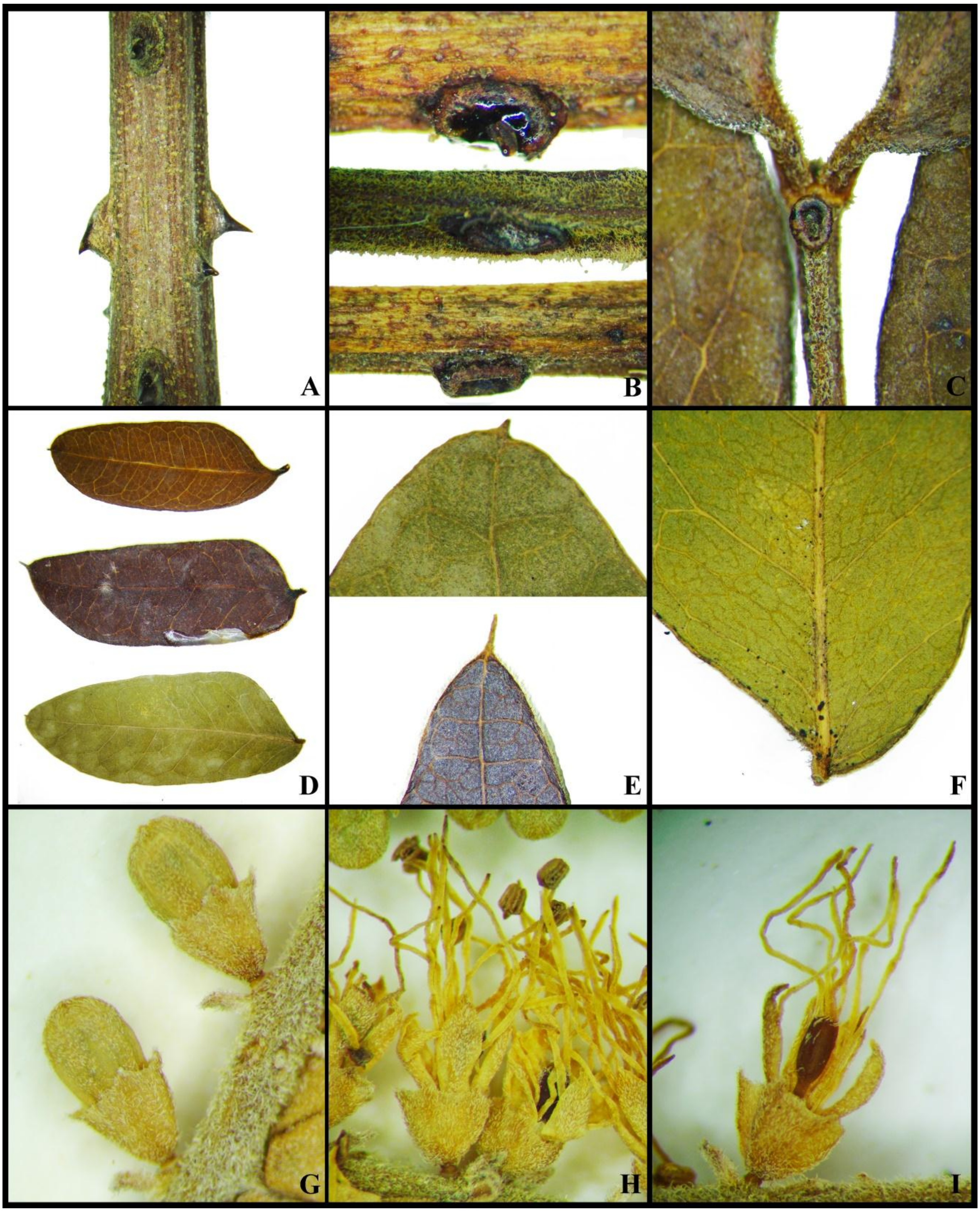

Fig.41.A-I. *Piptadenia paniculata.* A. Prickles, B. Petiolar nectary, C. Apex of pinnae, D. Leaflets on upper and lower surfaces, E. Apex of leaflets variations, F. Base of leaflet, G. Flower bud, H. Flowers, I. Flower showin ovary almost glabrous. Pictures by Earl Chagas.

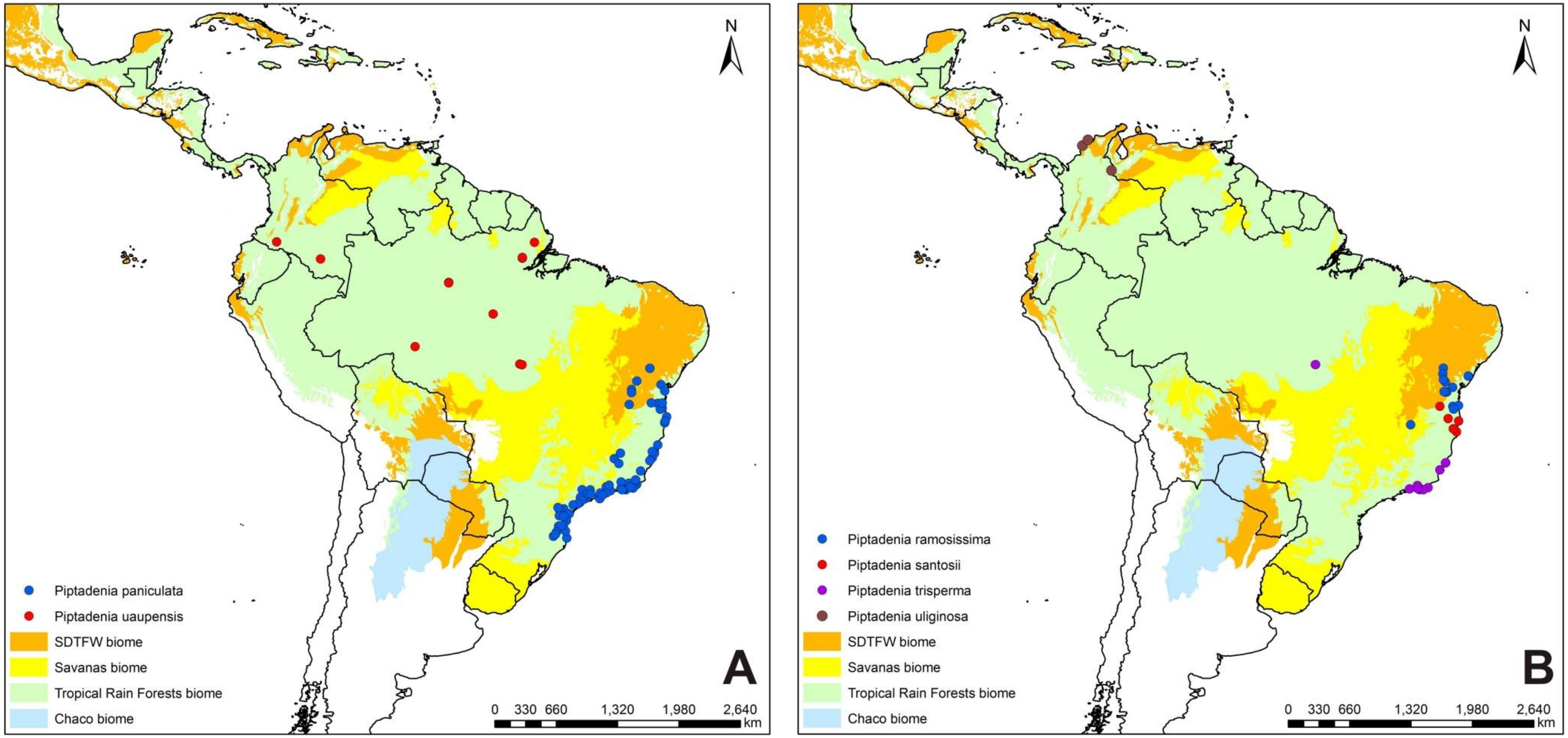

Fig. 42. Distribution maps of *Piptadenia.* **A**. *P. paniculata, P. uaupensis.* **B.** *P. ramosissima, P. santosii, P. trisperma* and *P. uliginosa.*

venation brochidodromous. **Inflorescences** mostly in terminal panicles or in pseudoracemes, with 2–3 spikes per node; individual spikes 51–53 × 7–8 mm, peduncle 6–10 mm long, the spike axis densely pubescent with white hairs; first-order 1–3, bracts at apex of peduncule, lanceolate, 1–1.4 mm long, densely pubescent, deciduous; floral bracts 0.8–1 × ca. 0.3 mm, lanceolate, apex acute, pubescent, persistent. **Flowers** 4–5 mm long, shortly pedicelate, pedicel 0.1–0.3 mm long; calyx 0.4–0.6 mm long, campanulate, glabrous to sparsely pubescent, tube 0.3–0.4 mm long, lobes 0.1–0.2 mm long, acute; corolla 1.8–2 mm long, campanulate, pubescent, tube 0.4–0.5 mm long, included in the calyx, lobes 1.3–1.5 mm long, erect; filaments 4–5 mm long, greenish-yellow, anther 0.2–0.35 × 0.15–0.2 mm long, anther gland subsessile, globose, early deciduous; ovary 0.8–0.9 mm long, pubescent to sparsely pubecent, ca. 12–13–ovulated, stipe 0.4–0.5 mm long, style 2–2.6 mm long; stemonozone present. **Legume** 12.1–17.2 × 3.3–3.6 cm, stipe 1.3–1.5 mm long, broad linear, apex obtuse, margins slightly thickened; valves brown, coriaceous, undulate, reticulate, glabrous. **Seeds** 10–12, 10–15 × 7–16 mm, ovoid to suborbicular; testa dark brown; pleurogram present, 2–4 mm diam.

Etymology—The name *paniculata* derives from the panicle inflorescence type.

Distribution and habitat – *Piptadenia paniculata* occurs in eastern Brazil at the states of Bahia, Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro, Paraná and Santa Catarina, at 140-615 m a.s.l. It occurs in dense wet forests and in semideciduous forests from the Atlantic Forest and Caatinga domains.

***Phenology* –** Flowering from January to March; Fruiting March and April, and from July to August.

Common names – Brazil: angico-brabo, angico-de-espinho, braúna-branca, faveira, faveira-de-espinho, jacarandá.

Taxonomy – *Piptadenia paniculata* is among the few known species with arboreal habitat, reaching up to 20 m in tall, a species that is recognized in the field because it presents trunks with woody prickles of thickened base. The branches vary in the same individual in prickles presence, some branches with prickles and others in which they are very small or absent. It also varies in branch development, the younger branches commonly lacking prickles which are visible in developed branches and in the trunk. *Piptadenia paniculata var. aculeata* thus represents only a variation in prickles density without taxonomic value.

Piptadenia paniculata was described by Bentham (1841) based on the sintypes collected by *Langsdorff*, *Sello* and *Pohl*, all from Rio de Janeiro. The *Pohl* materials deposited in the W herbarium were chosen as lectotype.

In previsous phylogenetic work (Jobson & Luckow 2007) the clade *P. paniculata* + *P. peruviana* was recovered (100 BS MP Jacknife), but on Simon et al (2016) this relationship is not resolved and *P. paniculata* appeared in a politomy with *P. peruviana*.

In our topology *P. pteroclada* and *P. peruviana* are on clade together *P. cuzcoënsis*, *P. laxipinna* and *P. santosii* (see discussions under *P. santosii*).

Examined material – BRAZIL: Paraná: Serra de Araraquara, Guaratuba, 100 m, 4 Jan 1968, *G.Hatschbach 18251* (MO); Antonina, Rio Cotia, 250-300 m, 21 Dec 1976, G.Hatschbach 39318 (MO); Guaraqueçaba, Río Açungui, 30-50 m, 4 Jul 1991, G.Hatschbach & M.Hatschbach 56111 (MO); Graciosa, Morretes, 100-300 m, 12 Dec 1989, J.M.Silva & G.Hatschbach 751 (MO). Bahia, Almadina: rodovia Almadina-Ibitupã, entrada ca. 5 km W da sede do município, Fazenda Cruzeiro do sul, Serra do Sete-Paus, ca. 8 km da entrada, 15-16 jan. 1998 (bot. e fl.), *J.G. Jardim et al. 1221* (CEPEC, HRB) Belmonte: s.l., 1 fev. 1967 (bot. e fl.), *R.P. Belém & R.S. Pinheiro 3251* (UB, NY). Itaberaba: Serra do Orobó, na base, subindo da Faz. Monte Verde, lado Sul, 11°19'35"S, 44°11'31"W, 13 mar. 1999 (fr.), *R.M. Harley et al. 53481* (HUEFS); parte da ARIE pertencente a Itaberaba, Fazenda Bom Jardim, Estância Baleeiro, 12°20'6"S, 40°28'33"W, 14 nov. 2004 (est.), *L.P.Queiroz et al. 9838* (HUEFS). Jacobina: estrada Jacobina-Itaitu, ca. 22Km a partir da Sede do município,21 fev. 1993 (bot. e fl.), *A.M. Amorim et al. 986* (ALCB, CEPEC, MBM, MBML, RB). Jussari: 3,2 Kmwest of BR-101, on road to Jussari, 15°00'S, 39°30'W, 2 fev. 1994 (bot. e fl.), *W.W. Thomas et al. 10213*(CEPEC, HUEFS, RB, NY). Porto Seguro: estação ESPAB-CEPLAC, 15 km de Porto Seguro, 30 mai.1989 (fr.), *S.M. Faria 286* (RB). Ruy Barbosa: Serra do Orobó, Fazenda Bom Jardim, 12°20'33"S, 40°28'40"W, 26 mai. 2005 (fr.), *L.P. Queiroz et al. 10682* (HUEFS); encosta da Serra do Orobó, BomJardim, 12°19'39"S, 40°28'33"W, 3 set. 2004 (est.), *L.P. Queiroz et al. 9446* (HUEFS). Salvador: s.l., 9 fev.1977 (est.), *M. Melo s.n.- BAH 1957* (BAH). Santa Cruz Cabrália: s.l., 15 jul. 1966 (fr.), *R.P. Belém & R.S. Pinheiro 2579* (CEPEC, IPA, NY, UB); estrada Eunápolis/Barrolândia, 16°12'S, 39°23'W, 2 ago.1984 (fr.), *J.C.A. Lima & M.M. Santos 141* (ALCB, BAH, CEPEC, HRB, IBGE, IPA, RB, MBM); área da Estação Ecológia do Pau-Brasil (ESPAB), ca. 16 km a W de Porto Seguro, rodovia BR 367 (PortoSeguro/ Eunápolis), 19 jan. 1984 (est.), *F.S. Santos 185* (CEPEC). Vitória da

Conquista: 1 km south ofBR-415, 14 km east of Vitória da Conquista , 14°59'34"S, 40°48'08"W, 22 mar. 1996 (bot. e fl.), *W.W.Thomas et al. 11101* (CEPEC, NY, RB). s.m.: Rod. Ubatã/Ibirapitanga, 9 mar. 1966 (bot. e fl.), *R.Pinheiro 84* (CEPEC, UB).

15. ***Piptadenia peruviana*** (Macbr.) Barneby, Brittonia 38(3): 226. 1986. ≡ *Piptadenia adiantoides* var. *peruviana* J. F. Macbr., Field Mus. Nat. Hist. Bot. Ser. 13(3/1): 101. 1943. Type: PERU. San Martin: Chazuta, Río Huallaga, Mar. 1935, *G. Klug 4018* (holotype: F [barcode F0042928F]!; isotypes: K [barcode K000504643]!, MO–2 sheets [barcodes MO-954394 and MO-954395]!, NY [barcode NY00003201]!, S [barcode S-R-8655], UC [barcode UC709953], US–2 sheets [barcodes US00001001 and US00997082]!).

Figs.6C, 8F, 43, 44A-I, 45A. Map Fig. 30A.

Liana or scandent shrub to 10 m tall; branches cream-brownish, not noticeably ridged, glabrous or minutely pubescent with short white hairs, with creamy, elliptic lenticels; prickles 1.5–1.7 mm, recurve, cream with apex orange to brownish or brown, scattered on the branch, in the leaf rachis and in the pinnae. **Stipules** 4–6 mm long, linear, caduceus. **Petiole** 3–6.5 cm long, rachis 5–14.5 cm long, minutely puberulent, pulvinus 4–5 mm long, interpinnal segments 16–40 mm long; pinnae 4–7 pairs, basal pinnae 3.5–6 cm long, median pinnae 6.5–7 cm long, distal pinnae slightly longer 6.5–8.5 cm long, interfoliolar segments 8–16 mm long; paraphyllidia absent; petiolar nectary solitary 3.5–6.5 mm diam, sessile, deppressed, sunkem at the base of the petiole, additional and smaller shortly cyllindric nectaries in leaf rachis between the all pair of pinnae and in the pinnae between the distal pairs of leaflets; leaflets 4–7 pairs per pinna, 15–42 × 10–20 mm, elliptic to oblong or obovate, apex mostly obtuse, base oblique, obtuse on one side, asymmetrical, margins plane, not ciliate, sparsely pubescent on both sides, midvein central or subcentral, raised on the lower surface, secondary venation brochidodromous, smaller venation reticulate. **Inflorescences** mostly in axyllary pseudoracemes, with 1–4 spikes per node;

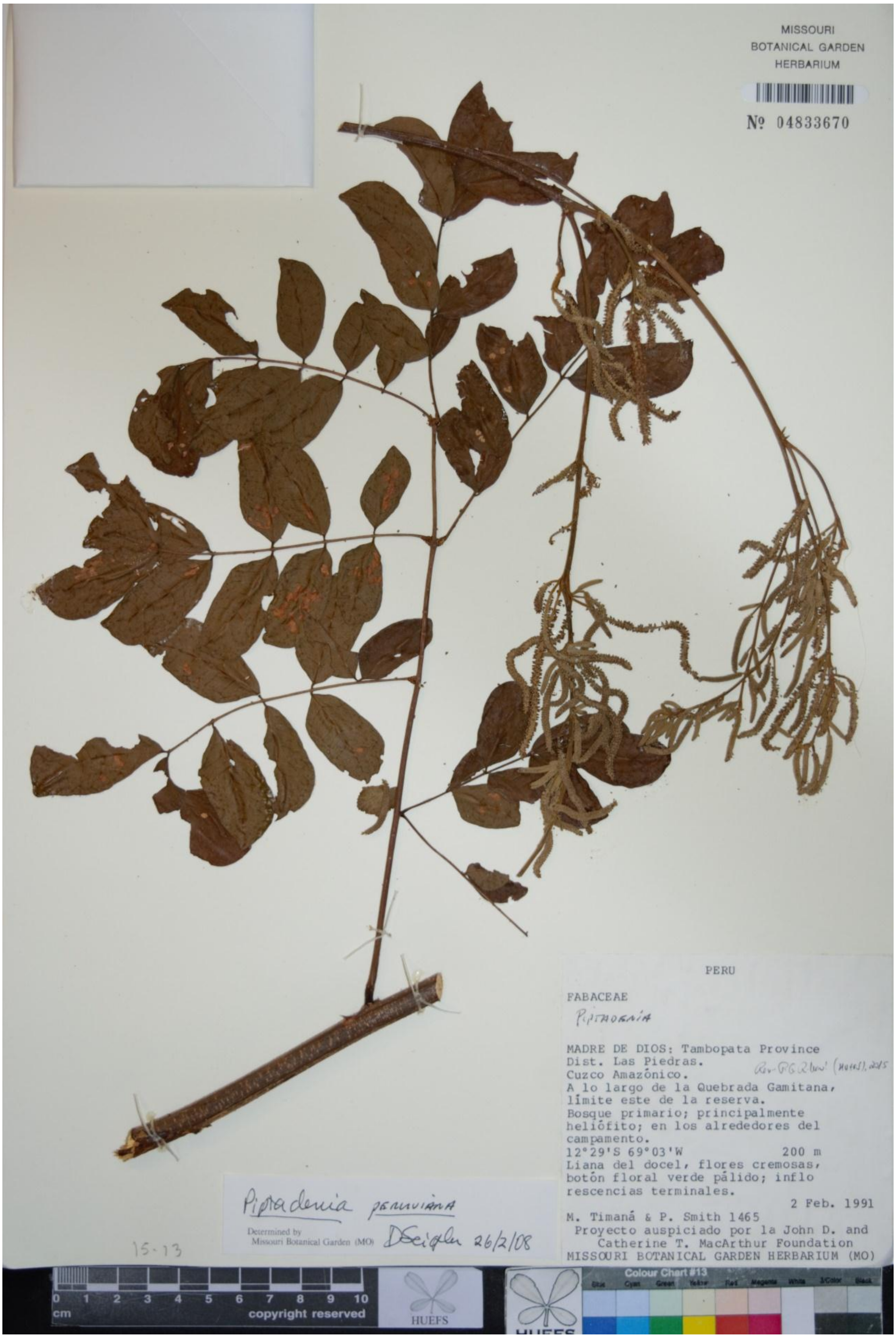

Fig.43. *Piptadenia peruviana.* Timaná 1465 (MO)

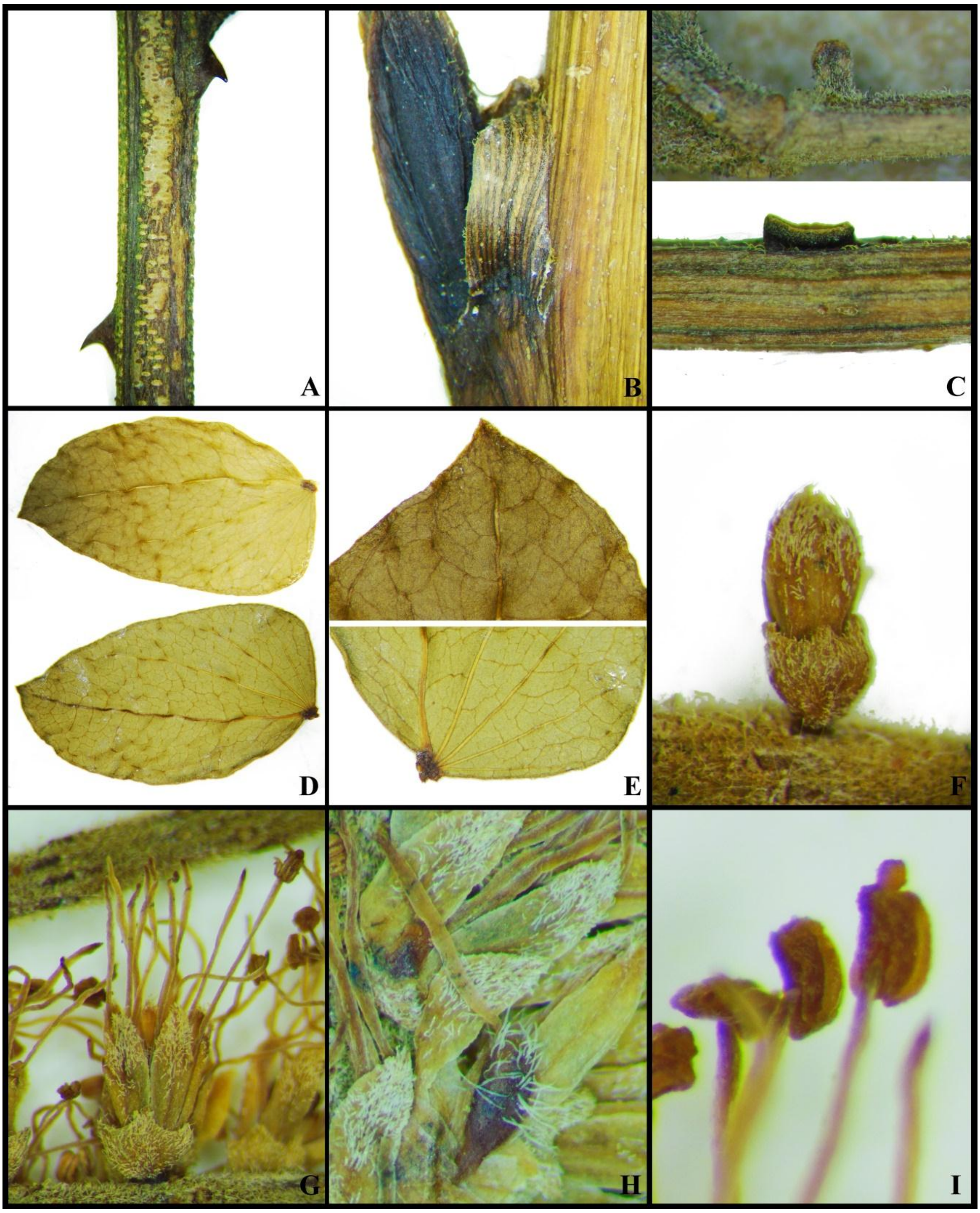

Fig.44.**A-I.** *Piptadenia peruviana.* A. Prickles, B. Stipules an Petiolar nectary, C. Petiolar nectary of pinnae, D. Leaflets on upper and lower surfaces, E. Base and apex of leaflet, F.Flower bud, G. Flower, H. Ovary, I.Anthers with glands on the top. Pictures by Earl Chagas.

Fig.45.**A.** *Piptadenia peruviana.* **A.** Habit liana, **B-H**. *Piptadenia pteroclada.* B. Trunk, C. Inflorescence showing flowers with filaments pink and cream, D. Trunk, F. Branches in fruiting, fruits matures. G. Tree, H. Detail of inflorescence showing the fillaments pink. Pictures A by Percy Nunez, B-H by Pétala G. Ribeiro.

individual spikes 4.9–13 × 0.9–1.3 cm, peduncle 6–15 mm long, the spike axis densely pubescent with short golden hairs; first-order bracts at apex of peduncule, 1, linear, 2–4 mm long, densely pubescent, early deciduous; floral bracts 0.4–0.7 × ca. 0.3 mm, ovate, apex acute, pubescent, persistent. **Flowers** 4.6–7 mm long, sessile; calyx 0.6–0.9 mm long, campanulate, puberulent, tube 0.5–0.8 mm long, lobes 0.1–0.2 mm long, acute; corolla 1.6–2.3 mm long, campanulate, puberulent, tube 0.6–0.9 mm long, included in the calyx, lobes 1–2.1 mm long; filaments 4–6 mm long, cream or greenish-yellow, anther 0.25–0.3 × 0.18–0.25 mm long, gland anther sessile; ovary 0.7–1.2 mm long, slightly pubescent, ca. 12–14-ovulated, stipe 0.7–1.2 mm long, style 2.6–3.1 mm long; stemonozone present. **Legume** 12–17.6 × 2.3–3.5 cm, stipe 8–13 mm long, broad linear, apex acute, margins slightly thickened; valves brown, coriaceous, flattened, reticulate, glabrous. **Seeds** 8– 10, 7–10.5 × 7–9 mm, oval to orbicular; testa dark brown; pleurogram 1.8–3 mm diam.

Etymology—The name *peruviana* derives from the local of occurrence, Peru. .

***Distribution and habitat* –** *Piptadenia peruviana* occurs in Peru. Rain forest, Amazonia, at altitudes of 150-250 m.n.m.

Phenology

Flowering in march Fruiting july.

***Common names* –** unknown

Taxonomy **–** Similar to *P. paniculata* by sharing leaflets with apex mostly obtuse, base asymmetrical, obliquely obtuse on one side, from which it differs by the habit liana (*vs.* tree in *P. paniculata*). See *P. paniculata* for phylogenetic results discussions.

Examined material **–** BOLIVIA: **Depto Santa Cruz**. Prov. Santiesteban: 6 km S of bridge at Chane Independencia and 12 km N of center of Mineros, *M. Nee 48865* (MEL); BRAZIL**: Acre.**. Assis Brasil, Basin of Rio Purus, upper Rio Acre, left bank. Riverside vegetation near high-water mark, river level descending, -10.92638 , *D.C. Daly 9765* (MO, NY); EQUADOR**:** Reserva Etnica Huaorani. Carretera y oleoducto de Maxus, km 120. Plataforma del Pozo Ginta. Bosque humedo. Tropical. Bosque primario. Terreno ligeramente plano., 01º02'S (fr.), *M. Aulestia & M.B. Loureiro 3637* (MO*); PERU: Cusco; Quispicanchis, 12º51'S (st.), *F. Cornejo & A. Balazero 3302* (MO); Balsapuerto, (fl. bot.), *G. Klug 2927* (NY*); Dept. of San Martín: Chazuta, Río Huallaga, *G. Klug 4018* (K); Distrito Las Piedras, Reserva Amazonica, Trocha F, D y Canopy., -12.54 (fr.), *L. Valenzuela et al. 9827* (K, MO*); Ucayali, Purús, Fundo ganadero L. & G. 8km. Abajo del puerto. Esperanza, margem derecho del Río Purús. Elev. 150-190 metros, 10º 12'S (fl. bot.), *J.S. Vigo & J.G. Graham S14981* (MO, NY).

16. ***Piptadenia pteroclada*** Benth., Trans Linn Soc. London 30: 370. 1875. Type: PERU. Prope Tarapoto: “in sylvis et campis”, 1855–1856, *R. Spruce 4536* (holotype: K [barcode K000201012]!; isotypes: B, destroyed = F negative nº 1486 [barcode F0BN001486], C [barcode C10012291], E [barcode E00296968], F [barcodes F0042985F = F negative nº 55061 and F0360976F = fragment ex B]!, GH [barcode GH00064053], K–2 sheets [barcodes K000201011 and K000201013]!, MPU [barcode MPU016108], NY [barcode NY00003238]!).

= *Piptadenia opacifolia* Ducke, Arch. Jard. Bot. Rio de Janeiro 5: 125. 1930. Type. BRAZIL. Amazonas: “Tonantins, ad ripas inundatis fluvii Solimões”, 12 Nov 1927, *A. Ducke s.n.* (lectotype: RB 20190–2 sheets [barcodes RB00540028 and RB00547553]!, **designated here**; isolectotypes: F [barcode F0360971F] fragmente ex P!, K [barcode K000504648]!, P [barcode P02930930] = F negative nº 39808!, S [barcode S-R-8662], U [barcode U0003430], US [barcode US01108321]!).

= *Piptadenia pteroclada* var. *klugii* J.F. Macbr. Publ. Field Mus. Nat. Hist., Bot. Ser. 13(3/1): 104. 1943. Type: PERU. San Martín: Juan Jui, Alto Río Huallaga, 1855–1856, *G. Klug 4386* (holotype: F [barcode F0042927F = F negative n° 57375]!; isotypes: A [barcode A00064054], BM [barcode BM000797950], K [barcodes K000504642]!, MO [barcode MO-954317]!, NY [barcode NY00003239]!, P [barcode P02272933], S [barcode S-R-8659]!, U [barcode U0003433], US [barcode US00001015]!).

Figs. 6D, 8G, 45B-H, 46, 47 A-I. Map Fig.30B.

Tree 8–35 m tall; branches purple-brown or brown, noticeably ridged, glabrous or sparsely pubescent with short white hairs, lenticels not seen; prickles 1–4 × 2–5 mm long on young

Fig.46. *Piptadenia pteroclada.* Froes 20805 (MG)

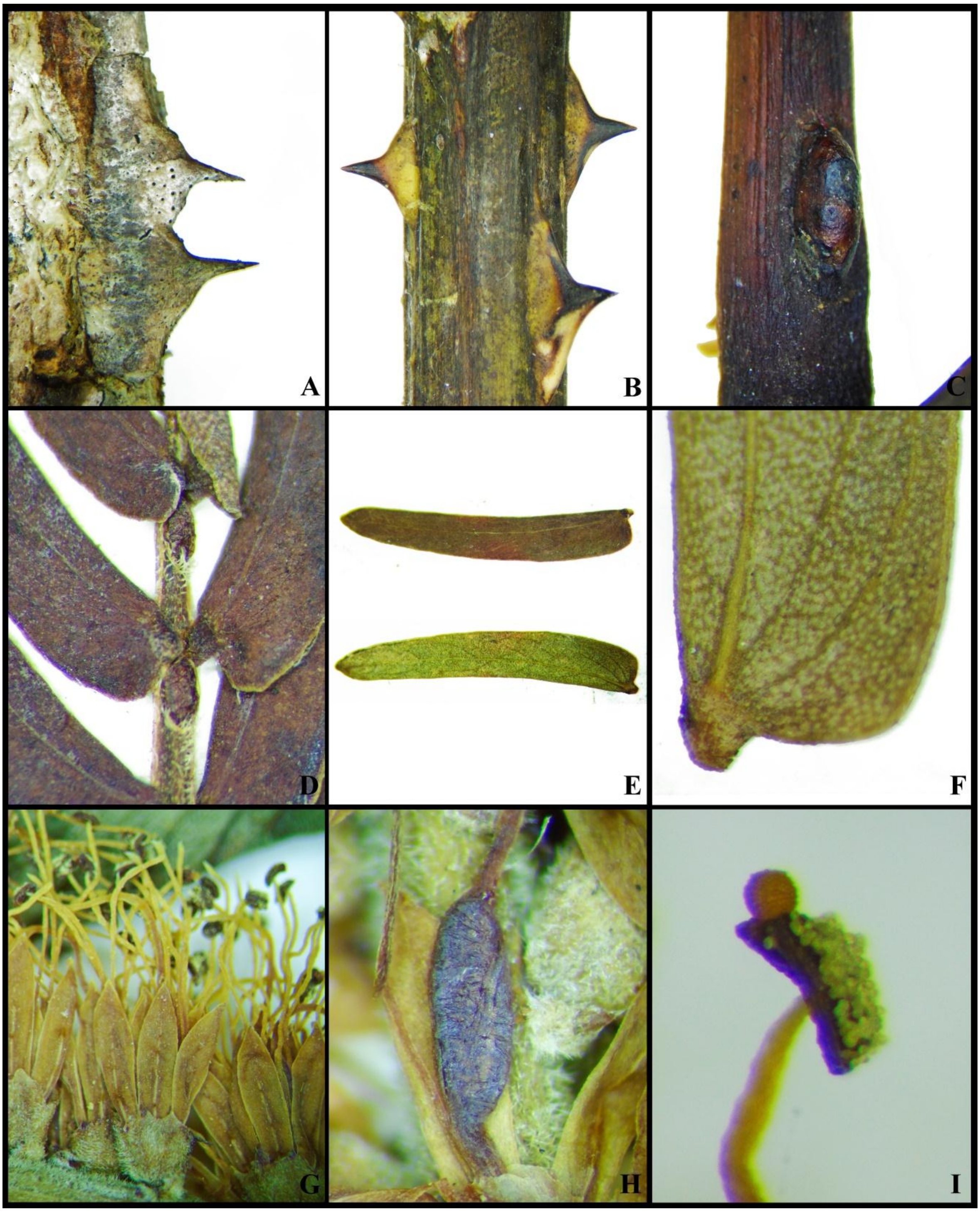

Fig.47.**A-I.** *Piptadenia pteroclada.* A. Prickles on older branches, B. Prickles on younger branches, C. Petiolar nectary, D. Apex of pinnae, E. Leaflets on upper and lower surfaces, F. Base of leaflet, F.Flower bud, G. Flowers, H. Gynoecium showing ovary glabrous, I. Anthers showingthe gland on the top. Pictures by Earl Chagas.

branches, erect, cream with apex orange to brownish, grayish-cream, uniformly, arranged in longitudinal series on branch ribs, merging in the older branches to defining suberous stem wings. **Stipules** not seen. **Petiole** 4.5–8.5 cm long, rachis 9–32 cm long, glabrous , pulvinus 4–8 mm long, interpinnal segments 10–25 mm long; pinnae 8–13 pairs, basal pinnae 5.6–8.5 cm long, median pinnae slightly longer 7–13.5 cm long, distal pinnae 5–8.3 cm long, interfoliolar segments 1.3–2.2 mm long; paraphyllidia absent; petiolar nectary solitary 3.1–6.5 mm diam, sessile, elliptic, conical, wrinkled, located from the base to the middle of the petiole, additional and smaller nectaries in leaf rachis between the distal pair of pinnae and in the pinnae between the distal pairs of leaflets; leaflets 35–55 pairs per pinna, 7–12 × 1.4–2.4 mm, oblong, apex acute, base oblique, asymmetrical, margins plane, not ciliate, glabrous on both sides, midvein displaced towards acroscopic margin, raised on the lower surface, secondary and smaller venation reticulate. **Inflorescences** mostly in terminal and axillary pseudoracemes with 1–3 spikes per node; individual spikes 12.5–22 × 9–15 mm, peduncle 12–25 mm long, the spike axis puberulent with short golden hairs; first-order bracts located at apex of peduncule 1, linear, 1–3 mm long, pubescent, deciduous; floral bracts 0.3–0.7 × 0.2–0.3 mm, ovate, apex acute, pubescent, early deciduous. **Flowers** 4.2–6.2 mm long, sessile; calyx 0.8–1.5 mm long, campanulate, puberulent, tube 0.7–1.3 mm long, lobes 0.1–0.2 mm long, acute; corolla 2.4–3.1 mm long, campanulate, glabrous, tube 0.2–0.3 mm long, included in the calyx, lobes 2.1–2.9 mm long, almost free at the base, erect; filaments 4–6 mm long, cream or greenish-yellow varying to light pink to reddish, anther 0.4–0.5 × 0.2–0.25 mm long, gland anther sessile, globose, early deciduous; ovary 0.8–1 mm long, glabrous, 8–10-ovulated, stipe 1–1.2 mm long, style 4.2–6 mm long; stemonozone present. **Legume** 12–23 × 2.5–3.5 cm, stipe 13–23 mm long, broad linear, apex acute to obtuse, margins slightly thickened; valves brown, coriaceous, flattened, reticulate, glabrous. **Seeds** 5–9, 7–9.7 × 5–7 mm, orbicular to oblong; testa reddish-brown; pleurogram 1.8–3 mm diam.

Distribution and habitat – *Piptadenia pteroclada* occurs in Amazonia areas from Brazil, Colombia, Ecuador e Peru.

Phenology **–** Flowering in July to September; Fruiting November to January.

Common names **–** pashaco-lagarto

Taxonomy **–** It resembles *P. gonoacantha* and *P. ramosissima* because it presents prickles arranged in longitudinal series at the branches, but it differs from *P. ramosissima* because it is a tree (*vs.* a liana in *P. ramosissima*). From *P. goanacantha*, it is distinguished by the size of the spikes (12.5 -22 × 9-15 cm, peduncle 12-25 mm long in *P. peroclada vs*. 5.8-11 × 0.6-1.3 cm, peduncle 3-7 mm long in *P. gonoacantha*). Its trunk resembles that of *P. gonoacantha* by presenting longetudinal ribs, from which comes its vernacular name, "pashaco-lagarto", similar to the lizard skin.

The holotype *of Piptadenia pteroclada* is the Spruce 4536 collection deposited in Herbarium Kwensis (K), we found three samples from the *Spruce* collection in K. Of these three, the sample K [barcode K000201012] is the holotype, since it is the original collection worked by the Bentham (collection in K ex herbarium benthamianum).

Piptadenia opacifolia was described by Ducke (1930) based on three sintypes (*Ducke s.n.* [RB 20190], *Ducke s.n.* [RB 20191] and *Kuhlmann s.n*. [RB 17604]), among which we chose *Ducke s.n*. (RB 20190) as a lectotype for this name.

The previous phylogenetic works on the Piptadenia group (Jobson & Luckow 2007) recovery a clade whereas *P adiantoides* is sister of a clade bringing together *P pteroclada*, *P. ramosissima* and *P. robusta*, suported by having a marginal vein in the leaflets (except *P. adiantoides*). Our phylogeny uncovered the affinity between the Andean *P. robusta* and *P. pteroclada* is recovered, but does not include *P. ramosissima.* In fact, *P. pteroclada* + *P.robusta* share some morphological characters, such as the tree habit reaching up to 20m high, vegetatively the both species are similar, with overlaping on these character : the leaf rachis 9-32 cm in *P. pteroclada* vs 12-38 in *P. robusta*, pairs of pinnae 8-13 vs 7-11, leaflets with 7-12 × 1.4- 2.4 mm in *P. pteroclada* vs. 7-20 × 1.6-3.5 mm in *P. robusta*.

Examined material – **Dept. of San Martin**, Juan Jui, Alto Río, *G. Klug 4386* (Herbarium); Chimbote, Rio Amazonas, *J.G. Kuhlmann 17604* (Herbarium); Prope Tarapoto. Peruviae Orientalis, *Spruce R. 4536* (Herbarium); *W.A. Ducke 111844* (BCTW, RB). BRAZIL: **Amazonas**, Sao Paulo de Olivenca, near Palmares B. A Krukoff, *P. Capucho 454* (Botany); Redenção, *P.P. Chaves* (HERBMG); Lago Tefé. Barrier Solimões, *W. D. Hamilton 28* (Herbarium); Tabatinga, margem inundada do Solimões, *W.A. Ducke 1518* (IAN, NY); São Paulo de Olivença Basin of Rio Solimoes, near Palmares, *B. A. Krukoff 8082* (NYBG_BR); São Paulo de Olivença, Varsea alagada do Solimões (bud. Fl.) *R. L. Fróes 20805* (IAC*, K, NY), Tabatinga, *A. Ducke* (R);**Toncantins**, civ. Amazonas, ripis inundandatis fluvii Solimões, *A. Ducke 20190* (F, K, S, US); *P. Capucho 454* (F); civ. Amazonas, fluvii Solimoes *A. Ducke* (Botany); Amazonum fluvii confluentia fluminis Pebas, Peruvia orientali, *A. Ducke* (Botany); A. Ducke (P); Tabatinga, *A. Ducke & N. A. Rosa* (HERBMG); Basin of Rio Solimoes; **Pará**, Redenção (bud, fl.) *L. C. B. Lobato et al. 3651* (HERBMG*); **Paraná**, Morretes Limeira (bud, fl.), *G. Hatschbach 46040* (MBM*, MO). COLOMBIA: Centro Experimental Amazonico *L. M. Aislant 15* (HPUJ); Leticia, Área protegida, Parque Nacional Natural Amacayacu. Centro Administrativo Mata-matá (Inderena). Trocha que va de Mata-matá a Amacayacu, en los alrededores de Mata-matá, en zona de Várzea, *A.R. Lleras et al. 2844* (HUIS, MO); Casanare, Paz de Ariporo, *D.E. Acero* (COL); Paz de Ariporo – Casanare, *D.E. Acero 16* (COL); Vereda Únete; *E. Acero 59* (FMB); Meta, Vilavicencio, Carretera a Restrepo. ca 1 km antes del puente sobre el río Guatiquía. Bosque detrás de la planta Bavaría. ca 600 m, *H. Arellano 76* (COL); Frontera Colombo-Peruana, margenes del rio Putumayo en La Concepcion, *J. Cuatrecasas 10809* (COL); Frontera Colombo - Ecuatoriana, selva higrofila del río San Miguel, junto a la desembocadura del río Conejo, *J. Cuatrecasas 11058* (COL); **Amazonas.** Puerto Nariño. Parque Nacional Amacayacu. Aguas del río Amazonas.100 m, *R. Vásquez* (COL); Parque Nacional Amacayacu, *R. Vásquez et al. 12478* (COL, MO); Carretera Santa Maria-San Luis de Gaceno, ca 1-6 km al E de Santa María. Orilla de carretera y orillas del río Garagoa, *R.G Bernal et al 2739* (COL); Puerto Nariño. Parque Nacional Amacayacu. Aguas del río Amazonas.100 m, *Vásquez R. 332367;* Parque Nacional Natural Tinigua. Serranía Chamusa. Centro de Investigaciones Primatológicas La Macarena. Trocha baño 150 m. (fr.), *P. Stevenson 456* (MO); ECUADOR: **Napo**, Cantón Lago Agrio, Dureno. Comunidad indigena Confán. (bud, fl.), *C. E. Cerón et al. 263* (MO*, NY); Lumbaqui, *T.D Pennington et al* (Botany); Lumbaqui. Mixed forest on poorly drained flat land T.D. Pennington 12246 (MO); Lago Agrio, Bosque Húmedo Tropical (bud, fl. Fr.), *D. Neill 7201* (MBM, MO*, S); **Puyo**, River walk along the Río Puyo, the "Paseo Turístico" between the campus of the Universidad Estatal Amazónica and the "malecón" near the city center. A remnant of the original primary forest with many large, old trees with abundant and diverse epip, *D. Neill 17668* (MO); La Isla. Bosque pantanoso, *E. Freire et al. 3758* (MO); Pozo Petrolero "Corrientes" de UNOCAL. Bosque húmedo Tropical. Bosque primario; árboles cortados por las obras petroleras *E. Gudiño 522* (MO); Pozo Petrolero

"Corrientes" de UNOCAL. Bosque húmedo Tropical. Bosque primario; árboles cortados por las obras petroleras, *E. Gudiño 535* (MO); Estacíon Experimental Pastaza, Km 33 vía Puyo-Macas, trayecto Km:33-36.5, al borde del carretero, *J. Caranqui et al. 410* (MO). Cordillera del Cóndor, Valle del Río Coangos. Río Tsurim entre los centros Shuar de Numpatkain y Banderas. Bosque intervenido con áreas preparadas para establecer cultivo de mai|z, junto a bosque primario, *P. Fuentes et al. 1120* (MO). Lumbaqui. Mixed forest on poorly drained flat land, *T. D. Pennington et al. 12303* (MO); Reserva Biologica Jatun Sacha, 8 km. de Puerto de Misahualli, margen derecha del Río Napo. Bosque húmedo tropical. Bosque primario, *W.A. Palacios 1704* (MO); **Contundo**. Tena-Baeza, *W.A. Palacios 16370* (MO); Tarapoto. Bosque húmedo tropical, *T.J. Rios 13-B* (MO); Shiringamazu, ca 20 km S of Iscozacin, Río Palcazu Valley. Wet lowland forest on clay, *A. H. Gentry et al. 63344A* (MO, NY); Seasonally inundated shruberry along banks of Rio Amazonas below Tamshiyaca, *A.H. Gentry et al. 25781* (MO); Yanamono, Explorama Tourist Camp on Río Amazonas between Indiana and mouth of Río Napo, Seasonally inundated Tahuampa, *A.H. Gentry et al. 29008* (MO); Shiringamazu, ca 20 km S of Iscozacin, Río Palcazu, *V. C. Díaz et al. 63344A* (Herbarium); Oxapampa, Iscozacin, near confluence of Rio Placazu and Rio Iscozacin (Juan Franzen property) Pasture edge, *D.N. Smith L. Franzen 1946* (F, MO); Pozuzo. Fundo de Agustin Egg, *Schuller E. B. et al. 1401* (MO); Fundo de Agustin Egg Schuller, *E.B. Gonzáles et al. 1414* (MO); PERU: **Dpto. Iquitos**. Loreto, San Roque (fr.), *T.D. Pennington & J. Ruiz 12476* (MBM); Río Amazonas, cerca a la sacarita de la quebrada de Yanayacu, en terreno bajo inundable, *Y.M. Rimachi 11560* (MO); Benjamin Constant (est.); *E.M. Drees s.n.* (FOX?, INPA); Loreto. Maynas Caballo Cocha. Sacorita de Caballo de Cocha. Zona inundable (Isla). (bud, fl.), *F. Ayala et al. 3359* (MO); Loreto, Maynas Restinga Central, Padre Isla (bud, Fl.), *F. Encarnación & K. Mejia 25137* (G*, MO); Loreto. Maynas. Carretera de Iquitos. A Nauta, km 10, al margin del pasto, en terreno arcilosso. (bud, fl.), *M. Y. Rimachi 7202* (MBM*); Loreto. Maynas. Río Amazonas, Isla Rondiña, opposite Leticia (bud, fl.) *T.C. Plowman et al. 6407* (INPA); San Martin Huahuiva ad Saposoa. (bud, fl. Fr.); *F. Woytkowski 5046* (MO*); San Martin. Chazuta, Río Huallaga, forest. (bud, fl.) *G. Klug 4022* (F, MO*, NY); Tocache. San Martin. Mariscal Caceres Nuevo. Desembocadura del Rio Tocache. Al borde del Rio, en bosque secundario. (bud, fl.) *J.V. Schunke 8249* (MO*). **Dpto. Honoria**. En campo abierto en el Camino a Shahuinto a 2 km. del Campamento de Iparía. Bosque Nacional de Iparia: Región de "bosque seco tropical" (sensu Tosi, 1960) a lo largo del Río Pachitea cerca del campamento Miel de Abeja (1 km. arriba del pueb (bud, fl.), *J. V. Schunke 1809* (COL, MO*); *K.A. Mayolo 346* (MO); *Kuhlmann* (P); Tarapoto, R. Spruce 4536 (Botany, E; GH, MO, NY, FMNH-B-Types); Tacsha cocha (Río Samiria). Bosque inundable estacional, *R. Vásquez et al. 6495* (MO); *R.T. Pennington et al. 1069* (E); Jenaro Herrera (rio ucayali), Cedro Isla; *S. Lamotte*; *Spruce R.* (MPU); *T. C. Plowman* (Botany); **Dept. of Loreto.** San Tomoz, Rio Maranon, below Peruate. River bank, *G.T Prance et al.* (Botany). Peruvia orientali, Chimbote, Rio Amazonas, *J. G. Kuhlmann 17604* (Botany, VascularPlants); *J. S. Vigo* (Botany); Chimbote, Rio Amazonas, Peruvia orientali, *J. G. Kuhlmann et al.*(Botany); Florída, Río Putumayo, at mouth of Río Zubineta; forest. (bud, fl.), *G. Klug 2034* (MO); Loreto, San Tomoz, Rio Marañon, below Peruate. (bud, fl.), *G.T. Prance & S.A. Mori 24672* (INPA); **Dept. of San Martín**. Juan Jui, Alto Rio Huallaga, alt. 400-800 m, *G. Klug 4386* (A, BOT, Botany, MO, NY, P, VascularPlants).

17. ***Piptadenia ramosissima*** Benth., in Hook J. Bot. 4(30/31): 336. 1841. Type: BRAZIL. Bahia: "in sylvis ad Ilheos", 1824, M. Wied-Neuwied s.n. (= Martii Herb. Fl. bras.) (holotype: BR [barcode BR0000005203406]; isotypes: BM [barcode BM001053849], K [barcode K000090271]!).

Figs. 6E, 8H-I, 48A-E, 49, 50A-I. Map Fig. 42B.

Liana or scandent shrub with several trunks from the base; branches greyish-brown, not noticeably ridged, sparsely pubescent with short white hairs, with cream-coloured to brown, elliptic lenticels; prickles 3–8 mm long on young branches, erect, cream-coloured with apex orange to brownish, arranged in longitudinal series on the branch ribs, in the leaf rachis and in the pinnae, merging in the older branches to defining suberous stem wings. **Stipules** 1.1–1.6 mm long, linear, caducous. **Petiole** 1.2–2.8 cm long, rachis 3.5–6.1 cm long, slightly grooved, puberulent, pulvinus 3–4 mm long, interpinnal segments 8–16 mm long; pinnae 3–5 pairs, proximal pinnae 2.8–4.2 cm long, median pinnae 3.8–6 cm long, distal pinnae 4.5–6 cm long, interfoliolar segments 2–3 mm long; paraphyllidia absent; petiolar nectary 1.2–1.3× 0.5–1 mm diam, sessile, elliptic-depressed located at the apex of the petiole, additional and smaller nectaries in leaf rachis between the distal pair of pinnae and in the pinnae between the distal pair of leaflets; leaflets 14–22 pairs per pinna, 7–12 × 2–3 mm, linear, apex rounded to slightly acuminate, base truncate, asymmetrical, margins plane, ciliate, glabrous to sparsely pubescent on both surfaces, midvein displaced towards the acroscopic margin, raised on the lower surface, secondary venation reticulate. **Inflorescences** mostly in terminal pseudoracemes; individual spikes 45–82 × ca. 6 mm, peduncle 5–10 mm long, the spike axis densely pubescent with short white hairs; first-order bracts 1–3, at apex of peduncule, linear, 1.5–1.8 mm long, pubescent, caducous;

Fig.48.**A-E.** *Piptadenia ramosissima.* **A.** Fruit, **B**. Branches, **C**. Pinnae apex showing the gland between leaflets, D. Branche on cross seccion, E. Leaf on the branches. F-I. *Piptadenia stipulacea.* F. Shrub on inflorescence period, G. Branches with inflorescence showing flowers with filaments pink, **H**. Inflorescences on flowers and buds, **I.** Inflorescence. Pictures A-E by Alex Popovkin; F by Luciano Paganucci and G-I by Domingos Cardoso.

Fig. 49. *Piptadenia ramosissima*. Queiroz 9435 (HUEFS)

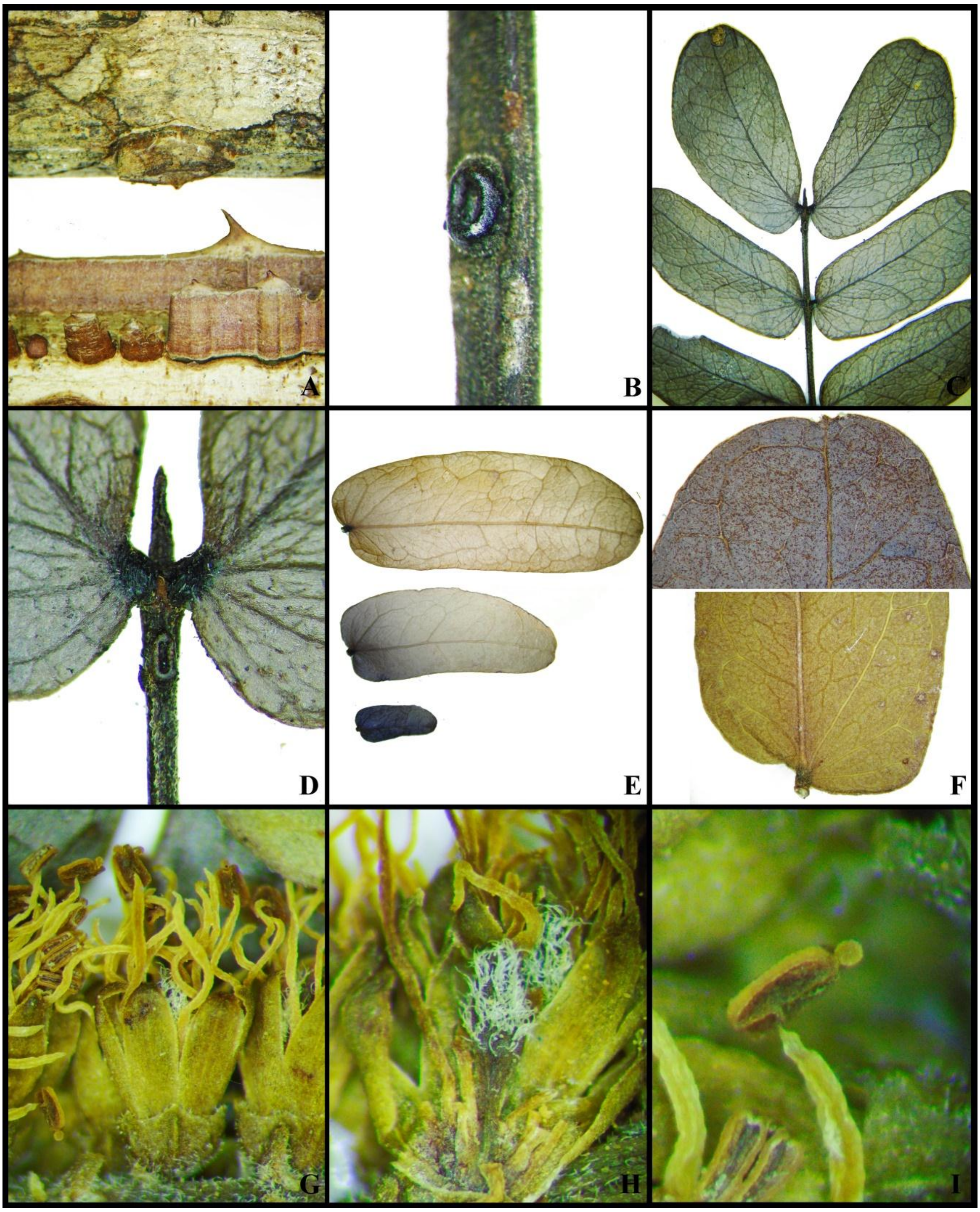

Fig. 50.**A-I.** *Piptadenia ramossima.* A. Prickles, B. Petiolar nectary, C. Apex of pinnae, D. Apex of pinnae showing the nectary between the leaflets and rachis extension, E. Leaflets variation of size, E. Base of leaflet show domacea, F.Apex and base pof leaflet, G.Flower, H. Flower onpened showing the pubescent ovary, I. Anthers showingthe gland on the top. Pictures by Earl Chagas.

floral bracts 0.5–0.8 × ca.0.4 mm, linear, apex acute, pubescent. **Flowers** 4.6–6.5 mm long, sessile; calyx 0.6–0.8 mm long, campanulate, pubescent, tube 0.5–0.7 mm long, lobes ca. 0.1 mm long, acute; corolla 2–2.2 mm long, campanulate, glabrous, tube 0.8–1 mm long, included in the calyx, lobes 1–1.2 mm long, erect; filaments 3.5–4 mm long, white, anther 0.2–0.4 × 0.15–0.25 mm long, anther gland sessile, globose, early caducous; ovary 0.7–0.8 mm long, densely pubescent, ca. 12–14–ovulated, stipe 0.3–0.5 mm long, style 1.4–3.1 mm long; stemonozone present. **Legume** 10.5–11.2 × 2.2–2.3 cm, stipe 8–20 mm long, broad linear, apex rounded to slightly acuminate, margins slightly thickened; valves brown, papery, undulate, reticulate, glabrous. **Seeds** 8–10, 6–7 × 6–7 mm, suborbicular; testa light brown; pleurogram present, 2–3.5 mm diam.

Etymology—The name *ramosissima* derives from the aspect of the branches, muito ramificada.

Distribution and habitat – *Piptadenia ramosissima* occurs in the state of Bahia, northeastern Brazil, in semideciduous forests of the Caatinga and Atlantic Forest domains, 177-200 m altitudes.

Phenology

Flowering in jan to may; Fruiting from may to november.

Common names **–** unknown

Taxonomy **–** Similar to *P. gonoacantha* by the prickles erect forming ribs on the branches and wings on the trunks. This kind of prickles are also found on *P. pteroclada*, but *P. gonoacantha* and *P. ptercolada* are trees, and *P. ramosissima* is a liana.

Due to the poor preserving quality of the type material, we hesitated in considering modern collections as belonging to this species. However, a careful study of the branches and pinnae and leaflet scars on detached leaves of type specimen provided evidence to consider all them within *P. ramosissima*.

Bentham (1841) described *Piptadenia ramosissima* based on a material indicated as collected by the Martius. In fact, it is a material collected by Prince Maximilian of Wied-Neuwied from the herbarium Flora Brasiliensis of Martius, collection currently allocated in BR.

In the phylogeny, it appears near to *P. irwinii*, relationship supported by the vegetative aspect (see discussion on this species)

On the other hand, *P. ramosissima* and *P. adiantoides* (99 MP Jacknife, Jobson & Luckow 2007) showed that *P. ramosissima* and *P. adiantoides* are grouped with *P. pteroclada* and *P. ramosissima*. However, this relationship of *P. ramosissima* with the other species of this clade did not appear in our topology, whereas *P. ramossima* is sister group of *P. irwinii.*

Examined material – BRAZIL:-14.890278 -39.613889, *E. Gross 260* (UESC); Possyble collected in Bahia, *K.F.P. von Martius s.n* (Herbarium, HUEFS); possyble collected in Bahia, (bot. e fl.), K.F.P. von Martius s.n. (HUEFS, K); *S/C s.n* (BOT, NHM_LONDON_BOT); (fr.), *Hashimoto s.n.* (RB*); **Bahia**. Serra do Timbó, Mata do Centro Sapucaia, área de Duas Barras, (fr.), *J.L. Paixão & M.S. Nascimento 1294*

(HUEFS*); Fazenda Rio do Negro, Residual stands of the Atlantic Forest. Restinga-type forest of the Rio do Negro valley, ca. 15 km southeast of Entre Rios, (bot. e fl.), *A.V. Popovkin 540* (HUEFS*); Fazenda Rio do Negro, Residual stands of the Atlantic Forest. Restinga-type forest of the Rio do Negro valley, ca. 15 km southeast of Entre Rios, (bot. e fl.), *A.V. Popovkin 548* (HUEFS*); Fazenda Rio do Negro. Residual stands of the Atlantic Forest. Restinga-type forest of the Rio do Negro valley, ca. 15 km southeast of Entre Rios., (fr.), *A.V. Popovkin 596* (HUEFS); Fazenda Rio do Negro. Residual stands of the Atlantic Forest. Restinga-type forest of the Rio do Negro valley, ca. 15 km southeast of Entre Rios., (fr.), *A.V. Popovkin 635* (HUEFS); Imbé, (bud, fl. e fr.), *A.V. Popovkin 867* (HUEFS); Próximo ao povoado de Imbé. Floresta Ombrófila Densa. Restinga arbórea. Solo arenoso, (fr.), *L.P. Queiroz 15493* (HUEFS); Litoral Norte, Fazenda Experimental, Escola de Medicina Veterinária (UFBA), Reserva Florestal do Povoado de Aguazinha, (bot.), *N. Roque et al. 2751* (ALCB*, HUEFS); Litoral Norte, Fazenda Experimental, Escola de Medicina Veterinária (UFBA), Reserva Florestal do Povoado de Aguazinha, (fr.), *N. Roque et al. 2838* (ALCB, HUEFS*); Ibicaraí, *E. Gross 260* (UESC); Ilhéus, in silvis primitivis ad Ilheos provinciae, *B. Luschnath s.n.* (HBVIRTFLBRAS); Itaberaba, Fazenda Leão dos Brejos. Localidade Gameleira, ca. 6 Km N do entroncamento com a BR-242, após a Fazenda Monte Verde e a Escola Ulysses Guimarães., (est.), *L.P. Queiroz 15326* (HUEFS*); ItIruçú, (fr.), *P. Souza s.n.* (ALCB*); Jacobina, Cocho de Fora, (fr.), *S.M. Faria et al. 1846* (HUEFS, RB*); Jussari, RPPN Serra do Teimoso., (bot. Fl.), *F.H.F. Nascimento 1564* (HUEFS); RPPN Serra do Teimoso., *F.H.F. Nascimento 1675* (HUEFS); Lajedo do Tabocal, ca. 10 km S de Lajedo do Tabocal na estrada para Maracás, (est.), *L.P. Queiroz et al. 15819* (HUEFS*); Maracás, 17,9Km antes do trevo de Maracás, ramal á direita de BA 026., (fr.), *F.M. Ferreira et al. 1754* (CEPEC, HUEFS*); Piritiba, (fr.), *M.O.A. Mello 1874* (IBS*); Ruy Barbosa, Serra do Orobó, (fr.), *E. P. Queiroz 1077*

(HRB*);Encosta da Serra do Orobó, Bom Jardim, (est.), *L.P Queiroz et al. 9474* (HUEFS*); Serra do Orobó, caminho para o Pátio das Orquídeas., (fr.), *L.P. Queiroz et al. 10728* (HUEFS*); Serra do Orobó. Riacho do Meio., (bud, fl. Fr.), *L.P. Queiroz 12007* (HUEFS); ARIE da Serra do Orobó, Riacho do Meio., *L.P. Queiroz et al 9255* (HUEFS); ARIE da Serra do Orobó. Riacho do Meio, (fr.), *L.P. Queiroz et al. 9435* (HUEFS); Serra do Orobó. Base da encosta da Serra, (bud, fl.), *L.P. Queiroz et al. 9915* (HUEFS); Jussari, RPPN Serra do Teimoso., *F.H.F. Nascimento 1675* (HUEFS).

18. ***Piptadenia robusta*** Pittier, Arb. Arbust. Venez. 6–8: 85. 1927. Type: VENEZUELA. Cotiza cerca de Caracas, 12 Dec. 1918, *H. Pittier 8297* (holotype: VEN [barcode VEN2768]; isotypes: F–2 sheets [barcodes F0058673F, F0360535F]!, MO, NY fragment [barcode NY00003241]!, US–2 sheets [barcodes US00001016, US01050208]!).

Figs. 6F, 8A-B, 51, 52A-I. Map Fig. 30B.

Tree to 20 m tall; branches dark purple-brown, not noticeably ridged, glabrous, lenticels not seen; prickles 1–5 × 1–6 mm, recurve, light brown with apex dark brown, scattered on the branch, in the leaf rachis and in the pinnae, not seen on most specimens examined. **Stipules** not seen. **Petiole** 3–7.5 cm long, rachis 12–38 cm long, glabrous, pulvinus 3–5 mm long, interpinnal segments 9–24 mm long; pinnae 7–11 pairs, basal pinnae 4.5–10 cm long, median pinnae slightly longer 7–15 cm long, distal pinnae 8–11 cm long, interfoliolar segments 2–3.5 mm long; paraphyllidia absent; petiolar nectary 2.1–5.2 mm long, sessile, oval to elliptic, located at the base of the petiole, additional and smaller nectaries in leaf rachis between the last pair of pinnae and in the pinnae between the distal or all pairs of leaflets; leaflets 22–45 pairs per pinna, 7–20 × 1.6–3.5 mm, oblong, apex acute, base oblique, obtuse on one side, asymmetrical, margins plane, not ciliate, glabrous, midvein submarginal, raised on the lower surface, secondary and smaller venation reticulate. **Inflorescences** in axillary pseudoracemes, with 2–3 spikes per node; individual spikes 60–120 × 8–13 mm, peduncle 5–12 mm long, the spike axis glabrous to lightly puberulent with short white hairs; first-order bracts 1–2, at apex of peduncule, linear, 2–3 mm long, pubescent, deciduous; floral bracts 0.5–0.8 × 0.2–0.3 mm, spatulate, apex acute, pubescent, early caducous. **Flowers** 4–6 mm long, sessile; calyx 0.5–1.2 mm long, campanulate,

Fig.51. *Piptadenia robusta.* Vargas 148 (MO)

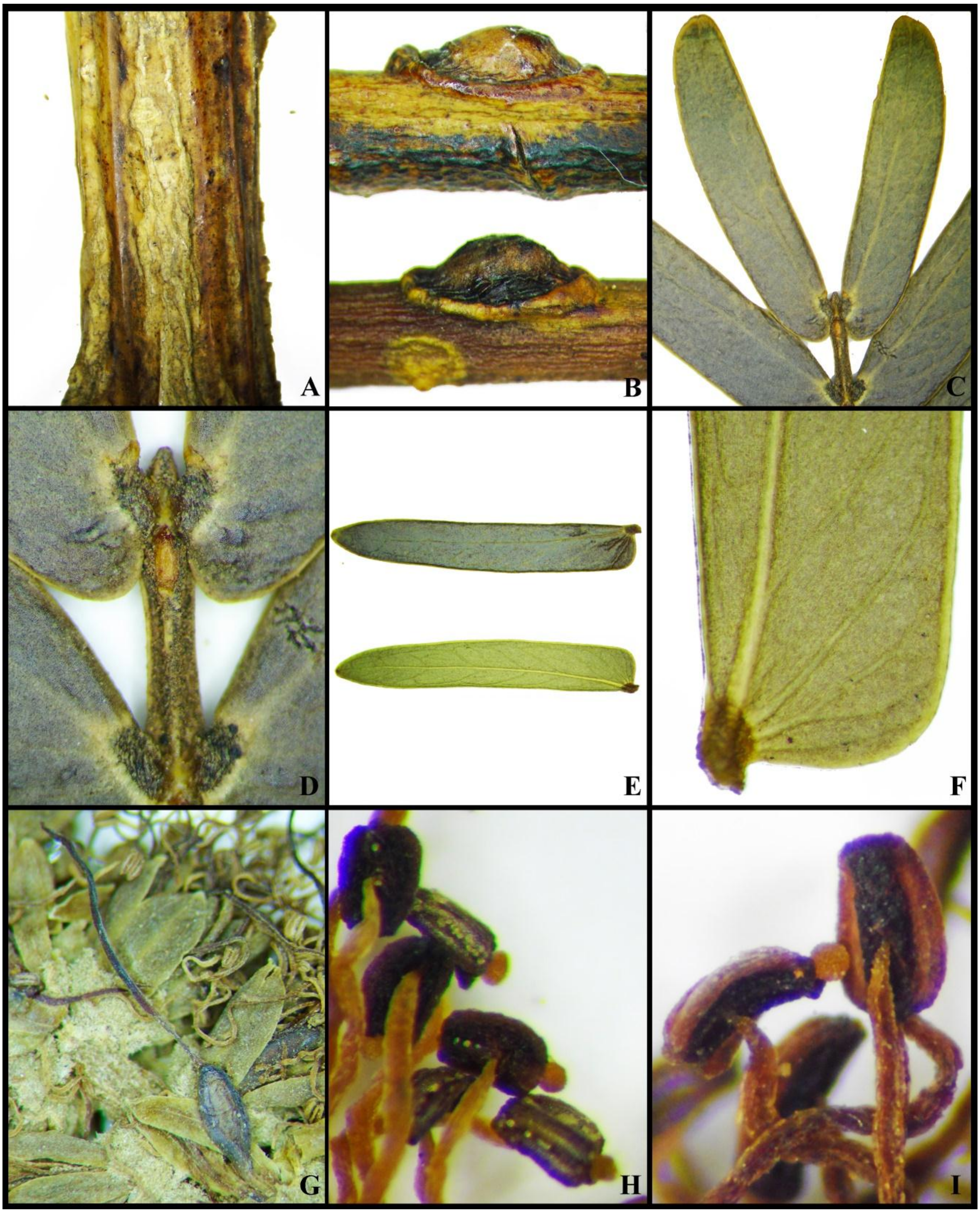

Fig.52.**A-I.** *Piptadenia robusta.* A. Branche, B. Petiolar nectary, C. Apex of pinnae, D. Nectary between the leaflets, E. Leaflets on upper and lower surface, F.Base of leaflet, note the acessories veins, on margins of leaflet, G. Gynoecium showing ovary glabrous, H-I. Anthers showing the gland on the top and. Pictures by Earl Chagas.

sparsely pubescent, tube 0.4–1 mm long, lobes 0.1–0.2 mm long, acute; corolla 1.8–3.1 mm long, campanulate, glabrous, tube 0.1–0.2 mm long, free or almost free to base, included in the calyx, lobes 1.7–2.9; filaments 4–6 mm long, white, red to vinaceous, anther 0.25–0.3 × 0.2–0.25 mm long, gland anther sessile, globose, early deciduous; ovary 0.8–1.2 mm long, glabrous, 10–12-ovulated, stipe 0.5–1.2 mm long, style 2.6–3.1 mm long; stemonozone present. **Legume** 9–17 × 2–2.7 cm, stipe 1.2–2 cm long, broad linear, apex most acute, margins slightly thickened; valves brown, coriaceous, flattened, reticulate, glabrous. **Seeds** 8– 9, 7–9 × 4–6 mm, oval to obovate; testa dark brown; pleurogram 2–3 mm diam.

O holótipo se encontra no herbário VEN, onde Pittier depositava suas coleções coletadas na Venezuela entre 1919 e 1936, quando foi diretor do Museu Comercial de Caracas. O isótipo de NY é apenas um fragmento, sem indicação de herbário de origem.

Seee the discussions of molecular results on *P. pteroclada.*(above).

Examined material: BOLIVIA: Azariamas, Parque Nacional Madidi, sector Resina, camino entre el campamento y la PPM 13, *A.F. Fuentes et al.* (MO); El Vallecido, 8 km al N de la ciudad de Santa Cruz, *G. Israel & G. Vargas* (MO). Campus Universitario, centro de la ciudad, jardin del campus, *L. Arroyo et al.* (MO); **Prov. Santiesteban**. 1.6 km N of center of Mineros on road to Chané Independencia, *M. Nee 48868* (MEL, MO, NY, SPF); 3 km SE of center of Cotoca, *M.H. Nee 48894* (MEL, MO, NY); Campus of Unviversidad Autónoma 'Gabriel René Moreno', between 1st. and 2nd. anillos, Santa Cruz de la Sierra, *M.H. Nee 48636* (MEL, MO, MBM, NY, SP). The plain around Santa Cruz that is bound by the 700 m contour of the Andean foothills to the west, and the Río Grande to the east, *M. H. Nee* (MO); Prov. Andres Ibanez, 5.5 km. N of center of Santa Cruz, on road to

Cotoca, *M. H. Nee 55004* (COL, MO, SPF); 40 KM E de San Borja. Isla de bosque rodeada por "Sabana de altura" - por decir estacionalmente húmeda, *T.J. Killeen et al.* (MO); Santa Cruz, Ibáñez, 5.5 Km N of center of Cotoca, 6.1 km (by road) N of Urubó bridge over Río Piraí, W of the Río Piraí, *M.H. Nee & S.R. Hill 55017* (MO, MEL, SPF); Santa Cruz, Andrés, Ibáñez, Campus of Universidad Autónoma "Gabriel René Moreno", between 1st. and 2nd. anilos, Santa Cruz de la Sierra, *M. H. Nee* (COL, MO, SP); PA Summit Gardens, *S.A. Mori & J.A. Kallunki* (MO); VENEZUELA: Lower Cotiza (Agr. Exp. St.), near reservoir, near Caracas, *H. Pittier 8297* (Botany, MO); Cotiza, H. F. *Pittier* (NY); *J. Standen 74* (Botany); Bosque tropófito de Caimital. 7 Km al sur de la población de Barrancas, *L. Ruiz-Teran* (UFP)

Caracas: on slope above Instituto Botánico, *P.E. Berry* (MO).

19. ***Piptadenia santosii*** Barneby ex G.P.Lewis, *Kew Bull.* 46(1): 162. 1991. Type: BRAZIL. Bahia: BR 101, Km 2 ao S de Itamaraju, 11 Feb. 1972, *T.S. Santos 2236* (holotype: CEPEC!; isotypes: HUEFS!, K [barcode K000090272], NY [barcode NY00003243]).

Figs. 53, 54A-I. Map Fig. 42B.

Illustration in Lewis (1991)

Scandent shrub, bark smooth; branches brownish, not noticeably ridged, densely pubescent with yellow hairs, with cream-coloured, conspicuous, elliptic lenticels; prickles 0,5–1,5 × 1–2 mm, recurve, cream-coloured to brownish, rare on branches, scattered on the in the leaf rachis and in the pinnae. **Stipules** 2.1–3 × 0.4–0.5, lanceolate, persistents. **Petiole** 2.5–3.2 cm long, rachis 2.5–7.5 cm long, slightly grooved, puberulent, pulvinus 1–2 mm long, interpinnal segments 10–40 mm long; pinnae 1–2 pairs, proximal pinnae 10–18 mm long, distal pinnae longer 2.5–3.5 cm long, interfoliolar segments 10–24 mm long; paraphyllidia absent; petiolar nectary 2–3 × 1 mm, sessile, discoid, depressed-eliptical, located at the base of the petiole, additional smaller nectaries cillindric in leaf rachis between the distal pair of pinnae and in the pinnae between the distal pairs of leaflets; leaflets 1–2 pairs per pinna, 38–80 × 20–50 mm, assimetrically obovate, apex acute to acuminate, base cuneate, asymmetrical, margins revolute, ciliate, densely pubescent on upper surface, trichomes long, erect, midvein subcentral, raised on the lower surface, secondary veins reticulate. **Inflorescences** in terminal panicles, with 2–3 spikes per node; individual spikes 5–8 × 6–7 mm, peduncle 11–17 mm long, the spike axis densely pubescent with short golden hairs; first-order bracts 1–3, located at the apex of peduncule, triangular, 2.6–3.1 × 0.5 mm, densely pubescent, caducous; floral bracts 1.6–2 × ca. 0.3

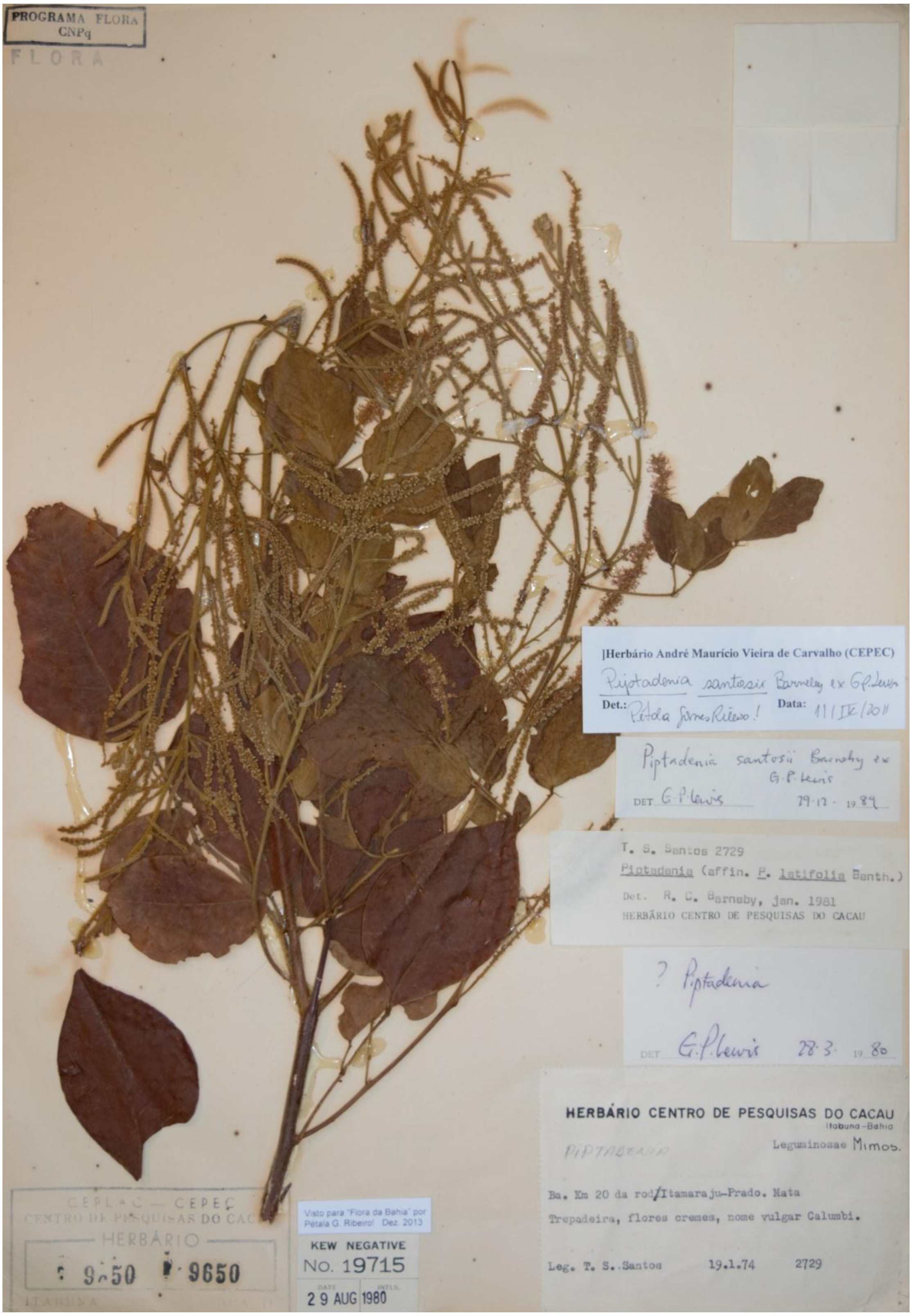

Fig.53. *Piptadenia santosii.* Santos 2729 (CEPEC)

Fig.54.**A-I.** *Piptadenia santosii*. A. Stipules, B. Petiolar nectary, C. Nectary between the leaflets, D. Leaflets on upper and lower surfaces, E. Base of leaflet, F.Apex of leaflet, Base of axis of inflorescence showing the bracts of first orfer and flower buds and flower bract, H. Flower, perianth densely pubescent, I. Anthers showingthe gland on the top. Pictures by Earl Chagas.

mm, linear, apex acute, pubescent, persistent. **Flowers** 4–4.3 mm long, sessile; calyx 0.8–1 mm long, campanulate, densely tomentulosous, tube 1.5–1.8 mm long, lobes 0.1–0.2 mm long, acute; corolla 2–2.3 mm long, cylindrical to campanulate, pubescent, tube 0.7–1.2 mm long, included in the calyx, lobes 1.5–2 mm long, erect; filaments 4–4.3 mm long, white, anther 0.3–0.5 × 0.2–0.25 mm long, anther gland stiptate, globose, early caducous; ovary 0.8–1.1 mm long, densely pubescent, ca. 12–14-ovulated, stipe 1.4–2 mm long, style 2.6–3.1 mm long; stemonozone present. **Legume** not seen.

Etymology—The name *santosii* is in honour to Talmon Santos, great collector of south of Bahia, Brazil, who collected a lot of new species from Atlantic rain forest.

***Distribution and habitat* –** *Piptadenia santosii* occurs in the Nordeste (Bahia) e Sudeste Espirito Santo and Minas Gerais, in areas of disturbed forests in Atlantic Forest domain, at 183-212 m a.s.l..

Phenology

Flowering in january to february; no Fruiting data.

***Common names* –** Brazil: calumbi

***Taxonomy* –**

It was considered to be endemic to Bahia (Lewis 1991), but Ribeiro (2012) reported its occurrence in Minas Gerais, in Salto da Divisa [*JA Lombardi et al. 5044*, near Itamaraju region (locality of the type material)].

It differs from other species with large leaflets (*P. uaupensis, P. floribunda*) by the vegetative and reproductive densely pubescent, unlike the other species that can vary the indumentum, as well by the petiolar nectary depression-elongated in *P. santosii* (vs. claviform on *P. floribunda* and cushion-shaped on *P. uaupensis*).

On our molecular data results, *P. santosii* grouped in a clade of species of Atlantic rain forests, with large leaflets, leave with few pair of pinnae, and few pairs of leaflets by pinnae (see discussions on *P. paniculata*). Is closely related to *P. paniculata* (99PP / 99ML / 93MP)

Examined material –BRAZIL, Bahia s.m.: BR-101 Km 2 ao sul de Itamaraju, 11 fev. 1972 (bot. e fl.), *T.S. Santos 2236* (CEPEC, HUEFS, K -negativo, NY); Km 20 da rod. Itamaraju-Prado, 19 jan. 1974 (bot. e fl.), *T.S. Santos 2729* (CEPEC, K-negativo, NY). MATERIAL ADICIONAL: MINAS GERAIS: Salto da Divisa: Fazenda Santana, 16º03'29,8-21,7"S, 40º01'50,6-59"W, 19 fev. 2003 (bot. e fl.), *J.A. Lombardi et al. 5044* (BHCB)

20. ***Piptadenia trisperma*** (Vell.) Benth., Hook. J. Bot. 4(31): 337. 1841. ≡ *Mimosa trisperma* Vell, Fl. Flum. 11, t. 40. 1831. ≡ *Pityrocarpa trisperma* (Vell.) Brenan, Kew Bull. 10(2): 177. 1955. Type: BRAZIL. Rio de Janeiro: “Habitat silvis maritimus Reg. Proed. S. Crucis”, 1783–1790, *J.M.C. Vellozo* (lectotype: iconograph in Vellozo 1831: tab. 40, **designated here**).

Figs. 55, 56A-I. Map Fig. 42B.

Liana or scandent; branches red or dark brown, noticeably ridged when young, glabrous or sparsely pubescent with short yellow hairs, with cream-coloured, conspicuous, elliptic lenticels; prickles 2–3.5 × 1–4 mm, recurve, cream-coloured with apex orange to brownish, scattered on the branch but in a usually regular presence of two nodals prickles and one infranodal, in the leaf rachis and in the pinnae. **Stipules** 2–3 mm long, linear, caducous. **Petiole** 2.3–3.5 cm long, rachis (2.5-) 4–8 cm long, grooved, puberulent, pulvinus 2–3 mm long, interpinnal segments 11–18 mm long; pinnae 3–7 (-11) pairs, proximal pinnae 4–6 cm long, median pinnae slightly longer 4.3–8 cm long, distal pinnae 4–6.3 cm long, interfoliolar segments 2–4 mm long; paraphyllidia present; petiolar nectary 0.5–1.8 mm diam, sessile, crateriform, discoid, located at the base of the petiole, additional and smaller nectaries in leaf rachis between the distal pair of pinnae and in the pinnae between the distal or all pairs of leaflets; leaflets 20–31 pairs per pinna, 7–12 × 1.5–3 mm, linear oblong, apex rounded-acute, base squared-oblique and sessile basally, asymmetrical, margins plane, not ciliate, glabrous on both sides, midvein displaced towards acroscopic margin, venation distinctive, 2marginal veins and a 1 acentric midvein, raised on the both surfaces, other venation between these major veins reticulate, shiny above. **Inflorescences** in terminal pseudoracemes, with 1–3 spikes per node; individual spikes 30–55 × 4–5 mm,

Fig.55. *Piptadenia trisperma.* Lewis 1191 (MBM)

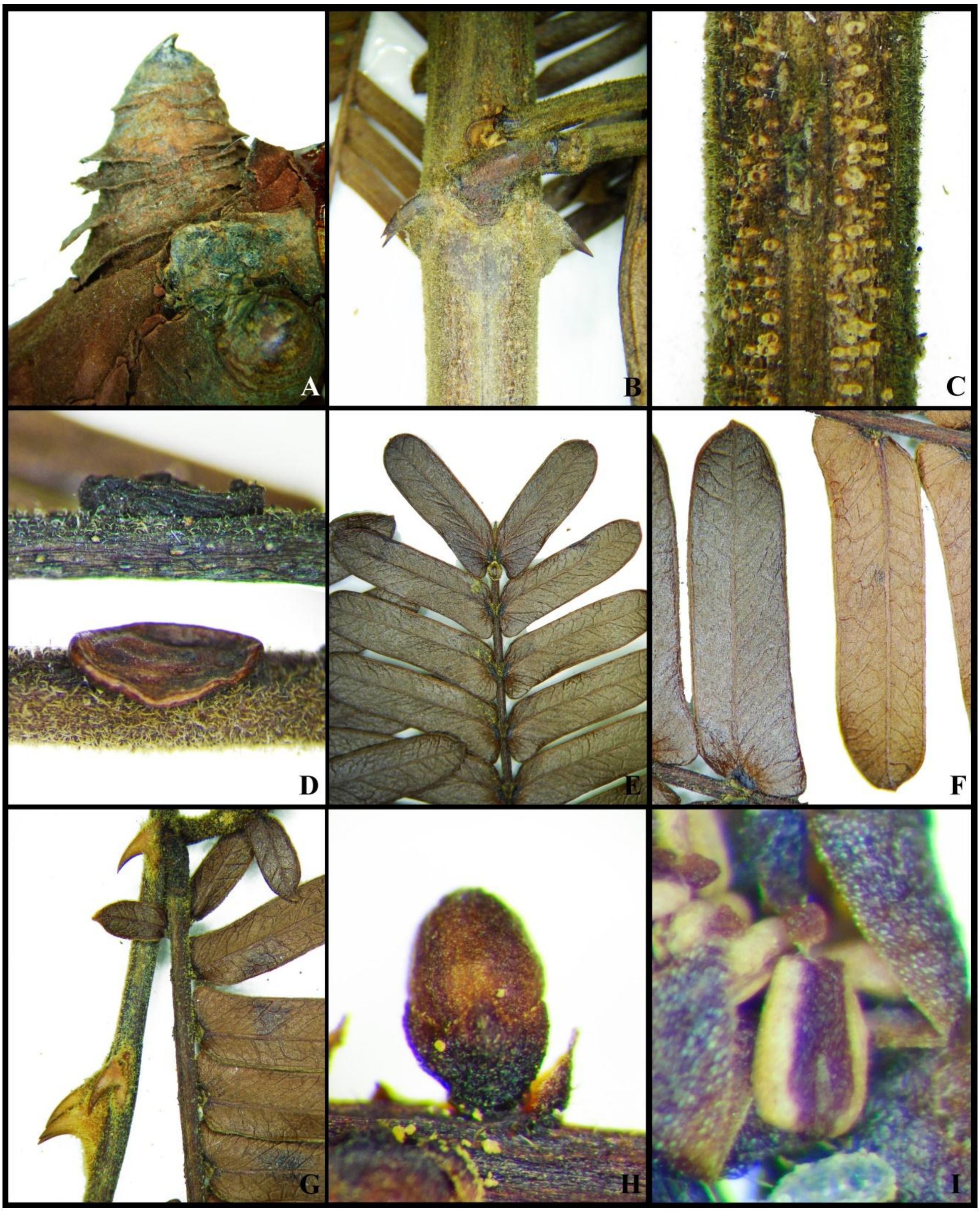

Fig.56.**A-I.** *Piptadenia trisperma.* A. Prickles of old branches, B. Prickles of younger branches, C. Lenticels, D. Petiolar nectary, E. pex of pinnae, F. Leaflets on upper and lower surfaces, G. Base of pinnae showing paraphylidia, H.Flower bud, I. Anthers showingthe gland on the top. Pictures by Earl Chagas.

peduncle 5–8 mm long, the spike axis sparsely pilosous with yellowish hairs; first-order bracts located at midle of peduncle, 1, triangular, 2–3.5 mm long, pubescent, deciduous; floral bracts 0.3–0.5 × ca. 0.2 mm, lanceolate, apex acute, pubescent, ciliate, persistent. **Flowers** 2.7–3.3 mm long, subsessile, calyx 0.3–0.4 mm long, campanulate, glabrous, tube 0.25–0.3 mm long, lobes 0.05–0.1mm long, acute; corolla 1.7–2 mm long, campanulate, glabrous, almost free to base with tube 0.1–0.2 mm long, included in the calyx, lobes 1.5–1.8 mm long, erect; filaments 2.5–3 mm long, vinaceous, gland 0.25–0.3 × 0.15–0.25 mm long, gland anther sessile; ovary 0.1–0.8 mm long, glabrous to too sparsely pubescent, 8–10–ovulated, short stipe 0.2–0.3 mm long, style 1.3–2 mm long; stemonozone present. **Legume** 7.8–8.6 × 1.3–1.8 cm, stipe 6–8 mm long, broad linear, apex rounded, margins slightly thickened; valves light brown, papery, flattened, reticulate, glabrous, sometimes present blackish glandulose trichomes.**Seeds** 6–7, 7–10 × 7–9 mm, transverse, oval-orbicular, flat, strongly compressed, provided with a circular, 0.5–1.2 mm wing; testa dark brown; pleurogram absent.

***Distribution and habitat* –** *Piptadenia trisperma* occurs in the Southest (Rio de Janeiro) from Brazil. In areas of restingas at 32-150 m a.s.l.

Phenology

Flowering in january to march; Fruiting in August.

***Common names* –** unknown.

Taxonomy **–** *P. trisperma* is a common species in the restinga, especially in Rio de Janeiro. Morphologically similar to *P. affinis* (see discussion of this species above). It among the three species of winged seeds in *Piptadenia* (beyond this P. *affinis* and *P. buchtienii*). When collected, *G.P. Lewis and H.C. Lima 1191*, already commented on the seeds "*old fruit papery, pale-brown, inner surface greyish-white; Red tine, seeds with slight wing, wing brown ith red tinge, seed area black, but also endosperm seeds i.e. between Piptadenia and Newtonia, "on this tag the determination is in doubt about Parapiptadenia being"? Parapiptadenia "*

I believe that his doubt is because of the winged seed, until this moment related to *Parapiptadenia, Pseudopiptadenia* and *Anadenanthera* of the informal group Piptadenia, or even by the color of the filaments, comum on *Parapiptadenia*.

Some inflorescence are entirely male, Lewis (1191) speculates that the male and female inflorescences are separate. Its fruit is very similar of the affinis, even in dimensions and in the general aspect.

The basionym proposed by Vellozo (ano) is lectotypificated here with the original illustration from the Flora Fluminensis (Vellozo, ano, página x plate x). By the illustration the species can easily be recognized and by the description the character like habit, color of the stamens is cited.

It is noteworthy that Lima (1995) did not mention *Mimosa trisperma* (= *Piptadenia trisperma*) in its list of Leguminosae treated in "Flora fluminensis". Additionally, Bentham (1876), in "Flora brasiliensis", listed *Acacia trisperma* Mart. as synonymous with *Piptadenia trisperma*. But in fact, this combination in *Acacia* deals only with a manuscript name in exsicata, with no nomenclatural validity

The phylogenetic position of this species was not resolved at the IB and MP topologies. In the ML analysis it appeared in a low supportted clade nested with samples of *P. ramosissima* and *P. irwinii*, but this result is suspicious as it is based only in *matK* sequences, is missing data of other regions.

21- ***Piptadenia uaupensis*** Spruce ex. Benth., Trans. Linn. Soc. London 30: 366. 1875. Type: BRAZIL. "In sylvis fl. Vaupés", Jan. 1853, *Spruce 2805* (holotype: K [barcode K000504647]!; isotypes: BM [barcode BM000952306]!, P-2 sheets [barcodes P02931450 and P02931452]!).

≡ *Adenopodia uaupensis* (Spruce ex. Benth.) Brenan, Kew Bull. 41(1):82. 1986.

= **synon. nov.** *Piptadenia minutiflora* Ducke, Arch. Jard. Bot. Rio de Janeiro 3: 77. 1922. = *Adenopodia minutiflora* (Ducke) Brenan, Kew Bull. 41(1): 84. 1985. Type: BRAZIL. Pará: Rio Tapajoz, "regione cataractarum inferiorum, loco Flechal, silva non inundata", 27 Jun. 1918, *A. Ducke s.n.* (lectotype: MG 17080! **designated here**; isolectotypes: F [F0360960F] fragmente ex MG!, G [barcode G00364584]!, K [barcode K000504656]!, P [barcode P02931512]!, R 5519!, RB 10425!).

= *Mimosa tessmannii* Harms, Notizbl. Bot. Gar. Berlin-Dahlem 9: 967. 1926. Type: PERU. Oberer Marafion: Miindung des Santiago, flutfreier Hochwald, 31 Nov. 1924, *G. Tessmann 4441* (holotype: B, destroyed; lectotype: NY [barcode NY00003088]!, **designated here**; isolectotypes: F–3 sheets [barcodes F0058622F = fragment ex B, F0058621F = fragment ex G, and F0BN001440 = negative from B]!, G!, US–2 sheets [US00997084, and US00000965 = fragment ex problably NY]!).

Figs. 57, 58A-I. Map Fig. 42A.

Scandent shrub, bark smooth; branches brownish, not noticeably ridged, pubescent with short white-yellowish hairs, rarely with creamy, inconspicuous, elliptic lenticels; prickles 2–2.5 × 2–4 mm, recurve, cream with apex orange to brownish, scattered on the branch, in

Fig.57. *Piptadenia uaupensis*. Ducke 1592(MG)

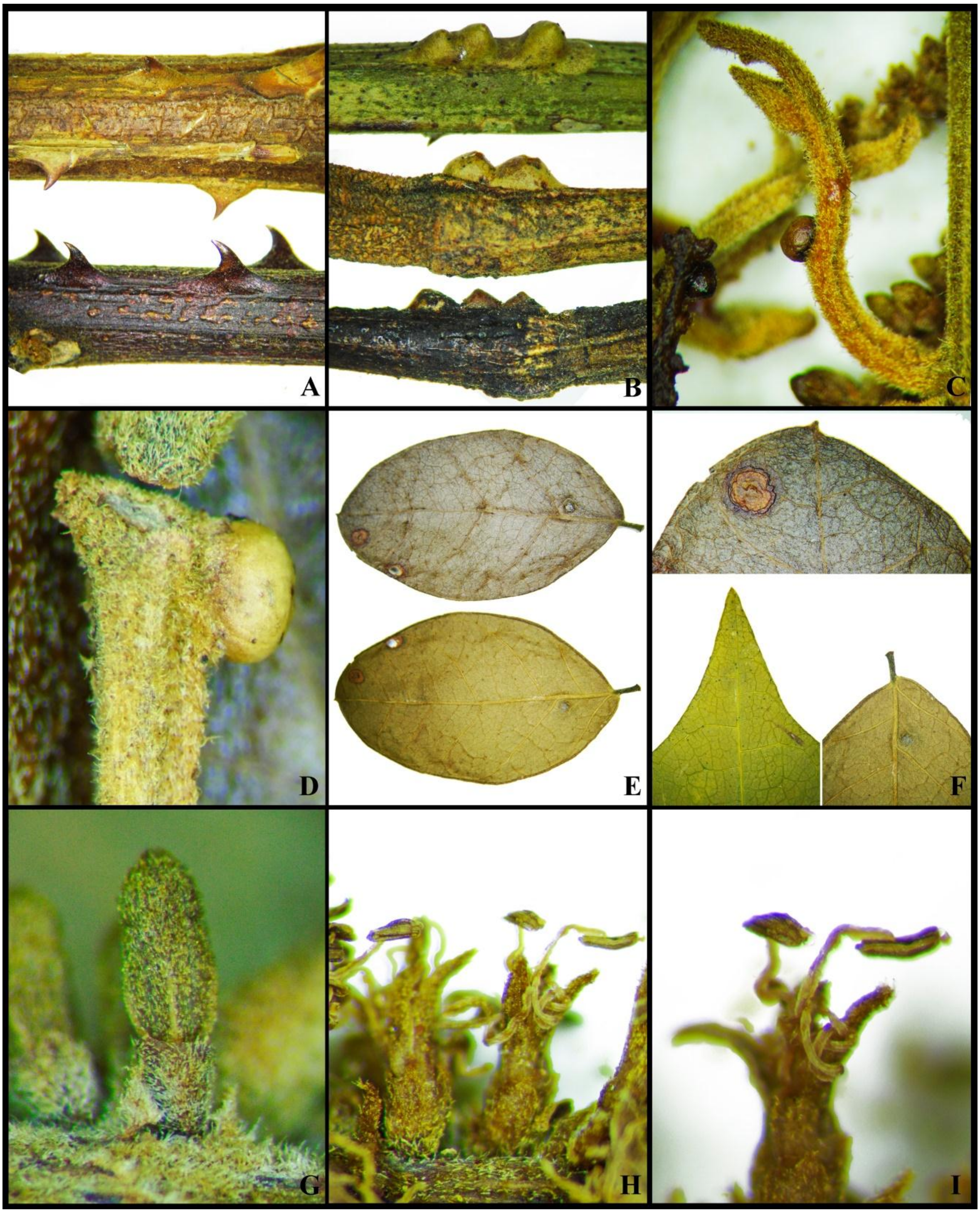

Fig.58.**A-I.** *Piptadenia uaupensis*. A. Prickles, B. Petiolar nectaries variation, C. Leaf growing, D. Nectary between the leaflet, E. leaflets on upper and lower surface, F.Apex and base of leaflets, G.Flower bud, H. Flowers, I. Anthers showingthe gland on the top. Pictures by Earl Chagas.

the leaf rachis and in the pinnae. **Stipules** 1–2 mm long, lanceolate, caduceous. **Petiole** 3–11.5 cm long, rachis 2.7–8 cm long, puberulent, pulvinus 2–5 mm long, interpinnal segments 2.7–8 cm long; pinnae (1–)2 pairs, basal pinnae 2–7.5 cm long, distal pinnae slightly longer 3–9.5 cm long, interfoliolar segments 2.5–3.5 mm long; paraphyllidia absent; 1-3 petiolar nectary 1.5–2 mm diam and high, sessile, shortly cylindrical, with margins raised, 1-4located from at the base of the petiole, additional and smaller nectaries in leaf rachis between the last pair of pinnae and in the pinnae between the distal or all pairs of leaflets; leaflets 2–4 pairs per pinna, 3–9.5 × 1.5–6.2 cm, ovate to obovate-oblong, apex varying to rounded to apiculate or acutely subacuminate, base rounded, asymmetrical, margins plane, ciliate, minutely appressed puberulous on upper sides, becoming almost glabrous, densely appressed puberulous on lower side, midvein central or subcentral, raised on the lower surface, secondary venation brochidodromous, smaller venation reticulate. **Inflorescences** in a terminal panicles fully exserted from foliage, with 1–3 spikes per node; individual spikes 2.5–4 × 5–6 mm, peduncle 0.3–1.5 cm long, the spike axis densely pubescent with brownish hairs; first-order bracts at apex of peduncule, 1–2, linear, 2–4 mm long, densely pubescent, deciduous; floral bracts 0.5–0.8 × ca. 0.2 mm, linear, apex acute, pubescent, persistent; flower buds ellipsoid. **Flowers** 2.6–3.1 mm long, sessile; calyx 0.5–1 mm long, campanulate, densely pubescent, tube 0.45–0.75 mm long, lobes 0.05–0.25 mm long, acute; corolla 2.3–3.5 mm long, campanulate, densely pubescent, tube 0.8–1.5 mm long, included in the calyx, lobes 1.5–2 mm long, erect; filaments 2.5–3 mm long, witish to pale greenish-yellow, anther 0.2–0.3 × 0.1–0.2 mm long, gland anther longly stipitate with 0.06-0.1 mm long stipte; ovary 0.5–0.7 × 0.3-0.4 mm, wider than other species longly and densely puberulent, ca. 8–10-ovulated, sessile to subsessil, style 2.1–2.3 mm long; stemonozone present. **Legume** 10–15 ×3–3.6 cm, stipe 2–2.5 cm long, broad linear, apex rounded, margins slightly thickened; valves light brown, papery, flattened, reticulate, almost glabrous, except by few blackish glandulose trichomes. **Seeds** 8– 11, 12–14 × 4–7 mm, ovoid-oblong; testa dark brown; pleurogram ca. 4 mm diam.

Etymology—The name *uaupensis* derives from locality type Uaupé - “In sylvis fl. Vaupés”,

***Distribution and habitat* –** *Piptadenia uaupensis* occurs in (Amazonia, Para) the from Brazil, Peru. In areas of Amazonia at altitudes of 250 m.n.m.

***Phenology* -** Flowering in January to april; Fruiting september to march.

***Common names* –** Brazil: conacaste, unha-de-gato.

***Taxonomy* –** *P. uaupensis* is morphological similar to *P. floribunda*, and on our molecular data is related to *P. floribunda* (see discussions on *P. floribunda*)

Many plants are completely male, this is not comon in *Piptadenia* genus, generaly are all hermaphrodits. Some samples, with only male flowers, not seen ovaries in some specimens.

Piptadenia minutiflora was described by Ducke (1922) based on 4 sintypes collected by him, and it is necessary to designate a Lectotype for this name. We chose as lectotype the sample Ducke s.n. 17080 deposited in MG, herbarium where Ducke deposited its collection.

Mimosa tessmanni, here synonimized under *Piptadenia uaupensis*, had its holotype, deposited in B, destroyed. We chose as lectotype the material of NY among the isotypes, since the others are only fragments.

Due to the large overlap of characters that were used to separate *P. uaupensis* from *P. minutiflora*, we are synonymizing *P. minutiflora* under *P. uaupensis*. Brenan (1986) when made the new combination to *Adenopodia*, reported "*A. minutiflora* is exttremely close to *A. uaupensis* and it is not without considerable hesitation that I have maintained it as distinct"

The carachters all overlaped, for example the flower size described by Ducke. Ducke when described *P. minutiflora* said that the species is separate from the other species of the genus by the smaller size of flowers, but does not mention *P. uaupensis*.

Our molecular data results on *Piptadenia uaupensis* sister to *P. floribunda* (discussion on *P. floribunda*)

Examined material – **Brazil:** Circo cataractas fluminensis, *Ducke 544* ; Rio Tapajós, *Ducke A. 10425* ; *Ducke, A. 1592* ;Reserva Florestal Ducke, Manaus-Itacoatiara, km 26., *E.C. Pereira et al. 1419* ; Basin of creek Belém., *Krukoff, B.A. 8820*; Estrada Santarém-Cuiabá, BR-163, km 1222 a 1227., *M. Hopkins et al. 1421* ; Vivenda Verde, *M. Hopkins 123*; Estação Esperimental de Silvicultura Tropical- ZF2, *M. Hopkins 138*; Igarapé do Buião, Igarapé do Buião, *M. Hopkins 1512*; AM-010, Estrada Manaus-Itacoatiara, km 64, Reserva W. Egler, *M. Hopkins 2116*; EMBRAPA, *M. Hopkins 28*; Parque Municipal das orquídeas. Área aberta com solo arenoso antes da cachoeira, *M. Hopkins 338*; Igarapé do

Bindá, Igarapé do Bindá, *M. Hopkins 3944*; Campus Universitário, estrada que leva ao Campus novo, próximo ao campo de futebol, *M. Hopkins 40*; Km 9 da BR 17., Km 9 da BR 17, *M. Hopkins 4395*; Mineração Rio do Norte - Porto Trombetas, *M. Hopkins 551*; Campus do INPA., Estrada do Aleixo, Campus do INPA, *M. Hopkins 576*; AM10, Km 133., Estrada Manaus-Itacoatiara, km 133, *M. Hopkins 9496*; Reserva Florestal Adolpho Ducke. Marco 018, *Queiroz L.P.de* 13927; Uaupés, *R. Spruce 2805*; km 35 da estrada do Palhão, ramal para o Igarapé do Pilão., Silva M. & Souza R. 2267; Prope Panure ad Rio Uaupés, *Spruce R. 2806*; *A. Ducke 17169*; **Amapá**. W bank of Rio Falsino, approx. 10Km upstream from confluence with Rio Araguari and about 8 hours upstream by boat from Pôrto Grande. Inventory side., D. Williams J *et al. 3308;* **Amazonas**. Estrada Manaus-Caracaraí, BR-174, km 57, *M. Hopkins & C.D.A. Mota 704* ; Itacoatiara, Estrada do Aeroporto, *M. Hopkins & D.F. Coêlho 27*; Manaus, Cachoeira Alta do Tarumã., Cachoeira Alta do Tarumã, *M. Hopkins 2101*; Reserva Florestal Adolfo Ducke, *M. Hopkins & C. D. Leme 6*; **Pará**. Almeirim, Mt. Dourado. Estação Ecológica do Jari, (SEMA), *M. Hopkins & M.J.P. Pires 1475*; Monte Dourado, Monte Dourado, Estação Ecológica do Jari, estrada entre sede e campo rupestre, *M. Hopkins & B. V. Rabelo 3560*; Itaituba, Estrada Santarém-Cuiabá, BR 163, km 1208, Serra Mazi, sul do Pará, *M. Hopkins & I.L. Amaral* 1293; Bas Xingui, Victoria, *A. Ducke 17169*; **Rondônia**. Porto Velho, Área do Reservatório da Usina Hidrelétrica de Samuel. Vicinal PR-1. Mata de terra firme, solo argiloso, *C. A. Cid Ferreira 7422*; Represa Samuel, forest at end of right dike road, ca. 1 km N of capinarana., *M. Hopkins et al. 5074*. COLOMBIA: Araracuara, bosque alto, suelo arcilloso rojizo de tierra firme, *Duivenvoorden J. 1044*;Araracuara, bosque alto, suelo arcilloso rojizo de tierra firme, *Duivenvoorden J. 1977* ; En la trocha que conduce a las torres de Telecom, *Rubiano L.J. 1146* .

22- ***Piptadenia uliginosa*** Britton & Killip, Ann. New York Acad. Sci. 35 (3): 156. 1936. Type: COLOMBIA. Bolivar: Los Volcanes, near Turbaco, 200-300 meters, 12 Nov. 1926, *E.P. Killip & A.C. Smith 14453* (holotype NY [barcode NY00003250]!; isotypes: A [barcode A00064058]!, BC [barcode BC638159]!, COL [barcode COL000001675]!, F [barcode F0058677F]!, GH [barcode GH00064057]!, K [barcode K000504641]!, US [barcode US00001022]!).

Figs. 59, 60A-I. Map Fig. 42A.

Shrub or tree 1.8–3 m tall, with thin and delicate branches from the base, trunks from the base, bark smooth, brown; branches light-brown grayish, yellowish-cream, noticeably ridged, glabrous to sparsely pubescent with short white hairs, rarely with cream-coloured or orange, inconspicuous, elliptic lenticels; mostly unarmed branches, when armeds the prickles 1–2.3 × 2–3 mm, recurve, cream-coloured with apex orange to brownish, dispersed on the branch and in the leaf rachis. **Stipules** 3–4 mm long, linear, glabrous, caducous. **Petiole** 1–1.8cm long, rachis 2.1–4.2 (-7) cm long, filiform, puberulent, pulvinus 0.5–1.3 mm length, interpinnal segments 4–9 mm long; pinnae 2–7 pairs, proximal pinnae, 1–2.5 cm long, median pinnae 1.5–3 cm long, distal pinnae 1.4–3.2 cm long, interfoliolar segments 0.5–1.2 mm long; paraphyllidia present 2; petiolar nectary 0.5–1 × 0.7–1 mm diam, sessile, crateriform, oblong , concave, margins strongly raised, 1located from the base to the medial portion of the petiole, additional and smaller in the distal portion of the rachis, between the distal or penultimate pair of pinnae and in the pinnae between the distal pairs of leaflets; leaflets 6–14 pairs per pinna, 4–13 × 1–2 mm, linear, apex acute, base asymmetrical, margins plane, sparsely ciliate, mostly glabrous on both sides, rare few hairs on lower base of the leaflet, forming a tufts, midvein displaced towards acroscopic margin,

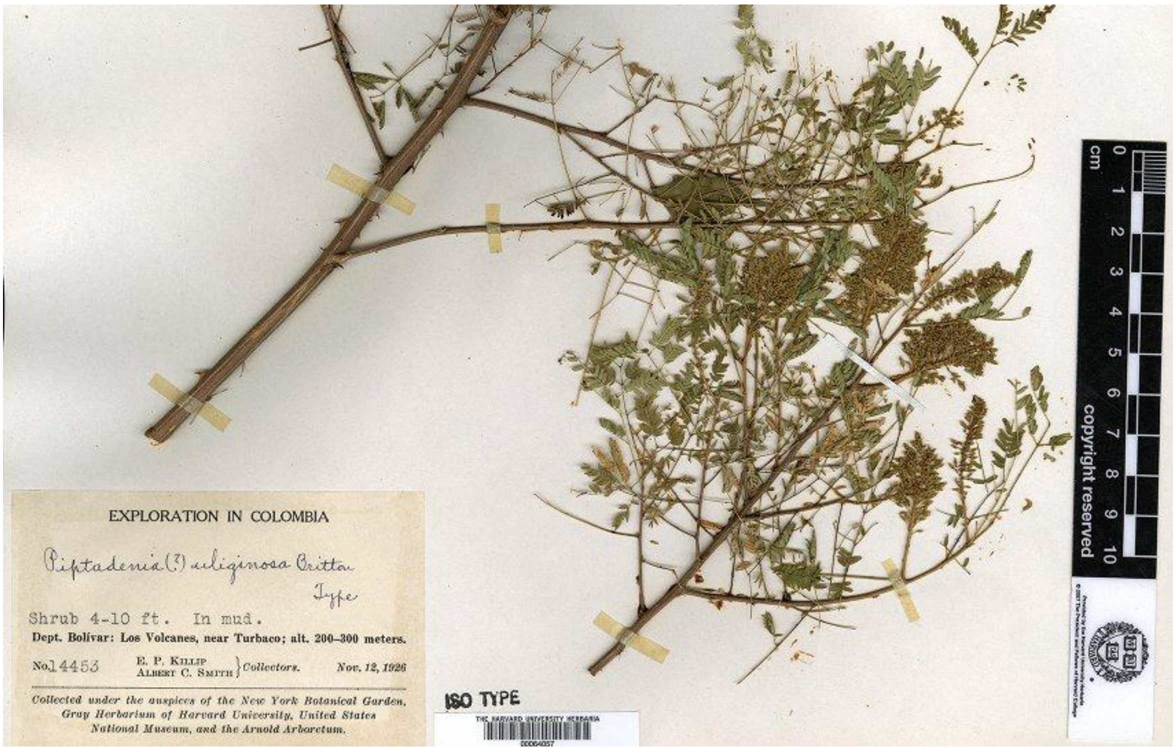

Fig.59. *Piptadenia uliginosa.* Killip 14453 (GH00064057)

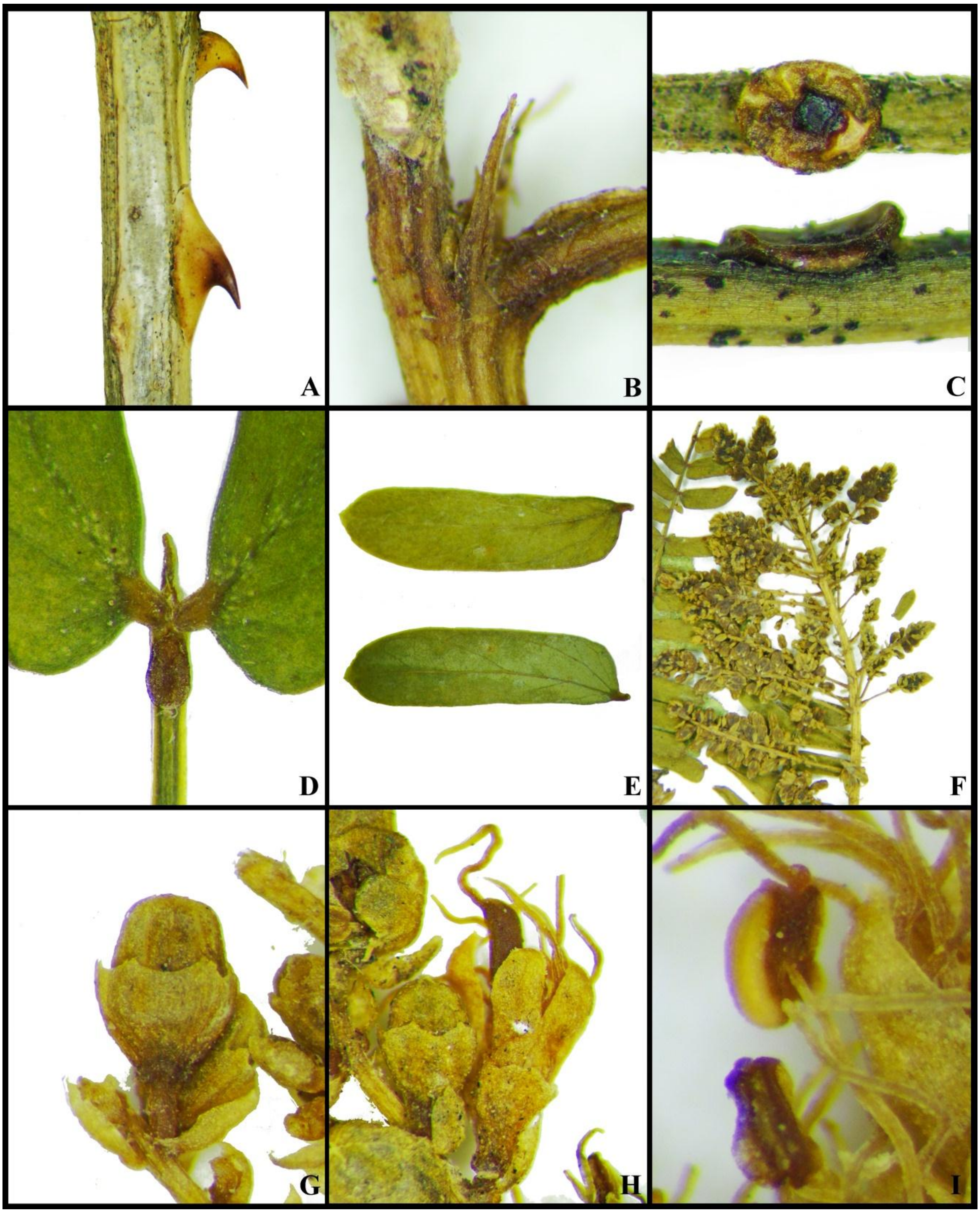

Fig.60.**A-I.** *Piptadenia uliginosa.* A. Prickles, B. Stipules, C. Petiolar nectary, D. Apex of pinnae, E. Leaflets on upper and lower surfaces, F. Inflorescence panicle of raceme, G.Flower bud, H. Flowers and bud, ovary, I. Anthers showingthe gland on the top. Pictures by Earl Chagas.

raised on the lower surface, one or two additional veins from the pulvinus, smaller venation reticulate. **Inflorescences** a panicle of racemes, axillary or at the apex of the branches; individual spikes 5–8 × 3 mm wide, peduncle 2–3 mm long, the spike axis densely pubescent with white to yellowish short hairs; first-order bracts located at axis of peduncle, 1-2, lanceolate, 0.6–0.8 mm long, glabrous, deciduous; floral bracts 0.6–0.8 × 0.15- 0.2 mm, sagitate, apex acuminate, glabrous, persistent. **Flowers** 3.8–4.1 mm long, pedicelate, pedicel 0.7–0.8 mm long; calyx 0.5–0.6 mm long, campanulate, glabrous, tube 0.4–0.5 mm long, lobes 0.1–0.2 mm long, acute; corolla 1.3–1.8 mm long, campanulate, glabrous, almost free to the base, tube 0.1–0.2 mm long, included in the calyx, lobes 1.1–1.6 mm long, erect; filaments 3–3.3 mm long, green-yellowish to yellow, anther 0.2–0.3 × 0.15–0.2 mm long, anther gland shortly stipitate; ovary 0.25–0.3 mm, glabrous, 8–10-ovulated, subsessile, style 2.7–3 mm long; stemonozone present. **Legume** imature 6–7.8 × 1.3–1.7 cm, stipe 6–7 mm long, broad linear, flat-compressed, apex acuminate, margins slightly thickened; valves brown, papery, smoothly undulate, reticulated, glabrous. **Seeds** very imature.

Etymology—The name *uliginosa*

***Distribution and habitat* –** *Piptadenia uliginosa* occurs in Colombia.

***Phenology* -** Flowering in October to january; Fruiting march to august.

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***Common names* –** Colombia:

Taxonomy **–** *Piptadenia uliginosa* present panicle of raceme, inflorescence unique among the species of the genus, very thin and delicate branches. The vegetative aspect resembles the *P. flava* species. However, *P. uliginosa* is much more delicate than *P. flava*, which may have a large variation in the number of leaves and folioles, leaflet size, as well as size peciolar net, size and shape in the petiole. Our results show *P. uliginosa* (missing *ITS* region sequence) related to *P. flava* (see discussion of this species). In previous molecular works on Piptadenia group (Jobson & Luckow 2007; Simon et al 2016) this species is not sampled.

***Final considerations.* –** As previously mentioned and previous results show (Simon et al 2016, Ribeiro et al., 2017, cap 1), Pseudopiptadenia and Pityrocarpa are not monophyletic because of the nested position of Pseudopiptadenia brenanii in Pityrocarpa. We found evidence for the placement of another two species of Pseudopiptadenia (*P*. sp. nov. and *P. inaequalis*) in *Pityrocarpa* which indicates the need of recircumscription of these two genera in a upcoming paper (Ribeiro et al. in prep.).

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Considerações finais

A partir do estudo da sistemática de *Piptadenia* podemos reconhecer 23 taxons (22 espécies e uma variedade): *Piptadenia adiantoides* (Spreng.) J.F. Macbr., *Piptadenia affinis* Burkart, *Piptadenia anolidurus* Barneby, *Piptadenia buchtienii* Barneby, *Piptadenia cuzcoënsis* Barneby, *Piptadenia flava* (DC.) Benth., *Piptadenia floribunda* Kleinhoonte, *Piptadenia gonoacantha* (Mart.) J.F. Macbr., *Piptadenia imatacae* Barneby, *Piptadenia irwinii* G.P. Lewis, *Piptadenia killipii* J.F. Macbr., *Piptadenia killipii* J.F. Macbr. var *killipii, Piptadenia killipii* var. *cacaophila* G.P. Lewis, *Piptadenia laxipinna* Barroso, *Piptadenia micracantha* Benth., *Piptadenia paniculata* Benth., *Piptadenia peruviana* (J.F. Macbr.) Barneby, *Piptadenia pteroclada* Benth., *Piptadenia ramosissima* Benth., *Piptadenia robusta* Pittier, *Piptadenia santosii* Barneby ex G.P. Lewis, *Piptadenia trisperma* (Vell.) Benth., *Piptadenia uaupensis* Spruce ex. Benth. e *Piptadenia uliginosa* Britton & Killip.

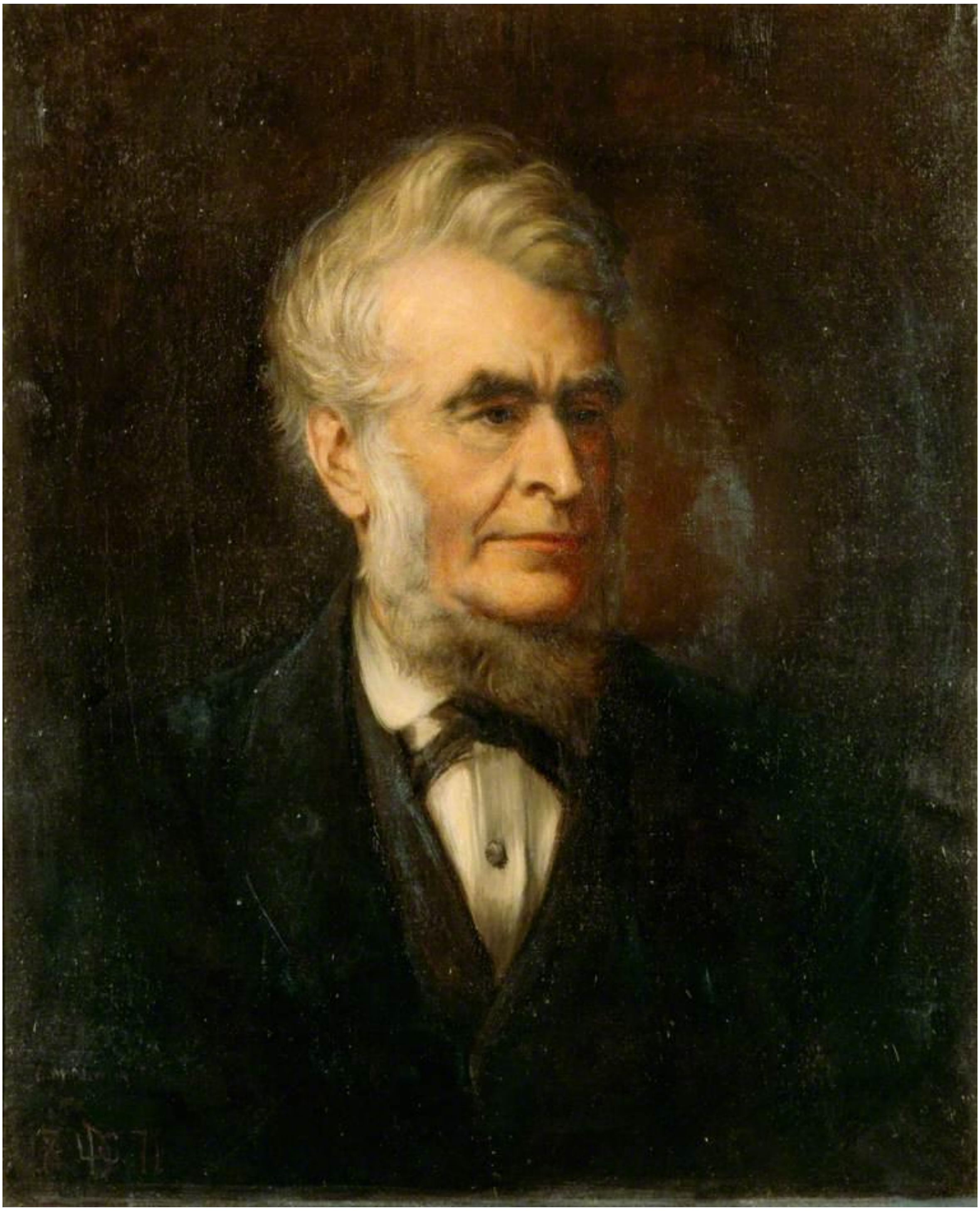
Os caracteres morfológicos que apresentam maior valor taxonômico na separação das espécies são: disposição de acúleos no ramo; forma, tamanho e quantidade do nectário peciolar; número de pinas nas folhas; número de folíolos por pina; comprimento do segmento interpinas; comprimento do segmento interfoliolares; forma, tamanho dos folíolos e disposição das nervuras; presença de alas nas sementes. Aliado a esses caracteres, o local de ocorrência das espécies também ajuda no reconhecimento, bem como o hábito.

Para a revisão taxonômica de *Piptadenia*, foi possível recoletar várias espécies; estudar os protólogos e ver a maior parte dos tipos, incluindo tipos nomenclaturais; analisar varias coleções de vários herbários do mundo, o que proporcionou a identificação correta das espécies. A revisão taxonômica foi realizada através da análise de aproximadamente

10.000 espécimes após visitar ca. 70 herbários brasileiros e estrangeiros. Pudemos tomar decisões taxonômicas e nomenclaturais após estudar obras originais e tipos nomenclaturais. Nessa revisão são designados 13 lectótipos e 4 sinônimos novos.

Para análises filogenéticas obtivemos sequencias de todas as espécies de *Piptadenia*, exceto *P. imatacae,* e incluímos múltiplos acessos da maioria delas. Fizemos análises de máxima parscimônia, máxima verossimilhança e inferência bayesiana, onde os resultados evidenciaram que *Piptadenia* s.s. é monofilético, após a exclusão *P. viridiflora*. Conseguimos sequências de duas regiões nucleares (ITS e ETS) e três plastidiais (*trnL-F, trnD-T e matK/trnK*) para espécies de *Piptadenia* e gêneros relacionados.

Como resultados descrevemos o gênero *Lachesiodendron* para acomodar *P. viridiflora* isolada das demais *Piptadenia*; apresentamos a filogenia e revisão de *Piptadenia* s.s. onde os múltiplos acessos da maioria das espécies de *Piptadenia* coalescem como monofiléticas.



George Bentham

(Stoke em Devon, 22 de setembro de 1800 — Londres, 10 de setembro de 1884)

O autor do gênero *Piptadenia*, revisado aqui nesta tese.