

**Universidade de São Paulo
Escola Superior de Agricultura “Luiz de Queiroz”**

**Estudo taxonômico de *Senna* sect. *Chamaefistula* ser. *Bacillares* (Bentham)
H.S.Irwin & Barneby (Leguminosae Juss. – Caesalpinioideae DC.) do Brasil**

Alexandre Gibau de Lima

Dissertação apresentada para obtenção do título de
Mestre em Ciências, Programa: Recursos Florestais.
Opção em: Conservação de Ecossistemas Florestais

**Piracicaba
2021**

Alexandre Gibau de Lima
Bacharel em Ciências Biológicas

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versão revisada de acordo com a resolução CoPGr 6018 de 2011

Orientador:
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EPÍGRAFE

“...A conversation with Rupert C. Barneby sparkles like a sunny day in April. Just ask him how he became one of the world's experts on beans. **"They choose you," he said. "I don't think I chose them"...**”

After England and Hollywood, Beans Win Out. The New York Times Archives, April 18, 1992, section 1, page 23.

SUMÁRIO

RESUMO.....	9
ABSTRACT.....	10
1 INTRODUÇÃO.....	11
1.1. Leguminosae Juss.....	11
1.2. Importância Econômica e Ecológica de Leguminosae.....	11
1.3. Histórico da Classificação Interna de Leguminosae.....	12
1.4. <i>Senna</i> Mill.....	13
1.5. <i>Senna</i> sect. <i>Chamaefistula</i> ser. <i>Bacillares</i> (Benth.) H.S.Irwin & Barneby.....	14
2. MATERIAL E MÉTODOS.....	17
2.1. Área de Estudo.....	17
2.2. Tratamento Taxonômico.....	17
2.2.1. Herbários consultados.....	18
2.2.2. Expedições de coleta.....	20
Referências.....	21
3 CAPÍTULO 1: A NEW ENDANGERED SPECIES OF <i>Senna</i> (leguminosae) FROM THE ATLANTIC FOREST OF BAHIA, BRAZIL, SUPPORTED BY X-RAY ANALYSIS OF LEAFLETS.....	27
Abstract.....	27
Introduction.....	27
Material and Methods.....	28
Taxonomic Treatment.....	28
Notes on Leaflet Venation.....	33
Discussion.....	35
Authors Contributions.....	35
Acknowledgements.....	35
Literature Cited.....	36
4 CAPÍTULO 2: A SYNOPSIS OF <i>Senna</i> sect. <i>Chamaefistula</i> ser. <i>Bacillares</i> (LEGUMINOSAE) IN BRAZIL.....	39
Abstract.....	39
Introduction.....	39
Material and Methods.....	41

Results and Discussion.....	41
Morphology.....	41
Taxonomic Treatment.....	45
Acknowledgements.....	97
Literature Cited.....	97
5 CONSIDERAÇÕES FINAIS.....	101
<i>Senna</i> sp. 1.....	102
<i>Senna</i> sp. 2.....	102
<i>Senna</i> sp. 3.....	103
<i>Senna</i> sp. 4	104

RESUMO

Estudo taxonômico de *Senna* sect. *Chamaefistula* ser. *Bacillares* (Bentham) H.S.Irwin & Barneby (Leguminosae Juss. – Caesalpinioideae DC.) do Brasil

Senna (Leguminosae, Cassiinae) compreende ca. 350 espécies distribuídas principalmente nas regiões tropicais e subtropicais das Américas. Somente no Brasil podem ser encontradas cerca de 80 espécies, distribuídas em quase todos os tipos de vegetações do país. Embora seja um grande gênero de Leguminosae, poucos estudos abordaram a sua taxonomia nas últimas décadas, permanecendo assim, muitas lacunas no seu conhecimento. *Senna* sect. *Chamaefistula* ser. *Bacillares* compreende cerca de 50 espécies restritas ao continente Americano e presentes em uma grande diversidade de habitats, sobretudo nas bordas das florestas. Muitas das espécies desta série ainda são pouco conhecidas pela ciência e carecem de novos estudos. Nesse sentido, o presente trabalho realizou um estudo taxonômico das espécies da *Senna* sect. *Chamaefistula* ser. *Bacillares* do Brasil. O presente trabalho baseou-se em expedições de campo para amostrar e observar os táxons em seu habitat, e na análise das coleções dos Herbários, além da revisão da literatura referente ao tema. Esta dissertação de mestrado, foi organizada em dois capítulos, sendo que o primeiro se refere a descoberta e descrição de uma espécie inédita e endêmica da Mata Atlântica da Bahia. O segundo capítulo corresponde a uma sinopse taxonômica onde estão registradas as 24 espécies e 11 variedades de *Senna* sect. *Chamaefistula* ser. *Bacillares* nativas dos ecossistemas brasileiros, além de conter chaves de identificação, comentários taxonômicos e dados de distribuição para cada táxon.

Palavras-chave: Cassiinae, Endemismo, Fabaceae, Flora brasileira, Taxonomia

ABSTRACT**Taxonomic study of *Senna* sect. *Chamaefistula* ser. *Bacillares* (Bentham) H.S.Irwin & Barneby (Leguminosae Juss. – Caesalpinioideae DC.) in Brazil**

Senna (Leguminosae, Cassiinae) comprises ca. 350 species mainly distributed throughout the tropical and subtropical regions of Americas. In Brazil, the genus *Senna* comprises ca. 80 species, widely distributed throughout all the Brazilian domains and in almost all vegetation types. Although a speciose genus, a few studies have addressed *Senna* in recent years and its taxonomic knowledge is still deficient. *Senna* sect. *Chamaefistula* ser. *Bacillares* comprises ca. 50 species restricted to the Americas being found in a great diversity of habitats, being particularly rich in forest ecotones. Many species of series *Bacillares* remains poorly known by scientists and further taxonomic studies are required. In this sense, the present study comprises a taxonomic study of the species of *Senna* sect. *Chamaefistula* ser. *Bacillares* from Brazil. The present study was based on field expeditions to sample and observe the taxa in their habitat, and on the analysis of the Herbarium collections. The present thesis is organized in two chapters, the first one refers to the discovery and description of a new and endemic species from the Atlantic Forest of Bahia. The second chapter corresponds to a taxonomic synopsis comprising 24 species and 11 varieties native to Brazil, identification keys, taxonomic comments and distribution data for each taxon.

Keywords: Brazilian flora, Cassiinae, Endemism, Fabaceae, Taxonomy

1 INTRODUÇÃO

1.1. Leguminosae Juss.

Leguminosae (nome alternativo - Fabaceae Lindl.) foi descrita por Jussieu (1789) na obra *Genera Plantarum* com base no gênero *Faba* Mill. Trata-se da terceira maior família de Angiospermas com cerca de 765 gêneros e 19.500 espécies, atrás apenas de Orchidaceae e Asteraceae (LPWG 2017). A família apresenta distribuição cosmopolita, ocorrendo desde florestas tropicais a desertos (Lewis *et al.* 2005, 2013; LPWG 2013, 2017). No Brasil, é a família com maior riqueza de espécies, compreendendo 253 gêneros e mais de 3.000 espécies distribuídas em todos os domínios fitogeográficos (BFG 2015, 2018; Flora do Brasil 2020).

Morfologicamente, Leguminosae pode ser caracterizada pelo hábito herbáceo, arbustivo, lianescente ou arbóreo; folhas geralmente alternas, compostas e com estípulas; flores pentâmeras, actinomorfas, zigomorfas ou assimétricas; cálice dialissépalo ou gamossépalo; corola dialipétala ou gamopétala, com pétalas iguais ou diferenciadas em formato e tamanho, às vezes apétalas, prefloração valvar ou imbricada; estames geralmente 10, livres ou unidos; ovário súpero e geralmente unicarpelar; fruto geralmente legume, mas também baga, craspédio, drupa, folículo, lomento ou sâmara (Jussieu 1789; Lewis *et al.* 2005, 2013; Tozzi *et al.* 2016).

1.2. Importância Econômica e Ecológica de Leguminosae

A família é a segunda mais importante do ponto de vista agropecuário, atrás apenas de Poaceae (Smýkal *et al.* 2015). Leguminosae abriga inúmeras espécies alimentícias, tais como o amendoim (*Arachis hypogaea* L.), o feijão (*Phaseolus vulgaris* L.) e a soja (*Glycine max* (L.) Merr.) (Judd *et al.* 2009; Smýkal *et al.* 2015). A família apresenta grande importância econômica pela qualidade e versatilidade da madeira encontrada, por exemplo, no jacarandá-da-bahia (*Dalbergia nigra* (Vell.) Benth.) e na bracatinga (*Mimosa scabrella* Benth.) (Carvalho 1994, 2003). Outras espécies são reconhecidas pelo seu potencial ornamental, como a manduirana (*Senna macranthera* (DC. ex Collad.) H.S.Irwin & Barneby)

(Irwin & Barneby 1982; Lorenzi 2008). Destaca-se também, o pau-brasil (*Paubrasilia echinata* (Lam.) E. Gagnon, H.C. Lima & G.P. Lewis) que no passado foi muito explorado pelos colonizadores europeus, além de ser a árvore nacional (Soares 1980; Tozzi *et al.* 2016).

A família é também reconhecida pela associação de muitas de suas espécies com bactérias fixadoras de nitrogênio no solo, característica de grande importância para a agricultura, a chamada adubação verde (Werner *et al.* 2014, 2015; LPWG 2017), além de ser fundamental para a colonização de ambientes degradados, sendo indispensável em projetos de restauração ambiental.

1.3. Histórico da Classificação de Leguminosae

Embora o monofiletismo de Leguminosae seja fortemente suportado por dados morfológicos e moleculares (Lewis *et al.* 2005; LPWG 2013), a sua classificação em subfamílias é um tema complexo e que até recentemente era baseado em poucas características morfológicas (LPWG 2013, 2017).

Bentham (1865), baseado na classificação de DeCandolle (1825) que considerava quatro subordens em Leguminosae, elaborou a tradicional subdivisão de Leguminosae em três subfamílias: Caesalpinioideae DC., Mimosoideae DC. e Papilionoideae DC. (Polhill *et al.* 1981; Lewis 1987; Lewis *et al.* 2005; Heywood 2007), sendo diferenciadas especialmente em relação à simetria floral e à prefloração da corola (Lewis *et al.* 2005; Heywood 2007). Para Hutchinson (1926, 1964), as características morfológicas que diferenciam as três subfamílias foram suficientes para elevá-las ao nível de família, sendo elas: Caesalpinaceae, Fabaceae e Mimosaceae. Tal conceito foi seguido por Cronquist (1988) em seu sistema de classificação.

A partir dos recentes estudos sobre a filogenia de Leguminosae, sintetizados em LPWG (2017), um novo sistema de classificação foi proposto, passando a compreender seis subfamílias: Caesalpinioideae DC. (com 148 gêneros, ca. 4.400 spp., incluindo Mimosoideae, agora referido como clado mimosóide), Cercidoideae LPWG (12 gêneros, ca. 335 spp.), Detarioideae Burmeister (84 gêneros, ca. 760 spp.), Dialioideae LPWG (17 gêneros, 85 spp.), Duparquetioideae LPWG (monoespecífica) e Papilionoideae DC. (503 gêneros, ca. 14.000 spp.).

1.4. *Senna* Mill.

Senna (Leguminosae, Caesalpinioideae, Cassiinae) compreende cerca de 350 espécies distribuídas nas regiões tropicais e subtropicais do planeta, sendo que cerca de 260 destas ocorrem nas Américas (Irwin & Barneby 1981, 1982; Randell & Barlow 1998; Lewis *et al.* 2005; Marazzi *et al.* 2006). No Brasil, foram registradas 81 espécies das quais 30 são provavelmente endêmicas dos ecossistemas deste país (Souza & Bortoluzzi 2015; Bortoluzzi *et al.* 2020).

As espécies de *Senna* são árvores, arbustos eretos ou escandentes, subarbustos, ervas ou lianas e são morfologicamente caracterizadas pelas suas folhas paripinadas, nectários extraflorais ausentes ou presentes (superfície secretora convexa) na raque e/ou pecíolo, bractéolas ausentes, flores pentâmeras, zigomorfas ou assimétricas, pétalas amarelas, androceu geralmente com sete estames férteis, anteras com deiscência poricida e pelos frutos indeiscentes ou deiscentes, mas sem deiscência elástica (Irwin & Barneby 1982).

Inicialmente, as espécies de *Senna* estavam subordinadas a *Cassia*, gênero descrito por Linnaeus (1753). Posteriormente, ao estudar as diferenças morfológicas nas espécies de *Cassia*, Miller (1754) descreveu o gênero *Senna* com base em *Senna alexandrina* Mill. No entanto, muitos tratamentos taxonômicos subsequentes não reconheceram *Senna*, optando por reconhecer apenas *Cassia* s.l. (De Candolle 1825; Vogel 1837; Bentham 1870, 1871; Irwin & Turner 1960). Apenas no final do século XX, Irwin & Barneby (1981, 1982) baseados principalmente na morfologia das flores e frutos das espécies de *Cassia* s.l. reconheceram *Cassia* L. s.s., *Chamaecrista* Moench e *Senna* Mill. (tabela 1), compondo a subtribo Cassiinae.

O estudo conduzido por Irwin & Barneby (1982) sobre as Cassiinae reconheceu seis seções e 35 séries em *Senna* e, embora tenha contemplado a maior parte das espécies deste gênero, abordou apenas os táxons nativos e naturalizados do Continente Americano. Nos anos seguintes, foram realizados outros estudos taxonômicos de Cassiinae para as demais regiões do planeta, nos quais foram feitas as novas combinações para as espécies de *Senna*, descrição de novos táxons e o reconhecimento de 38 séries dentro do gênero (Randell 1988, 1989, 1990; Randell & Barlow 1998; Singh 2001; Marazzi *et al.* 2006).

Estudos de filogenia baseados em dados moleculares e morfológicos evidenciaram *Senna* como um gênero monofilético (Bruneau *et al.* 2001; Herendeen *et al.* 2003; Marazzi *et al.* 2006). No entanto, a sua classificação infragenérica como reconhecida por Irwin & Barneby (1982) se mostrou em grande parte incongruente com a filogenia conduzida por Marazzi *et al.* (2006), na qual apenas uma das seis seções — *Psilorhegma* (Vogel) H.S.Irwin & Barneby — apresentou suporte como monofilética, enquanto que parte das séries foram suportadas como monofiléticas, inclusive a série *Bacillares*, alvo do presente estudo.

Tabela 1. Distinção morfológica de *Cassia*, *Chamaecrista* e *Senna* (Irwin & Barneby 1982).

	<i>Cassia</i>	<i>Chamaecrista</i>	<i>Senna</i>
Nectários extra-florais	Ausente	Presente ou ausente, quando presente a superfície côncava	Presente ou ausente, quando presente a superfície secretora convexa
Bractéolas	Presente	Presente	Ausente
Androceu	Zigomorfo; filetes abaxiais sigmóides	Actinomorfo; filetes retos ou curvados	Zigomorfo ou assimétrico; filetes retos ou curvados
Deiscência do fruto	Indeiscente	Deiscente (deiscência elástica)	Indeiscente ou deiscente (deiscência não elástica)

1.5. *Senna* sect. *Chamaefistula* ser. *Bacillares* (Benth.) H.S.Irwin & Barneby

Senna sect. *Chamaefistula* ser. *Bacillares* (Benth.) H.S.Irwin & Barneby compreende cerca de 50 espécies nativas do México até a região Sul do Brasil e Paraguai, sendo encontradas em uma grande diversidade de habitats, especialmente nas bordas das florestas (Irwin & Barneby 1982). As espécies de *Senna* ser. *Bacillares* são arbustos eretos ou escandentes, lianas ou árvores e são caracterizados pelas folhas com dois pares de folíolos, nectários extra-florais na raque foliar, anteras rostradas, ovário geralmente com mais de 50 óvulos e frutos com sementes dispostas transversalmente (Irwin & Barneby 1982).

Desde a monografia de Irwin & Barneby (1982), nenhuma outra abordagem taxonômica mais completa foi conduzida para *Senna* sect. *Chamaefistula* ser. *Bacillares*. Os

poucos trabalhos que abordaram especificamente esta série correspondem as descrições de três novas espécies — *Senna monilifera* H.S.Irwin & Barneby nativa do Peru (Barneby 1992). *Senna coimbrae* M. Nee & Barneby nativa da Bolívia (Nee & Barneby 1993) e *Senna acatlanensis* C. Rojas-Martínez & A. Delgado, nativa do México (Rojas-Martínez *et al.* 2019) — e uma nova combinação: *Senna tocotana* (Rose ex Britton & Killip) Silverst., uma espécie nativa da Colômbia (Silverstone-Sopkin 2012).

Como afirmado por Irwin & Barneby (1982, p. 103) “knowledge of the *Bacillares*, and consequently the taxonomy, leaves much to be desired” (o conhecimento das *Bacillares*, e conseqüentemente, a taxonomia, deixa muito a desejar) em uma referência aos temas que ainda precisam ser melhor investigados, sobretudo, a morfologia e distribuição dos táxons, a delimitação das espécies e variedades — como por exemplo, as duas variedades de *S. splendida* e suas notáveis diferenças no formato e dimensão das sépalas — e o grande potencial de novas espécies ainda não descritas.

Embora na filogenia molecular de Marazzi *et al.* (2006), a série *Bacillares* tenha sido recuperada como monofilética, foram amostradas apenas cerca de 20% das espécies da série. Nesse sentido, uma filogenia molecular com maior amostragem de espécies será importante para a confirmação do seu monofiletismo e também, permitir estudos futuros, como por exemplo, estudos de biogeografia.

2 MATERIAL E MÉTODOS

2.1. Área de Estudo

As espécies de *Senna* sect. *Chamaefistula* ser. *Bacillares* ocorrem naturalmente desde o México até o Paraguai e sul do Brasil, ocupando uma grande diversidade de habitats, desde florestas até savanas (Irwin & Barneby 1982; Marazzi *et al.* 2006). No presente estudo foram consideradas apenas as espécies nativas do Brasil.

2.2. Tratamento Taxonômico

O levantamento das espécies e nomes foi baseado nas principais obras para o gênero (Miller 1794; Vogel 1837; Bentham 1870, 1871; Irwin & Barneby 1982) e bases de dados (Tropicos, IPNI, Plants of the World Online), e nas consultas aos principais herbários do Brasil e do exterior (físicos e virtuais), bem como nas coletas e observações de campo.

Os dados morfológicos e comentários taxonômicos foram baseados exclusivamente nos materiais herborizados e observações de campo. As medidas máximas e mínimas dos órgãos estão indicadas, sendo os extremos apresentados entre parênteses. A chave de identificação foi elaborada com as características morfológicas diagnósticas que permitiram a diferenciação das espécies e variedades. A terminologia morfológica das espécies seguiu trabalhos de morfologia e outros específicos para o gênero (Radford *et al.* 1974; Irwin & Barneby 1982; Harris & Harris 2001). A avaliação do status de conservação das espécies foi baseada nos critérios estabelecidos pela IUCN (2012).

As amostras vegetais foram coletadas e herborizadas seguindo os procedimentos estabelecidos por Mori *et al.* (1989) e então depositadas no herbário ESA, sendo que duplicatas estão sendo enviadas a outros herbários, principalmente o herbário do Jardim Botânico do Rio de Janeiro (RB) e herbários próximos dos locais onde as coletas foram realizadas.

2.2.1. Herbários consultados

Para a realização deste trabalho, foram consultadas as coleções dos herbários listados abaixo, tanto pessoalmente quanto através da consulta às imagens disponíveis. Siglas de acordo com Thiers (atualizado constantemente):

ALCB – Universidade Federal da Bahia, Salvador, BA

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

BR – National Botanic Garden of Belgium, Belgium

CEN – Centro Nacional de Pesquisa de Recursos Genéticos e Biotecnologia, Cenargen/EMBRAPA, Brasília, DF

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

CEPEC – Centro de Pesquisas do Cacau/CEPLAC, Ilhéus, BA

CVRD – Reserva Natural da Vale, Linhares, ES

ESA – Escola Superior de Agricultura “Luiz de Queiroz”/Universidade de São Paulo, Piracicaba, SP

F – Field Museum of Natural History, Chicago, USA

FLOR – Herbário da Universidade Federal de Santa Catarina, Florianópolis, SC

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

HUTO – Universidade Estadual do Tocantins, Palmas, TO

IAN – EMBRAPA Amazônia Oriental, Belém, PA

INPA – Instituto Nacional de Pesquisas na Amazônia, Manaus, AM

K – Royal Botanic Garden, Kew, England

MAC – Instituto do Meio Ambiente de Alagoas, Alagoas, AL

MBM – Museu Botânico Municipal, Curitiba, PR

MBML – Museu de Biologia Mello Leitão, Santa Teresa, ES

MG – Museu Paraense Emílio Goeldi, Belém, PA

MO – Missouri Botanical Garden, Saint-Louis, USA

NY – The New York Botanical Garden, New York, USA

P – Muséum National d’Histoire Naturelle, Paris, France

R – Museu Nacional do Rio de Janeiro, Rio de Janeiro, RJ

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

RON – Universidade Federal de Rondônia, Porto Velho, RO

SP – Instituto de Botânica, São Paulo, SP

SPF – Universidade de São Paulo, São Paulo, SP

UB – Universidade de Brasília, Brasília, DF

UEC – Universidade Estadual de Campinas, Campinas, SP

UFG – Universidade Federal de Goiás, Goiânia, GO

VIC – Universidade Federal de Viçosa, Viçosa, MG

VIÉS – Universidade Federal do Espírito Santo

2.2.2. Expedições de coleta

Foram realizadas expedições de coleta e de observação de campo (tabela 2). Durante as expedições, os indivíduos vegetativos e férteis foram amostrados (inclusive em sílica para futuros estudos de filogenia), fotografados e tomadas observações sobre habitats preferenciais e variações morfológicas das populações.

Tabela 2. Expedições para coleta e observação das espécies de *Senna*.

Data	Estado	Províncias Geográficas
VIII/2018	MT	Poconé (Pantanal), Chapada dos Guimarães (Cerrado)
III/2019	RJ	Cabo Frio (Mata Atlântica)
III/2019	ES	Guarapari, Santa Teresa, Baixo Guandu, Linhares (Mata Atlântica)
III – IV/2019	BA	Una, Ilhéus (Mata Atlântica), Chapada Diamantina (Caatinga)
IV	SP	Araçoiaba da Serra, Iperó (Cerrado, Mata Atlântica)
X/2019	AL	Maceió, Coqueiro Seco (Mata Atlântica)
XII/2019	SP	Itirapina (Cerrado)
I/2020	SP	Paraibuna, Ubatuba (Mata Atlântica)

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26

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CAPÍTULO 1: A NEW ENDANGERED SPECIES OF *Senna* (Leguminosae) FROM THE ATLANTIC FOREST OF BAHIA, BRAZIL, SUPPORTED BY X-RAY ANALYSIS OF LEAFLETS

Manuscrito submetido à **Systematic Botany**. O capítulo segue a formatação exigida pela revista.

LIMA ET AL. A NEW SPECIES OF SENNA FROM THE ATLANTIC FOREST

A new endangered species of *Senna* (Leguminosae) from the Atlantic Forest of Bahia, Brazil, supported by X-ray analysis of leaflets

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Abstract—*Senna* (Leguminosae, Cassiinae) is a speciose genus widely distributed throughout tropical and subtropical regions of the World. During taxonomic studies of *Senna* sect. *Chamaefistula* ser. *Bacillares*, a new endemic and endangered species from the Atlantic Forest of Bahia, Brazil was discovered. The new species *Senna bahiensis* is compared with its morphologically similar species *Senna gardneri*, including X-ray analysis comparison of their leaflet venation patterns. The use of high resolution X-ray digital images provided the decisive information, being a promising technique to be used in systematic studies.

Keywords—*Bacillares*, Brochidodromous venation, Cassiinae, *Chamaefistula*, Craspedodromous venation, Endemic, Fabaceae, Faxitron LX-60, High resolution images, Montane forest, Taxonomy.

Senna Mill. (Leguminosae, Cassiinae) comprises ca. 350 species widespread over tropical and subtropical regions, mainly in the New World (Lewis et al. 2005; Marazzi et al. 2006). Its inclusion in a broadly circumscribed *Cassia* L. *sensu lato* was accepted by several authors in the past two centuries (De Candolle 1825; Vogel 1837; Bentham 1871; Irwin and

Turner 1960). Only near the end of the 20th century, *Cassia* s.l. was re-segregated into three separate genera: *Cassia* sensu stricto, *Chamaecrista* Moench and *Senna*, all three placed in subtribe Cassiinae (Irwin and Barneby 1981, 1982). This reclassification was subsequently supported by phylogenetic studies based on molecular data (Bruneau et al. 2001; Herendeen et al. 2003; Marazzi et al. 2006), although five of the six sections recognised within *Senna* were not supported as monophyletic (see discussion).

The new species of *Senna* described here belongs to *Senna* sect. *Chamaefistula* ser. *Bacillares* (Benth.) H.S.Irwin & Barneby, a large and taxonomically complex series comprising approximately 50 species, which are widely distributed throughout tropical and subtropical areas of the Americas, occurring in a wide range of habitats from savannas to ombrophilous forests, and being particularly rich in forest ecotones (Irwin and Barneby 1982; Marazzi et al. 2006). Species of series *Bacillares* are shrubs, treelets or trees, characterized by leaves with two pairs of leaflets, extra-floral nectaries on the leaf rachis, beaked anthers, multi-seeded and often pulpy fruits with transversely orientated seeds (Irwin and Barneby, 1982). In Bahia, many species of series *Bacillares* are known by the vernacular name “são-jão” (Queiroz 2009).

During our taxonomic studies of the species belonging to this series a new species exclusive to the Atlantic Forest in eastern Bahia was discovered. The present study describes and illustrates this species and provides a distribution map, notes on habitat and phenology and comparison with the most morphologically similar species.

MATERIALS AND METHODS

This study is based on field expeditions and analyses of specimens deposited in the following herbaria: ALCB, ASE, CEN, CEPEC, EAC, ESA, HUEFS, HRB, INPA, K, MBM, NY, RB, SP, SPF and US (acronyms according to Thiers 2020). Morphological terms used in the description follow Irwin and Barneby (1982) and Harris and Harris (2001), except for the leaflet venation patterns, which are based on Hickey (1973, 1974) and LAWG (1999). The 2D X-ray images of leaflet venation patterns were made using the digital X-ray equipment Faxitron LX-60, with an exposure time of 5.6 seconds at a voltage of 29 kV (Schneider et al. 2018). The X-ray analysis comprised a non-destructive technique and all the leaflets returned to their exsiccatae after the images were taken. The species conservation assessment was evaluated following the IUCN guidelines and criteria (IUCN 2012). The Area of Occupancy (AOO) and Extent of Occurrence (EOO) were calculated using the Geospatial Conservation Assessment Tool (Bachman et al. 2011). The geographical distribution map was made using QGIS (2019).

TAXONOMIC TREATMENT

Senna bahiensis A.Lima & V.C.Souza, sp. nov. TYPE: BRAZIL. Bahia. Ibirapitanga. 22 km N of Itamarati on BR 101, then 6.8 km E on road to Embratel Tower, Reserva Municipal Cachoeira do Pau, Southern Bahian wet forest, 690 m, 19 March 2003, *W.W. Thomas, A.M.*

Amorim, J.L. Paixão, P. Fiaschi, S. Sant'Ana & B. Clifton 13447 (holotype: CEPEC! [herbarium number 119058]; isotypes: HUEFS!, RB!, SPF!).

Senna bahiensis is morphologically similar to *Senna gardneri* (Benth.) H.S.Irwin & Barneby, but can be differentiated by its lianescent habit (vs. self-supporting habit in *S. gardneri*); grey young branches (vs. nigrescent); narrow oblanceolate and falcate stipules (vs. setaceous); brochidodromous secondary veins (vs. craspedodromous); persistent bracts (vs. caducous); petals 3.3–4.5 x 2.5–3.3 cm (vs. 1.8–2.5 x 1.3–1.7 cm). Table 1.

Scandent shrub or vine ca. 2.5–10 m tall; branches cylindrical, striate, grey, glabrous, young branches noticeably zig-zag. **Leaves** with stipules 6–10 × 0.6–1 mm, falcate to narrowly oblanceolate, glabrous; petiole 1.5–3.5 cm long, glabrous; rachis 3–8 (–10) mm long, sulcate, glabrous; extra-floral nectary 1, present between the proximal pair of leaflets, 1.5–2 mm long, stipitate, claviform; leaflets of the proximal pair 1.6–2.5 × 1.1–1.8 cm, leaflets of the distal pair 2.5–3.6 × 1.5–2 cm, papery, discoloured, symmetrical, obovate, base cuneate or obtuse, apex truncate or rounded and additionally retuse and mucronate, margins revolute, adaxial and abaxial surfaces glabrous, penninerved, veins slightly prominent on the abaxial surface, secondary veins brochidodromous, tertiary venation reticulate. **Racemes** axillary, slightly longer than the subtending leaf; peduncle 1.5–2 cm long, glabrous; rachis 0.3–1 cm long, glabrous; bracts 4–6 × 0.8–1 mm, narrowly lanceolate, cymbiform, glabrous, persistent. **Flowers** with pedicel 2.5–3.5 cm long, glabrescent to glabrous; sepals 0.7–1.6 × 0.4–1 cm, unequal, ovate or obovate, base truncate, apex rounded or obtuse, glabrescent on the abaxial surface, glabrous on the adaxial surface; corolla asymmetric, central-adaxial petal 3.5–4.5 × 2.5–3.3 cm, obovate, base unguiculate, apex retuse, two lateral-adaxial petals 3.5–4.4 × 2.5–3 cm, obovate, base unguiculate, apex rounded, two abaxial petals 3.3–4.5 × 2.5–2.8 cm, one obovate and the other slightly incurved and cucullate, base unguiculate, apex rounded, puberulent or glabrescent on the abaxial surface, glabrous on the adaxial surface; three adaxial staminodes, 3–4 mm long, four median stamens with the filaments 3–4 mm long and anthers 7–10 mm long, oblong, apex geniculate, two lateral-abaxial stamens with filaments 5 mm long and anthers 13–15 mm long, oblong, apex curved, the central-abaxial stamen with its filament 4 mm long and anther 12–13 mm long, oblong, apex curved; ovary 18–25 mm long, sparsely sericeous to glabrescent, stipe 2–3 mm long, sparsely sericeous to glabrescent, style 4–7 mm long, glabrescent. **Fruits** unknown. Figure 1.

Taxonomic notes—*Senna bahiensis* is characterized by its narrowly oblanceolate and falcate stipules, symmetrical obovate leaflets, one clavate extra-floral nectary inserted between the proximal pair of leaflets, brochidodromous secondary veins, short axillary

racemes, large asymmetrical corolla and abaxial stamens longer than median ones. Although fruits are not yet known, the species has all the remaining features of *Senna* sect. *Chamaefistula* ser. *Bacillares*: two pairs of leaflets, an extra-floral nectary on the leaf rachis and beaked anthers. We predict that this taxonomic placement will be reinforced when new collections with fruits become available and the species is included in molecular studies.

Etymology—The epithet refers to *Senna bahiensis* being endemic to the state of Bahia.

Distribution and habitat—*Senna bahiensis* has a restricted distribution in the Atlantic Forest of eastern Bahia, reaching its northern limit at the junction with the Caatinga vegetation in Bahia (Fig. 2). It was collected in the Municipal Reserve of Cachoeira do Pau and in the Serra da Jibóia (including Morro da Pioneira), where it occurs at the edge of montane forest and on rocky outcrops, ranging from 690 to 800 m a.s.l. *Senna bahiensis* appears to not be sympatric with *S. gardneri*, the latter has been collected in Caatinga and sometimes in Cerrado vegetation, in drier areas and usually in sandy soils.

Phenology—*Senna bahiensis* has been collected in flower from March to May.

Conservation—The Atlantic Forest of Bahia is considered one of the most biodiverse regions on Earth with a great number of endemic plant species, but it is under strong pressure from various human activities (Mori et al. 1983; Thomas and Carvalho 1997; Saatchi et al. 2001). In addition, the plant diversity of the mountainous regions of Bahia remains poorly known (Amorim et al. 2009). This rare species is presently known by only three collections from restricted areas in the Serra da Jibóia and in the Municipal Reserve of Cachoeira do Pau. Following IUCN (2012) criteria B1ab(i,iii) + 2ab(ii,iii) *Senna bahiensis* can be considered Endangered (EN) based on its area of occupancy (AOO = 12 km²), in its extent of occurrence (EOO = 267.408 km²), and on the decline in quality of its habitat due to various human activities (Carvalho-Sobrinho and Queiroz 2005).

Additional Specimens Examined (Paratypes)—BRAZIL: Bahia: Castro Alves. Mata Higrófila na Serra da Jibóia, 25 April 1994 (fl), L. P. Queiroz & N. S. Nascimento 3832 (CEPEC!, HUEFS!, K, MBM, NY, SP). Santa Terezinha. Serra da Pioneira, 3 km da Pedra Branca, 800 m, 16 May 1984 (fl), L. Noblick, Lemos & Valdomiro 3217 (CEPEC!, HUEFS!, US).

TABLE 1. Morphological characters which separate *S. bahiensis* from *S. gardneri*

Character	<i>S. bahiensis</i>	<i>S. gardneri</i>
Colour of young branches	Grey	Nigrescent
Stipule (size; shape)	6–10 x 0.6–1 mm; falcate to narrowly oblanceolate	1–3 x 0.3–0.5 mm; setaceous
Leaflets (colour; secondary venation; marginal vein)	Discolorous; brochidodromous; inconspicuous and not prominent	Sub-concolorous; craspedodromous; conspicuous and prominent
Bracts	Persistent	Caducous
Pediceal length	2.5–3.5 cm	1.6–2.3 cm
Petals size	3.3–4.5 x 2.5–3.3 cm	1.8–2.5 x 1.2–1.7 cm

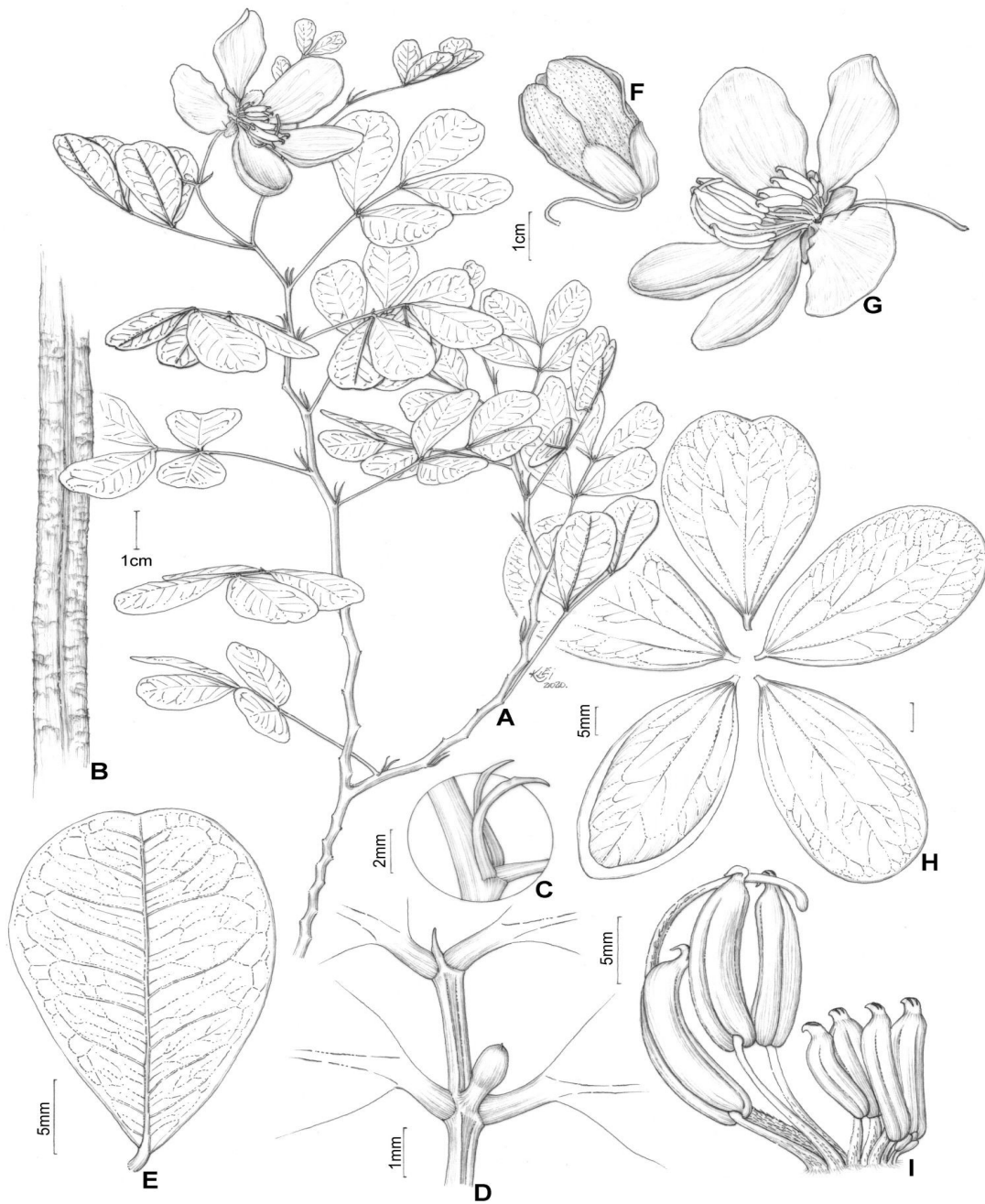
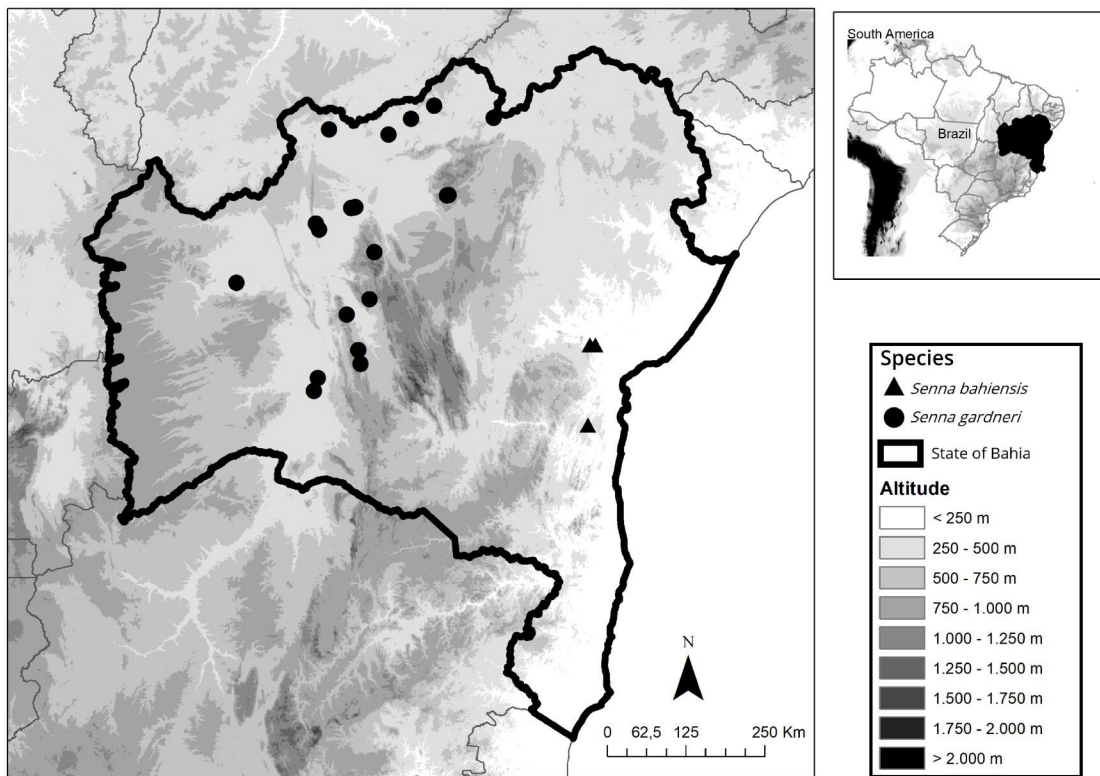


FIG.1. Illustration of *Senna bahiensis* A.Lima & V.C.Souza. A. Flowering branch; B. Stem; C. Stipules; D. Extra-floral nectary; E. Leaflet; F. Flower bud; G. Flower; H. Corolla; I. Stamens. Drawn by Klei Souza, based on *W. W. Thomas et al. 13447* (A, C–I) and *L. P. Queiroz & N. S. Nascimento 3832* (B).



Fl

G.2. Distribution of *Senna bahiensis* in the Atlantic Forest of eastern Bahia and its morphologically similar species *Senna gardneri* widespread in the Caatinga.

NOTES ON LEAFLET VENATION

Leaflet venation was compared between the new species and its morphologically similar species, *Senna gardneri* (Table 1). The major venation pattern of *Senna bahiensis* is pinnate, with a single primary vein. Secondary veins diverge from the primary one at an acute angle, and finally join up forming a series of prominent arches below the marginal vein, a brochidodromous pattern. The marginal vein is inconspicuous and not prominent (Fig. 3).

Senna gardneri also has pinnate venation pattern, but in this species the secondary veins diverge from the primary one at acute angles, but then terminate at the margin, a craspedodromous pattern (Fig. 3). The conspicuous and prominent marginal vein is a diagnostic character of this species, which was mentioned by Irwin and Barneby (1982). A morphologically similar marginal vein also has been observed in other taxa of Cassiinae: *Chamaecrista hymenaeifolia* (Benth.) H.S.Irwin & Barneby and *Chamaecrista ipanorensis* Rando & H.C.Lima, both from the white sand forest vegetation in the upper Rio Negro, northern Amazon (Rando and Lima 2020).

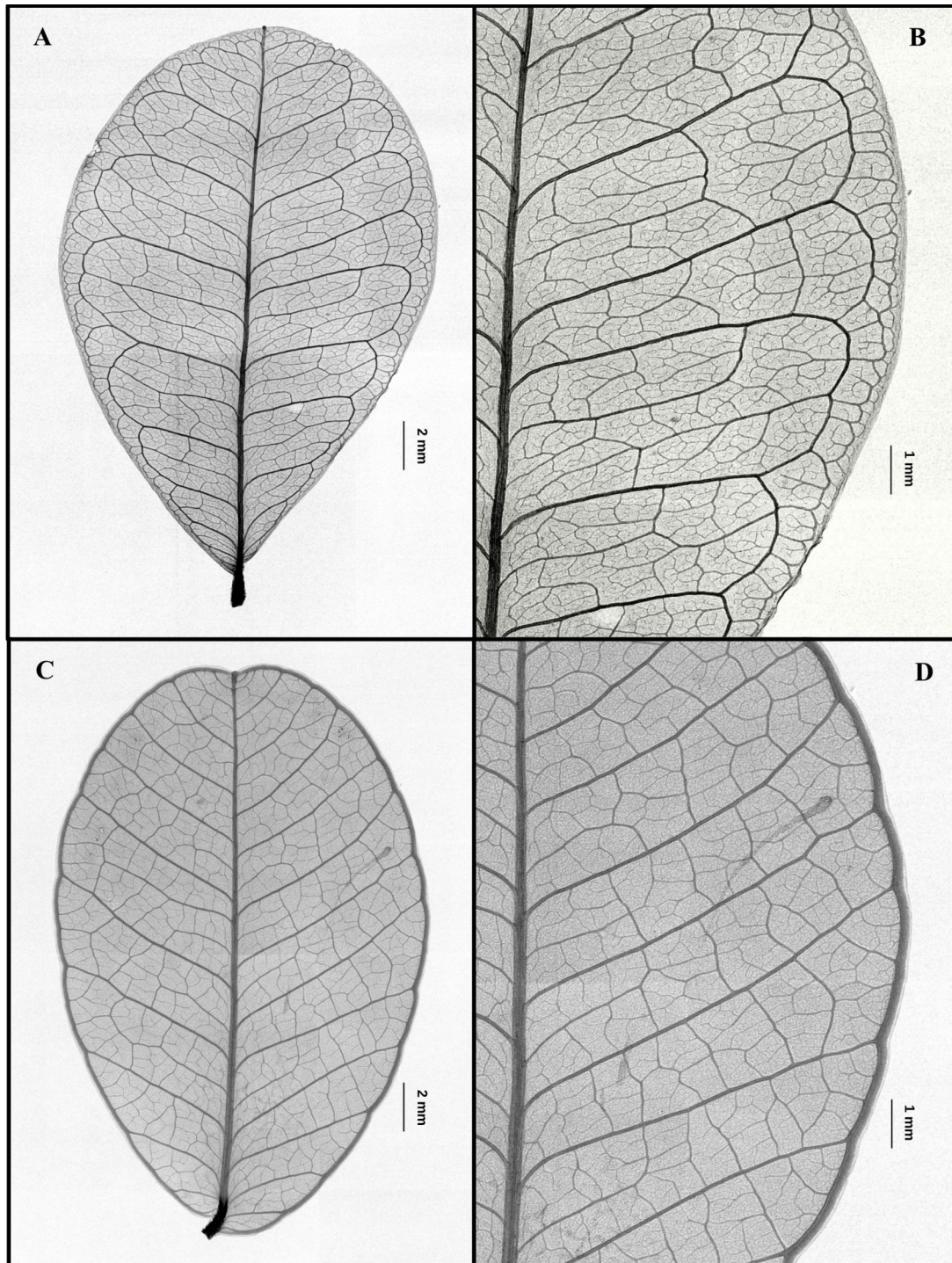


FIG. 3. A–B. X-ray images of the leaflet venation of *Senna bahiensis* (from *W. W. Thomas et al. 13447*). C–D. X-ray images of the leaflet venation of *Senna gardneri* (from *L. P. Queiroz 4803*).

Although the leaflet venation pattern has been little used in taxonomic studies of Leguminosae, it proved to be useful in *Mimosa* (Grohar et al. 2018), *Crotalaria* (Devecchi et al. 2014), *Bauhinia* (Fortunato et al. 2017) and *Chamaecrista* (Coutinho et al. 2016). In this

perspective, the high resolution X-ray digital images of leaflet venation supported our analysis, without destroying the leaflets. The X-ray was applied in a few previous taxonomic studies – e.g. in Lauraceae (Moraes 2018) and Myrtaceae (Flores et al. 2019) – but it proved to be an advantageous technique to be used in new ones.

DISCUSSION

In their taxonomic revision of the Cassiinae from the New World, Irwin and Barneby (1982) recognized six sections and 35 series within *Senna*. Most of the sections, including *Senna* sect. *Chamaefistula*, were not supported as monophyletic in the study of Marazzi et al. (2006), although the circumscriptions of several Series, including *Senna* sect. *Chamaefistula* ser. *Bacillares* were recovered as monophyletic.

To date, analyses of leaflet venation have been little used in taxonomic studies of Leguminosae, including *Senna*. In our study a detailed analysis of leaflet venation proved to be useful in differentiating *S. bahiensis* from its morphologically similar species, *S. gardneri*. The use of high resolution X-ray digital images of leaflet venation patterns provided the decisive information, with advantages in relation to the clearing methodologies. As a result of this finding, in our future systematic studies on *Senna* sect. *Chamaefistula* ser. *Bacillares* we will include, a digital X-ray an analysis of leaflet venation of all the species of this series.

AUTHORS CONTRIBUTIONS

AGL performed the description of the new species, the distribution and conservation analysis, the analysis of leaflet venation and wrote the manuscript. LPQ contributed to the description of the new species. MTF supervised the first author with the analysis of leaflet venation. GPL revised the manuscript. VCS supervised the first author and revised the manuscript.

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4 CAPÍTULO 2: A SYNOPSIS OF *Senna* sect. *Chamaefistula* ser. *Bacillares* (Leguminosae) IN BRAZIL

Manuscrito a ser submetido à **Brittonia**. O capítulo segue a formatação exigida pela revista.

A synopsis of *Senna* sect. *Chamaefistula* ser. *Bacillares* (Leguminosae) in Brazil.

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Abstract. *Senna* (Leguminosae, Cassiinae) comprises ca. 350 species mainly distributed throughout the Americas. Although speciose and complex, a very few studies have addressed the systematics of *Senna* in recent years and a lot of subjects remains unresolved. *Senna* sect. *Chamaefistula* ser. *Bacillares* is the largest series of American *Senna* and also the taxonomic most problematic with several taxa still little known or with problematic delimitation. After field work and extensive analysis of herbarium collections, it was found 24 species of *Bacillares* from all over Brazilian territory, which represents ca. 50% of all known species of this series. This synopsis presents an identification keys, taxonomic commentaries, distribution and phenologic data of all species and varieties of *Bacillares* from Brazil.

Key words: Caesalpinioideae, Cassiinae, Fabaceae, Neotropics, taxonomy.

Senna Mill. (Leguminosae, Cassiinae) comprises ca. 350 predominantly distributed throughout the Americas (Irwin & Barneby, 1982; Lewis et al., 2005; Marazzi et al., 2006). The genus was first described by Miller (1754), one year after Linnaeus (1753) described *Cassia* L.. Historically, most authors have recognised *Senna* as a synonym of *Cassia* (e.g., De Candolle, 1825; Vogel, 1837; Bentham, 1871; Irwin & Turner, 1960). More than two centuries after Miller (1754), Irwin & Barneby (1981, 1982) — based mainly on the

morphological differences present in the flowers and fruits in *Cassia* sensu lato — reinstated the three genera *Cassia* sensu stricto, *Chamaecrista* Moench and *Senna*, recognizing them as morphologically distinct, although closely related and positioned inside subtribe Cassiinae.

In their treatments of American Cassiinae, Irwin & Barneby (1981, 1982) recognized six sections and 35 series within *Senna*. In the following years, new revisions of *Senna* were published for other regions (Randell, 1988, 1989, 1990; Randell & Barlow, 1998; Singh, 2001), these included new combinations, descriptions of new taxa and the recognition of three more series.

Phylogenetic studies based on morphological and molecular data corroborated the monophyly of *Senna* (Bruneau et al., 2001; Herendeen et al., 2003; Marazzi et al., 2006a), although five of the six sections (including *Senna* sect. *Chamaefistula*) recognized by Irwin & Barneby (1982) were not supported as monophyletic in the study of Marazzi et al. (2006). In contrast, several series were recovered as monophyletic, including *Senna* sect. *Chamaefistula* ser. *Bacillares* (Benth.) H.S. Irwin & Barneby.

Senna series *Bacillares* comprises approximately 50 species restricted to tropical and subtropical areas of the Americas. Species occur in different ecosystems, but especially in forest margins (Irwin & Barneby, 1982; Marazzi et al., 2006). Species of series *Bacillares* are shrubs, vines or trees, being recognized by leaves with two pairs of leaflets, extra-floral nectaries on the leaf rachis, beaked anthers, multiovulate ovary (mostly with more than 50 ovules) and often pulpy fruits with transversely orientated seeds (Irwin and Barneby, 1982).

Since Irwin & Barneby (1982), there have been few taxonomic studies focusing on series *Bacillares*. These include the descriptions of four new species — in Peru (Barneby, 1992), Bolivia (Nee & Barneby, 1993), Mexico (Rojas-Martínez et al., 2019) and Brazil (Lima et al., submitted to Systematic Botany) — and one new combination (Silverstone-Sopkin, 2012). Studies addressing some species complexes within the series *Bacillares* are in progress.

In Brazil, the genus *Senna* comprises ca. 80 species, widely distributed throughout all the Brazilian domains and in almost all vegetation types (Souza & Bortoluzzi, 2015). During our taxonomic studies of *Senna* sect. *Chamaefistula* ser. *Bacillares* we found 24 species and 11 varieties in the Brazilian territory.

Materials and Methods

This work was based on field expeditions for observation of taxa in their natural habitats and on herbarium specimens from herbaria with important collections from Brazilian territory (acronyms according to Thiers, 2020): ALCB, B, BHCB, BR, CEN, CESJ, CEPEC, CVRD, ESA, F, FLOR, HUEFS, HUTO, IAN, INPA, K, MAC, MBM, MBML, MG, MO, NY, P, R, RB, RON, SP, SPF, UB, UEC, UFG, VIC, VIES. Morphological terms used in the taxonomic treatment follow Irwin & Barneby (1982) and Harris & Harris (2001) for habit, indumentum, leaves, flowers and fruits; LAWG (1999) for leaflet venation; and Weberling (1989) for inflorescence.

Results and Discussion

It was found 24 species (and 11 varieties) of *Senna* sect. *Chamaefistula* ser. *Bacillares* in Brazil, 10 of them restricted to this country. Taxa of series *Bacillares* were found throughout the Brazilian territory in different vegetation types, especially in forest ecotones in more humid environments, with a great diversity of species in the Brazilian Atlantic Forest and in the Amazon.

MORPHOLOGY

Leaves (extra-floral nectaries, leaflets and rachis appendix).— The leaves with two pairs of leaflets is one of the diagnostic features of series *Bacillares* (figure 1). We observed in a very few specimens of *S. subtrijuga* and *S. splendida* var. *splendida* leaves with both two and three pairs of leaflets in the same specimens. This variation seems to be not taxonomically significant. The leaflets lamina can be symmetric (e.g. in *S. acutisepala* and *S. georgica*) or asymmetric (e.g. in *S. chrysoarpa* and *S. rizzinii*) and lamina shape varied from elliptic, lanceolate, obovate, oblong, orbicular ovate or reniform. We've observed a strong variation in shape, size and indumentum of leaflets of *S. macranthera* throughout their distribution. In general, the secondary venation pattern in the species of series *Bacillares* is the brochidodromous — with variations in the divergence angle and the spacing between the secondary veins — except in *S. gardneri* which is craspedodromous (Irwin & Barneby, 1982; Lima et al. submitted). The leaf rachis appendix can be caducous or persistent, varying from

setaceous, filiform, hooked or horn-shaped (in *S. cornigera*) and sometimes glandular in *S. herzogii* and *S. macranthera*.

Extra-floral nectaries in *Senna* (when present) secrete nectar from a convex surface (Irwin & Barneby, 1982), representing a strategy in plant defense which might have allowed a large diversification in *Senna* (Marazzi et al., 2006a). In *Bacillares*, extra-floral nectaries are always present (figure 1) and we've observed that the number of nectaries were useful to differentiate species with a single extra-floral nectary in the rachis from those species with two extra-floral nectaries in the rachis. Exceptionally in *S. latifolia*, it was observed individuals with two or one extra-floral nectaries, which may be better investigated in future studies. The extra-floral nectaries are positioned between (or a little above) the pairs of leaflets on the adaxial side. Extra-floral nectaries are sessile or stipitate, and their shape are clavate, conical, elliptic, fusiform, globose, lanceolate or ovate.

Inflorescence and bracts.— Inflorescences are racemes or panicles axillar, terminal or cauliflorous (in *S. ruiziana*). The density of flowers proved to be useful to differentiate some species, such as the congested racemes of *S. chrysocarpa* or the laxly flowered panicle of *S. quinquangulata*.

Bracts can be caducous or persistent during the anthesis, and in addition the size and shape of bracts were also important to recognize taxa, such as the large and persistent bracts of *S. angulata* and *S. undulata*.

Flowers.— The calyx is homomorphic with the sepals equally shaped and sized (e.g. *S. acutisepala*) or heteromorphic with the sepals differentiated in size and shape (e.g. *S. georgica*). In *S. latifolia*, the sepals are yellowish-green and the outermost one surrounds more than a half of the flower bud until just before the anthesis. *S. macrophylla* can be readily recognized by its sepals with prominent and nigrescent veins. The sepal shapes are oblong, oboval, orbicular, oval or lanceolate.

In series *Bacillares*, corolla can be symmetric or asymmetric (figure 1). In asymmetric corolla, one abaxial petal is cuculated and sometimes partially involves the abaxial stamens (e.g. *S. pinheiroi*). In the symmetric corolla, the petals are equal in shape and size, sometimes just slightly differentiate in size (e.g. *S. quinquangulata*). The size of petals is also useful, with petals reaching up to 2 cm long (e.g. *S. undulata*) and longer petals that can reach 4.5 cm long (e.g. *S. splendida*).

The androecium can be divided in 3 adaxial staminodes, 4 median stamens and 3 abaxial stamens (commonly one central and two lateral). The species were grouped in species with the sets of stamens strongly differentiate in length with the abaxial stamens approximately twice longer than the median ones (e.g. *S. bahiensis*) and species with the sets of stamens of equal length, or sometimes the abaxial stamens $\frac{1}{3}$ longer or shorter than the median ones. The anthers are oblong or curved-oblong and all have a beak at the apex, which varied from truncate, erect, geniculate or curved.

We observed that the gynoecium is centrally positioned or laterally displaced (enantio styly). The style is acute or attenuated, except for the clavate style in *S. latifolia* and *S. quinquangulata* which in addition have expanded stigma easily observable. The ovary is multiovulate, mostly with more than 50 ovules.

Fruits.— Fruits are indehiscent or tardily dehiscent with follicular dehiscence, cylindrical to sub-cylindrical (except in *S. georgica*, which is laterally compressed) and the mesocarp usually pulpy. Fruits varied from short fruits not exceeding 10 cm long (e.g. *S. chrysocarpa*) to large fruits with 35–40 cm long (e.g. *S. quinquangulata*). The fruit valves are corrugated, venulose or smooth, and the color (when mature) varied from dark green, nigrescent or brown. Seeds are always transversely positioned, and in addition they are uniseriate or biseriate.

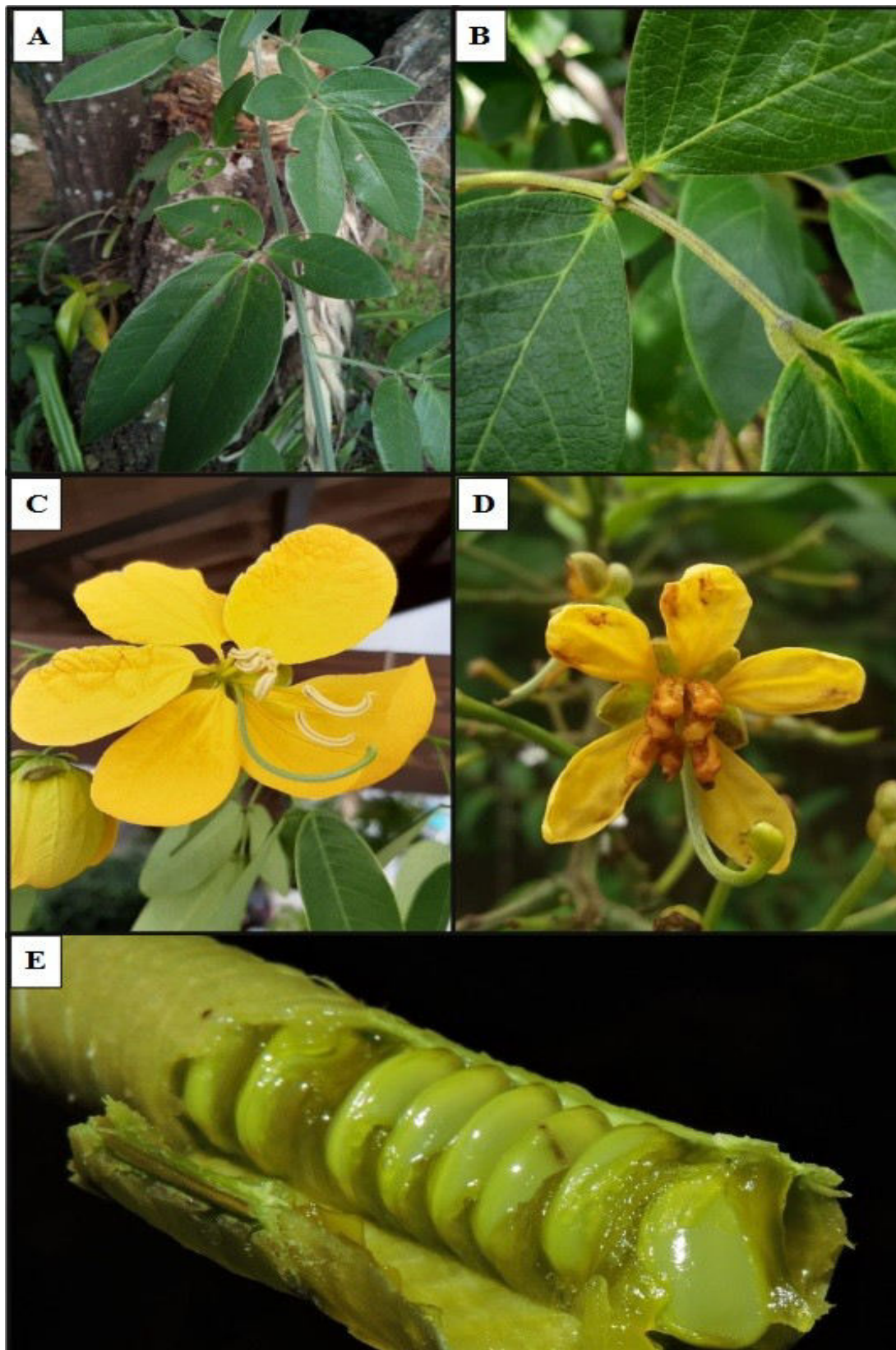


FIG. 1. **A.** Leaves. **B.** Extra-floral nectary. **C.** Asymmetric corolla and the sets of stamens strongly differentiate in length. **D.** Symmetric corolla and the sets of stamens of equal length. **E.** Fruits with seeds transversely positioned. Credits: **D.** Lukas Daneu. **E.** Rubens Queiroz.

Taxonomic Treatment

Senna sect. *Chamaefistula* ser. *Bacillares* (Benth.) H.S. Irwin & Barneby, Mem. New York Bot. Gard. 35:102, 1982. *Cassia* ser. *Bacillares* in Fl. Bras. (Martius) 15(2): 96. 1870. Type: *Senna bacillaris* (L. f.) H.S. Irwin & Barneby.

Erect or scandent **shrubs**, vines or trees. Branches cylindrical to angular. **Leaves** alternate; rachis with 1–2 extra-floral nectaries on the adaxial side, sometimes 1 nectary present on the abaxial side positioned above the distal pair of leaflets, the nectaries sessile or stipitate, clavate, elliptic, globose, conical or ovate; rachis appendix caducous or persistent; leaflets 2 pairs per leaf, lamina symmetric or asymmetric. **Inflorescence** a raceme or panicle, axillary, terminal or sometimes cauliflorous. **Flowers** with sepals usually heteromorphic, sometimes homomorphic; corolla asymmetric or zygomorphic, 1 adaxial petal commonly wider, oblong, obovate or orbicular, 2 lateral-adaxial petals oblong or obovate, 2 abaxial petals, homomorphic or 1 petal obovate and the other cuculate; androecium usually comprising 3 adaxial staminoids, 4 median stamens, and 3 abaxial stamens (commonly one central and two lateral), anthers oblong, straight or curved; gynoecium centrally positioned or laterally displaced (enantiostyly), ovary stipitate, style attenuate or clavate. **Fruits** indehiscent or tardily dehiscent, dehiscence follicular, cylindrical to sub-cylindrical (except in *Senna georgica*, which is laterally compressed), mesocarp usually pulpy. **Seeds** transversely positioned, uni or biseriate.

Key to the Brazilian species of *Senna* sect. *Chamaefistula* ser. *Bacillares*

1. Leaf rachis with two extra-floral nectaries (on the adaxial side), one between each pair of leaflets.....2
2. Sets of stamens strongly differentiated in length, abaxial stamens approximately twice the length of the adaxial ones.....3
3. Petiole shorter than the rachis; lamina coriaceous; fruit 1.3–2 cm wide.....*Senna rugosa*
- 3'. Petiole longer than the rachis; lamina membranaceous; pod 0.5–0.8 cm wide.....
.....*Senna pinheiroi*
- 2'. Sets of stamens of equal length or sometimes the abaxial stamens up to $\frac{1}{3}$ longer or shorter than the median ones.....4
4. Style clavate; stigma dilated, 1–2 mm diam.....5

5. Leaf rachis extra-floral nectaries ovate; panicle densely flowered; outer sepal rigid and yellowish, enclosing the flower bud until just before anthesis; petals 1.5–2.3 cm wide.....
.....*Senna latifolia*
- 5'. Leaf rachis extra-floral nectaries elliptic or clavate; panicle laxly flowered; outer sepal membranaceous and greenish, not enclosing the flower bud; petals 0.6–1.2 cm wide.....
.....*Senna quinquangulata*
4. Style cylindrical or attenuate; stigma not dilated, 0.4–0.8 mm diam.....6
6. Stipules oblanceolate or falcate, 10–25 x 2–5 mm; bracts 12–21 x 4–7 mm, persistent.....
.....*Senna undulata*
- 6'. Stipules setaceous to filiform, 3–10 x 0.5–1 mm; bracts 2–6 x 2 mm, caducous.....7
7. Leaf rachis slightly sulcate, 0.5–0.8 mm wide; extra-floral nectaries stipitate, clavate or elliptic, distal leaflets elliptic to narrowly elliptic, 1.5–2.5 cm wide.....*Senna rupununiensis*
- 7'. Leaf rachis strongly sulcate, 1.5–2 mm wide; extra-floral nectaries sessile, ovoid, distal leaflets obovate to broadly elliptic, 4–5 cm wide.....*Senna subtrijuga*
- 1'. Leaf rachis with only one extra-floral nectary (on the adaxial side), positioned between the proximal leaflets.....8
8. Sets of stamens of equal length or sometimes the abaxial stamens up to $\frac{1}{3}$ longer or shorter than the median ones.....9
9. Outer sepal rigid, enclosing the flower bud until just before anthesis; stigma 1.5–2 mm diam.....*Senna latifolia*
- 9'. Outer sepal membranaceous and not enclosing the flower bud; stigma 0.5–0.8 mm diam.....10
10. Leaflets symmetric.....11
11. Leaflets with cuneate base, distal leaflets 5–10 x 2–5 cm; outer sepal lanceolate with acute apex, sepal venation inconspicuous; fruit valves venulose.....*Senna acutisepala*
- 11'. Leaflets with obtuse base, distal leaflets (12–)15–40 x 7–20 cm; outer sepal oblong with obtuse apex; sepal venation conspicuous; fruit valves slightly corrugate....*Senna macrophylla*
- 10'. Leaflets asymmetric.....12
12. Inflorescence usually cauliflorous; fruits falcate to cochleate.....*Senna ruiziana*
- 12'. Inflorescence axillary or terminal; fruits straight or slightly curved.....13
13. Stipules widely ovate, foliaceous, 45–55 x 36–40 mm.....*Senna herzogii*
- 13'. Stipules filiform, setaceous, oblanceolate or falcate 4–20 x 0.5–3 mm.....14
14. Branches fractiflex (zig-zagged); distal leaflets 8–23 x 4–10 cm; extra-floral nectary conical; fruits 15–35 x 0.8–1.2 cm.....15

15. Leaflets with conspicuous tertiary venation; petals 2.2–3.2 x 1.2–2 cm; beak of abaxial anthers with one pore each.....*Senna bacillaris*
- 15'. Leaflets with inconspicuous tertiary venation; petals 1.4–2 x 0.7–1.2 cm; beak of abaxial anthers with two pores each..... *Senna affinis*
- 14'. Branches straight to slightly fractiflex; distal leaflets 2–5.5 x 1.5–3 cm; extra-floral nectary fusiform to clavate; fruits 4.5–9 x 1–1.5 cm.....16
16. Bracts 5–10 x 3–6 mm, persistent; abaxial anthers slightly longer than the median anthers; style 5–8 mm long.....*Senna rizzinii*
- 16'. Bracts 1–3 x 1–2 mm, caducous; abaxial anthers slightly shorter than median anthers; style 2–3.5 mm long.....*Senna chrysocarpa*
- 8'. Sets of stamens strongly differentiated in length, abaxial stamens approximately twice the length of the median ones.....17
17. Distal leaflets symmetric.....18
18. Petiole 0.8–1.2 cm long; leaf rachis appendix 10–13 mm long, horn-shaped.....*Senna cornigera*
- 18'. Petiole 2–6 cm long; leaf rachis appendix 2–6 mm long, setaceous, filiform or curved or sometimes glandular.....19
19. Leaflets obovate or orbicular.....20
20. Shrub or treelet, young branches nigrescent when dry; leaflets nigrescent when dry, secondary venation craspedodromous, marginal vein conspicuous; petals 2–2.5 x 1.3–2 cm....*Senna gardneri*
- 20'. Scandent shrub to high-climbing vine, young branches grey when dry; leaflets brown when dry, secondary venation brochidodromous, marginal vein inconspicuous; petals 3.3–4.5 x 2.5–3.3 cm.....*Senna bahiensis*
- 19'. Leaflets elliptic or ovate.....21
21. Distal leaflets 9–22 x 6–10 cm; fruits laterally compressed; seeds uniseriate.....*Senna georgica*
- 21'. Distal leaflets 4.5–10 x 1.5–3 cm; fruits cylindrical; seeds biseriate.....*Senna splendida*
- 17'. Distal leaflets asymmetric.....22
22. Young branches quadrangular.....23
23. Bracts sepeloid, 7–14 x 3–6 mm, persistent.....*Senna angulata*
- 23'. Bracts 2–4 x 1.5–2 mm, caducous.....*Senna tapajozensis*
- 22'. Young branches cylindrical.....24
24. Inflorescence racemose; petals 2–3 x 1–2 cm; seeds uniseriate.....*Senna tenuifolia*

24'. Inflorescence paniculate; petals 3–4.5 x 1.6–2.5 cm; seeds biseriate...*Senna macranthera*

Senna rugosa (G.Don) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 188. 1982.
Cassia rugosa G.Don, Gen. Hist. 2: 440. 1832. (Fig. 2A, B)

Distribution and habitat.—*Senna rugosa* occurs in Bolivia, Brazil and Paraguay (Irwin & Barneby, 1982; Marazzi et al., 2006b). In Brazil it can be found in the central-western (Goiás, Mato Grosso do Sul, Mato Grosso and Federal District), northern (Pará, Rondônia and Tocantins), northeastern (Bahia, Ceará, Maranhão, Pernambuco and Piauí), southeastern (Minas Gerais and São Paulo) and southern (Paraná) regions, in the Amazon Rainforest, Atlantic Forest, Caatinga, Cerrado and Pantanal domains. *S. rugosa* is a typical species of the Brazilian savannas, occurring in grasslands and wooded savanna, and also in rocky grasslands (*campos rupestres*) and occasionally at the edge of seasonal forests and riparian vegetation mostly from 500 to 1400 m a.s.l.

Phenology.—Flowering and fruiting throughout the year.

Notes.—This beautiful shrubby species is easily recognized by the petiole always shorter than the leaf rachis, the rachis with two extra-floral nectaries, leaflets with conspicuous reticulate venation, and by its large corolla with petals 3–4 cm long, and the its fruits 1.3–1.8 cm wide.

Representative specimens examined. BRAZIL. Bahia: Encruzilhada, ca. 26 km na estrada para Divinópolis, 15 Aug 2001 [fl, fr], *Carvalho, A. M. et al. 6957* (ALCB, HUEFS); Cocos, Fazenda Trijunção, Ponto 1, solo arenoso-argiloso, relevo levemente ondulado, campo sujo, 15 May 2001 [fl], *Fonseca, M. L. et al. 2668* (EAC); São Desidério, BR 020 entre Posse e Barreiras Km 50, 15 Jun 1983 [fl, fr], *Coradin, L. et al. 5696* (NY); Caetité, 1.5 km S of Brejinhos das Ametistas, *Harley, R. M. 21242* (NY); Lençóis, vicinity of Lençóis, 2-5 Km N of Lençóis, on trail to Barro Branco, 11 Jun 1981 [fl], *Mori, S. A. & Boom, B. M. 14321* (NY); Seabra, ca. 3km S de Lagoa do Chure, 22 Jun 1993 [fl, fr], *Queiroz, L. P. et al. 3364* (MBM); Piatã, Chapada Diamantina, Três Morros, 19 Sep 2004 [fr], *Guedes, M. L. et al. 11349* (ALCB); Senhor do Bonfim, serra de Santana, 12 Jul 2005 [fl], *Cardoso, D. et al. 678* (HUEFS). **Ceará:** Crato, chapada do Araripe, 15 Feb 1985 [fl], *Gentry, A. H. et al. 50159*

(NY); Barbalha, FLONA do Araripe, 02 Aug 2000 [fr], Costa, I. R. & Lima-Verde, L. W. 42 (EAC); Viçosa do Ceará, caminho para Vambira, 16 Sep 1988 [fl,fr], *Fernandes, A. Et al. 15673* (EAC); **Federal District:** Brasília, Parque Nacional do Gama, 25 May 1965 [fl], *Sucre, D. 302* (NY); Brasília, Parque Nacional de Brasília, cascalheira em frente ao Centro de Visitantes, 10 Apr 2016 [fl], *Martin, C. R. 2115* (CEN). **Goiás:** Aporé, próximo GO 260, Sep 2018 [fl], *Souza, L. F. 5849* (HJ); Rio Verde, c. 8 km S.W. of town, 13 Jan 1968 [fl], *Philcox, D. 3979* (NY); Piranhas, Ca. 70 km SE of Aragarças, road to Piranhas, 23 Jun 1966 [fr], *Irwin, H. S. 17659* (NY); Caldas Novas, Parque Estadual da Serra de Caldas Novas, 30 Jul 2008 [fr], *Moura, T. M. et al. 343* (CEN, UEG); Cristalina, 35 km by road E of Cristalina, 06 Apr 1973 [fl], *Anderson, W. R. 8300* (NY); Pirenópolis, 20 km N.W. of Corumbá de Goiás, near Pico dos Pirineus, 26 Jan 1968 [fl], *Irwin, H. S. et al. 19218* (NY); Alto Paraíso de Goiás, Chapada dos Veadeiros, 10 Feb 1966 [fl, fr], *Irwin, H. S. et al. 12463* (NY). **Maranhão:** São João dos Patos, BR 230, estrada para Barão do Grajaú, 19 Apr 1980 [fl], *Fernandes, A. & Nunes, E. s.n.* (EAC); Porto Franco, BR010, 11 Dec 1979 [fl], *Nunes, E. & Martins, P. s.n.* (HUEFS). **Mato Grosso:** Chapada dos Guimarães, 30 Jan 1989 [fl], *Figueiredo, M. A. s.n.* (EAC); Diamantino, Chapada dos Parecis, 12 May 1995 [fl], *Hatschbach, G. et al. 62671* (MBM); Serra do Roncador, N of Xavantina, 04 Jun 1966 [fl, fr], *Irwin, H. S. et al. 16575* (NY). **Mato Grosso do Sul:** Bataguacú, near highway BR 257, ca. 58 km W of São Paulo, 06 Feb 1975 [fl], *Anderson, W. R. 11203* (NY). Campo Grande, rio Anhandui, 12 Jul 1969 [fl], *Hatschbach, G. & Guimarães, O. 22151* (NY). **Minas Gerais:** Aiuruoca, à beira de mata, 13 Mar 1989 [fl], *Krieger, L. & Brugger, M. 24487* (MBM). São Tomé das Letras, 17 Mar 2012 [fl], *Escobar, N. A. G. & Reno, I. P. 128* (UEC); Belo Horizonte, parque da Serra do Curral, trilha ecológica na crista da serra, 1409 m altitude, 25 Apr 2018 [fl], *Lopes, A. D. C. 201* (BHCB); São João Batista do Glória, Serra da Canastra, 15 Nov 2011 [fr], *Costa, M. F. B. et al. 50* (UEC); Uberlândia, 23 km W de Uberlândia on road to Tupaciguara, 1 Feb 1959 [fl], *Irwin, H. S. 2529* (NY); Curvelo, 3 Jun 1999 [fr], *Tameirão-Neto, E. 3029* (MBM); Diamantina, ca. 18 km by road SW of Diamantina on road to Curvelo, Serra do Espinhaço, 10 Apr 1973 [fl, fr], *Anderson, W. R. 8475* (NY); Rio Pardo de Minas, campo rupestre, 23 May 2005 [fl, fr], *Sevilha, A. C. et al. 4343* (CEN). **Pará:** Serra do Cachimbo, BR 163, 22 Feb 1977 [fl], *Kirkbride, J. H. & Lleras, E. 2983* (INPA, NY, US); **Paraná:** Sengés, cerrado, 28 Feb 2007 [fl], *Barbosa, E. & Silva, J. M. 2120* (HUFU); Jaguariaíva, 29 Dec 1992 [fl], *Cervi, A. C. 4027* (MBM); Campo Mourão, estrada do aeroporto, 3 Feb 1962 [fl], *Hatschbach, G. 8857* (MBM). **Pernambuco:** Serra do Araripe, 30 Jul 1997 [fl], *Thomas, W. W. et al. 11675* (MBM). **Piauí:** Currais, 5 Jul 2017 [fl], *Viana, G.*

45 (UB); Bom Jesus, Serra do Uruçuí, 5 Jun 1998 [fl], *Fernandes, A. & Nunes, E. s.n.* (EAC).
Rondônia: Colorado do Oeste, estrada para Colorado do Oeste, km 25, 07 Jun 1984 [fl, fr],
Cid, C. A. et al. 4322 (NY); Vilhena, cerrado na beira da BR-364, 07 Dec 2013 [fl], *Bígio, N. C. et al. 1272* (RON) **São Paulo:** Porto Ferreira, Parque Estadual de Porto Ferreira, trilha da
 borda do parque paralela à estrada, 20 May 2010 [fl], *Oliveira, A. P. C. & Osasco, M. 73*
 (UEC); Votuporanga, 19 Jun 1964 [fl], *Pires, J. M. 57920* (NY); Itirapina, Reserva do
 Instituto Florestal, 14 Feb 1989 [fl], *Queiroz, L. P. et al. 2283* (HUEFS, MBM); Botucatu, 18
 Km N of Botucatu (14 km E of Sao Manuel); Along the S. Manuel-Piracicaba highway. Near
 ex-RR Station, "13 de Maio", 16 Apr 1970 [fl, fr], *Silberbauer, I. S. 106* (NY); Assis, Estação
 Experimental do Instituto Florestal, 18 Feb 1988 [fl], *Leitão-Filho, H. F. et al. 20087* (CEN,
 UEC); São José dos Campos, córrego da ressaca, 21 Mar 1962 [fl], *Mimura, I. 320* (US);
 Jundiaí, Parque do Cerrado, 21 Dec 2016 [fl, fr], *Silva, B. G. & Pires, T. P. 342* (UEC);
 Caieiras, 2 Mar 1945 [fl], *Hoehne, W. s.n.* (MBM); Itararé, estrada Estrada Itararé - Itapeva,
 próximo a ponte do Rio Verde, 18 Aug 1995 [fr], *Souza, V. C. et al. 8749* (ESA, LUSC).
Tocantins: Mateiros, Parque Estadual do Jalapão, margens da TO-110, 1 Jul 2014 [fl, fr],
Lombardi, J. A. 10302 et al. (HRCB, HUEFS); Palmas, sub-bacia do Ribeirão São João 19 Jun
 2006 [fl], *Santos, E. R. & Pereira, C. B. 346* (HUTO); Piraquê, cerrado, Apr 2007 [fl], *Lima,
 J. E. G. 41* (HUTO).

Senna pinheiroi H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 180–181. 1982. (Fig. 2C, D)

Distribution and habitat.—*Senna pinheiroi* is restricted to northeastern (Alagoas, Bahia, Paraíba, Pernambuco and Sergipe) and southeastern (Rio de Janeiro) Brazil, in the Atlantic Forest and Caatinga domains. The locality data of *O. Machado s.n.* (RB) — which refers to *restinga* vegetation of Tijuca in the municipality of Rio de Janeiro — is somewhat doubtful since no other individuals were found in Rio de Janeiro state nor in neighbouring Espírito Santo during our field expeditions and any herbarium studies. This species occurs in disturbed areas, at the edge of ombrophilous forests, in seasonal forests, *restingas*, *brejos de altitude* and rocky outcrops, mostly below 700 m a.s.l.

Phenology.—Flowering from February to August and fruiting from June to March.

Notes.—*Senna pinheiroi* is a shrub characterized by its leaf rachis with two extra-floral nectaries, its leaflets glossy on their adaxial surface, the reticulate leaflet venation, the

large asymmetric corolla, petals 3–3.5 cm long, and the abaxial stamens approximately twice the length of the median stamens.

Representative specimens examined. BRAZIL. Alagoas. Maceió, APA de Catolé e Fernão Velho, 15 Apr 2009 [fl], *Rodrigues, M. N. & Caju, M. V.* 2503 (MAC); Maceió, parque municipal de Maceió, 27 Jul 2009 [fr], *Chagas-Mota, E. & Gonçalves, E.*, 4418 (MAC) Murici, Poço D'Anta, ca. 16–19 km NW of Murici by road. Mata de Murici, 14 May 2001 [fl], *Thomas, W. W. et al.* 12424 (RB); Satuba, 6 Aug 2004 [fr], *Barbosa, E.*, 58 (MAC) **Bahia:** Entre Rios, Fazenda Rio do Negro. Residual stands of the Atlantic Forest of the Rio do Negro valley, 27 Apr 2011 [fl], *Popovkin, A. V. & Mendes* 862 (HUEFS); Entre Rios, Fazenda Rio do Negro. Residual stands of the Atlantic Forest of the Rio do Negro valley, 27 May 2008 [fl], *Popovkin, A. V.* 281 (HUEFS); Entre Rios, Fazenda Rio do Negro. Residual stands of the Atlantic Forest of the Rio do Negro valley, 21 Apr 2009 [fl], *Popovkin, A. V.* 563 (HUEFS); Marau, 6 May 1966 [fl], *Belém, R. P. & Pinheiro, R. S.* 2091 (NY); Itacaré, Ubaitaba, capoeira, 14 Apr 1970 [fl], *Santos, T. S.* 687 (CEPEC, NY). **Paraíba:** João Pessoa, campus UFPB, 27 Mar 1979 [fl, fr], *Agra, M. F. s.n.* (EAC); Mataraca, millennium inorganic chemicals mineração Ltda: substrato areno-argiloso, mata de restinga, 20 Oct 2011 [fl], *Gadelha-Neto, P. C. et al.* 3092 (JPB, NY, RB); Rio Tinto, fragmento PB 114, floresta estacional semidecidual das terras baixas, 29 Mar 2012 [fl], *Gadelha-Neto, P. C.* 3250 (HUEFS, JPB, NY, RB); Conde, área de preservação permanente da Tambaba, mata da chica, 28 May 2010 [fl], *Araújo, A. A. M. et al.* 272 (JPB, RB). **Pernambuco:** Maraiial, Serra do Urubu, 19 Apr 1994 [fl], *Miranda, A. M. & Félix, L. P.* 1511 (ALCB, RB); Gravatá, engenho jussara, mata benedito, 7 Jul 2010 [fl], *Silva, L. R.* 288 (RB); Igarassu, borda da mata, 3 May 2002 [fl], *Oliveira, A. & Silva, A. G.* 8 (NY). **Rio de Janeiro:** Rio de Janeiro, restinga da Tijuca, bosque húmido, 23 Apr 1944 [fl], *Machado, O. s.n.* (RB). **Sergipe:** Santa Luzia do Itanhi, Entrada 2 km à esquerda na estrada Sta.Luzia/Crasto, 14 Jun 1994 [fr], *Jomar, J. G. et al.* 471 (CEPEC, NY); Pirambu, tabuleiro arenoso, 3 Apr 1984 [fl], *Viana, G.* 924 (ASE, CEN); Areia Branca, borda da trilha para os riachos que cortam a entrada, PARNA Serra da Itabaiana, 20 Apr 2008 [fl], *Alves-Araújo, A. et al.* 943 (ASE).

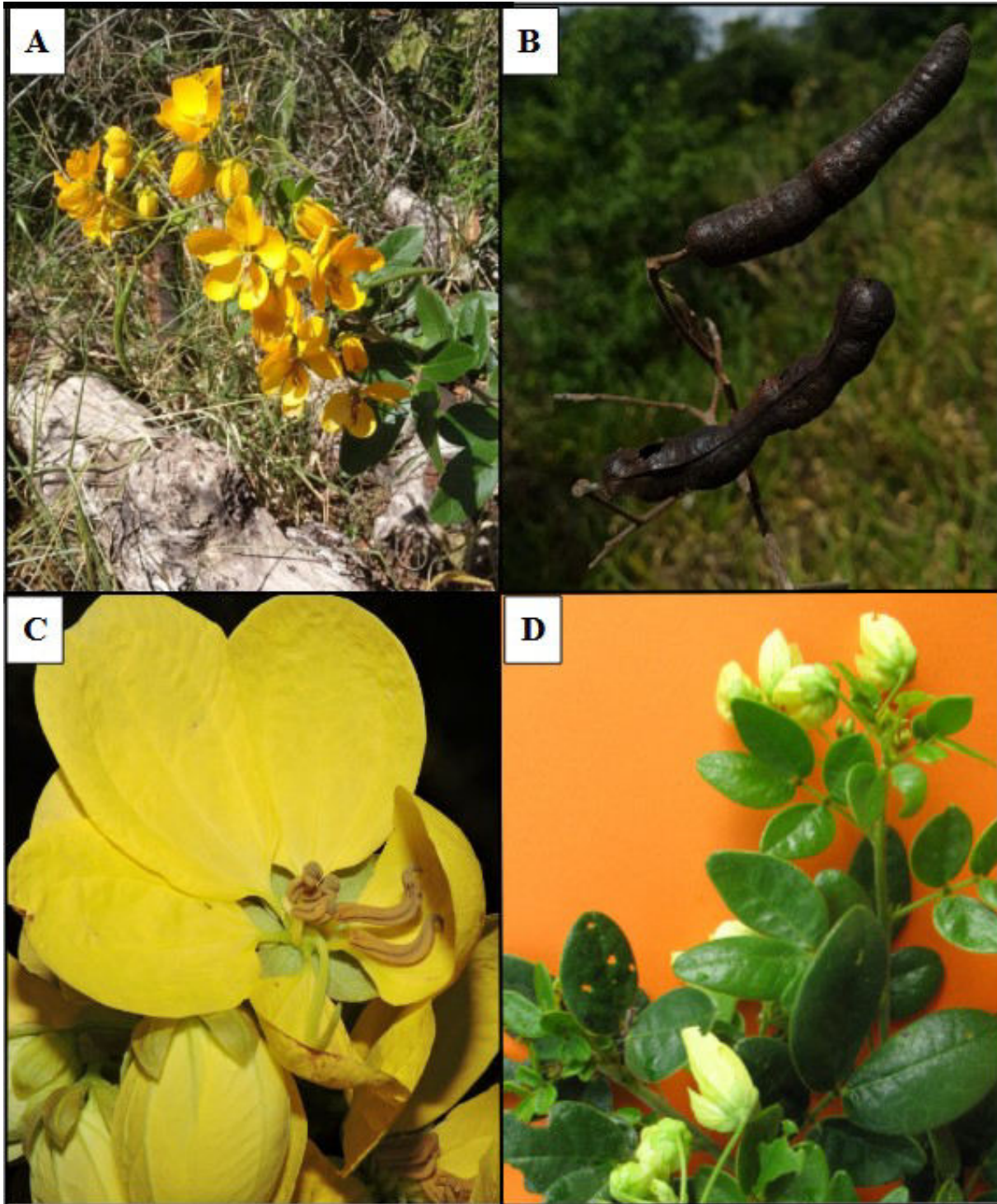


FIG. 2. A–B. *Senna rugosa* (habit and fruits). C–D. *Senna pinheiroi* (flower and flowering branches). Credits: C. Rubens Queiroz. D. Alex Popovkin.

Senna latifolia (G.Mey.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 143. 1982.
Cassia latifolia G. Mey. Prim. Fl. Esseq. 166. 1818. (Fig. 4C, D)

Distribution and habitat.—*Senna latifolia* is widespread in South America, occurring in the Amazon and Andean forests in Bolívia, Brazil, Colombia, French Guiana, Guyana, Peru, Suriname and Venezuela (Irwin & Barneby, 1982). In Brazil, it has been collected in the central-western (Mato Grosso), northeastern (Maranhão) and northern (Acre, Amazonas, Amapá, Pará, Rondônia, Roraima and Tocantins) regions, in the Amazon Rainforest and Cerrado domains. It grows on clay, sandy and rocky soils at the edge of ombrophilous forests, riparian forests, *terra firme* forests, *igapó* forests, Amazonian savannas and disturbed areas, mostly below 600 m a.s.l.

Phenology.— Flowering from October to July and fruiting from February to August.

Notes.—*Senna latifolia* is readily recognized by its broadly obovate to oblanceolate stipules (these sometimes narrowly falcate), its coriaceous leaflets, glossy on the adaxial surface, its rigid and yellowish sepals, a zygomorphic corolla, the sets of stamens of almost equal in length, a dilated stigma 12–18 mm in diam., and its fruits with venulose valves.

Representative specimens examined. BRAZIL. Acre. Rio Branco, Parque Zoobotânico, 24 Apr 1992 [fl], *Claros, G. 58* (INPA); Sena Madureira, rio Macauã, colônia Bom Futuro, 30 Mar 1994 [fl], *Lima, L. A. et al. 537* (NY); Mâncio Lima, Parque Nacional da Serra do Divisor, Serra do Moa, eastern piedmont, 6 May 1996 [fl], *Daly, D. C. et al. s.n.* (NY). **Amazonas:** Manaus-Porto Velho highway km 124, open roadside, 21 Mar 1974 [fl], *Campbell, D. G. Et al. s.n.* (NY); Careiro da Várzea, BR-319, sentido Porto Velho, a ca. 30 Km entra a esquerda antes de um posto de gasolina e segue até ca. 9 Km sentido lago Santa Maria de Purupuru, 25 Apr 2010 [fl], *Cardoso, D. et al. 2878* (HUEFS); Presidente Figueiredo, vila de Balbina, 4 Jan 2006 [fr], *Silva, J. A. C. 1199* (INPA); Esperança, 27 Jan 1942 [fl], *Ducke, A. 891* (NY). **Amapá:** Mazagão, rio Jarí, margem esquerda, morro do Felipe V, 21 Feb 1986 [fl], *Pires, M. J. P. Et al. 791* (INPA, NY); Rio Matapi, entre a estrada do Matapi e do rio, 4 Mar 1983 [fl], *Rabelo, B. V. 1847* (NY); Macapá, estrada da fazendinha, ramal do gruta, 15 Feb 1984 [fl], *Rabelo, B. V. 2524* (NY). **Maranhão:** Imperatriz, campestre, 28 Mar 1976 [fl], *Hatschbach, G. et al. 38467* (MBM); Grajaú, rodovia a 6 km da cidade de Grajaú, 21 Apr 1983 [fl], *Silva, M. F. F. et al. 1150* (NY); São Benedito do Rio

Preto, 2 Jun 1979 [fl, fr], *Castro, A. J. & Nunes, E. s.n.* (EAC). **Mato Grosso:** São Félix do Araguaia, beira do rio, localmente chamado de “riozinho” (paralelo ao rio das Mortes), 17 Mar 1997 [fl], *Souza, V. C. et al. 14355* (ESA, UEC, UFG, UB, SPF); Santa Cruz do Xingu, Parque Estadual do Xingu, limite norte do parque, 3 Mar 2011 [fl, fr], *Soares, C. R. A. et al. 3149* (RB, HUEFS). **Pará:** Conceição do Araguaia, ca. 20 km W of redenção, near correço são João and troncamento Santa Teresa, 12 Feb 1980 [fl,fr], *Plowman, T. C. et al. 8735* (NY, US); Serra dos Carajás, “azul”, near camp at serra norte, 8 Dec 1981 [fl], *Daly, D. C. et al. 1799* (NY); Belém, 8 Feb 1964 [fl], *Silva, N. T. s.n.* (NY); Belém, IPEAN, 30 Mar 1967 [fl, fr], *Pires, J. M. & Silva, N. T. 10509* (NY); Vigia, along highway PA-140, 29 Mar 1980 [fl], *Davidse, G. 17535* (NY); Itaituba, Parque Nacional da Amazônia, beira da BR-230, 17 May 2011 [fr], *Pinto, R. B. & Mansano, V. F. 219* (IAN, NY, MG, RB); Porto Trombetas, mineração rio do Norte, 1990 [fl], *Soares, E. 769* (INPA); Parque Indígena do Tumucumaque, rio Parú d’Oeste, missão Tiriyo, 20 Feb 1970 [fl], *Cavalcante, P. B. 2455* (NY). **Rondônia:** Porto Velho, ramal acesso garimpo, mata de igapó entre campina e campinarana e floresta ombrófila aberta, 8 May 2013 [fl], *Bigio, N. C. et al. 884* (CEN, NY, RB, RON). **Roraima:** Mucajaí, along Mucajaí – Caracá road (BR-174), 8 Nov 1977 [fl], *Coradin, L. 1022* (CEN, NY); Pacaraima, BR-174, sentido Boa Vista- Pacaraima, Serra de Pacaraima, 18 Apr 2010 [fl,fr], *Cardoso, D. & Moura, T. M. 2850* (HUEFS). **Tocantins:** Pindorama do Tocantins, bacia do Tocantins, sub-bacia rio Balsas, estrada de terra para Natividade, 16 Oct 2008 [fr], *Guimarães, L. L. et al. s.n.* (EAC); Araguaína, ca. 2 km N of Araguaína, 13 Mar 1968 [fl], *Irwin, H. S. et al. 21141* (NY); Ananas, acampamento de ENGEVIX, próximo ao aeroporto, 15 Apr 2004 [fl], *Pereira-Silva, G. et al. 8612* (CEN).

Senna quinquangulata (Rich.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 153. 1982. *Cassia quinquangulata* Rich., Actes Soc. Hist. Nat. Paris 108. 1972. (Fig. 3A, B).

Distribution and habitat.—*Senna quinquangulata* is widespread from Mexico to Brazil (Irwin & Barneby, 1982). In Brazil, it occurs in the central-western (Mato Grosso), in the northern (Acre, Amapá, Amazonas, Pará, Rondônia and Roraima) and in the northeastern (Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco and Sergipe) regions, in the Amazonian, Caatinga, Cerrado and Atlantic Forest domains. It occurs at the edge of ombrophilous forests, seasonal forests, Amazonian savannas, *mata de igapó*, *cangas*, *brejos de altitude*, coastal forests, riparian forests and disturbed areas, from sea level up to 1200 m a.s.l.

Phenology.— Flowering and fruiting throughout the year.

Notes.—Irwin & Barneby (1982) recognized two varieties of *Senna quinquangulata*. Only *S. quinquangulata* var. *quinquangulata* is found in Brazil; it is morphologically characterized by a leaf rachis with two extra-floral nectaries, its asymmetrical leaflets with a lustrous adaxial surface, a laxly flowered panicle, a zygomorphic corolla, its petals 0.6–1.2 cm wide, a dilated stigma 12–20 mm diam., and fruits 10–23 cm long with venulose valves.

Representative specimens examined. BRAZIL. Acre. Rio Branco, área do Parque Zoobotânico da UFAC, trilhas próximo ao Herbário, 19 May 1991 [fl], *Cid, C. A. et al. 10109* (NY); Reserva extrativista do Alto Juruá, in the vicinity of Igarapé Caipora, 19 Jul 1992 [fr], *Ming, L. C. 321* (NY) **Alagoas:** Pilar, mata do Lamarão, 18 Jul 2006 [fl, fr], *Amaral, C. & Santos, E. 75* (ASE); Murici, serra do ouro, caminho para a estação da embratel, 15 Mar 2002 [fl], *Lemos, R. P. et al. 6295* (ALCB, MAC, NY); São Luis do Quitunde, local de coleta castanha grande, 10 Apr 1980 [fl], *Lyra, R. P. 240* (MAC, RB) **Amapá:** Mazagão, médio do rio Maracá, 16 May 1983 [fr], *Rabelo, B. V. et al. 2245* (NY); Oiapoque, river banks between Oiapoque and Santo Antonio, 26 Jul 1980 [fl], *Irwin, H. S. et al. 47157* (IAN, NY); Rio Oiapoque, about 0.5 km W of Cachoeira Utussansain, 8 Sep 1960 [fl], *Irwin, H. S. et al. 48092* (IAN, NY). **Amazonas:** Paraná do Autaz-Mirim, lago do Caióé, 26 Aug 1973 [fl, fr], *Berg, C. C. et al. 19770* (INPA, NY); Manaus, estrada do Aleixo km 3, sede do INPA, 4 Nov 1975 [fl], *Silva, M. F. 1830* (INPA); Careiro Castanho, propriedade Bom Futuro, lote 159, vicinal 2 da BR 319, Aug 2004 [fl, fr], *Bacelar-Lima, C. G. et al. 30* (INPA); Manaus, Ponta Negra, igarapé da cachoeira alta, 11 Jan 1961 [fl], *Rodrigues, W. & Chagas, J. 2078* (INPA); Manaus, Reserva Florestal Adolpho Ducke, 15 May 1997 [fl], *Martins, L. H. P. et al. 3* (INPA, RB); São Gabriel da Cachoeira, estrada BR-307, 19 Jul 1979 [fl], *Maia, L. A. et al. 757* (INPA). **Bahia:** Úna, Reserva Biológica do Mico-Leão (IBAMA), entrada no km 46 da BA-001 Ilhéus/Úna, 9 May 1998 [fl, fr], *Amorim, A. M. et al. 2410* (CEPEC, NY); Valença, estrada para Orobó, 10 Jan 1982 [fl], *Lewis, G. P. & Carvalho, A. M. 1071* (MBM, NY); Salvador, ilha dos Frades, ponta de Nossa Senhora, 16 Jul 2012 [fl], *Queiroz, E. P. et al. 5374* (ALCB); Rio Real, litoral Norte, vale do rio Itapicurú, Aug 1950 [fl], *Pinto, G. C. P. s.n.* (ALCB) **Ceará:** Aratuba, sítio Pau Cardoso, substrato arenoso, 14 May 1980 [fl], *Nunes, E & Martins, P. s.n.* (EAC); Guaramiranga, Pacoti, 27 Jul 1991 [fl, fr], *Nunes, E. et al. s.n.* (EAC); Maranguape, topo da serra, 28 Jun 1981 [fl, fr], *Nunes, E. & Martins, P. s.n.* (EAC). **Maranhão:** Turiaçu, km 6 da BR-106, fazenda Maracaçumé Agro Industrial, 1 Dec 1978 [fr],

Rosa, N. A. & Vilar, H. 2820 (NY); **Mato Grosso:** Itaúba, resgate de Flora da UHE Colíder, lote D de supressão, 05 May 2015 [fl], Santos, R. C. et al. 217 (RB); Matupá, localidade BR-080, agropecuária Cachimbo, fazenda São José, 25 Apr 1997 [fl], Souza, V. C. Et al. 15681 (ESA, UEC). **Pará:** Santarém-Cuiabá highway, km 812 along BR-163, 21 Feb 1977 [fl], Kirkbride, J. H. & Llera, E. 2959 (NY); Marabá, Serra dos Carajás, 30 Mar 1977 [fl, fr], Silva, M. G. Bahia, R. 2948 (NY); Acará, Thomé Assú, água branca, 21 Jul 1931 [fl], Mexia, Y. 5950 (NY, US); Porto Trombetas, aeroporto, 5 Oct 1987 [fl], Knowles, O. H. s.n. (INPA); Itaituba, estrada Santarém-Cuiabá, BR-163, km 1007 a 1012, 15 May 1983 [fl], Silva, M. N. F. 350 (NY). **Paraíba:** Areia, Escola de Agronomia do Nordeste, 10 May 1953 [fl], Moraes, J. C. 883 (NY); Rio Tinto, fragmento Pb 114, 29 Mar 2012 [fl, fr], Gadelha-Neto, P. C. 3249 (JPB, RB); João Pessoa, jardim botânico Benjamim Maranhão, 11 Aug 2008 [fl], Filardi, F. L. R. et al. 894 (JPB, RB). **Pernambuco:** Jaqueira, usina Frei Caneca, borda da Mata do Monteiro, 1 Jun 2011 [fl, fr], Correia, D. S. et al. 131 (NY); Caruaru, distrito de Murici, brejo dos cavalos, 28 Feb 1996 [fl], Pimentel, D. S. & Amador, M. B. 25 (NY); Recife, mata de Dois Irmãos, 20 Feb 1990 [fl], Guedes, M. L. et al. 2316 (ALCB). **Rondônia:** Jaciparaná, island in rio Madeira at mouth of rio Jaciparaná, 29 Jun 1968 [fl], Prance, G. T. et al. 5346 (NY). **Roraima:** Mucajaí, rio Mucajaí, Mar 1971 [fl], Prance, G. T. et al. 11185 (INPA, NY) ; Serra dos surucucus, NE of Mission station, 17 Feb 1969 [fl], Prance, G. T. et al. 10005 **Sergipe:** Capela, próximo à nascente do rio Siriri, 24 Mar 1995 [fl, fr], Landim, M. 255 (HUEFS).

Senna undulata (Benth.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 157. 1982.
Cassia undulata Benth., J. Bot. (Hooker). 2: 76. 1840. (Fig. 3C, D)

Distribution and habitat.—*Senna undulata* occurs from southern Mexico to northern Brazil (Irwin & Barneby, 1982). In Brazil, it has been recorded from the states of Amapá, Amazonas, Pará and Roraima in the Amazon Rainforest domain. It can be found growing at the edge of *terra firme* forests, *igapó* forests, coastal forests, Amazonian savannas and disturbed areas, mostly below 500 m a.s.l.

Phenology.— Flowering throughout the year and collected in fruit in February

Notes.—*Senna undulata* is readily recognized by the its oblanceolate and falcate stipules, its leaf rachis with two extra-floral nectaries, an acute to acuminate leaflet apex, and

persistent sepaloid bracts. It's morphologically similar to *S. quinquangulata* and sometimes difficult to be distinguished from it. This complex will be better addressed in our future studies.

Representative specimens examined. BRAZIL. Amapá. Savanna, road to Amapa, km 48, Macapá, 7 Jul 1962 [fl], *Pires, J. M. & Cavalcante, P. B.* 51981 (NY, SP, US); Coastal Region. Road to Amapá, km 110, 20 Jul 1962 [fl], *Pires, J. M. & Cavalcante, P. B.* 52227 (NY). **Pará:** Ilha do Mosqueiro, 3 Nov 1929 [fl], Killip, E. P. & Smith, A. C. 30493 (NY); Região do Rio Jarí, serrinha entre M. Dourado e Planalto A, 12 Sep 1968 [fl], *Silva, N. T.* 963 (NY); **Roraima:** Caracaraí, estrada Manaus-Caracaraí (BR-174/210) entre Km 530 e 540, 27 Aug 1987 [fl], *Ferreira, C. A. C. et al.* 9258 (NY); Caracaraí, BR-174, Manaus-Venezuela Highway, estrada Manaus-Boa Vista, 52 km N of Caracaraí, 4 Dec 1977 [fl], *Steward, W. C. et al.* 259 (INPA, NY); Estrada Boa Vista-Caracaraí, margem da estrada, 15 Feb 1977 [fr], *Rosa, N. A. & Cordeiro, M. R.* 1508 (INPA, NY); Boca da Mata, base of Serra Tepequem, 11 Feb 1967 [fl], *Prance, G. T. et al.* 4330 (INPA, NY).

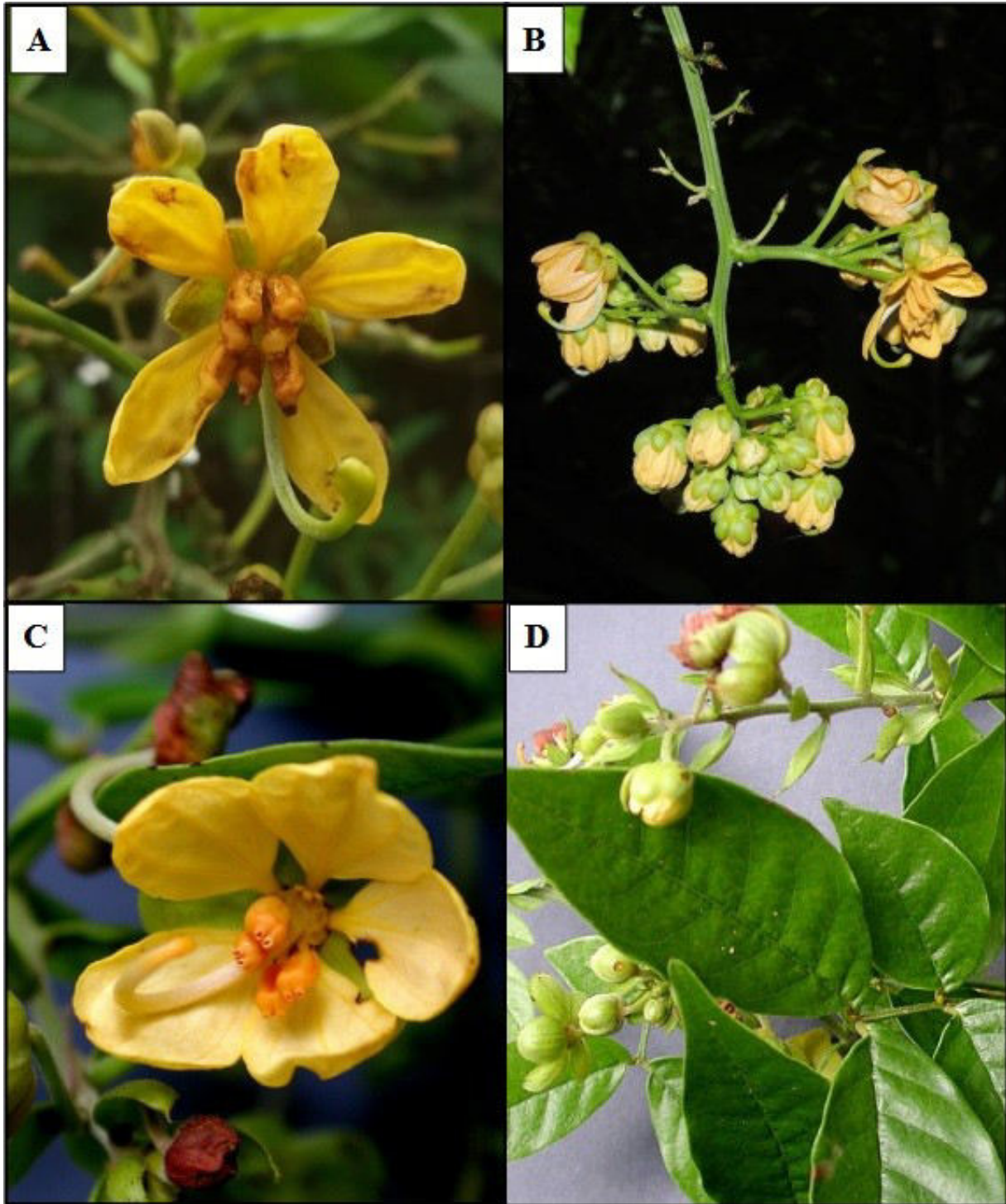


FIG. 3. A–B. *Senna quinquangulata* (flower and inflorescence). C–D. *Senna undulata* (flower and flowering branches). Credits: A. Lukas Daneu. B. Rubens Queiroz. C–D W. John Hayden, University of Richmond.

Senna rupununiensis H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 166–167. 1982.

Distribution and habitat.—Occurring in Brazil and Guyana. In Brazil the species is known from only a few collections from the state of Roraima, in Amazon rainforest. It grows on sandy or clayey soils at the edge of riparian forests and Amazonian savannas, mostly below 400 m a.s.l.

Phenology.—In Brazil the species has been collected in flower in July and August. Additionally, specimens with fruits were collected in Guyana in November.

Notes.—*Senna rupununiensis* can be recognized by its leaf rachis with two extra-floral nectaries, its leaflets with reticulate veins, prominent on the adaxial surface, fruits with slightly venulose valves and a thickened margin.

Representative specimens examined. BRAZIL. Roraima. Boa Vista, estrada para a Colônia do Apiauí, 7 Aug 1986 [fl], *Silva, J. A. et al.* 675 (INPA, NY); Boa Vista, Rio Branco, Jul 1913 [fl] *Kuhlmann, J. G.* 3232 (NY); Mucajaí, margem do rio Mucajaí. 6 Aug 1986 [fl], *Silva, E. L. S.* 749 (NY, US).

Additional specimens examined. GUYANA. Basin of Rupununi River, near mouth of Charwair Creek, 1 Nov 1937 [fl, fr], *Smith, A. C.* 2358 (holotype: NY; isotype: US).

Senna subtrijuga H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 141–143. 1982.

Distribution and habitat.—*Senna subtrijuga* is endemic to the Atlantic Forest of southern Bahia, and known only by two collections. This rare species is a climber occurring in ombrophilous forest and reaching the forest canopy, near 100 m a.s.l.

Phenology.— Collected in flower in February and March.

Notes.—*Senna subtrijuga* can be recognized by its strongly sulcate leaf rachis, with two extra-floral nectaries, its symmetric leaflets with a cuneate to obtuse base, the rigid outermost sepal, and the sets of stamens of equal length or with the abaxial ones just a little

longer. Only two collections of this rare species are known and more field collecting efforts are required. Fruits are currently unknown.

Representative specimens examined. BRAZIL. Bahia. Santa Cruz Cabrália, mata costeira, 8 Mar 1967 [fl], *Belém, R. P. & Pinheiro, R. S. 3312* (holotype: CEPEC; isotype: IAN, GH, NY, RB); Porto Seguro, Estação Pau-Brasil, 14 Mar 2014 [fl], *Neves, D. M. et al. 1751* (CEN, HUEFS, RB).

Senna acutisepala (Benth.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 140. 1982. *Cassia acutisepala* Benth., Fl. Bras. 15(2): 97. 1870.

Distribution and habitat.—*Senna acutisepala* is restricted to Brazil, occurring in the states of Bahia and Pernambuco (and likely also in the states of Alagoas and Sergipe) in the Caatinga, Cerrado and Atlantic Forest domains. In the protologue of *S. acutisepala*, Bentham (1870) mentioned the locality “prov. Espiritu Santo silvis”, but according to Irwin & Barneby (1982) the occurrence of this taxon in the forests of Espírito Santo state remains doubtful. In the present study, no collections of this species were found in Espírito Santo. *Senna acutisepala* occurs at the edges of the coastal ombrophilous forests, *matas de cipó*, *brejos de altitude* and in disturbed areas, mostly from 100 to 1100 m a.s.l.

Phenology.— Flowering from March to July and fruiting in April and October.

Notes.—*Senna acutisepala* is a rare species, morphologically characterized by the symmetrical leaflets with a cuneate base, the clavate extra-floral nectary, the lanceolate sepals with an acute apex, and fruits with slightly venulose valves.

Representative specimens examined. BRAZIL. Bahia. Estrada para Bonito, 32 km até entrada para Alto da MR, à esquerda mais 4 km., Morro do Chapéu, 18 Jun 2011 [fl], *Melo, E. 10044* (HUEFS); Mun. Bonito, Estrada para Bonito., Bonito, Brasil, 6 Mar 1997 [fl] *Gasson, P. et al. 6098* (HUEFS, K); Saída de Santo Amaro ao entrocamento de Valença, Rod. BR 101, 7 May 1969 [fl], *Jesus, J. A. 345* (CEPEC, NY, RB); Senhor do Bonfim, Serra de Sant’Ana, campo de altitude, bioma caatinga, área de tensão ecológica, 27 Mar 2011 [fl], *Schwartsburd, P. B. 2425* (HUEFS); Morro do Chapéu, Fazenda Guariba, Bacia do Salitre, cerrado, 12 Oct 2007 [fr], *Melo, E. & Marques-Silva, B. 5195* (HUEFS); Mun. Maracás, Rod.

BA 250, Faz. dos Pássaros a 24 km a E de Maracás, 4 May 1979 [fl], *Mori, S. A. & Santos, T. S. 11783* (CEPEC, K, NY, RB); Mun. Itaberaba, Serra do Orobó, Fazenda Gameleira., 23 Apr 2006 [fr], *Cardoso, D. 1270* (HUEFS, NY); Jacobina, 1850 [fl], *Blanchet 3668* (MO, US). **Pernambuco:** Mun. Jataúba, Fazenda Balame, Brejo de altitude, 26 Jul 1995 [fl], *Moura, F. 225* (EAC).

Senna macrophylla (Kunth) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 137. 1982. *Cassia macrophylla* Kunth, Mimoses 126. 1823.

Senna macrophylla var. *gigantifolia* (Britton & Killip) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 139. 1982. *Chamaefistula gigantifolia* Britton & Killip, Ann. New York Acad. Sci. 35(3): 171–172. 1936.

Distribution and habitat.—*Senna macrophylla* is widespread in Brazil, Ecuador, Colombia, Panama, Peru and Venezuela (Irwin & Barneby, 1982). In Brazil, it occurs in the states of Acre, Amazonas, Rondônia, Roraima and likely in Mato Grosso (on its border with Rondônia), in the Amazon rainforest domain. It grows on clayey and sandy soils, at the edge of *terra firme* forests, riparian forests and in disturbed areas, mostly below 200 m a.s.l.

Phenology.— Flowering throughout the year and fruiting from April to August.

Notes.—Two varieties were recognized by Irwin & Barneby (1982), but only *Senna macrophylla* var. *gigantifolia* occurs in Brazil. the taxon is characterized by its large distal leaflets (20–40 x 7–20 cm), its densely flowered racemes, prominent sepal veins, and fruits 18–30 cm long, constricted at the apex and with slightly corrugate valves.

Representative specimens examined. BRAZIL. Acre. Rio Branco, BR 364, km 30, 6 Oct 1980 [fl], *Lowrie, S. R. et al. 423* (INPA, NY); Cruzeiro do Sul, ponto 2, SB 18, TB, 17 Feb 1976 [fl], *Marinho, L. R. 213* (NY); Cruzeiro do Sul, Serra do Moa, vicinity of Serra do Moa, 22 Apr 1971 [fr], *Prance, G. T. et al. 12283* (INPA, NY). **Amazonas:** Esperança, (ad ostium fluminis Javary), ad ripas igarapé Santo Antonio, 17 Mar 1942 [fl], *Ducke, W. A. 1502* (IAN, NY); Ilha Aramaçá, almost opposite Tabatinga, 24 Jul 1973 [fr], *Prance, G. T. et al. 16797* (INPA, NY); Behind Fonte Boa, rio Solimões Amazonas, 21 Aug 1973 [fl], *Lleras, E. et al. 17421* (INPA, NY); Estrada Manaus-Porto Velho, km 265, 17 Apr 1976 [fl],

Monteiro, O. P. & Ramon, J. 729 (INPA). **Rondônia:** Porto Velho, BR 29, 15 Jan 1963 [fl], *Oliveira, J. s.n.* (INPA, NY); Machado river region, source of the Jaturaha river, Dec 1931 [fl], Krukoff, B. A. 1570 (MO, NY); **Roraima:** Alto Alegre, ilha de Maracá, SEMA Estação, Forest trails close to Estação, 9 Jun 1986 [fl], *Hopkins, M. J. G. et al. 629* (INPA, NY); Ilha de Maracá, SEMA Ecological Reserve, 20 Apr 1987 [fl], *Milliken, W. 75* (INPA, NY); Rio Uraricoeira, indian trail from Surucucu to Uaicá, 8 Mar 1971 [fl], *Prance, G. T. et al. 10905* (NY).

Senna ruiziana (G.Don) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 150. 1982. *Chamaefistula ruiziana* G. Don., Gen Hist. Dichl. Pl. 2: 451. 1832.

Distribution and habitat.—*Senna ruiziana* is restricted to western Amazonian rainforest and Andean forests in Brazil, Bolivia, Colombia, Ecuador and Peru (Irwin & Barneby, 1982; Souza & Bortoluzzi, 2015). In Brazil it is only known from a few collections from the state of Acre, where it occurs at the edge of riparian forests and *terra firme* forests, mostly below 200 m a.s.l.

Phenology.—Flowering in November, March and April and fruiting in March and April.

Notes.—*Senna ruiziana* is a remarkable cauliflorous species, recognized by a glandular appendix on the abaxial side of the leaf rachis apex, by its asymmetrical leaflets, and falcate fruits. Irwin & Barneby (1982) recognized two varieties, but only *Senna ruiziana* var. *ruiziana* occurs in Brazil.

Representative specimens examined. BRAZIL. Acre. Manoel Urbano, Rio Purus, left bank, Colocação Nova Olinda, Sr. Raimundo Gomes (“Raimundo Cícero”), 25 Nov 1996 [fl], *Daly, D. C. et al. 9159* (NY); Cruzeiro do Sul, Reserva Extrativista do Alto Juruá, basin of Rio Juruá, Rio Bagé, near mouth of river, 11 Mar 1992 [fr], *Daly, D. C. et al. 7361* (NY); Marechal Thaumaturgo, rio Juruá, reserva extrativista do Alto Juruá, N of São João do Breu, right bank, moist upland forest on hilly terrain, 2 Apr 1993 [fl, fr], *Daly, D. C. et al. 7722* (INPA, NY).

Senna herzogii (Harms) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 145. 1982.
Cassia herzogii Harms, Meded. Rijks-Herb.27: 37. 1915.

Distribution and habitat.—*Senna herzogii* was previously only known from the moist forests of the Andes and Amazon in Bolivia and Peru (Irwin & Barneby, 1982). In Brazil it was collected for the first time in 2002 in seasonally flooded riverbanks of the Chandless river in the state of Acre, in the Amazonian domain.

Phenology.— Fruiting in March in Brazil.

Notes.—This scandent shrub can be recognized by the amply foliaceous stipules, the glandular rachis appendix, the asymmetrical distal leaflets, the median and abaxial stamens of equal length or sometimes the abaxial ones slightly longer, and the subcylindric fruits with corrugate valves.

Representative specimens examined. BRAZIL. Acre. Manoel Urbano, rio Chandless (tributary of rio Purus), left bank, 18 Mar 2002 [fr], *D.C. Daly et al. 11397* (NY).

Additional specimens examined. PERU. Ucayali. Prov. Purús, camino a la quebrada de Esperancilla, 19 Mar 2002 [fl,fr], *J. Schunke-Vigo & J. G. Graham S15082* (NY).

Senna bacillaris (L.f.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 111. 1982.
Cassia bacillaris L. f., Suppl. Pl. 231. 1781

Distribution and habitat.—*Senna bacillaris* ranges in native distribution from southern Nicaragua to northern South America, and is cultivated or naturalized outside this native range (Irwin & Barneby, 1982).

Phenology.—In Brazil, flowering from November to July and fruiting from April to July and November.

Notes.—*Senna bacillaris* can be distinguished by the fractiflex young branches, the asymmetric leaflets with a conspicuous reticulate venation, the uniporate abaxial anthers, the mature fruits dark green and with a thickened margin.

The collection *Quelch, J. J. & McConnell 23 (K)* and *Maguire, B. & Maguire, C. 40312 (NY)* from Mount Roraima have leaflets with more prominent reticulation, and dilated and persistent stipules. These collections corresponds to *Cassia insignis* described by Brown (1901) and after synonymized in *S. bacillaris* by Irwin & Barneby (1982), and requires more collections for a better comprehension of their identities.

Irwin & Barneby (1982) recognized two varieties of *Senna bacillaris* and both were found in Brazil in this study.

Key to the Varieties of *Senna bacillaris*

1. Leaves and inflorescences covered with a whitish indumentum; abaxial anthers of equal length.....*Senna bacillaris* var. *bacillaris*
- 1'. Leaves and inflorescences usually covered with a golden indumentum; central-abaxial anther smaller than the lateral-abaxial anthers.....*Senna bacillaris* var. *benthamiana*

Senna bacillaris var. *bacillaris*

Distribution and habitat.—Roraima, growing at the edge of ombrophilous forest, *terra firme* forest, *igapó* forest, riparian forest and Amazonian savannas, mostly below 500 m a.s.l., but ascending to 1500 m a.s.l. in Mount Roraima.

Representative specimens examined. BRAZIL. Roraima. Boa vista, BR-174, km 23, along Mucajaí-Caracarái, 8 Nov 1977 [fr], *Coradin, L. et. al 1021* (IAN, INPA); Ilha de Maracá, SEMA Ecological Reserve, Ilha de Maracá, Furo de Maracá, 14 Nov 1987 [fl], *Milliken, W. 746* (K, NY); Mount Roraima, slopes of Roraima, 1894 [fl], *Quelch, J. J. & McConnell 23* (K).

Senna bacillaris* var. *benthamiana (J.F. Macbr.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 114. 1982. *Cassia fruticosa* var. *benthamiana* J.F. Macbr., Publ. Field Mus. Nat. Hist., Bot. Ser. 13(3/1): 165. 1943.

Distribution and habitat.—The states of Amazonas, Pará and Rondônia, growing on clay, rocky and sandy soils at the edge of ombrophilous forest, *terra firme* forest, *igapó* forest, riparian forest and Amazonian savannas, mostly below 500 m a.s.l.

Representative specimens examined. BRAZIL. Amazonas: Rio Purus opposite Lábrea, 23 Jun 1971 [fr], *Prance, G. T. et al. 13491* (NY); Tabatinga, margem alagada do rio Solimões, 13 Aug 1998 [fl], *Ducke, W. A. 1501* (IAN, NY); São Paulo de Olivença, rio Solimões, 24 May 1940 [fl, fr], *Ducke, W. A. 1014* (NY); Cambixe, lago do Inemazinho, 6 May 1962 [fl], *Melo, F. C. s.n.* (INPA, US); Igarapé Patrona, lago do castanho-mirim, 19 Jun 1973 [fl], *Albuquerque, B. W. P. et al. 750* (INPA); Igarapé Grande, lago do Rei, 3 Jun 1964 [fl], *Rodrigues, W & Coelho, D. 5879* (INPA); Barreirinha, rio Auti Paraná, 12 Apr 1970 [fl], *Byron & Lima, J. 245* (MBM); Cucuí, estrada de Cucuí ao aeroporto, 30 Oct 1987 [fl], *Rodrigues, W. A. 10802* (INPA, NY). **Pará:** Óbidos, 9 Nov 1919 [fr], *Ducke, A. s.n.* (RB) **Rondônia:** Porto Velho, distrito de Jaci-Paraná, fora da parcela 29 (alagada), setor 03 margem esquerda do rio Jacy, 3 Mar 2010 [fl], *Nascimento, R. F. 5* (CEN, RON); Porto Velho, distrito de Jaci-Paraná, rio Jacy, margem esquerda, 10 Mar 2010 [fl], *Silveira, V. X. 160* (CEN).

Senna affinis (Benth.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 123. 1982. *Cassia affinis* Benth., Fl. Bras. 15(2): 98. 1870. (Fig. 4A, B)

Distribution and habitat.—*Senna affinis* is restricted to Brazil occurring in the states of Espírito Santo, Bahia, Minas Gerais, Rio de Janeiro and São Paulo (northern coast), in the Atlantic Forest and Cerrado domains. It can be found mainly at the edge of ombrophilous forest, seasonal forest, *restinga*, dunes, riparian forest and rocky outcrops, from sea level up to 1300 m a.s.l.

Phenology.— Flowering from August to May and fruiting from April to September.

Notes.—This scandent shrub can be recognized by its fractiflex (zig-zagged) branches, the ovate extra-floral nectary between the proximal pair of leaflets, the asymmetrical leaflets, the pale yellow flowers, the zygomorphic to slightly asymmetric corolla, petals 1.5–2 cm long., and the green fruit (even when mature) with smooth valves.

Representative specimens examined. BRAZIL. Bahia. Mun. Nova Viçosa, 10 Apr 1984 [fl], *Hatschbach G. 47795* (MBM); Mun. Porto Seguro, mata litorânea, 15 Apr 1965 [fl], *Belém, R. P. & Magalhães, M. 852* (NY); Mun. Una Rod. BA-001, 8-10 km da Una, 12 Apr 1992 [fl], *Hatschbach G. et al. 57029* (MBM); Mun. Ilhéus, Banco central. Faz. S. José, 19 Apr 1971 [fl], *Pinheiro, R. S. 1189* (CEPEC, NY); Mun. Boa Nova, Parque Nacional de

Boa Nova, Recanto dos Pássaros, 15 Mar 2014 [fl], *Carvalho D. N.* 412 (HUEFS); Mun. Itacaré, mata litorânea, *Belém, R. P. & Pinheiro, R. S.* 2190 (CEPEC, NY); Maracás, BA 250, entre Maracás e Contendas do Sincorá. A 13–15 km ao W de Maracás, 26 Apr 1978 [fl], *Mori, S. A. et al.* 9977 (CEPEC, NY); Laje, Fazenda Sete Voltas, 24 Apr 2018 [fl], *Silva, T. T.* 253 (HUEFS, HURB). **Espírito Santo:** Mun. Cariacica, estrada do entorno da reserva em acesso a Alegre. Floresta Ombrófila Densa Montana, 11 Apr 2009 [fl], *Amorim, A. M. et al.* 7840 (CEPEC, MBML, RB, UPGB); Mun. Conceição da Barra, APA Conceição da Barra ponto de amostragem 2, 26 May 2019 [fl], *Firmino, A. D. et al.* 994 (VIES); Água Doce do Norte, Pedra das Torres. Floresta Estacional, 12 Mar 2003 [fl], *Forzza, R. C. et al.* 5817 (HUEFS, K, MBML, RB); Mun. Santa Leopoldina, Colina Verde (Morro do Agudo), prop.: Israel Elias Ramos (trilha acima do bananal), 30 May 2007 [fr], *Demuner, V.* 4098 (HUEFS, MBML); Fundão, Goiapaba-Açu, 17 Jun 1998 [fr], *Kollmann, L. & Bausen, E.* 122 (ESA, MBML); Mun. Aracruz, Aricanga, 04 Mar 2018 [fl], *Sagrillo, T. F.* 276 (MBML); Mun. Santa Teresa, estrada 25 de julho, terr. Fracalossi, 29 Mar 2011 [fl], *Kollmann, L. & Groppo, M.* 12249 (MBML); Mun. Santa Teresa, Reserva Biológica Augusto Ruschi - Nova Lombardia, 14 Ago 2008 [fr], *Rossini J. et al.* 434 (MBML, UEC); Linhares, Pontal do Ipiranga, 20 Jun 1996 [fr], *Souza, R. L. D & Assis, A. M.* 49 (VIES); Vila Velha, Parque Natural Municipal de Jacarenema, 12 Jun 2013 [fr], *Silva L. A.* 360 (VIES); Mun. Iúna, Serra do Valentim., 25 Feb 2014 [fl], *Zorzanelli, J.P.F.* 958 (VIES). **Minas Gerais:** Mun. Santa Rita do Sapucaí, Serra da Bela Vista, 20 Feb 2011 [fl], *Ribas, O.S.* 1315 (MBM); Mun. Viçosa, State Agricultural School, Viçosa, 18 Feb 1959 [fl], *Irwin, H. S.* 2655 (NY); Arcos, Fazenda Faroeste, margem direita do Rio São Miguel, 08 Mar 2003 [fl], *Melo, P.H.A.* 476 (BHCB, HUEFS); Prudente de Moraes, Maciço Escrivânia. Morro com afloramento de calcário com paredões e campos de lapiás., 02 Jun 2015 [fr], *Melo, P. H. A.* 4492 (HRCB, HUEFS); Serra do Cabral, middle slopes of Serra do Cabral, ca. 2 km W. of Cantoni, 08 Mar 1970 [fl], *Irwin, H. S. et al.* 27187 (NY); Marliéria, Parque Estadual do Rio Doce, entrada do alojamento, trilha para Porto Capim, 30 Mar 1996 [fl], *Lombardi, J. A.* 1213 (BHCB, NY). **Rio de Janeiro:** Angra dos Reis, Fazenda Japubyba, 19 Mar 1951 [fl], *Kuhlmann, M.* 2622 (MBM); Rio de Janeiro, restinga da Tijuca, 13 Apr 1945 [fr], *Machado, O. X. B.* 617 (NY, RB); Rio de Janeiro, Estrada da Vista Chinesa, pr. a Estação Biológica, 17 Apr 1964 [fr], *Angeli, C.* 370 (NY) Nova Iguaçu, Estrada da Boa Esperança, 26 Apr 2002 [fr], *Bovini, M. G.* 2186 (RB); Teresópolis, Fazenda de Bom Fim, 12 Jan 1941 [fl], *H. P. Vellozo* 185 (NY); Cabo Frio, Praias das Conchas, 31 May 1992 [fr], *Braga, J.M.A.* 17 (RB, VIC). **São Paulo:** São Sebastião, mata marítima, beira d'um ribeirão, 26 Mar 1892 [fl, fr], *Edwall* 1730 (SP).

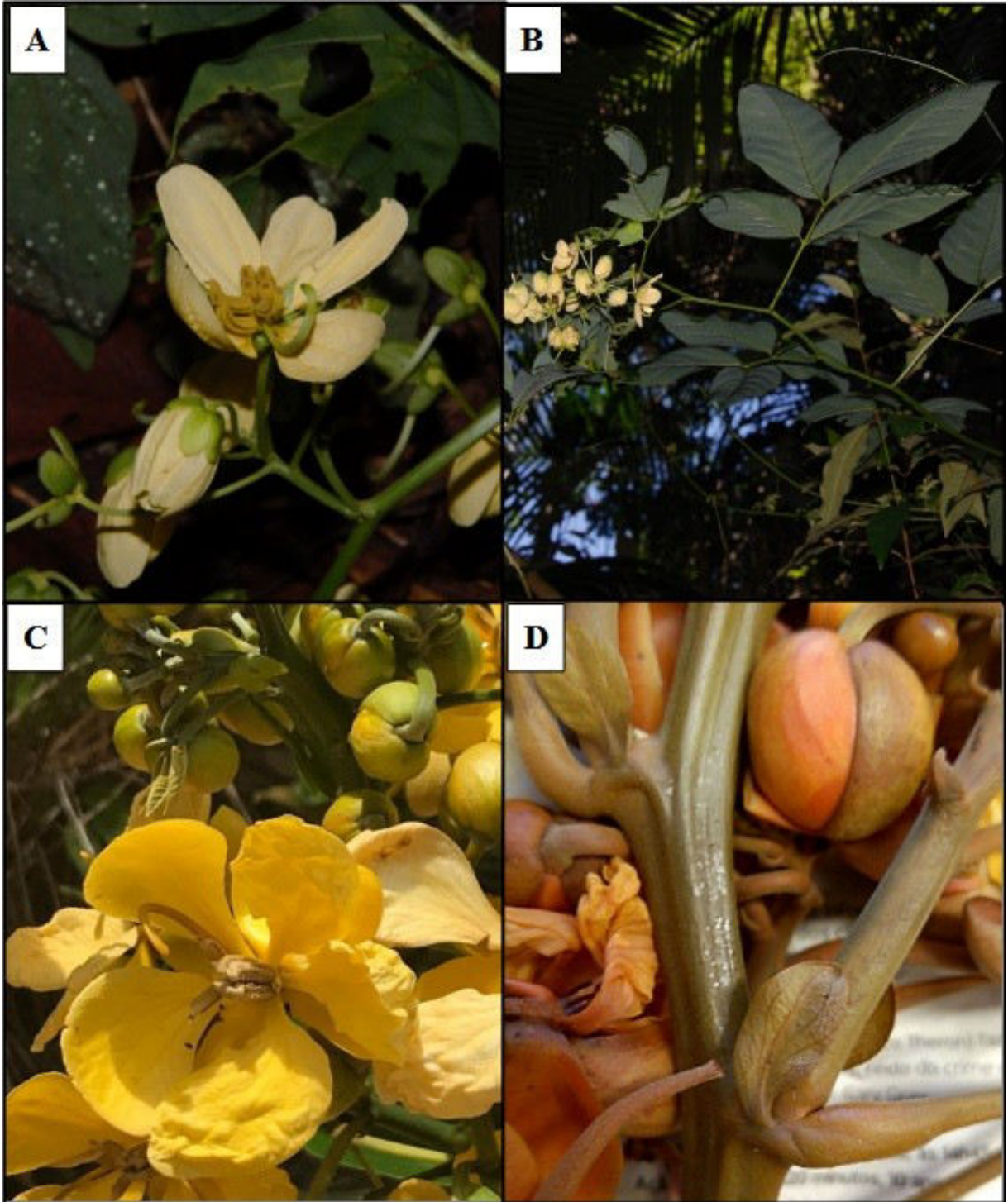


FIG. 4. A–B. *Senna affinis* (flower and habit). C–D. *Senna latifolia* (flower and flowering branches). Credits: C. Juliana Kuntz.

Senna chrysocarpa (Desv.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 171. 1982.
Cassia chrysocarpa Desv., J. Bot. Agric. 3: 72. 1814. (Fig. 5A, B)

Distribution and habitat.—*Senna chrysocarpa* is widespread in Brazil, French Guiana, Guyana and Suriname (Irwin & Barneby, 1982). In Brazil it is known from northeastern (Alagoas, Bahia, Ceará, Maranhão, Pernambuco and Sergipe states) and northern (Amazonas, Amapá, Pará, Roraima and Tocantins states) regions, in the Amazon Rainforest, Atlantic Forest, Caatinga, Cerrado and Pantanal domains. It occurs in seasonal forest, ombrophilous forest, riparian forest, *igapó* forest, *terra firme* forest, Amazonian savannas, coastal forest, on dunes and in anthropized areas, mostly at altitudes below 300 m a.s.l.

Phenology.—Flowering throughout the year and fruiting from July to December.

Notes.—*Senna chrysocarpa* can be recognized by its quadrangular young branches, asymmetric, elliptical to kidney-shaped leaflets, inflorescences and flower buds usually covered by a conspicuous golden indumentum, racemes usually densely flowered, petals 1.5–2 cm long, median and abaxial anthers of equal length, or sometimes the latter a little shorter, fruits 4.5–8 x 1–1.5 cm. Many *S. chrysocarpa* specimens in herbaria have been wrongly determined as *S. rizzinii* which is mostly found in drier environments. Nevertheless, the two species are morphologically similar.

Representative specimens examined. BRAZIL. Alagoas. Maceió, fazenda Santa Luzia próximo a riacho Doce, 30 Oct 1979 [fl, fr], *Lira, R. P. 9* (NY); Rio Largo, área de influência do Pratagy, mata secundária, 11 Nov 1999 [fl], *Lyra-Lemos, R. P. et al. 4400* (ESA, MAC); Murici, fazenda bananeiras, 20 Nov 2012 [fl, fr], *Mota, M. C. S. & Chagas, E. O. 11819* (RB); 7 Nov 2002 [fl, fr], *Lyra-Lemos, R. P. et al. 7080* (ALCB, MAC). **Amazonas:** Urucará, São Sebastião, 5 Set 1968 [fl], *Silva, M. G. 1821* (NY). **Amapá:** Macapá, estrada de Fazendinha-Santana, 1 Jul 1980 [fl], *Rabelo, B. V. 497* (NY); Macapá, estrada de Santana, Coração, 15 Nov 1979 [fl, fr], *Rabelo, B. V. 179* (NY); Macapá, margem do rio Araguari, arredores de Porto Grande, 13 Oct 1976 [fr], *Rosa, N. A. & Santos, M. 994* (NY); Calcoene, coastal region, along road to gold mines, km 12, 20 Aug 1962 [fl], *Pires, J. M. & Cavalcante, P. B. s.n.* (NY); Marica, about 1.5 km from confluence with Oiapoque (córr. Crandiutú), 6 Sep 1960 [fl], *Irwin, H. S. et al. s.n.* (NY); Rio Oiapoque, near cachoeira Utussansain, 9 Sep 1960 [fl, fr], *Irwin, H. S. et al. s.n.* (NY). **Bahia:** Entre Rios, road from

Imbé to Porto Sauípe, 18 Nov 2010 [fl], *Popovkin, A. V. 803* (HUEFS); Conde, fazenda do BU, mata da Maré, 2 Feb 1996 [fl], *Jost, T. & Ferreira, M. C. 222* (RB). **Ceará:** Ubajara, sitio murimbeca, entorno parque de Ubajara, 26 Aug 2012 [fl], *Loiola, M. I. B. et al. 1944* (EAC); Ubajara, Chapada da Ibiapaba, 31 Oct 1988 [fl], *Fernandes, A. et al. s.n.* (EAC). **Maranhão:** Vargem Grande, 8 Dec 1979 [fl], *Martins, P. & Nunes, E. s.n.* (EAC, HUEFS); Santa Luzia, BR-222, entre o porto Pindaré e Açailândia, 4 Aug 1978 [fl, fr], *Fernandes, A. & Matos s.n.* (EAC, HUEFS). **Pará:** Porto Trombetas, mineração rio do norte, 1991 [fl], *Evandro, S. & Knowles, O. H. 337* (INPA); Santarém, laguinho, estrada Palhão, km 35, 23 Nov 1990 [fl, fr], *Knowles, O. H. 1660* (INPA); Carajás, serra norte, 13 Jul 1987 [fl], *Silva, S. M. 1360* (NY); Belém, 6 km NW instituto agrônômico do norte, near São Joaquim, 4 Oct 1942 [fl], *Silva, M. B. 136* (IAN); Primavera, 12 Aug 2013 [fl], *Lucas, F. C. A. 1205* (MFS). **Pernambuco:** Rio Formoso, Rebio Saltinho, 26 Sep 2002 [fl], *Sevilha, A. C. 2648* (CEN); Rio Formoso, Horto Florestal de Saltinho, 6 Sep 1954 [fl], *Falcão, J. I. A. et al. 956* (VIC); **Roraima:** Manaus Venezuela highway BR-174, km 515, along bank of Igarapé, 21 Nov 1977 [fl], *Steward, W. C. et al. s.n.* (INPA, NY); Manaus Venezuela highway BR-174, estrada Manaus- Boa Vista, 52 km north of Caracaraí, *Steward, W. C. et al. s.n.* (INPA, NY). **Sergipe:** Japarutuba, pov. São José, 29 Oct 2007 [fl], *Santos, A. V. & Santos, E. 5* (CEN); Japarutuba, próximo ao fosso CP1234, próximo ao polo de tratamento de resíduos de Jericó, 7 Mar 2013 [fl], *Barbosa, P. & Santos, E. 3* (ASE) Estância, nascente 6, 18 Dec 2009 [fl, fr], *Calazans, C. et al. 427* (ASE). **Tocantins:** Caseara, praia do Sol, 5 Jul 2007 [fl], *Santos, E. R. & Santos, W. F. 1478* (HUTO).

Senna rizzinii H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 174–175. 1982. *Cassia granulata* Rizzini, Leandra 4-5: 16. 1974. (Fig. 5C, D)

Distribution and habitat.—*Senna rizzinii* is restricted to northeastern Brazil (Alagoas, Bahia, Ceará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe states), in the Caatinga and Cerrado domains, and occasionally in the Atlantic Forest. The species is most common in caatinga and its transition to cerrado, and commonly occurs on sandy soils, but it can also be found at the edge of seasonal forest, in savannas, *brejos de altitude*, rocky outcrops, dunes and disturbed areas, from 200 to 1300 m a.s.l.

Phenology.— Flowering and fruiting throughout the year.

Notes.—*Senna rizzinii* is a profusely flowering shrub characterized by its ovate to orbicular, persistent bracts (5–10 x 3–6 mm), petals 1.5–1.8 cm long, and fruits 4.5–9 x 1–1.5 cm.

Representative specimens examined. BRAZIL. Alagoas. Mata Grande, serra do Parafuso, no topo da serra, próximo ao Alto do Angico, sítio Favela, caatinga arbórea, 2 Jun 2001 [fl], Lemos, R. P. L. 5659 (UEC); São Miguel, 3 km depois do entroncamento da AL-101 com AL-201, 25 Aug 1988 [fl, fr], Staviski, M. N. R. Et al. 867 (K, MAC). **Bahia:** Santo Estevão, 5.3 km ao N da ponte do Paraguaçu, 17 Mar 2004 [fl], *Queiroz, L. P. et al* 9159 (HUEFS); Palmeiras, 9 Jun 1992 [fl], *Hatschbach, G. G. et al.* 56927 (NY); Palmeiras, BR-242, entre Pai Inácio e Palmeiras, 11 Mar 2004 [fl], *Conceição, A. A. & Marazzi, B.* 1126 (HUEFS, SP); Morro do Chapéu, 27 Aug 2006 [fl], *França, F.* 5524 (HUEFS); Paulo Afonso, BR 110, road from Paulo Afonso to Jeremoabo, 39-46 km S of Paulo Afonso, 7 Jun 1981 [fl, fr], *Mori, S. A. et al.* 14236 (NY). **Ceará:** Icaraiá, Caucaia, 1 Aug 1979 [fl], Matos s.n. (EAC, HUEFS); Cascavel – Beberibe, tabuleiro litorâneo, 19 Oct 1990 [fl, fr], *Nunes, E. et al.* 1990 (EAC); Aquiras, Barco Preto, 26 Jul 1986 [fl, fr], *Fernandes, A. et al. s.n.* (EAC); São Gonçalo do Amarante, dunas litorâneas, Apr 2000 [fl], *Magalhães, H.* 275 (EAC); **Paraíba:** Teixeira, pico do Jabre, 18 May 2002 [fl, fr], *Agra, M. F. et al.* 5905 (HUEFS); Teixeira, sopé pico do Jabre, 30 Jun 1979 [fl], *Fernandes, A. & Matos s.n.* (ASE, HUEFS); Areia, brejo Paraibano, 9 Dec 2011 [fl, fr], *Melo, E.* 10742 (HUEFS); Areia, chã do jardim, 13 May 1975 [fl, fr], *Barbosa, V. P.* 133 (VIC). **Pernambuco:** Tacaratu, distrito de Espinheiro, 30 Nov 1996 [fl, fr], *Oliveira, L. B. et al.* 79 (ICN); Triunfo, 27 Aug 1996 [fl], *Miranda, A. M. et al.* 2454 (HUEFS); Caruaru, peladas, inselbergue “pedra Cruzeiro de São João”, 27 Aug 2009 [fl], *Sobral-Leite, M. et al.* 979 (HUEFS). **Rio Grande do Norte:** Martins, serra Martins, 17 Jul 1991 [fl], *Figueiredo, M. A. et al.* 346 (EAC, HUEFS); Florânia, serra do Cajueiro, na trilha da Braúna, 27 Sep 2008 [fl, fr], *Oliveira, R. C. et al.* 2296 (ASE); Pureza, ca. 7 km após Bebida Velha, no sentido de Pure, 17 Jul 2006 [fl], *Araújo, J. E. et al.* 101 (EAC). **Sergipe:** Poço Redondo, serra da Guia, brejo de altitude, 17 Oct 2009 [fl], *Costa, S. M.* 619 (ASE); Poço Redondo, serra da Guia, 17 Oct 2009 [fl,FR], *Costa, S. M.* 659 (ASE).

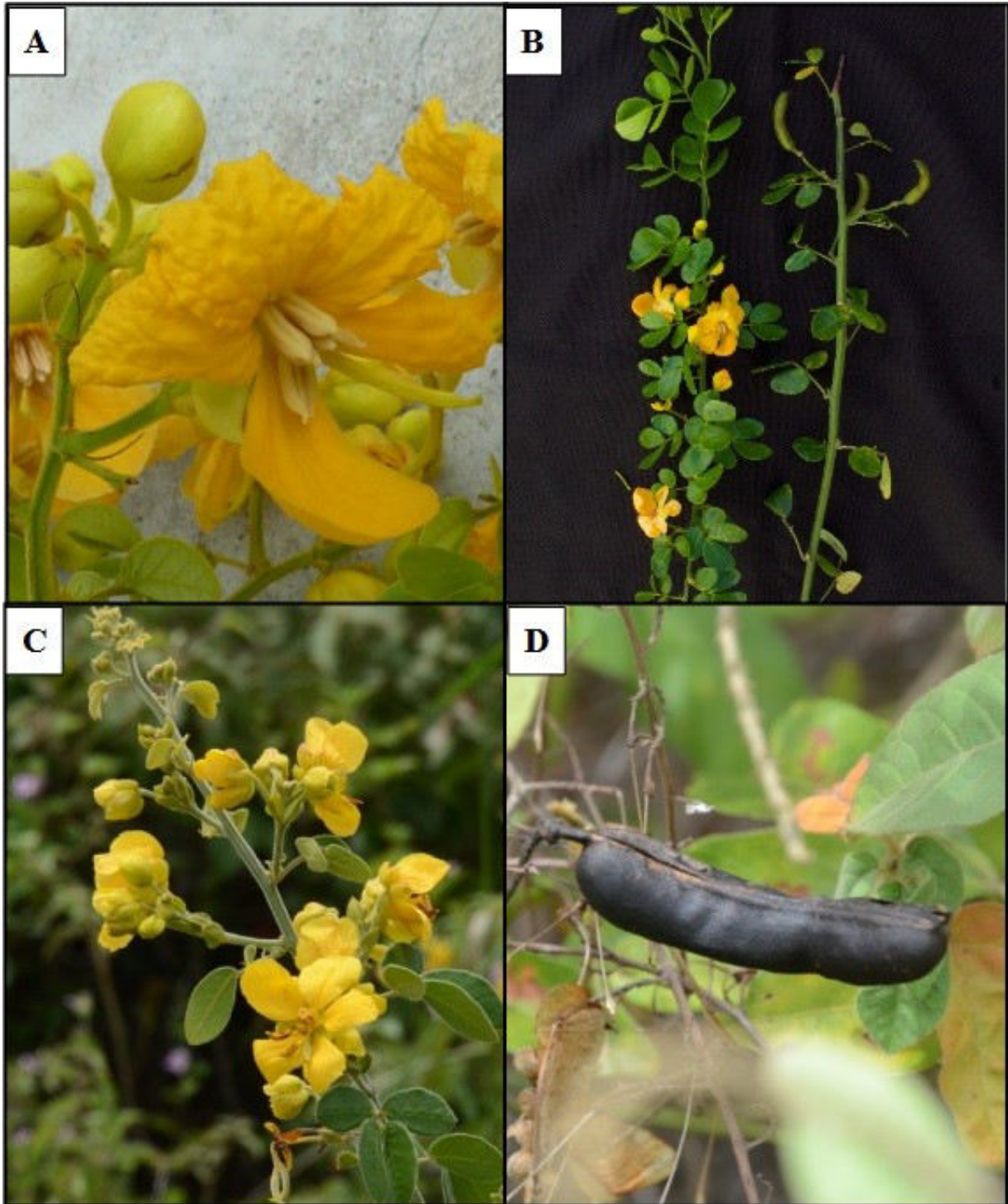


FIG. 5. A–B. *Senna chrysocarpa* (flower and flowering branch). C–D. *Senna rizzinii* (flowering branch and fruit). Credits: A. Alex Popovkin. B. Narcísio Bigio.

Senna cornigera H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 199–200. 1982.

Distribution and habitat.—*Senna cornigera*, a climbing species, is only known by a single collection from the riparian forest of the Jarí river, in the municipality of Monte Dourado between the states of Amapá and Pará.

Phenology.— Collected in flower and immature fruits in October.

Notes.—This rare species is remarkable by its horn-shaped appendix at the apex of the leaf rachis, which probably assists its climbing habit. Additionally, *Senna cornigera* can be recognized by its symmetrical and broadly elliptical leaflets, its asymmetrical corolla, and the sets of stamens strongly differentiated in length.

Representative specimens examined. BRAZIL. Amapá. Monte Dourado, planalto B, rio Jarí, mata de terra firme, 11 Oct 1968 [fl, fr], *Silva, N. T. 1187* (holotype: R; isotypes: IAN, NY, US).

Senna gardneri (Benth.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 192. 1982.
Cassia gardneri Benth., Fl. Bras. 15(2): 120. 1870.

Distribution and habitat.—*Senna gardneri* is restricted to the Caatinga and Cerrado domains in northeastern Brazil (Bahia, Ceará, Maranhão, Piauí and Pernambuco). It grows on sandy and rocky soils in the caatinga, *carrasco*, savannas, rupestrian grasslands, dunes along the São Francisco river and reaches the *restinga* (in Ceará), mostly from 300 to 1000 m a.s.l.

Phenology.— Flowering throughout the year and fruiting from April to December.

Notes.—*Senna gardneri* is a very ornamental shrub and is readily recognized by the fractiflex (zig-zagged) young branches, these nigrescent when dry, the obovate to orbicular leaflets with craspedodromous venation and a conspicuous marginal vein, and by the abaxial stamens approximately twice the length of the median stamens.

Representative specimens examined. BRAZIL. Bahia. Bom Jesus da Lapa, ca. 10 km na estrada para Ibotirama, 9 Aug 1996 [fr], *Jardim, J. G. et al. 923* (ALCB, MBM, NY);

Bom Jesus da Lapa, Basin of the Upper São Francisco River. Fazenda Imbuizeiro da Onça, ca. 8 km from Bom Jesus da Lapa, on by-road to Calderão, 19 Apr 1980 [fl], *Harley, R. M. et al.* 21537 (NY, US); Brotas de Macaúbas, 2 km de Brotas de Macaúbas, vindo da BR 242, 1 Jun 2007 [fl, fr], *Conceição, A. A. et al.* 2112 (HUEFS); Oliveira dos Brejinhos, estrada Canabrava a Chapadão de Cima, próximo ao alto da Serra Geral, 16 Mar 1998 [fl], *Hatschbach, G. et al.* 67814 (MBM, NY); Cotegipe, fazenda Granflor, 16 Apr 2018 [fl], *Moraes, T. M.* 1727 (UB); Barra, Ba-116, a 18 km de Barra, sentido Ibotirama, caatinga, 4 May 2002 [fl, fr], *Jost, T. et al.* 544 (ALCB, HUEFS); Santo Inácio, ramal para cachoeira., 20 Jul 2000 [fl], *Silva, M. M. et al.* 477 (HUEFS); Xique-Xique, km 6 a 8 da estrada que liga Santo Inácio/Gentio do Ouro, margem do rio próximo a ponte, 1 Jun 1991 [fl, fr], *Brito, H. S. et al.* 317 (NY); Umburanas, Barra dos Alegres, caminho p/ Riacho da Barra, caatinga, 28 Jan 2010 [fl], *Carvalho-Sobrinho, J. G. et al.* 2624 (EAC, HVASF); Pilão Arcado, estrada para as Carnaúbas, Lago Grande, caatinga arbórea, 28 Sep 2005 [fl, fr], *Queiroz, L. P. et al.* 10948 (HUEFS); Casa Nova, ca. de 30 km de Remanso para Casa Nova, 16 Jun 2001 [fl, fr], *Nunes, T. S. et al.* 551 (ALCB, HUEFS); Casa Nova, estrada para balneário, 28 Oct 2015 [fl], *Souza, I. M. et al.* 219 (HUEFS). **Ceará:** Novo Oriente, Serra da Ibiapaba, estrada Novo Oriente a São Miguel do Tapuio, 25 Jul 1979 [fl, fr], *Fernandes, A. et al. s.n.* (EAC, HUEFS); Cratéus, Serra das Almas, Trilha do Lajeiro, 26 Aug 2004 [fl, fr], *Soares, A. A. & Andrade, J. L.* 37 (EAC); Ibiapina, Serra da Ibiapaba, 4 Nov 1978 [fl, fr], *Fernandes, A. & Bezerra, P. s.n.* (EAC, HUEFS); Viçosa do Ceará, próx. inharim, carrasco, 27 Aug 2010 [fl, fr], *Silveira, E. s.n.* (EAC); Acaraú, jericoacoara, restinga, 20 Oct 1984 [fl, fr], *Fernandes, A. & Georgen, J. s.n.* (EAC, UFRN); **Maranhão:** Barreirinhas, Village of Barreirinhas, 40 km SW along the road to the village of Urbano Santos, 8 Nov 1982 [fl], *Gottsberger, G. K.* 29-81182 (NY). **Piauí:** Esperança, corrente, 14 May 1982 [fl, fr], *Fernandes, A. & Matos s.n.* (EAC); Bom Jesus, comunidade Eugenópolis, 1 May 2019 [fl], *Silva, L. S.* 3 (HDJF); Serra Grande, Parque Nacional da Serra das Confusões, carrasco, 18 Jul 2011 [fl], *Conceição, A. A. et al.* 4031 (HUEFS); Castelo do Piauí, amostragem lateral à estrada de terra que segue para as torres de transmissão, 27 Jun 2014 [fl], *Nascimento, F. H. F. et al.* 1326 (HUEFS). **Pernambuco:** Petrolina, 13 Jun 1995 [fl, fr], *Silva, M. M. et al.* 25 (HUEFS); Petrolina, quartel do exército, 14 Sep 2006 [fl], *Siqueira-Filho, J. A. et al.* 1732 (HUEFS); Petrolina, 3 km ao norte de Petrolina, 9 May 1983 [fl, fr], *Fotius, G.* 3454 (HUEFS).

Senna bahiensis A. Lima & V.C. Souza (Lima *et al.*, submitted to Systematic Botany).

Distribution and habitat.— A rare, endemic species of the Atlantic Forest in Bahia state, known by only three collections. The species occurs at the edge of ombrophilous forest, climbing to the tree canopy, and also in rocky outcrops in mountainous areas, ranging from 690 to 800 m a.s.l.

Phenology.— Collected in flower from March to May.

Notes.—*Senna bahiensis* is an endangered species discovered during our taxonomic studies. It can be recognized by its leaf rachis with a single extra-floral nectary, its oboval symmetrical leaflets, its petals 3.3–4.5 x 2.5–3.3 cm, and the sets of stamens strongly differentiated in length.

Representative specimens examined. BRAZIL. Bahia. Ibirapitanga. 22 km N of Itamarati on BR 101, then 6.8 km E on road to Embratel Tower, Reserva Municipal Cachoeira do Pau, Southern Bahian wet forest, 19 Mar 2003 [fl], *Thomas, W.W. et al. 13447* (holotype: CEPEC; isotypes: HUEFS, RB, SPF); Castro Alves. Mata Higrófila na Serra da Jibóia, 25 Apr 1994 [fl], *Queiroz, L.P. & Nascimento, N.S. 3832* (CEPEC, HUEFS, K, MBM, NY, SP); Santa Terezinha, Serra da Pioneira, 3 km da Pedra Branca, 800 m, 16 May 1984 [fl], *Noblick, L.R., Lemos & Valdomiro 3217* (CEPEC, HUEFS, US).

Senna georgica H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 193. 1982. *Cassia hoffmannseggii* var. *gardneriana* Benth. in Fl. Bras. (Martius) 15(2): 104, 1870. (Fig. 7C, D)

Distribution and habitat.—*Senna georgica* is widely distributed in South America, including Bolivia, Brazil, French Guiana, Guyana and Paraguay (Irwin & Barneby, 1982). In Brazil, it occurs in the central-western (Mato Grosso and Goiás), northern (Amazonas, Pará and Tocantins), northeastern (Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí and Rio Grande do Norte) regions, in the Amazon rainforest, Caatinga, Cerrado and Atlantic Forest domains. It has been collected in seasonal forest, riparian forest, ombrophilous forest, *terra firme* forest, rocky outcrops and in anthropized areas, up to 1000 m a.s.l.

Phenology.— Flowering from April to December and fruiting from June to December.

Notes.—This scandent shrub is characterized by the combination of a leaf rachis with only one extra-floral nectary, symmetrical, broadly elliptic to ovate leaflets, a large asymmetric corolla with petals 3–4 cm long, one abaxial petal cuculate, the abaxial stamens approximately twice the length of the median stamens, and the laterally compressed fruits nigrescent. Irwin & Barneby (1982) recognized two varieties; only *Senna georgica* var. *georgica* was found in Brazil.

Representative specimens examined. BRAZIL. Alagoas. Ibateguara, flora dos fragmentos: alto do Guzerá, 16 Dec 2003 [fr], *Oliveira, M. & Grillo, A. A. 1517* (HUEFS); São Miguel dos Campos, mata próxima ao campo 123, balneário Tipiriçá, 18 Aug 2001 [fl], *Lyra-Lemos, R. P. 5851* (MAC). **Amazonas:** Rio Guaporé, Jul 1942 [fl], *Sandeman, C. 2149* (K). **Bahia:** Amaralina, Sep 1948 [fl], *Moreira, A. X. s.n.* (NY); Entre Rios, fazenda Rio do Negro, 26 Sep 2012 [fl], *Popovkin, A. V. & Mendes, J. C. 1236* (HUEFS); Entre Rios, fazenda Rio do Negro, 26 Sep 2012 [fl], *Popovkin, A. V. & Mendes, J. C. 1238* (HUEFS); **Ceará:** Baturité, 9 Nov 2016 [fl], *Guedes, M. L. et al. 25239* (ALCB, EAC); Guaramiranga, pico alto, 9 Oct 2007 [fl, fr], *Silveira, E. et al. s.n.* (EAC); Guaramiranga, pico alto, 18 Sep 2007 [fl], *Lima, J. R. 163* (EAC); Pacatuba, serra da Aratanha, Martins, 3 Oct 1979 [fl, fr], *P. & Castro, A. J. s.n.* (EAC, HUEFS); Tianguá, subida da serra, 5 Sep 2012 [fl], *Loiola, M. I. B. et al. 1727* (EAC) **Goiás:** Uruacu, fazenda grotão, margem esquerda do rio Tocantins, 9 Jul 1992 [fl], *Walter, B. M. T. et al. 1733* (CEN); Niquelândia, fazenda São João, córrego do Val, 9 Jun 1992 [fl], *Walter, B. M. T. et al. 1507* (HUEFS); Monte Alegre de Goiás, fazenda Nica, 31 Oct 2000 [fl, fr], *Oliveira, F. C. A. et al. 1170* (CEN). **Maranhão:** Carolina, fazenda Ressaca, 22 May 2010 [fl], *Silva-Pereira, G. 15304* (CEN); Açailândia, 90 km from Imperatriz, 16 Jul 1987 [fl], *Tsugaru, S. & Sano, Y. 247* (NY); Caxias, 28 Nov 2017 [fl, fr], *Silva, K.F. 527* (UB); São Luis, reserva florestal do Sacavém, 3 Jun 1992 [fl], *Muniz, F. H. 113* (INPA). **Mato Grosso:** Pontes e Lacerda, próximo ao córrego Bugres, 16 Aug 1997 [fl], *Hatschbach, G. et al. 66949* (HUEFS, MBM); Cáceres, BR-070, 19 May 2013 [fl], *Farias, J. E. Q. & Zanatta, M. R. V. 3602* (CEN, UB); Castanheira, Juina-Juruena, beira da estrada, 8 Jul 1997 [fl], *Souza, V. C. et al. 18369* (ESA); Novo Horizonte, estrada vicinal, 9 Aug 1997 [fl, fr], *Nave, A. G. et al. 1784* (ESA, UEC, UFG). **Pará:** Paragominas, Itinga do Pará, 3 Sep 1976 [fl], *Silva, M. G. 2746* (NY); Serra Norte, Carajás, rio Itacaiunas, 12 Jul 1987 [fl], *Silva, S. M. 1357* (NY); Tucuruí, BR-422, rio Caraipé, 4 Nov 1983 [fr], *Ramos, J. F. 972*

(INPA); Belterra, estrada de Santarém, 7 Oct 1962 [fl, fr], Duarte, A. P. 7229 (NY); Belém, Capoeira do Catu, IPEAN, 8 Sep 1968 [fl], Pires, J. M. 14827 (NY); São Francisco do Pará, travessa do 96, 13 Dec 1978 [fl, fr], Bastos, M. C. et al. 139 (NY). **Paraíba:** Pitimbu, litoral, 26 Oct 1995 [fl, fr], Castro, A. S. F. 48 (EAC); Areia, escola de agronomia do Nordeste, 12 Sep 1944 [fl], Vasconcelos, J. M. 641 (SP); Mamanguape, BR-101, 17 Sep 1979 [fl, fr], Martins, P. et al. s.n. (EAC, HUEFS); Mamanguape, REBIO Guaribas, área II, mata Maranjá, 30 Nov 2002 [fl, fr], Sevilha, A. C. 2585 (CEN) **Pernambuco:** Goiana, ponta de pedras, área antropizada frente a praia, 26 Nov 2013 [fl, fr], Silva, L. R. 424 (HST, HUEFS); São Vicente Ferrer, mata do estado, 31 Jul 1998 [fl, fr], Ferraz, E. M. N. & Bispo, A. G. 361 (NY); São Lourenço da Mata, estação ecológica do Tapacurá, 19 Dec 2000 [fl], Silva, E. S. 46 (NY); Recife, Parque Estadual Dois Irmãos, 15 Sep 2006 [fl], Machado, M. M. s.n. (HST, HUEFS). **Piauí:** Tamboril, 20 Jul 1979 [fl], Silva, F. C. 9 (NY); Teresina, 29 Jul 1979 [fl, fr], Fernandes, A. et al. s.n. (EAC, HUEFS); Esperantina, estrada Volta da Jurema a Esperantina, pequena mata, 31 May 1979 [fl, fr], Castro, A. J. & Nunes, S. s.n. (EAC, HUEFS). **Tocantins:** Filadélfia, W of Filadélfia in serra de Mamoneira, 2 Aug 1964 [fl, fr], Prance, G. T. et al. 58516 (NY); Porto Nacional, 27 May 2009 [fl], Soares, C. B. & Azevedo, A. G. 1053 (HUTO).

Senna splendida (Vogel) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 190. 1982.
Cassia splendida Vogel, Gen. Cass. Syn. 17. 1837.

Distribution and habitat.—*Senna splendida* is native to Bolívia, Brazil and Paraguay. Collections from Uruguay are likely to be from cultivated specimens (Irwin & Barneby, 1982).

Phenology.— Flowering and fruiting throughout the year.

Notes.—This ornamental, scandent shrub is readily recognized by its symmetric, elliptic leaflets, the large asymmetric corolla with petals 3.5–4.5 cm long, and the abaxial stamens approximately twice the length of the median stamens. Irwin & Barneby (1982) erroneously described *Senna splendida* var. *gloriosa* as “*Cassia splendida* var. *gloriosa*”, but it is clear that this was a slip of the pen. The marked difference in the morphology of the calyces of the two varieties calls for a re-evaluation of the status of the two taxa.

We are working on a morphological, ecological and molecular study of *Senna splendida*, to be presented in our future manuscripts. Here, we adopt the infra-specific classification of Irwin & Barneby (1982).

Key to the Varieties of *Senna splendida*

1. Flower buds globose; calyx with sepals strongly differentiated in shape and size, the outermost sepal oblong to obovate with a rounded apex.....*Senna splendida* var. *splendida*
- 1'. Flower buds ovate; calyx with sepals equal or almost so, the outermost sepal lanceolate with an acute apex.....*Senna splendida* var. *gloriosa*

Senna splendida var. *splendida* (Fig. 6C, D)

Distribution and habitat.—In Brazil, this taxon occurs in the central-western (Goiás and Mato Grosso do Sul), northeastern (Bahia and Sergipe), southeastern (Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo), and southern (Paraná) regions, in the Atlantic Forest, Cerrado and Pantanal domains. *Senna splendida* var. *splendida* occurs in disturbed areas, at the edge of seasonal forest, ombrophilous forest, coastal forest, araucaria forest, riparian forest, rupestrian grasslands, and in savannas, mostly up to 1300 m a.s.l.

Representative specimens examined. **BRAZIL. Alagoas.** Piaçabuçu, jacozinho, cordões litorâneos, 22 Sep 1987 [fl,fr], *Staviski, M. N. R. et al. 996* (EAC, ESA). **Bahia:** Salvador, dunas de Itapuã, arredores da lagoa do Abaeté, 19 Oct 1984 [fl, fr], *Noblick, L. R. et al. 3431* (NY); Maraú, litoral sul, fazenda Taipus de Fora, 24 May 2009 [fl], *Guedes, M. L. et al. 15150* (ALCB); Ilhéus, along road from Ilhéus to Serra Grande, 8 May 1992 [fl], *Thomas, W. W. et al. 9229* (NY); Porto Seguro, km 56 da BR-367, 22 Oct 1978 [fl], *Mori, S. A. et al. s.n.* (NY); Prado, reserva florestal da Brasil de Holanda, 20 Oct 1993 [fl], *Thomas, W. W. et al. 10122* (NY, US); Prado, on road from Itamaraju to Cumuruxatiba, 20 Oct 1993 [fl, fr], *Thomas, W. W. et al. 10036* (NY); **Espírito Santo:** Conceição da Barra, REBIO Córrego Grande, 27 Aug 2012 [fl], *Flores, T. B. et al. 1208* (ESA, MBML); Conceição da Barra, FLONA Rio Preto, 26 Nov 2019 [fr], *Scheidegger, A. F. A. et al. 157* (VIES); Conceição da Barra, FLONA Rio Preto, 4 Aug 2010 [fl], *Rossini, J. et al. 723* (VIES); Linhares, REBIO Sooretama, 17 Jun 1985 [fl], *Hatschbach, G. & Silva, J. M. 49441* (MBML, NY); Linhares,

Reserva Florestal da Vale do Rio Doce, 16 Oct 1992 [fr], *Hatschbach, G. et al. 58121* (NY); Santa Teresa, Santo Antônio, terreno do Boza, 26 Oct 1999 [fl, fr], *Demuner, V. et al. 176* (MBML, RB). **Mato Grosso do Sul:** Anaurilândia, rio Paraná, a montante da Barragem de Porto Primavera, 17 Oct 1998 [fl], *Amaral, A. et al. 267* (UEC); Bela Vista, córrego Capei, 17 Mar 1985 [fl], *Hatschbach, G. et al. 49181* (NY). **Minas Gerais:** Ouro Fino, 10 May 1927 [fl], *Hoehne, F. C. s.n.* (SP); Belo Horizonte, Bento Pires, 13 Mar 1945 [fl], *Williams, L. O. & Assis, V. 5896* (US); Corinto, fazenda do diamante, base da serra do angico, 20 Apr 1931 [fl], *Mexia, Y. E. J. 5674* (NY); Camanducaia, Monte Verde, 26 Apr 2012 [fl], *Kinoshita, L. S. et al. 1204* (UEC); São João del Rey, Mar 1970 [fl], *Krieger, L. 8336* (HUFU); Alfenas, 7 Sep 1987 [fl, fr], *Gentry, A. H. et al. 59157* (NY). **Paraná:** Jundiá do Sul, 23 Oct 2001 [fl], *Carneiro, J. 1224* (ESA); Jaguariaíva, fazenda Cajuru, source of rio Cajuru, 18 Jan 1965 [fl, fr], *Smith, L. B. et al. 14812* (US); Rio Branco do Sul, 30 Apr 1967 [fl], *Lindeman, J. C. 5235* (NY); Mato Rico, Estação Ecológica Municipal Juquiri, 31 Mar 2016 [fl], *Caxambu, M. G. et al. 7326* (MBM); Porto Camargo, Parque Nacional de Ilha Grande, Ilha Bandeirantes, 3 Oct 2014 [fl], *Caxambu, M. G. et al. 5578* (MBM). **Rio de Janeiro:** Rio de Janeiro, [fl], *Glaziou, M. 9413* (K). **São Paulo:** Analândia, 21 Mar 1995 [fl], *Assis, M. A. et al. 514* (ESA); Rio Claro, 15 May 1985 [fl, fr], *Cesar, O. 421* (ESA); Piracicaba, mata da fazenda Areão, ESALQ, 13 Jun 1984 [fl, fr], *Catharino, E. L. M. 99* (ESA); Piracicaba, ESALQ, 5 Apr 2000 [fl], *Romão, G. O. 58* (ESA); Botucatu, fazenda Nossa Senhora da Conceição, SP-191, cerradão, 9 Jun 1996 [fl], *Souza, V. C. & Souza, J. P. 11443* (ESA, LUSC); Campos do Jordão, 13 Mar 1985 [fl], *Robim, M. J. & Carvalho, J. P. M. 236* (ESA); São Paulo, Butantan, 13 Apr 1917 [fl], *Hoehne, F. C. 36* (NY); São Paulo, 5 Apr 1910 [fl], *Luederwalt, H. s.n.* (ESA); São Paulo, 5 May 1988 [fl, fr], *Pastore, J. A. 218* (ESA). **Sergipe:** Santa Luzia do Itanhy, RPPN Mata do Crasto, 9 Aug 2011 [fl, fr], *Prata, A. P. et al. 2712* (NY); Aracaju, Pov. Areia Branca, 17 Jun 1982 [fl], *Santana, M. C. 107* (ASE).

Senna splendida* var. *gloriosa H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 192. 1982. (Fig. 6A, B)

Distribution and habitat.—*Senna splendida* var. *gloriosa* occurs in the northeastern (Alagoas, Bahia, Ceará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe) and southeastern (northern Minas Gerais) regions, in the Caatinga and Cerrado domains, and occasionally in the northeastern Atlantic Forest. It occurs in caatinga, savanna, dry forest,

dune, *brejos de altitude*, seasonal forest and rocky outcrop vegetations, mostly from 100 to 1000 m a.s.l.

The collections *Nee, M. H. 54970*, *Nee, M. H. & Becerra, A. 48767* and *Nee, M. H. & Sundue, M. 51987* from the slopes with dry forests of Bolivia, are morphologically similar to *S. splendida* var. *gloriosa*, and additional collections (specially fruiting) and molecular data are required to better understand their affinities. If confirmed, it may represent a remarkable geographical disjunction.

Representative specimens examined. BRAZIL. Alagoas. Pão de Açúcar, 22 Jun 2002 [fl], *Lyra-Lemos, R. P. 6894* (ESA); Estrela de Alagoas, 18 Jan 2001 [fl], *Lyra-Lemos, R. P. 5388* (ALCB); Maravilha, 16 Sep 2000 [fl], *Lyra-Lemos, R. P. 5042* (ESA). **Bahia:** Caetitê, 30 Jun 2003 [fl, fr], *Hatschbach, G. et al. 75912* (MBM); Abaíra, Chapada Diamantina, 26 Mar 2005 [fl], *Guedes, M. L. et al. 11745* (MBM); Seabra, na estrada para Lençóis, 18 May 2002 [fl], *Souza, E. R. et al. 315* (HUEFS); Caém, Piemonte da Diamantina, 19 Aug 1980 [fr], *Fonseca, W. N. 241* (ALCB); Xique-xique, 22 Jun 1996 [fl], *Harley, R. M. et al. s.n.* (HUEFS); Juazeiro, 10 Jun 2007 [fl], *Mariano, K. R. S. 15* (HUEFS). **Ceará:** Belmonte, Chapada do Araripe, Crato, 14 Jun 2000 [fl, fr], *Nunes, E. & Cavalcanti, F. S. s.n.* (HUEFS); Brejo Santo, igrejinha, 28 Apr 2015 [fl], *Oliveira, M. 6067* (HUEFS); Cratéus, RPPN Serra das Almas, 20 May 2002 [fl], *Araújo, F. S. et al. 1566* (EAC); Viçosa do Ceará, 30 May 1979 [fl, fr], *Nunes, E. & Castro, A. J. s.n.* (EAC); Fortaleza, campus do Pici, 14 Aug 1987 [fl, fr], *Nunes, E. & Aparecida, M. s.n.* (EAC). **Minas Gerais:** Itacarambi, rio São Francisco, 19 Jun 2004 [fl], *Hatschbach, G. et al. 78008* (MBM); Januária, distrito de Fabiao, 23 May 1997 [fl], *Lombardi, J. A. 1645* (NY); Rio Pandeiros, ca. 52 km by road W of Januária near road to Serra das Araras, 21 Apr 1973 [fl], *Anderson, W. R. 9344* (NY). **Paraíba:** Mataraca, Millennium Inorganic Chemicals Mineração, 20 Oct 2011 [fl, fr], *Gadelha-Neto, P. C. et al. 3091* (HUEFS); Areia, Escola de Agronomia do Nordeste, 15 Sep 1953 [fl], *Moraes, J. C. 888* (NY); São José dos Cordeiros, RPPN Fazenda Almas, 22 Jun 2005 [fl], *Lacerda, A. V. 479* (HUEFS). **Pernambuco:** Bezerros, Parque Ecológico de Serra Negra, 27 Dec 1995 [fl, fr], *Tschá, M. C. 448* (NY); Buíque, trilha dos Torres, Parque Nacional do Catimbau, 27 Jun 2007 [fl], *Santos, R. M. 1563* (HUEFS); Mirandiba, sítio Chacal, 19 Apr 2007 [fl], *Córdula, E. 271* (HUEFS); Ouricuri, BR-122, 22 May 1980 [fl], *Coradin, L. 2497* (CEN); **Piauí:** Castelo do Piauí, perto da divisa PI-CE, caminho dos Tucuns, 11 Jun 1979 [fl, fr], *Nunes, E. & Castro, A. J. s.n.* (EAC, HUEFS) **Rio Grande do Norte:** Nísia Floresta, distrito de Imuna, fragmento de Mata Atlântica, 27 Aug 2011 [fl], *Moura, E. O. 26*

(HUEFS); Natal, campus da UFRN, 11 Oct 1999 [fl, fr], Gimenes, M. s.n. (HUEFS); Serrinha, Luís Gomes, 16 Jun 1980 [fl], *Oliveira, O. F. et al. 1064* (ASE). **Sergipe:** Simão Dias, Assentamento Maria Bonita, caatinga, 13 Aug 2010 [fl], *Prata, A. P. et al. 2430* (ASE); Nossa Senhora da Glória, 6 Aug 1982 [fl, fr], *Gomes, E. 109* (ASE).

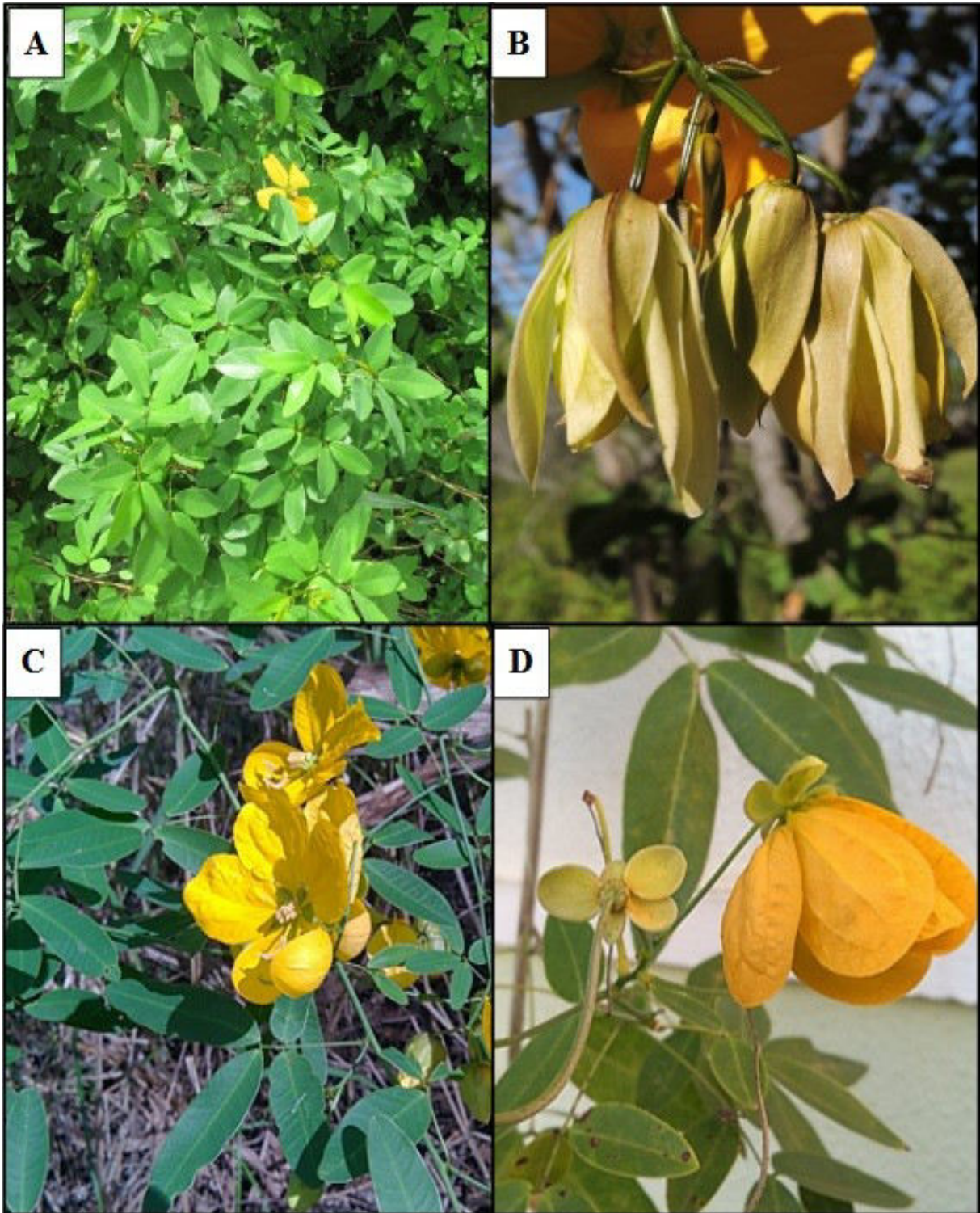


FIG. 6. A–B. *Senna splendida* var. *gloriosa* (habit and sepals). C–D. *Senna splendida* var. *splendida* (habit and sepals). Credits: A–B. Rubens Queiroz.

Senna angulata (Vogel) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 177. 1982.
Cassia angulata Vogel, Gen. Cass. Syn. 16. 1837.

Distribution and habitat.—*Senna angulata* is exclusive to the Brazilian Atlantic Forest and Cerrado domains, occurring in the states of Bahia, Espírito Santo, Minas Gerais, Paraná, Rio de Janeiro, Santa Catarina and São Paulo. It grows in anthropized areas, at the edge of ombrophilous forest, seasonal forest, *restinga*, rocky outcrops, riparian forest, savannas and rupestrian grasslands, from sea level up to 1800 m a.s.l.

Phenology.— Flowering throughout the year and fruiting from March to September.

Notes.—*Senna angulata* is a scandent shrub characterized by its leaf rachis with only one extra-floral nectary, its bracts sepeloid (6–10 x 3–6 mm), its asymmetric large corolla, petals 3.8–4.2 cm long, and the abaxial stamens approximately twice the length of the median stamens. Two varieties were recognized by Irwin & Barneby (1982).

Key to the Varieties of *Senna angulata*

1. Branches and inflorescences velutinous.....*Senna angulata* var. *angulata*
 1'. Branches and inflorescences tomentose to glabrescent.....*Senna angulata* var. *miscadena*

Senna angulata var. *angulata* (Fig. 7A, B)

Distribution and habitat.—This variety is restricted to the central region of Minas Gerais state.

Representative specimens examined. BRAZIL. Minas Gerais. Serra do Espinhaço, middle slopes of Serra da Piedade, ca. 40 km E. of Belo Horizonte, BR-31, 1800 m, 16 Jan 1971 [fl], *Irwin, H. S. 30520* (NY); Itabira do Campo, Apr 1892 [fl], *Ule, E. 2482* (NY); Belo Horizonte, campus UFMG, próximo a prefeitura, 10 Aug 1995 [fr], *Lombardi, J. A. 917* (NY); Belo Horizonte, morro das pedras, 1100 m, 25 Mar 1945 [fl], *Williams, L. O. & Assis, V. 6489* (F); Belo Horizonte, camelo, 09 Apr 2008 [fl, fr], *Ordonez, J. et al. s/n* (BHZB, HUEFS); Ouro Preto, [fl], *Clausen, P. 195B* (NY);

Senna angulata var. *miscadena* (Vogel) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 178. 1982. *Cassia angulata* var. *miscadena* Vogel Gen. Cass. Syn. 16. 1837.

Distribution and habitat.—This variety is widely distributed along the coastal plain and in the Atlantic Forest mountains, from Santa Catarina to southern Bahia state.

Representative specimens examined. BRAZIL. Bahia. Belmonte, 30 Jun 1996 [fl], *Belém, R. P. & Pinheiro, R. S. 2448* (NY); Barrolândia, Estação Experimental "Gregorio Bondar" CEPLAC, 48 km east of BR 101 on road to Belmonte, 12 May 1993 [fl], *Thomas W. W. et al. 9894* (NY); Porto Seguro, fazenda bom sossego, 28 May 2005 [fl], *Almeida, L. P. et al. 121* (CEN); Santa Cruz de Cabrália, estrada velha para Sta. Cruz de Cabrália, entre a Estação Ecológica Pau-Brasil e Sta. Cruz de Cabrália, 17 May 1979 [fl], *Mori, S. A. s.n.* (CEPEC, NY). **Espírito Santo:** São Mateus, Reserva Florestal de Sooretama. Lagoa do Macaco, 15 May 1977 [fl, fr]. *Martinelli G. 2249* (ICN, RB); Governador Lindenberg, Morelo, propr.: Fernando Nicolli (mata próximo da sede), 24 Apr 2007 [fl], *Demuner, V. et al. 3740* (MBML, RB); Linhares, Reserva Florestal Linhares CVRD. Próximo a estrada 134, Talhão 301, 22 Mar 1973 [fl], *Spada J. 229* (NY, RB); Pancas, Serra do Alto Mutum Preto, proximidades da rampa de vôo Livre, 07 Mar 2003 [fl], *Fraga, C. N. et al. 972* (ESA, MBML, RB); Santa Teresa, Reserva Biológica Augusto Ruschi - Nova Lombardia, 11 Mar 2003 [fl, fr], *Vervloet, R. R. & Bausen, E. 1949* (MBML, RB); Serra, 24 Mar 1998 [fl], *Pereira, O. J. et al. 1435* (VIES); Guarapari, Parque Estadual Paulo César Vinha, restinga, borda de floresta periodicamente inundável, 09 May 2009 [fl], *Chagas, A. P. et al. 42* (VIES). **Minas Gerais:** Serra do Caparaó, 30 Apr 1988 [fl], *Krieger, L. et al. 126* (RB); Alto Caparaó, Parque Nacional do Caparaó; estrada entre alojamento e Vale Verde; Mata de Altitude, 01 Sep 1996 [fr], *Souza, V. C. et al. 12099* (ESA, RB). **Paraná:** Campina Grande do Sul, Serra do Capivari Grande, 20 Mar 1967 [fl], *Hatschbach, G. 16200* (MBM, MO, NY); Bocaiúva do Sul, rio Capivari, 14 Jan 1969 [fl], *Hatschbach, G. et al. 20728* (MBM). **Rio de Janeiro:** Armação dos Búzios, fragmento próximo à praia da Tartaruga, 29 Aug 2004 [fr], *Ribeiro, R. D. et al. 319* (RB); Cabo Frio, 20 Mar 1943 [fl], *Vidal, J. s.n.* (NY); Cabo Frio. Parque Ecológico Municipal do Mico-Leão-Dourado, 07 Apr 2003 [fl], *Rezende, G. S. Z. 122* (RB, SPF) Saquarema, praia de itaúnas, restinga arbórea sobre solo arenoso, 25 Apr 1987 [fl, fr], *Lima, H. C. & Lewis, G. P. 2832* (RB, VIC); Rio de Janeiro, Jacarepaguá, via 9, 05 Sep 1972 [fr], *Sucre, D. 9605* (RB); Petrópolis. Jacó, trilha do encanamento. Parque Nacional da Serra dos Órgãos, 29 Apr 2008 [fl], *Nadruz, M. et al. 2190* (RB). **Santa Catarina:** Palhoça, morro

do cambirela, 05 Apr 1972 [fl], *Bresolin, A. 534* (FLOR, US). **São Paulo:** Pariquera-Açú, estação experimental do instituto agrônômico, floresta atlântica, 18 Apr 1995 [fl], *Ivanauskas, N. M. 122* (ESA, UEC).

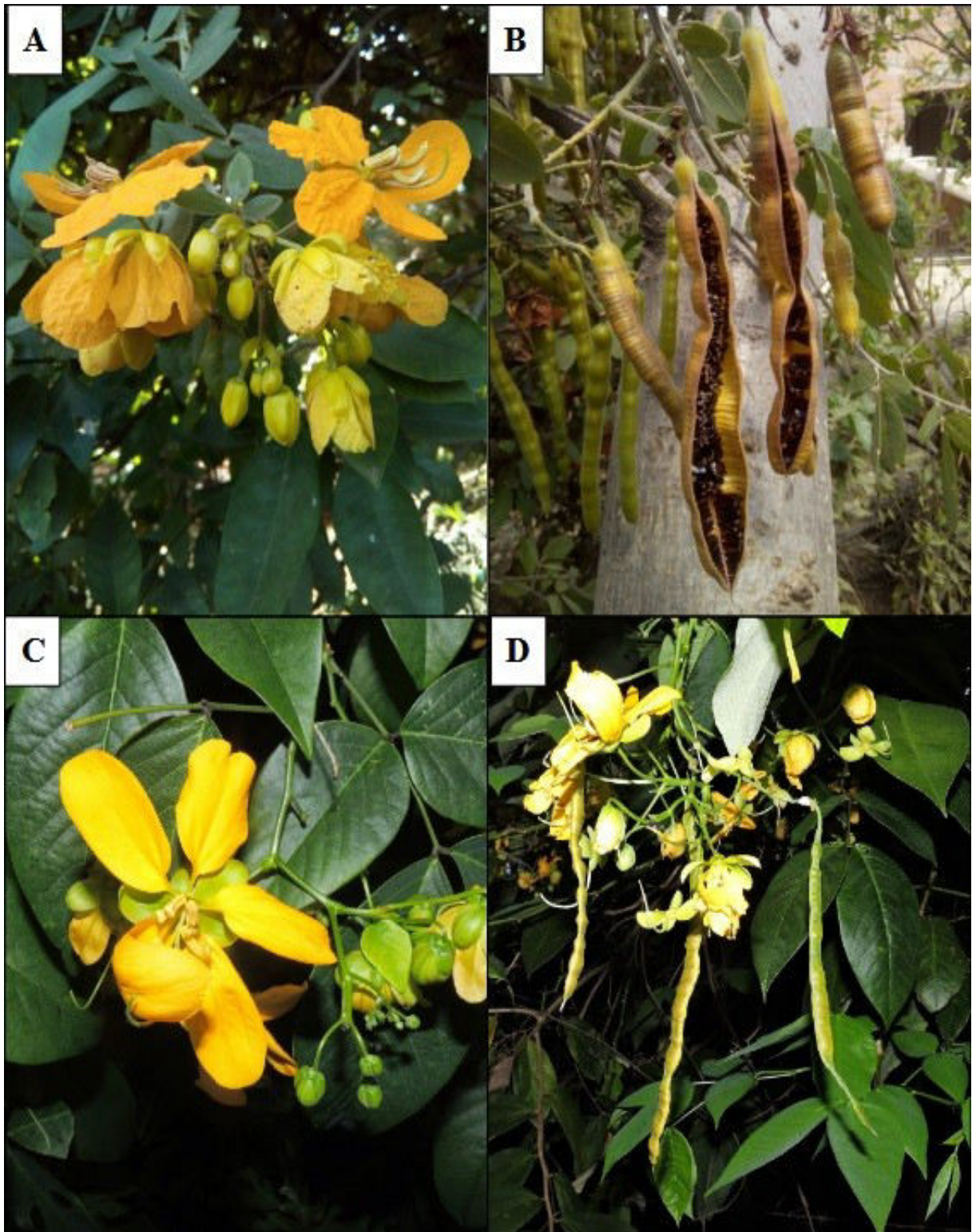


FIG. 7. A–B. *Senna angulata* var. *angulata* (flowers and fruits). C–D. *Senna georgica* var. *georgica* (flowers and fruits). Credits: A–B. Franklin Logan. C–D. Rubens Queiroz..

Senna tapajozensis (Ducke) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 175. 1982. *Cassia tapajozensis* Ducke, Arch. Jard. Bot. Rio de Janeiro 4: 57–58. 1925.

Distribution and habitat.—In Brazil, the species is widespread in the central-western (Mato Grosso state) and northern (Acre, Amazonas, Amapá, Mato Grosso, Pará and Rondônia) regions in the Amazon Rainforest and its limit with the Cerrado domain. It grows on sandy or clayey soils of riparian forest, *igapó* forest, *terra firme* forest, Amazonian savannas and disturbed areas, mostly at altitudes below 300 m a.s.l.

Phenology.— Flowering from October to July and fruiting from May to September.

Notes.—This scandent shrub is easily recognized by the quadrangular young branches, the asymmetric, elliptical to kidney-shaped leaflets, the rigid sepals, the sets of stamens strongly differentiated in length, and the fruits 15-30 cm long with venulose valves.

Representative specimens examined. BRAZIL. Acre. Rio Branco, BR 317 (Estrada Rio Branco-Brasília) approx. 10 km W of km 68, 9 Jun 1991 [fl, fr], *Daly, D. C. et al. 6929* (INPA, NY); Rio Branco, Parque Zoobotânico, bloco 01, 2 Jun 1992 [fl], *Claros, G. & Reginaldo 96* (INPA); Xapuri, Reserva Extrativista Chico Mendes, 4 hours from Colocação Pimenteira Vai-Quem-Quer, 20 Apr 1995 [fr], *Brilhante, N. A. 3* (NY). **Amazonas:** Rio Ituxi, lake west of Boca do Curuquetê, 11 Jul 1971 [fl, fr], *Prance, G. T. et al. 14112* (NY); Margin of Lábrea airstrip Amazonas, rio Purus, rio Ituxi, 28 Jun 1971 [fl, fr], *Prance, G. T. et al. 13880* (INPA, NY, US); Humaitá, estrada Humaitá-Lábrea, km 70, 9 Jun 1982 [fl, fr], *Teixeira, L. O. A. et al. 1036* (INPA, NY); Humaitá, estrada Humaitá-Jacarecanga, entre o km 64 e 70, 14 Jun 1982 [fl, fr], *Teixeira, L. O. A. et al. 1107* (NY); Carauari, cerca de 3 km Norte da cidade, 13 Jul 1980 [fl], *Silva, A. S. L. et al. 630* (NY); SWW from Manaus, en route from Cacau Pirera to Manacapuru, along the Rt. AM-070, 6 Aug 1987 [fr], *Tsugaru, S. & Sano, Y. B-746* (NY); Manaus, km 139 da estrada Manaus-Itacoatiara, 11 Jun 1972 [fl], *Pires, O & Lima, J. 111* (INPA). **Amapá:** Igarapé do Palha, estrada para Amapá, 20 Jul 1962 [fl, fr], *Pires, J. M. & Cavalcante, P. B. 52236* (NY, US). **Mato Grosso:** Cristópolis, rod. MT-339, 18 km de Cristópolis para Tangará da Serra, 25 Oct 1995 [fl], *Hatschbach, G. et al. 63880* (NY); Nova Bandeirantes, estrada para Fazenda Novo Horizonte, floresta ombrófila aberta, relevo suave ondulado, solo tipo podzólico, 30 May 1997 [fl], *Árbocz, G.F. et al. 3909* (ESA); São José do Rio Claro, bairro Piracema, contato savana florestada/floresta estacional, relevo

suave ondulado, solo do tipo latossolo vermelho-escuro, textura média, 25 Apr 1997 [fl], *Ivanauskas, N. M. et al. 1933* (ESA); Nova Ubiratã, contato floresta ombrófila aberta com floresta estacional, beira de estrada, antropizada, 28 Apr 1997 [fl], *Nave, A. G. et al. 1320* (ESA). **Pará:** Marabá, coleta no acampamento azul, 24 May 1982 [fl], *Secco, R. S. et al. 337* (NY); Itaituba, estrada Santarém-Cuiabá, BR 163, km 886 a km 881, Serra do Cachimbo, 4 May 1983 [fl], *Amaral, I. L. et al. 1137* (NY); Porto Trombetas, Mina Saracá, Mineração Rio do Norte, Porto Trombetas - Mina Saracá, 1997 [fl], *Barbosa, E. M. et al. 57* (INPA); Oriximiná, mineração Rio do Norte, Porto Trombetas, mina Saracá, adjacências, área de reflorestamento, 18 Jun 1999 [fl, fr], *Miranda, I. P. et al. 408* (INPA). **Rondônia:** Costa Marques, Chapada dos Parecis, Distrito de Alta Floresta, estrada P-56, km 17, 16 Jun 1984 [fr], *Cid, C. A. et al. 4573* (INPA, NY); Ariquemes, Mineração Mibrasa, Setor Alto Candeias, km 128, Sudoeste de Ariquemes, 11 May 1982 [fl], *Teixeira, L. O. A. et al. 327* (NY); Santa Bárbara, rodovia BR 364, km 120, Santa Bárbara, 24 May 1982 [fl], *Teixeira, L. O. A. et al. 716* (NY); São Lourenço, São Lourenço cassiterite mine, ca. 20 km NW of Rio Madeira, across from Mutuparaná, ca. 4 km N of S. Lourenço on road to "A Macisa" mine, 15 Jul 1979 [fr], *Calderon, C. E. et al. 2850* (NY).

Senna tenuifolia (Vogel) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 179. 1982.
Cassia tenuifolia Vogel, Gen. Cass. Syn. 16. 1837. (Fig. 8A, B)

Distribution and habitat.—*Senna tenuifolia* is restricted to the Atlantic Forest domain in southeastern Brazil in the states of Espírito Santo, Minas Gerais and Rio de Janeiro. It grows in mountainous areas at the edge of ombrophilous forest, seasonal forest, riparian forest, rocky outcrops and disturbed areas, mostly from 500 to 1500 m a.s.l.

Phenology.— Flowering from January to October and fruiting from April to October.

Notes.—*Senna tenuifolia* is a shrub to treelet, morphologically characterized by the villous branches, the leaf rachis with one slenderly clavate to elliptical extra-floral nectary, the axillary racemes, the sets of stamens strongly differentiated in length, and the fruits with uniseriate seeds.

Representative specimens examined. BRAZIL. Espírito Santo. Domingos Martins, Parque Estadual da Pedra Azul, trilha das piscinas, 13 Jul 2005 [fl], *Kollmann, L. & Kollmann, R. L. 8049* (ESA, MBML); Parque Estadual da Pedra Azul, floresta estacional

semidecidual montana em arredores de campo de altitude granítico, 17 Aug 2013 [fl], *Coutinho, I. A. C. & Laurenção, P. M. C.* 262 (VIC); Dores do Rio Preto, estrada entre a entrada do Parque Nacional do Caparaó e o centro do município de Pedra Menina, estrada vicinal à direita logo após a primeira ponte, 21 Oct 2012 [fl, fr], *Flores, T. B. et al.* 1391 (ESA, RB). **Minas Gerais:** Alto Caparaó, entrada entre o alojamento e Vale Verde. mata de altitude, 1 Sep 1996 [fl], *Souza, V. C. et al.* 12100 (ESA, MBML); Parque Nacional do Caparaó, acesso à cachoeira bonita, 18 Sep 1988 [fl], *Krieger, P. L. et al.* 213 (CESJ); Serra do Caparaó, próximo ao rio Caparaó, rancho dos Três Barras, 26 Jun 1950 [fl, fr], *Santos, N. & Campos, I. s.n.* (NY); Caparaó, Encosta da Serra do Caparaó, abaixo do Parque Nacional, 24 Oct 1989 [fl, fr], *Pirani, J. R. et al.* 2550 (NY); Realeza, arredores, 15 Oct 1983 [fl], *Hatschbach, G. & Guimarães, O.* 46858 (NY); Teófilo Otoni, margem da estrada, 18 Sep 1959 [fl], *Magalhães, M.* 15603 (RB) **Rio de Janeiro:** Petrópolis, San Antonio, 1874 [fl, fr], *Glaziou, A. F. M.* 7580 (NY); Petrópolis, 1 Apr 1941 [fl], *Silva, O. A. s.n.* (RB); Paraíba do Sul, estrada para Rio das Flores, 2 Aug 2006 [fl, fr], *Iganci, J. et al.* 168 (RB); Engenheiro Paulo de Frontin, Morro Azul, descida de trilha de acesso, 7 Jul 1998 [fl, fr], *Santos, M. C. F. et al.* 178 (RB); Santa Maria Madalena, Parque Estadual do Desengano, trilha da Rifa, lado direito, área dos eucaliptos, 22 Aug 2003 [fl], *Santos, M. C. F. et al.* 1517 (RB).

***Senna macranthera* (DC. ex Collad.) H.S.Irwin & Barneby** Mem. New York Bot. Gard. 35: 181. 1982. *Cassia macranthera* DC. ex Collad., Hist. Nat. Méd. Casses 99, pl. 8. 1816.

Distribution and habitat.—One of the most widespread species of *Senna*, being found in different ecosystems in Brazil, Colombia, Ecuador and Venezuela. The species also is naturalized and cultivated in many other countries (Irwin & Barneby, 1982).

Notes.—*Senna macranthera* can be recognized by its large asymmetrical corolla with petals 2.5–3 cm long, and the sets of stamens strongly differentiated in length (abaxial stamens approximately twice the length of the median ones). The current accepted circumscription of the species was defined by Irwin & Barneby (1982) after analysing an extensive number of specimens and subsequently transferring six species named by other authors to variety level within *S. macranthera* and adding two extra varieties. Some of the varieties are very geographically disjunct. The circumscription of the species by Irwin and

Barneby (1982) showed strong polymorphism in habit, indumentum, and leaflet shape and size, but a relatively uniform corolla and androecium.

Since Irwin and Barneby (1982), new fruiting collections have been deposited in herbaria, and these display some differences in fruit morphology across the geographical distribution of the five varieties which occur in Brazil. The varieties associated mainly with Caatinga vegetation (var. *micans*, var. *pudibunda* and var. *striata*) have shorter pods with smooth to slightly corrugated valves, while the varieties of the Atlantic Forest and Cerrado (var. *macranthera* and var. *nervosa*) have longer fruits with strongly corrugated valves.

We are working on a detailed morphological, ecological and molecular study of *Senna macranthera*, to be presented in the future. Here, we adopt the infra-specific classification of Irwin & Barneby (1982).

Key to the Varieties of *Senna macranthera*

1. Trees or treelets, 3–18 m tall; distal leaflets 6–15 cm long; fruits (16–) 18–35 (–38) cm long, valves strongly corrugated.....2
2. Branches, abaxial face of leaflets and inflorescences velutinous, usually with golden trichomes.....*Senna macranthera* var. *nervosa*
- 2'. Branches, abaxial face of leaflets and inflorescences pubescent to glabrescent.....
.....*Senna macranthera* var. *macranthera*
- 1'. Shrubs or sometimes treelets, 1–3 (–4) m tall; distal leaflets 2–8 cm long; pods 6–16 cm long, valves smooth to slightly corrugated.
3. Branches and abaxial face of leaflets pubescent to glabrescent; fruits 10–16 cm long
.....*Senna macranthera* var. *striata*
- 3'. Branches and abaxial face of leaflets velutinous; fruits 6–12 cm long.....4
4. Leaflets 2–4.5 x 1–2 cm; inner sepals 6.5–13 x 5–8.5 mm.....
.....*Senna macranthera* var. *pudibunda*
- 4'. Leaflets 5–7 x 2–4 cm; inner sepals 3–6 x 2.5–4 mm.....
.....*Senna macranthera* var. *micans*

Senna macranthera* var. *macranthera

Distribution and habitat.—The native range of this variety includes the Atlantic Forest domain and occasionally the Cerrado, occurring in northeastern (Bahia), southeastern (Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo) and southern (Paraná and Santa Catarina) regions. The variety also is cultivated in many Brazilian cities. The few specimens from Rio Grande do Sul indicates to be cultivated, but more collections and field work are required to better understand its occurrence in Rio Grande do Sul. It grows on clayey, rocky and sandy soils at the edge of ombrophilous forest, seasonal forest, riparian forest and in disturbed areas, near the coast, on the atlantic slopes and inland, from sea level to 1400 m a.s.l.

Representative specimens examined. BRAZIL. Espírito Santo: Santa Teresa, Penha, no mato do Tabajara, 22 Mar 2005 [fl], *Kollmann, L. et al.* 7526 (MBM, MBML); Santa Teresa, próximo ao Governador, 16 Jul 2003 [fr], *Demuner, V.* 1589 (MBML). **Bahia:** Wenceslau Guimarães, Reserva Estadual, 1 Apr 1993 [fl], *Sant'Ana, S. C. & Silva, L. A. M.* 321 (CEPEC, NY). **Minas Gerais:** Lima Duarte, Parque Estadual Ibitipoca, 24 Mar 1988 [fl], *Andrade, P. et al.* 1151 (NY); Viçosa, State Agricultural School, 14 Feb 1959 [fl], *Irwin, H. S.* 2625 (NY); **Paraná:** Campo Mourão, Parque Estadual Lago Azul (PELA), 29 May 2012 [fl], *Caxambu, M. G.* 1438 (EVB); Assis Chateaubriand, em direção a Nova Aurora, 15 Apr 2002 [fl], *Bortoluzzi, R. L. C. & Biondo, E.* 1244 (ICN); Cascavel, zoológico municipal de Cascavel, 2 Apr 2011 [fl], *Scariotto, M. C. s.n.* (EVB); **Rio de Janeiro:** Rio de Janeiro, Vista Chinesa, próximo ao DECAM, 23 Mar 1977 [fl], *Araújo, D.* 1560 (NY); Rio de Janeiro, Vista Chinesa, matas do distrito federal, 19 Mar 1940 [fl], *Silva, F. F. s.n.* (NY); Petrópolis, Itaipava, vale do Sossego, fragmento de mata de encosta próxima à Rua D., 4 Mar 2007 [fl], *Lima, H. C.* 6519 (MBM, RB); Petrópolis, Itaipava, vale do Sossego, 20 Feb 2004 [fl], *Lima, H. C.* 6150 (MBM, RB); Nova Friburgo, Reserva Ecológica de Macaé de Cima, 20 Apr 1989 [fl], *Lima, H. C. et al.* 3552 (MBM, RB); Cantagalo, [fl], *Peckolt, T.* 218 (NY). **Santa**

Catarina: Garuva, BR-101, posto de pesagem ca. 15 km da cidade, 23 Jan 2002 [fl], *Bortoluzzi, R. L. C. et al. 1087* (ICN); São Francisco do Sul, Ilha das Flores, 20 May 2004 [fr], *Fischer, T. 12* (FURB, MBM); São Francisco do Sul, Ilha dos Herdeiros, 19 Mar 2005 [fl], *Casas, G. 99* (MBM); Jaraguá do Sul, 27 May 2000 [fl], *Sobczak, A. 9* (HUCP); Balneário Camboriú, 17 Jul 2017 [fl], *Medeiro, A. s.n.* (CRI); Lages, 25 Apr 2006 [fl], *Pereira, G. S. s.n.* (LUSC); Araranguá, BR-101, km 418, 31 Jan 2001 [fl], *Bortoluzzi, R. L. C. & Miotto, S. T. S. 910* (ICN). **São Paulo:** Botucatu, Rubião Junior, faculdade de ciências médicas e biológicas, jardim botânico antigo, no morro, 11 Feb 1969 [fl], *Gottsberger, G. K. 11* (NY); São Paulo, Jardim Botânico de São Paulo, 26 Jan 1932 [fl], *Hoehne, F. C. 28778* (NY, SP).

Senna macranthera* var. *micans (Nees) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 185. 1982. *Cassia micans* Nees, Flora 4: 303. 1821.

Distribution and habitat.—*Senna macranthera* var. *micans* occurs in northeastern (Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe) in the Caatinga domain and occasionally in the Cerrado. It occurs on sandy, clayey and rocky soils at the edge of seasonal forest, in caatinga, savanna, rupestrian grasslands and in disturbed areas, mostly from 300 to 1500 m a.s.l.

Representative specimens examined. BRAZIL. Bahia: Santa Inês, ca. 55 km Milagres/ Jequie, 15 Apr 1990 [fl], *Carvalho, A. M. V. & Thomas, W. W. 3100* (CEPEC, NY); Serra do Sincorá, Cascavel on the road to Mucugé, 25 Mar 1980 [fl], Harley, R. M. 20941 (K, NY); Palmeiras, ca. 3 km da entrada de Lençóis em direção a Seabra, 13 Apr 1990 [fl], *Carvalho, A. M. V. & Thomas, W. W. 2986* (CEPEC, NY); Maracás, 27 Apr 1978 [fl], *Mori, S. A. et al. 10043* (NY); Mucugê, caminho para Igatu, 27 Jul 2013 [fr], *Guedes, M. L. 20875* (MBM); Caetité, serra Geral, brejinho das Ametistas, 22 May 2008 [fr], *Guedes, M. L. & Gomes, F. S. 14544* (ALCB). **Ceará:** Catuana, 1935 [fl], *Dahlgren, B. E. 790* (US); Crato, chapada do Araripe, 29 Feb 1980 [fl], *Martins, P. s.n.* (EAC); Barbalha, chapada do Araripe,

17 Jul 2002 [fl], *Augusto, E. I* (EAC). **Maranhão:** São João dos Patos, Bom Jesus, BR-135, 1 May 1978 [fl], *Fernandes, A. & Matos s.n.* (EAC); Barra do Corda, 10 Nov 1979 [fl,fr], *Nunes, E. & Martins, P. s.n.* (EAC). **Paraíba:** Serra de Teixeira, pico do Jabre, 16 Apr 1993 [fl], *Agra, M. F. 1991* (NY); Monteiro, serra de Jabitacá, 12 Jun 2008 [fl], *Gadelha, P. C. et al. 2331* (JPB, HUEFS). **Pernambuco:** Parnamirim, fazenda Floresta, serra do Rumão, 14 May 2015 [fl,fr], Fontana, A. P. 9375 (HUEFS); Pesqueira, serra do Ororobá, 17 May 1995 [fl], *Correia, M. 433* (HUEFS); Garanhuns, depois da clínica UFRPE, 1 Dec 1996 [fl], *Miranda, A. M. 2554* (HST, INPA). **Piauí:** Brasileira, Capão do Mariano, PARNA de Sete Cidades, 12 Jul 2001 [fl], *Alencar, M. E. 1382*. **Rio Grande do Norte:** Riachuelo, 60 km W from Natal, 28 Aug 1987 [fl, fr], *Tsugaru, S. 1239* (NY) **Sergipe:** Lagarto, povoado Colônia 13, 15 Jul 2008 [fl], *Santos, C. S. 211* (ASE); Capela, mata do Junco, 16 Aug 2012 [fl, fr], *Gomes, L. A. et al. 643* (ASE).

Senna macranthera* var. *nervosa (Vogel) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 184. *Cassia nervosa* Vogel, Gen. Cass. Syn. 39. 1837. (Fig. 8C, D).

Distribution and habitat.—*Senna m acranthera* var. *nervosa* is widely distributed in the Atlantic Forest and in the Cerrado domains, occurring naturally in central-western (Federal District, Goiás and Mato Grosso do Sul), northeastern (Bahia), southeastern (Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo) and southern (northern Paraná) regions. Due to its showy features, it is widely cultivated as a street and park ornamental throughout Brazil, and is possibly naturalized in some areas. Across its native range it occurs in savannas, rupestrian grasslands, riparian forest, seasonal forest, ombrophilous forest and in disturbed areas, from 100 to 1600 m a.s.l.

Representative specimens examined. BRAZIL. Bahia: Porto Seguro, BR-367, mata higrófila sul bahiana, 9 May 1980 [fl], *Euponino, A. 466* (US); Porto Seguro a Eunápolis, Estação Ecológica do Pau-Brasil, 22 Feb 1984 [fl] *Santos, F. S. 279* (CEPEC, NY); Una, REBIO Mico-Leão (IBAMA), 1 May 1996 [fl], *Jardim, J. G. 816* (CEPEC, NY);

Cruz das Almas, Fazenda Primavera, Nov 1987 [fr], *Pinto, G. C. P. s.n.* (ALCB). **Espírito Santo:** São Gabriel da Palha, faz. Rondelo, 26 Apr 2008 [fl], *Assis, A. M. & Demuner, V. G. 1558* (MBML); Nova Venécia, APA Pedra do Elefante, 25 Jun 2015 [fl], *Pena, N. T. L. et al. 163* (VIES); São Roque do Canaã, Alto Misterioso, 2 Dec 2009 [fl], *Kollmann, L. et al. 8731* [fl]. **Federal District:** Brasília, Fundação Zoobotânica, 25 Jan 1962 [fl], *Cobra, L. Q. & Belém, R. P. 150* (NY); Brasília, gallery at Capão Onça, DF-13, *Irwin, H. S. et al. 26511* (NY). **Goiás:** Cristalina, Serra dos Cristais, 8 Mar 1966 [fl], *Irwin, H. S. et al. 13783* (MBM, NY); Água Fria de Goiás, Serra Geral do Paraná, 17 Mar 1971 [fl], *Irwin, H. S. et al. 32075* (NY); Alto Paraíso de Goiás, rodovia para Colinas do Sul, 23 Feb 1991 [fl], *Pereira, B. A. S. et al. 1525* (NY). **Mato Grosso do Sul:** Corumbá, Morraria Santa Cruz, 14 Mar 1990 [fl], *Boobaid, L. F. 1* (COR). **Minas Gerais:** Capitólio, região de Furnas, trilha da cachoeira Feixo da Serra, 13 Aug 2007 [fl], *Bernardes, P. H. N. et al. 15* (HUFU); Felixlândia, 30 km W of Curvelo, 22 Feb 1975 [fl], *Anderson, W. R. 11522* (NY); Diamantina, serra do espinhaço, at Lapinha, 23 Feb 1968 [fl], *Irwin, H. S. 20710* (NY); Governador Valadares, ca. 10 km of Rio Doce, 28 Mar 1976 [fl], *Davidse, G. & D'Arcy, W. G. 11458* (SP). **Paraná:** São Jerônimo da Serra, reserva Indígena, 17 Apr 2002 [fr], *Sá, K. L. V. R. 125* (MBM); Campo Mourão, 1978 [fl], *Lima, J. M. 490* (US). **Rio de Janeiro:** Itatiaia, vicinity of ponte Maromba, 12 Apr 1929 [fl], *Ferreira, J. 2315* (NY); Volta Redonda, Fazenda Santa Cecília do Ingá, 14 Mar 2005 [fl], *Lima, H. C. & Diniz, A. P. 6262* (MBM, RB). **São Paulo:** Vinhedo, rodovia Anhanguera, borda de mata, sítio do Marcel, 5 Apr 2003 [fl], *Guillaumon, J. R. s.n.* (MBM, SPSF); Socorro, 26 Feb 2001 [fl], *Grosso, M. 587* (ESA); Mogi Guaçu, 5 May 1992 [fr], *Romaniuc S. et al. 1308* (ESA); Mogi Mirim, fazenda Esmeralda, 19 Mar 1994 [fl], *Árbocz, G. F. 240* (UEC); São Paulo, Parque do Estado, 26 Jan 1932 [fl], *Hoehne, F. C. s.n.* (NY, SP).

Senna macranthera var. *pudibunda* (Mart. ex Benth.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 186. 1982. *Cassia pudibunda* Mart. ex Benth., Fl. Bras. 15(2): 102. 1870.

Distribution and habitat.—*Senna macranthera* var. *pubibunda* is widespread in northeastern (Bahia, Ceará, Paraíba, Pernambuco, Piauí and Rio Grande do Norte) in the Caatinga domain and at the limits of this vegetation as it grades into Cerrado. It grows in xeric ecosystems, mostly on sandy soils in the caatinga, savanna, and in disturbed areas, as well as in the São Francisco river dunes, mostly below 500 m a.s.l.

Representative specimens examined. BRAZIL. Bahia: Urandi, BR-122, 4 Apr 1992 [fl, fr], *Hatschbach, G. & Barbosa, E.* 56535 (MBM); Aracatu, arredores, 17 May 1983 [fl] , *Hatschbach, G.* 46381 (MBM, NY); Lagoa Real, açude, 16 Jan 1997 [fl], *Hatschbach, G. et al.* 65835 (MBM, NY); Ibitiara, 17 Jun 1986 [fl, fr], *Hatschbach, G. & Zelma, F. J.* 50447 (MBM); Morro do Chapéu, ca. 1 km da BR-122 ao S do entrocamento com a BA-52, 21 Jun 1993 [fl, fr], *Queiroz, L. P. & Nascimento, N. S.* 3321 (HUEFS, NY); Xique-xique, Irecê, 31 May 1991 [fl, fr], *Brito, H. S. & Pennington, T. D.* 312 (ALCB, NY); Juazeiro, BR-407 to Senhor do Bonfim, 24 Jan 1993 [fl, fr], *Thomas, W. W. et al* 9629 (MBM, NY); Juacema, fazenda pé de serra, 28 Jul 2005 [fl], *Carneiro-Torres, D. S.* 357 (HUEFS). **Ceará:** Cratêus e Novo Oriente, 16 Apr 1980 [fl, fr], *Fernandes, A. & Nunes, E. s.n.* (EAC); Barra, Estação Ecológica de Aiuaba, serra do Ermo, 26 Feb 1997 [fl], *Lima-Verde, L. W. et al.* 523 (EAC). **Paraíba:** Arara, agreste, 17 Mar 1975 [fl], *Barbosa, V. P.* 217 (RB); Patos, 4 Jul 1955 [fl], *Gonçalves, C. R. s.n.* (RB); Arara, agreste, 17 Mar 1975 [fl], *Barbosa, V. P.* 234 (RB). **Pernambuco:** Floresta, REBIO Serra Negra, 20 Jul 1995 [fl], *Laurênio, A.* 93 (NY); Ibimirim, 19 Jul 1995 [fl, fr], *Ferraz, E. & Laurênio, A.* 261 (NY); Ibimirim, *Rodal, M. J. N. et al.* 603 (NY); Bezerros, Parque Ecológico de Serra Negra, 27 Dec 1995 [fl], *Hora, M. J. & Campelo, M. J.* 9 (NY). **Piauí:** Jacaré, Cocal, 25 Jul 2003 [fl, fr], *Chaves, E. M. F.* 456 (HUEFS); **Rio Grande do Norte:** Currais Novos, cânion dos apertados, 24 Aug 2017 [fl], *Pezzini, F. F. & Menezes, T. G. C.* 302 (HUEFS).

Senna macranthera var. *striata* (Vogel) H.S. Irwin & Barneby, Mem. New York Bot. Gard. 35: 185–186. 1982. *Cassia striata* Vogel Gen. Cass. Syn. 39–40. 1837.

Distribution and habitat.—*Senna macranthera* var. *striata* occurs predominantly in the Caatinga domain, although occasionally it is found in the Atlantic Forest and Cerrado domains. It occurs in central-western (Goiás), northeastern (Bahia, Ceará and Pernambuco) and northern (Tocantins) regions. The variety grows mostly in xeric ecosystems, including caatinga, savanna and rocky outcrops, mostly from 100 to 500 m a.s.l.

Representative specimens examined. BRAZIL. Bahia: Jequié, Contendas do Sincorá, 23 Dec 1981 [fl, fr], *Lewis, G. P. et al. 976* (K, NY); Jequié, 13 Jul 1979 [fl], *Mori S. A. et al 12193* (NY); Vitória da Conquista, BR-116, 15 Jul 1982 [fl], *Hatschbach, G. & Guimarães, O. 45034* (MBM, NY); Cristópolis, BR-242, 14 Jan 1977 [fl], *Hatschbach, G. & Guimarães, O. 39507* (MBM); Serrinha, ca. 12 km south of Village of Araci, 19 Jul 1962 [fl, fr], *Eiten, G. et al. 5012* (NY). **Ceará:** Quixadá, fazenda Flamengo, serra Azul, 18 Mar 1993 [fr], *Andrade, I. M. s.n.* (EAC). **Goiás:** Nova Vista, Posse, 11 Jan 1977 [1977], *Hatschbach, G 39396* (MBM, NY). **Pernambuco:** Russinha, 6 Mar 1935 [fl], *Pickel, B. J. 3911* (NY). **Tocantins:** Arraias, rodovia para Campos Belos, 15 Feb 1990 [fl], *Hatschbach, G. et al. 54027* (MBM, NY).



FIG. 8. A–B. *Senna tenuifolia* (flowers and fruits). C–D. *Senna macranthera* var. *nervosa* (flowers and fruits). Credits: A. Juliana Kuntz.. B. Letícia Rosignoli.

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5 CONSIDERAÇÕES FINAIS

Quase 40 anos se passaram desde a última abordagem taxonômica dedicada às espécies de *Senna ser. Bacillares* das Américas, e muitas lacunas no seu conhecimento permanecem. A afirmação de Irwin & Barneby (1982, p. 103) de que “knowledge of the *Bacillares*, and consequently the taxonomy, leaves much to be desired” foi confirmada no presente trabalho, onde ficaram evidentes as lacunas existentes neste grupo taxonômico, sobretudo, na delimitação das espécies e variedades, na morfologia e distribuição de táxons ainda pouco amostrados. Além disso, há um grande potencial de descoberta e descrição de novas espécies.

Nesse sentido, a dissertação aqui apresentada, além de fornecer dados mais atualizados sobre o grupo no Brasil, permitiu que se evidenciasse a necessidade de prosseguimento dos estudos em *Bacillares* e deve ser o tema de doutorado a ser desenvolvido nos próximos anos, incluindo uma filogenia molecular e uma revisão taxonômica para todas as espécies subordinadas a série *Bacillares*, ampliando-se as atividades de campo e as consultas às coleções. Dentre os principais tópicos a serem investigados pode-se citar: a delimitação mais das espécies e variedades; um tratamento nomenclatural; a confirmação de novas espécies e a preparação de uma revisão taxonômica com uma maior amostragem de espécimes.

A lista a seguir, evidencia alguns dos pontos que permaneceram em aberto em relação à taxonomia das *Bacillares* no Brasil.

POSSÍVEIS ESPÉCIES NOVAS

Abaixo estão listadas possíveis espécies novas que estão sendo melhor estudadas nas coleções dos herbários e em campo pelo presente aluno e que serão tratadas em breve em artigos científicos.

Senna sp. 1

Baldwin, J. T. 3268 e Maas, P. J. M. 6646

Senna sp. 1 é morfologicamente semelhante à *S. wurdackii* H.S.Irwin & Barneby e *S. rupununiensis* H.S.Irwin & Barneby. Mas pode ser diferenciada da primeira por um nectário extra-floral na raque (vs. dois nectários extra-florais em *S. wurdackii*), pelo androceu com 3 estames abaxiais férteis (vs. androceu com 2 estames abaxiais férteis e um atrofiado). Difere de *S. rupununiensis*, por apresentar um nectário extrafloral na raque (vs. dois nectários extra-florais em *S. rupununiensis*), e pelos estames abaxiais menores que os estames medianos (vs. estames abaxiais maiores que os medianos).

Nos dados da etiqueta consta que o espécime *Baldwin, J. T. 3268* foi coletado em Providencia, no Rio Negro, estado do Amazonas. Já o espécime *Maas, P. J. M. 6646* foi coletado nas florestas de igapó entre o Rios Ararirá e o Rio Preto, na região do Rio Negro no estado do Amazonas.

Um estudo mais detalhado e expedições para a região estão previstas para ocorrer em breve.

Senna sp. 2

Giordano, L. C. et al. 1945 e Pereira, E. 1249

Senna sp. 2 é morfologicamente semelhante à *S. quinquangulata*, podendo ser distinguida desta por possuir apenas um nectário-extrafloral na raque (vs. dois nectários extra-florais na raque em *S. quinquangulata*) e panícula congesta (vs. panícula laxa).

Senna sp. 2 é somente conhecida para as florestas de Santa Maria Madalena - RJ, a 800–900 m de altitude. Já *S. quinquangulata*, embora amplamente distribuída na Amazônia e Mata Atlântica do Nordeste, tem como limite de ocorrência austral, o sul da Bahia. Após extensiva análise das coleções de *Senna* provenientes do ES, MG e RJ, nenhuma coleta de *S. quinquangulata* foi encontrada para esses estados, o que reforça a possibilidade de ser uma nova espécie e não apenas uma variação de *S. quinquangulata*.

Novos esforços estão sendo realizados na região de Santa Maria Madalena em busca de mais registros desta espécie, principalmente de indivíduos com frutos para uma melhor comparação entre os materiais.

***Senna* sp. 3**

Glaziou 12616

O espécime Glaziou 12616 mantido como indeterminado em Irwin & Barneby (1982), é caracterizado pelos folíolos assimétricos, sépalas lanceoladas com ápice agudo e estames abaxiais maiores que os medianos. O espécime é morfológicamente semelhante a *S. macranthera* var. *macranthera* (dimensões da corola e androceu) e a *S. acutisepala* (pelo formato das sépalas).

Irwin & Barneby (1982) ao estudar as coleções de Glaziou e seu diário, concluíram que a localidade de origem deste espécime se refere às imediações de Belo Horizonte-MG, referido em Glaziou (1895) como “Santa Quitéria, Minas Gerais”. Apesar dos esforços, no presente estudo, nenhuma outra coleta de *Senna* sp. 3 foi encontrada nas coleções provenientes de Minas Gerais.

Ademais, o espécime *Glaziou 10687* — citado conjuntamente com *Glaziou 12616* como sendo *Cassia bacillaris* e também proveniente de Santa Quitéria, em Glaziou (1895) — corresponde a *S. georgica*, uma espécie nativa das florestas ombrófilas e estacionais do Norte, Nordeste e parte do Centro-Oeste do Brasil, mas que não ocorre em Minas Gerais. Esse fato levanta dúvidas quanto a verdadeira localidade de origem do espécime *Glaziou 12616*. Desse modo, este táxon ainda permanece em estudo, sendo que mais materiais e a confirmação da sua área de ocorrência são necessários.

***Senna* sp. 4**

Guimarães 130

Senna sp. 4 — coletado no Parque Estadual da Serra do Brigadeiro, Minas Gerais — assemelha-se a *S. angulata*, diferendo desta pelas suas brácteas caducas (vs. persistentes e sepalóides em *S. angulata*). O espécime é morfológicamente semelhante a *S. tenuifolia*,

diferindo desta pelo hábito arbustivo escandente (vs. hábito arbustivo ereto em *S. tenuifolia*) e pelos ramos quadrangulares (vs. ramos cilíndricos).

Nesse sentido, expedições de campo serão realizadas em busca de novos indivíduos para uma melhor comparação.