UNIVERSIDADE ESTADUAL DE FEIRA DE SANTANA
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PROGRAMA DE PÓS-GRADUAÇÃO EM BOTÂNICA

SISTEMÁTICA E DIVERSIFICAÇÃO DE *AMORIMIA* (MALPIGHIACEAE)

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TESE APRESENTADA AO PROGRAMA DE PÓS-GRADUAÇÃO EM BOTÂNICA DA UNIVERSIDADE ESTADUAL DE FEIRA DE SANTANA COMO PARTE DOS REQUISITOS PARA A OBTENÇÃO DO TÍTULO DE *DOUTOR EM BOTÂNICA*.

ORIENTADOR: PROF. DR. ANDRÉ MARCIO ARAÚJO AMORIM (UESC)
CO-ORIENTADOR: PROF. DR. CÁSSIO VAN DEN BERG (UEFS)

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BANCA EXAMINADORA

AOS MEUS PAIS, IRMÃO E MARIDO,

EXEMPLOS DE FIBRA MORAL E AMOR INCONDICIONAL,

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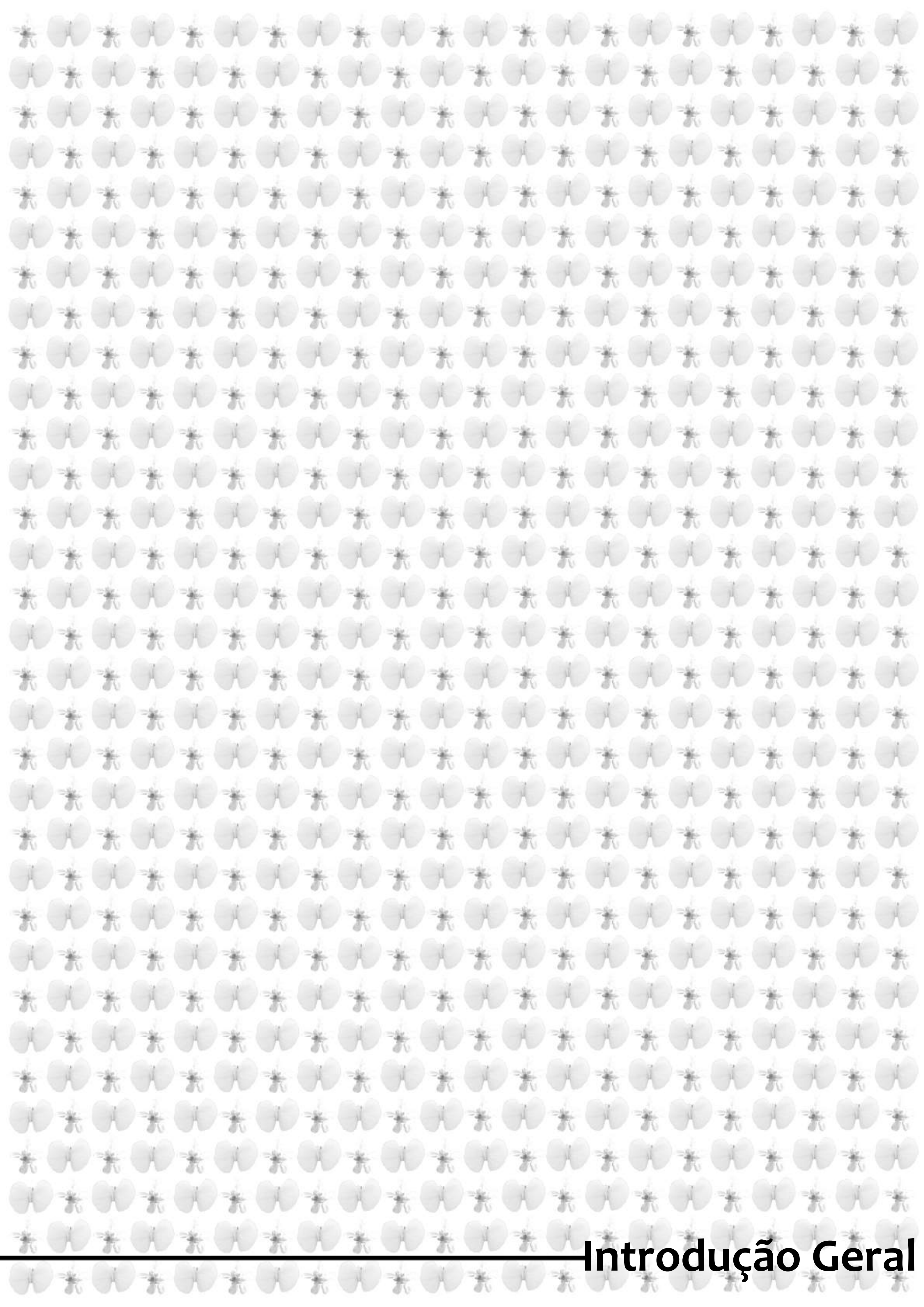
RESUMO

Apresentamos estudos sistemáticos e biogeográficos de *Amorimia* (Malpighiaceae), um dos oito gêneros recentemente segregados de *Mascagnia* a partir de filogenias moleculares. O primeiro capítulo contém uma proposta de resolução do complexo *Amorimia rigida*, incluindo uma nova combinação, três novas espécies e a redescrição de *A. rigida* e *A. velutina*. O segundo capítulo apresenta a descrição de uma nova espécie de *Amorimia*, pertencente ao complexo *A. rigida*, com base em anatomia foliar e taxonomia alfa. No capítulo três apresentamos uma nova classificação infragenérica para *Amorimia* baseada em caracteres macro/micromorfológicos, fitoquímicos e moleculares, além da proposição de dois novos subgêneros. No capítulo quatro apresentamos a revisão taxonômica de *Amorimia*, incluindo tipificações e redescrições de *A. amazonica*, *A. camporum*, *A. concinna*, *A. exotropica*, *A. kariniana*, *A. maritima*, *A. pubiflora* e *A. septentrionalis*. O capítulo cinco contém um estudo biogeográfico de *Amorimia* baseado em uma nova filogenia molecular amostrando todas suas quinze espécies, além da datação e calibração desta topologia como base para as reconstruções de áreas ancestrais usando S-Diva e DEC. Nossos resultados sugerem que o ancestral comum mais recente (ACMR) do gênero teria surgido em Florestas Sazonalmente Secas do Atlântico no Mioceno inicial e os ACMR de seus subgêneros teriam surgido em Florestas Sazonalmente Secas do Sul e Sudeste do Brasil no Mioceno médio. As demais linhagens no gênero teriam se diversificado a partir do Mioceno médio ao Plioceno tardio. Ainda, recuperamos uma história biogeográfica complexa para *Amorimia* em Florestas Secas, incluindo dois eventos de expansão e colonização de diferentes núcleos de Florestas Secas na América do Sul. Por fim, no capítulo seis apresentamos um guia rápido de campo à cores do Field Museum para *Amorimia* no Brasil.

ABSTRACT

We present systematic and biogeographic studies of *Amorimia* (Malpighiaceae), one of the eight segregated genera from *Mascagnia,* based on molecular phylogenies. In the first chapter, we present a proposal for the resolution of the *Amorimia rigida* complex, including a new combination, three new species and the redescription of *A. rigida* and *A. velutina*. In the second chapter, we present the description of a new species of *Amorimia* belonging to the *A. rigida* complex, based on leaf anatomy and alpha taxonomy. In chapter three, we present a proposal for a new infrageneric classification of *Amorimia* based on macro/micromorphology, phytochemical and molecular evidence, besides the proposition of two new subgenera. In chapter four, we present the taxonomic revision of *Amorimia*, including typifications and redescriptions for *A. amazonica*, *A. camporum*, *A. concinna*, *A. exotropica*, *A. kariniana*, *A. maritima*, *A. pubiflora* and *A. septentrionalis*. In chapter five, we present a biogeographic study of *Amorimia* and its relatives based on a new molecular phylogeny sampling all its species. We produced a time-calibrated tree as the basis for the reconstruction of ancestral areas using S-Diva and DEC analysis. Our results suggest that the most recent common ancestor (MRCA) of *Amorimia* arose in Atlantic Seasonally Dry Tropical Forests (SDTFs) around the early Miocene. The MRCA of its subgenera arose in Southern and Southeastern Atlantic SDTFs around the mid-Miocene. The remaining lineages in the genus diversified from the mid-Miocene to the late Pliocene. We also recovered a complex biogeographic history for *Amorimia* in South America SDTFs, including two expansion events in different SDTFs nuclei, besides the colonization of these nuclei by different lineages. Finally, in chapter six, we present a rapid color guide from the Field Museum for Brazilian species of *Amorimia*.

SUMÁRIO



Introdução Geral

INTRODUÇÃO GERAL

Amorimia compreende um dos oito gêneros segregados de *Mascagnia* a partir de dados moleculares e morfológicos na última década (Anderson 2006). Dentre estes gêneros, *Amorimia* é aquele mais proximamente relacionado à *Mascagnia sensu stricto*, sendo posicionado como grupo irmão do grande e complexo clado *Malpighia*, no qual *Mascagnia* é a primeira linhagem a divergir (Davis & Anderson 2010). *Amorimia* compreende 15 espécies distribuídas por florestas estacionais e ombrófilas na América do Sul, ocorrendo do Norte da Colômbia até o estado do Rio Grande do Sul, no Brasil (Anderson 2006). Suas espécies são conhecidas por causar insuficiência cardíaca seguida de óbito em animais utilizados na pecuária, devido ao acúmulo de compostos organofluorados monofluoroacetatos em suas folhas, flores e sementes (Pavarini *et al.* 2011; Peixoto *et al.* 2011; Lee *et al.* 2012). Morfologicamente, o gênero é caracterizado pela presença de nectários extraflorais na face abaxial da lâmina foliar, por suas pétalas pubescentes abaxialmente, por suas brácteas com nectários extra-florais, por seus estiletes retos de ápice truncado ou uncinado e samarídeos com alas laterais livres, coriáceas e flabeliformes. É facilmente distinto de *Mascagnia*, o qual possui pétalas glabras, brácteas pequenas e eglandulosas, samarídeos com alas laterais membranáceas, fusionadas em uma única ala orbicular com um proeminente retículo de anastomoses arqueadas, além de um disco carnoso subtendendo os samarídeos (Anderson 2006; Davis & Anderson 2010).

Grande parte das espécies de *Amorimia* foram inicialmente tratadas nos gêneros *Hiraea* Jacq. e *Mascagnia* (Bertero ex DC.) Bertero (1824). As primeiras espécies descritas para *Amorimia* equivalem a *Hiraea pubiflora* e *H. rigida*, publicadas por Jussieu (1833). Posteriormente, Grisebach (1858) transferiu *H. pubiflora* e *H. rigida* para *Mascagnia* (Colla, 1824), um novo gênero descrito com base em *Hiraea* sect. *Mascagnia* de Bertero (De Candolle, 1824). *Mascagnia* possuía uma única espécie, *M. americana*, e só destacou-se como novo gênero com o tratamento de Grisebach, devido às novas combinações e novidades taxonômicas apresentadas por este autor. Foi posicionada na tribo Hiraeae dentre os gêneros caracterizados pela presença de frutos com uma ou duas alas laterais, sendo os pedicelos articulados na porção mediana nas flores de *Mascagnia* sensu Grisebach, e articulados na base nas flores de *Hiraea*. Grisebach subdividiu o gênero *Mascagnia* em seções, baseando-se principalmente no formato e tamanho das alas laterais do samarídeo, sendo a seção *Pleuropterys* aquela em que *M. pubiflora* e *M. rigida* foram posicionadas.

A seção *Pleuropterys* era caracterizada por espécies de *Mascagnia* que apresentavam samarídeo com alas laterais distintas e ala dorsal curta ou ausente. No tratamento de Grisebach (1858) novas combinações e novidades taxonômicas foram apresentadas para esta seção, em um total de dez espécies: *M. biglandulosa*, *M. bunchosioides*, *M. coriacea*, *M. doniana*, *M. exotropica*, *M. fluminensis*, *M. psilophylla*, *M. pubiflora* e *M. rigida*. Posteriormente, Niedenzu (1914) combinou *Bunchosia multiflora* Hook. & Arn. em *Heladena* e sinonimizou *M. biglandulosa* e *M. bunchosioides* nesta nova combinação. Ainda, apresentou novidades taxonômicas para *Mascagnia* seção *Pleuropterys*, entre elas *Mascagnia amazonica* e *Mascagnia lehmanniana* (Niedenzu, 1926). Morton (1932) descreveu uma nova espécie de *Mascagnia* seção *Pleuropterys* para a Colômbia, *Mascagnia dumetorum*, posteriormente combinada em *Mascagnia concinna*, por ser um nome ilegítimo publicado anteriormente por Grisebach. Johnson (1986) em sua revisão para o gênero *Callaeum* combinou *M. psilophylla* no mesmo.

Por fim, o último autor a trabalhar com *Mascagnia senso lato* foi Anderson (1987), o qual combinou *Mascagnia fluminensis* em *Heteropterys*. Esta espécie havia sido descrita baseada somente em coleções com flores, mas com o aparecimento de coleções com frutos ficou evidente que a mesma pertencia a *Heteropterys*, por sua ala dorsal ser mais desenvolvida que as alas laterais e espessada em sua face abaxial, ambas características diagnósticas do gênero.

Posteriormente, Anderson (2006), com base em dados moleculares, segregou oito novos gêneros de *Mascagnia senso lato*, combinando *M. doniana* em *Aenigmatanthera*, *M. chlorocarpa* em *Carolus*, *M. lehmanniana* em *Heteropterys* e as demais espécies em *Amorimia*. Ainda, *Hiraea maritima* A. Juss. foi também combinada neste novo gênero e quatro novidades taxonômicas foram apresentadas: *A. camporum*, *A. kariniana*, *A. septentrionalis* e *A. velutina*.

Assim, *Amorimia* apresentava dez espécies de difícil delimitação no início da elaboração desta tese. Através de um extenso trabalho de campo e do estudo de ca. 90 coleções de herbários nacionais e internacionais, é apresentada aqui uma revisão taxonômica para este gênero, incluindo uma resolução para o complexo *A. rigida*. Ainda, foi elaborado um estudo molecular abrangente, aliado a um estudo biogeográfico visando elucidar as relações de parentesco entre as espécies de *Amorimia*, evolução de caracteres morfológicos no gênero, bem como os eventos e processos que agiram diretamente na diversificação deste gênero na América do Sul. Somados, estes resultados são apresentados em forma de capítulos e refletem os objetivos iniciais propostos em meu projeto de doutorado, sendo eles:

- **Capítulo I**: Resolução do complexo *Amorimia rigida* (Malpighiaceae), um grupo intrigante de lianas neotropicais.
- **Capítulo II:** Anatomia foliar e macromorfologia revelam uma nova espécie de *Amorimia* (Malpighiaceae) para o Sudeste do Brasil.
- **Capítulo III:** Uma nova classificação infragenérica para *Amorimia* (Malpighiaceae) baseada em evidências macro/micromorfológicas e moleculares.
- **Capítulo IV**: Revisão taxonômica de *Amorimia* W.R.Anderson (Malpighiaceae).
- **Capítulo V:** Origem de *Amorimia* (Malpighiaceae) no Mioceno inferior esclarece a diversificação de lianas em florestas sazonalmente secas da América do Sul.
- **Capítulo VI:** Guia Rápido de Campo a Cores do Field Museum – *Amorimia* do Brasil.
- **Anexos**: Publicações adicionais elaboradas durante meu doutorado.

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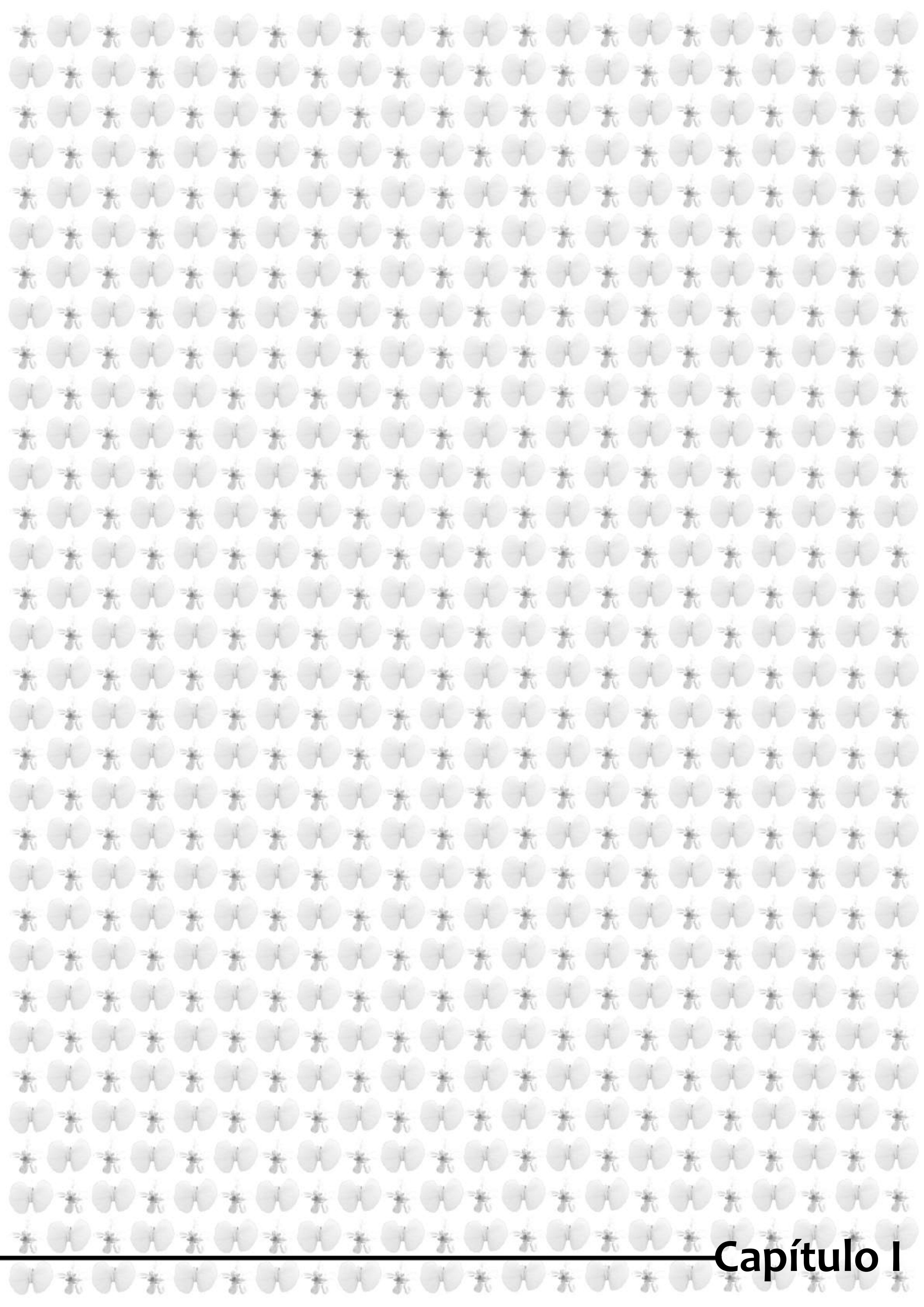

Capítulo I

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Untangling the *Amorimia rigida* complex, a puzzling group of lianescent Malpighiaceae from Eastern Brazil

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Abstract

A proposal for the resolution of the *Amorimia rigida* complex is presented, including a new combination, three new species, and the redescription of *A. rigida* and *A. velutina*. The newly described and the re-established taxa are endemic to Eastern Brazil, and can be differentiated from *A. rigida s.s.* by details in the leaves, indumenta, floral, and fruit morphology. This study includes morphological descriptions for all taxa, along with an identification key, illustrations, a distribution map, conservation assessments, comments on ecology, nomenclature, and taxonomy, and a table comparing all species belonging to this complex.

Keywords: Atlantic Forest, Caatinga, Malpighiales, *Mascagnia*, Taxonomy

Resumo

A resolução do complexo *Amorimia rigida* é proposta, incluindo uma nova combinação, três novas espécies e uma redescrição de *A. rigida* e *A. velutina*. Estas novidades taxonômicas são endêmicas do Leste do Brasil, podendo ser diferenciadas pela morfologia de suas folhas, indumento, flores e frutos. Este trabalho inclui descrições morfológicas completas para todos os táxons tratados, além uma chave de identificação, ilustrações, um mapa de distribuição, comentários sobre status de conservação, ecologia, nomenclatura, taxonomia e uma tabela comparando todas as espécies relacionadas a este complexo.

Palavras-chave: Caatinga, Floresta Atlântica, Malpighiales, *Mascagnia*, Taxonomia

Introduction

Amorimia Anderson (2006: 176) is one of the eight segregates of *Mascagnia s.l.* (Bertero *ex* De Candolle 1824: 585) Colla (1824: 85), uncovered in recent molecular phylogenies for Malpighiaceae (Anderson 2006; Cameron *et al.* 2001; Davis *et al.* 2001; Davis & Anderson 2010). It can be recognized by the presence of extrafloral nectaries (glands) on the abaxial side of the bracts, pubescent petals, straight styles, and by the production of monofluoroacetate, a toxic compound that leads livestock to sudden death (Anderson 2006; Lee *et al.* 2012). The genus is represented by ten species distributed throughout Rainforests and Seasonally Dry Tropical Forests (SDTF) in South America, from northern Colombia to southern Brazil and Argentina (Anderson 2006).

Within the last one hundred years, most species currently accepted in *Amorimia* were segregated by different authors (e.g. Anderson 2006; Niedenzu 1928), from a broader concept of *A. rigida* (Jussieu 1833: 14) Anderson (2006: 183). Even though much progress was made for Andean taxa associated to the *A. rigida* complex, little attention was given to the species from eastern Brazil (Anderson 2006). So far, this complex comprises only two species, *A. rigida* and *A. velutina* Anderson (2006: 185), widespread in the Atlantic Forest and Caatinga domains in Northeastern and Southeastern Brazil (Anderson 2006; BFG 2015). Thus, intensive field studies combined with a thorough analysis of Brazilian herbaria were necessary in order to shed some light on the specific delimitation in this species complex (Anderson pers. comm.).

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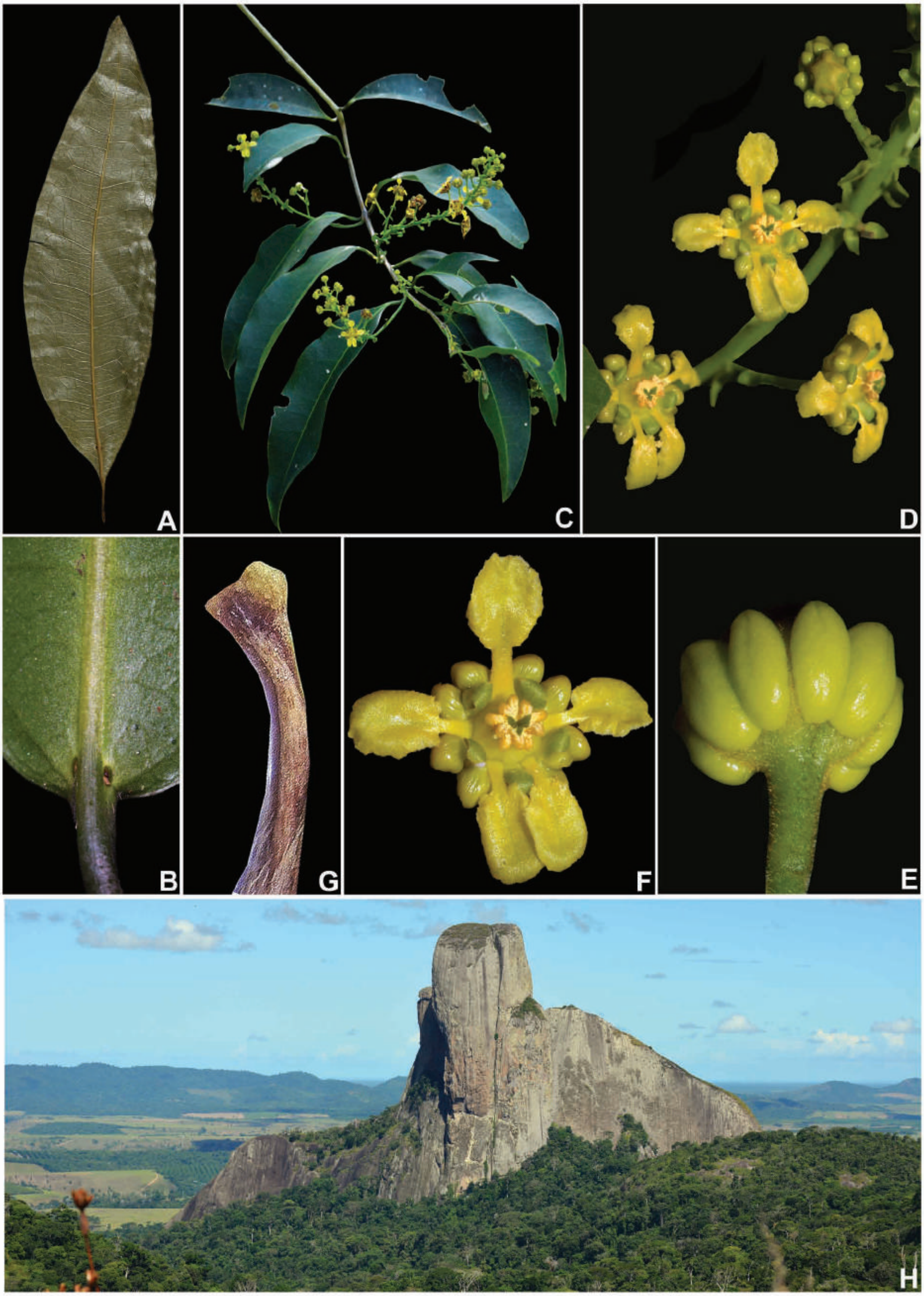

FIGURE 1. *Amorimia andersonii* R.F.Almeida: A. stem leaf; B. abaxial view of a leaf base showing a pair of glands; C. flowering branch; D. inflorescence showing floral buds and flowers; E. detail of sepal glands; F. flower in frontal view; G. detail of a style; H. Seasonally Dry Forest associated to rocky outcrops in Southern Bahia state (photographs C, H by A.M.A. Amorim; A–B, D–F, G by F. Michelangeli).

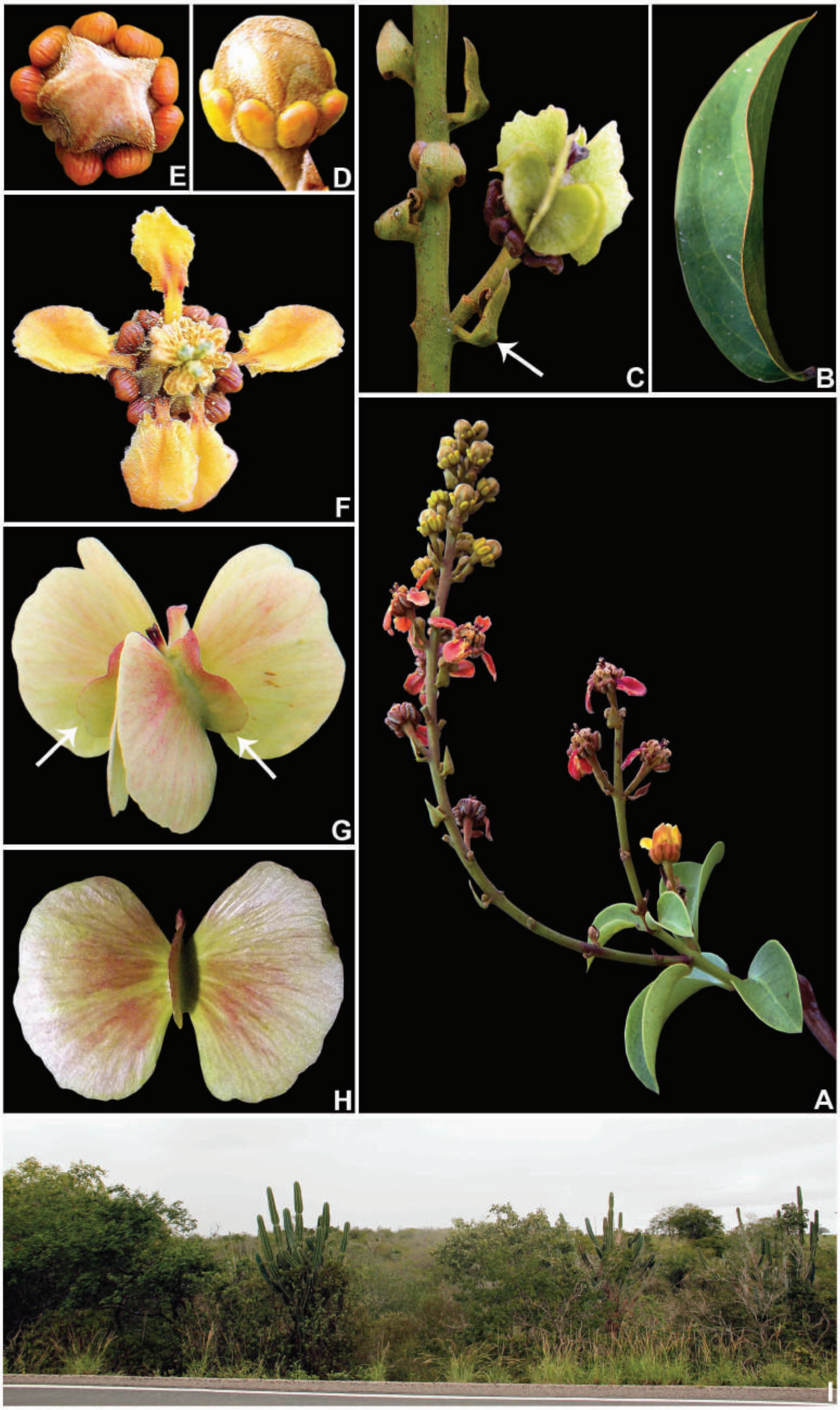

FIGURE 2. *Amorimia candidae* R.F.Almeida: A. flowering branch; B. conduplicate leaf; C. mature inflorescence showing a detail of a bract (arrow); D. floral bud in side view; E. floral bud in frontal view; F. flower in frontal view; G. detail of dorsal wing of samaras (arrow); H. samara in dorsal view; I. Seasonally Dry Forest in Central Bahia state (photographs by R.F. Almeida).

We present a proposal for circumscribing the species of the *A. rigida* complex from eastern Brazil. A redescription of *A. rigida* and *A. velutina* is presented herein, along with a new combination and the description of three new species. This work includes full morphological descriptions for all taxa, along with an identification key, illustrations, a distribution map, conservation assessments, comments on ecology, nomenclature and taxonomy, and a table comparing all species related to this species complex.

Material and Methods

Morphological and phenological data were based on herbarium samples (ALCB, ASE, BHCB, BM, CEPEC, CESJ, EBDA, FLOR, HRB, HRCB, HST, HUEFS, HUFU, HURB, IPA, K, MBM, MICH, NY, P, PAMG, PMSP, R, RB, SP, SPF, UEC, US, and VIC; herbarium acronyms according to Thiers, continuously updated), spirit specimens and fieldwork data. The indumentum terminology follows Anderson (1981), structure's shapes follow Radford *et al.* (1974), the inflorescence terminology and morphology follows Weberling (1965, 1989), and fruit terminology follows Spjut (1994) and Anderson (1981). The conservation status was proposed following the recommendations of IUCN Red List Categories and Criteria, Version 3.1 (IUCN 2012). GeoCAT (Bachman *et al.* 2011) was used for calculating the Extent of Occurrence (EOO) and the Area of Occurrence (AOO). Maps were elaborated using ArcGIS 9.3 software (ESRI 2010) and geographical coordinates were obtained from herbaria specimens and fieldwork data.

Taxonomy

1. ***Amorimia andersonii*** R.F.Almeida, *sp.nov.* (Figs. 1, 3, 11–12)

Type:—BRAZIL. Bahia: Mun. Itamaraju, Serra ao lado do Morro do Pescoço, entrando pela Fazenda Novo Horizonte e passando pela propriedade do Sr. Ailton, área rochosa no alto da serra, 16 February 2014, fl. fr., *L.C. Marinho, A.M.A. Amorim, R. Goldenberg & L. Daneu 654* (Holotype: CEPEC!; isotypes: HUEFS!, P!, RB!).

Differs from *Amorimia rigida* by its leaves lanceolate to elliptic to narrow-elliptic, 10–16 pairs of secondary veins, bracts and bracteoles reflexed to the peduncle; sepals revolute at anthesis; petals entirely velutine adaxially; anterio-lateral petals overlapping; filaments pubescent at apex; apex of styles uncinate; dorsal wing of samaras depressed ovate, lower angle of lateral wings narrower.

Woody vines to scandent shrubs; stem sparsely velutine to glabrous at age; stipules 0.4–0.6 mm long, triangular, epipetiolar, deciduous. *Leaves* subopposite, not reduced in inflorescences; petioles 6.5–8 mm long, sparsely sericeous-velutine to glabrous, eglandular at apex; leaf blades 5.15–11.5 × 1.6–4.3 cm, plane, not bullate, lanceolate to elliptic to narrow-elliptic, base cuneate to attenuate, margin revolute, apex acute, adaxially glabrous, abaxially sparsely velutine to glabrous, 1 pair of glands, 0.6–0.7 mm diam., near base or up to 0.8–0.9 mm of margins; midvein adaxially impress, abaxially prominent, 10–16 pairs of secondary veins, arching 60°–64°, subopposite to alternate, adaxially impress, abaxially prominent, reticulum adaxially impressed and inconspicuous, abaxially prominent and conspicuous. *Thyrses (pseudoracemes)*, axillary; main axis 9.4–15.2 cm long, cylindrical, smooth, velutine; cincinni 20–40, 1-flowered, proximally spirally alternate, distally decussate; bracts 3.5–5 × 1–1.2 mm, lanceolate, conduplicate, subsessile, reflexed to peduncle, 1 pair of marginal glands near base, both sides minute velutine; peduncle 5–8 × 1–1.3 mm, velutine; bracteoles 1.5–2.5 × 1.0–1.2 mm, elliptic, sessile, inserted 0.5–2 mm below the apex of peduncles, opposite to subopposite, reflexed to the peduncle, 1–2 glands near base, both sides velutine; pedicels 6–7.5 × 1.5–1.7 mm, velutine. *Flowers* 13–14 mm diam. at anthesis; floral buds 5–6 × 4–5 mm. *Sepals* 0.5–1 × 0.5 mm, narrowly oblong, not appressed to the androecium, apex acute, obtuse to rounded, revolute at anthesis, both sides sericeous-velutine; glands yellow turning ocher at age, 1–1.2 × 0.3–0.5 mm. *Petals* bright yellow, not turning darker at age, margin sinuate, anterior-lateral petals overlapping; lateral petals patent at anthesis, anterior-lateral petals overlapping at anthesis, limb 2.4–3.4 × 1–1.2 mm, wide elliptic, base truncate, adaxially distally velutine, abaxially sericeous-velutine; claws 0.5–0.8 × 0.2 mm, adaxially velutine, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 1.4–1.5 × 1.2–1.3 mm, wide elliptic, base cuneate, adaxially velutine, abaxially sericeous-velutine; claw 1–1.2 × 0.3–0.4 mm, adaxially velutine, abaxially sericeous-velutine. *Stamens* 10, those opposite petals shorter than those opposite sepals, except for the one opposite to the anterior sepal which is shorter than others; filaments 1–1.6 × 0.4–0.6 mm, connate 0.4–0.5 mm long at base, sericeous at apex; anthers heteromorphic, recurved with a glandular connective, 0.8–1 × 0.4–0.6

mm, reflexed in anthesis, base, connective and apex pubescent. *Ovary* 1–1.1 × 0.9–1 mm, each carpel with primordial lateral and dorsal wings, sericeous-velutine; styles 3, cylindrical at base, flattened and curved at apex, parallel at base, divergent at middle, apex truncate with uncinate angle, sericeous-velutine at base, anterior style 1.2–1.4 mm long, posterior styles 1.4–1.6 mm long; stigma lateral, discoid. *Samaras* (immature) green in vivo; dorsal wing ca. 6.3 × 1.5 mm, depressed ovate, margin entire, velutine on both sides; lateral wings 8–17.2 × 4–17.9 mm, flabelliform, margin entire to sinuate, upper angle 58°, lower angle 63° from the nut, both sides velutine to glabrous; nut ellipsoid, velutine; areole ca. 1 × 0.5 mm. *Seeds* not seen.

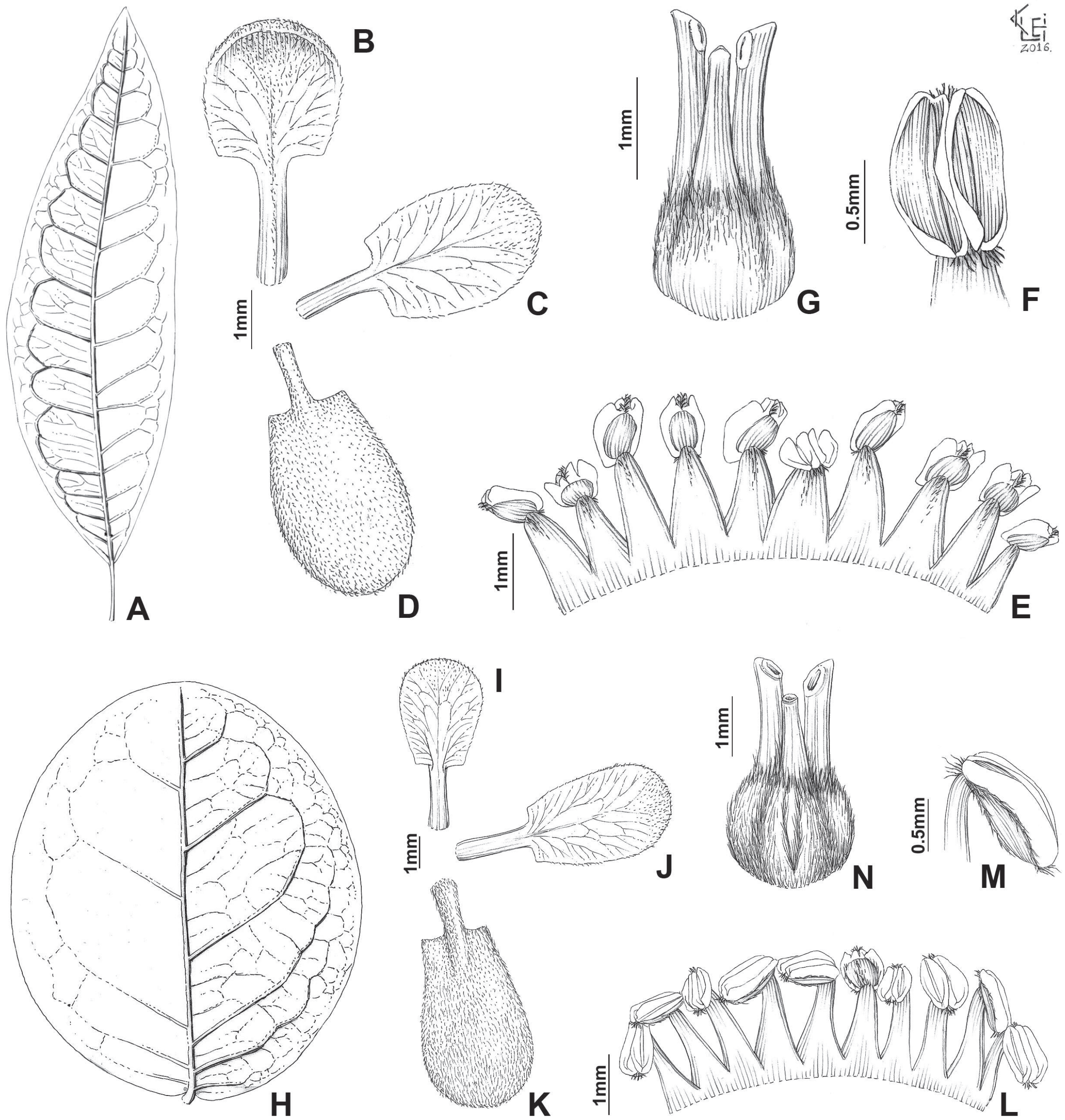

FIGURE 3. *Amorimia andersonii* R.F.Almeida (based on *L.C. Marinho 654*): A. abaxial side of a leaf showing vein pattern; B. posterior petal in adaxial view; C. posterior-lateral petal in adaxial view; D. anterior-lateral petal in abaxial view; E. androecium, the first stamen on the left is opposite the anterior sepal; F. stamen showing hairy anther; G. gynoecium showing the anterior style at center. *Amorimia candidae* R.F.Almeida (based on *R.F. Almeida 594*): H. abaxial side of a leaf showing vein pattern; I. posterior petal in adaxial view; J. posterior-lateral petal in adaxial view; K. anterior-lateral petal in abaxial view; L. androecium, the first stamen on the right opposite the anterior sepal; M. stamen showing hairy anther; N. gynoecium showing anterior style at center (drawings by Klei Sousa).

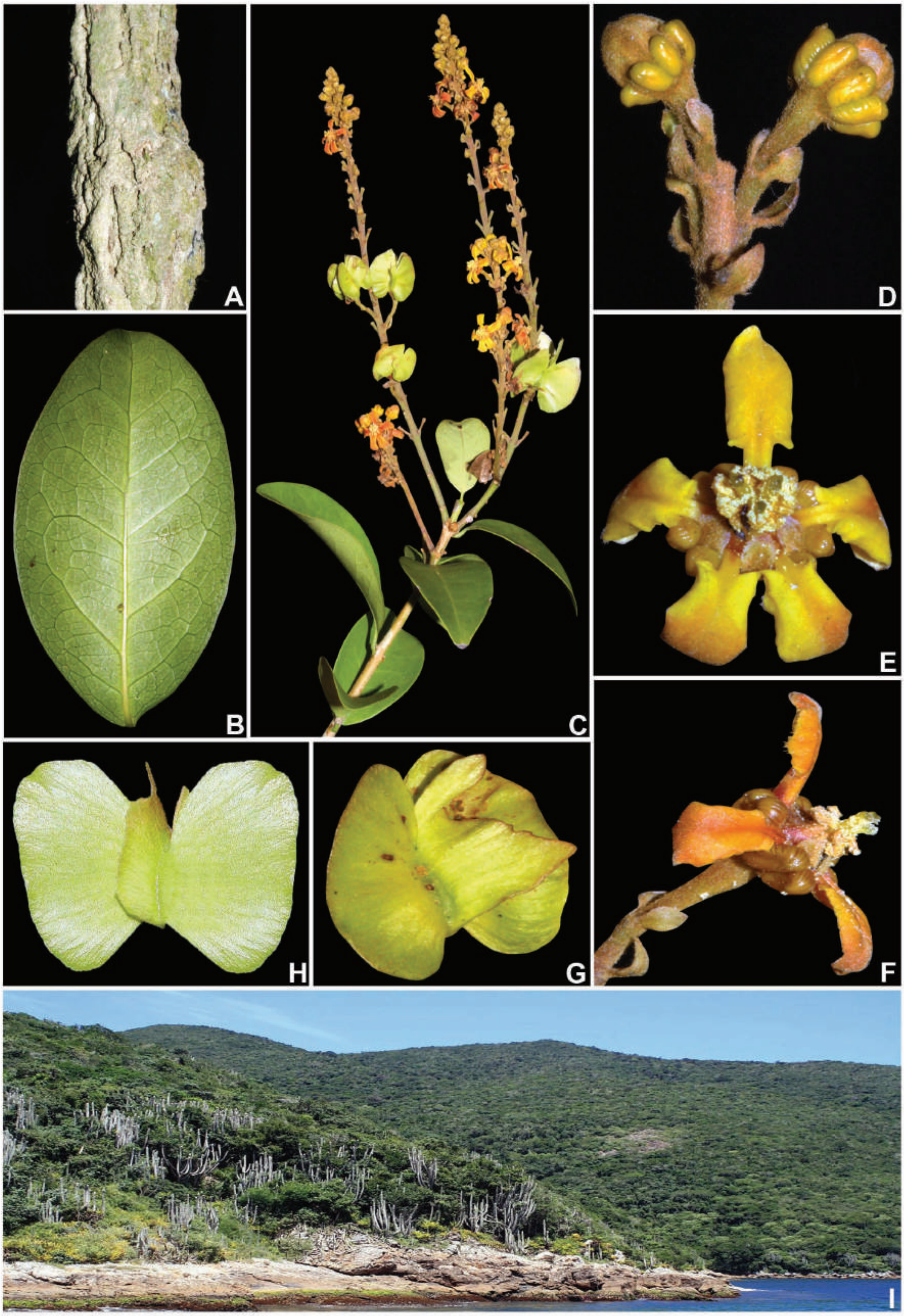

FIGURE 4. *Amorimia coriacea* (Griseb.) R.F.Almeida: A. detail of the woody stem; B. abaxial side of a leaf; C. flowering and fruiting branch; D. detail of floral buds; E. flower in frontal view; F. mature flower in side view; G. mature samara in side view showing the dorsal wing; H. mature samara in dorsal view; I. Seasonally Dry Forest in Rio de Janeiro state (photographs A–F, I by M.O.O. Pellegrini; G by C.N. Fraga).

TABLE 1. Morphological comparison between species of the *Amorimia rigida* complex.

Characters/Species	***Amorimia andersonii***	***Amorimia candidae***	***Amorimia coriacea***	***Amorimia pellegrinii***	***Amorimia rigida***	***Amorimia velutina***
Leaf	Plane	Conduplicate	Conduplicate	Plane	Plane	Plane
Leaf shape	Lanceolate elliptic to narrow-elliptic	Elliptic to orbicular	Elliptic	Elliptic	Ovate to wide-elliptic	Ovate to wide-elliptic
Leaf blade	Not bullate	Not bullate	Not bullate	Bullate	Bullate	Bullate
Pairs of secondary veins	10–16	5–7	5–7	4–6	7–8	7–8
Leaf indumenta	Velutine	Sericeous-velutine	Sericeous-velutine	Sericeous-velutine	Sericeous-velutine	Sericeous-velutine
Leaf glands (pair)	1 near base or near margin	1 at base	1 near base	1 at base	1 near margin or near base	1 near base
Length of peduncles at anthesis	Exceeding bracts	Not exceeding bracts	Exceeding bracts	Exceeding bracts	Not exceeding bracts	Not exceeding bracts
Position of bracts and bracteoles	Reflexed	Parallel	Parallel	Parallel	Parallel	Parallel
Position of sepals at anthesis	Erect	Appressed to the androecium	Appressed to the androecium	Appressed to the androecium	Appressed to the androecium	Appressed to the androecium
Apex of sepals at anthesis	Revolute	Straight	Straight	Straight	Straight	Straight
Color of elaiophores	Yellow turning ocher	Yellow turning brown	Yellow turning brown	Yellow turning brown	Yellow turning brown	Yellow turning red
Color of petals	Yellow	Yellow turning red	Yellow turning orange	Yellow turning orange	Yellow turning orange	Yellow turning orange
Position of lateral petals at anthesis	Patent	Patent	Reflexed	Patent	Patent	Reflexed
Posterior petal glands	Eglandular	2-glandular at base of limbs	Eglandular	Eglandular	Eglandular	Eglandular
Thickness of the posterior petal claw	0.3–0.4 mm	0.70–0.75 mm	0.4–0.5 mm	0.62–0.75 mm	0.4–0.5 mm	0.4–0.5 mm
Anterior-lateral petals position	Overlapping	Overlapping	Divergent	Divergent	Divergent	Overlapping
Indumentum of petal claws	Adaxially velutine, abaxially sericeous-velutine	Adaxially glabrous, abaxially sericeous-velutine	Adaxially glabrous, abaxially sericeous-velutine	Adaxially glabrous, abaxially sericeous-velutine	Adaxially glabrous, abaxially sericeous-velutine	Adaxially glabrous, abaxially sericeous-velutine

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TABLE 1. (Continued)

Characters/Species	***Amorimia andersonii***	***Amorimia candidae***	***Amorimia coriacea***	***Amorimia pellegrinii***	***Amorimia rigida***	***Amorimia velutina***
Size of filaments	that opposite to anterior sepal shorter than others, those opposite petals shorter than those opposite lateral sepals	those opposite petals longer than those opposite sepals	those opposite sepals longer than those opposite petals	those opposite petals longer than those opposite sepals	those opposite the anterior sepal, posterior-lateral sepals and posterior petal longer than those opposite lateral petals	Those opposite sepals shorter than those opposite petals
Indumenta of filaments	Pubescent at apex	Glabrous	Glabrous	Glabrous	Glabrous	Glabrous
Indumenta of anthers	Pubescent at apex, connectives and base	Pubescent at apex, connectives and base	Pubescent at base	Pubescent at apex, connectives and base	Pubescent at apex, connectives and base	Pubescent at base
Shape of apex of styles	Uncinate	Truncate	Truncate	Truncate	Truncate	Truncate
Shape of dorsal wing	Depressed ovate	Obtrapezoidal with rounded angles	Obtrapezoidal bearing an aciculate projection at apex	Triangular	Triangular	Obtrapezoidal bearing two triangular projections at apex

Specimens analyzed:—BRAZIL. Bahia: Itamaraju, Morro do Pescoço, ca. 15 km da entrada da cidade, 11 February 2007, fl., *Amorim 6856* (CEPEC); *loc. cit.*, 16 February 2014, fl., *Marinho 676* (CEPEC).

Distribution, habitat and phenology:—*Amorimia andersonii* is only known from Semi-deciduous forests associated to rocky outcrops in southern state of Bahia (Fig. 12), flowering in February.

Conservation status:—*Amorimia andersonii* is known by only three collections from Semi-deciduous Forests, associated to rocky outcrops within the Atlantic Forest of southern Bahia. Thus, this species should be regarded as Critically Endangered (categories B1a and B1b), due to its range of distribution being about 4.678 km^2 and continually declining habitat quality.

Etymology:—The epithet honors the North American botanist Dr. William Russell Anderson (*1942–2013†), late colleague, and longtime contributor in the studies of Neotropical Malpighiaceae.

Taxonomic notes:—*Amorimia andersonii* resembles *A. rigida* on sepal and anther indumenta, but differs on indumentum type, leaf shape, size of peduncles at anthesis, position of bracts and bracteoles, position of sepals, color of sepal glands, color of petals, petal indumenta, thickness of the posterior petal claw, position o anterior-lateral petals, filaments indumenta, shape of apex of styles, and shape of dorsal wings of samaras. A list of informative characters to differentiate them is presented on Table 1.

2. *Amorimia candidae* R.F.Almeida, *sp.nov.* (Figs. 2–3, 11–12)

Type:—BRAZIL. Bahia: Mun. Itaberaba, margens da Rodovia BR 242, 16 July 2013, fl. fr., *R.F. Almeida, M. Alves, L.M.M. Conti, E.C. Chagas & C.F. Hall 594* (Holotype: HUEFS!; isotypes: CEPEC!, MICH!, NY!, P!, RB!, US!).

Differs from *Amorimia rigida* by its conduplicate leaf blades with mucronate, rounded to retuse apex; leaves associated to the inflorescence elliptic to orbicular; secondary veins 5–7; peduncles shorter; petals golden yellow turning red at post-anthesis; stamens opposite to petals longer than those opposite to sepals; samaras whitish to reddish; dorsal wing of samaras obtrapezoidal with rounded angles.

FIGURE 5. Original line drawing of *Mascagnia coriacea* Griseb. published in *Flora Brasiliensis*: A. flowering branch; B. bract; C–D. bracteoles; E. floral bud; F. 1-flowered cincinnus; G. petal in abaxial view; H. petal in adaxial view; I. hairs; J. sepal in side view; K. sepal in adaxial view; L. sepal in abaxial view; M. floral diagram; N–Q. stamens; R. gynoecium; S. carpel laterally cut showing a single bent embryo.

Woody vines to scandent shrubs; stems sparsely sericeous-velutine to glabrous at age; stipules 0.4–0.5 mm long, triangular, epipetiolar, persistent to deciduous. *Leaves* decussate, reduced in inflorescences; petioles 2–5 mm long, sparsely sericeous-velutine to glabrous, eglandular at apex; leaf blades 3–7.7 × 1.8–4.4 cm, conduplicate, not bullate, ovate, wide-elliptic to orbicular (frequently when associated to the inflorescence), base cordate to rounded, margin revolute, apex mucronate, rounded to retuse, both sides glabrous, 1–2 pairs of glands near base or up to 3 mm of margins on the distal half, 0.4–0.5 mm diam.; midvein adaxially impressed, abaxially prominent, 5–7 pairs of secondary veins, abaxially reddish, prominent, arching 22–24°, subopposite to alternate, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, axillary; main axis 5–24 cm long, striated, sericeous–velutine; cincinni 28–32, 1-flowered, decussate; bracts 3.5–4 × 1.5–2 mm, ovate to elliptic (sometimes leaf-like), sessile, parallel to peduncle, 1 pair of glands at base, sericeous-velutine on both sides; peduncle 1–1.5 × 0.9–1 mm, sericeous-velutine; bracteoles 1.5–2 × 1.4–1.5 mm, elliptic, inserted at the apex of peduncles, parallel to the pedicel, eglandular, both sides sericeous-velutine; pedicels 3.5–4 × 0.9–1 mm, sericeous-velutine. *Flowers* 9–11 mm diam. at anthesis; floral buds 3.5–4.5 × 3.5–4 mm. *Sepals* 1.8–2 × 1–1.5 mm, ovate, appressed to the androecium, apex obtuse to rounded, plane at anthesis, both sides sericeous-velutine; glands yellow turning orange to dark-orange at age, 1.8–2 × 0.7–0.8 mm. *Petals* golden yellow turning red at age, margin sinuate; lateral petals patent at anthesis, anterior-lateral petals overlapping at anthesis, limb 4.5–5 × 3–3.5 mm, elliptic to obovate, truncate at base, adaxially sericeous-velutine distally, abaxially sericeous-velutine, claws 1.4–1.5 × 0.4–0.5 mm, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect at anthesis,

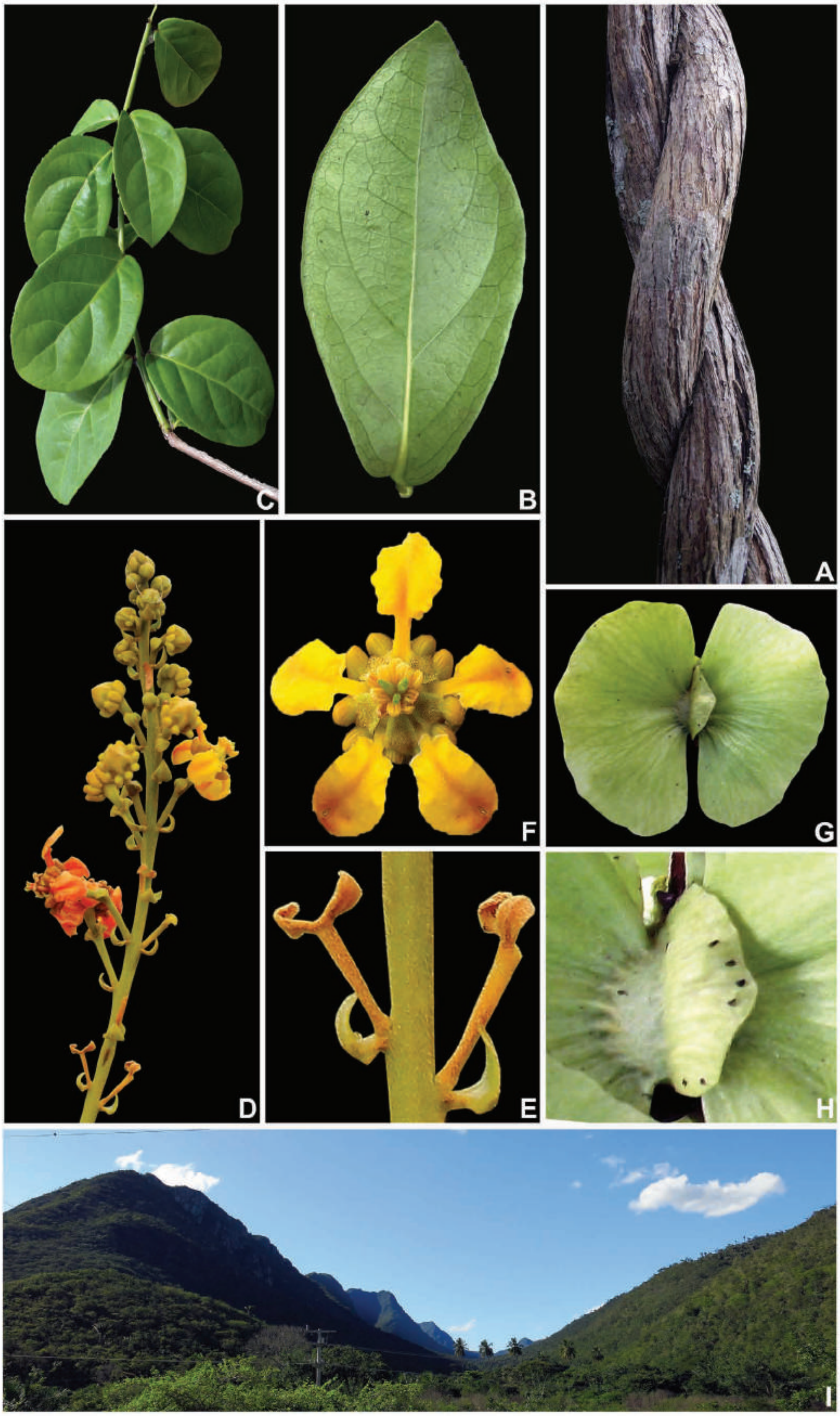

FIGURE 6. *Amorimia pellegrinii* R.F.Almeida: A. detail of the woody stem; B. abaxial view of a mature leaf; C. sterile branch with young leaves; D. inflorescence, E. detail of bracts and bracteoles, F. flower in frontal view, G. samara in dorsal view; H. detail of the dorsal wing; I. Seasonally Dry Forest from Northern Bahia state (photographs by R.F.Almeida).

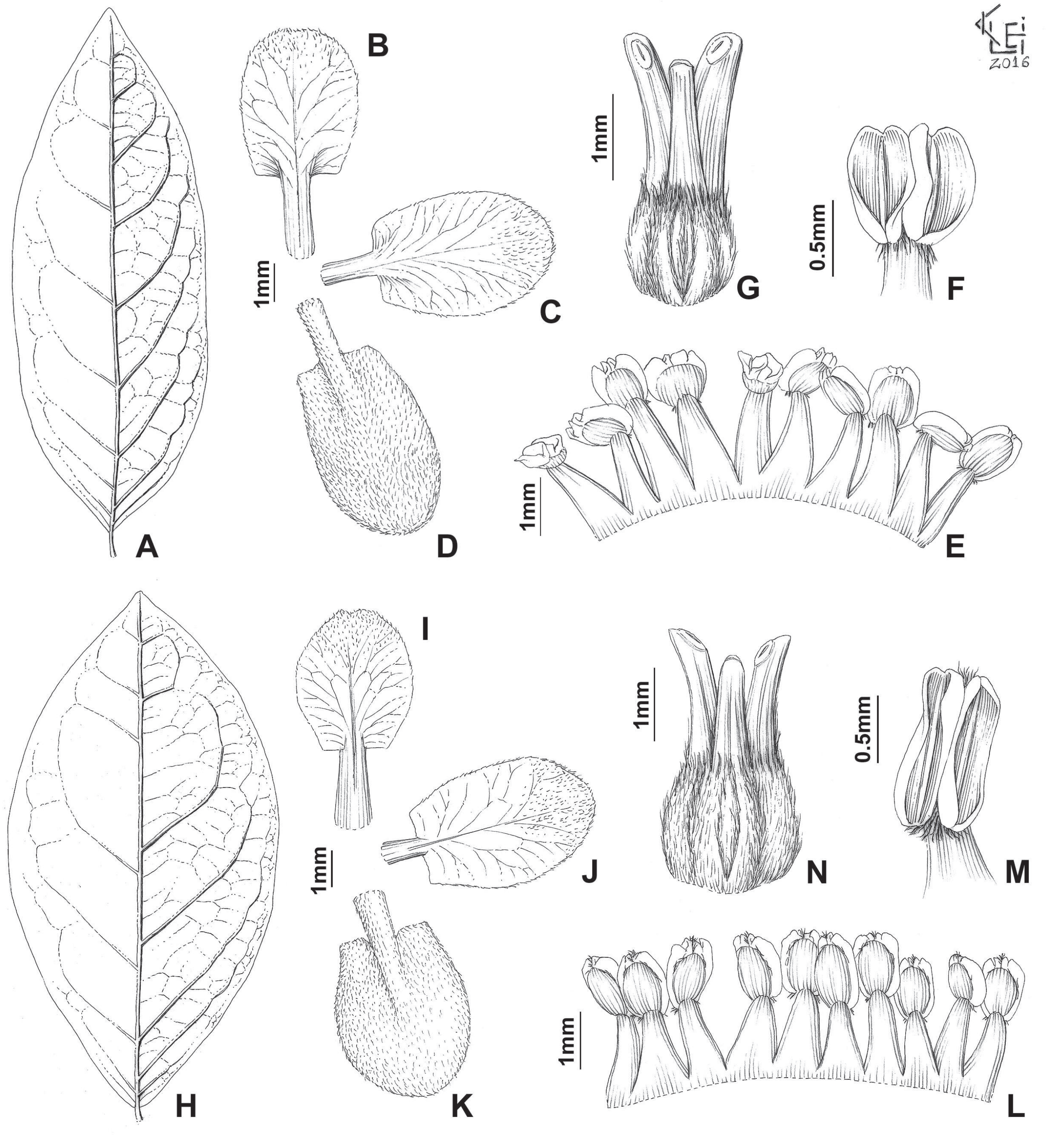

FIGURE 7. *Amorimia coriacea* (Griseb.) R.F.Almeida (based on *R.F. Almeida 615*): A. abaxial side of a leaf showing vein pattern, B. posterior petal in adaxial view, C. posterior-lateral petal in adaxial view, D. anterior-lateral petal in abaxial view, E. androecium, the first stamen on the left opposite the anterior sepal; F. Stamen showing hairy anther, G. gynoecium with anterior style at center. *Amorimia pellegrinii* R.F.Almeida (based on *R.F. Almeida 614*): H. abaxial side of a leaf showing vein pattern, I. posterior petal in adaxial view, J. posterior-lateral petal in adaxial view, K. anterior-lateral petal in abaxial view, L. androecium, the first stamen on the left opposite the anterior sepal; M. stamen showing hairy anther, N. gynoecium with anterior style at center (drawings by Klei Sousa).

limb 4–4.2 × 3.4–3.5 mm, elliptic, truncate at base, 1-pair of red glands at base, adaxially sericeous-velutine distally, abaxially sericeous-velutine, claw 2.3–2.5 × 0.70–0.75 mm, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite petals longer than those opposite sepals; filaments 2.25–2.5 × 0.25–0.5 mm, connate 0.9–1 mm long at base, glabrous; anthers heteromorphic, those opposite sepals elliptic, those opposite petals obovate, 1–1.25 × 0.5–0.6 mm, reflexed at anthesis, base, connective and apex pubescent. *Ovary* 1.3–1.5 × 1.3–1.5 mm, each carpel with primordial lateral and dorsal wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, diverging at middle, apex truncate with apiculate angle, rarely geniculate, sericeous-velutine at base, anterior style 1.1–1.25 mm long, posterior styles 1.4–1.5 mm long; stigma lateral, discoid. *Samaras* whitish to reddish *in vivo*; dorsal wing 6–7 × 3–3.25 mm, obtrapezoidal with rounded angles, margin sinuate, sericeous-velutine on both sides; lateral wings 1.7–2.5 × 1.6–2 cm, flabellate, margin sinuate, upper angle 20°, lower angle 25° from the nut, sparsely sericeous-velutine on both sides; nut ovoid, sericeous-velutine; areole 4.5–5 × 2–2.2 mm, elliptic. *Seeds* 3.6–4 × 2–2.25 mm, testa rugose; embryo ovoid, cotyledons folded.

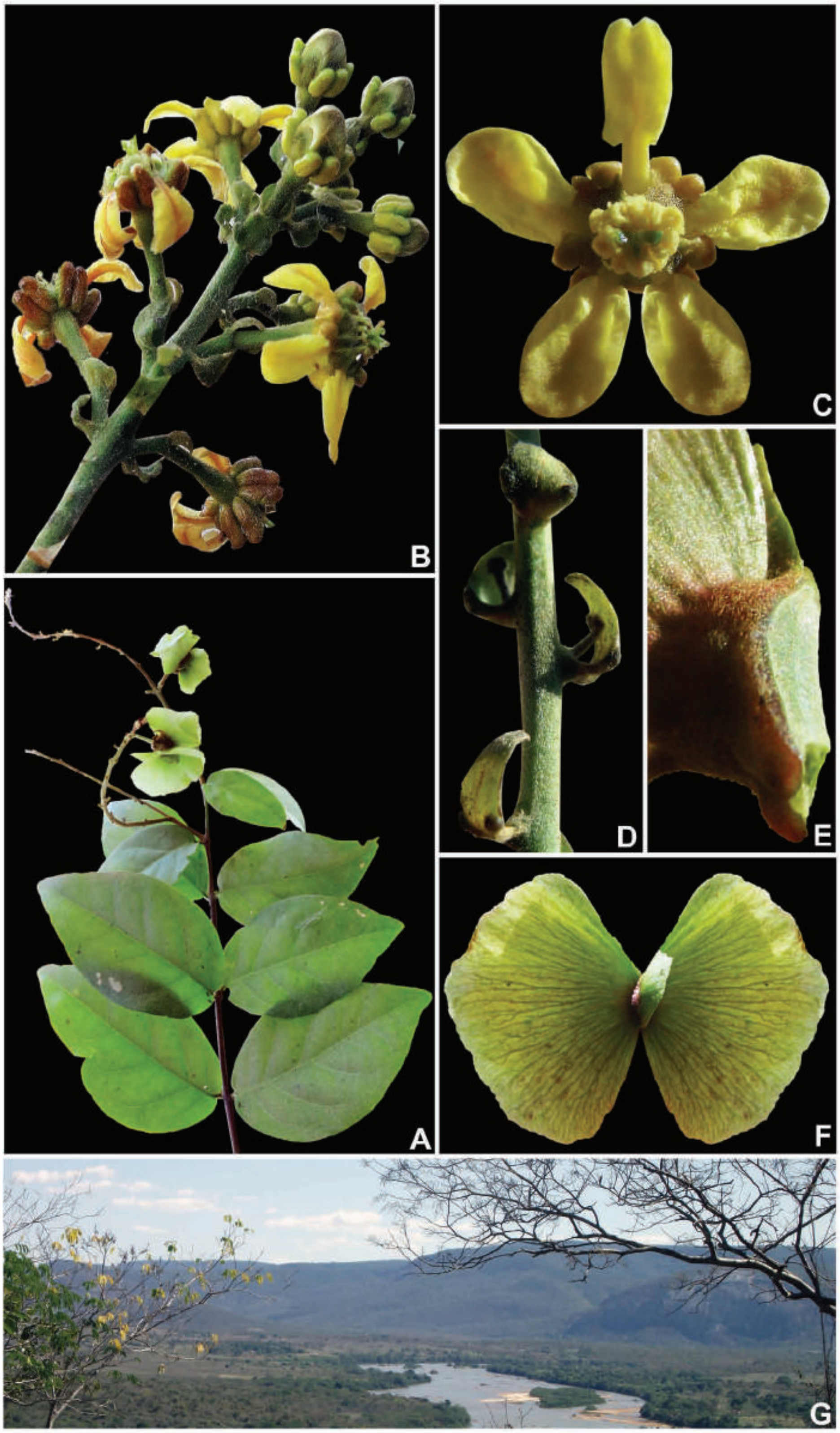

FIGURE 8. *Amorimia rigida* (A.Juss.) W.R.Anderson: A. fruiting branch; B. detail of the inflorescence; C. flower in frontal view; D. bracts showing glands; E. nut in side view; F. samara in dorsal view; G. Seasonally Dry Forest from Jequitinhonha Valley in Northern Minas Gerais state (photographs by R.F. Almeida).

Additional specimens analyzed (paratypes):—BRAZIL. Bahia: Mun. Ibiquera, January 1980, fr., *Pinto 05-1980* (CEPEC, FLOR, HRB); Mun. Itaberaba, pastagem, S12°28' W40°18', 15 October. 2002, fl., *Moura 3* (HUEFS); *loc. cit.*, Fazenda Morro da Pedra, 15 July 1982, fl., *Bastos 266* (CEPEC, HUEFS, IPA); *loc. cit.* Fazenda Itaberaba, morro de Itaberaba, sítio com pinturas, S12°29'57" W40°04'56", 5 June 2005, fr., *Melo 3936* (CEPEC, HUEFS); *loc. cit.*, margens do Paraguaçu, June 1973, fl., *Pinto s.n.* (ALCB1929); Mun. Milagres, caatinga arbustiva, September 2009, fl., *Brito 23* (HUEFS); *loc. cit.*, caatinga arbustiva, December 2009, fl., *Brito 28* (HUEFS); *loc. cit.*, BR-116, embaixo da ponte, 19 August 2015, fr., *Aona 4208* (HUEFS, HURB); Mun. Rafael Jambeiro, Fazenda Coqueiro Rosarinho, km 29 road BR-242, 2 July 2002, fl., *Santos s.n.* (CEPEC, HUEFS64423); Mun. Santa Terezinha, Serra da Jibóia, S12°47'46" W39°31'37", 303 m, 9 October. 2010, fl., *Melo 8557* (HUEFS). *loc. cit.*, S12°47'46" W39°31'37", 303 m, 9 October 2010, fl., *Melo 8563* (HUEFS); *loc. cit.*, May 1999, fl., *Pinto s.n.* (ALCB17936); *loc. cit.*, Serra do Leão, Fazenda Limeira, 12 February 2016, fr., *Costa 1630* (HURB);

Distribution, habitat and phenology:—*Amorimia candidae* is known only from SDTF within Caatinga vegetation in Bahia state, Brazil (Fig. 12), flowering from May to July, and fruiting from January to February and August.

Conservation status:—*Amorimia candidae* is represented by only few records, restricted to five municipalities, within an area of occurrence of approximately 20.000 km² in anthropomorphically modified Caatinga vegetation. Thus, this species should be regarded as Endangered (categories B1a and B1b), due to its range of distribution being less than 100 km² and continually declining habitat quality.

Etymology:—The epithet honors the Brazilian botanist Dr. Maria Candida Henrique Mamede (b. 1956), colleague, former advisor, and longtime contributor in the studies of Brazilian Malpighiaceae.

Taxonomy notes:—*Amorimia candidae* resembles *A. rigida* on indumenta type, inflorescence morphology, sepal shape, position of petals at anthesis, anthers indumenta and shape of the apex of style, but differs on position and shape of the leaves, petal morphology, size of the filaments and shape of the dorsal wings of the samaras. A list of informative characters to differentiate them is presented on Table 1.

3. ***Amorimia coriacea*** (Griseb.) R.F.Almeida, *comb. nov.* (Figs. 4–5, 7, 11–12)

Basionym:—*Mascagnia coriacea* Grisebach (1858: 92) ≡ *Mascagnia rigida* subsp. *coriacea* (Griseb.) Niedenzu (1908: 19). Lectotype (designated by Anderson 2006):—BRAZIL. Rio de Janeiro: Woods of Tijuca, *G. Gardner 5394* (K000427423!; Isolectotype: BM000611548!).

Woody vines to scandent shrubs; stems sparsely sericeous-velutine to glabrous at age; stipules 0.5–0.6 mm long, triangular, persistent to deciduous. *Leaves* decussate, reduced in inflorescences; petioles 3–5 mm long, sparsely sericeous-velutine to glabrous, eglandular to abaxially biglandular at apex; leaf blades 3–9 × 2–4.5 cm, conduplicate, not bullate, elliptic to ovate, base cuneate, margin plane, apex acute to acuminate, both sides glabrous, eglandular to 1–2 pairs of glands, 0.5–1 mm diam., at base or distally, up to ca. 3 mm from the margin; midvein adaxially impress, abaxially prominent, secondary veins 5–7 pairs, arching 40–50°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, terminal; main axis 9–19 cm long, cylindrical, smooth, sericeous-velutine; cincinni 25–40, 1–flowered, alternate to decussate; bracts 1.9–2.1 × 1.4–1.5 mm, ovate, sessile, parallel to peduncle, 1 pair of glands at base, both sides sericeous-velutine; peduncle 4–5 × 0.5–0.7 mm, sericeous-velutine; bracteoles 1.7–2 × 1.5–1.75 mm, wide-elliptic, inserted at the apex of the peduncle, parallel to pedicel, 1–2 pairs of glands at base, both sides sericeous-velutine; pedicels 4.5–5.5 × 0.4–0.5 mm, sericeous-velutine. *Flowers* 9–12 mm diam. at anthesis; floral buds 3–4 × 3.5–4.5 mm. *Sepals* 1.3–1.5 × 1–1.1 mm, ovate, appressed to the androecium, apex obtuse to rounded, plane to revolute at anthesis, both sides sericeous-velutine; glands yellow turning orange to reddish at age, 1.5–2 × 0.75–1 mm. *Petals* yellow turning orange to red at age, margin sinuate; lateral petals reflexed at anthesis, anterior-lateral petals not overlapping at anthesis, limb 2.5–4 × 1.5–2 mm, elliptic, base hastate, adaxially sericeous-velutine distally, abaxially sericeous-velutine, claws 0.67–0.75 × 0.3–0.4 mm, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 1.5–1.7 × 1.4–1.5 mm, elliptic, base hastate, adaxially sericeous-velutine distally, abaxially sericeous-velutine, claw 1.4–1.5 × 0.4–0.5 mm, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite sepals longer than those opposite petals; filaments 1–1.25 × 0.3–0.4 mm, connate 0.15–0.2 mm long at base, glabrous; anthers heteromorphic, those opposite sepals shorter, those opposite petals longer, 1–1.25 × 0.5–0.75 mm, reflexed in anthesis, base pubescent. *Ovary* 1–1.25 × 1–1.25 mm, each carpel with primordial lateral and dorsal wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, diverging at middle, apex truncate with obtuse angle, glabrous at base, anterior style 1–1.25 mm long, curved, posterior styles 1.3–1.5 mm long, erect; stigma lateral, crateriform. *Samaras* green to ocher in vivo;

dorsal wing 7.5–8 × 2.5–3.5 mm, depressed ovate with 1 triangular projection at apex, margin sinuate, both sides sericeous-velutine; lateral wings 1.7–2 × 1–1.3 cm, flabellate, margin erose to sinuate, upper angle 50°–55°, lower angle 60°–65° from the nut, both sides sericeous-velutine; nut orbicular, sericeous-velutine; areole 6–6.5 × 4.5–5 mm, ellipsoid to orbicular. *Seeds* 4.5–5 × 3.9–4 mm, testa smooth; embryo ovoid, cotyledons folded.

Specimens analyzed:—BRAZIL. Rio de Janeiro: Mun. Armação de Búzios, Área de Proteção Ambiental da Azeda, S22°44'44" W41°52'09", 20 April 2004, fr., *Dantas 610* (HUEFS, RB); *loc. cit.*, Azeda, S22°44'40" W41°52'50", 4 April 2004, fr., *Dantas 283* (CEPEC, HUEFS, RB); *loc. cit.*, José Gonçalves, S22°48'00" W41°55'00", 20 February 2004, fl., *Dantas 176* (HUEFS, RB); *loc. cit.*, Ponta Zapata, S22°43'00" W41°57'00", 16 February 2004, fl. fr., *Dantas 104* (CEPEC, HUEFS, RB); *loc. cit.*, Ponta do Olho do Boi, 19 January 2000, fl., *Fernandes 403* (CEPEC, HUEFS, RB). Mun. Arraial do Cabo, Morro do Miranda, 17 January 2000, fl., *Farney 3963* (CEPEC, HUEFS, RB). Mun. Cabo Frio, Morro da Gamboa, próximo ao Bairro da Gamboa, S22°53' W42°01', 14 March 2004, fl. fr., *Jardim 4228* (CEPEC, HUEFS); *loc. cit.*, 20 January 1967, fl., *Sucre 1421* (CEPEC, RB, UB); *loc. cit.*, 18 December 1996, fl., *Farag 309* (CEPEC, HUEFS, RB); *loc. cit.*, 29 March 2007, fl., *Farney 4650* (CEPEC, HUEFS, RB); *loc. cit.*, estrada nova para Armação de Búzios, Baia Formosa, entrada para o Capão da Pedra do Sr. Henrique Massala, 6 May 1987, fl. fr., *Lima 2877* (CEPEC, HUEFS, RB); *loc. cit.*, Peró, praia das Conchas, 14 January 2016, fl. fr., *Almeida & Pellegrini 615* (CEPEC, HUEFS, RB). Mun. Niterói, Itaipuaçu, Pico Alto Moirão, 17 June 1985, fr., *Andreata 708* (CEPEC, HUEFS, RB); *loc. cit.*, Pico Alto Moirão, 14 January 1982, fl., *Andreata 373* (CEPEC, HUEFS, RB). Mun. Rio das Ostras, praia, 4 April 1971, fl., *Krieger 10298* (CEPEC, CESJ, HUEFS). Mun. Rio de Janeiro, Mundo Novo, Botafogo, June 1921, fl., *Kuhlmann s.n.* (HUEFS, RB).

Distribution, habitat and phenology:—*Amorimia coriacea* is known only from restingas (sand dunes vegetation) and rocky outcrops along the coast of state of Rio de Janeiro (Fig. 12). Flowering from December to June, and fruiting from February to June.

Conservation status:—*Amorimia coriacea* has records with an area of occurrence of approximately 3.620 km², and area of occupancy of 32.000 km², in anthropomorphically modified restinga vegetation in the state of Rio de Janeiro, Brazil. Thus, this species should be regarded as Endangered (categories B1a and B1b), due to its range of distribution being less than 100 km2 and continually declining habitat quality.

Etymology:—The epithet probably makes reference to the coriaceous texture of its leaves.

Nomenclatural notes:—*Mascagnia coriacea* was lectotypified by Anderson (2006) based on two sheets from BM and K. However, the type locality from the lectotype at K is cited only as Woods "Tejuco", Brazil. After some research, the author might have mistakenly assumed that the type locality was an abbreviation of "Arraial do Tejuco", a locality currently renamed to Diamantina municipality, in the state of Minas Gerais. Anderson was probably lead to this assumption based on the type locality of *Mascagnia rigida*, which is somewhere near Northern Minas Gerais (Jequitinhonha municipality). Nonetheless, after analyzing the label on the isolectotype at BM, we observed that it clearly states Woods Tejuca, state of Rio de Janeiro as the type locality. "Tejuca" is a misspelling of the tupi-guarani word "Tijuca", meaning swampy area. The Floresta da Tijuca (Woods of Tijuca) currently comprehends the area of the Tijuca National Park, in the municipality of Rio de Janeiro, state of Rio de Janeiro.

Taxonomic notes:—*Amorimia coriacea* resembles *A. rigida* on indumenta type, inflorescence morphology, sepal shape, petal morphology, filaments indumenta and shape of apex of style, but differs on position and shape of leaves, size of peduncles, petal position, size of filaments, anthers indumenta, and shape of dorsal wings of samaras. A list of informative characters to differentiate them is presented on Table 1.

4. ***Amorimia pellegrinii*** R.F.Almeida, *sp.nov.* (Figs. 6–7, 11–12)

Type:—BRAZIL. Bahia: Mun. Feira de Santana, Fazenda Cruzeiro do Mocó, 3 November 2015, fl. fr., *R.F. Almeida, A.C.M. Marques & M.O.O. Pellegrini 614* (Holotype: HUEFS!; isotype: CEPEC!, MICH!, NY!, P!, RB!, US!).

Differs from *Amorimia rigida* by its elliptic to ovate leaf blades with base cordate to rounded; 4–6 pairs of secondary veins; shorter peduncles; smaller flowers; stamens opposite to petals longer than those opposite to sepals; upper and lower angle of lateral wings narrower.

Woody vines to scandent shrubs; stems sparsely sericeous-velutine to glabrous at age; stipules 0.5–1 mm long, triangular, epipetiolar, persistent to deciduous. *Leaves* decussate, reduced in inflorescences; petioles 5–6 mm long, sparsely sericeous-velutine to glabrous, eglandular at apex; leaf blades 6–11.3 × 3–6 cm, plane, bullate, elliptic to ovate, base cordate to rounded, margin plane, apex acute to acuminate, both sides glabrous, eglandular to 1–2 pairs of glands, 0.4–0.5 mm

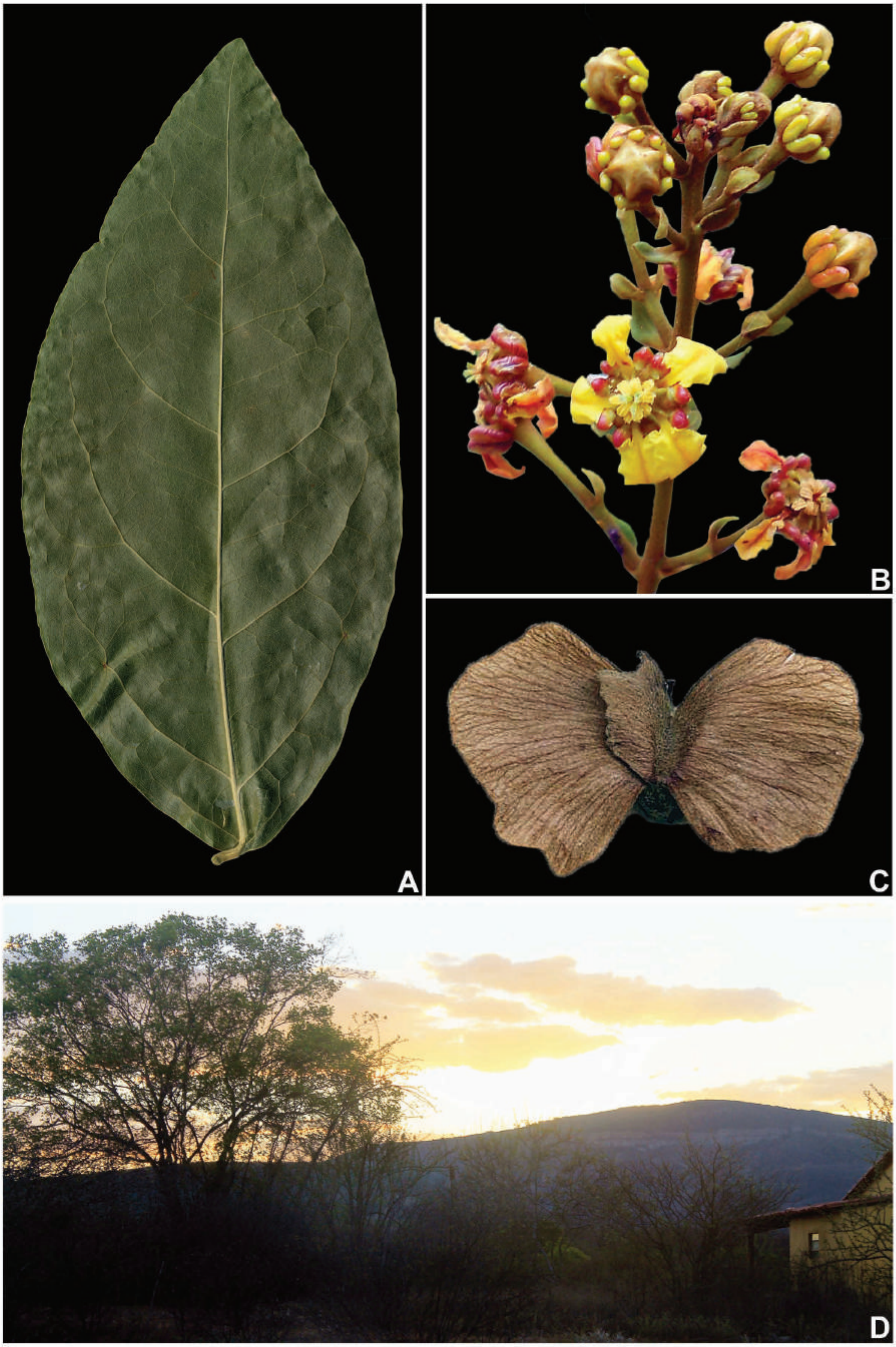

FIGURE 9. *Amorimia velutina* W.R.Anderson: A. leaf, B. inflorescence, C. samara in dorsal view, and D. Seasonally Dry Forest from Southern Bahia state (photos A-C by L.C. Marinho, and D. by A.C. Marques).

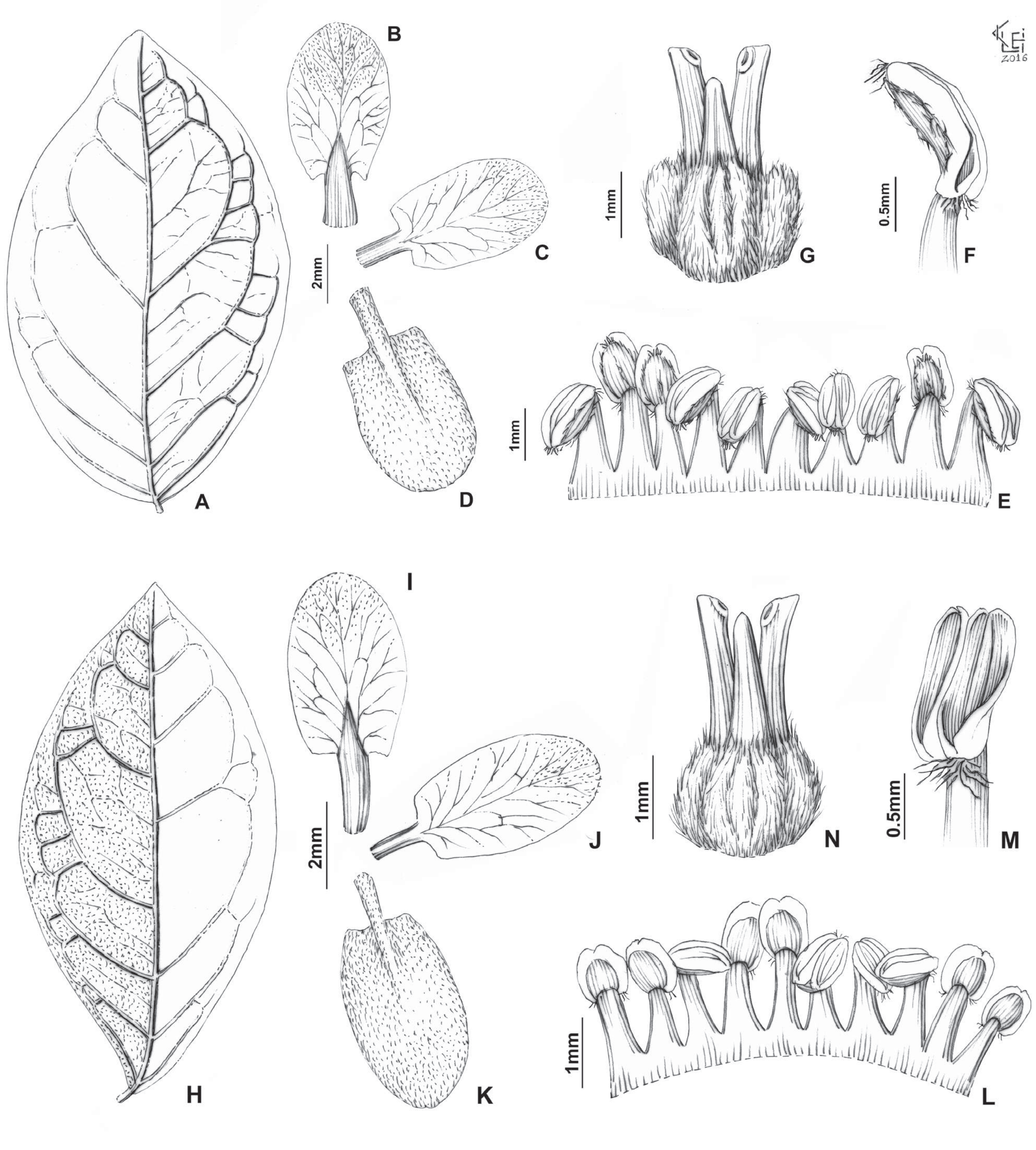

FIGURE 10. *Amorimia rigida* (A.Juss.) W.R.Anderson (based on *R.F. Almeida 561*): A. abaxial side of a leaf showing vein pattern; B. posterior petal in adaxial view; C. posterior-lateral petal in adaxial view; D. anterior-lateral petal in abaxial view; E. androecium, the first stamen on the left is opposite the anterior sepal; F. stamen showing hairy anther; G. gynoecium showing anterior style at center. *Amorimia velutina* W.R.Anderson (based on *G. Shepherd 4409*): H. abaxial side of a leaf showing vein pattern; I. posterior petal in adaxial view; J. posterior-lateral petal in adaxial view; K. anterior-lateral petal in abaxial view; L. androecium, the first stamen on the left is opposite the anterior sepal; M. stamen showing hairy anther at base; N. gynoecium showing anterior style at center (drawings by Klei Sousa).

diam., up to 3.5–8 mm from the margin; midvein adaxially impress, abaxially prominent, secondary veins 4–6 pairs, arching 45°–50°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, axillary; main axis 10–28 cm long, cylindrical, striated, sericeous-velutine; cincinni 26–56, 1–flowered, decussate; bracts 3–3.5 × 2–2.25 mm, ovate, sessile, spreading to peduncle, eglandular to 1–3 pairs of glands at base to middle, both sides sericeous-velutine; peduncle 2.5–3 × 0.5–0.6 mm, sericeous-velutine; bracteoles 2.5–2.6 × 1.5–1.7 mm, elliptic, inserted right below the apex of the peduncles, parallel to pedicel, eglandular to 1 pair of basal glands, both sides sericeous-velutine; pedicels 3.8–4 × 0.5–0.6 mm, sericeous-velutine. *Flowers* 8–10 mm diam. at anthesis; floral buds 3–3.5 × 2.5–3 mm. *Sepals* 1.5–2.25 × 1–1.25 mm, triangular, appressed to the androecium, apex obtuse to rounded, plane at anthesis, both sides sericeous-velutine; glands yellow turning orange to ocher at age, 1.65–1.75 × 0.8–1 mm. *Petals* yellow turning light orange at age, margin sinuate; lateral petals patent at anthesis, anterior-lateral petals not overlapping at anthesis, limb 3–4 × 2–2.5 mm, elliptic to obovate, base truncate, adaxially sericeous-velutine distally, abaxially sericeous velutine, claws 0.75–1 × 0.4–0.5 mm, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 2.8–3 × 1.8–2 mm, elliptic, base truncate, adaxially sericeous-velutine distally, abaxially sericeous velutine, claw 1.8–2 × 0.62–0.75 mm, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite to petals longer than those opposite to sepals; filaments 1.25–1.5 × 0.3–0.4 mm, connate 0.25–0.3 mm long at base, glabrous; anthers heteromorphic, 0.8–1 × 0.4–0.6 mm, reflexed at anthesis, base, connectives and apex pubescent. *Ovary* 1.4–1.5 × 1.4–1.5 mm, each carpel with primordial lateral and dorsal wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, diverging at middle, apex truncate with rounded angle, sericeous-velutine at base, anterior style 1.4–1.5 mm long, posterior styles 1.6–1.8 mm long; stigma lateral, crateriform. *Samaras* green to ocher in vivo; dorsal wing 7–8 × 2.5–3 mm, very shallowly triangular, margin sinuate, both sides sericeous-velutine; lateral wings 1.2–1.5 × 1.2–1.4 cm, flabellate, margin erose, upper angle 40°, lower angle 60° from the nut, both sides sericeous-velutine; nut ovoid, sericeous-velutine; areole 5–6 × 2–3 mm, ovate. *Seeds* 4–4.5 × 2–2.5 mm, testa rugose; embryo ovoid, cotyledons folded.

Additional specimens analyzed (paratypes):—BRAZIL. Bahia: Mun. Cachoeira, Barragem de Bananeiras, vale dos rios Paraguaçu e Jacuípe, S12°32’ W39°05’, 120 m, 25 November 2003, fl., *Amorim 3801* (ALCB, CEPEC, HUEFS); *loc. cit.*, Pedra do Cavalo, Barragem de Bananeiras, May 1980, fr., *Pedra do Cavalo 8* (CEPEC, HUEFS); *loc. cit.*, December 1980, fl. fr., *Pedra do Cavalo 1021, 1031* (ALCB, CEPEC, HUEFS, RB); *loc. cit.*, *April 1936*, fl., *Torrend s.n.* (ALCB1928, HUEFS204347, SP); Mun. Castro Alves, 28 March 1994, fl., *Carvalho 29* (HUEFS); Mun. Conceição do Coité, Serra do Mucambo, S11°30’ W39°11’, 26 June 2013, fl. fr., *Carvalho 296* (HUEFS); Mun. Feira de Santana, Fazenda Chapada, S12°15’21” W39°05’00”, 2 June 2007, fl., *Melo 4790* (HUEFS); *loc. cit.*, distrito de São José, 4 June 2005, fr., *Cruz 32* (HUEFS); *loc. cit.*, Fazenda Cruzeiro do Mocó, S12°13’12” W39°02’44”, 185 m, 28 May 2013, fl. fr., *Queiroz 54* (HUEFS); *loc. cit.*, Ipuaçu, inselberg Monte Alto, S12°15’17” W39°04’59”, 130 m, 22 June 2009, fl., *Melo 6370* (HUEFS); *loc. cit.*, distrito de Ipuaçu, S12°13’58” W38°04’28”, 7 April 2005, fl., *Couto 35* (CEPEC, HUEFS); *loc. cit.*, 22 June 2009, fr., *Melo 6372* (HUEFS); *loc. cit.*, distrito de Bonfim de Feira, entrada no km 8, Inselberg Monte Alto, 2 May 2008, fl., *Oliveira 1553, 1554* (HUEFS); Ipirá, S11°22’ W38°41’, 14 October 2002, fr., *Moura s.n.* (HUEFS69135, HUEFS69137); *loc. cit.*, S11°59’49” W40°05’50”, 868 m, 10 April 2001, fl., *Nunes 266* (CEPEC, HUEFS); *loc. cit.*, Fazenda Nova Fanela, ca. 2,5 km S de Ipirá, S12°10’45” W39°46’12”, *s.d.*, fl. fr., *Queiroz 10607* (CEPEC, HUEFS); Mun. Iraquara, along road 12 km from city to BR-242, 600m, 14 June 1981, fr., *Mori 14435* (CEPEC, NY); Mun. Itiuba, a 10 km de Itiuba, S10°39’28” W39°44’16”, 375 m, 28 January 2002, fr., *Nascimento 38* (CEPEC, HUEFS); *loc. cit.*, ca. 5 km em direção a Coité, Fazenda Grotão, 10 May 2002, fl., *Nascimento 83* (CEPEC, HUEFS); Mun. Jaguari, caminho do Engenho, estrada para Grotas, S10°08’ W40°13’, 24 June 2005, fr., *Souza-Silva 15, 20* (CEPEC, HUEFS); Mun. Jaíba, periferia do povoado São Roque, S12°15’05” W38°50’36”, 174 m, 22 May 2010, *Silva 85* (HUEFS); Mun. Jeremoabo, ca. 12 km da cidade, 22 May 1978, fl. fr., *Souza-Silva 612* (HUEFS, SP); Mun. Mairí, margem direita do rio Jacuípe, 29 March 1985, fl., *Oliveira 658* (CEPEC, HUEFS); Mun. Miguel Calmon, arredores da cidade, 16 June 1985, fr., *Noblick 3876* (CEPEC, HUEFS); *loc. cit.*, estrada Miguel Calmon para Cabeceiras, a 16 km de Miguel Calmon, S11°21’33” W40°33’52”, 6 April 2001, fl., *Jesus 1299* (CEPEC, HRB, HUEFS); Mun. Piritiba, 31 May 1980, fr., *Noblick 1839* (HUEFS); Mun. Quijilingue, lagoa de dentro, a ca. 3 km E do povoado Quixaba do Mandacaru, S10°55’ W39°03’, 270 m, 15 May 2005, fl. fr., *Cardoso 518* (HUEFS); Mun. Retirolândia, ca. 5km N da cidade, S11°28’45” W39°26’32”, 250 m, 1 November 1999, fl., *Oliveira 299* (CEPEC, HUEFS); Mun. Riachão do Jacuípe, caminho para Gavião, S11°31’49” W39°42’30”, 647 m, 26 March 2000, *Guedes 7291* (ALCB, CEPEC, HUEFS); Mun. Ruy Barbosa, Serra do Orobó, Fazenda Bom Jardim, S12°20’33” W40°28’40”, 426 m, 25 May 2005, fr., *Queiroz 10655* (CEPEC, HUEFS); Mun. Senhor do Bonfim, Serra da Maravilha, S10°24’16” W40°12’36”, 739 m, 28 July 2005, fr., *Castro 1281* (HUEFS); *loc. cit.*, Serra de Santana, 28 July 2005, fr., *Nunes 1218* (CEPEC, HUEFS); *loc. cit.*, 13 May 1974, fr., *Andrade-Lima 7664* (HUEFS, IPA); Mun. Serra Preta, 6 km do ponto de Serra Preta, Fazenda Santa Clara, 17 July 1985, fr., *Noblick 4228* (CEPEC, HUEFS); Mun. Tanquinho, estrada para Exu, S12°42’ W39°43’, 2 June 2005, fl. fr., *Carvalho 111, 114* (CEPEC, HUEFS); *loc. cit.*, Fazenda Beira do Rio, 27 May 1999, fl., *Vanilda 146* (HUEFS); Tucano, povoado Bizamum, Serra Grande, S10°51’18” W38°02’14”, 452 m, 21 April 2005, fl., *Cardoso 493* (HUEFS); *loc. cit.*, S10°53’43” W38°58’47”, 236 m, 10 April 2004, fr., *Cardoso 40* (HUEFS). **Ceará:** Mun. Brejo Santo, lote 5, povoado Oitis, reservatório porcos, S07°36’45” W38°53’17”, 685 m, 5 August 2011, fr., *Ferreira 339* (HUEFS, HVASF). **Pernambuco:** Mun. Floresta, Floresta do Navio, 24 May 1978, fl. fr., *Souza-Silva 650* (HUEFS, SP); Mun. Inajá, Reserva Biológica Serra Negra, S08°39'00" W38°23'00", 799 m, 3 September 2009, fr., *Carvalho-Sobrinho 2353* (CEPEC, HUEFS, HVASF); Mun. Ipubi, margem da estrada para a mineradora Bonito, 15 April 2010, fl., *Miranda 6171* (HUEFS, HST); Mun. Santa Maria da Boa Vista, próximo a ponte do rio das Garças, em direção a lagoa, 2 May 1971, fl., *Academia Brasileira de Ciências 462* (HUEFS, IPA); Mun. São José do Belmonte, Mirandiba, 15 May 1971, fr., *Academia Brasileira de Ciências 780* (HUEFS, IPA). **Sergipe:** Mun. Macambira, Cachoeira de Macambira, 5 March 2013, fl., *Matos 84* (ASE); Mun. Riachão do Dantas, 8 April 1986, fl., *Viana 1397* (ASE, IPA); *loc. cit.*, Fazenda Dr. Belmiro, 28 November 2013, fr., *Matos 325* (ASE).

Distribution, habitat and phenology:—*Amorimia pellegrinii* occurs in Seasonally Tropical Dry Forests from northern Bahia, and surroundings of Ceará, Pernambuco and Sergipe states (Fig. 12), flowering and fruiting throughout the year.

Conservation status:—*Amorimia pellegrinii* should be regarded as least concern (LC) due to its extent of occurrence of 165,341 km².

Etymology:—The epithet pays honor to Marco Octávio de Oliveira Pellegrini (b.1990), a Brazilian botanist contributor to the study of the Malpighiaceae from the Atlantic Forest, additional collector of the type specimen, and future husband of the first author.

Taxonomy notes:—*Amorimia pellegrinii* resembles *A. rigida* on indumenta type, inflorescence morphology, sepal shape, petal morphology, anthers indumenta, shape of the apex of the style, and dorsal wing morphology, but differs on leaf shape, number of secondary veins, size of peduncles, and size of filaments. A list of informative characters to differentiate them is presented on Table 1.

5. *Amorimia rigida* (A.Juss.) Anderson (2006: 183) ≡ *Mascagnia rigida* (A.Juss.) Grisebach (1858: 92) ≡ *Hiraea rigida* Jussieu (1833: 14). Lectotype (designated by Anderson 2006):—BRAZIL. Minas Gerais: São Miguel do Jequitinhonha, *A. St.-Hilaire B1-1501* (P barcode P02429227!; isolectotypes: P barcodes P02429228!, P02429229!). Figs. 8, 10, 11-12.

Woody vines to scandent shrubs; stems sparsely sericeous-velutine to glabrous at age; stipules 0.8–1 mm long, narrowly triangular, epipetiolar, persistent to deciduous. *Leaves* decussate, reduced in inflorescences; petioles 4–5 mm long, sparsely sericeous-velutine to glabrous, eglandular at apex; leaf blades 7.7–11.5 × 4.2–6 cm, plane, bullate, ovate to elliptic to slightly obovate, base rounded to cuneate, margin plane, apex acute to acuminate, both sides glabrous, eglandular to 2–pairs of glands, 0.4–0.5 mm diam., near base or up to 6.5–8.5 mm from the margin; midvein adaxially impressed, abaxially prominent, secondary veins 7–8 pairs, arching 50°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent and conspicuous on both sides. *Thyrses (pseudoracemes) or panicles*, axillary to terminal; main axis 12–15 cm long, cylindrical, striated *in vivo*, green *in vivo*, sericeous-velutine; cincinni 26–30, 1–flowered, spirally alternate; bracts 3.2–3.5 × 2.1–2.5 mm, ovate, sessile, parallel to peduncle, 1–2 pairs of marginal glands, at base to middle, both sides sericeous-velutine; peduncle 2.5–3 × 0.9–1 mm, sericeous-velutine; bracteoles 2–2.5 × 1.25–1.5 mm, elliptic, inserted at the apex of the peduncles, parallel to pedicel, eglandular, both sides sericeous-velutine; pedicels 5–6.5 × 0.9–1 mm, sericeous-velutine. *Flowers* 10–12 mm diam. at anthesis; floral buds 4.5–6 × 4.5–5 mm. *Sepals* 1.5–2 × 1–1.5 mm, ovate, appressed to the androecium, apex obtuse to rounded, plane at anthesis, both sides sericeous-velutine; glands yellow turning orange to ocher at age, 2–2.5 × 0.8–1 mm. *Petals* yellow, turning orange at age, margin of limb sinuate; lateral petals patent at anthesis, anterior-lateral petals not overlapping at anthesis, limb 3–4 × 2–2.5 mm, elliptic, base truncate to hastate, adaxially sericeous-velutine distally, abaxially sericeous-velutine, claws 0.9–1.2 × 0.3–0.4 mm, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 3–3.5 × 2.8–3 mm, elliptic, base truncate to hastate, adaxially sericeous-velutine distally, abaxially sericeous-velutine, claw 0.9–1 × 0.4–0.5 mm, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite to the anterior sepal, lateral-posterior sepals and posterior petal longer than those opposite to the lateral petals; filaments 1.25–1.5 × 0.25–0.4 mm, connate 0.4–0.5 mm long at base, glabrous; anthers monomorphic, 1–1.25 × 0.4–0.5 mm, reflexed at anthesis, base, connective and apex pubescent. *Ovary* 1.1–1.25 × 1.4–1.5 mm, each carpel with primordial lateral and dorsal wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, diverging at middle, apex truncate with rounded angle, sericeous-velutine at base, anterior style 0.9–1 mm long, posterior styles 1.2–1.25 mm long; stigma lateral, crateriform. *Samaras* green turning pale ocher *in vivo*; dorsal wing 9–10 × 4.5–5.5 mm, very shallowly triangular, margin sinuate, sericeous-velutine on both sides; lateral wings 1.3–1.5 × 2.5–2.6 cm, flabelliform, margin sinuate, upper angle 60°, lower angle 75° from the nut, sericeous-velutine on both sides; nut ovoid, sericeous-velutine; areole 6–6.5 × 2.5–3 mm, elliptic. *Seeds* 4.7–5 × 3–3.2 mm, testa smooth; embryo ovoid, cotyledons folded.

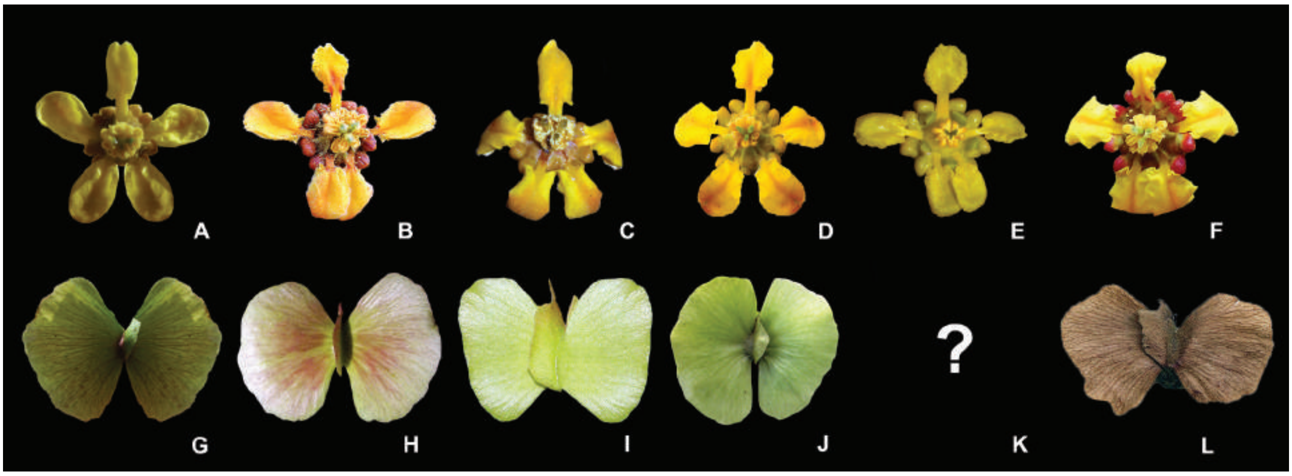

FIGURE 11. Illustration plate comparing flowers and fruits from species of the *Amorimia rigida* complex: *Amorimia rigida*, A. flower in frontal view, G. samara in dorsal view; *Amorimia candidae*, B. flower in frontal view, H. samara in dorsal view; *Amorimia coriacea*, C. flower in frontal view, I. samara in dorsal view; *Amorimia pellegrinii*, D. flower in frontal view, J. samara in dorsal view; *Amorimia andersonii*, E. flower in frontal view, K. mature samara unknown; *Amorimia velutina*, F. flower in frontal view, L. samara in dorsal view (photographs A, B, D, G, H, J—R.F. Almeida, C—M.O.O. Pellegrini, E—F. Michelangeli, I—C.N. Fraga).

Specimens analyzed:—BRAZIL. Bahia: Mun. Almadina, road Almadina to Ibitupã, ca. 20km, Fazenda São Roque, ca. 10 km da entrada do ramal, S14°38'27" W39°42'47", 12 March 2005, fl., *Fiaschi 2761* (CEPEC, NY); Mun. Itagibá, Mata da Botinha, S14°10'53" W39°42'31", 12 July 2009, fr., *Guedes 16327* (ALCB); Mun. Itajú da Colônia, km 8 da estrara Itajú da Colônia-Pau Brasil, a 3 km do ramal a direita, *s.d.*, fl., *Santos 354* (CEPEC); Mun. Itororó, Fazenda Santa Ana, 14.4 Km of Itajú da Colônia, on road to rio do meio, S15°09'01" W39°49'57", 200 m, 24 July 2003, fl., *Thomas 13476* (CEPEC, NY); Mun. Jussari, ca. 2.5 km N of Palmira on road to Itajú da Colônia, S15°08'03" W39°34'03", 300-450 m, 2 February 1999, fl., *Thomas 11954* (CEPEC, NY); Posse, near Vitória da Conquista, road to Boa Nova, km 5, 25 January 1973, fl., *Gottsberger 24-25173* (NY); Mun. Santa Cruz da Vitória, ca. 8.1 km from the city, fazenda Uruguaiana, 28 June 2000, fr., *Amorim 3565* (CEPEC, NY, SP). **Minas Gerais:** *s. loc.*, 1838, fl., *Claussen s.n.* (P4843527); *s. loc.*, 1883, fl., *Glaziou 13601* (P); Mun. Iguatama, Fazenda Faroeste, margem esquerda do rio São Miguel, S20°15'44" W45°40'15", 650-700 m, fr., *Melo 1334* (BHCB); Mun. Itumiritinga, 12 April 1999, fl., *Rodrigo s.n.* (UFPB54379, VIC23366); *loc. cit.*, assentamento 1° de junho, 16 September 2001, fr., *Freitas s.n.* (UFPB54378, VIC26216); Mun. Lagoa Santa, 1907, fl., *Warming 838* (P); Mun. Mariana, Serra do Caraça, 19 January 1880, fl., *Simard 12493* (NY, P); Mun. Matozinhos, Fazenda Cauaua, Mata Cubieri, 5 April 2004, fl. fr., *Rodrigues-Silva 335* (HUEFS, PMSP); Mun. Jequitinhonha, Reserva Biológica Mata Escura, 27 July 2013, fl fr., *Almeida et al. 561, 562* (CEPEC, HUEFS, RB); Mun. Prudente de Morais, Fazenda Santa Rita, 25 May 1977, fr., *Francisco 11* (PAMG); Resplendor, parcela para estudos do EIA do Mineroduto Morro do Pilar, S19°16'37" W41°04'51", 23 June 2013, fl., *Saddi 865* (RB); Mun. Rio de Casca, Fazenda Esmeralda, Serra da Mantiqueira, 21 January 1989, fl., *Brozek 12* (HUEFS, HRCB); Mun. Sete Lagoas, CNP-MS, 24 August 1982, fl., *Cunha 741* (PAMG).

Distribution, habitat and phenology:—*Amorimia rigida* is only known from Semi-deciduous Forests in the states of Bahia and Minas Gerais (Fig. 12). Flowering from January to March, less frequently on July and August, and fruiting from April to July.

Conservation status:—*Amorimia rigida* should be regarded as least concern (LC) due to its extent of occurrence of 77,395 km². However, it is important to highlight that Semi-deciduous forests from the state of Minas Gerais are now reduced to small fragments. This is the probable cause of the few modern collections of *A. rigida* in the area. The only recent collection protected by a conservation unit is in Jequitinhonha municipality, in Northern Minas Gerais (Mata Escura Biological Reserve).

Etymology:—The epithet probably refers to the rigid texture of its leaf blades.

Taxonomic notes:—*Amorimia rigida* resembles *A. velutina* Anderson on leaf, inflorescence, sepal, petal and gynoecium shape, but differs on the color of sepal glands at anthesis, position of the anterior-lateral petals, size of the filaments, indumenta of the anthers, and the shape of dorsal wing of the samaras. A list of informative characters to differentiate them is presented on Table 1.

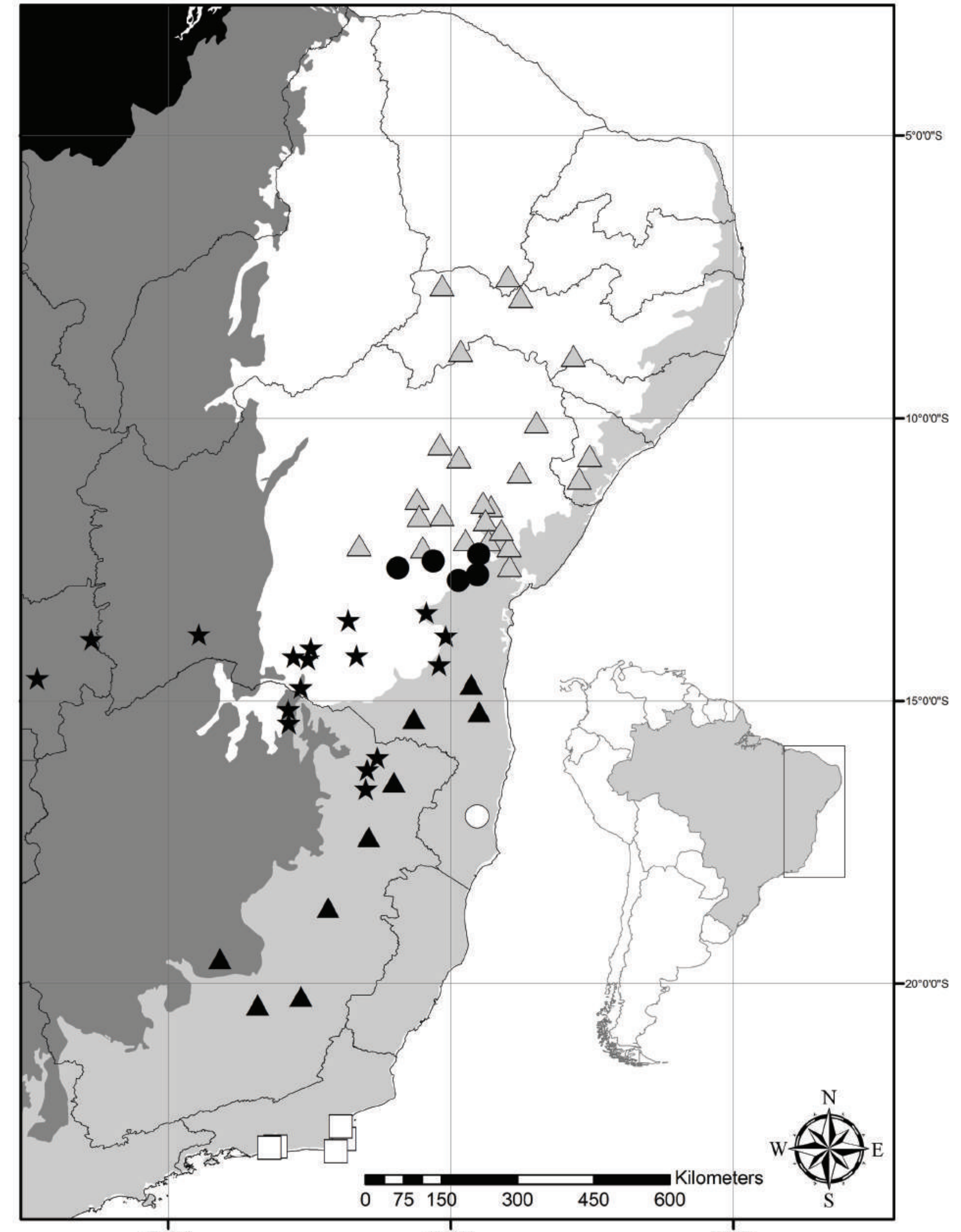

FIGURE 12. Distribution map of species from the *Amorimia rigida* complex in eastern Brazil: white circle—*A. andersonii*, black circle—*A. candidae*, white square—*A. coriacea*, gray triangle—*A. pellegrinii*, black triangle—*A. rigida*, dark star—*A. velutina.* White area—Caatinga domain, light gray area—Atlantic Forest domain, dark gray area—Cerrado domain, dark area—Amazon Forest domain.

6. ***Amorimia velutina*** W.R.Anderson (2006: 185–186). Type:—BRAZIL. Minas Gerais: Mun. Itinga, Fazenda Timirim (property of Dr. Alexandre), 16°35'S, 41°47'W, 22 April 1985, *SAP 243* (Holotype, mounted on two sheets: MICH003064A!, MICH003064B!; Paratypes: MBM54998!, MBM58786!, NY00998242!, R000143432!, R000143432a!, UEC009835!). Fig. 9–12.

Woody vines to scandent shrubs; stem sparsely sericeous-velutine to glabrescent at age; stipules 0.7–1.5 mm long, narrowly triangular, epipetiolar, persistent to deciduous. *Leaves* opposite, reduced in inflorescences; petioles 2–4.5 mm long, velutine to glabrescent, eglandular; leaf blades 5–10 × 3.5–5 cm, plane, bullate, ovate, elliptic to obovate, base rounded to attenuate, margin plane, apex acute, both sides velutine to glabrescent, eglandular to 1–pair of glands, 0.4–0.5 mm diam., near base or distally up to 2-5 mm from the margin; midvein adaxially impressed, abaxially prominent, secondary veins 7–8 pairs, arching 40°, subopposite to alternate, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, axillary or terminal; main axis 4–20 cm long, cylindrical, smooth *in vivo*, ocher *in vivo*, sericeous-velutine; cincinni (10–)30–50, 1–flowered, spirally alternate; bracts 3–4.5(–6) × 1.5–3 mm, ovate, elliptic to lanceolate, subsessile, leaf-like, parallel to peduncle, 2 pairs of glands at base, velutine on both sides; peduncle 1–4.5 × 0.9–1.1 mm, velutine; bracteoles 2–4 × 1–2 mm, elliptic, inserted at the apex of peduncles, parallel to the pedicel, 1 pair of glands at base, sericeous-velutine on both sides; pedicels 3–5.5 × 0.9–1.1 mm, velutine, thin at apex. *Flowers* 9–11 mm diam. at anthesis; floral buds 4–4.2 × 4.2–4.4 mm. *Sepals* 2.8–3 × 1.5–1.8 mm, ovate, appressed to the androecium, apex obtuse to rounded, plane to revolute at anthesis, both sides sericeous-velutine; glands yellow turning reddish at age, 2–3.2 × 0.9–1 mm. *Petals* yellow, turning dark orange, margin of limb sinuate; lateral petals reflexed at anthesis, anterior-lateral petals overlapping at anthesis, limb 3.5–5 × 2.5–3.5 mm, elliptic, base truncate to hastate, adaxially sericeous-velutine distally, abaxially sericeous-velutine, claws 1–1.5 × 0.3–0.4 mm, adaxially sericeous-velutine distally, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 3–4 × 2.2–3.5 mm, elliptic, base truncate at base, adaxially sericeous-velutine distally, abaxially sericeous-velutine, claw 2–2.7 × 0.5–0.7 mm, adaxially sericeous-velutine distally, abaxially sericeous-velutine. *Stamens* 10, those opposite to sepals shorter than those opposite to petals; filaments 1.5–2.2 × 0.25–0.3 mm, connate 0.4–0.5 mm long at base, glabrous; anthers heteromorphic, 0.5–1 × 0.4–0.5 mm, reflexed in anthesis, hairy at base. *Ovary* 0.6–1.5 × 0.8–1 mm, each carpel with primordial lateral and dorsal wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, diverging at middle, anterior style curved, apex truncate with acuminate angle, sericeous-velutine at base; anterior style 0.6–1.3 mm long; posterior styles 0.9–1.7 mm long; stigma lateral, crateriform. *Samaras* yellowish in vivo; dorsal wing 7–9 × 3.5–5 mm, pentagonal with two triangular projections at apex, margin sinuate, sericeous-velutine on both sides; lateral wings 10–15 × 9–10 mm, flabelliform, margin sinuate, upper angle 30°, lower angle 70° from the nut, sericeous-velutine on both sides; nut narrowly ovoid, sericeous-velutine; areole 5.5–6 × 2–3.5 mm, triangular. *Seeds* 4.2–4.5 × 2.5–3 mm, testa rugose; embryo ovoid, cotyledons folded.

Specimens analyzed:—BRAZIL. Bahia: Mun. Boa Nova, Parque Nacional de Boa Nova, S14°21' W40°15', 600 m, 25 February 2013, fl., *Marinho* 396 (HUEFS); Mun. Caetité, Fazenda Baixa Grande, caminho para Pajeú do Vento, S14°04'03" W42°38'12", 820 m, 9 February 1997, *Stannard 5312* (HUEFS); Mun. Coribe, estrada de são Félix do Coribe para Coribe, 22.4 km vilarejo Colônia, S13°41'28" W44°15'28", 560 m, 7 June 2007, fr., *Lopes 1340* (CEPEC, HUEFS); *loc. cit.*, Alagoinha, S14°56'00" W44°43'56", 10 April 2005, fr., *Castro 1193* (HUEFS); Mun. Iramaia, Fazenda Segredo, 5 December 2001, fl., *Leal 246* (EBDA); Mun. Itaeté, Chapada Diamantina, próximo ao poço encantado, S12°98'64' W40°97'25", 900 m, 13 November 2014, fr., *Guedes 23072* (ALCB); Mun. Maracás, Fazenda Tanquinho, ca. 20 km N de Maracás, ramal para Fazenda Santa Rita, na estrada para Planaltino, 30 June 1993, fl., *Queiroz 3259* (HUES); Mun. Tanhuaçu, Floresta Nacional Contendas do Sincorá, trilha do rio Cumbuca, 13 May 2011, fr., *Marinho 31* (HUEFS); *loc. cit.*, 50 m da sede, via rio Cumbuca, S13°55'18" W41°07'08", 377 m, 6 February 2015, fl., *Aona 3852* (ALCB, HUEFS, HURB); *loc. cit.*, ramal contrário a grade de estrada para sede, S13°55'49" W41°05'16", 348 m, 6 February 2015, fl., *Aona* 3892 (ALCB, HUEFS, HURB); Mun. Urandi, Fazenda Feijão Preto, 7 km de Urandi no sentido Urandi/Guanambi, S14°43'59" W42°39'00", 689 m, 9 April 2002, fr., *Jost 495* (HUEFS, HRB). **Goiás:** Mun. Formoso, region Southern Serra Dourada, S13°45' W48°50', 20 June 1956, fl., *Dawson 15006* (P); Mun. Monte Alegre, Sumidouro, 23 May 2008, fl., *Cordeiro 2678* (MBM). **Minas Gerais:** Mun. Araguari, Fazenda da Mata, 23 March 1993, fl., *Araújo 838* (HUEFS, HUFU); Mun. Chapada do Norte, Fazenda Mariléo, 21 May 1990, fr., *Lima 163* (PAMG); Mun. Mato Verde, São João do Bonito, estrada para as lavras na serra geral, 2.5 km de São João Bonito, 12.5 km rodovia Mato Verde-Monte Azul, BR 122, S15°18'21" W42°49'37", 7 April 2004, fl. fr., *Pirani 5462* (HUEFS, SPF); Mun. Medina, entre Itaobim e Medina, S16°50'60" W41°28'97", 3 September 2008, fr., *Oliveira 1611* (HUEFS); Mun. Itaobim, margem da BR-116, próximo a ponte sobre o Rio Jequitinhonha, 28 December 1984, fl., *Pirani s.n.* (HUEFS203426, SPF).

Distribution, habitat and phenology:—*Amorimia velutina* is known from Seasonally Dry Tropical Forests in Southwestern Bahia, Northern Minas Gerais, and Eastern Goiás states (Fig. 12), flowering and fruiting throughout the year.

Conservation status:—*Amorimia velutina* should be regarded as least concern (LC) due to its extent of occurrence of 169,240 km^2. However, it is important to highlight that Semi-deciduous forests from the states of Bahia, Goiás and Minas Gerais are now reduced to small fragments.

Etymology:—The epithet makes reference to the velutine indumenta on its leaf blades.

Taxonomic notes:—*Amorimia velutina* resembles *A. pellegrinii* and *A. rigida* on leaf, inflorescence, sepal, petal and gynoecium shape, but differs on the color of sepal glands at anthesis, position of the anterior-lateral petals, size of the filaments, indumenta of the anthers, and the shape of dorsal wing of the samaras. A list of informative characters to differentiate them is presented on Table 1.

Key to the species of the *Amorimia rigida* complex

1a. Leaves lanceolate elliptic to narrow-elliptic, velutine to glabrous at age, with 10–16 pairs of secondary veins; bracts and bracteoles reflexed; sepals erect with revolute apex at anthesis, glands turning ocher, petals adaxially entirely velutine, filaments pubescent at apex, styles uncinate at apex; samaras with dorsal wing depressed ovate .... ***Amorimia andersonii***

1b. Leaves ovate to elliptic to wide-elliptic to orbicular, sericeous-velutine to glabrous at age, with 8 or fewer pairs of secondary veins; bracts and bracteoles parallel; sepals appressed to the androecium with straight apex at anthesis, glands turning brown or red, petals adaxially proximally glabrous, filaments glabrous, styles truncate at apex; samaras with dorsal wing obtrapezoidal or triangular 2

2a. Petals turning red at post-anthesis, posterior petal 2-glandular at base of limb; samaras with dorsal wing obtrapezoidal with rounded angles.. ***Amorimia candidae***

2b. Petals turning orange at post-anthesis, posterior petal eglandular; samaras with dorsal wing triangular or obtrapezoidal bearing a projection at apex 3

3a. Leaves with a pair of glands near margin or near base; claw of the posterior petal up to 1 mm long; stamens opposite the anterior sepal, posterior-lateral sepals and posterior petal longer than those opposite lateral petals .... ***Amorimia rigida***

3b. Leaves with a pair of glands near or at base; claw of the posterior petal more than 1 mm long; stamens opposite petals longer than those opposite sepals 4

4a. Claw of the posterior petal larger than 0.5 mm wide, lateral petals patent at anthesis, anthers pubescent at apex, connectives and base; samaras with dorsal wing triangular.. ***Amorimia pellegrinii***

4b. Claw of the posterior petal up to 0.5 mm wide, lateral petals reflexed at anthesis, anthers pubescent only at base; samaras with dorsal wing obtrapezoidal.. 5

5a. Leaves conduplicate, not bullate; peduncles exceeding bracts at anthesis; glands turning brown at post-anthesis, anterior-lateral petals divergent; samaras with dorsal wing bearing an aciculate projection at apex .... ***Amorimia coriacea***

5b. Leaves plane, bullate; peduncles not exceeding bracts at anthesis; glands turning red at post-anthesis, anterior-lateral petals overlapping; samaras with dorsal wing bearing two triangular projections at apex .... ***Amorimia velutina***

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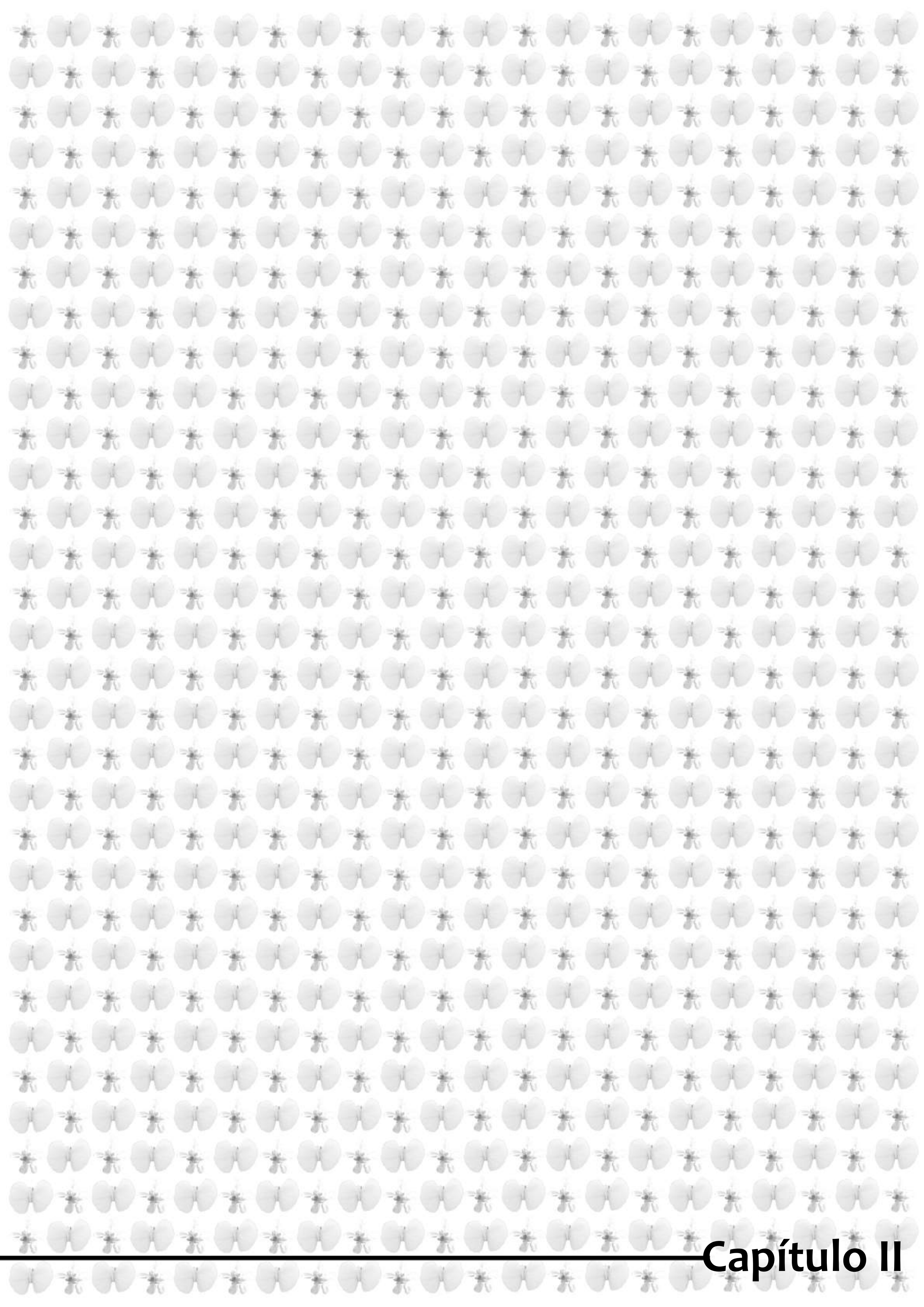

Capítulo II

Leaf anatomy and macro-morphology uncover a new species of *Amorimia* (Malpighiaceae) from Southeastern Brazil

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Abstract

The description of a new species belonging to the *Amorimia rigida* complex (Malpighiaceae) is presented, based on leaf anatomy and macro-morphology. *Amorimia tumida* is endemic to northern state of Rio de Janeiro, Brazil, and it can be differentiated from the remaining species of the *A. rigida* complex by the absence of glands on the leaf blades, shape of the leaf blades, divergent angle of secondary veins, reduced number of flowers in the inflorescence, thickness of fruiting pedicels, and indumentum of the filaments, styles and samaras. This study includes macro and micro-morphological descriptions, along with an updated identification key for the species of the complex, illustrations, a distribution map, a conservation assessment, and comments on ecology and taxonomy.

Keywords: Atlantic Forest, Malpighiales, Malpighioid clade, Plant Anatomy, Taxonomy.

Resumo

Apresentamos a descrição de uma nova espécie pertencente ao complexo *Amorimia rigida* (Malpighiaceae), baseada em anatomia foliar e macromorfologia. *Amorimia tumida* é endêmica

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do norte do estado do Rio de Janeiro, Brasil, sendo diferenciada das demais espécies deste complexo pela ausência de glândulas, forma e ângulo de divergência das nervuras secundárias das lâminas foliares, além do número reduzido de flores na inflorescência, espessura dos pedicelos em frutos e pelo indumento dos filetes, estiletes e mericarpos. Este estudo inclui descrições macro e micromorfológicas, uma chave de identificação atualizada para as espécies deste complexo, ilustrações, um mapa de distribuição, e comentários sobre conservação, ecologia e taxonomia.

Palavras-chave: Anatomia Vegetal, Clado Malpighioid, Floresta Atlântica, Malpighiales, Taxonomia.

Introduction

Amorimia Anderson (2006: 176) is a lianescent genus of Neotropical Malpighiaceae, comprising 14 species distributed throughout Rainforests and Seasonally Dry Tropical Forests in South America (Anderson 2006; Almeida *et al.* 2016). It is distinguished from *Mascagnia s.s.* (Bertero *ex* De Candolle 1824: 585) Colla (1824: 85) by the presence of extra-floral nectaries on the abaxial face of leaves, bracts and bracteoles, elongated thyrsi with 1-flowered cincinni (i.e. pseudoracemes), pubescent petals, straight styles, and by the production of monofluoroacetate, a toxic compound that leads livestock to sudden death (Anderson 2006; Almeida *et al.* 2016; Lee *et al.* 2012). Three new species and a new combination were recently published for this genus, in an attempt to solve the *A. rigida* complex (Almeida *et al.* 2016). This species complex currently comprises six species confined to eastern Brazil and previously treated under a much broader sense of *A. rigida*: *A. andersonii* Almeida *et al.* (2016: 4), *A. candidae* Almeida *et al.* (2016: 8), *A. coriacea* (Grisebach 1858: 92) Almeida *et al.* (2016: 13), *A. pellegrinii* Almeida *et al.* (2016: 14), *A. rigida* (Jussieu 1833: 14) Anderson (2006: 183), and *A. velutina* Anderson (2006: 183).

During numerous visits to the RB herbarium for the ongoing taxonomic revision of *Amorimia* (Almeida *et al.* in prep.), we came across a peculiar fruiting specimen from the state of Rio de Janeiro, Brazil. Nevertheless, the lack of flowers and floral buds discouraged us to describe it as a new species, before a more thorough analysis could be carried on. After a comprehensive analysis of its leaf anatomy and macro-morphology, this specimen is here confirmed to represent a new species, belonging to the *A. rigida* complex. We present a complete anatomical description of the leaves for this new species, and compare with its closest morphological relative, *A. andersonii*. Additionally, we provide a macro-morphological description, illustrations, a distribution map, a conservation assessment, and comments on the ecology and taxonomy, along with an updated identification key for the species in the *A. rigida* complex.

Material and methods

Taxonomic study

Morphological and phenological data were based on herbaria specimens (CEPEC, HUEFS, P, and RB herbaria acronyms according to Thiers, continuously updated). The indumentum terminology follows Anderson (1981), structure shapes follows Radford et al. (1974), the inflorescence terminology and morphology follows Weberling (1965, 1989), and fruit terminology follows Anderson (1981) and Spjut (1994). The conservation status was proposed following the recommendations of IUCN Red List Categories and Criteria, Version 3.1 (IUCN 2012). GeoCAT (Bachman et al. 2011) was used for calculating the Extent of Occurrence (EOO) and the Area of Occurrence (AOO). Maps were elaborated using ArcGIS 9.3 software (ESRI 2010) and geographical coordinates were obtained from herbaria specimens and fieldwork data.

Anatomic study

The anatomic study was based on herborized leaves from the specimens *L.C. Marinho 654* (CEPEC - *A. andersonii*) and *M.N. Coelho 2794* (HUEFS - *Amorimia tumida*). Leaves were hydrated in hot water, followed by a two-hour immersion in potassium hydroxide 2%, and washed to complete the reversion process (Smith & Smith 1942, modified). All leaves were gradually dehydrated with ethanol, embedded in (2-hydroxyethyl)-methacrylate Leica™ (Paiva *et al.* 2011), transversal and longitudinally sectioned from 6 to 8 µm in a Zeiss™ Hyrax M40 rotary microtome, stained with 0.05%toluidine blue in acetate buffer at 4.7 pH (O'Brien *et al.* 1964, modified), and mounted on slides with Entellan™. Three different histochemical tests were performed with unstained sections: Sudan IV (Pearse 1980) to recognize the cuticle and other lipids, Ruthenium red (Jensen 1962) to highlight pectic substances of the cell wall and to detect mucilage, and Ferric chloride (Johansen 1940) to identify phenolic compounds.

Entire leaves were cleared with 5% sodium hydroxide, and stained with basic 1% fuchsine in 95% ethyl alcohol, according to Fuchs (1963). The description of leaf architecture followed Hickey (1979). Pieces of cleared leaves were mounted on slides with gelatin glycerin. All samples were analyzed and photographed in a light microscope Zeiss™ Primo Star and stereomicroscope Zeiss™ Stemi 2000-C, both coupled with a Canon™ Power Shot A650 digital camera.

Results

Taxonomy

Amorimia tumida R.F.Almeida & A.C.Marques, *sp. nov.* (Figs. 2–6)

Type:—BRAZIL. Rio de Janeiro: Mun. Cardoso Moreira, Serra da Bandeira, 17 December 2013, fr., *M.N. Coelho & I.G. Costa 2794* (Holotype: RB!; isotypes: CEPEC!, HUEFS!).

Differs from *Amorimia andersonii* (Fig. 1) by its leaf blades elliptic, eglandular at base, fewer secondary veins, secondary veins joining the primary vein in an acute angle, more obtuse in the apex; fewer flowers in the inflorescence; pedicel tumid in fruits; filaments entirely sericeous; styles entirely sericeous; samaras sericeous and metallic coloured.

Woody vines; stem sparsely sericeous to glabrous at age; stipules 0.5–0.6 mm long, triangular, epipetiolar, persistent to deciduous. *Leaves* opposite, reduced to bracts in the inflorescences; petioles 4.3–6.6 mm long, sparsely sericeous to glabrous, eglandular at apex; blades 4–9.5 × 2.1–5.1 cm, plane, elliptic, base obtuse, margin slightly revolute *in sicco*, apex acuminate, adaxially glabrous, abaxially sparsely sericeous to glabrescent at age, eglandular; midvein adaxially prominent, abaxially prominent, 8–9 pairs of secondary veins, arching 48–55°, opposite to subopposite, both sides impressed, reticulum impressed and conspicuous on both sides. *Thyrses* (pseudoracemes) axillary; main axis 8.45–9.75 cm long, cylindrical, striated, sericeous; cincinni 1-flowered, 6–8-cincinni, decussate; bracts 1.3–3.3 × 1–1.6 mm, lanceolate, petiolate, conduplicate, deflexed, 1 pair of marginal glands near base, both sides sericeous; peduncle 11–20 × 0.7–1 mm, laterally flattened, sericeous; bracteoles 1.1–1.8 × 0.5–0.6 mm, oblong, sessile, conduplicate, inserted 2.5–4 mm below the apex of peduncles, subopposite, deflexed, eglandular, both sides sericeous. *Flowers* unknown; floral buds (fragments) 5.5–8 × 5–6 mm; pedicels (in fruits) 6–8 × 1–1.5 mm, sericeous to glabrescent, tumid. *Sepals* (in fruit) 3.5–4 × 2.5–3 mm, narrowly oblong, apex obtuse to rounded, revolute at anthesis, both sides sericeous; glands 3–3.1 × 1.3–1.5 mm, greenish turning brown at age. *Petals* unknown. *Stamens* (persistent in young fruits) 10; filaments 1.8–2 × 0.5–0.7 mm, connate 1–1.5 mm long at base, entirely sericeous on both sides; anthers unknown. *Ovary* unknown (probably sericeous); styles 3, cylindrical at base, cylindrical at apex, parallel at base and middle, apex apiculate, entirely sericeous; anterior style 2–2.1 mm long; posterior styles 2.5–2.8 mm long; stigma lateral, crateriform. *Samaras* metallic green *in vivo* and metallic ocher *in sicco*; dorsal wing 10–15 × 5–6 mm, depressed ovate, margin entire, sericeous on both sides; lateral wings 1.6–2.3 × 1.8–3 cm, flabelliform, margin entire to sinuate, upper angle 15° and lower angle 55° from the nut, sericeous on both sides; nut narrowly ovoid, sericeous; areole 8.6–10 × 2.6–3.5 mm, narrowly ovoid. *Seeds* 6.1–9 × 3.5–6.5 mm, testa rugose with lateral crests; embryo ovoid, cotyledons folded.

Distribution, habitat and phenology:—*Amorimia tumida* is known only from Semi-Deciduous forests in northern Rio de Janeiro state (Fig.6), fruiting in December.

Conservation status:—Despite recent efforts on recollecting *A. tumida* in its type locality on Northern state of Rio de Janeiro, we were unable to locate it on the field. The collector of the type specimen did not record geographic coordinates for this specimen, and little was written in the specimen’s label on its habitat and gazetteer. Unfortunately, this species remains represented by a single collection from Semi-Deciduous Forests associated to rocky outcrops within the Atlantic Forest of Serra da Bandeira, northern Rio de Janeiro state. Thus, this species should be regarded as Data Deficient (DD).

Etymology:—The epithet makes reference to the species thickened fruiting pedicels, a unique feature in the genus.

Leaf anatomy:—*Amorimia tumida* R.F.Almeida & A.C.Marques *sp. nov.* and *A. andersonii* are quite similar, regarding their leaf anatomy (compare Fig. 4a–b with Fig. 4c–d). In the distal third, the petioles show thin-walled cells in epidermis on both sides (Fig. 4e, g). In *A. tumida*, a subepidermal layer similar to the epidermis is observed in the entire petiole, but cells are larger than in the epidermis (Fig. 4e); the subepidermal layer is undifferentiated in *A. andersonii* (Fig. 4g). A mildly thickened collenchyma is adjacent to the epidermis throughout the petiole (Fig. 4a, e and Fig. 4c, g), being more evident in *A. andersonii*. The main vascular unity shows secondary growth and forms an open arch with non-convoluted extremities in transversal section, arranged collaterally (Fig. 4a, c, f, h). Two accessory vascular bundles are adaxially presented in each side of the main vascular unit (Fig. 4a, c).

The leaf blade of both species is hypostomatic (Fig. 4i, l) with paracytic stomata (Fig. 4j, m) occurring on the same level of the ordinary epidermal cells (Fig. 4i, l). The cuticle is thin and cuticular flanges (Fig. 4k, n) can be seen throughout the leaf blade extension. The epidermis is unistratified and shows thin cell walls. In transversal section, the epidermal cells are larger on the adaxial face than on the abaxial one (Fig. 4i, l). Furthermore, the cells are larger on the semiblade and smaller on the primary vein on both sides (Fig. 4b, d). At the blade margin in *A. andersonii*, it is also possible to notice a subepidermal layer similar to the epidermis (Fig. o, p). The leaf blade possesses collenchyma adaxially and abaxially in the midrib (Fig. 4b, d) and has a dorsiventral mesophyll (Fig. 4i, l, o, p), with a unistratified palisade parenchyma extending all the way until the margins, in *A. tumida* (Fig. 4o); and ending before the margin in *A. andersonii* (Fig. 4p). Idioblasts containing druses occur in the palisade parenchyma (Fig. 4i, l). The margin is revolute in *A. andersonii*, showing a fiber block near the epidermis, separated by few layers of subepidermal parenchyma (compare Fig. 4o and Fig. 4p). The spongy parenchyma is composed of braciform cells and idioblasts containing druses (Fig. 4q, s). The midvein shows secondary growth and reproduces the collateral disposition observed in the petiole (Fig. 4b–d). Fibers contour the primary vein and present more layers abaxially (Fig. 4b, d). Glands are present on the abaxial face of leaf blades for both species. The epidermis of these glands is composed of palisade cells and the subglandular parenchyma is different of the adjacent tissues, showing smaller, denser and juxtaposed cells (Fig. 4r, t).

Leaf architecture:—In *A. tumida* the leaf blade shows a camptodromous-brochidodromous venation pattern, with a straight and non-ramified primary vein (Fig. 5a), as we can also see in *A. andersonii* (Fig. 5b). Secondary veins possess a moderate caliber and are also non-ramified (Fig. 5a, b). In the median region of the leaf blade, the angle of divergence of the secondary veins in relation to the primary vein is acute in *A. tumida* (Fig. 5a), and straight in *A. andersonii* (Fig. 5b). Distal secondary veins show more obtuse angle than the proximal ones in *A. tumida* (Fig. 5a), while *A. andersonii* has uniform divergence angles (Fig. 5b). The course of the secondary veins is uniformly curved, joining the superadjacent secondary vein in right angles in *A. tumida* (Fig. 5a), and abruptly curves joining the superadjacent secondary veins in acute angles in *A. andersonii* (Fig. 5b). The last marginal veins form arches on both species (Fig. 5c, d). Areoles are imperfect in shape, randomly arranged, and predominantly quadrangular in both species (Fig. 5c, g). Veinlets vary from simple and linear to branched (Fig. 5d, h).

Discussion

Taxonomy

Amorimia tumida resembles *A. andersonii* on the shape and position of bracts and bracteoles, disposition of sepals at anthesis, color of sepal glands in anthesis, indumenta of filaments, shape of styles, and shape of the dorsal wing of samaras. However, it differs of *A. andersonii* in the shape of the leaf blades and presence of glands at base, fewer secondary veins, veins joining the primary vein in an acute angle, fewer flowers in the inflorescences, pedicels becoming thickened in fruit, filaments completely sericeous, styles completely sericeous, samaras sericeous. An updated key for the *Amorimia rigida* species complex is presented below:

Updated key to the species of the *A. rigida* complex (modified from Almeida *et al.* 2016)

1. Leaves lanceolate elliptic to narrowly elliptic, sericeous, velutine to glabrous at age, with 8–16 pairs of secondary veins; bracts and bracteoles deflexed, bracteoles inserted below the apex of peduncle; sepals erect with revolute apex at anthesis, glands turning ocher, filaments pubescent, styles uncinate at apex; samaras with dorsal wing depressed ovate........................ 2

1. Leaves ovate to elliptic to widely elliptic to orbicular, sericeous-velutine to glabrous at age, with 8 or fewer pairs of secondary veins; bracts and bracteoles parallel, bracteoles inserted at apex of peduncle; sepals appressed to the androecium with straight apex at anthesis, glands turning brown or red, petals adaxially proximally glabrous, filaments glabrous, styles truncate at apex; samaras with dorsal wing obtrapezoidal or triangular... 3

2. Leaf blade without a pair of glands at base, inflorescences up to 8-flowered, pedicel thickened in fruit, filaments completely pubescent, style pubescent near apex, samaras sericeous to glabrous... ***A. tumida***

2. Leaf blade with a pair of glands at base, inflorescences 9-many-flowered, pedicel thin in fruit, filaments pubescent only at apex, style pubescent at base, samaras velutine.. ***A. andersonii***

3. Petals turning red at post-anthesis, posterior petal 2-glandular at base of limb; samaras with dorsal wing obtrapezoidal with rounded angles.. ***A. candidae***

3. Petals turning orange at post-anthesis, posterior petal eglandular; samaras with dorsal wing triangular or obtrapezoidal bearing a projection at apex... 4

4. Leaves with a pair of glands near margin or near base; claw of the posterior petal up to 1 mm long; stamens opposite the anterior sepal, posterior-lateral sepals and posterior petal longer than those opposite lateral petals... ***A. rigida***

4. Leaves with a pair of glands near or at base; claw of the posterior petal more than 1 mm long; stamens opposite petals longer than those opposite sepals... 5

5. Claw of the posterior petal more than 0.5 mm wide, lateral petals patent at anthesis, anthers pubescent at apex, connectives and base; samaras with dorsal wing triangular... ***A. pellegrinii***

5. Claw of the posterior petal up to 0.5 mm wide, lateral petals reflexed at anthesis, anthers pubescent only at base; samaras with dorsal wing obtrapezoidal... 6

6. Leaves conduplicate, not bullate; peduncles exceeding bracts at anthesis; glands turning brown at post-anthesis, anterior-lateral petals divergent; samaras with dorsal wing bearing an aciculate projection at apex... ***A. coriacea***

6. Leaves plane, bullate; peduncles not exceeding bracts at anthesis; glands turning red at post-anthesis, anterior-lateral petals overlapping; samaras with dorsal wing bearing two triangular projections at apex... ***A. velutina***

Leaf anatomy

The regular parietal thickening of epidermal cells was shared by the two analyzed species of *Amorimia*. The subepidermal layer similar to the epidermis is exclusive to the petiole of *A. tumida*, easily differentiating both species in transversal section. Paracytic stomata restricted to the abaxial face of leaves are widely described for Malpighiaceae in the literature (see Wilkinson 1979), but cuticular thickness is a variable character in the family. *Amorimia andersonii* and *A. tumida* presented a thin cuticle, contrasting with the pattern reported by Araújo *et al.* (2010), in which 14 out of the 16 species sampled, belonging to different genera of Malpighiaceae, possessed thickened cuticles. The occurrence of cuticle flange seems to be variable within the family. Our data showed cuticle flanges for both *Amorimia* species, corroborating Araújo et al. (2010), which recorded this character for 12 out of 16 species of different Malpighiaceae genera. Unistratified epidermis with cells bearing regular faces were observed in the petioles and leaf blades of both species of *Amorimia*. Larger epidermal cells on the adaxial face of leaf blades were also recorded for *Malpighia glabra* Linnaeus (1753: 435) (Soares *et al.* 1997), a genus closely related to *Amorimia* in the last molecular phylogeny for the family (Davis & Anderson 2010). Nonetheless, the same pattern is also reported for some species of *Byrsonima* Richard ex Kunth (1822: 147) (Ferreira *et al.* 2015), an early diverging lineage of Malpighiaceae and distantly related to *Amorimia* (Davis & Anderson 2010). Thus, its taxonomic relevance needs to be properly investigated.

Collenchyma surrounding the petioles might be synapomorphic to *Amorimia*, since some species of *Diplopterys* Jussieu (1837: 20), *Peixotoa* Jussieu (1833: 59), and *Stigmaphyllon* Jussieu (1833: 57) analyzed by Mello *et al.* (in prep.) did not record this feature. Collenchyma adjacent to the midvein was shared by both analyzed species, and it is also reported in the literature for species of *Byrsonima* (Silva 2013). All Malpighiaceae described until now possess dorsiventral mesophyll, but the extension of the palisade parenchyma is an important character to differentiate *A. tumida* from *A. andersonii*. The ground system is described as continuum for several genera of Malpighiaceae by Mamede (1993), Bieras & Sajo (2009), Ferreira *et al.* (2015), and Guimarães *et al.* (2016). However, these authors did not provide any information on the extension of the palisade parenchyma. The only additional study to provide this information is that from Ferreira (1981), which described the palisade parenchyma extending near to the margin of the leaf blade in *Peixotoa hispidula* Jussieu (1840: 279). This character has great taxonomic potential in Malpighiaceae, since it is variable within the family and can be easily observed in transversal sections. The occurrence of druses is quite common within Malpighiaceae, occurring in the mesophyll of different species of *Banisteriopsis* Robinson (1910: 131), *Byrsonima* and *Diplopterys* (Araújo *et al.* 2010; Silva 2013; Ferreira *et al.* 2015).

The presence of a fiber block near the epidermis is reported here for the first time in the family. Revolute margins also revealed to be an important character in distinguishing *A. tumida* and *A. andersonii*, but relatively common in the other genera in the family (Ferreira 199; Mamede 1993; Bieras & Sajo 2009). In the petiole, the main vascular unity organization as described for both species of *Amorimia*, along with the presence of accessory vascular bundles, seems to be a general pattern in Malpighiaceae (Araújo *et al.* 2010; Guimarães *et al.* 2016). The results obtained for leaf glands corroborate those from Castro *et al.* (2001), Possobom *et al.* (2010), and Araújo & Meira (2016).

Leaf architecture

The leaf blades in both species of *Amorimia* show a camptodromous-brochidodromous venation pattern, being characteristic of most Malpighiaceae (Judd *et al.* 2007; Araujo *et al.* 2010). However, some traits are helpful in recognizing the new species described here. The angle of divergence of secondary veins from the midvein is acute to obtuse towards apex in *A. tumida*, easily distinguishing it from the right angles that characterize *A. andersonii*. This is the more effective way to distinguish the two species of *Amorimia* in the field and in herbarium specimens, since diaphanization is not mandatory to observe this character.

Marginal veins forming arches were described for all Malpighiaceae species studied by Araújo *et al.* (2010), as was observed by us in both studied species. On the other hand, areoles are sometimes absent in the species of this family analyzed by Mamede (1993) and Araújo *et al.* (2010), while *A. tumida* and *A. andersonii* presented imperfect areoles.

Conclusions

One of the main paradigms faced by several plant taxonomists throughout history is to describe new taxa from a single specimen and/or locality. We showed that whenever alpha taxonomy is associated to additional biosystematic methods, such as leaf anatomy, those paradigms might be successfully surpassed. Leaf anatomy continues to be an important tool in determining taxonomic boundaries in flowering plants. Additionally, we highlight that some previously unreported anatomical characters might play an important role in the taxonomy of *Amorimia*, and of Malpighiaceae as a whole. Characters such as the presence of subepidermal collenchyma tissue in the petioles and fiber blocks near margins were reported for the first time in the family.

Nonetheless, only a thorough anatomical study of leaf blades of *Amorimia* and its relatives will properly shed some light into these characters and their systematic importance in Malpighiaceae.

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FIGURE 1. *Amorimia andersonii* R.F.Almeida: a. Sterile leaf, b. abaxial view of a leaf base showing a pair of glands, c. flowering branch, d. inflorescence showing floral buds and flowers, e. detail of sepal glands, f. flower in frontal view, g. detail of a style (photographs c. by A.M.A. Amorim, a–b, d–g by F. Michelangeli).

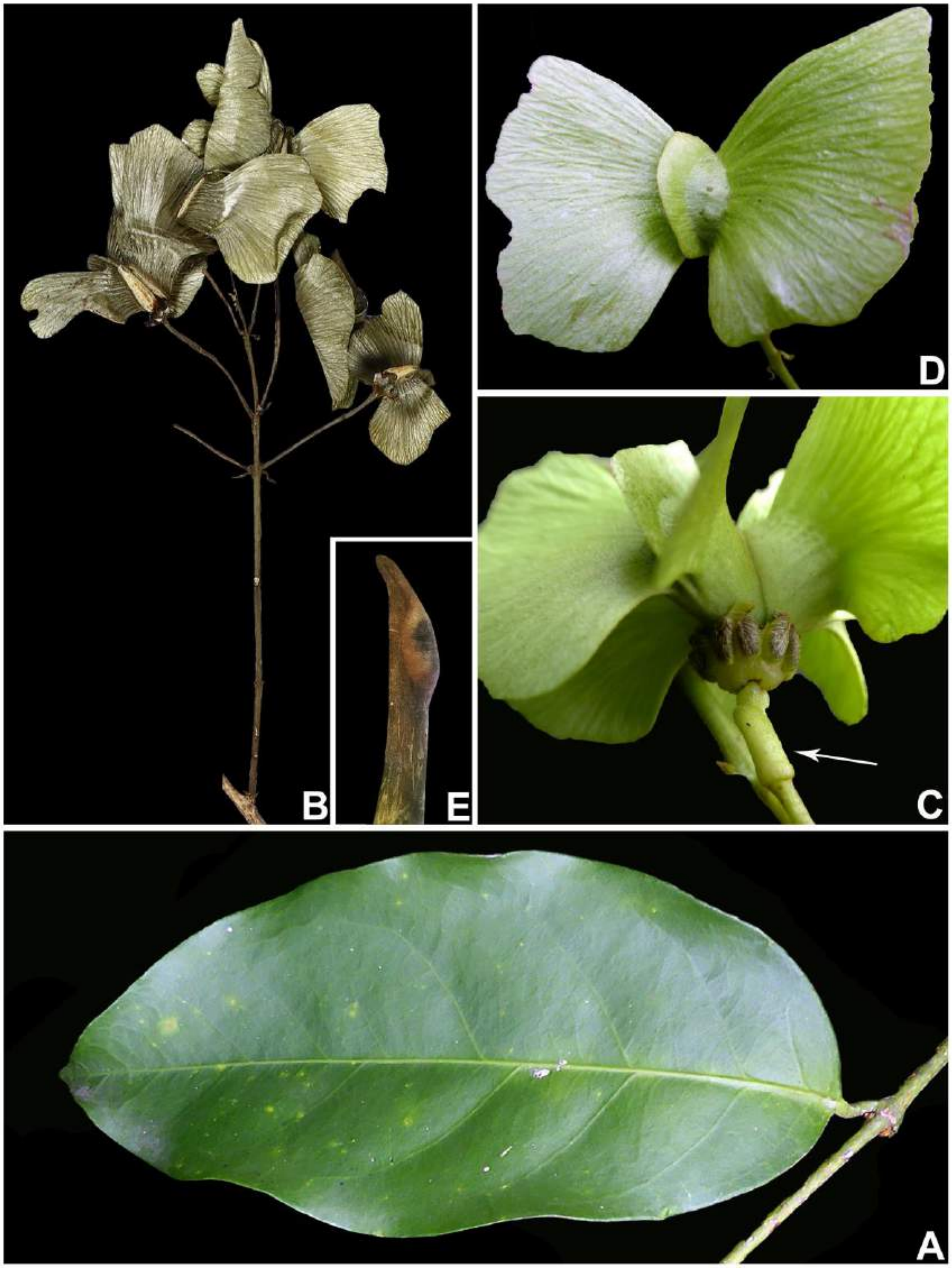

FIGURE 2. *Amorimia tumida* R.F.Almeida & A.C.Marques: a. Adaxial side of a leaf, b. fruiting branch, c. detail of fruits showing the tumid pedicel (arrow), d. samara in frontal view, e. detail of a style (photographs by M.A. Nadruz Coelho).

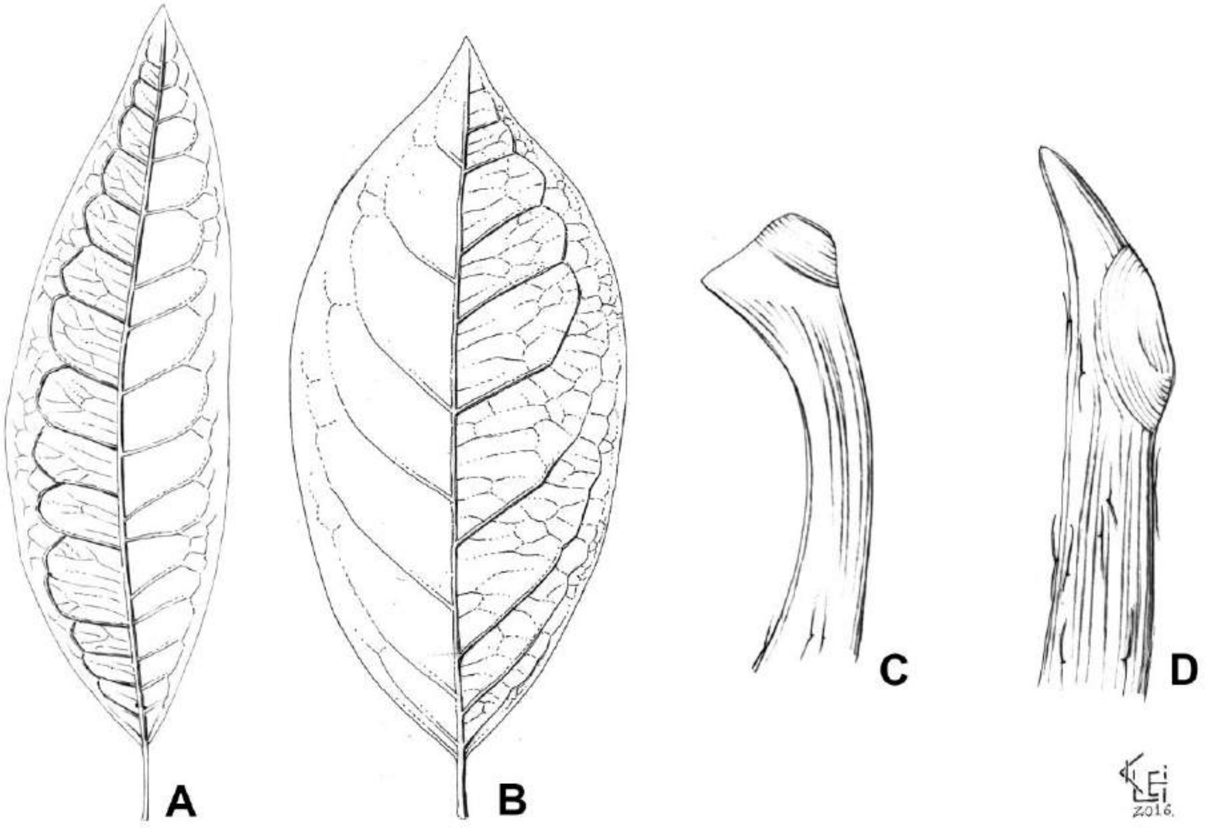

FIGURE 3. Line drawings of the studied *Amorimia* species: *Amorimia andersonii*. a. Leaf in abaxial side, c. detail of a style (based on *L.C. Marinho 654*). *Amorimia tumida*. b. leaf in abaxial side, d. detail of a style (based on *M.N. Coelho 2794*).

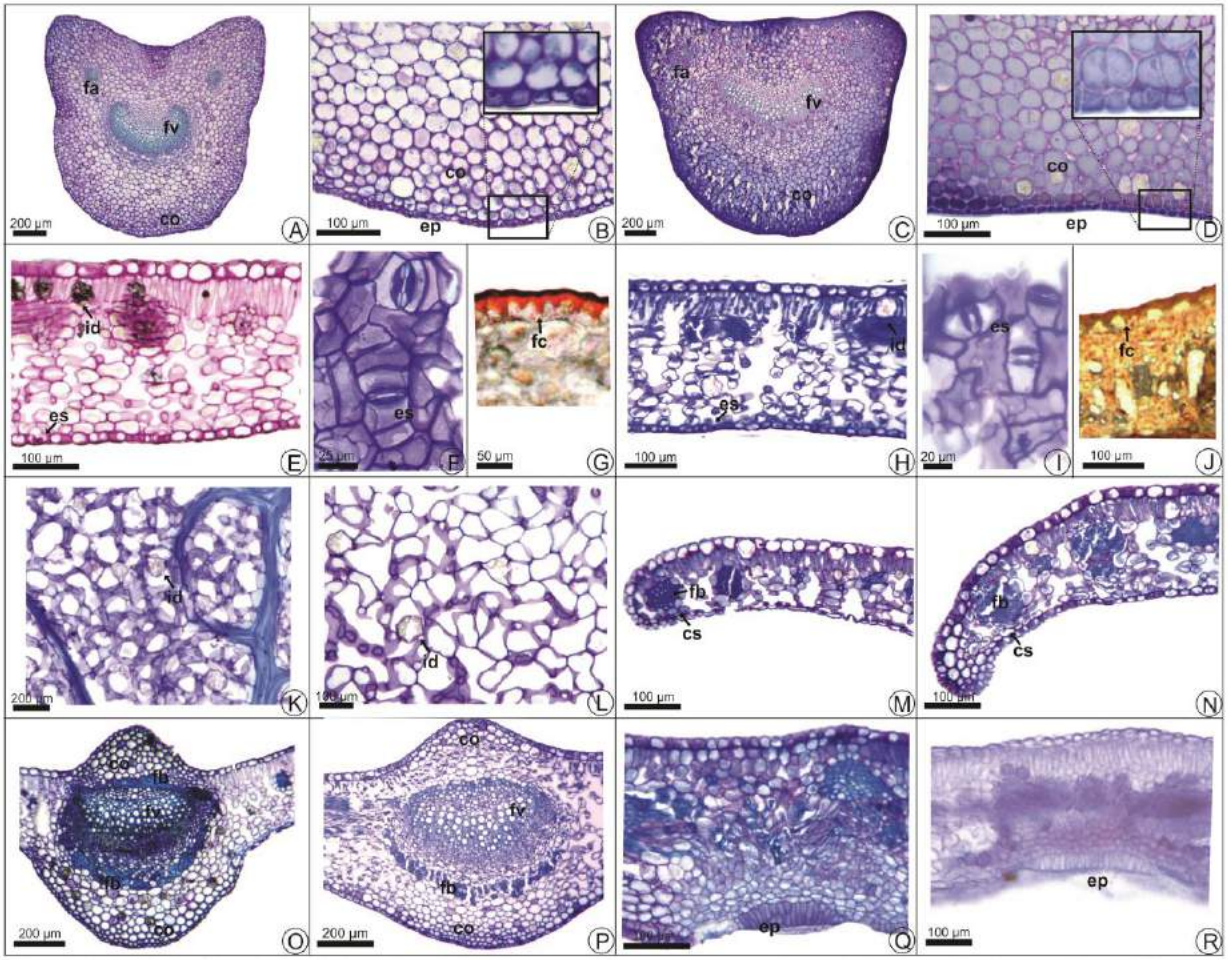

FIGURE 4. Leaf anatomy of *Amorimia tumida* (two columns left) and *Amorimia andersonii* (two columns right) in transversal (a–i, k, l, n–p, r, t) and longitudinal (j, m, q, s) sections. a, c, e–h Petiole in general view (a, c), detail of the epidermis and ground system (e, g), and of the vascular system (f, h), b, d, i–t leaf blade in general view of the midvein (b, d), detail of the semiblade (i, l) highlighting stomata (j, m) and cuticle flange (k, n), detail of the margin (o, p), detail of the spongy parenchyma (q, s), and glands (r, t). *ab*= accessory bundle, *cf*= cuticle flange, *co*= collenchyma, *dr*= idioblast containing druse, *fi*= fibers, *mv*= main *v*ascular unity, *sl*= subepidermal layer, *st*= stomata.

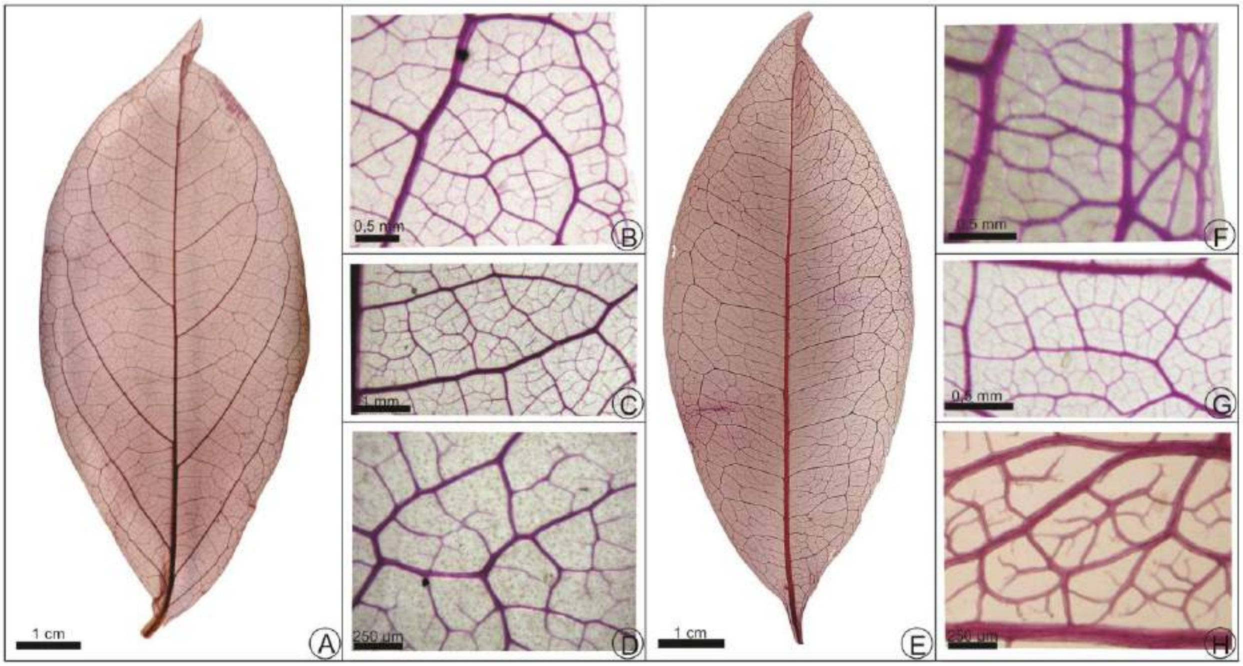

FIGURE 5. Diaphanized leaves of *Amorimia tumida* (left column) and *Amorimia andersonii* (right column): a–b General pattern of venation, c–d detail of the marginal ultimate venation, e–f detail of the areoles, g–h detail of the veinlets.

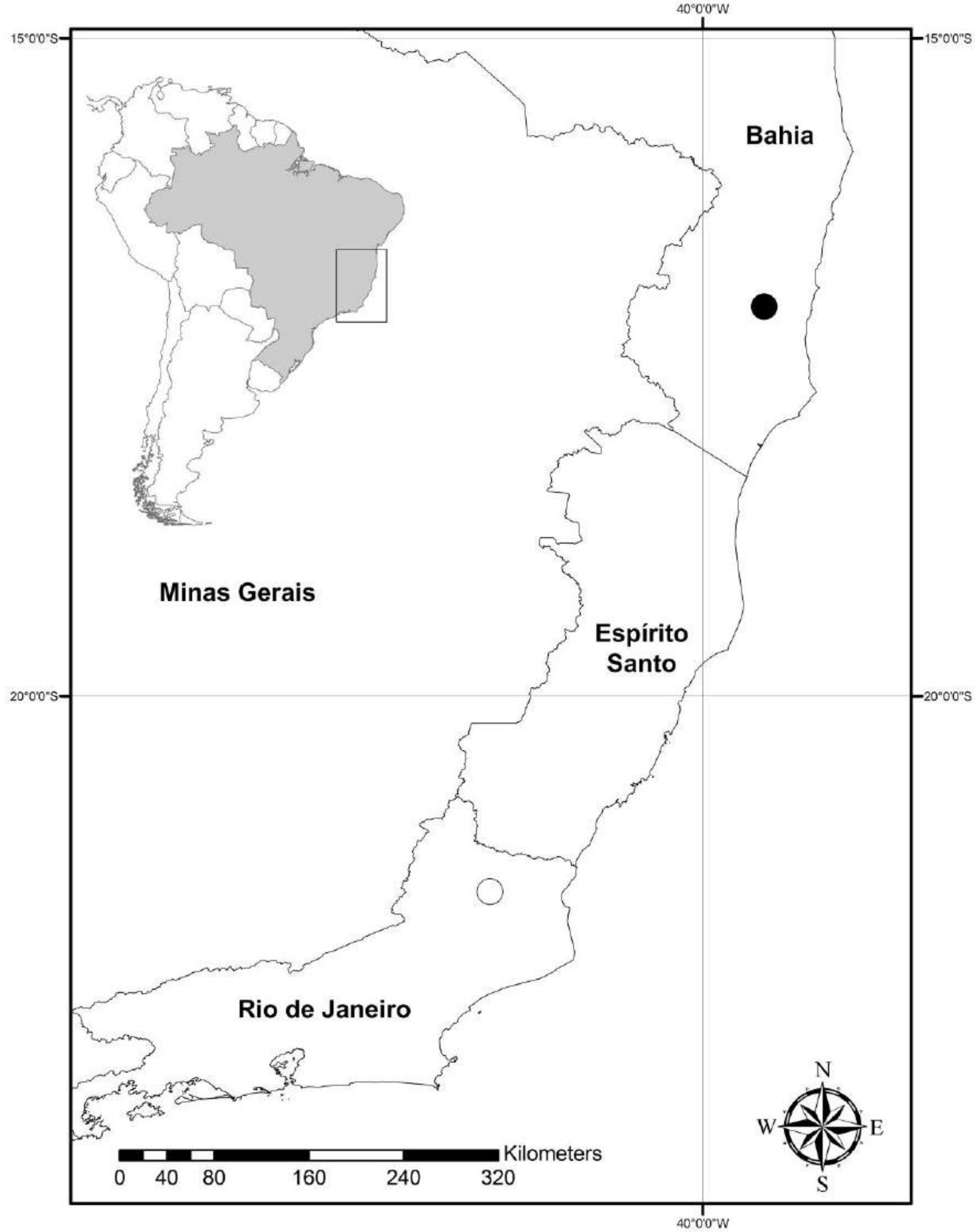

FIGURE 6. Distribution map of *Amorimia tumida* (white circle), and *Amorimia andersonii* (black circle) in Eastern Brazil.

Capítulo III

A new infrageneric classification for *Amorimia* (Malpighiaceae) based on macro/micromorphology, phytochemical and molecular evidence

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Abstract

Phylogenetic relationships for 14/15 species of *Amorimia* (Malpighiaceae) were inferred based on *ndhF* cpDNA and ETS rDNA using both parsimony and Bayesian methods. Our results show that: (1) the monophyly of the genus is still corroborated with the new circumscription of the *A. rigida* complex; (2) several macro/micromorphological, and phytochemical characters support *Amorimia* and/or its two main lineages; and (3) these lineages can be proposed as new subgenera in *Amorimia*.

Keywords: Character evolution, Malpighiales, Neotropical Flora, Palynology, Phylogeny.

Resumo

Relações filogenéticas para 14/15 espécies de *Amorimia* (Malpighiaceae) foram inferidas com base nos marcadores *ndhF* do DNA plastidial e ETS do DNA ribossômico usando métodos de inferência bayesiana e parcimônia. Nossos resultados evidenciaram que: (1) o monofiletismo do gênero continua sendo corroborado com a nova circunscrição do complexo *A. rigida*; (2) vários caracteres macro e micromorfológicos, e fitoquímicos suportam *Amorimia* e/ou suas duas principais linhagens; e (3) estas duas linhagens podem ser propostas como subgêneros de *Amorimia*.

Palavras-chave: Evolução de caracteres, Filogenia, Flora Neotropical, Malpighiales, Palinologia.

Introduction

Malpighiaceae Jussieu (1789: 252) is one of the major families of Neotropical shrubs and lianas (Xi *et al.* 2012), with ca. 85% of its species being confined to this region (Davis & Anderson 2010). This family has received broad phylogenetic attention in the past few years (Cameron *et al.* 2001; Davis 2002; Davis *et al.* 2001, 2002, 2004; Davis & Anderson 2010), including more focused investigations on generic delimitation, and the phylogenetic position of Old World lineages (Davis *et al.* 2002; Davis & Anderson 2010). Efforts to determine finer scale patterns of molecular phylogenies and character evolution in Neotropical Malpighiaceae are quite sparse in the literature (Davis 2002; Davis *et al.* 2002).

Amorimia Anderson (2006: 176) is one of the several new lineages identified on those previous molecular phylogenies (Davis *et al.* 2002; Davis & Anderson 2010). It represents one of the eight genera segregated from the polyphyletic *Mascagnia s.l.* (Bertero *ex* De Candolle 1824: 585) Bertero (in Colla 1824: 85), but still remains closely related to this genus. *Amorimia* was described by Anderson (2006) to accommodate ten species of lianas and shrubs mostly confined to Seasonally Dry Tropical Forests of South America. It is distinguished from other Malpighiaceae by the presence of glands on the abaxial side of inflorescence bracts, petals pubescent on both sides, and straight styles. The monophyly of *Amorimia* was corroborated with the inclusion of its type species, *Amorimia rigida* (Jussieu 1833: 14) Anderson (2006: 183), along with five additional species into a molecular framework (Davis & Anderson 2010). As a result, two main lineages were recovered, a Northern and an Eastern South American clade (Davis & Anderson 2010). Recent taxonomic studies in the genus have uncovered four new taxa segregated from *A. rigida* (Almeida *et al.* 2016b).

In this study, we estimate the molecular phylogeny of *Amorimia*, and use this phylogenetic framework as the basis to further understanding the patterns of morphological evolution in the genus. More specifically, we: (1) revisit the molecular phylogeny of *Amorimia* based on plastid and nuclear genes; (2) map selected macro, micromorphological, and phytochemical characters in order to test for secondary homologies; and (3) propose a new infrageneric classification reflecting its evolutionary history.

Material and methods

Taxon sampling and plant material

We sampled a total of 24 taxa, including outgroups *Diplopterys* Jussieu (1837: 20), *Ectopopterys* Anderson (1980: 11), *Mascagnia*, *Peixotoa* Jussieu (1832: 59), and *Stigmaphyllon* Jussieu (1832: 57). All species of *Amorimia*, except *Amorimia concinna* (Morton 1936: 130) Anderson (2006: 180), were included, and 1−2 samples for each species in the *A. rigida* complex (Fig. 1). For DNA extraction, we used mainly silica-gel dried leaves (12–80 mg), and herborized leaves for *A. amazonica* (Niedenzu 1926: 59) Anderson (2006: 179), *A. camporum* Anderson (2006: 179), *A. kariniana* Anderson (2006: 180), *A. pubiflora* Anderson (2006: 183), and *E. soejartoii* Anderson (1980: 11) when necessary. All specimens used in this study are listed in Table 1.

Molecular protocols

Genomic DNA was extracted using the CTAB 2× protocol, modified from Doyle & Doyle (1987). Fragments were amplified by PCR (Polymerase Chain Reaction). We tested three regions suggested by the literature as potentially useful in phylogenetic reconstructions at the species level (Table 2). A single plastid (*ndhF* gene) and two nuclear regions (External Transcribed Spacer and *phyC*) were partially selected based on their previous variability and number of parsimony-informative characters in Malpighiaceae (Table 2).

Protocols to amplify and sequence the plastid gene for NADH dehydrogenase F followed Davis *et al.* (2001) and for the ETS region we followed Baldwin & Markos (1998). The amplification mix that achieved success consisted of a TopTaq (Quiagen) mix following the standard protocol in the kit manual, with the addition of 1.0 M betaine and 2% DMSO for the ETS region. PCR products were purified using PEG (polyethylene glycol) 11%, and were sequenced directly with the same primers used for PCR amplification. Sequence eletropherograms were produced in an automatic sequencer (ABI 3130XL Genetic Analyzer) using the kit Big Dye Terminator 3.1 (Applied Biosystem). Additional sequences for *ndhF* region were retrieved from genbank. Newly generated sequences were edited using the Geneious software (Kearse *et al.* 2012), and aligned using Muscle (Edgar 2004), with subsequent adjustments in the preliminary matrices made manually by eye. The complete data matrices are available upon request from the first author.

Phylogenetic analysis

Combined analysis of plastid, nuclear and plastid + nuclear regions were performed. Before them, we performed the Incongruency Length-Difference (ILD) test (Farris *et al.* 1994) to investigate incongruence between DNA data sets. Analyses using Maximum Parsimony (MP) in both matrices were carried out with PAUP 4.0b10a (Swofford 2002). An heuristic search was performed using the algorithm TBR (tree-bisection reconnection) and 1,000 random taxon-addition sequence replicates with TBR swapping limited to 15 trees per replicate in order to prevent extensive searches (swapping) in suboptimal islands, followed by TBR in the resulting trees with a limit of complete swapping in 1,000 trees. In all analyses, the characters were equally weighted and the states of characters were specified as unordered (Fitch 1971). Relative support for individual branches was assessed using non-parametric bootstrapping (Felsenstein 1985), with 1,000 bootstrap (BS) pseudoreplicates, TBR swapping, simple taxon addition and a limit of 15 trees per replicate.

For the model-based approach, we selected the model using hierarchical likelihood ratio tests (HLRT) on J Modeltest 2 (Darriba *et al.* 2012, results presented in Table 2). A Bayesian analysis (BA) was conducted with a mixed models and unlinked parameters, using MrBayes 3.1.2 (Ronquist & Huelsenbeck 2003). The Markov Chain Monte Carlo (MCMC) was performed using two simultaneous independent runs with four chains each (one cold and three heated), saving one tree every 1,000 generations, for a total of ten million of generations. We excluded as ‘burn in’ trees from the first two million generations, and tree distributions were checked for a stationary phase of likelihood. The posterior probabilities (PP) of clades were based on the majority-rule consensus, using the remaining trees, calculated with MrBayes 3.1.2 (Ronquist & Huelsenbeck 2003).

Character Selection, Coding and morphological analysis

Macromorphological characters were scored from herbarium samples (ALCB, ASE, BAH, BHCB, CEN, CEPEC, CESJ, CGMS, COL, CPAP, CRVD, CTES, EAC, ESA, F,

FLOR, FUEL, FURB, FZB, G, GUA, HAS, HB, HCF, HEPH, HRB, HRCB, HSJRP, HST, HUCP, HUEFS, HUEM, HUFG, HUFU, HUPG, HURB, IAC, IAN, ICN, INPA, IPA, JPB, K, MAC, MBM, MBML, MICH, MO, NY, OUPR, P, PACA, PAMG, PEUFR, PMSP, R, RB, RBR, RFA, S, SI, SP, SPF, SPSF, UB, UEC, UFP, UFMS, UFMT, UFRN, UPCB, US, VIC, and VIES; herbaria acronyms according to Thiers, continuously updated) from the taxonomic revision of *Amorimia* (Almeida *et al.* in prep.) and from the literature (Lee *et al.* 2012).

Pollen morphology of 11 species of *Amorimia* was studied in flower buds obtained from the same vouchers used in the molecular study of *Amorimia* (Table 1). Pollen grains were acetolysed following Erdtman (1960), mounted in slides with jelly, and sealed with wax. Dimensions of morphological structures were obtained from 25 pollen grains per species of *Amorimia*. Data on pollen grains from outgroups used in this study were obtained from Lowrie (1982). Terminology follows Lowrie (1982) and Punt *et al.* (2007). Photomicrographs (LM) were obtained using an Olympus BX 50 light microscope with a video camera and the CellSens software for Windows and edited on Adobe Photoshop®. A comprehensive palynological study, including measurements and statistical analysis will be presented in a different study (Almeida *et al.* in prep.).

Character coding followed the recommendations of Sereno (2007) for morphological phylogenies. Primary homology hypotheses (De Pinna 1991) were proposed for stem, leaf, inflorescence architecture, floral, fruit, and phytochemical characters. A total of 31 characters were scored, with 29 macromorphological, 1 micromorphological, and 1 phytochemical (Table 4). All characters were optimized on a majority-rule (50% values) consensus tree resulted from the Bayesian inference of the combined datasets using the parsimony ACCTRAN function on Mesquite 2.73 (Maddison & Maddison 2006).

Results

Phylogenetic analysis

The ETS characters represented 495 characters of the dataset, of which 113 characters were variable, and 151 characters were parsimony-informative (see Table 3 for a summary of regions and matrices). We did not record any evidence of paralogue copies for ETS during electrophoresis. The *ndhF* characters represented 706 characters of the dataset, of which 62 were variable, and 43 were parsimony-informative (Table 3).

The combined plastid + nuclear matrix includes 1,201 analyzed characters, of which 175 were variable, all being 194 parsimony-informative.

Based on the nuclear dataset, the heuristic search found 5 trees (CI = 0.7725, RI = 0.7674) whose strict consensus (SC) presented 21 moderately supported clades (BSP75% and >PP95%; Fig. 2). Based on the plastid dataset, the analysis found 2 trees (CI = 0.9333, RI = 0.9192) whose SC presented 14 well-supported clades (BSP75% and >PP95%; Fig. 2). Topologies produced by MP and BI analyses, based on the combined datasets, were congruent according to the ILD test (p = 0.01), and provided higher support for more clades than the results based on independent plastid or nuclear datasets (Fig. 2). Thus, based on the combined plastid + nuclear dataset, the maximum parsimony analysis found 7 trees (CI = 0.7635, RI = 0.7686) whose MRC presented 22 moderately supported clades (BSP75%). The Bayesian analysis recovered a fully resolved tree with 24 well-supported clades (>PP95%) (Fig. 3).

The monophyly of *Amorimia* (clade A, fig. 3) was strongly supported by MP and BI analyses, and recovered as sister-group of *Mascagnia* (here representing the remaining members of the *Malpighia* clade, *sensu* Davis & Anderson 2010). The clade *Amorimia* + *Mascagnia* was well supported and sister to *Ectopoterys* (Fig. 3). Within *Amorimia*, two main lineages were recovered and strongly supported by MP and BI, represented by clades B and C (Fig. 3). Clade B comprises six species associated to the *A. amazonica* complex, mainly restricted to Seasonally Dry Tropical Forests nuclei in South America (Fig. 4). Clade C comprises eight species associated to the *A. rigida* complex, and restricted to Seasonally Dry to Evergreen Forests of Eastern Brazil (Fig. 5).

Morphological analysis

Out of the 31 morphological characters mapped into the SC tree, 15 were recovered as putative morphological synapomorphies for different lineages (Fig. 6–11). A total of four synapomorphies were recovered for *Amorimia* (clade A): glandular bracts, petals pubescent on both sides, samaras with two lateral wings larger than the dorsal wing, presence of monofluoracetate. For clade B, we recovered seven synapomorphies: sepals acute at apex and glabrous abaxially, elaiophores green turning yellow at post-anthesis, petals yellow never turning orange or red at post-anthesis, and cuneate at base, styles uncinate at apex, and spherical pollen grains. Finally, for clade C we recovered seven synapomorphies: sepals rounded at apex and pubescent abaxially, elaiophores yellow turning red to ocher at post-anthesis, petals yellow turning orange to red at post-anthesis and truncate at base, styles truncate at apex, and polygonal pollen grains. For *Mascagnia*, we recovered four synapomorphies: elaiophores pink turning ocher at post-anthesis, keeled petals, samaras with lateral wings larger than dorsal wing, and fused into an orbicular wing. For *Ectopopterys*, we recovered five synapomorphies: eglandular, deflexed sepals, anther with enlarged connectives, foliate apex of styles, and samaras with the dorsal wing larger than the lateral wings thickened on the lower side. No morphological synapomorphy was found for the Malpighioid clade with our current dataset.

Discussion

Phylogenetics of ***Amorimia***

The topology recovered with the combined dataset corroborates the circumscription of *Amorimia* proposed by Anderson (2006), being also congruent with the phylogeny presented by Davis & Anderson (2010). These authors recovered a well-supported *Amorimia* with two main lineages, based on a single nuclear (*phyC*) and on three plastidial (*matK*, *ndhF* and *rbcL*) markers. Both lineages are allopatric, one of them mainly restricted to Northern South America, and the other mainly occurring on Eastern Brazil (Anderson 2006). Additionally, it corroborates the circumscription of the *A. rigida* complex recently proposed by Almeida *et al.* (2016b). This species complex comprises seven species [*A. andersonii* Almeida *et al.* (2016b: 4), *A. candidae* Almeida *et al.* (2016b: 8), *A. coriacea* (Grisebach 1858: 92) Almeida *et al.* (2016b: 13), *A. pellegrinii* Almeida *et al.* (2016b: 14), *A. rigida*, *A. tumida* Almeida *et al.* (in prep.), and *A. velutina* Anderson (2006: 185)] confined to Eastern Brazil. From those, *A. coriacea* and *A. velutina* were recovered as early diverging lineages in the Eastern Brazil clade (clade C), and distantly related to the remaining species of the *A. rigida* complex. On the other hand, *A. tumida* was recovered as sister to *A. pubiflora*, both nested within the Northern South American clade (clade B). Only *A. andersonii*, *A. candidae*, *A. pellegrinii*, and *A. rigida* were recovered as closely related in our results.

Systematics of ***Amorimia*** *and its relatives*

From the four synapomorphies recovered for *Amorimia*, three were previously proposed as putative synapomorphies by Anderson (2006) (i.e. glandular bracts, petals pubescent on both sides, and samaras with two lateral wings larger than the dorsal wing). Even though wing dominance on mericarps evolved several times in Malpighiaceae (i.e. Christianelloid clade, Hiraeoid clade, and Tetrapteroid clade), it appears to be a stable and important character to circumscribe *Amorimia* within the Malpighioid clade. Except for *Ectopopterys*, all the remaining genera in this clade possess mericarps with lateral wings fused into an orbicular wing or reduced to fleshy crests [e.g. *Malpighia* Linnaeus (1753: 425)]. The last synapomorphy recovered for the genus (i.e. presence of monofluoracetate) was previously suggested by Lee *et al.* (2012). These authors tested leaves of all accepted names in *Amorimia*, at the time, for the presence of monofluoracetate. This compound is economically important, since it is the main cause of sudden death of cattle in South America (Lee *et al.* 2012). All studied species tested positive for the presence of this compound. Since all the additional new species recently published in the genus are also described as toxic to cattle in their labels, we believe it is safe to assume that they also produce monofluoracetate.

Out of the seven synapomorphies recovered by us for clades B and C, just the indumentum on both sides of petals was used by Anderson (2006) to differentiate the species belonging to these two lineages. Characters such as phytochemical compounds and pollen morphology are tested here as secondary homologies in Malpighiaceae for the first time. Even though the occurrence of monofluoracetate was already known in the literature for ten species of *Amorimia* (Lee *et al.* 2012), all new species or combinations proposed in this genus were recorded as toxic to cattle on herbarium specimens (Almeida pers. obs.). Pollen morphology in *Amorimia* was compatible with the Mascagnioid type proposed by Lowrie (1982), which was defined by this author by the occurrence of many branched and fusing rugae, pores more than six in number and randomly dispersed, but overlaid by the intersection of two rugae. Most lineages from the Neotropical grade of the Malpighioid clade (i.e. *Amorimia*, *Malpighia*, and *Mascagnia*) show Mascagnioid pollen types, except *Calcicola*, which still lacks palynological studies, and *Ectopopterys*, which shows a Clonodioid pollen type (Lowrie 1982). Additionally, all the remaining synapomorphies for *Amorimia* (i.e. glandular bracts, samaras with two lateral wings larger than the dorsal wing, and presence of monofluoracetate) are indicated here for the first time. Altogether, these characters provide strong morphological evidence that can be used for the proposition of a new infrageneric classification for the genus, based on the recovered phylogenetic relationships.

None of the four synapomorphies recovered for *Mascagnia* are exclusive of this genus within Malpighiaceae. Pink elaiophores are common in some Byrsonimoid lineages [i.e. *Blepharandra* Grisebach (1849: 7), *Lophanthera* Jussieu (1840: 328), *Pterandra* Jussieu (1833: 72), and *Spachea* Jussieu (1838: 19)) and Stigmaphylloid (i.e. *Banisteriopsis* Robinson (1910: 131), and *Janusia* Jussieu (1840: 250)] (Anderson 1981). Keeled petals also occur in some Tetrapteroid lineages [i.e. *Heteropterys* Kunth (1822: 163) and *Tetrapterys s.s.*] (Almeida *et al.* 2016a). In addition, mericarps with lateral wings larger than the dorsal wing and fused into an orbicular wing also occur in some Malpighioid lineages [i.e. *Aspidopterys* Jussieu (1840: 1060), *Diaspis* Niedenzu (1891: 314), *Calcicola* Anderson & Davis (2007: 148), *Caucanthus* Forsskal (1775: 91), *Triaspis* Burchell (1824: 280), *Digoniopterys* Arenes (1946: 133), *Madagasikaria* Davis (2002: 702), *Microsteira* Baker (1883: 111), and *Rhynchophora* Arenes (1946: 127)]. Since our taxon sampling for *Mascagnia* represents only ca. 10% of its species, a comprehensive phylogenetic study is imperative in order to test our proposed circumscription.

All five synapomorphies recovered by us for *Ectopopterys*, have also been previously postulated for the genus by Anderson (1980). Eglandular sepals are found in few Neotropical lineages of Malpighiaceae [i.e. *Galphimia* Cavanilles (1799: 489), *Ptilochaeta* Turczaninow (1843:52), *Thryallis* Martius (1829: 77)], but a constant morphological feature in Old World lineages, due to a shift their pollination syndromes (Anderson 1990; Davis *et al.* 2014). Styles with foliate apex are quite rare, being only found in *Stigmaphyllon* (Anderson 1980; Anderson 1997). In addition, mericarps with the dorsal wing larger than the lateral wings and thickened on the lower side is also rare in Malpighiaceae, being additionally only known for *Heteropterys* (Anderson 1980; Amorim 2002). In some phylogenetic studies (e.g. Willis *et al.* 2014), *Ectopopterys* was not recovered as sister to the remaining lineages of the Malpighioid clade, but as sister to the Tetrapteroid clade. This might be an artifact from the analysis, since the authors added mainly *matK* and *ndhF* sequences of Mexican Malpighiaceae to the dataset from Davis & Anderson (2010). When taking into account only phylogenetic studies with up to 10% of missing data in their datasets, *Ectopopterys* remains well supported as sister of the remaining lineages of the Malpighioid clade (Davis & Anderson 2010; Davis *et al.* 2014), as in our results.

Finally, the absence of synapomorphies for the Malpighioid clade (including *Amorimia* + *Ectopopterys*) in our analysis does not corroborate the current narrow circumscription of this clade. The remarkable pattern of inflorescence and fruit reduction in this clade highly supports the recognition of a Malpighioid clade *s.l.*, including *Amorimia* + *Ectopopterys*. The inflorescence in *Ectopopterys* is composed of thyrses, with short internodes between each cincinnus. arranged in a synflorescence (Anderson 1980). In *Amorimia*, the length of each internode in the thyrsus is longer and constant, while in the remaining genera of the Malpighioid clade it is abruptly shorter towards the apex, causing the inflorescence to acquire a corymb- or umbel-like appearance (Almeida pers. obs.).

Taxonomy

1. *Amorimia* subg. ***Amorimia*** (Fig. 5, 11).

Type:—*Amorimia rigida* (Jussieu 1832: 14) Anderson (2006: 183).

Differs from *Amorimia* subgenus *Uncina* by its sepals adaxially hairy; sepal glands yellow turning orange or red or ocher; petals elliptic, base truncate to hastate, adaxially entirely to distally hairy, claws canaliculate; anthers always hairy (at base, connective and/or apex); styles with apex truncate, acuminate or rounded; and pollen grains polygonal.

Notes:—This subgenus includes nine species (*A. andersonii*, *A. candidae, A. coriacea*, *A. exotropica* (Grisebach 1858: 93) Anderson (2006: 180), *A. maritima* (Jussieu 1840: 259) Anderson (2006: 181), *A. pellegrinii, A. rigida*, and *A. velutina*) mostly restricted to Seasonally Dry to Evergreen Forests from Eastern South America (Figure 5).

2. *Amorimia* subg. ***Uncina*** R.F.Almeida**,** *subg. nov.* (Fig. 4, 11).

Type:—*Amorimia pubiflora* (Jussieu 1833: 14) Anderson (2006: 183).

Differs from *Amorimia* subgenus *Amorimia* by its sepals adaxially glabrous; sepal glands green turning yellow to dark green; petals obovate to spatulate, base cuneate, adaxially glabrous (occasionally distally hairy in *A. septentrionalis*), plane claws; anthers usually glabrous (occasionally hairy in *A. pubiflora* and *A. septentrionalis*); styles with apex uncinated to occasionally apiculate; and spherical pollen grains.

Notes:—This subgenus includes seven species (*A. amazonica, A. camporum, A. concinna, A. kariniana, A. pubiflora, A. septentrionalis* Anderson (2006: 185), and *A. tumida*) mostly restricted to Seasonally Dry Tropical Forests from Northwestern and Eastern South America (Figure 4).

Key to the subgenera of *Amorimia*

1. Sepals adaxially glabrous; sepal glands green turning yellow to dark green; petals obovate to spatulate, cuneate at base, adaxially glabrous (occasionally distally hairy in *A. septentrionalis*), claws plane; anthers usually glabrous (occasionally hairy in *A. pubiflora* and *A. septentrionalis*); styles with apex uncinated to occasionally apiculate; spherical pollen grains... subg. *Uncina*

1. Sepals adaxially hairy; sepal glands yellow turning orange or red or ocher; elliptic petals, base truncate to hastate, adaxially entirely to distally hairy, canaliculate claws; anthers always hairy (at base, connective and/or apex); styles with apex truncate, acuminate or rounded; polygonal pollen grains..………………………... subg. *Amorimia*

Conclusions

Our results demonstrate the importance to integrate several sources of evidence into a molecular framework in order to elaborate stable systematic classifications in Malpighiaceae. Further studies should be focus in efforts to expand our molecular and morphological dataset including the remaining genera of the Malpighioid clade. We believe that only integrative systematic studies might pave the way to a future proposition of a new classification for Malpighiaceae reflecting its natural history.

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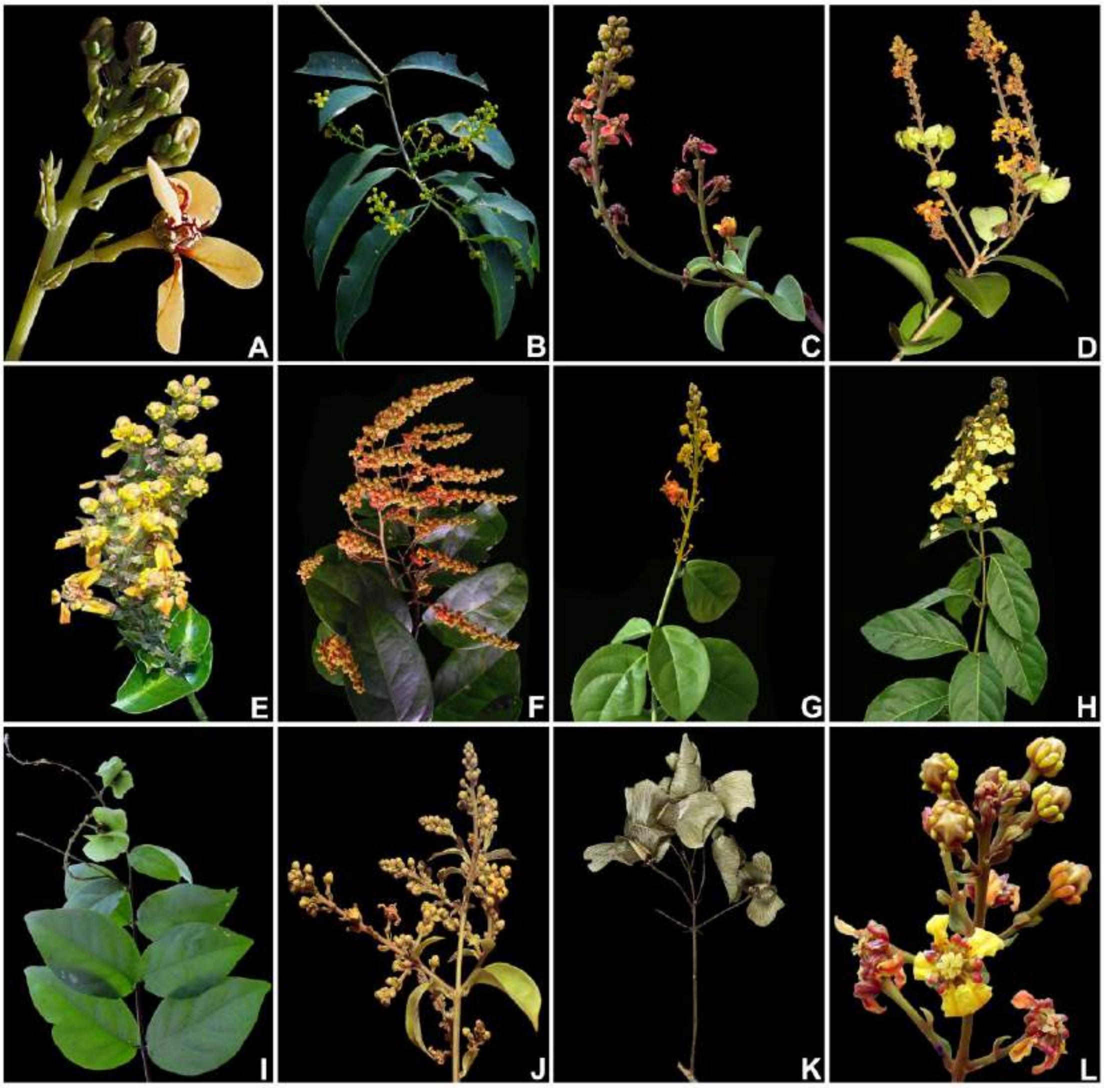


FIGURE 1. Some species of *Amorimia* sampled in this study: A. *A. amazonica* (photograph by D. Daly); B. *A. andersonii* (photograph by A.M.A. Amorim); C. *A. candidae* (photograph by R.F. Almeida); D. *A. coriacea* (photograph by M.O.O. Pellegrini); E. *A. exotropica* (photograph by A. Gava); F. *A. maritima* (photograph by F. Flores); G. *A. pellegrinii* (photograph by R.F. Almeida); H. *A. pubiflora* (photograph by E. Moleta); I. *A. rigida* (photograph by R.F. Almeida); J. *A. septentrionalis*

(photograpjn nh by M.O.O. Pellegrini); K. *A. tumida* (photograph by M.N. Coelho); L. *A. velutina* (photograph by L.C. Marinho).

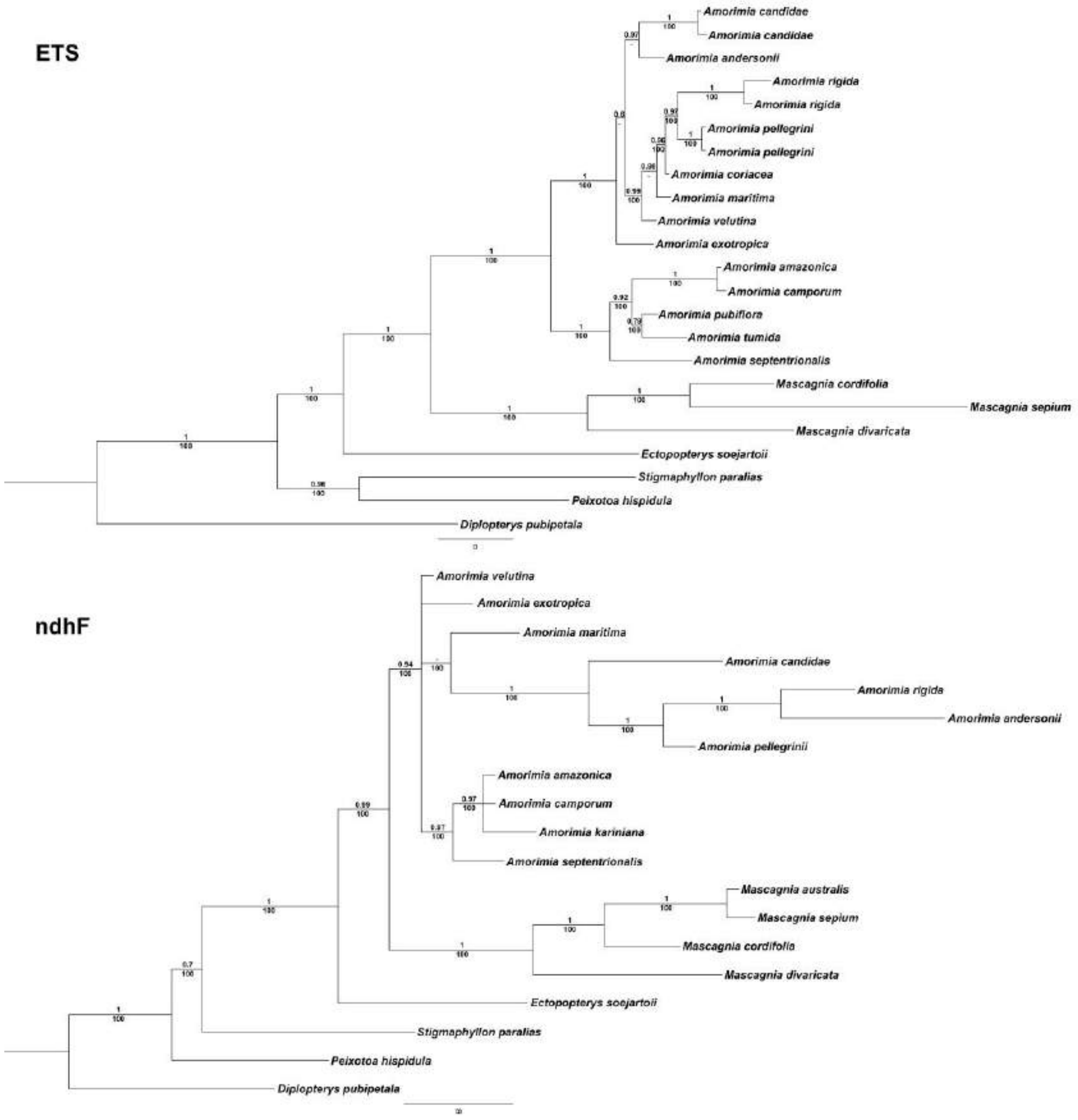


FIGURE 2. Best tree produced by the Bayesian Inference and Maximum Parsimony based on the ETS and *ndhF* datasets. Clade support for BI/MP are above/bellow branches.

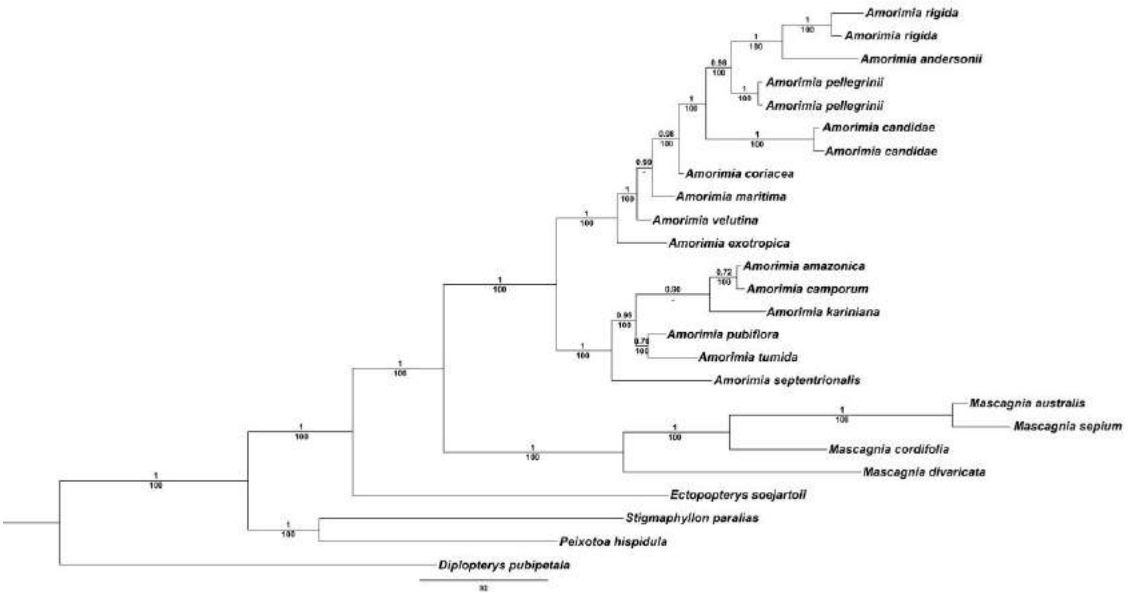


FIGURE 3. Best tree produced by the Bayesian Inference and Maximum Parsimony based on the combined plastid and nuclear datasets. Clade support for BI/MP are above/bellow branches.

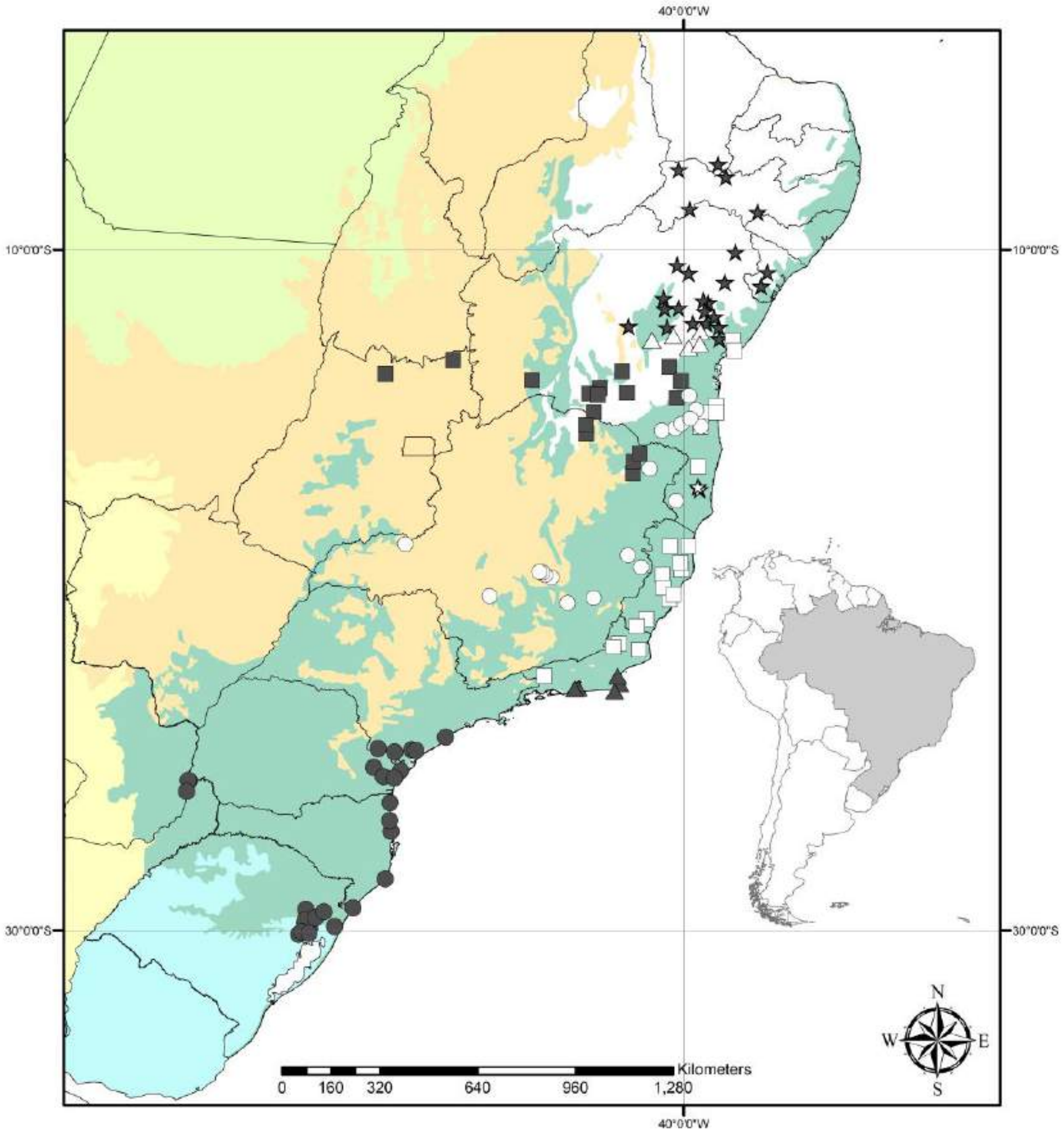


FIGURE 4. Distribution map of species from *Amorimia* subg. *Amorimia*: ● – *A. exotropica*; ○ – *A. rigida*; ▲ – *A. coriacea*; Δ – *A. candidae*; ■ – *A. velutina*; □ – *A. maritima*; ★ – *A. pellegrinii*; ☆ – *A. andersonii*. South American phytogeographical domains: Amazon Rainforest - light green, Chaco/Pantanal - yellow, Cerrado - orange, Caatinga - white, Atlantic Rainforest - dark green, and Pampas - blue.

FIGURE 5. Distribution map of species from *Amorimia* subg. *Uncina* R.F.Almeida: ● – *A. septentrionalis*; ○ – *A. amazonica*; ▲ – *A. pubiflora*; Δ – *A. tumida*; ■ – *A. kariniana*; □ – *A. camporum*;★– *A. concinna.* South American phytogeographical domains: Amazon Rainforest - light green, Chaco/Pantanal - yellow, Cerrado - orange, Caatinga - white, Atlantic Rainforest - dark green, and Pampas - blue.

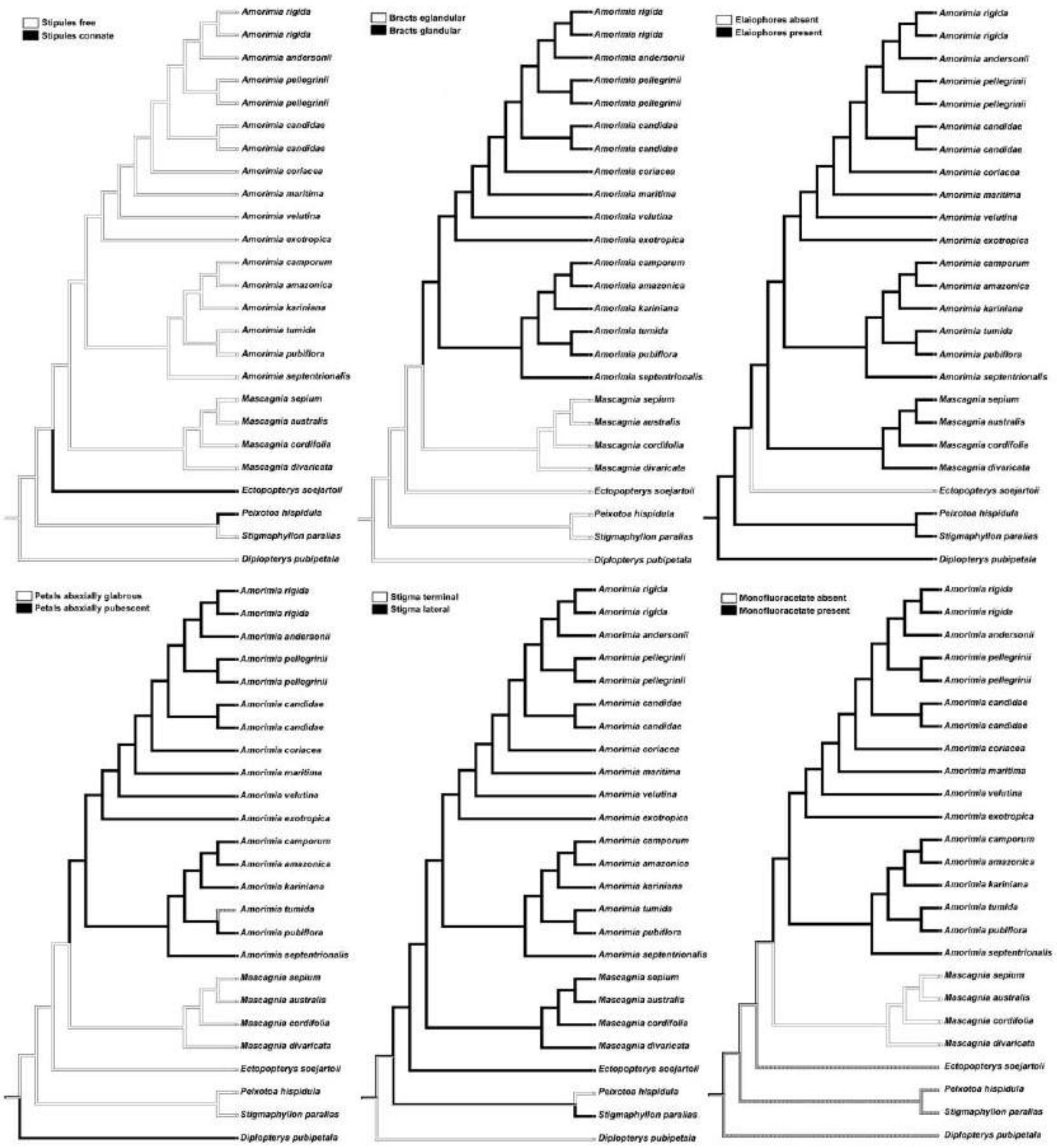


FIGURE 6. Parsimony ancestral reconstruction of morphological (conation of stipules, occurrence of glands on bracts, occurrence of elaiophores, indumentum of petals abaxially, and position of stigmas) and chemical traits (monofluoracetate) onto a combined-data 50% majority-rule consensus Bayesian tree of *Amorimia*, as resolved in Figure 3.

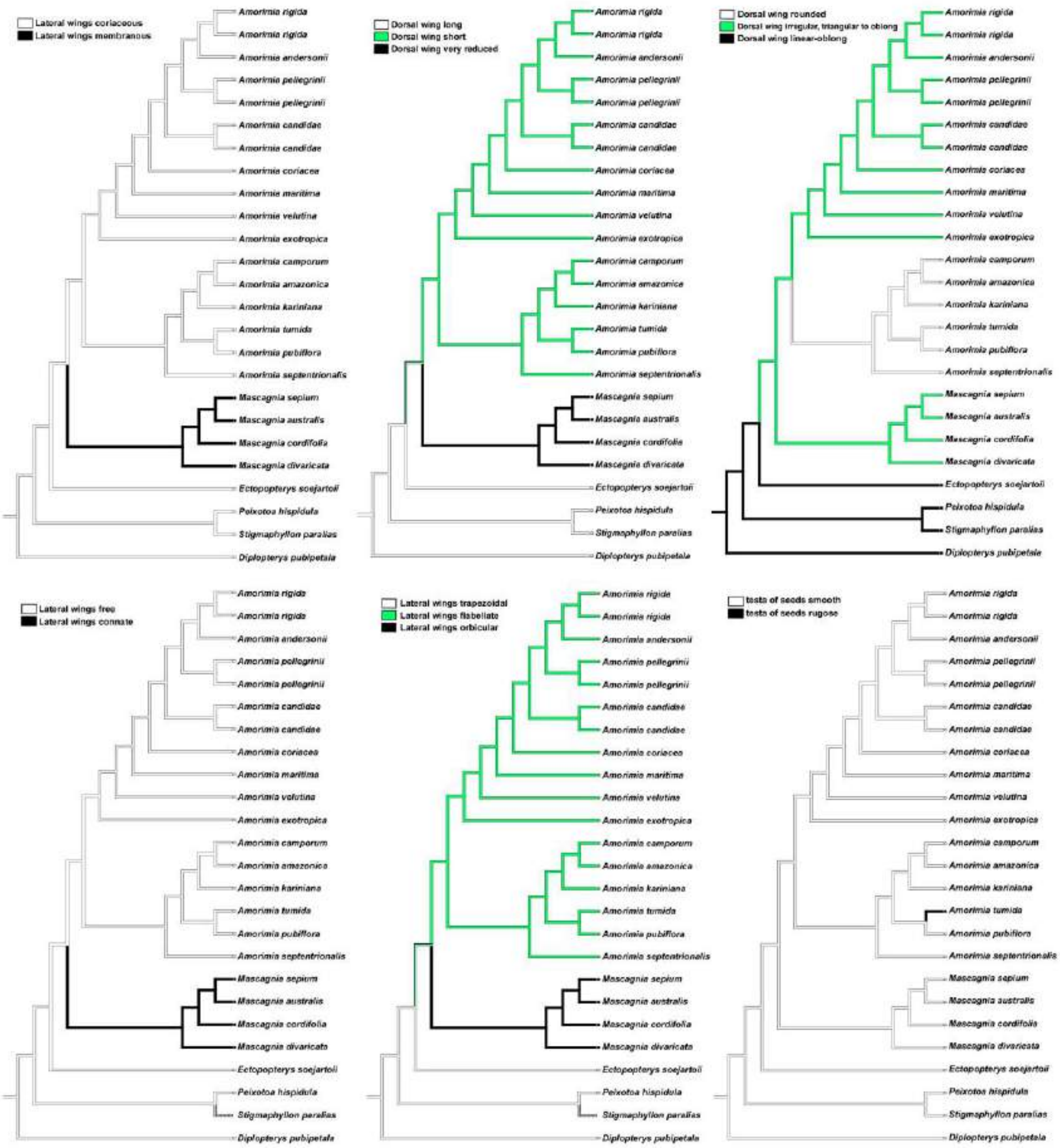


FIGURE 7. Parsimony ancestral reconstruction of morphological (texture of lateral wings, size of dorsal wing, shape of dorsal wing, conation of lateral wings, shape of lateral wings, and seed texture) onto a combined-data 50% majority-rule consensus Bayesian tree of *Amorimia*, as resolved in Figure 3.

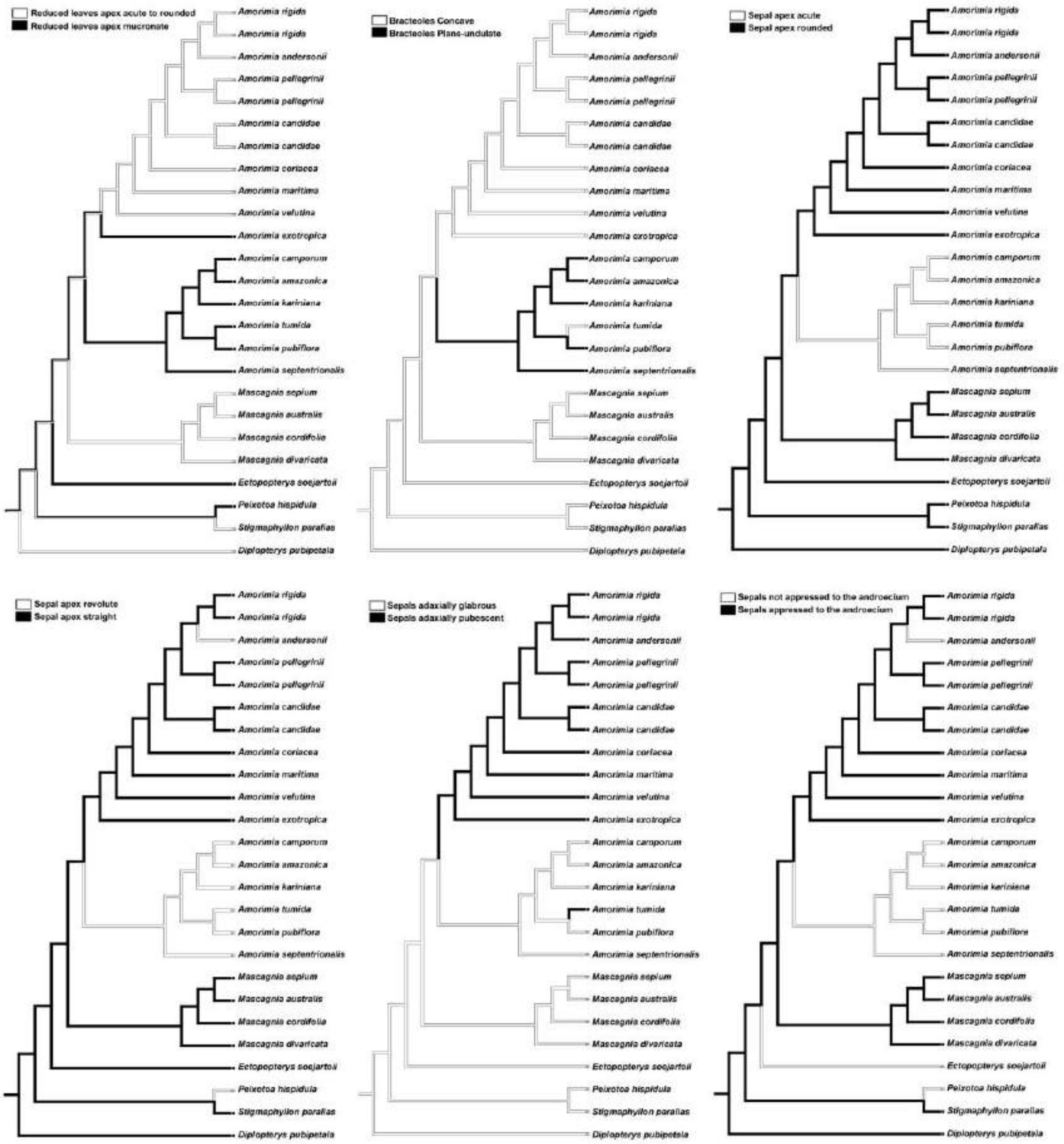


FIGURE 8. Parsimony ancestral reconstruction of morphological (shape of the apex of reduced leaves associated to the inflorescence, shape of bracteoles, shape of the apex of sepals, posture of the apex of sepals, indumentum of sepals adaxially, and posture of sepals) onto a combined-data 50% majority-rule consensus Bayesian tree of *Amorimia*, as resolved in Figure 3.

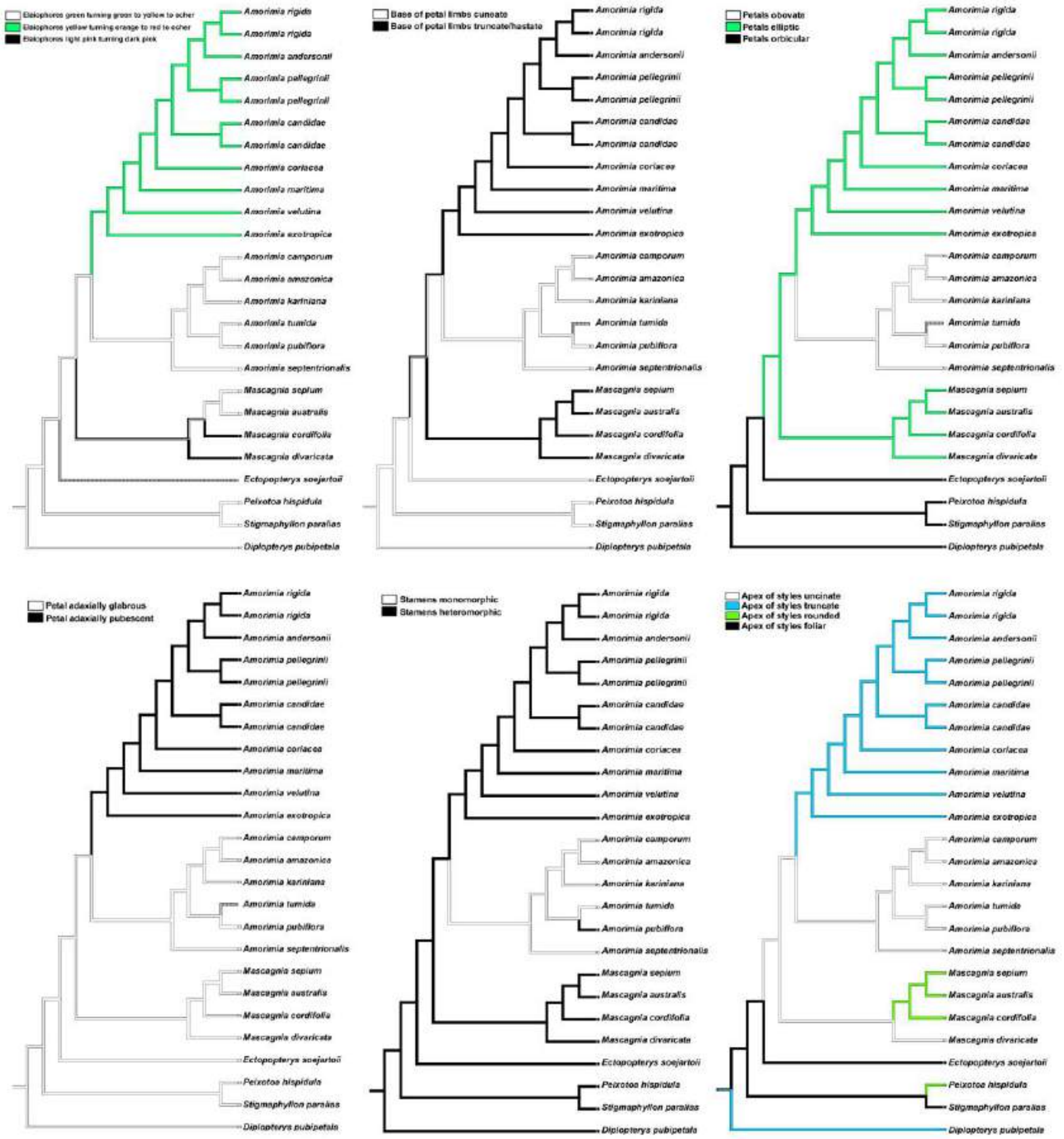


FIGURE 9. Parsimony ancestral reconstruction of morphological (color of elaiophores, shape of petals at base, shape of petals, indumentum of petals adaxially, stamens symmetry, and shape of the apex of styles) onto a combined-data 50% majority-rule consensus Bayesian tree of *Amorimia*, as resolved in Figure 3.

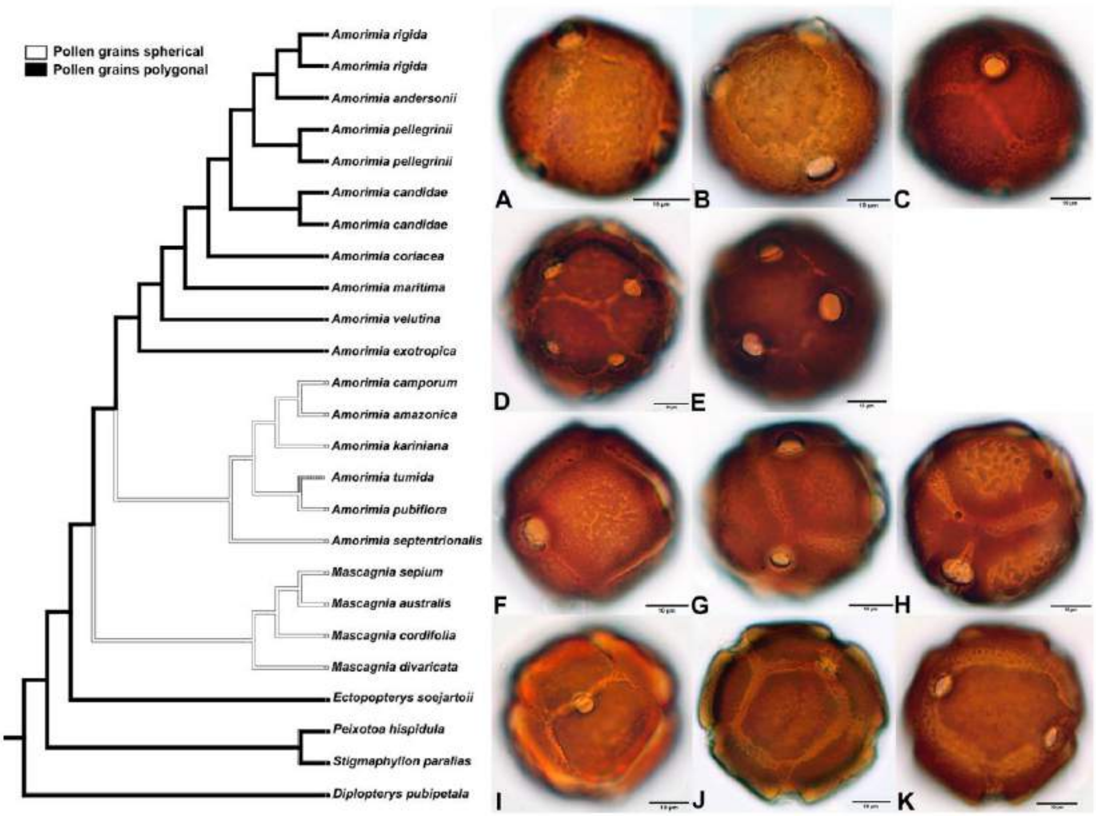
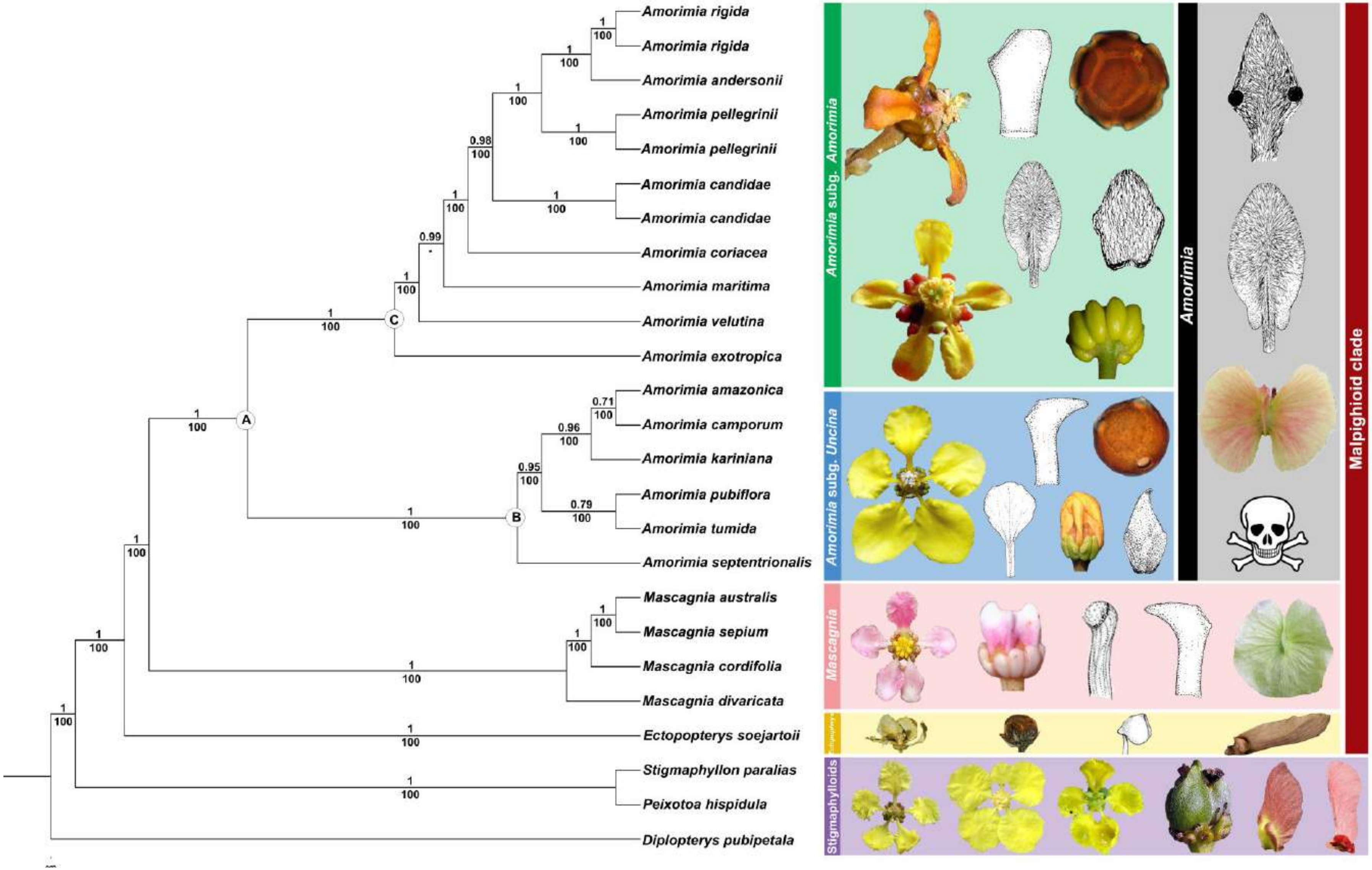


FIGURE 10. Parsimony ancestral reconstruction of pollen morphology onto a combined-data 50% majority-rule consensus Bayesian tree of *Amorimia*, as resolved in Figure 3. Pollen morphology of eleven species of *Amorimia* sampled in this study: *Amorimia* subg. *Uncina* - A. *A. amazonica*; B. *A. concinna*; C. *A. kariniana*; D. *A. pubiflora*; E. *A. septentrionalis*. *Amorimia* subg. *Amorimia* - F. *A. candidae*; G. *A. coriacea*; H. *A. exotropica*; I. *A. maritima*; J. *A. pellegrinii*; K. *A. rigida*.


Amorimia rigida
Amorimia rigida
Amorimia andersonii
Amorimia pellegrinii
Amorimia pellegrinii
Amorimia candidae
Amorimia candidae
Amorimia coriacea
Amorimia maritima
Amorimia velutina
Amorimia exotropica
Amorimia amazonica
Amorimia camporum
Amorimia kariniana
Amorimia pubiflora
Amorimia tumida
Amorimia septentrionalis
Mascagnia australis
Mascagnia sepium
Mascagnia cordifolia
Mascagnia divaricata
Ectopopterys soejartoii
Stigmaphyllon paralias
Peixotoa hispidula
Diplopterys pubipetala
A
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C
1 100
0.98 100
0.99 *
0.71 100
0.96 100
0.95 100
0.79 100
Amorimia subg. Amorimia
Amorimia subg. Uncina
Mascagnia
Ectopopterys
Stigmaphylloids
Amorimia
Malpighioid clade

FIGURE 11. Infographic for character mapping in *Amorimia* and relatives. synapomorphies of *Amorimia* (clade A): bracts glandular, petals pubescent on both sides, samaras with two lateral wings larger than the dorsal wing, presence of monofluoracetate; synapomorphies of *Amorimia* subg. *Uncina* (clade B): sepals acute at apex and glabrous abaxially, elaiophores green turning yellow, petals yellow never turning orange or red at age and cuneate at base, styles uncinate at apex, pollen grains spherical; synapomorphies of *Amorimia* subg. *Amorimia* (clade C): sepals rounded at apex and pubescent abaxially, elaiophores yellow turning red to ocher, petals yellow turning orange to red at age and truncate at base, styles truncate at apex, pollen grains polygonal; synapomorphies of *Mascagnia*: elaiophores pink turning ocher at age, petals keeled, and samaras with lateral wings larger than dorsal wing, and fused into an orbicular wing; synapomorphies of *Ectopopterys*: sepals eglandular, deflexed, anther with enlarged connectives, apex of styles foliate, and samaras with the dorsal wing larger than the lateral wings thickened on the lower side.

TABLE 1. Species and DNA regions sampled in this study. *Sequences obtained from genbank.

Species	Voucher (herbarium acronym)	ETS	*ndh*F
Amorimia amazonica (Nied.) W.R.Anderson	*R.Rojas 753* (NY)	KR092914	HQ246739.1*
Amorimia andersonii R.F.Almeida	*L.C.Marinho 654* (CEPEC)	KR092924	-
Amorimia camporum W.R.Anderson	*G.Klug 4259* (NY)	KR092915	HQ246740.1*
Amorimia candidae R.F.Almeida	*R.F.Almeida 594* (HUEFS)	KR092920	KY271741
Amorimia candidae R.F.Almeida	*E.Melo 8563* (HUEFS)	KR092921	KY421892
Amorimia coriacea (Griseb.) R.F.Almeida	*J.G.Jardim 4228* (CEPEC)	KR092922	KR092951
Amorimia exotropica (Griseb.) W.R.Anderson	*R.F.Almeida 549* (HUEFS)	KR092923	HQ246741.1*
Amorimia kariniana W.R.Anderson	*O.Haught 3070* (NY)	-	HQ246742.1*
Amorimia maritima (A.Juss.) W.R.Anderson	*Souza-Silva 15* (HUEFS)	KR092925	KM197313.1*
Amorimia pellegrinii R.F.Almeida	*R.F.Almeida 612* (HUEFS)	KR092926	KY271742
Amorimia pellegrinii R.F.Almeida	*R.F.Almeida 586* (HUEFS)	KR092927	KY421893
Amorimia pubiflora (A.Juss.) W.R.Anderson	*V.J.Pott 4204* (CGMS)	KR092916	KY421894
Amorimia rigida (A.Juss.) W.R.Anderson	*R.F.Almeida 556* (HUEFS)	KR092928	-
Amorimia rigida (A.Juss.) W.R.Anderson	*R.F.Almeida 562* (HUEFS)	KR092929	KR092952
Amorimia septentrionalis W.R.Anderson	*J.Costa_Lima 1161* (UNIVASF)	KR092918	KM197314.1*
Amorimia tumida R.F.Almeida & A.C.Marques	*M.N.Coelho 2794* (RB)	KY368391	-
Amorimia velutina W.R.Anderson	*G.J.Sheperd 4409* (UEC)	KR092930	HQ246743.1*
Diplopterys pubipetala (A.Juss.) W.R.Anderson & C.C.Davis	*A.Francener* 1126 (SP)	KR092986	HQ246821.1*
Ectopopterys soejartoii W.R.Anderson	*Wurdack 2356* (US)	KR092910	AF351064.1*
Mascagnia australis C.E.Anderson	*A.Francener* 1177 (SP)	-	HQ246886.1*
Mascagnia cordifolia (A.Juss.) Griseb.	*A.Francener* 1172 (SP)	KR092911	HQ246888.1*
Mascagnia divaricata (Kunth) Nied.	*R.F.Almeida* 547 (HUEFS)	KR092912	HQ246890.1*
Mascagnia sepium (A.Juss.) Griseb.	*R.A.Silva* 2464 (HUEFS)	KR092913	AF351025.1*
Peixotoa hispidula A.Juss.	*S.S.Dutra 149* (VIES)	KR093002	KM197421.1*

Stigmaphyllon paralias A.Juss.	*R.F.Almeida 509* (SP)	KR054593	AF351065.1*

TABLE 2. Regions of the plastid and nuclear genome tested for *Amorimia* species, its success in amplification (Ampl.) and sequencing (Seq.). Quantitative traits evaluated for choice of markers: L = length of the aligned sequences; N = number of species.

Regions	Reference	Ampl.	Seq.	L(pb)	BFM (best fitting model)	N
nuclear						
ets	Baldwin & Markos 1998	yes	yes	495	HKY+I	23
phyC	Davis *et al.* 2002	no	no	-	-	-
plastidial						
ndhF	Davis *et al.* 2001	yes	yes	706	HKY	20
Combined nuclear+plastid datasets	-	-	-	1201	-	25

TABLE 3. Features of regions and combined molecular datasets.

	Plastid dataset	Nuclear dataset	Combined plastid+nuclear datasets
Matrix length (bp)	706	495	1201
Analyzed characters	706	495	1201
Constant characters	601	231	832
Variable characters	62	113	175
Parsimony-informative characters	43	151	194
Consistency index	0.9333	0.7376	0.7712
Retention index	0.9192	0.7442	0.7656

TABLE 4. Selected morphological characters mapped into the topology of the combined molecular dataset.

Morphological characters	Character states
1. Indumentum, type:	(0) velutine, (1) sericeous or sericeous-velutine, (2) tomentose
2. Branch, stipules, connation:	(0) free, (1) connate
3. Leaf blade, apex, shape:	(0) acute, (1) acuminate, (2) mucronate, (3) rounded
4. Inflorescence, architecture, type:	(0) thyrses, (1) solitary umbels, (2) panicles, (3) dichasia of umbels
5. Bract, gland, presence:	(0) eglandular, (1) 1-many pairs of glands
6. Bract, shape:	(0) plane with involute margins, (1) concave

7. Pedicel, consistency:	(0) not tumid in fruit, (1) tumid in fruit
8. Sepal, adaxial side, indumenta:	(0) glabrous, (1) pubescent
9. Sepal, apex, shape:	(0) acute, (1) rounded
10. Sepal, position:	(0) not appressed to the androecium, (1) appressed to the androecium
11. Sepal, apex, posture:	(0) revolute, (1) straight
12. Elaiophore, presence:	(0) absent, (1) present
13. Elaiophore, color:	(0) green turning dark green to yellow, (1) yellow turning orange to red to ochre, (2) light pink turning dark pink
14. Petal, adaxial side, indumentum:	(0) glabrous, (1) pubescent
15. Petal, abaxial side, indumenta:	(0) glabrous, (1) pubescent
16. Petal, shape:	(0) obovate, (1) elliptic, (2) orbicular
17. Petal, base, shape:	(0) cuneate, (1) truncate/hastate
18. Androecium, filaments, length:	(0) monomorphic, (1) heteromorphic
19. Androecium, anther, indumentum:	(0) glabrous, (1) pubescent at base and connective, (2) hairy at base, connective and apex, (3) hairy at base and apex
20. Gynoecium, style, apex, shape:	(0) hooked, (1) truncate, (2) rounded, (3) foliar
21. Fruit, dorsal and lateral wings, consistency:	(0) coriaceous, (1) membranous
22. Fruit, mericarp, dorsal wing, size:	(0) long, (1) short, (2) very reduced
23. Fruit, mericarp, dorsal wing, shape:	(0) rounded, (1) irregular with a crista in the apex of the nut, (2) triangular, (3) oblong
24. Fruit, mericarp, dorsal wing, insertion:	(0) at the base of the nut, surpassing region of insertion of the lateral wings, (1) at the middle of the nut, equaling the region of insertion of the lateral wings, (2) fused with lateral wings
25. Fruit, mericarp, lateral wings, connation:	(0) free, (1) connate
26. Fruit, mericarp, lateral wings, shape:	(0) trapezoidal, (1) flabellate, (2) orbicular
27. Fruit, mericarp, lateral wings, margin, shape:	(0) sinuate, (1) erose
28. Fruit, mericarp, lateral wings, upper angle:	(1) 15°, (2) 20-25°, (3) 30-35°, (4) 40-45°, (5) 50-55°, (6) 60-65°, (7) 70°
29. Fruit, mericarp, lateral wings, lower angle:	(1) 20-25°, (2) 40°, (3) 50-55°, (4) 60-65°, (5) 70-75°, (6) 80°
30. Toxicity, presence of monofluoracetate:	(0) absent, (1) present
31. Pollen grain, shape:	(0) spherical, (1) polygonal

Capítulo IV

Taxonomic revision of *Amorimia* W.R.Anderson (Malpighiaceae)

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Abstract

The taxonomic revision of *Amorimia* (Malpighiaceae) is presented, including typifications, and redescriptions of *A. amazonica*, *A. camporum*, *A. concinna*, *A. exotropica*, *A. kariniana*, *A. maritima*, *A. pubiflora*, and *A. septentrionalis*. The genus is endemic to Seasonally Dry Tropical Forests and Rainforests of South America, and its species are distinguished by details in the leaves, indumenta, inflorescences, floral, and fruit morphology. This study includes full morphological descriptions for all taxa, along with an identification key for its subgenera and species, illustrations, distribution maps, conservation risk assessments, and comments on ecology, nomenclature, and taxonomy. Additionally, we provide a key to differentiate *Amorimia* from the remaining genera of the Malpighioid clade.

Keywords: Malpighiales, *Mascagnia*, Neotropical flora, Seasonally Dry Tropical Forests, Taxonomy.

Resumo

Apresentamos a revisão taxonômica de *Amorimia* (Malpighiaceae), incluindo tipificações e redescrições de *A. amazonica*, *A. camporum*, *A. concinna*, *A. exotropica*, *A. kariniana*, *A. maritima*, *A. pubiflora* e *A. septentrionalis*. O gênero é endêmico à Florestas Sazonais e Úmidas da América do Sul, e suas espécies podem ser distinguidas por caracteres da morfologia de folhas, indumento, inflorescências, flores e frutos. Este estudo inclui descrições morfológicas completas para todas as espécies, além de uma chave de identificação para seus subgêneros e espécies, ilustrações, mapas de distribuição, avaliações de risco de extinção e comentários sobre ecologia, nomenclatura e taxonomia

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de suas espécies. Ainda, apresentamos uma chave de identificação para diferenciar *Amorimia* dos demais gêneros do clado Malpighioide.

Palavras-chave: Flora Neotropical, Florestas Tropicais Sazonalmente Secas, Malpighiales, *Mascagnia*, Taxonomia.

Introduction

Amorimia Anderson (2006: 176) is a small genus of Neotropical lianas, comprising fifteen species distributed throughout Seasonally Dry Tropical Forests (SDTF) and Rainforests in South America, ranging from Northern Colombia to Southern Brazil and Argentina (Anderson 2006; BFG 2015; Almeida *et al.* 2016a; Almeida *et al.* in prep.). The genus can be recognized by the presence of extra-floral nectaries on the abaxial surface of leaves, bracts, and bracteoles, pubescent petals, straight styles and the production of monofluoroacetate (Anderson 2006; Lee *et al.* 2012; Almeida *et al.* 2016a, 2016b; Almeida *et al.* in prep.).

Many species currently treated under *Amorimia*, were previously treated by many authors as part of a much wider and polyphyletic *Hiraea* Jacquin (1760: 21), or of an also polyphyletic *Mascagnia* (De Candolle, 1824: 585) Bertero (in Colla 1824: 85). Based on recent systematic and taxonomic studies, we now know that these two artificial assembles actually represent eight independent lineages (Anderson 2006; Davis & Anderson 2010). About 190 years ago, Jussieu (1833) described under *Hiraea*, the first two species of *Amorimia*: *H. pubiflora* Jussieu (1833: 14), and *H. rigida* Jussieu (1833: 14). Few years later, Grisebach (1858) transferred these species to *Mascagnia*, a genus based on *Hiraea* sect. *Mascagnia* De Candolle (1824: 585). Previously, *Mascagnia* comprised a single accepted name, *Hiraea macradena* De Candolle (1824: 85), which was only brought to light by Grisebach's monograph on Brazilian Malpighiaceae (1858). *Mascagnia sensu* Grisebach (1858) was characterized by the presence of samaras with two lateral wings, and pedicels articulate in the median portion; while *Hiraea* was distinguished by samaras with 1–2 lateral wings, and pedicels proximally articulate. The sections proposed by Grisebach (1858) for *Mascagnia* were based on the shape and size of lateral wings of samaras, with *M. pubiflora* (A.Juss.) Grisebach (1858: 91) and *M. rigida* (A.Juss.) Grisebach (1858: 92) being placed in *M.* sect. *Pleuropterys* Grisebach (1858: 91). This section was characterized by samaras with distinct lateral wings, and a single and shortened (sometimes absent) dorsal wing. In Grisebach's monograph (1858), he proposed new combinations and taxonomic novelties for this section, which at the time comprised ten accepted names: *Mascagnia biglandulosa* (Jussieu 1840: 323) Grisebach (1858: 91), *M. bunchosioides* (Jussieu 1833: 13) Grisebach (1858: 92), *M. coriacea* Grisebach (1858: 92), *M. doniana* Grisebach (1858: 94), *M. exotropica* Grisebach (1858: 93), *M. fluminensis* (Grisebach 1839:243) Grisebach (1858: 94), *M. psilophylla* (Jussieu 1833: 20) Grisebach (1858: 94), *M. pubiflora*, and *M. rigida*.

Posteriorly, Niedenzu (1914) considered *M. biglandulosa* and *M. bunchosioides* as synonyms of *Heladena multiflora* (Hooker & Arnott 1832: 157) Niedenzu (1914: 16). The author also presented taxonomic novelties for this section, such as the description of *M. amazonica* Niedenzu (1926: 59), and *M. lehmanniana* Niedenzu (1926: 59). Few years later, Morton (1932) described a new name of *Mascagnia* sect. *Pleuropterys* endemic to Colombia, *M. dumetorum* Morton (1932: 53). However, Morton later noticed that his name was illegitimate, since it was a posterior homonym of *M. dumetorum* Grisebach (1879: 67), and proposed *M. concinna* Morton (1936: 130) as a replacement name. Later, Johnson (1986) transferred *M. psilophylla* to *Callaeum* Small (1910: 128), while Anderson (1987) transferred *M. fluminensis* to *Heteropterys* Kunth (1822: 163), and Anderson and Davis (2007) transferred *M. lehmanniana* also to *Heteropterys*. Recently, aiming to finally render *Mascagnia* monophyletic, Anderson (2006) described *Amorimia* as a new genus, combining the remaining species from *M.* sect. *Pleuropterys*, based on morphological and molecular data (Cameron *et al.* 2001; Davis *et al.* 2001, 2002; Anderson 2006).

On the other hand, the broad concept of *Amorimia rigida* (A.Juss.) Anderson (2006: 183) adopted by previous authors lead to a misunderstanding of the morphological variation within this species distribution range (Anderson 2006). Consequently, nine names have been segregated or reestablished from the *Amorimia rigida* complex in the past few years: *A. andersonii* R.F.Almeida (in Almeida *et al.* 2016: 4), *A. camporum* Anderson (2006: 179), *A. candidae* R.F.Almeida (in Almeida *et al.* 2016: 8), *A. coriacea* (Grisebach 1858: 92) R.F.Almeida (in Almeida *et al.* 2016: 13), *A. kariniana* Anderson (2006: 180), *A. pellegrinii* R.F.Almeida (in Almeida *et al.* 2016: 14), *A. septentrionalis* Anderson (2006: 183), *A. tumida* R.F.Almeida & A.C.Marques (in Almeida *et al.* in prep.), and *A. velutina* Anderson (2006: 185). After extensive field and herbarium studies, in association with additional molecular studies (Almeida *et al.* in prep.), we unraveled new morphological, evolutionary and biogeographical data to the systematics of

Amorimia. These systematic efforts paved the way for the elaboration of a new, comprehensive and updated taxonomic revision for the genus, herein presented.

Material and Methods

Morphological descriptions and phenology of the studied species were based on herbaria (ALCB, AMAZ, ASE, BAH, BM, BHCB, BOTU, CEN, CEPEC, CESJ, CGMS, COL, CPAP, CRVD, CTES, CUZ, EAC, ESA, F, FLOR, FUEL, FURB, FZB, G, GH, GUA, HAS, HB, HCF, HEPH, HRB, HRCB, HSJRP, HST, HUCP, HUCS, HUEFS, HUEM, HUESC, HUFG, HUFU, HUPG, HURB, HUT, IAC, IAN, ICN, INPA, IPA, JPB, L, LIL, K, MAC, MBM, MBML, MG, MICH, MO, MPU, NY, OUPR, P, PACA, PAMG, PEUFR, PMSP, R, RB, RBR, RFA, S, SI, SMF, SP, SPF, SPSF, U, UB, UEC, UFP, UFMS, UFMT, UFRN, UPCB, US, USZ, W, VIC, and VIES), and spirit specimens (herbaria acronyms according to Thiers, continuously updated). The indumenta terminology follows Anderson (1981), structure shapes follows Radford *et al.* (1974), the inflorescence terminology and morphology follows Weberling (1965, 1989), and fruit terminology follows Spjut (1994) and Anderson (1981). The conservation status was proposed following the recommendations of IUCN Red List Categories and Criteria, Version 3.1 (IUCN 2012). GeoCAT (Bachman *et al.* 2011) was used for calculating the Extent of Occurrence (EOO) and the Area of Occurrence (AOO). Maps were elaborated using Arcgis 9.3 software (ESRI 2010), geographical coordinates were obtained from herbaria specimens and fieldwork data, and shapefiles were obtained from Sarkinen *et al.* (2011) and WWF (2017).

Results

Most botanists in general still have a lot of trouble differentiating the genera segregated from *Mascagnia s.l.* This can be evidenced by the great number of specimens from different genera erroneously assigned to *Mascagnia* in most visited herbaria. Similarities and differences between these various genera are presented in Anderson (2006) and partially in Almeida *et al.* (2016). *Amorimia* is placed in the, herein named, Malpighioid clade, a group combining all genera from the *Malpighia* clade + *Amorimia* and *Ectopopterys* (Fig. 1). The Malpighioid clade is morphologically diverse, but anatomical studies (Marques et al. in prep.) indicate that the group is also morphologically supported by some characters. A key to distinguish the genera from the Malpighioid clade is presented below:

Key to the genera of the Malpighioid clade

1. Flowers actinomorphic, lacking sepal glands, stigmas terminal; Paleotropics............. 2

1. Flowers zygomorphic, bearing sepal glands, stigmas lateral; Neotropics..................... 9

2. Styles truncate at apex.. 3

2. Styles with a projection (lobe) at apex.. 5

3. Flower buds smooth, petals entire, reflexed; Asia.................***Aspidopterys*** (Fig.1 K–L)

3. Flowers bud keeled, petals fimbriate to undulate, patent; Africa and Arabian Peninsula.. 4

4. Leaves spirally-alternate; petals fimbriate, anthers with thecae smooth, 2-carpelate.. ***Diaspis***

4. Leaves opposite; petals undulate, anthers with thecae rugose, 3-carpelate. ***Caucanthus***

5. Plants monoecious; buds keeled, petals fimbriate, style 1-lobed at apex; Africa.. ***Triaspis*** (Fig.1 M–N)

5. Plants dioecious; buds smooth, petals entire, style 2-lobed at apex (sometimes reduced to a triangular lobe); Madagaskar.. 6

6. Leaves up to 5 mm wide; petals narrowly spatulate and densely sericeous over whole abaxial surface, styles longly-lobed... ***Digoniopterys***

6. Leaves at least 1 cm wide, mostly much wider; petals elliptical to orbicular, glabrous or thinly sericeous on abaxial keel, styles shortly-lobed.. 7

7. Stipules enlarged, leaf-like, persistent; flowers borne in elongated axillary pseudoracemes of 8 or more, with definite internodes between successive flowers.. ***Madagasikaria*** (Fig.1 Q–R)

7. Stipules reduced, triangular, persistent to deciduous; flowers borne in umbels or corymbs of 4–many, with internodes not or hardly present between successive flowers.. 8

8. Ovary bearing initials for lateral wings and dorsal crest on each carpel, visible even in young flowers... ***Microsteira*** (Fig.1 S–T)

8. Ovary lacking any obvious sign of initials for wings or crests.. ***Rhynchophora*** (Fig.1 O–P)

9. Connectives of anthers bearing large glands, styles foliate at apex, dorsal wing of samaras larger.. ***Ectopopterys*** (Fig.1 A–B)

9. Connectives of anthers bearing an inconspicuous glandular tissue, styles truncate at apex, lateral wings of samaras larger.. 10

10. Mericarps indehiscent, fleshy, dorsal and lateral wings much reduced, free, fleshy.. ***Malpighia*** (Fig.1 I–J)

10. Mericarps dehiscent, dry, lateral wings larger, fused, dry... 11

11. Bracts glandular, bracteoles 2–6-glandular; petals adaxially pubescent, lateral wings of samaras free... ***Amorimia*** (Fig.1 C–D)

11. Bracts eglandular, bracteoles 0–1-glandular; petals adaxially glabrous, lateral wings of samaras fused.. 12

12. Lianas to scandent shrubs; leaves long-petiolate; thyrses to corymbs; flower buds keeled... ***Mascagnia*** (Fig.1 E–F)

12. Erect shrubs; leaves subsessile; 2–4-flowered umbels; flower buds smooth.. ***Calcicola*** (Fig.1 G–H)

Taxonomy

Amorimia Anderson (2006: 176). Type:—*Amorimia rigida* (A.Juss.) Anderson (2006: 183). Fig. 2–40.

= *Mascagnia* sect. *Pleuropterys* Grisebach (1858: 91). Lectotype (designated by Anderson 2006):—*Hiraea pubiflora* Jussieu (1833: 14) ≡ *Mascagnia pubiflora* (A.Juss.) Grisebach (1858: 91) ≡ *Amorimia pubiflora* (A.Juss.) Anderson (2006: 183).

Woody vines to scandent shrubs; indumenta from throughout the plant varying from sericeous-velutine (composed by a mixture of short-T and V–Y shaped unicellular hairs) to velutine (composed only by V–Y-shaped hairs); stipules minute, triangular, interpetiolar, persistent to deciduous. *Leaves* usually opposite, sometimes subopposite, to alternate near inflorescences, often reduced in inflorescences; petioles canaliculated, eglandular, or rarely biglandular at apex; leaf blade narrowly elliptic, elliptic, to widely elliptic, base obtuse, cuneate to attenuate, apex acute, acuminate to mucronate, eglandular or bearing 2–many small glands impressed abaxially, near midvein, base or margins. *Thyrses (pseudoracemes) to panicles*, axillary to terminal; 1-flowered cincinni, decussate to spirally arranged; bracts parallel, spreading to reflexed, elliptic, ovate to lanceolate, bearing 1–2–(3) pairs of glands; peduncles short to elongate; bracteoles borne at or below apex of peduncles, parallel, spreading to reflexed, elliptic, ovate, lanceolate to filiform, eglandular to 1–(2) pairs of glands. *Flowers* bisexual, zygomorphic, chasmogamous; pedicels short to elongate, sometimes thickened in fruits; sepals leaving petals exposed during enlargement of bud, apex appressed to the androecium or revolute at anthesis; lateral sepals bearing 2-glands abaxially; the anterior eglandular, rarely bearing 1-gland; petals clawed, yellow, usually turning orange or red at age, adaxially sericeous-velutine to velutine distally or sometimes uniformly, abaxially uniformly sericeous-velutine to velutine; limb elliptic to wide elliptic to spatulate to obovate to orbicular, base cuneate to hastate to truncate to obtuse, margin entire, sinuate to plane, apex rounded, claw plane to canaliculate, posterior petal erect, lateral petals usually reflexed in age. *Stamens* 10, all fertile, filaments connate at base, straight, varying from longer opposite sepals to longer opposite petals, anthers monomorphic, rarely dimorphic, glabrous or pubescent at base, connective and/or apex. *Gynoecium* with carpels connate their whole length in the ovary, styles cylindrical or laterally flattened toward apex, erect to recurved, subequal or the anterior somewhat shorter, slenderer, and more recurved than the posterior 2, apex of styles dorsally rounded or truncate or acute to short-hooked, stigma lateral, crateriform to discoid. *Fruits* dry, breaking apart into 3 samaras separating from a short or moderately high pyramidal torus; samara butterfly-shaped to depressed-elliptical with lateral wings dominant, chartaceous with many fine parallel veins, cleft towards nut at apex, continuous at base or cleft part-way or completely towards nut, margin entire or sinuate to coarsely dentate; dorsal wing distinct at apex and base or confluent with lateral wings at base; nut almost always smooth between lateral and dorsal wings; ventral areole triangular, ovate, orbicular to very narrowly elliptical. *Seeds* smooth to rugose; embryos ovoid, cotyledons bent.

Distribution and ecology:—*Amorimia* comprises 15 species found in Evergreen and Seasonally Dry Tropical Forests, usually associated to water streams in South America (Figs. 2–3).

Conservation:—*Amorimia* has been the subject of countless toxicology studies in veterinary medicine since the 1960's in Brazil (Tokarnia *et al.* 1961; Tokarnia & Dobereiner 1973). As a result, a couple of species (e.g. *A. rigida*, and *A. maritima*; commonly referred either as *A. rigida* or as *A. aff. rigida*) have been usually appointed as responsible for bovine sudden death in different parts of the country (Arruda *et al.* 2017; Assis *et al.* 2009, 2010; Barbosa *et al.* 2008; Barros & Meneguetti 2014; Becker *et al.* 2013; Borboleta *et al.* 2011, 2012; Duarte *et al.* 2013; Garcez *et al.* 2009; Lago *et al.* 2009; Lee *et al.* 2012; Medeiros *et al.* 2002; Melo *et al.* 2008; Neto *et al.* 2013; Nogueira *et al.* 2011; Pavarini *et al.* 2011; Pessoa *et al.* 2013; Schons *et al.* 2011; Silva *et al.* 2006, 2008; Soares *et al.* 2011; Tokarnia & Dobereiner 1973, 1985; Tokarnia *et al.* 1961, 1990, 1994, 1996, 2000, 2002; Vasconcelos *et al.* 2008). Recently, broad phytochemical studies have identified monofluoracetate as the compound responsible for *Amorimia*'s toxicity to mammals (Lee *et al.* 2012). In the past 60 years, some methods for the control of *Amorimia* outbreaks became widespread among Brazilian farmers and veterinarians, such as biological, manual, and mechanical control (Duarte *et al.* 2013; Pessoa *et al.* 2013) (Figure 4). Since most species of *Amorimia* commonly occur associated to gallery forests and waterstreams, we believe that deforestation, associated with a drastic increase of the removal of mature individuals by farmers, has drastically affected populations of *Amorimia* in the past 6 decades. Evidence to corroborate our hypothesis resides in herbarium collections, in which most specimens of *Amorimia* are from mid 80's to late 90's (Specieslink 2017). Additionally, during fieldwork in Eastern Brazil, we could notice a significant number of localities known to occur species of the genus turned into rice crops, damns, wind farms, but more commonly, turned into pastures (Almeida pers. obs.) (Fig. 4).

Even though most species of *Amorimia* show a wide distribution range, most of them falls within the endangered conservation status the AOO is taken into account (e.g. *A. amazonica*, *A. exotropica*, *A. maritima*, *A. pubiflora*, *A. rigida*, *A. septentrionalis*, and *A. velutina*). It is widely known that tropical environments are highly threatened due to human activities (Myers *et al.* 2000; Marchese 2015). However, when considering plants regarded as harmful to the cattle farming economy, the level of threat is significantly higher. In Brazil, is estimated that ca. 5% of the cattle and horse population annually dies from different causes, and about 15% of this total is caused by plant poisoning (Pessoa *et al.* 2013). Few studies regarding the natural abundance of toxic weeds in tropical environments are available in the literature (Carvalho & Pitelli 1992). However, based on the scarce information available, it is possible to assume that *Amorimia* populations are sparsely distributed within natural habitats (Carvalho & Pitelli 1992). We confirmed this assumption during field trips to re-collect species of *Amorimia* in Central, and Eastern Brazil, where large populations were only found in well-preserved gallery forests.

Etymology:—The genus honors the Brazilian botanist André Márcio Araujo Amorim (b. 1966), contributor to the study of the Neotropical genus *Heteropterys* (Malpighiaceae).

Recommendations for field collectors:—Most *Amorimia* species are differentiated by the morphology of their indumenta, bracts/bracteoles, flowers and fruits. Therefore, it is recommended, whenever possible, to collect young vegetative branches, as well as reproductive branches bearing flowers and fruits, besides annotating the color of glands, petals and fruits during pre and post-anthesis.

Indumentum:—The indumenta in *Amorimia* predominantly consists of V and T-shaped hairs densely to sparsely intertwined (Fig. 5). All species bear densely haired young stems, leaves, inflorescences, and fruits that mostly become glabrescent to completely glabrous at age. The only species that consistently show hairy leaves throughout its life span are *A. concinna and A. pubiflora*. Due to its mixed nature, it is quite difficult sometimes to classify the indumenta of *Amorimia* in a single category. Thus, in order to make it easier for general botanists, we adopted only two types of indumenta in *Amorimia*: sericeous-velutine, and velutine. The first type includes any indumentum made of a similar proportion of V and T-shaped hairs (Fig. 4). The latter, comprises only indumenta with V-shaped hairs (Fig. 5).

Stipules:—All species of *Amorimia* show intrapetiolar stipules (Fig. 6B), instead of epipetiolar stipules as stated by Almeida *et al.* (2016). In fact, the stipules might move during inflorescence development and end up placed at the base of leaves associated to the inflorescence and/or bracts (Fig. 6A). The shape of stipules seems to be a conserved character among the subgenera of *Amorimia*. In *Amorimia* subg. *Amorimia* stipules are triangular and in *Amorimia* subg. *Uncina* they are narrowly-triangular (Fig. 6).

Leaves:—The leaves in *Amorimia* vary in shape from elliptic to abovate, with bases cuneate, rounded or cordate, and apices rounded, acute or mucronate (Fig. 7–8). It is quite common that leaves associated to the inflorescence become wide-elliptic to orbicular, bearing mucronate to emarginated apices (Fig. 7–8).

Inflorescences:—The inflorescence in *Amorimia* follows the general pattern of Malpighiaceae, being composed by 1-flowered cincinii arranged in a thyrsus or a panicle (Fig. 9). When comparing its inflorescence architecture with the remaining genera of the Malpighioid clade, a reductionary pattern is observed. *Ectopopterys* was the first lineage to diverge in this clade, showing few 1-flowered cincinii arranged in umbels, corymbs or thyrses. *Amorimia* is the second lineage to diverge, showing (10–)30–40(–50) 1-flowered cincinii arranged in a thyrse or, rarely, in a panicle. *Mascagnia* and the remaining genera of the Malpighioid clade show 1-flowered cincinii arranged in a thyrse with reduced internodes, a corymb or completely reduced to an umbel in *Malpighia*.

The 1-flowered cinccinus is divided into a peduncle, which always bears a bract at base and two bracteoles at or near apex, and a pedicel that bears the flower (Fig. 9). The most definying character that distinguishes *Amorimia* from the remaining Malpighiaceae genera is its glandular bracts (Fig. 9). Its bracteoles frequently bear (0–)1–3-pairs of glands, but this character is not exclusive of this genus, also occuring in *Tetrapterys s.l.*

Sepals:—The sepals in *Amorimia* vary in pubescence, shape and posture of the apex (Fig. 10). The abaxial side of sepals are pubescent in *Amorimia* subg. *Amorimia*, and glabrous in *Amorimia* subg. *Uncina* (Fig. 10). The apex of sepals are rounded in *Amorimia* subg. *Amorimia*, and acute in *Amorimia* subg. *Uncina* (Fig. 10). Aditionally, the apex of sepals are straight *Amorimia* subg. *Amorimia*, and revolute in *Amorimia* subg. *Uncina* (Fig. 10).

Elaiophores:—The elaiophores (sepal glands) in *Amorimia* follows an interesting color pattern that easily differentiate both subgenera. Those from *Amorimia* subg. *Amorimia* vary in color from green, yellow, orange to reddish at age (Fig. 11). While the elaiophores of *Amorimia* subg. *Uncina* vary in color from green to ocher at age (Fig. 11). Naturalists and modern systematics have long ignored shape and color of elaiophores in Malpighiaceae in their classification systems. Future broad taxonomic studies in Malpighiaceae clades should pay attention to this neglected character, which might reveal itself as important as it is in *Amorimia*.

Petals:—The petals in *Amorimia* are mostly elliptic in shape, but it might also vary from wide-elliptic to obovate (Fig. 12–13). The margins are always entire, the base of petal limbs might vary from truncate to cuneate, and the claws might vary in length and from canaliculate to plane (Fig. 12–13). The abaxial side is consistently pubescent in all species, but only adaxially pubescent in species from the *Amorimia* subg. *Amorimia* (Fig. 12–13). All species show plane petals at anthesis, except *A. concinna*, which shows cucullate lateral-petals at anthesis (Fig. 12–13).

Androecium:—The androecium in *Amorimia* is composed of two whorls of five stamens each, both connate at base in a single whorl of stamens as most genera of Malpighiaceae (Anderson 1981). The filaments are usually glabrous in most species, being entirely pubescent or pubescent only at apex in *A. tumida* and *A. andersonii*, respectively. The length of filaments in species from *Amorimia* subg. *Amorimia* might vary from filaments opposite petals shorter than those opposite sepals (*A. andersonii*, *A. coriacea*, and *A. exotropica*); to filaments opposite petals longer than those opposite sepals (*A. candidae*, *A. maritima*, *A. pellegrinii*, and *A. velutina*); or filaments opposite the anterior sepal, lateral-posterior sepals and posterior petal longer than those opposite the lateral petals (*A. rigida*) (Fig. 14). In species from *Amorimia* subg. *Uncina*, the length of stamens filaments might vary from filaments opposite petals longer than those opposite sepals (*A. amazonica*, *A. camporum*, *A. pubiflora*, and *A. septentrionalis*) to filaments opposite petals shorter than those opposite sepals (*A. concinna*, and *A. kariniana*) (Fig. 14).

The anthers in *Amorimia* are mostly elliptic, erect at anthesis and reflexed at post anthesis (Fig. 14). The connectives are covered by a glandular tissue, easily visualized under a stereomicroscope (Fig. 15). However, it does not form a protuberant gland as in other genera of Malpighiaceae (e.g. *Banisteriopsis*, and *Stigmaphyllon*) (Anderson 1997; Gates 1982). The pollen sacs are rimose and commonly liberates pollen grains in floral buds. The indument of anthers show significant taxonomic relevance in distinguishing species of *Amorimia* (Fig. 15). The anthers might be entirely pubescent (i.e. *A. candidae*, *A. pelegrinii* and *A. rigida*), pubescent only at apex and/or basis (i.e. *A. andersonii*, *A. pubiflora* and *A. septentrionalis*), pubescent at connectives and base (i.e. *A. coriacea*, *A. exotropica*, *A. maritima*, *A. velutina*), or entirely glabrous (i.e. *A. amazonica*, *A. camporum*, *A. concinna*, and *A. kariniana*) (Fig. 15).

Gynoecium:—All species of *Amorimia* show densely sericeous-velutine to velutine ovaries bearing primordial dorsal and lateral wings (Fig. 16). The styles are usually cylindrical at base and flattened towards the apex, entirely glabrous, and pubescent at base and middle (pubescent at apex only in *A. tumida*) (Fig. 16). The shape of the apex of styles is an important character that distinguishes both subgenera in *Amorimia*: styles truncate at apex are diagnostic of species from *Amorimia* subg. *Amorimia*, and styles uncinate at apex are diagnostic of species from *Amorimia* subg. *Uncina* (Fig. 16).

Fruits:—The fruit in *Amorimia* is always a schizocarp separating into three winged mericarps (Anderson 2006). All mericarps resembles a bow tie due to two lateral wings longer than the dorsal wing (Fig. 17). The dorsal wing might be consistently rounded (*Amorimia* subg. *Uncina*, and *A. candidae*) to triangular, sericeous-velutine to velutine, and sometimes bear a projection at apex (e.g. *A. coriacea*, and *A. velutina*) (Fig. 17). The lateral wings are usually flabellate, sinuate, sericeous-velutine to velutine, and might vary on the angle of insertion in the upper or lower part of the nut (Fig. 17). The nuts are always ovoid, smooth, and densely sericeous-velutine to velutine (Fig. 17). The areole is the insertion of the mericarp into the floral receptacle, and might vary in shape from narrow to wide-elliptic (Fig. 17).

Seed and Embryo:—The seed in *Amorimia* is usually ovoid and show a smooth testa (rugose in *A. tumida*) (Fig. 18). The embryos are consistently ovoid, showing folded cotyledons (Fig. 18). We noticed that most species show preserved seeds even in herbarium specimens from the 70's (i.e. *A. amazonica*). It is possible that these seeds are still viable, making it possible to perform a study on chromosome numbers in the genus. *Amorimia* is the only Neotropical genus of the Malpighioid clade with unknown chromosome numbers (pers. obs.).

Key to the subgenera of *Amorimia*

1. Sepals abaxially glabrous, petals obovate to spatulate, base cuneate, claws plane, styles uncinated at apex, pollen grain spherical................................ *Amorimia* subg. *Uncina*

1. Sepals abaxially pubescent, petals elliptic, base truncate to hastate, claws canaliculate, styles truncate at apex, acuminate to rounded, pollen grain polygonal ……………..…………………………………………….. *Amorimia* subg. *Amorimia*

1. *Amorimia* W.R.Anderson subg. ***Amorimia*** (2006: 176). Type:—*Amorimia rigida*.

Differs from *A.* sub. *Uncina* R.F.Almeida by its stipules triangular; bracteoles concave; sepals adaxially pubescent; petals elliptic, base truncate to hastate, adaxially entirely to distally pubescent, claws canaliculate; anthers always pubescent (at base, connective and/or apex); styles with apex truncate, acuminate to rounded; pollen grains polygonal; samaras with dorsal wing usually confluent with lateral wings at base.

Notes:—This subgenus includes eight species (*A. andersonii, A. candidae, A. coriacea, A. exotropica, A. maritima, A. pellegrinii,* A. *rigida*, and *A. velutina*) mostly restricted to SDTF to Rainforests from Eastern South America (Fig. 19).

Key to the species of *Amorimia* subg. *Amorimia*

1. Leaves lanceolate elliptic to narrowly elliptic, sparsely velutine to glabrous at age, with 8–16 pairs of secondary veins; bracts and bracteoles deflexed, bracteoles inserted below apex of peduncle; sepals erect with revolute apex at anthesis, glands turning ocher, filaments pubescent, styles uncinated at apex; samaras with dorsal wing depressed ovate; Atlantic Forest Inselbergs from southern state of Bahia.. ***A. andersonii***

1. Leaves ovate to elliptic to widely elliptic to orbicular, sericeous-velutine to glabrous at age, with 8 or fewer pairs of secondary veins; bracts and bracteoles parallel, bracteoles inserted at apex of peduncle; sepals appressed to the androecium with straight apex at anthesis, glands turning brown or red, petals adaxially proximally glabrous, filaments glabrous, styles truncate at apex; samaras with dorsal wing obtrapezoidal or triangular; Caatinga, Cerrado and Atlantic Forest domains....................................... 2

2. Petals turning red at post-anthesis, posterior petal 2-glandular at base of limb; samaras with dorsal wing obtrapezoidal with rounded angles; Caatinga from central Bahia state.. ***A. candidae***

2. Petals turning orange at post-anthesis, posterior petal eglandular; samaras with dorsal wing triangular or obtrapezoidal bearing a projection at apex................................... 3

3. Leaves with a pair of glands near margin or near base; claw of the posterior petal up to 1 mm long; stamens opposite the anterior sepal, posterior-lateral sepals and posterior petal longer than those opposite lateral petals; Atlantic Forest from states of Bahia and Minas Gerais... ***A. rigida***

3. Leaves with a pair of glands near or at base; claw of the posterior petal more than 1 mm long; stamens opposite petals longer than those opposite sepals... 4

4. Claw of the posterior petal larger than 0.5 mm wide, lateral petals patent at anthesis, anthers pubescent at apex, connectives and base; samaras with dorsal wing triangular; Caatinga from Northeastern Brazil.. ***A. pellegrinii***

4. Claw of the posterior petal up to 0.5 mm wide, lateral petals reflexed at anthesis, anthers pubescent only at base; samaras with dorsal wing obtrapezoidal; SDTF and Rainforests... 5

5. Leaves conduplicate; peduncles exceeding bracts at anthesis; sepal glands turning brown at post-anthesis, anterior-lateral petals divergent; samaras with dorsal wing bearing an aciculate projection at apex; restinga from state of Rio de Janeiro.. ***A. coriacea***

5. Leaves plane; peduncles not exceeding bracts at anthesis; sepal glands turning red at post-anthesis.. 6

6. Leaves bullate; anterior-lateral petals overlapping; samaras with dorsal wing bearing two aciculate projections at apex; SDTF from states of Bahia, Goiás, and Minas Gerais.. ***A. velutina***

6. Leaves not bullate; anterior-lateral petals divergent; samaras with dorsal wing bearing a reduced single aciculate projection at apex; Rainforests along coastal Brazil... 7

7. Leaves ovate, elliptic to lanceolate, apex acuminate; styles glabrous; samaras bearing lateral wings always free; Atlantic Forest from Argentina, and Brazil (states of Paraná, Rio Grande do Sul, Santa Catarina, São Paulo)...................................... ***A. exotropica***

7. Leaves elliptic to obovate, apex acute; styles pubescent at base; samaras bearing lateral wings frequently fused (sometimes free); Atlantic Forest from states of Bahia, Espírito Santo and Rio de Janeiro.. ***A. maritima***

1.1. *Amorimia andersonii* R.F.Almeida (in Almeida *et al.* 2016: 4). Holotype:—BRAZIL. Bahia: Mun. Itamarajú, Serra ao lado do Morro do Pescoço, entrando pela Fazenda Novo Horizonte e passando pela propriedade do Sr. Ailton, área rochosa no alto da serra, 16 February 2014, fl., *L.C. Marinho, A.M.A. Amorim, R. Goldenberg & L. Daneu* 654 (CEPEC!; isotypes: HUEFS!, P!, RB!). Fig. 20, 22.

Woody vines to scandent shrubs; branches smooth, sparsely lenticelate, lenticels inconspicuous, sparsely velutine to glabrous at age; stipules 0.4–0.6 mm long, triangular, glabrous, interpetiolar on branches, epipetiolar on inflorescences, deciduous. *Leaves* subopposite, not reduced in inflorescences; petioles 6.5–8 mm long, canaliculate, sparsely sericeous-velutine to glabrous at age, eglandular at apex; leaf blades 5.15–11.5 × 1.6–4.3 cm, plane, not bullate, lanceolate to elliptic to narrow-elliptic, base cuneate to attenuate, margin revolute, apex acute, adaxially glabrous, abaxially sparsely velutine to glabrous, 1 pair of glands, 0.6–0.7 mm diam., near base or up to 0.8–0.9 mm of margins; midvein adaxially impress, abaxially prominent, 10–16 pairs of secondary veins, arching 60–64°, subopposite to alternate, adaxially impress, abaxially prominent, reticulum adaxially impressed and inconspicuous, abaxially prominent and conspicuous. *Thyrses (pseudoracemes)*, axillary; main axis 9.4–15.2 cm long, cylindrical, smooth, velutine; cincinni 20–40, 1-flowered, proximally spirally alternate, distally decussate; reduced leaves absent; bracts 3.5–5 × 1–1.2 mm, lanceolate, plane, subsessile, deflexed to the peduncle, 1 pair of marginal glands near base, both sides minute velutine; peduncle 5–8 × 1–1.3 mm, cylindrical, velutine; bracteoles 1.5–2.5 × 1.0–1.2 mm, elliptic, concave, sessile, inserted 0.5–2 mm below the apex of peduncles, opposite to subopposite, reflexed to the peduncle, 1–2 glands near base, both sides velutine. *Flowers* 13–14 mm diam. at anthesis; floral buds 5–6 × 4–5 mm at anthesis; pedicels 6–7.5 × 1.5–1.7 mm, cylindrical, velutine. *Sepals* 0.5–1 × 0.5 mm, narrowly oblong, not appressed to the androecium, apex acute, obtuse to rounded, revolute at anthesis, both sides sericeous-velutine; glands yellow turning ocher at age, 1–1.2 × 0.3–0.5 mm. *Petals* bright yellow, not turning darker at age, margin sinuate, anterior-lateral petals overlapping; lateral petals patent at anthesis, limb 2.4–3.4 × 1–1.2 mm, wide elliptic, base truncate, adaxially entirely velutine, abaxially sericeous-velutine; claws 0.5–0.8 × 0.2–0.3 mm, plane, adaxially velutine, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 1.4–1.5 × 1.2–1.3 mm, wide elliptic, base cuneate, eglandular, adaxially velutine, abaxially sericeous-velutine; claw 1–1.2 × 0.3–0.4 mm, plane, adaxially velutine, abaxially sericeous-velutine. *Stamens* 10, those opposite petals shorter than those opposite sepals, except for the one opposite to the anterior sepal which is shorter than others; filaments 1–1.6 × 0.4–0.6 mm, connate 0.4–0.5 mm long at base, sericeous at apex; anthers heteromorphic, recurved, with a glandular connective, 0.8–1 × 0.4–0.6 mm, reflexed at anthesis, base, connective and apex pubescent. *Ovary* 1–1.1 × 0.9–1 mm, each carpel with primordial lateral and dorsal wings, sericeous-velutine; styles 3, cylindrical at base, flattened and curved at apex, parallel at base, divergent at middle, apex truncate with uncinated angle, sericeous-velutine at base, glabrous at middle and apex, anterior style 1.2–1.4 mm long, posterior styles 1.4–1.6 mm long; stigma lateral, discoid. *Samaras* (immature) green in vivo; dorsal wing ca. 6.3 × 1.5 mm, depressed ovate, margin entire, plane, velutine on both sides; lateral wings 8–7.2 × 4–17.9 mm, flabelliform, margin entire, sinuate, upper angle 58°, lower angle 63° from the nut, both sides velutine to glabrous; nut ca. 1.3 × 0.7 mm, ellipsoid, velutine; areole ca. 1 × 0.5 mm. *Seeds* not seen.

Specimens analyzed:—BRAZIL. Bahia: Mun. Itamaraju, Morro do Pescoço, ca. 15 km da entrada da cidade, 11 February 2007, fl., *Amorim 6856* (CEPEC); *loc. cit.*, 16 February 2014, fl., *Marinho 676* (CEPEC).

Distribution, habitat and phenology:—*Amorimia andersonii* is known only from Semi-deciduous forests associated to rocky outcrops in Southern state of Bahia (Fig. 19), flowering in February.

Conservation status:—*Amorimia andersonii* is known from only three collections from Semi-deciduous Forests, associated to rocky outcrops within the Atlantic Forest of southern Bahia. Despite our efforts to recollect this species in December 2015, no individuals were found at Pedra do Pescoço, its type locality. Thus, this species should be regarded as Critically Endangered [CR, A3b+B1ab(v)+C2a(i, ii)+D1+E], due to its EOO being about 4.678 km² and continually declining habitat quality.

Etymology:—The epithet honors the North American botanist Dr. William Russel Anderson (*1942–2013†), colleague, and longtime contributor in the studies of Neotropical Malpighiaceae.

Taxonomic notes:—*Amorimia andersonii* is similar to *A. pellegrinii* and *A. rigida*, due to their plane leaf-blades with a pair of glands near base or near margin, patent lateral petals at anthesis, eglandular posterior petals, and anthers pubescent at apex, connectives and base. However, *A. andersonii* can be easily differentiated from *A. pellegrinii* and *A. rigida* by its non-bullate, velutine leaf-blades, with 10–16 pairs of right-angled secondary veins, reflexed bracteoles, sepals erect at anthesis, petal claws adaxially velutine, overlapping anterior-lateral petals, filaments pubescent at apex, uncinate style apex, and samaras with depressed ovate dorsal wings.

1.2. *Amorimia candidae* R.F.Almeida (in Almeida *et al.* 2016: 8). Holotype:—BRAZIL. Bahia: Mun. Itaberaba, margens da rodovia BR–242, 16 July 2013, fl. fr., *R.F. Almeida, M. Alves, L.M.M. Conti, E.C. Chagas & C.F. Hall 594* (HUEFS!; isotypes: CEPEC!, MICH!, NY!, P!, RB!, US!). Fig. 21–22.

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels brown, sparsely sericeous-velutine to glabrous at age; stipules 0.4–0.5 mm long, triangular, glabrous, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* opposite, reduced in inflorescences; petioles 2–5 mm long, canaliculated, sparsely sericeous-velutine to glabrous, eglandular at apex; leaf blades 3–7.7 × 1.8–4.4 cm, conduplicate, not bullate, ovate, widely elliptic to orbicular (frequently when associated to the inflorescence), base cordate to rounded, margin revolute, apex mucronate, rounded to retuse, both sides glabrous, 1–2 pairs of glands near base or up to 3 mm of margins on the distal half, 0.4–0.5 mm diam.; midvein adaxially impressed, abaxially prominent, 5–7 pairs of secondary veins, adaxially impressed, abaxially reddish, prominent, arching 22–24°, subopposite to alternate, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, axillary; main axis 5–24 cm long, cylindrical, striated, sericeous–velutine; cincinni 28–32, 1-flowered, decussate; reduced leaves orbicular, apex rounded to mucronate; bracts 3.5–4 × 1.5–2 mm, ovate to elliptic (sometimes leaf-like), plane, sessile, parallel to the peduncle, 1 pair of glands at base, both sides sericeous-velutine; peduncle 1–1.5 × 0.9–1 mm, cylindrical, sericeous-velutine; bracteoles 1.5–2 × 1.4–1.5 mm, elliptic, concave, inserted at the apex of peduncles, opposite, parallel to the pedicel, eglandular, both sides sericeous-velutine. *Flowers* 9–11 mm diam. at anthesis; floral buds 3.5–4.5 × 3.5–4 mm at anthesis; pedicels 3.5–4 × 0.9–1 mm, cylindrical, sericeous-velutine. *Sepals* 1.8–2 × 1–1.5 mm, ovate, appressed to the androecium, apex obtuse to rounded, straight at anthesis, both sides sericeous-velutine; glands yellow turning orange to dark-orange at age, 1.8–2 × 0.7–0.8 mm. *Petals* golden yellow turning red at age, margin sinuate, anterior-lateral petals overlapping at anthesis; lateral petals patent at anthesis, limb 4.5–5 × 3–3.5 mm, elliptic to obovate, truncate at base, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claws 1.4–1.5 × 0.4–0.5 mm, canaliculate, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 4–4.2 × 3.4–3.5 mm, elliptic, truncate at base, 1-pair of red glands at base, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claw 2.3–2.5 × 0.70–0.75 mm, canaliculated, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite petals longer than those opposite sepals; filaments 2.25–2.5 × 0.25–0.5 mm, connate 0.9–1 mm long at base, glabrous; anthers heteromorphic, those opposite sepals elliptic, those opposite petals obovate, straight, with a glandular connective, 1–1.25 × 0.5–0.6 mm, reflexed at anthesis, base, connective and apex pubescent. *Ovary* 1.3–1.5 × 1.3–1.5 mm, each carpel with primordial dorsal and lateral wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, divergent at middle, apex truncate with apiculate angle, rarely geniculate, sericeous-velutine at base, glabrous at middle and apex, anterior style 1.1–1.25 mm long, posterior styles 1.4–1.5 mm long; stigma lateral, discoid. *Samaras* whitish to reddish *in vivo*; dorsal wing 6–7 × 3–3.25 mm, obtrapezoidal with rounded angles, margin entire, sinuate, both sides sericeous-velutine; lateral wings 1.7–2.5 × 1.6–2 cm, flabellate, margin erose, sinuate, upper angle 20°, lower angle 25° from the nut, both sides sparsely sericeous-velutine; nut 5–5.5 × 2.5–3 mm, ovoid, sericeous-velutine; areole 4.5–5 × 2–2.2 mm, elliptic. *Seeds* 3.6–4 × 2–2.25 mm, testa rugose; embryo ovoid, cotyledons folded.

Specimens analyzed:—BRAZIL. **Bahia:** Mun. Ibiquera, January 1980, fr., *Pinto 05-1980* (CEPEC, FLOR, HRB, MG); Mun. Itaberaba, pastagem, S12°28’ W40°18’, 15 October. 2002, fl., *Moura 3* (HUEFS); *loc. cit.*, 8 February 1979, fl., *Costa 2124* (ALCB); *loc. cit.*, Fazenda Morro da Pedra, 15 July 1982, fl., *Bastos 266* (BAH, CEPEC, HUEFS, IPA); *loc. cit.*, UEP/Paraguaçú, 6 August 1988, fr., *Bastos 818* (BAH); *loc. cit.*, 11 March 1982, fl., *Ferreira 233* (BAH, MO); *loc. cit.* Fazenda Itaberaba, morro de Itaberaba, sítio com pinturas, S12°29’57’’ W40°04’56’’, 5 June 2005, fr., *Melo 3936* (CEPEC, HUEFS); *loc. cit.*, margens do Paraguaçu, June 1973, fl., *Pinto s.n.* (ALCB1929); Mun. Milagres, caatinga arbustiva, September 2009, fl., *Brito 23* (HUEFS); *loc. cit.*, caatinga arbustiva, December 2009, fl., *Brito 28* (HUEFS); *loc. cit.*, BR-116, embaixo da ponte, 19 August 2015, fr., *Aona 4208* (HUEFS, HURB); Mun. Rafael Jambeiro, Fazenda Coqueiro Rosarinho, km 29 road BR-242, 2 July 2002, fl., *Santos s.n.* (CEPEC, HUEFS64423); *loc. cit.*, rio do Peixe, km 22 da BR-242, 11 May 1975, fl., *Barroso s.n.* (ALCB1930); *loc. cit.*, km 30 da BR-242, 11 May 1975, fl., *Barroso s.n.* (ALCB1937); Mun. Santa Terezinha, Serra da Jibóia, S12°47’46’’ W39°31’37’’, 303 m, 9 October. 2010, fl., *Melo 8557* (HUEFS). *loc. cit.*, S12°47’46’’ W39°31’37’’, 303 m, 9 October 2010, fl., *Melo 8563* (HUEFS); *loc. cit.*, May 1958, fl., *Pinto s.n.* (ALCB17936); *loc. cit.*, Serra do Leão, Fazenda Limeira, 12 February 2016, fr., *Costa 1630* (HURB);

Distribution, habitat and phenology:—*Amorimia candidae* is known only from SDTF within Caatinga vegetation in Bahia state, Brazil (Fig. 19). Flowering from July to December. Fruiting from June to July.

Conservation status:—*Amorimia candidae* is represented by only few records restricted to five municipalities, AOO of approximately 20.000 km² in anthropomorphically modified Caatinga vegetation. Thus, this species should be regarded as Critically Endangered [CR, A2ab+B1b(ii, iii, v)+C2a(i)+D2+E], due to its EOO being less than 100 km² and continually declining habitat quality.

Etymology:—The epithet honors the Brazilian botanist Dr. Maria Candida Henrique Mamede (b. 1956), colleague, former advisor from the authors and longtime contributor in the studies of Brazilian Malpighiaceae.

Taxonomy notes:—*Amorimia candidae* is similar to *A. pellegrinii* and *A. rigida*, due to its leaf-blades sericeous-velutine, with 4–8 pairs of secondary veins, parallel bracteoles, sepals appressed to the androecium, with straight apex at anthesis, elaiophores turning brown at post-anthesis, petal claws adaxially glabrous, patent lateral petals at anthesis, filaments glabrous, anthers pubescent at apex, connectives and base, and styles truncate at apex. Nonetheless, *A. candidae* is can be easily differentiated by its conduplicate, non-bullate leaf-blades, petals turning red at post-anthesis, posterior petal 2-glandular at base of limbs, anterior-lateral petals overlapping, and samaras with obtrapezoidal dorsal wings, with rounded angles.

1.3. *Amorimia coriacea* (Griseb.) R.F.Almeida (in Almeida *et al.* 2006: 13). Basionym:—*Mascagnia coriacea* Grisebach (1858: 92) ≡ *Mascagnia rigida* subsp. *coriacea* (Griseb.) Niedenzu (1908: 19). Lectotype (designated by Anderson 2006):—BRAZIL. Rio de Janeiro: Woods of Tijuca, *G. Gardner 5394* (K barcode 000427423!; Isolectotype: BM barcode 000611548!). Fig. 23, 25.

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels blackish, sparsely sericeous-velutine to glabrous at age; stipules 0.5–0.6 mm long, triangular, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* decussate, reduced in inflorescences; petioles 3–5 mm long, canaliculated, sparsely sericeous-velutine to glabrous at age, eglandular to 2-glandular at apex; leaf blades 3–9 × 2–4.5 cm, conduplicate, not bullate, elliptic to ovate, base cuneate, margin plane, apex acute to acuminate, both sides glabrous, eglandular to 1–2 pairs of glands, 0.5–1 mm diam., at base or distally, up to ca. 3 mm from the margin; midvein adaxially impress, abaxially prominent, secondary veins 5–7 pairs, arching 40–50°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, terminal; main axis 9–19 cm long, cylindrical, smooth, sericeous-velutine; cincinni 25–40, 1–flowered, alternate to decussate; reduced leaves elliptic, apex acute; bracts 1.9–2.1 × 1.4–1.5 mm, ovate, plane, sessile, parallel to the peduncle, 1 pair of glands at base, both sides sericeous-velutine; peduncle 4–5 × 0.5–0.7 mm, cylindrical, sericeous-velutine; bracteoles 1.7–2 × 1.5–1.75 mm, wide-elliptic, concave, inserted at the apex of the peduncle, parallel to pedicel, 1–2 pairs of glands at base, both sides sericeous-velutine. *Flowers* 9–12 mm diam. at anthesis; floral buds 3–4 × 3.5–4.5 mm at anthesis; pedicels 4.5–5.5 × 0.4–0.5 mm, cylindrical, sericeous-velutine. *Sepals* 1.3–1.5 × 1–1.1 mm, ovate, appressed to the androecium, apex obtuse to rounded, straight to revolute at anthesis, both sides sericeous-velutine; glands yellow turning orange to reddish at age, 1.5–2 × 0.75–1 mm. *Petals* yellow turning orange to red at age, margin sinuate, anterior-lateral petals not overlapping at anthesis; lateral petals reflexed at anthesis, limb 2.5–4 × 1.5–2 mm, elliptic, base hastate, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claws 0.67–0.75 × 0.3–0.4 mm, plane, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 1.5–1.7 × 1.4–1.5 mm, elliptic, base hastate, eglandular, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claw 1.4–1.5 × 0.4–0.5 mm, plane, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite petals shorter than those opposite sepals; filaments 1–1.25 × 0.3–0.4 mm, connate 0.15–0.2 mm long at base, glabrous; anthers heteromorphic, those opposite sepals shorter, those opposite petals longer, straight, with a glandular connective, 1–1.25 × 0.5–0.75 mm, reflexed in anthesis, base pubescent, connective and apex glabrous. *Ovary* 1–1.25 × 1–1.25 mm, each carpel with primordial dorsal and lateral wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, divergent at middle, apex truncate with obtuse angle, glabrous at base, middle and apex, anterior style 1–1.25 mm long, curved, posterior styles 1.3–1.5 mm long; stigma lateral, crateriform. *Samaras* green to ocher in vivo; dorsal wing 7.5–8 × 2.5–3.5 mm, depressed ovate with 1 triangular projection at apex, margin entire, sinuate, both sides sericeous-velutine; lateral wings 1.7–2 × 1–1.3 cm, flabellate, margin erose, sinuate, upper angle 50–55°, lower angle 60–65° from the nut, both sides sericeous-velutine; nut 5.2–5.8 × 2.5–3 mm, orbicular, sericeous-velutine; areole 6–6.5 × 4.5–5 mm, ellipsoid to orbicular. *Seeds* 4.5–5 × 3.9–4 mm, testa smooth; embryo ovoid, cotyledons folded.

Specimens analyzed:—BRAZIL. Rio de Janeiro: Mun. Armação de Búzios, Área de Proteção Ambiental da Azeda, S22°44’44’’ W41°52’09’’, 20 April 2004, fr., *Dantas 610* (HUEFS, RB); *loc. cit.*, Azeda, S22°44’40’’ W41°52’50’’, 4 April 2004, fr., *Dantas 283* (CEPEC, HUEFS, RB); *loc. cit.*, José Gonçalves, S22°48’00’’ W41°55’00’’, 20 February 2004, fl., *Dantas 176* (HUEFS, RB); *loc. cit.*, Ponta Zapata, S22°43’00’’ W41°57’00’’, 16 February 2004, fl. fr., *Dantas 104* (CEPEC, HUEFS, RB); *loc. cit.*, Ponta do Olho do Boi, 19 January 2000, fl., *Fernandes 403* (CEPEC, HUEFS, RB). Mun. Arraial do Cabo, Morro do Miranda, 17 January 2000, fl., *Farney 3963* (CEPEC, HUEFS, RB). Mun. Cabo Frio, Morro da Gamboa, próximo ao Bairro da Gamboa, S22°53’ W42°01’, 14 March 2004, fl. fr., *Jardim 4228* (CEPEC, HUEFS); *loc. cit.*, 20 January 1967, fl., *Sucre 1421* (CEPEC, RB, UB); *loc. cit.*, 18 December 1996, fl., *Farag 309* (CEPEC, HUEFS, RB); *loc. cit.*, morro do Mico, 29 March 2007, fl., *Farney 4650* (CEPEC, HUEFS, RB); *loc. cit.*, estrada nova para Armação de Búzios, Baia Formosa, entrada para o Capão da Pedra do Sr. Henrique Massala, 6 May 1987, fl. fr., *Lima 2877* (CEPEC, HUEFS, RB); *loc. cit.*, Peró, praia das Conchas, 14 January 2016, fl. fr., *Almeida & Pellegrini 615* (CEPEC, HUEFS, RB). Mun. Niterói, Itaipuaçu, Pico Alto Moirão, 17 June 1985, fr., *Andreata 708* (CEPEC, HUEFS, RB); *loc. cit.*, Pico Alto Moirão, 14 January 1982, fl., *Andreata 373* (CEPEC, HUEFS, RB); *loc. cit.*, Jurujuba, APA Morro do Morcego, Morro do Pico, S22°57’92,3’’ W43°00’49,7’’, 66 m, 15 May 2013, fr., *Barros 4909* (RB); Mun. Rio das Ostras, praia, 4 April 1971, fl., *Krieger 10298* (CEPEC, CESJ, HUEFS, MBM). Mun. Rio de Janeiro, Mundo Novo, Botafogo, June 1921, fl., *Kuhlmann 3534* (HUEFS, RB); *loc. cit.*, *s.dat.*, fl., *Pohl 5780* (W); *loc. cit.*, *s.dat.*, fl., *Schuch 5721* (W68979, W68980).

Distribution, habitat and phenology:—*Amorimia coriacea* is known only from restingas (sand dunes vegetation) and rocky outcrops along the coast of state of Rio de Janeiro (Fig. 19). Flowering from January to June, and fruiting from February to June.

Conservation status:—*Amorimia coriacea* is represented by records restricted to an EOO of approximately 3,620.000 km² and AOO of 32.000 km² in anthropomorphically modified restinga vegetation in the state of Rio de Janeiro, Brazil. Thus, it should be regarded as Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2], due to its range of distribution being less than 100 km2 and continually declining habitat quality.

Etymology:—The epithet probably makes reference to the coriaceous texture of its leaves.

Nomenclatural notes:—*Mascagnia coriacea* was lectotipified by Anderson (2006) based on two sheets from BM and K. However, the type locality from the lectotype at K is cited only as Woods "Tejuco", Brazil. After some research, the author might have mistakenly assumed that the type locality was "Tejuco" (Arraial do Tejuco), a locality currently renamed to Diamantina municipality, in state of Minas Gerais. He probably was lead to this assumption based on the type locality of *Mascagnia rigida*, which is somewhere near Northern Minas Gerais (Jequitinhonha municipality). Nonetheless, after analyzing the label on the isolectotype at BM, we observed that it clearly states Woods Tejuca, state of Rio de Janeiro as the type locality. "Tejuca" is a misspelling of the tupi-guarani word "Tijuca", meaning swampy area. Woods of Tijuca currently comprehends the area of the Tijuca National Park in the municipality of Rio de Janeiro, state of Rio de Janeiro.

Taxonomic notes:—*Amorimia coriacea* is similar to *A. maritima* and *A. rigida* due to its leaf-blades with 5–8 pairs of secondary veins, parallel bracts and bracteoles, sepals apressed to the androecium at anthesis, petal claws adaxially glabrous, posterior petals eglandular, anterior-lateral petals divergent, and styles truncate at apex. Nevertheless, *A. coriacea* can be differentiated from *A. maritima* and *A. rigida* by its conduplicate leaf-blades, peduncles exceeding the bracts at anthesis, lateral petals reflexed at anthesis, filaments opposite sepals longer than those opposite petals, anthers pubescent only at base, and samaras with dorsal wing obtrapezoidal bearing an aciculate projection at apex.

1.4. ***Amorimia exotropica*** (Griseb.) Anderson (2006: 180). Basionym:—*Mascagnia exotropica* Grisebach (1858: 93). Lectotype (designated by Anderson 2006):—BRAZIL. Rio Grande do Sul: near Mun. Porto Alegre, fl., *H. Fox 19* (K barcode 000427411!). Fig. 24–25.

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels whitish, sparsely sericeous-velutine to glabrous at age; stipules 0.7–1.2 mm long, triangular, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* opposite, reduced in inflorescences; petioles 8–15 mm long, canaliculated, sparsely sericeous-velutine to glabrous at age, eglandular; leaf blades 5–11.5 × 2–7 cm, plane, not bullate, elliptic to ovate, base rounded to obtuse, margin plane, apex acuminate, both sides glabrous, 1 pair of glands at base, 0.25–0.5 mm diam., 1–3 pairs of glands up to 1.5–4.0 mm of margins; midvein adaxially impressed, abaxially prominent, 11 pairs of secondary veins, arching 15°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, axillary; main axis 6–18 cm long, flattened, irregularly longitudinally costate, sericeous-velutine; cincinni 26–42, 1-flowered, spirally alternate to decussate; reduced leaves elliptic, apex acute; bracts 3–3.5 × 1–1.5 mm, ovate to lanceolate, plane, petiolate, parallel to the peduncle, 1–3 pairs of marginal glands, both sides sericeous-velutine; peduncle 2.5–4 × 0.4–0.5 mm, cylindrical, sericeous-velutine; bracteoles 2–3 × 0.5–1 mm, elliptic to lanceolate, concave, opposite, inserted bellow the apex of peduncles, spreading to the pedicel, eglandular to 1 pair of marginal glands, both sides sericeous-velutine. *Flowers* 1.2–1.3 mm diam. at anthesis; floral buds 3.5–4 × 3–3.5 mm at anthesis; pedicels 3.5–7.5 × 0.5–0.6 mm, cylindrical, sericeous-velutine. *Sepals* 1–1.5 × 0.5–0.75 mm, ovate, appressed to the androecium, apex obtuse to rounded, straight to revolute at anthesis, adaxially sericeous-velutine, abaxially velutine; glands yellow turning orange or red, 2–2.5 × 1–1.2 mm. *Petals* yellow turning orange, margin sinuate, anterior-lateral petals not overlapping; lateral petals patent at anthesis, limb 3.5–4.5 × 2–2.5 mm, elliptic, base truncate, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claws 1.4–1.5 × 0.45–0.5 mm, plane, adaxially glabrous, abaxially velutine; posterior petal erect at anthesis, limb 3.5–4 × 2.5–3 mm, elliptic, base truncate, eglandular, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claw 1.9–2 × 0.5–0.6 mm, plane, adaxially glabrous, abaxially velutine. *Stamens* 10, those opposite petals shorter than those opposite sepals; filaments 1.1–2.5 × 0.25 mm, connate ca. 0.5 mm long at base, glabrous; anthers monomorphic, straight, with a glandular connective, 0.75–1 × 0.48–0.5 mm, reflexed in anthesis, base, connective and apex pubescent. *Ovary* 1–1.4 × 1–1.4 mm, each carpel with primordial dorsal and lateral wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, divergent at middle, apex rounded, base sericeous-velutine, middle and apex glabrous, anterior style 1.25–1.3 mm long, posterior styles 1.45–1.5 mm long;

stigma lateral, crateriform. *Samaras* green to ocher *in vivo*; dorsal wing 8–10 × 4.5–5 mm, trapezoidal with right angles and a subulate projection at apex, margin entire, sinuate, both sides sericeous-velutine; lateral wings 1.8–2 × 1.3–1.5 cm, flabelliform, margin entire, sinuate, upper angle 35°, lower angle 55° from the nut, both sides sericeous-velutine; nut 7.5–8 × 3.5–3.8mm, ovoid, sericeous-velutine; areole 7.5–8 × 3.3–3.5 mm, ovate. *Seeds* 6–6.5 × 3.8–4 mm, testa smooth; embryo ovoid, cotyledons folded.

Specimens analyzed:—ARGENTINA. Missiones: Dep. Iguazú, Parque Nacional Iguazú, 16 December 1991, fl., *Vanni 2903* (CTES); *loc. cit.*, Cataratas, senderos superiors, 8 December 1988, fl., *Guaglianone 2128* (F, SI); *loc. cit.*, Puerto Bemberg, 15 March 1945, fl., *Hayward s.n.* (LIL, NY). **BRAZIL. Paraná:** *sin. loc.*, *s.dat.*, fl., *Dusén 14093* (NY); Mun. Adrianópolis, Colônia Tatupeva, 19 April 1995, fr., *Cordeiro 1217* (CEPEC, MBM); Mun. Bocaiuva do Sul, Descampado, 22 April 1957, fl., *Hatschbach 3780* (MBM); Mun. Foz do Iguaçu, Porto Meira, em frente ao portão de entrada do porto, 8 June 2013, fr., *Almeida 549* (FUEL, HUEFS, MBM); *loc. cit.*, 10 March 1980, fl., *Buttura 567* (MBM); *loc. cit.*, Parque Nacional do Iguaçu, rio Iguaçu, S25°36’50,7’’ W54°23’36,3’’, 193 m, 16 October, 2015, fl. fr., *Caxambu 7035* (HCF); Mun. Guaraqueçaba, Serrinha, 30-50 m, 8 March 1968, fl., *Hatschbach 18685* (MBM, MO); *loc. cit.*, Tagaçaba de Cima, 25 April 1980, fl., *Hatschbach 42983* (MBM); Mun. Morretes, Barra do Passa 7, rio Nhundiaquara, 16 January 1976, fl., *Hatschbach 37957* (MBM, MO, P); *loc. cit.*, Colônia Floresta, 23 January 1969, fl. fr., *Hatschbach 20871* (MBM); Mun. Paranaguá, Ilha do Mel, Praia Grande, Morro do Meio, 24 April 1987, fl. fr., *Britez s.n.* (UPCB32213); Mun. Rio Branco do Sul, caverna de Bromado, 25 May 1996, fr., *Tiepolo 632* (EFC). **Rio Grande do Sul:** Mun. Dois Irmãos, December 1983, fl., *Neves 332* (HAS); Mun. Gravataí, Morungava, 9 December 1983, fl., *Mentz s.n.* (ICN95118); *loc. cit.*, 27 March 1983, fr., *Schenkel s.n.* (ICN95120); Mun. Guaíba, Morro José Lutzenberger, 12 September 2013, fr., *Grings 1774* (ICN); Mun. Nova Petrópolis, Panelão, *s.dat.*, fl., *Grings 1186* (ICN); *loc. cit.*, Bairro Joaneta, Margem sul da Serra Geral, 15 January 1990, fl., *Schlindwein 532* (MPUC, UFP); *loc. cit.*, Bairro Joaneta, Margem sul da Serra Geral, 4 January 1990, fl., *Schlindwein 534* (MPUC); Mun. Novo Hamburgo, Ferrabraz, 12 January 1949, fl., *Rambo 39952* (PACA); Mun. Osório, Lagoa dos Barros, encosta da serra, 19 December 1945, fl., *Schultz 463* (ICN, HAS); *loc. cit.*, 7 January 1965, fl., *Hagelund 3210* (ICN); *loc. cit.*, Maquiné, Estação Experimental Fitotécnica, January 1981, *Mattos 22457* (HAS); *loc. cit.*, Morro da Borússia, 23 February

2011, fl., *Durigon 570* (ICN); *loc. cit.*, 27 March 1982, fr., *Sobral s.n.* (MBM73963); Mun. Parecis, Monte Negro, 28 November 1945, fl. fr., *Sehnem 1390* (PACA); *loc. cit.*, 25 January 1946, fl., *Trieder 33074* (PACA); *loc. cit.*, 1 July 1952, fr., *Rambo 52768* (PACA); Mun. Parobé, morro do Pinhal, 3 April 1986, fl., *Ritter s.n.* (F2111927); Mun. Porto Alegre, morro da Glória, 17 May 2009, fr., *Grings 752* (HUCS); *loc. cit.*, Vila Conceição, 28 May 1949, fr., *Emrich s.n.* (PACA52618, PACA32867); *loc. cit.*, Montserrat, 25 January 1939, fl., *Emrich s.n.* (PACA26863, PACA30022); *loc. cit.*, Reserva Biológica do Lami, 1 January 2012, fl., *Silva-Filho s.n.* (MPUC17129); *loc. cit.*, Morro Santa Teresa, 29 April 1949, fr., *Rambo 41303* (L, PACA, W); *loc. cit.*, Belém Novo, 5 March 1944, fr., *Schultz 61* (ICN); *loc. cit.*, estrada da Ponta Grossa, 20 November 1972, fl., *Vianna s.n.* (ICN9660, U1367689);9 Mun. São Francisco de Paula, a 26 km da cidade, caminho a Taquara, 29 January 1994, fl. fr., *Krapovickas 44714* (CTES, U); *loc. cit.*, Fazenda 3 Cachoeiras, January 1999, fl., *Senna 135* (HAS); *loc. cit.*, Taquara, a 10 km de São Francisco de Paula, March 1981, fr., *Mattos 22640* (HAS); *loc. cit.*, José Velho, 780 m, 21 January 2001, fl., *Wasum 914* (HUCS, MBM); Mun. Torres, Morro Azul, 18 January 1979, fl., *Waechter 1176* (ICN); Mun. Viamão, praia do cego, 1 June 1968, fr., *Irgang 384* (ICN). **Santa Catarina:** Mun. Itapema, September 1897, fr. *Schwacke 12939* (RB); *loc. cit.*, Praia do Cabeço, 10 m, 11 April 2001, fl., *Cervi 8134* (MBM); Mun. Laguna, Morro Nossa Senhora da Glória, 24 January 1984, fl., *Krapovickas 39391* (CTES, MBM); Mun. Penha, Morro sobre el mar, coordenadas, 16 January 1985, fl., *Krapovickas 39599* (CTES, MO); Mun. Praia Grande, 25 March 2005, fl., *Marchett 155* (HUCS, MBM). **São Paulo:** Mun. Barra do Turvo, Rio do Turvo, 22 February 2009, fl., *Ribas 8101* (MBM); Mun. Eldorado, Fazenda Itaipava/Catre, S24°33’22,7’’ W48°06’18,5’’, 40 m, 27 March 2015, fr., *Caxambu 6011* (HCF); Mun. Iguape, Estação Ecológica Juréia-Itatins, Serra da Juréia, trilha do Imperador, 9 November 1993, fr., *Nicolau 1482* (SP); Mun. Peruíbe, Estação Ecológica Juréia-Itatins, Núcleo Guarau, Morro do Fernando, 27 January 2000, fl., *Cordeiro* 1997 (HUEFS, SP).

Distribution, habitat and phenology:—*Amorimia exotropica* is known to Semi-Deciduous Forests and Rainforests in Southern Brazil, Argentina, and probably Paraguay (Fig. 19). Flowering from November to February and fruiting from February to August.

Conservation status:—Despite possessing a wide EOO (ca. 307,263.546 km²), *A. exotropica* possesses a rather small AOO (ca. 16.000 km²). After extensive field trips, we were able to recollect *A. exotropica* in only one of the several visted localities. Most of the visited localities had been greatly affected by human activities, especially rice crops and urban development. Thus, *A. exotropica* should be regarded as Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2].

Etymology:—The epithet makes reference to its distribution out of the tropics.

Taxonomic notes:—*Amorimia exotropica* is similar to *A. coriacea* and *A. marítima* due to its elliptic to ovate, sericeous-velutine, non-bullate leaf-blades, concave bracteoles, sepals appressed to the androecium, petal claws adaxially glabrous, eglandular posterior petal, posterior petal as long as the lateral petals, and anterior-lateral petals divergent. However, *A. exotropica* can be differentiated by its leaf-blades with 11 pairs of secondaty veins, bracteoles subopposite and inserted below the apex of the peduncle, petal claws abaxially velutine, anthers pubescent at base, connective and apex, and style apex rounded.

1.5. ***Amorimia maritima*** (A.Juss.) Anderson (2006: 181). Basionym:—*Hiraea maritima* Jussieu (1840: 259) ≡ *Triopterys polycarpa* Salzm. *ex* Jussieu (1843: 562) *nom. illeg.* ≡ *Mascagnia rigida* subsp. *typica* Niedenzu (1908: 19) *nom. illeg.* Holotype:—BRAZIL. Bahia: in petrosis maritimis (rocky coast), *P. Salzmann s.n.* (G barcode 00352762!; isotypes: HAL barcode 0118194!, K barcode 000427424!, K barcode 000427425!, MO barcode 2155376!, MPU barcode 020107!, MPU barcode 020108!, MPU barcode 020109!, MPU barcode 020110!, MPU barcode 020111!, MPU barcode 020185!, P barcode 02429158!, P barcode 02429159!, P barcode 02429160!, P barcode 02429161!, W315362!). Fig. 26–27.

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels whitish, sparsely sericeous-velutine to glabrous age; stipules 0.5–0.6 mm long, triangular, interpetiolar on branches, epipetiolar on inflorescences, glabrous, persistent to deciduous. *Leaves* opposite to subopposite, reduced in inflorescences; petioles 7–17 mm long, canaliculate, sparsely sericeous-velutine to glabrous at age, eglandular to biglandular at apex; leaf blades 7–17.7 × 2.7–8.7 cm, plane, not bullate, elliptic to ovate, base cuneate, margin plane, apex acute to acuminate, both sides glabrous, 1–2 pairs of glands, 0.5–2 mm diam., near base or up to 4 mm of margins; midvein adaxially impressed, abaxially prominent, 6–8 pairs of secondary veins, arching 40°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, axillary; main axis 5–22.5 cm long, flattened, slightly costate, sericeous-velutine; cincinni 15–30, 1-flowered, alternate; reduced leaves elliptic, apex acute; bracts 2.5–3 × 1–2 mm, ovate to lanceolate, plane, sessile, parallel to the peduncle, 1–2 pairs of basal glands, both sides sericeous-velutine; peduncle 1.8–2 × 0.5–0.6 mm, cylindrical, sericeous-velutine; bracteoles 1.8–2.2 × 1.25–1.5 mm, elliptic to ovate, concave, inserted at the apex of peduncles, spreading to the pedicel, 1 pair of glands at base or middle, both sides sericeous-velutine. *Flowers* 1–1.2 mm diam. at anthesis; floral buds 3.5–4 × 2.8–3 mm at anthesis; pedicels 3–3.5 × 0.5–0.6 mm, cylindrical, sericeous velutine. *Sepals* 1.25–1.5 × 0.75–1 mm, ovate, appressed to the androecium, apex obtuse to rounded, straight to revolute at anthesis, both sides sericeous-velutine; glands yellow turning orange to reddish, 1.5–2.5 × 0.75–1 mm. *Petals* yellow turning red, margin sinuate, anterior-lateral petals not overlapping; lateral petals patent, limb 3.8–4 × 2–2.25 mm, elliptic, base truncate, adaxially sericeous-velutine distally, abaxially sericeous velutine; claws 1.25–1.5 × 0.25–0.30 mm, plane, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect, limb 4–4.3 × 2–2.2 mm, elliptic, base truncate, eglandular, adaxially sericeous-velutine distally, abaxially sericeous velutine; claw 2–2.2 × 0.5–0.54 mm, plane, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite petals longer than those opposite sepals; filaments 1.25–2 × 0.25–0.5 mm, connate ca. 0.5 mm at base, sericeous at apex; anthers heteromorphic, those opposite petals narrower than those opposite sepals, straight, with a glandular connective, 0.75–1.25 × 0.5–0.55 mm, reflexed in anthesis, pubescent at base and apex. *Ovary* 1–1.5 × 1–1.5 mm, each carpel with primordial dorsal and lateral wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, divergent at middle, apex truncate with obtuse angle, sericeous-velutine at base, glabrous at middle and apex, anterior style 1.5–2.0 mm long, curved, posterior styles 1.75–2.25 mm long, erect; stigma lateral, discoid. *Samaras* bright green turning reddish *in vivo*; dorsal wing 8–13 × 5–7 mm, trapezoidal with right angles and a subulate projection at apex, margin entire, sinuate, both sides sericeous-velutine; lateral wings 1.8–3.8 × 1.1–2.5 cm, flabelliform, margin erose, sinuate, upper angle 40–50°, lower angle 50–60° from the nut, both sides sericeous-velutine; nut 6–8.5 × 3–5 mm, orbicular, sericeous-velutine; areole 6–9.5 × 4–6.5 mm, ellipsoid to orbicular. *Seeds* 4.5–5 × 3–3.5 mm, testa rugose; embryo ovoid, cotyledons folded.

Specimens analyzed:—BRAZIL. Bahia: *sin. loc.*, *s.dat.*, fl., *Blanchet s.n.* (P04843525); *sin. loc.*, 1833, fl., *Blanchet 1660* (F, G); *sin. loc.*, 1834, fl., *Blanchet 1720* (3 ex F, 3 ex G); Mun. Barro Preto, estrada para Pedra Lascada, 12 km após a saída da cidade, 5 June 2013, fl., *Pace 350* (HUEFS, SPF); *loc. cit.*, Serra da Pedra Lascada, 13,7 km da cidade, entrada de acesso pela Fazenda São Miguel, S14°46’13’’ W39°12’10’, 600-900 m, 26 April 2004, fl., *Amorim 4102* (CEPEC); Mun. Candeias, Fazenda Mariza, May 2004, fl., *Reis s.n.* (CEPEC99176); Mun. Ilhéus, ramal que separa a Fazenda Alegrias do Campus da Universidade Estadual de Santa Cruz, 7 June 1995, fl., *Mattos Silva 3136* (ALCB, CEPEC, HUEFS, HUESC); *loc. cit.*, Castelo Novo, December 1821, fl., *Riedel 503* (K); *loc. cit.*, km 22 da rodovia Ilhéus-Itabuna (BR-415), Área do Centro de Pesquisas do Cacau, quadra D, 2 June 1982, fr., *Santos 21* (CEPEC); *loc. cit.*, 24 August 1991, fl., *Amorim 319* (CEPEC, NY); *loc. cit.*, 3 September 1998, fr., *Amorim 2483* (CEPEC, RB); Mun. Itabuna, rodovia BR-415, sentido Itabuna-Ibicaraí, ca. 5 km de Ferradas, margem da rodovia, S15°12'10" W39°27'40", fl., *Jardim 5350* (CEPEC); *loc. cit.*, saída para Uruçuca, 15 May 1968, fl., *Belém 3551* (IAN, NY); Mun. Jussari, RPPN Serra do Teimoso, S15°10’ W39°35’, fr., *Oliveira 751* (CEPEC, HUEFS); *loc. cit.*, Rodovia Jussari-Palmira, entrada ca. 7.5 km de Jussari, S15°09'16" W39°31'52", 641 m, fl., *Amorim 4127* (CEPEC, HUEFS); Mun. Salvador, Região Metropolitana de Salvador, Ilha de Maré, Povoado de Botelho, S12º47’05’’ W38º31’, 13 June 2011, fl., *Guedes 18404* (ALCB); *loc. cit.*, Ondina, 8 July 1954, fl., *Espinosa 901* (BAH, RB). **Espírito Santo:** Mun. Alegre, São João do Norte, 17 March 2009, fl., *Couto 1130* (MBML, SP, VIES); Mun. Cachoeiro do Itapemirim, Sítio do Remy, 4 November 1991, fl., *Vinha 1204* (CEPEC, VIES); Mun. Colatina, June 1984, fr., *Dobereiner & Tokarnia 1765* (NY); Mun. Linhares, Bebedouro, 26 August 1981, fl., *Dobereiner & Tokarnia 1677* (CEPEC, R, RB, UB); Mun. Mimoso do Sul, Fazenda Gabiroba, S21°12'36" W41°21'26", 36 m, 2 April 2001, fl., *Pereira 37-84* (RFA); Mun. Nova Venécia, APA Pedra do Elefante, trilha principal na mata da Fazenda Santa Rita, S18°46'57" W40°25'58", 154 m, 17 July 2008, fr., *Amorim 7512* (CEPEC, RB); *loc. cit.*, APA Pedra do Elefante, Serra de Baixo, S18°46'01" W40°27'28", 653 m, fl., *Amorim 7425* (CEPEC, MBML, RB, UPCB); *loc. cit.*, APA Pedra do Elefante, Serra de Baixo, S18°46'01" W40°27'28", 653 m, fl., *Amorim 7426* (CEPEC, MBML, RB, UPCB); *loc. cit.*, APA Pedra do Elefante, Serra de Baixo, S18°46'01" W40°27'28", 653 m, fr., *Amorim 7525* (CEPEC, MBML, RB, UPCB); *loc. cit.*, APA Pedra do Elefante, Serra de Baixo, S18°46'01" W40°27'28", 653 m, fr., *Amorim*

7526 (CEPEC, MBML, RB, UPCB); *loc. cit.*, APA Pedra do Elefante, S18°46'37" W40°26'38", 400 m, 17 July 2008, fl., *Amorim 7528a* (CEPEC, MBML, RB, UPCB); *loc. cit.*, APA Pedra do Elefante, S18°46'37" W40°26'38", 400 m, 17 July 2008, fr., *Amorim 7529* (CEPEC, MBML, RB, UPCB); *loc. cit.*, APA Pedra do Elefante, Serra de Baixo, Mata da Fazenda Santa Rita, S18°46'40" W40°26'40", 154 m, fr., *Forzza 5534* (CEPEC, MBML, RB, UPCB); *loc. cit.*, Serra de Cima, Torre 101/1, S30°18'49.9" W40°28'46.8", 120 m, *Assis 1522* (MBML, SP); Mun. Santa Teresa, Pedra da Onça, propriedade de Antonio Rocon, 13 June 2000, fr., *Demuner 1101* (CEPEC, HUEFS, MBML); *loc. cit.*, Escola Agrotécnica, Federal, 12 May 1999, fr., *Lopes 698* (HUEFS, MBML); *loc. cit.*, Várzea Alegre, mata do sr. Fausto, fundos do patrimônio, S19°53’42’’ W40°45’46’’W, 244 m, fl., *Groppo Jr. 983* (CEPEC, SPF); *loc. cit.*, rio Saltinho, beira da estrada Fundão-Santa Teresa, 29 May 2001, fr., *Kollmann 3726* (CEPEC, MBML, SP); Mun. São Mateus, 24 May 1998, fr., *Dobereiner & Tokarnia s.n.* (NY01018898); *loc. cit.*, 19 June 1999, fr., *Dobereiner & Tokarnia s.n.* (NY01018899); *loc. cit.*, Fazenda Pedra Linda, pasto cachoeira, 16 June 1984, fl., *Dobereiner & Tokarnia 1771* (CEPEC, MICH, NY, RB); *loc. cit.*, Reserva Biológica do Córrego Grande, 18 June 1984, fl. fr., *Dobereiner & Tokarnia 1773* (CEPEC, K, R, RB); *loc. cit.*, Fazenda Boa Lembrança, 19 June 1984, fl. fr., *Dobereiner & Tokarnia 1774* (CEPEC, K, R, RB); *loc. cit.*, Reserva Biológica de Sooretama, lagoa do Macaco, 15 May 1977, fl., *Martinelli 2232, 2240* (RB); Mun. Serra, APA Mestre Álvaro, 15 February 2013, fl., *Barros 160* (HUEFS, VIES); Mun. Sooretama, Reserva Biológica de Sooretama, próximo a ponte do córrego Rodrigues, 13 August 2010, fr., *Siqueira 561* (CEPEC, CRVD). **Rio de Janeiro:** Mun. Cambuci, três irmãos, 9 May 1919, fr., *Sampaio 3219* (R); Mun. Campos dos Goytacazes, Morro do Itaoca, trilha pra torre, 22 January 2010, fl., *Mauad 128* (RB, UEHF); Mun. Itaocara, ilhas fluviais do rio Paraíba, ilha do Santíssimo, 22 May 2004, fr., *Vieira 1401* (RB, RFA); Mun. Volta Redonda, Área de Relevância Ecológica da SEMA, Floresta da Cicuta, 13 August 1987, fr., *Lima 154* (HUEFS, HRB, RB).

Distribution, habitat and phenology:—*Amorimia maritima* is known only to coastal lowland seasonal and rainforests in the states of Bahia, Espírito Santo and Rio de Janeiro (Fig. 19). Flowering and fruiting throughout the year.

Conservation status:—Despite possessing a wide EOO (ca. 113,060.191 km²), *A. maritima* possesses a rather small AOO (ca. 32.000 km²). *Amorimia maritima* is exclusive to the Central Corridor of the Atlantic Forest, one of the most greatly threatned portions of this devastated domain (CEPF 2011). Thus, *A. maritima* should be regarded as Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2].

Etymology:—The epithet makes reference to its restricted occurrence to coastal forests, usually at sea level.

Taxonomic notes:—*Amorimia maritima* is similar to *A. pellegrinii* and *A. rigida* due to its plane, sericeous-velutine, elliptic to ovate leaf-blades, parallel bracteoles, sepals appressed to the androecium, petal claws adaxially glabrous, patent lateral petals, and styles with truncate apex. However, *A. maritima* can be easily differentiated by its bullate leaf-blades, elaiophores turning orange to red at post-anthesis, petals turning red at post-anthesis, eglandular posterior petal, anterior-lateral petals divergent, filaments sericeous at apex, anthers pubescent only at base and apex, and dorsal wing trapezoidal with right angles and a subulate projection at apex.

1.6. *Amorimia pellegrinii* R.F.Almeida (in Almeida *et al.* 2016: 14). Holotype:—BRAZIL. Bahia: Mun. Feira de Santana, Fazenda Cruzeiro do Mocó, 3 November 2015, fl. fr., *R.F. Almeida, A.C. Marques & M.O.O. Pellegrini 614* (HUEFS!; isotype: CEPEC!, MICH!, NY!, P!, RB!, US!). Fig. 28, 30.

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels brown, sparsely sericeous-velutine to glabrous at age; stipules 0.5–1 mm long, triangular, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* decussate, reduced in inflorescences; petioles 5–6 mm long, canaliculated, sparsely sericeous-velutine to glabrous at age, eglandular at apex; leaf blades 6–11.3 × 3–6 cm, plane, bullate, elliptic, wide-elliptic to ovate, base cordate to rounded, margin plane, apex acute to acuminate, both sides glabrous, eglandular to 1–2 pairs of glands, 0.4–0.5 mm diam., up to 3.5–8 mm from the margins; midvein adaxially impressed, abaxially prominent, 4–6 pairs of secondary veins, arching 45–50°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, axillary; main axis 10–28 cm long, cylindrical, striated, sericeous-velutine; cincinni 26–56, 1–flowered, decussate; reduced leaves elliptic, apex acute; bracts 3–3.5 × 2–2.25 mm, ovate, plane, sessile, parallel to the peduncle, eglandular to 1–3 pairs of glands at base to middle, both sides sericeous-velutine; peduncle 2.5–3 × 0.5–0.6 mm, cylindrical, sericeous-velutine; bracteoles 2.5–2.6 × 1.5–1.7 mm, elliptic, concave, sessile, inserted right below the apex of the peduncles, opposite, parallel to pedicel, eglandular to 1 pair of basal glands, both sides sericeous-velutine. *Flowers* 8–10 mm diam. at anthesis; floral buds 3–3.5 × 2.5–3 mm at anthesis; pedicels 3.8–4 × 0.5–0.6 mm, cylindrical, sericeous-velutine. *Sepals* 1.5–2.25 × 1–1.25 mm, triangular, appressed to the androecium, apex obtuse to rounded, straight at anthesis, both sides sericeous-velutine; glands yellow turning orange to ocher at age, 1.65–1.75 × 0.8–1 mm. *Petals* yellow turning light orange at age, margin sinuate, anterior-lateral petals not overlapping at anthesis; lateral petals patent at anthesis, limb 3–4 × 2–2.5 mm, elliptic to obovate, base truncate, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claws 0.75–1 × 0.4–0.5 mm, plane, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 2.8–3 × 1.8–2 mm, elliptic, base truncate, eglandular, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claw 1.8–2 × 0.62–0.75 mm, plane, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite petals longer than those opposite sepals; filaments 1.25–1.5 × 0.3–0.4 mm, connate 0.25–0.3 mm long at base, glabrous; anthers heteromorphic, straight, with a glandular connective, 0.8–1 × 0.4–0.6 mm, reflexed at anthesis, base, connectives and apex pubescent. *Ovary* 1.4–1.5 × 1.4–1.5 mm, each carpel with primordial lateral and dorsal wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, divergent at middle, apex truncate with rounded angle, sericeous-velutine at base, glabrous at middle and apex, anterior style 1.4–1.5 mm long, posterior styles 1.6–1.8 mm long; stigma lateral, crateriform. *Samaras* green to ocher *in vivo*; dorsal wing 7–8 × 2.5–3 mm, very shallowly triangular, margin erose, sinuate, both sides sericeous-velutine; lateral wings 1.2–1.5 × 1.2–1.4 cm, flabelliform, margin erose, sinuate, upper angle 40°, lower angle 60° from the nut, both sides sericeous-velutine; nut 7–8 × 4.5–5 mm, ovoid, sericeous-velutine; areole 5–6 × 2–3 mm, ovate. *Seeds* 4–4.5 × 2–2.5 mm, testa rugose; embryo ovoid, cotyledons folded.

Specimens analyzed:—BRAZIL. Bahia: BRAZIL. Bahia: Mun. Baixa Grande, Fazenda Taquiri, 12 May 1985, fl., *Gatto 01* (BAH); Mun. Cachoeira, Barragem de Bananeiras, vale dos rios Paraguaçu e Jacuípe, S12°32’ W39°05’, 120 m, 25 November 2003, fl., *Amorim 3801* (ALCB, CEPEC, HUEFS); *loc. cit.*, 22 March 1956, fl., *Lordelo 56-307* (ALCB); *loc. cit.*, Pedra do Cavalo, Barragem de Bananeiras, May 1980, fr., *Pedra do Cavalo 8* (CEPEC, HUEFS); *loc. cit.*, December 1980, fl. fr., *Pedra do Cavalo 1021, 1031* (ALCB, CEPEC, HUEFS, HRB, RB); *loc. cit.*, *April 1936*, fl., *Torrend s.n.* (ALCB1928, HUEFS204347, SP); Mun. Castro Alves, 28 March 1994, fl., *Carvalho 29* (HUEFS); Mun. Conceição do Coité, Serra do Mucambo, S11°30’ W39°11’, 26 June 2013, fl. fr., *Carvalho 296* (HUEFS); Mun. Feira de Santana, Fazenda Chapada, S12°15’21’’ W39°05’00’’, 2 June 2007, fl., *Melo 4790* (HUEFS); *loc. cit.*, distrito de São José, 4 June 2005, fr., *Cruz 32* (HUEFS); *loc. cit.*, Fazenda Cruzeiro do Mocó, S12°13’12’’ W39°02’44’’, 185 m, 28 May 2013, fl. fr., *Queiroz 54* (HUEFS); *loc. cit.*, Ipuaçu, inselberg Monte Alto, S12°15’17’’ W39°04’59’’, 130 m, 22 June 2009, fl., *Melo 6370* (HUEFS); *loc. cit.*, distrito de Ipuaçu, S12°13’58’’ W38°04’28’’, 7 April 2005, fl., *Couto 35* (CEPEC, HUEFS); *loc. cit.*, 22 June 2009, fr., *Melo 6372* (HUEFS); *loc. cit.*, distrito de Bonfim de Feira, entrada no km 8, Inselberg Monte Alto, 2 May 2008, fl., *Oliveira 1553, 1554* (HUEFS); Mun. Iaçu, estrada Iaçu-Milagres, Fazenda Santo Antônio, S12°48'01’’ W40°05’44’’, 300 m, 20 July 2001, fr., *Souza 26565* (ESA, RB); Mun. Ipirá, S11°22’ W38°41’, 14 October 2002, fr., *Moura s.n.* (HUEFS69135, HUEFS69137); *loc. cit.*, S11°59’49’’ W40°05’50’’, 868 m, 10 April 2001, fl., *Nunes 266* (CEPEC, HUEFS); *loc. cit.*, Fazenda Nova Fanela, ca. 2,5 km S de Ipirá, S12°10’45’’ W39°46’12’’, *s.d.*, fl. fr., *Queiroz 10607* (CEPEC, HUEFS); Mun. Iraquara, along road 12 km from city to BR-242, 600m, 14 June 1981, fr., *Mori 14435* (CEPEC, NY); Mun. Itiuba, a 10 km de Itiuba, S10°39’28’’ W39°44’16’’, 375 m, 28 January 2002, fr., *Nascimento 38* (CEPEC, HUEFS); *loc. cit.*, ca. 5 km em direção a Coité, Fazenda Grotão, 10 May 2002, fl., *Nascimento 83* (CEPEC, HUEFS); *loc. cit.*, Serra de Itiúba, vila de Adro, 27 May 1983, fl. fr., *Bautista 780* (HRB, MBM); Mun. Jacobina, margem esquerda do rio Jacuípe, 28 March 1985, fl. fr., *Bastos 420* (BAH, NY); Mun. Jaguari, caminho do Engenho, estrada para Grotas, S10°08’ W40°13’, 24 June 2005, fr., *Souza-Silva 15, 20* (CEPEC, HUEFS); Mun. Jaíba, periferia do povoado São Roque, S12°15’05’’ W38°50’36’’, 174 m, 22 May 2010, *Silva 85* (HUEFS); Mun. Jeremoabo, ca. 12 km da cidade, 22 May 1978, fl. fr., *Souza-Silva 612* (HUEFS, SP); Mun. Mairí, margem direita do rio Jacuípe, 29 March 1985, fl., *Oliveira 658* (BAH, CEPEC, HUEFS, NY); Mun. Miguel Calmon, arredores da cidade, 16 June 1985, fr., *Noblick 3876* (CEPEC, HUEFS); *loc. cit.*, estrada Miguel Calmon para Cabeceiras, a 16 km de Miguel Calmon, S11°21’33’’ W40°33’52’’, 6 April 2001, fl., *Jesus 1299* (CEPEC, HRB, HUEFS); *loc. cit.*, Piemonte da Diamantina, entorno do Parque Sete Passagens, 22 December 2006, fl. fr., *Guedes 13101* (ALCB, MBM); Mun. Milagres, BR-116, embaixo da ponte, S13°07’28’’ W38°58’07’’, 19 August 2015, fr., *Aona 4208* (HURB); Mun. Monte Santo, 11 January 2006, fr., Guedes 12067 (ALCB); Mun. Piritiba, 31 May 1980, fr., *Noblick 1839* (HUEFS); Mun. Pintadas, Fazenda Laguinha, May 2004, fl., Nunes s.n. (CEPEC, RB571); Mun. Quijilingue, lagoa de dentro, a ca. 3 km E do povoado Quixaba do Mandacaru, S10°55’ W39°03’, 270 m, 15 May 2005, fl. fr., *Cardoso 518* (HUEFS, NY); Mun. Retirolândia, ca. 5km N da cidade, S11°28’45’’ W39°26’32’’, 250 m, 1 November 1999, fl., *Oliveira 299* (CEPEC, HUEFS); Mun. Riachão do Jacuípe, caminho para Gavião, S11°31’49’’ W39°42’30’’, 647 m, 26 March 2000, *Guedes 7291* (ALCB, CEPEC, HRB, HUEFS); Mun. Ruy Barbosa, Serra do Orobó, Fazenda Bom Jardim, S12°20’33’’ W40°28’40’’, 426 m, 25 May 2005, fr., *Queiroz 10655* (CEPEC, HUEFS); *loc. cit.*, margem do rio Água Branca, S12°04’21’’ W40°33’38’’, 19 May 2007, fl. fr., *Santana 542* (ALCB); Mun. Santo Amaro, Oliveira dos Campinhos, 4 April 1990, fl., *Neves 89* (BAH); Mun. Santo Estevão, 10 April 1990, fl., *Batatinha 01* (BAH); Mun. Senhor do Bonfim, Serra da Maravilha, S10°24’16’’ W40°12’36’’, 739 m, 28 July 2005, fr., *Castro 1281* (HUEFS); *loc. cit.*, Serra de Santana, 28 July 2005, fr., *Nunes 1218* (CEPEC, HUEFS); *loc. cit.*, 13 May 1974, fr., *Andrade-Lima 7664* (HUEFS, IPA); Mun. Serra Preta, 6 km do ponto de Serra Preta, Fazenda Santa Clara, 17 July 1985, fr., *Noblick 4228* (CEPEC, HRB, HUEFS); Mun. Tanquinho, estrada para Exu, S12°42’ W39°43’, 2 June 2005, fl. fr., *Carvalho 111, 114* (CEPEC, HUEFS, NY); *loc. cit.*, Fazenda Beira do Rio, 27 May 1999, fl., *Vanilda 146* (HUEFS); Tucano, povoado Bizamum, Serra Grande, S10°51’18’’ W38°02’14’’, 452 m, 21 April 2005, fl., *Cardoso 493* (HUEFS, NY); *loc. cit.*, S10°53’43’’ W38°58’47’’, 236 m, 10 April 2004, fr., *Cardoso 40* (HUEFS). **Ceará:** Mun**.** Brejo Santo, lote 5, povoado Oitis, reservatório porcos, S07°36’45’’ W38°53’17’’, 685 m, 5 August 2011, fr., *Ferreira 339* (HUEFS, HVASF). **Pernambuco:** Mun. Bom Conselho, 7 February 1969, fl., *Dobereiner & Tokarnia 498* (PAMG); Mun. Floresta, Floresta do Navio, 24 May 1978, fl. fr., *Souza-Silva 650* (HUEFS, SP); Mun. Inajá, Reserva Biológica Serra Negra, S08°39’00’’ W38°23’00’’, 799 m, 3 September 2009, fr., *Carvalho-Sobrinho 2353* (CEPEC, HUEFS, HVASF); Mun. Ipubi, margem da estrada para a mineradora Bonito, 15 April 2010, fl., *Miranda 6171* (FUEL, HUEFS, HST, HSTA, SP); loc. cit., Mina Belo/Lucena, 15 May 2010, fl., *Silva s.n.* (HST17938); Mun. Santa Maria da Boa Vista, próximo a ponte do rio das Garças, em direção a lagoa, 2 May 1971, fl., *Heringer 462* (HUEFS, IPA, R, RB); Mun. São José do Belmonte, Mirandiba, 15 May 1971, fr., *Academia Brasileira de Ciências 780* (HUEFS, IPA). **Sergipe:** Mun. Macambira, Cachoeira de Macambira, 5 March 2013, fl., *Matos 84* (ASE); Mun. Riachão do Dantas, 8 April 1986, fl., *Viana 1397* (ASE, IPA); *loc. cit.*, Fazenda Dr. Belmiro, 28 November 2013, fr., *Matos 325* (ASE).

Distribution, habitat and phenology:—*Amorimia pellegrinii* in known to SDTF from northern Bahia state, and surroundings of Ceará, Pernambuco and Sergipe states (Fig. 19). Flowering and fruiting throughout the year.

Conservation status:—Despite possessing a wide EOO of 118,474.482 km², *A. pellegrinii* should be regarded as Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2] due to its restricted AOO (ca. 44.000 km²) in anthropomorphically modified Caatinga vegetation.

Etymology:—The epithet pays honor to Marco Octávio de Oliveira Pellegrini (b.1990), a Brazilian botanist contributor to the study of the Malpighiaceae from the Atlantic Forest, husband of the first author, and additional collector of the type specimen.

Taxonomy notes:—*Amorimia pellegrinii* is similar *A. rigida* and *A. velutina* due to its plane, bullate, sericeous-velutine leaf-blades, with a gland pair near margin or near base, parallel bracteoles, sepals appressed to the androecium with straight apex, petals turning orange at post-anthesis, calws adaxially glabrous, posterior petal eglandular, filaments glabrous, and styles truncate at apex. Nonetheless, *A. pellegrinii* can be differentiated by its elliptic leaf-blades, with 4–6 pairs of secondary veins, peduncles exceeding the bracts at anthesis, and posterior petal claw 0.62–0.75 mm wide.

1.7. *Amorimia rigida* (A.Juss.) Anderson (2006: 183). Basionym:—*Hiraea rigida* Jussieu (1833: 14) ≡ *Mascagnia rigida* (A.Juss.) Grisebach (1858: 92) ≡ *Triopterys brachypteris* Mohl ex Niedenzu (1928:108) *nom. illeg.* Lectotype (designated by Anderson):—BRAZIL. Minas Gerais: Mun. São Miguel do Jequitinhonha, 1816-1821, fl. fr., *A. St.-Hilaire Catal. B1 no. 1501* (P barcode 02429227!; isolectotypes: P barcode 02429228!, P barcode 02429229!). Fig. 29–30.

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels brown, sparsely sericeous-velutine to glabrous at age; stipules 0.8–1 mm long, triangular, glabrous, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous.

Leaves decussate, reduced in inflorescences; petioles 4–5 mm long, canaliculate, sparsely sericeous-velutine to glabrous at age, eglandular at apex; leaf blades 7.7–11.5 × 4.2–6 cm, plane, bullate, ovate to elliptic to slightly obovate, base rounded to cuneate, margin plane, apex acute to acuminate, both sides glabrous, eglandular to 2–pairs of glands, 0.4–0.5 mm diam., near base or up to 6.5–8.5 mm from margins; midvein adaxially impressed, abaxially prominent, 7–8 pairs of secondary veins, arching 50°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, axillary to terminal; main axis 12–15 cm long, cylindrical, striated, green *in vivo*, sericeous-velutine; cincinni 26–30, 1–flowered, spirally alternate; reduced leaves elliptic, apex acute; bracts 3.2–3.5 × 2.1–2.5 mm, ovate, plane, sessile, parallel to peduncle, 1–3 pairs of marginal glands, at base to middle, both sides sericeous-velutine; peduncle 2.5–3 × 0.9–1 mm, cylindrical, sericeous-velutine; bracteoles 2–2.5 × 1.25–1.5 mm, elliptic, concave, sessile, inserted at the apex of the peduncles, parallel to pedicel, eglandular, both sides sericeous-velutine. *Flowers* 10–12 mm diam. at anthesis; floral buds 4.5–6 × 4.5–5 mm at anthesis; pedicels 5–6.5 × 0.9–1 mm, cylindrical, sericeous-velutine. *Sepals* 1.5–2 × 1–1.5 mm, ovate, appressed to the androecium, apex obtuse to rounded, straight at anthesis, both sides sericeous-velutine; glands yellow turning orange to ocher at age, 2–2.5 × 0.8–1 mm. *Petals* yellow turning orange at age, margin sinuate, anterior-lateral petals not overlapping at anthesis; lateral petals patent at anthesis, limb 3–4 × 2–2.5 mm, elliptic, base truncate to hastate, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claws 0.9–1.2 × 0.3–0.4 mm, plane, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 3–3.5 × 2.8–3 mm, elliptic, base truncate to hastate, eglandular, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claw 0.9–1 × 0.4–0.5 mm, plane, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite the anterior sepal, lateral-posterior sepals and posterior petal longer than those opposite the lateral petals; filaments 1.25–1.5 × 0.25–0.4 mm, connate 0.4–0.5 mm long at base, glabrous; anthers monomorphic, straight, with a glandular connective, 1–1.25 × 0.4–0.5 mm, reflexed at anthesis, base, connective and apex pubescent. *Ovary* 1.1–1.25 × 1.4–1.5 mm, each carpel with primordial dorsal and lateral wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, divergent at middle, apex truncate with rounded angle, sericeous-velutine at base, glabrous at middle and apex, anterior style 0.9–1 mm long, posterior styles 1.2–1.25 mm long; stigma lateral, crateriform. *Samaras* green turning pale ocher *in vivo*; dorsal wing 9–10 × 4.5–5.5 mm, very shallowly triangular, margin entire, sinuate, both sides sericeous-velutine; lateral wings 1.3–1.5 × 2.5–2.6 cm, flabelliform, margin erose, sinuate, upper angle 60°, lower angle 75° from the nut, both sides sericeous-velutine; nut 7–8 × 2.5–3 mm, ovoid, sericeous-velutine; areole 6–6.5 × 2.5–3 mm, elliptic. *Seeds* 4.7–5 × 3–3.2 mm, testa smooth; embryo ovoid, cotyledons folded.

Specimens analyzed:—BRAZIL. Bahia: Mun. Almadina, road Almadina to Ibitupã, ca. 20km, Fazenda São Roque, ca. 10 km da entrada do ramal, S14°38’27’’ W39°42’47’’, 12 March 2005, fl., *Fiaschi 2761* (CEPEC, NY, RB); *loc. cit.*, rodovia para Ibitupan, 12 March 1971, fl., *Pinheiro 1132* (CEPEC); Mun. Itagibá, Mata da Botinha, S14°10’53’’ W39°42’31’’, 12 July 2009, fr., *Guedes 16327* (ALCB, MBM); Mun. Itajú da Colônia, km 8 da estrara Itajú da Colônia-Pau Brasil, a 3 km do ramal a direita, *s.d.*, fl., *Santos 354* (CEPEC); Mun. Itapetinga, 1 June 1980, fl., *Dobereiner 1673* (PAMG); Mun. Itororó, Fazenda Santa Ana, 14.4 Km of Itajú da Colônia, on road to rio do meio, S15°09’01’’ W39°49’57’’, 200 m, 24 July 2003, fl., *Thomas 13476* (CEPEC, NY); Mun. Jussari, ca. 2.5 km N of Palmira on road to Itajú da Colônia, S15°08’03’’ W39°34’03’’, 300-450 m, 2 February 1999, fl., *Thomas 11954* (CEPEC, NY); *loc. cit.*, Fazenda Santa Isabel, rodovia que liga BR 101 a Jussari, 27 January 2009, fl., *Mattos-Silva 5117* (CEPEC, HUESC); *loc. cit.*, RPPN Serra do Teimoso, entrada 7,5 km da rodovia Jussari/Palmira, Fazenda Teimoso, 1,7 km da entrada, S15°9’16’’ W39°31’52’’, 26 January 2006, fl., *Paixão 676* (CEPEC, NY); Mun. Medeiros Neto, 9 September 1974, fl., *Souza s.n.* (BAH509); Mun. Posse, near Vitória da Conquista, road to Boa Nova, km 5, 25 January 1973, fl., *Gottsberger 24-25173* (BOTU, NY); Mun. Santa Cruz da Vitória, ca. 8.1 km from the city, fazenda Uruguaiana, 28 June 2000, fr., *Amorim 3565* (CEPEC, NY, SP); *loc. cit.*, Fazenda Boa Fé, 9,3 km na rodovia para Itajú da Colônia, S15°02’24’’ W39°47’10’’, 18 April 2006, fl., *Lopes 655* (CEPEC, NY). **Minas Gerais:** *s. loc.*, 1838, fl., *Claussen s.n.* (P4843527); *s. loc.*, 1883, fl., *Glaziou 13601* (P); Mun. Araguari, Fazenda da Mata, 23 March 1993, fl., *Araújo 838* (HUFU); Mun. Iguatama, Fazenda Faroeste, margem esquerda do rio São Miguel, S20°15’44’’ W45°40’15’’, 650-700 m, fr., *Melo 1334* (BHCB); Mun. Jequitinhonha, Reserva Biológica Mata Escura, 27 July 2013, fl fr., *Almeida et al. 561, 562* (CEPEC, HUEFS, RB); *loc. cit.*, Fazenda Porto Novo, 20 June 1972, fr., *Dobereiner 858* (PAMG, RB); Mun. Lagoa Santa, 1907, fl., *Warming 838* (P); Mun. Mariana, Serra do Caraça, 19 January 1880, fl., *Simard 12493* (NY, P); Mun. Matozinhos, Fazenda Cauaua, Mata Cubieri, 5 April 2004, fl. fr., *Rodrigues-Silva*

335 (HUEFS, PMSP); Mun. Prudente de Morais, Fazenda Santa Rita, 25 May 1977, fr., *Francisco 11* (PAMG); Mun. Resplendor, parcela para estudos do EIA do Mineroduto Morro do Pilar, S19°16’37’’ W41°04’51’’, 23 June 2013, fl., *Saddi 865* (RB); Mun. Rio de Casca, Fazenda Esmeralda, Serra da Mantiqueira, 21 January 1989, fl., *Brozek 12* (HUEFS, HRCB); *loc. cit.*, Usina Hidrelétrica de Jurumirim, 3 February 1998, fl. fr., *Salino 3953* (BHCB); Mun. Sete Lagoas, CNP-MS, 24 August 1982, fl., *Cunha 741* (PAMG); Mun. Tumiritinga, 12 April 1999, fl., *Rodrigo s.n.* (JPB54379, SP337133, VIC23366); *loc. cit.*, assentamento 1° de junho, 16 September 2001, fr., *Freitas s.n.* (JPB54378, VIC26216).

Distribution, habitat and phenology:—*Amorimia rigida* is known only from Semi-deciduous Forests in the states of Bahia and Minas Gerais (Fig. 19). Flowering from January to July, and fruiting from April to July.

Conservation status:—*Amorimia rigida* possesses a wide EOO (ca. 231,385.245 km²). However, its AOO is considerably smaller (ca. 40,000.00 km²), with semi-deciduous forests from state of Minas Gerais are currently reduced to small forest fragments, probably reflecting on the few modern collections of *A. rigida* in this state. The only recent collection from a population protected by a conservation unit is that from the type locality of *A. rigida* in Jequitinhonha municipality in Northern Minas Gerais (Reserva Biológica da Mata Escura). Thus, *A. rigida* should be considered Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2].

Etymology:—The epithet probably refers to the rigid texture of its leaf blades.

Taxonomic notes:—*Amorimia rigida*, in its current circumscription, is morphologically similar to *A. velutina*, due to its plane, ovate to wide elliptic, bullate, sericeous-velutine leaf-blades, with 7–8 pairs of secondary veins and a pair of glands near base or near margin, peduncles not exceeding the bracts, bracts and bracteoles parallel, sepals appressed to the androecium, with straight apex at anthesis, petal claws adaxially glabrous, petals turning orange at post-anthesis, eglandular posterior petal, with claw 0.4–0.5 mm wide, filaments glabrous, and style with truncate apex. Nonetheless, *A. rigida* can be differentiated by its elaiophores turning brown at post-anthesis (*vs.* red in *A. velutina*), lateral petals patent at anthesis (*vs.* reflexed), anterior-lateral petal divergent (*vs.* overlapping), filaments opposite the anterior sepal, posteriorlateral sepals and posterior petal longer than those opposite lateral petals (*vs.* opposite sepals shorter than those opposite petals), anthers pubescent at apex, connectives and base (*vs.* pubescent only at base), and samaras with triangular dorsal wing (*vs.* obtrapezoidal bearing two triangular projections at apex).

1.8. ***Amorimia velutina*** Anderson (2006: 185). Holotype:—BRAZIL. Minas Gerais: Mun. Itinga, Fazenda Timirim, property of Dr. Alexandre, 16°35'S, 41°47'W, 22 April 1985, fl. fr., *SAP 243* (mounted on two sheets MICH barcode 1003064!). Fig. 31–32.

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels brown, sparsely sericeous-velutine to glabrescent at age; stipules 0.7–1.5 mm long, triangular, glabrous, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* opposite, reduced in inflorescences; petioles 2–4.5 mm long, canaliculate, sericeous-velutine to glabrescent at age, eglandular; leaf blades 5–10 × 3.5–5 cm, plane, bullate, ovate, elliptic to obovate, base rounded to attenuate, margin plane, apex acute, both sides sericeous-velutine to glabrous at age, eglandular to 1–pair of glands, 0.4–0.5 mm diam., near base or distally up to 2–5 mm from margins; midvein adaxially impressed, abaxially prominent, secondary veins 7–8 pairs, arching 40°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*, axillary or terminal; main axis 4–20 cm long, cylindrical to slightly flattened, slightly striated, ocher *in vivo*, sericeous-velutine; cincinni (10–)30–50, 1–flowered, spirally alternate; reduced leaves wide-elliptic, apex mucronate; bracts 3–4.5(–6) × 1.5–3 mm, ovate, plane, elliptic to lanceolate, petiolate, leaf-like, parallel to the peduncle, 2 pairs of glands at base, both sides sericeous-velutine; peduncle 1–4.5 × 0.9–1.1 mm, cylindrical, velutine; bracteoles 2–4 × 1–2 mm, elliptic, concave, sessile, inserted at the apex of peduncles, parallel to the pedicel, 1 pair of glands at base, both sides sericeous-velutine. *Flowers* 9–11 mm diam. at anthesis; floral buds 4–4.2 × 4.2–4.4 mm at anthesis; pedicels 3–5.5 × 0.9–1.1 mm, cylindrical, sericeous-velutine. *Sepals* 2.8–3 × 1.5–1.8 mm, ovate, appressed to the androecium, apex obtuse to rounded, straight to revolute at anthesis, both sides sericeous-velutine; glands yellow turning reddish at age, 2–3.2 × 0.9–1 mm. *Petals* yellow turning dark orange, margins sinuate, anterior-lateral petals overlapping at anthesis; lateral petals reflexed at anthesis, limb 3.5–5 × 2.5–3.5 mm, elliptic, base truncate to hastate, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claws 1–1.5 × 0.3–0.4 mm, plane, adaxially sericeous-velutine, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 3–4 × 2.2–3.5 mm, elliptic, base truncate at base, eglandular, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claw 2–2.7 × 0.5–0.7 mm, plane, adaxially sericeous-velutine, abaxially sericeous-velutine. *Stamens* 10, those opposite petals longer than those opposite sepals; filaments 1.5–2.2 × 0.25–0.3 mm, connate 0.4–0.5 mm long at base, glabrous; anthers heteromorphic, straight, with a glandular connective, 0.5–1 × 0.4–0.5 mm, reflexed in anthesis, pubescent at base, glabrous at connective and apex. *Ovary* 0.6–1.5 × 0.8–1 mm, each carpel with primordial dorsal and lateral wings, sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base, divergent at middle, apex truncate with acuminate angle, sericeous-velutine at base, glabrous at middle and apex, anterior style 0.6–1.3 mm long, curved, posterior styles 0.9–1.7 mm long, erect; stigma lateral, crateriform. *Samaras* yellowish *in vivo*; dorsal wing 7–9 × 3.5–5 mm, pentagonal with two triangular projections at apex, margin erose, sinuate, both sides sericeous-velutine; lateral crests between dorsal and lateral wings; lateral wings 10–15 × 9–10 mm, flabelliform, margin erose, sinuate, upper angle 30°, lower angle 70° from the nut, both sides sericeous-velutine; nut 6–7 × 2.7–3.1 mm, narrowly ovoid, sericeous-velutine; areole 5.5–6 × 2–3.5 mm, triangular. *Seeds* 4.2–4.5 × 2.5–3 mm, testa rugose; embryo ovoid, cotyledons folded.

Specimens analyzed:—BRAZIL. Bahia: Mun. Boa Nova, Parque Nacional de Boa Nova, S14°21’ W40°15’, 600 m, 25 February 2013, fl., *Marinho* 396 (CEPEC, HUEFS); Mun. Caetité, Fazenda Baixa Grande, caminho para Pajeú do Vento, S14°04’03’’ W42°38’12’’, 820 m, 9 February 1997, *Stannard 5312* (ALCB, CEPEC, HRB, HUEFS, SPF); Mun. Contendas do Sincorá, ca. 26 km na estrada em direção a Maracás, 9 April 1999, fl., *Amorim 2772* (CEPEC, MBML, MO, NY, SP); Mun. Coribe, estrada de são Félix do Coribe para Coribe, 22.4 km vilarejo Colônia, S13°41’28’’ W44°15’28’’, 560 m, 7 June 2007, fr., *Lopes 1340* (CEPEC, HUEFS); *loc. cit.*, Alagoinha, S14°56’00’’ W44°43’56’’, 10 April 2005, fr., *Castro 1193* (HUEFS); Mun. Iramaia, Fazenda Segredo, 5 December 2001, fl., *Leal 246* (EBDA); Mun. Itaeté, Chapada Diamantina, próximo ao poço encantado, S12°98’64’ W40°97’25’’, 900 m, 13 November 2014, fr., *Guedes 23072* (ALCB); Mun. Jequié, barragem de pedra, pela BR 330 a 16 km da BR 116, 19 February 2011, fl., *Macedo 2112* (HUESB, JPB, NY); Mun. Livramento do Brumado, on road to Brumado, 10 April 1991, fl., *Lewis 1971* (CEPEC, K, NY, SP). Mun. Maracás, Fazenda

Tanquinho, ca. 20 km N de Maracás, ramal para Fazenda Santa Rita, na estrada para Planaltino, 30 June 1993, fl., *Queiroz 3259* (CEPEC, HUESC); *loc. cit.*, Águia Branca, 23 June 2010, fr., *Queiroz 4539, 4590, 4701* (HRB); Mun. Rio de Contas, ca. 6 km da cidade em direção a Livramento do Brumado, 800 m, 6 March 1994, fl., *Souza 5254* (CEPEC, ESA, SPF); Mun. Tanhuaçu, Floresta Nacional Contendas do Sincorá, trilha do rio Cumbuca, 13 May 2011, fr., *Marinho 31* (HUEFS); *loc. cit.*, 50 m da sede, via rio Cumbuca, S13°55'18'' W41°07'08'', 377 m, 6 February 2015, fl., *Aona 3852* (ALCB, HUEFS, HURB); *loc. cit.*, ramal contrário a grade de estrada para sede, S13°55'49'' W41°05'16'', 348 m, 6 February 2015, fl., *Aona* 3892 (ALCB, HUEFS, HURB); Mun. Urandi, Fazenda Feijão Preto, 7 km de Urandi no sentido Urandi/Guanambi, S14°43'59'' W42°39'00'', 689 m, 9 April 2002, fr., *Jost 495* (HUEFS, HRB). **Goiás:** Mun. Formoso, region Southern Serra Dourada, S13°45' W48°50', 20 June 1956, fl., *Dawson 15006* (P); Mun. Monte Alegre, Sumidouro, 23 May 2008, fl., *Cordeiro 2678* (MBM). **Minas Gerais:** Mun. Chapada do Norte, Fazenda Mariléo, 21 May 1990, fr., *Lima 163* (PAMG); Mun. Itaobim, margem da BR-116, próximo a ponte sobre o Rio Jequitinhonha, 28 December 1984, fl., *Pirani s.n.* (HUEFS203426, SPF); Mun. Mato Verde, São João do Bonito, estrada para as lavras na serra geral, 2.5 km de São João Bonito, 12.5 km rodovia Mato Verde-Monte Azul, BR 122, S15°18'21'' W42°49'37'', 7 April 2004, fl. fr., *Pirani 5462* (HUEFS, SPF); Mun. Medina, entre Itaobim e Medina, S16°50'60'' W41°28'97'', 3 September 2008, fr., *Oliveira 1611* (HUEFS); *loc. cit.*, Reservatório do Córrego Ribeirão, 26 May 1999, fr., *Salino 4658* (BHCB, SP); Mun. Pedra Azul, ca. 5 km NW da cidade em direção a BR-116, 10 February 1994, fl., *Souza 5155* (CEPEC, ESA, SPF); *loc. cit.*, Reservatório do Córrego Soberbo, 28 May 1999, fr., *Salino 4713* (BHCB, SP);

Distribution, habitat and phenology:—*Amorimia velutina* is known from SDTF in Southwestern Bahia, Eastern Goiás, and Northern Minas Gerais states (Fig. 19). Flowering and fruiting throughout the year.

Conservation status:—*Amorimia velutina* possesses a wide EOO of ca. 130,780.585 km². Nonetheless, it possess a restricted AOO (ca. 28.000 km²), accentuated by the anthropomorphically modified Caatinga vegetation, convertion of natural habitats into wind farm sites, and deforestation for the implementation of soy crops. Thus, *A. velutina* should be regarded as Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2].

Etymology:—The epithet makes reference to the velutine indumenta on its leaf blades.

Taxonomic notes:—*Amorimia velutina* is similar to *A. andersonii* and *A. rigida* due to its plane leaf-blades, with a pair of glands near margin or near base, eglandular posterior petal, and posterior petal claw 0.3–0.5 mm wide. Nonetheless, *A. velutine* can be differentiated by its lateral petals reflexed at anthesis, filaments opposite sepals shorter than those opposite petals, anther pubescent only at base, and samaras with obtrapezoidal dorsal wing, bearing two triangular projections at apex.

2. *Amorimia* W.R.Anderson subg. ***Uncina*** Almeida *et al.* (in prep.). Type:—*Amorimia pubiflora* (A.Juss.) Anderson (2006: 183).

Differs from subgenus *Amorimia* by its stipules narrowly triangular; bracteoles plane or plane with revolute margins or concave; sepals adaxially glabrous; petals obovate to spatulate, base cuneate, adaxially glabrous (occasionally distally pubescent in *A. septentrionalis*), claws plane; anthers usually glabrous (occasionally pubescent in *A. pubiflora* and *A. septentrionalis*); styles with apex uncinated to occasionally apiculate; pollen grains spherical; samaras with dorsal wing usually continuous to the base of the nut.

Notes:—This subgenus includes seven species (*A. amazonica*, *A. camporum, A. concinna*, *A. kariniana*, *A. pubiflora, A. septentrionalis*, and *A. tumida*) mostly restricted to SDTF from Northwestern and Northeastern South America (Fig. 33).

Key to the species of *Amorimia* subg. *Uncina*

1. Anthers pubescent... 2
1. Anthers glabrous... 4
2. Leaf blade without a pair of glands at base, inflorescences up to 8 flowers, pedicel thickened in fruits, filaments completely pubescent, style pubescent near apex, samaras metallic green to ocher; Atlantic Forest from northern state of Rio de Janeiro.. ***A. tumida***
2. Leaf blade with a pair of glands at base, inflorescences with more than 10 flowers, pedicel thin in fruits, filaments completely glabrous, styles glabrous near apex, samaras pale green to ocher; Caatinga, Cerrado or Pantanal domains........................ 3

3. Stem velutine, without lenticels; leaf blades cordate or subcordate at base, velutine; petals adaxially glabrous; Cerrado domain in central Brazil and adjacent areas.. ***A. pubiflora***

3. Stem tomentose, lenticelate; leaf blades cuneate or rounded at base, tomentose; petals adaxially sparsely sericeous-velutine; Caatinga domain in Northeastern Brazil... ***A. septentrionalis***

4. Petals only sparsely sericeous abaxially in center of limb, otherwise glabrous; bracts linear, eglandular; leaf glands marginal; northern Colombia..................... ***A. concinna***

4. Petals densely and evenly pubescent over the whole abaxial surface; bracts lanceolate, usually biglandular near base; leaf glands borne in abaxial surface, at least the distal glands set in from margin, the glands at base of lamina sometimes almost marginal... 5

5. Branches with blackish lenticels, estipules 0.8–1.1 mm long; petiole 0.4–1.5 mm long, lamina sparsely sericeous below, soon glabrate or sericeous only on midrib with straight appressed hairs; samaras with areoles narrowly triangular to triangular; southwestern Amazonia... ***A. amazonica***

5. Branches with whitish lenticels, estipules 0.3–0.7 mm long; petiole longer than 2 mm long, lamina at least velutine below, the hairs persistent or the lamina glabrescent at maturity; samaras with areoles narrowly ovate to ovate to elliptic............................ 6

6. Petiole of larger leaves (5–)7–10 mm long; sepals mostly appressed in anthesis; posterior petal strongly differentiated from lateral petals, with a much longer claw and smaller limb; limb of lateral petals 7.5–8.5 × 6–7 mm; lateral wings of samara 30–42 mm high, 20–30 mm wide; dorsal wing of samara extending to base of nut or nearly so; Guianas, Ecuador.. ***A. kariniana***

6. Petiole of larger leaves up to 6 mm long, mostly shorter; sepals revolute at apex in anthesis; posterior petal only moderately differentiated from lateral petals, the claw thicker and slightly longer, the limb somewhat smaller; limb of lateral petals 5.5–8 × 4–6 mm; lateral wings of samara 11–30 × 6–18 mm; dorsal wing of samara usually extending at most to middle of nut, from there to base represented only by a rib; Cajamarca and San Martin, Peru... ***A. camporum***

2.1. ***Amorimia amazonica*** (Nied.) Anderson (2006: 179). Basionym:—*Mascagnia amazonica* Niedenzu (1926: 59). **Lectotype (designated here):**—BRAZIL. Amazonas: Seringal São Francisco, Rio Acre, August 1911, fl., *E. Ule 9478* (MG barcode 014323!; Isolectotypes: G barcode 00352819!, K barcode 000427418!, L barcode 0064048!, MO barcode 2155280!, NY barcode 00067646!). Fig. 32, 34.

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels blackish, sparsely sericeous-velutine to glabrescent at age; stipules 0.8–1.1 × 0.3–0.5 mm long, narrowly triangular, sericeous-velutine, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* opposite, reduced in inflorescences; petioles 0.4–1.5 mm long, canaliculate, sparsely sericeous-velutine to glabrescent at age, eglandular to 1 pair of glands at apex; leaf blades 5–11.3 × 2.2–6.5 cm, plane, not bullate, narrow-elliptic, elliptic to wide-elliptic, base cuneate, margin plane, apex short to long acuminate, both sides sparsely sericeous-velutine at young and glabrescent at age, eglandular to 2-pairs of glands abaxially, 0.3–0.4 mm diam., near base or up to 3–4 mm of margins; midvein adaxially impressed, abaxially prominent, secondary veins 6–7 pairs, arching 50°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum conspicuous on both sides. *Thyrses (pseudoracemes) or panicles*, axillary to terminal; main axis 6–10 cm long, flattened, irregularly longitudinally costate, sericeous-velutine; cincinni 24–26, 1-flowered, spirally-alternate; reduced leaves widely elliptic, apex mucronate; bracts 3–3.5 × 1–1.2 mm, lanceolate, plane, petiolated, parallel to the peduncle, 1 pair of marginal glands at base, both sides sericeous-velutine; peduncle 2–3.5 × 0.5–0.6 mm, cylindrical, sericeous-velutine; bracteoles 2.5–3.5 × 0.4–0.6 mm, lanceolate, conduplicate, sessile, inserted right below the apex of peduncles, opposite, parallel to the pedicel, eglandular to 2-glandular at margins, both sides sericeous-velutine. *Flowers* 0.8–1.7 mm diam. at anthesis; floral buds 0.45–0.6 × 0.35–0.4 mm at anthesis; pedicels 5–6 × 0.5–0.6 mm, cylindrical, sericeous-velutine. *Sepals* 2.5–3 × 1–1.5 mm, triangular, not appressed to the androecium, apex acute, revolute at anthesis, adaxially glabrous, abaxially sericeous-velutine; glands yellow turning ocher at age, 1.5–1.6 × 1–1.1 mm. *Petals* yellow turning orange on claws at age, margin sinuate, anterior-lateral petals not overlapping; lateral petals patent at anthesis, limb 6.5–7 × 4.5–5 mm, wide elliptic to obovate, base cuneate, adaxially glabrous, abaxially sericeous-velutine; claws 1.5–1.6 × 0.5–0.6 mm, plane, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect and slightly curved at anthesis, limb 5–5.1 × 4–4.1 mm, obovate, base cuneate, 1-pair of reddish glands at base, adaxially glabrous, abaxially sericeous-velutine; claw 2–2.1 × 1–1.1 mm, plane, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite petals longer than those opposite sepals; filaments 2–2.5 × 0.34–0.35 mm, connate ca. 0.2 mm long at base, glabrous; anthers monomorphic, straight, with a glandular connective, 0.9–1.1 × 0.5–0.6 mm, reflexed at anthesis, glabrous. *Ovary* 2.4–2.5 × 1.4–1.5 mm, each carpel with primordial dorsal and lateral wings, sericeous-velutine; styles 3, cylindrical at base, laterally flattened at apex, parallel at base, divergent at middle, apex apiculate, sericeous-velutine at base, glabrous at middle and apex, anterior style 1.4–1.45 mm long, posterior styles 1.55–1.6 mm long; stigma lateral, crateriform. *Samaras* green to yellowish *in vivo*; dorsal wing reduced to a crest or 6–6.1 × 2–2.1 cm, depressed obovate, margin entire to irregularly dentate, plane, both sides sericeous-velutine; lateral wings 2.5–2.6 × 1.5–1.6 cm, flabelliform, margin erose, sinuate, upper angle 70°, lower angle 80° from the nut, both sides sericeous-velutine; nut 6–8 × 3–4mm, narrowly ovoid, sericeous-velutine; areole 5.5–5.6 × 2–2.1 mm, narrowly triangular to triangular. *Seeds* 4.5–6 × 2–3.5 mm, testa smooth; embryo narrowly-ovoid to ovoid, cotyledons folded.

Specimens analyzed:—BOLIVIA. Beni: Mun. Vaca Diez, laguna Tumi Chucua, 30 km S of Riberalta, S11º08’ W66º10’, 210 m, 29 September 1981, fl., *Solomon 6515* (LPB, MO); **La Paz:** Mun. Guanay, May 1886, fl., *Rusby 512* (F, GH, MO, NY, P). **Santa Cruz:** província Sara, bosque del rio Palometillas, 9 October 1924, fl., *Steinbach 6606* (F, USZ); Mun. Santa Cruz de la Sierra, Angostura, margino of Río, 1 July 1966, fl., *Steinbach 339* (F, MICH, MO, NY, U, USZ); Mun. Santa Rosa Del Sara, Laguna Juan Chulo, S16º59’13,7’’ W63º44’46’’, 260 m, 9 November 2006, fr., *Linneo 873* (MO, USZ). **BRAZIL. Acre:** Mun. Assis Brasil, Basin of Rio Acre, S10º56’20’’W69º29’51’’, 20 October 1997, fl. fr., *Daly 9637* (MO, NY, UFACPZ); Mun. Bujari, Riozinho do Andirá, Ramal Nova Linha 1, ao longo da estrada, S9°42’59,4’’ W68°08’15,9’’, 6 September 2013, fl., *Costa 271* (NY, RB); Mun. Jordão, Tarauca river, S09°14’19,8’’ W71°55’27,1’’, 5 February 2009, fl., *Acevedo-Rodriguez 14780* (NY, RB); Mun. Rio Branco, road to Rio Branco, 33 km from the city, 29 September 1980, fr., *Lowrie 259* (INPA, MG, NY, R); Mun. Sena Madureira, Basin of Rio Iaco, Fazenda São Jorge I, ca. 22 km E on Toco Preto access road, S9°25’04’’ 68°36’45’’, 8 July 2008, fl., *Daly 13263* (NY, RB, UFACPZ). **Amazonas:** rio Jau ad Belem, 12 May 1881, fl., *Schwacke 3008* (RB). **Pará:** *s.loc.*, *s.dat.*, fl., *Schwarz s.n.* (W68981). **PERU.** *s.loc.*, 5 December 1877, fl., *Vidal-Senege sn.* (P06173021). **Amazonas:** Mun. Bagua, Aramango-Salinas, S05º25'00'' W79º30'00'', 380 m, 6 November 1999, fr., *Rojas & R. Vásquez 753* (HUT, MICH, MO, NY, USM); *loc. cit.*, km 489 of Oleoducto nor Peruano, small stream near Mayo, S05º30' W78º30', 430-460 m, 4 June 1986, fr., *Knapp 7575* (F, MO); *loc. cit.*, Valley of Río Marañon, S05º30' W78º30', 430 m, 16 April 1984, fr., *Croat 58329* (MO, NY); *loc. cit.*, road from La Peca – Bagua, 24 October 1978, fl., *Barbour 4256* (MO). **Huánuco:** Gauso Azul, rio Pachitea, September 1942, fl., *Vandeman 3309* (K). **Junin:** Mun. Satipo, road from San Ramon to Satipo, 39 km from La Merced, S10°52'21'' W75°02'48'', 589 m, 14 September 2001, fl., *Weigend 5735* (HUT, NY, SMF). **Madre de Dios:** Mun. Iberia, Vic. Río Ahuamanu, 6 September 1945, fr., *Seibert 2171* (MO); Mun. Manu, Cocha Cashu Camp, Río Manu, 18 October 1979, fr., *Gentry 26915* (AMAZ, MO, SFM); *loc. cit.*, Parque Nacional Manú, Rio Cumerjali, S11°49' W71°32', 350-450 m, 22 October, 1986, fl., *Foster 11965* (CUZ, F, INPA, K, US); Mun. Tambopata, Puerto Maldonado, Cuzco Amazónico, S13º08' W69º36', 290-300 m, 26 November 2002, fr., *Valenzuela 1062* (CUZ, HUT, MO, USM); *loc. cit.*, Las Piedras, Quebrada Loboyoc, S12º21'09'' W68º59'57'', 161 m, 21 October 2005, fl., *Farfán 779* (AMAZ, CUZ, HUT, MO, MOL, P, USM); *loc. cit.*, Campamento turistico Cusco Amazonico, zona 2, plot E, S12°33' W69°03', 200 m, 8 October 1998, fr., *Vásquez 25843* (F, MO, NY); *loc. cit.*, Las Piedras, Cusco Amazonico, S12°29' W69°03', 200 m, 7 October 1991, fl. fr., *Timaná 2427* (MO). **Ucayali:** Mun. Coronel Portillo, Tournavista, centro ganadero, margin of Río Pachitea, 16 March 1982, fl., *Encarnación 26053* (G, MBM, MO, NY); *loc. cit.*, 16 March 1982, fl., *Encarnación 26055* (MO, NY); Mun. Purus, Cuenca del Rio Purus, Rio Curanja, ca. De la comunidad nativa de Colombiana, 300-350 m, 18 October 1997, fl., *Graham 205* (MICH); *loc. cit.*, 300-350 m, 12 February 2000, fl. fr., *Graham 866* (MICH).

Distribution, habitat and phenology:—*Amorimia amazonica* is known only to lowland Igarapé Forest in the Amazon basin from western Brazil, Bolivia and Peru (Fig. 33). Flowering from March to October and fruiting throughout the year.

Conservation status:—*Amorimia amazonica* possesses a wide EOO of ca. 985,460.095 km². Nonetheless, it possesses a restricted AOO (ca. 24.000 km²), intimately associated with Acre, Madeira, Purus, Mamore, Beni, Madre do Dios, Ucayali, Pachitea, and Halluaga river basins. *Amorimia amazonica* is mainly threathned by the deforestation of the Amazon Forest in Brazil (states of Acre and Rondônia), Bolivia, and Peru (WWF 2009). Thus, *A. amazonica* should be regarded as Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2].

Etymology:—The epithet makes reference to the restricted distribution of this species to the Amazon Forest.

Nomenclatural notes:—The basionym of *Amorimia amazonica* was described by Niedenzu (1926) based on a single collection, Ule 9478, collected along the Acre River in Seringal of São Francisco do Iracema (currently the municipality of Xapuri), state of Acre, Brazil. According to Stafleu & Cowan (1986), Niedenzu's specimens were generally housed at B, and were all destroyed during WWII. After consulting several herbaria, we found syntypes housed at G, K, L, MG, MO, and NY (the one at NY consisting of just two fragments). We designate the specimen at MG as the lectotype, since it is the most complete and well preserved, being also the only specimen housed in a Brazilian herbarium.

Taxonomic notes:—*Mascagnia amazonica* Niedenzu (1926:59) was described only two years before the publication of the last revisionary monograph for Malpighiaceae (Niedenzu 1928). In addition to the original material listed in 1926, Niedenzu (1928) cited two additional collections for this species, one from the municipality of Baturité and the second from the municipality of Ipú, both in the state of Ceará, Brazil. Nonetheless, these collections occur in caatingas and rocky outcrops, divergent from the original material, which was collected in western Amazon Rainforests. About 80 years later, Anderson (2006), transfered *M. amazonica* to his new genus *Amorimia*, in order to accommodate all species from *Mascagnia* sect. *Pleuropetrys* (Grisebach 1858: 91). At this time, he also described two new species of *Amorimia* for Eastern Brazil, one of them, *Amorimia septentrionalis* Anderson (2006: 183), perfectly matches those disjunct specimens cited by Niedenzu (1928) as part of *M. amazonica*, due to their pubescent anthers. *Amorimia amazonica* is morphologically related to *A. camporum* and *A. kariniana*, and can distinguished from both by its sericeous-velutine indumenta on vegetative and reproductive organs, inflorescence bracts petiolate and lanceolate, and by sericeous-velutine samaras.

2.2. ***Amorimia camporum*** Anderson (2006: 179). Holotype:—PERU. Cajamarca: Mun. San Ignacio, District Chirinos, entre La Catagua y Tablón, 5°19'S, 78°47'W, 550–650 m, 9 February 1996, fl., *J. Campos & O. Díaz 2490* (MICH barcode 1254384!; sotypes: F barcode 0092855F!, MO barcode 1809916!, MO barcode 1809917!). Fig. 35.

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels whitish, sparsely velutine to glabrescent at age; stipules 0.3–0.5 mm long, narrowly triangular, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous, velutine. *Leaves* opposite, reduced in inflorescences; petioles 2–6 mm long, canaliculated, sparsely velutine, eglandular to 2-glandular at apex; leaf blades 5–11 × 3–6.7 cm, plane, not bullate, elliptic to ovate, base cuneate to rounded, margin revolute, apex acute, obtuse, rounded, acuminate to apiculate, both sides velutine to glabrous at age, 1–many glands, 0.3–0.4 mm diam., up to 5 mm of margins; midvein adaxially impressed, abaxially prominent, 4–7 pairs of secondary veins, arching 45–50°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum conspicuous on both sides. *Thyrses (pseudoracemes)* or panicles, axillary to terminal; main axis 5–18 cm long, flattened, smooth, velutine; cincinni 10–40, 1-flowered, decussate to spirally-alternate; reduced leaves wide-elliptic, apex mucronate; bracts 2–7 × 0.7–2.5 mm, ovate, plane, sessile, parallel to the peduncle, 1–2 pairs of glands at margins near base, both sides velutine; peduncle 2–11 × 0.5–0.7 mm, cylindrical, velutine; bracteoles 2.5–3 × 0.4–0.7 mm, ovate, plane with margins revolute, inserted at the apex of peduncles, opposite, spreading to the pedicel, eglandular, both sides velutine. *Flowers* 15–20 mm diam. at anthesis; floral buds 5–6 × 3.5–4 mm at anthesis; pedicels 4–10 × 0.5–0.7 mm, cylindrical, velutine. *Sepals* 1–2 × 1.5–1.7 mm, triangular to ovate, appressed to the androecium, apex acute to obtuse, revolute at anthesis, adaxially glabrous, abaxially sericeous-velutine; glands yellow turning ocher at age, 1.8–3 × 1–1.3 mm. *Petals* yellow, margin sinuate, anterior-lateral petals not overlapping; lateral petals patent at anthesis, limb 5.5–8 × 4–6 mm, elliptic, obovate to orbicular, base cuneate, adaxially glabrous, abaxially sericeous-velutine; claws 1–2 × 0.5–0.53 mm, plane, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect at anthesis, limb 5–7.5 × 3.5–5 mm, orbicular, base cuneate, eglandular, adaxially glabrous, abaxially sericeous-velutine; claw 2–2.5 × 1–1.2 mm, plane, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite petals longer than those opposite sepals; filaments 1.3–2.5 × 0.35–0.40 mm, connate ca. 0.2 mm long at base, glabrous; anthers monomorphic, straight, with a glandular connective, 0.8–1.1 × 0.5

mm, reflexed at anthesis, glabrous. *Ovary* 1.3–2 × 1.3–1.4 mm, each carpel with primordial dorsal and lateral wings, velutine; styles 3, cylindrical at base, flattened at apex, parallel at base, divergent at middle, apex uncinated, sericeous-velutine at base,glabrous at middle and apex, anterior style ca. 1.4–1.45 mm long, posterior styles ca. 1.7–1.8 mm long; stigma lateral, crateriform. *Samaras* yellowish *in vivo*; dorsal wing 3–6 × 1–2 cm, depressed obovate, margin erose, plane, both sides velutine; lateral wings 1.4–3 × 0.6–1.8 cm, flabelliform, margin dentate, sinuate, upper angle 65°, lower angle 80° from the nut, both sides sparsely velutine; nut 5–5.5 × 4–4.5 mm, narrowly ovoid, velutine; areole 4.5–7 × 2–3 mm, narrowly ovate. *Seeds* 4.5–5 × 2–3.5 mm, testa smooth; embryo ovoid, cotyledons folded.

Specimens analyzed:—**PERU. Cajamarca:** Distr. San Ignacio, Chirinos, S05º20’30’’ W78º46’00’’, 600-650 m, 6 January 1997, fl. fr., *Campos 3266* (MO, NY); *loc. cit.*, Chirinos, Las Juntas, *Campos 4846* (MICH); *loc. cit.*, Distr. Huarango, entre Puerto Tabalozo y Nueva Esperanza, 550-700 m, 18 January 1996, *Campos 2015* (HUT, MO); *loc. cit.*, Puerto Ciruelo–Camino a Huarango, *s.dat.*, *Campos 2658* (MICH). **San Martín:** Mun. Huallaga, entre Bellavista y Baños, *s.dat.*, *Ferreyra 4744* (MICH); Mun. Huinguillo, *s.dat.*, *Woytkowski 7183* (MICH, MO); Mun. Juan Jui, 5 km SE of Puente Colombia, 30 June 1984, fl. fr., *Murray 1531* (MO, NY); Mun. Saposoa, S6°56’ W76°48’, 450 m, 3 October 1959, fl., *Woytkowski 5459* (F, MO, P); Mun. Tarapoto, along banks of Río Mayo, S06º23’ W76º39’, 350 m, 6 November 1980, fr., *Croat 51085* (MO); *loc. cit.*, June 1855, fl. fr., *Spruce 4227* (F, MG, NY, P); *loc. cit.*, road 10-25 km S of Tarapoto, S6°35’ W76°25’, 300-350, 18 July 1982, fl. fr., *Gentry 37660* (AMAZ, MO, NY, SMF); *loc. cit.*, Valley of Rio Halluaga, 29 km S of Tarapoto, near El Abra, S6°40’ W76°20’, 450-540 m, 5 February 1984, fr., *Gentry 44992* (MO); *loc. cit.*, alto Río Huallaga, February 1936, *Klug 4259* (K, MO, NY, US); *loc. cit.*, Alto Rio Huallaga, 100 m, October 1934, fl., *Klug 3881* (F, MO, NY); *loc. cit.*, *s.dat.*, *Woytkowski 7200* & *7202* (MICH, MO); Mun. Morales, Polvoraico, bosque secundario, 270 m, 31 December 1984, fr., *Salas 418* (AMAZ).

Distribution, habitat and phenology:—*Amorimia camporum* is known from Seasonally Dry and Rainforests at 400–800 m in Cajamarca and San Martín, Peru (Fig. 33). Flowering and fruiting from December to April and in September.

Conservation status:—*Amorimia camporum* is represented by only few records restricted to five municipalities within an EOO of ca. 135,981.058 km², and AOO of 20.000 km², in SDTF within Mayo and Halluaga river basins, in Peru. This species is mainly threathned by deforestation in the regions of Tarapoto and Iquitos. Thus, *A. camporum* should be regarded as Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2].

Etymology:—The epithet pays honor to the collector of the type specimen, the Peruvian botanist José Ricardo Campos (b. 1955).

Taxonomic notes:—*Amorimia camporum* is similar to *A. amazonica* and *A. kariniana* due to its leaf-blades abaxially glandular, bracts lanceolate, usually biglandular near base, petals abaxially densely and evenly pubescent, and glabrous anthers. *Amorimia camporum* is especially similar to *A. kariniana*, due to their branches with whitish lenticels, estipules 0.3–0.7 mm long, petiole longer than 2 mm long, and samaras with areoles narrowly ovate to ovate to elliptic. Nonetheless, *A. camporum* can be differentiated by its larger leaves with petioles 6 mm long or shorter, sepals with revolute apex at anthesis, posterior petal only moderately differentiated from the lateral petals (the claw thicker and slightly longer, the limb somewhat smaller), limb of lateral petals 5.5–8 × 4–6 mm, and samaras with lateral wings 11–30 × 6–18 mm and dorsal wing usually extending at most to middle of nut, from there to base represented only by a rib.

2.3. *Amorimia concinna* (C.V.Morton) Anderson (2006: 180). Basionym:—*Mascagnia concinna* Morton (1936: 130) ≡ *Mascagnia dumetorum* Morton (1932: 53), *nom. illeg.*, non *M. dumetorum* Grisebach (1879: 67). Holotype:—US barcode US00108446†. **Lectotype (designated here):**—COLOMBIA. Bolívar: Mun. Sincé, 25 January 1918, fl. fr., *F.W. Pennell 4033* (NY barcode 00067653!; isolectotype: GH barcode 00045140!). Fig. 35.

Woody vines to scandent shrubs; branches striated, densely lenticelate, lenticels whitish, sparsely sericeous-velutine to glabrescent at age; stipules 1–1.2 mm long, narrowly triangular, glabrous, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* opposite, reduced in inflorescences; petioles 8–9.5 mm long, canaliculated, densely sericeous-velutine, eglandular to 2-glandular at apex; leaf blades 7.1–10.7 × 3.5–6 cm, plane, bullate, wide elliptic to ovate, base cuneate to rounded, margin plane, apex long acuminate to short mucronate, both sides sparsely to densely velutine to glabrescent at age, 1 pair of marginal glands at margins, 0.4–0.5 mm diam.; midvein adaxially impressed, abaxially prominent, 5–8 pairs of secondary veins, arching 45–50°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum adaxially inconspicuous, abaxially conspicuous. *Thyrses (pseudoracemes) or panicles*, axillary to terminal; main axis 4–5.5 cm, flattened, smooth, velutine; cincinni 10–12, 1-flowered, decussate; reduced leaves elliptic, apex acuminaste; bracts 3.9–4.5 × 0.8–1 mm, lanceolate, filiform, plane, sessile, parallel to the peduncle, eglandular, adaxially glabrous, abaxially velutine; peduncle 4–4.5 × 0.5–0.6 mm, cylindrical, velutine; bracteoles 2.5–3 × 0.4–0.5 mm, lanceolate, filiform, plane, sessile, inserted at the apex of peduncles, opposite, parallel to the pedicel, eglandular, adaxially glabrous, abaxially velutine. *Flowers* 1.4–1.5 mm diam. at anthesis; floral buds 7–8 × 5–6 mm at anthesis; pedicels 5–9 × 0.5–0.6 mm, cylindrical, velutine *Sepals* 3.7–4 × 2–2.1 mm, triangular, appressed to the androecium, apex acute, revolute at anthesis, adaxially glabrous, abaxially sericeous-velutine; glands greenish to yellow, 2.2–2.5 × 1–1.25 mm. *Petals* yellow, cucullate, margin sinuate, anterior-lateral petals not overlapping; lateral petals patent at anthesis, limb 5.5–6 × 4.5–5.5 mm, wide elliptic to obovate, base cuneate, adaxially glabrous, abaxially sparsely sericeous; claws 1–2 × 0.5–0.55 mm, plane, both sides glabrous; posterior petal erect at anthesis, limb 5.5 × 3–3.2 mm, elliptic, base cuneate, eglandular, adaxially glabrous, abaxially sparsely sericeous; claw 2–2.5 × 1–1.2 mm, plane, both sides glabrous. *Stamens* 10, those opposite petals shorter than those opposite sepals; filaments 3–4 × 0.35–0.4 mm, connate 0.15–0.2 mm long at base, glabrous; anthers monomorphic, straight, with a glandular connective, 0.9–1 × 0.5–0.55 mm, erect at anthesis, glabrous. *Ovary* 2–2.5 × 2–2.5 mm, each carpel with primordial dorsal and lateral wings, velutine; styles 3, cylindrical at base, flattened at apex, divergent at base, apex apiculate, base velutine, middle and apex glabrous, anterior style 1.8–2 mm long, posterior styles 2.1–2.2 mm long; stigma lateral, crateriform. *Samaras* yellowish *in sicco*; dorsal wing 1–1.1 × 0.35–4 cm, depressed obovate, margin dentate, sinuate, both sides velutine; lateral wings 1.5–2 × 2.1–2.1 cm, obdeltoid, margin erose, sinuate, upper angle 30°, lower angle 40° from the nut, both sides velutine; nut 3.2–4.5 × 2.2–2.5 mm, narrowly ovoid, velutine; areole 3–3.2 × 1.9–2 mm, ovate. *Seeds* 3.8–4 × 3–3.3 mm, testa rugose; embryo ovoid, cotyledons folded.

Specimens analyzed:—COLOMBIA. Bolívar: Mun. Magangué, Corregimiento de Juan Arias, hacienda Valle María, propriedad de Gonzalo Botero, 19 February 1958, fr., *Botero s.n.* (COL52205); Mun. San Pedro, 30 m, December 1956, fl. fr., *Arteta s.n.* (COL50614); Mun. Sincelejo, road entre Sincelejo y Colosó, December 1962, fl., *Castañeda 9292* (COL, NY); *loc. cit.*, November 1962, fl. fr., *Castañeda 9252* (COL, NY); *loc. cit.*, 20 April 1963, fl. fr., *Castañeda 9646* (COL, NY). **Magdalena:** Mun. Fundación, km 3 de la carretera a Valledupar, Hacienda Córdoba de F. García & Cía, August 1964, fr., *Salas 1* (COL); *loc. cit.*, Hacienda da Córdoba, situada al pie de la ciudad, December 1963, fl., *Castañeda 10040* (COL); Mun. Pivijay, 6 April 2006, fl., *Mojica 1* (COL); Mun. Valledupar, roadside, 150 m, 12 January 1944, fl. fr., *Haught 3927* (COL, F, US). **Sucre:** Mun. Cince, July 1997, fl., *Uribe s.n.* (COL423253).

Distribution, habitat and phenology:—*Amorimia concinna* is known only from SDTF from the departments of Bolivar and Magdalena in northern Colombia (Fig. 33). It is mostly restricted to the Magdalena river basin to Valledupar near the borders with Venezuela. Flowering from November to January and fruiting from August to February.

Conservation status:—*Amorimia concinna* is represented by only few records restricted to five municipalities within an EOO of 11,867.658 km² and AOO of 16.000 km² in anthropomorphically modified SDTFs. *Amorimia concinna* is greatly threathned by deforestation due to banana, coffee, cocoa, cassava and cotton crops, cattle breeding and farming in Colombia. Thus, it should be regarded as Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2].

Etymology:—The epithet makes reference to the beautiful and elegant aspect of this species *in vivo*.

Nomenclatural notes:—In January 2015, during a visit to the US herbarium, we were unable to locate the holotype of *M. concinna*. This specimen was previously loaned to the late Dr. William R. Anderson (MICH) for his studies in *Mascagnia s.l.* and the publication that resulted in the description of *Amorimia*, together with seven additional segregates (Anderson 2006). In 2008, the specimen was returned to the US by Dr. Christianne Anderson (Christianne Anderson, pers. comm.), but was never received by the herbarium (John Boggan, US herbarium type collection curator, pers. comm.). During the following years, there have been several attempts from both collections (i.e. US and MICH) to locate and retrieve the lost holotype. Nonetheless, they have all been unsuccessful. Thus, in accordance to the Code (McNeill *et al.* 2012, Art. X.X), we designate one of the still extant isotypes as the lectotype of *M. concinna*. If the holotype is ever recovered, the herein designated lectotypification is to be superseded (McNeill *et al.* 2012, Art. X.X).

Taxonomic notes:—*Amorimia concinna* resembles *A. pubiflora* due to their similar fruit morphology, and because they are the only two species from *A.* subg. *Uncina* that possess densely velutine indumentum in several vegetative organs. *Amorimia concinna* is also similar to *A. kariniana* due to its pubescent anthers, being differentiated its marginal leaf glands, bracts linear and eglandular, and petals only sparsely sericeous abaxially in center of limb, otherwise glabrous.

2.4. ***Amorimia kariniana*** Anderson (2006: 180). Holotype:—ECUADOR. Guayas: Mun. Guayaquil, Cerro Azul, 50 m, 22 October 1958, fl., *G. Harling 3026* (S!; Isotype: MICH barcode 1244753!). Fig. 36.

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels whitish, sparsely sericeous-velutine to glabrescent at age; stipules 0.3–0.7 mm long, narrowly triangular, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* opposite, not reduced in inflorescences; petioles 5–10 mm long, canaliculated, sparsely sericeous-velutine to glabrous at age, eglandular to biglandular at apex; leaf blades 8.5–13 × 5–8.5 cm, plane, not bullate, wide-elliptic, base cuneate to rounded, margin plane, apex short-acuminate, both sides velutine to glabrescent, eglandular to 1-many pairs of glands, 0.25–0.28 mm diam., up to 3 mm of margins; midvein adaxially impressed, abaxially prominent, 5–7 pairs of secondary veins, arching 35°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles,* axillary to terminal; main axis 7–18 cm long, flattened, smooth, velutine; cincinni 16–26, 1-flowered, decussate; reduced leaves absent; bracts 3–6 × 1–3 mm, lanceolate, plane, sessile, parallel to the peduncle, 1 pair of marginal glands at base, both sides velutine; peduncle 2–7 × 0.5–0.6 mm, cylindrical, velutine; bracteoles 2–2.3 × 0.3–0.4 mm, lanceolate to filiform, plane with revolute margins, sessile, opposite, inserted at the apex of peduncles, parallel to the pedicel, eglandular, both sides velutine. *Flowers* 2–2.2 mm diam. at anthesis; floral buds

6–7 × 6–7 mm at anthesis; pedicels 6–9 × 0.5–0.6 mm, cylindrical, velutine. *Sepals* 1.5–2 × 1.7–2.5 mm, widely ovate, appressed to the androecium, apex acute to obtuse, revolute at anthesis, adaxially glabrous, abaxially sericeous-velutine; glands yellowish, 2.5–3.5 × 1–1.2 mm. *Petals* yellow, margin sinuate, anterior-lateral petals not overlapping; lateral petals patent, limb 7.5–8.5 × 6–7 mm, wide obovate, base cuneate, adaxially sparsely velutine to glabrous distally, abaxially sericeous-velutine; claws 1.5–2 × 0.5–0.6 mm, plane, adaxially glabrous, abaxially sericeous-velutine; posterior petal erect, limb 6–6.5 × 4.5–5 mm, spatulate, base cuneate, eglandular, adaxially sparsely velutine to glabrous distally, abaxially sericeous-velutine; claw 3.5–4 × 1–1.3 mm, plane, adaxially glabrous, abaxially sericeous-velutine. *Stamens* 10, those opposite petals shorter than those opposite sepals; filaments 2.5–3.5 × 1–1.25 mm, connate ca. 0.2 mm long, glabrous or abaxially sparsely sericeous; anthers monomorphic, straight, with a glandular connective, 0.8–1.4 × 0.5–0.7 mm, reflexed in anthesis, glabrous. *Ovary* 1.7–2 × 1.3–1.5 mm, each carpel with primordial dorsal and lateral wings, velutine; styles 3, cylindrical at base, laterally flattened at apex, parallel at base, divergent at middle, apex uncinate, base sericeous-velutine, anterior style 1.8–2 mm long, posterior styles 2.1–2.2 mm long; stigma lateral, crateriform. *Samaras* yellowish *in vivo*; dorsal wing 12–15 × 4–5 mm, depressed obovate, margin erose, sinuate, both sides velutine; lateral wings 3–4.2 × 2–3 cm, flabelliform, margin erose, sinuate, upper angle 70°, lower angle 80° from the nut, both sides velutine; nut 8–12 × 4–6 mm, narrowly ovoid, velutine; areole 8–12 × 4–6 mm, ovate to elliptic. *Seeds* ca. 8 × 5 mm, testa smooth; embryo ovoid, cotyledons bent.

Specimens analyzed:—Ecuador. Guayas: Mun. Guayaquil, Cerro Azul, *s.dat.*, fl., *Asplund 16617 & 17586* (S); *loc. cit.*, road to Aguas Piedras, *s.dat.*, fl. fr., O*wlee 1109* (US); *loc. cit.*, Cerro Mirador de los Monos, *s.dat.*, fl., *Rubio 2445* (MICH, MO); Mun. Pedro Carbo, along a stream, 8 July 1940, fl., *Haught 3070* (MICH, NY, US). Santa Elena: E of Las Juntas, *s.dat.*, fl., *Fagerlind 242* (S);

Distribution, habitat and phenology:—*Amorimia kariniana* is known only from lowland SDTF from Guayas, Ecuador (Fig. 33), along streams, roadside thickets, and pastures. Flowering from June to October, and fruiting from February to June.

Conservation status:—*Amorimia kariniana* is represented by few records, restricted to an EOO of 1,215.151 km² and AOO of 12.000 km² in anthropomorphically modified

STDFs in Guayas, Ecuador. *Amorimia kariniana* is highly threathned by sugar refinaries, iron foundries, tanneries and sawmills, but also by deforestation for the development of banana, cocoa and coffee crops. Thus, it should be regarded as Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2].

Etymology:—The epithet pays honor to Karin Weishaar Douthit (b. 1926), a remarkable and long–time plant illustrator from the University of Michigan.

Taxonomic notes:—*Amorimia kariniana* resembles *A. amazonica*, *A. camporum* and *A. concinna* due to their pubescent anthers. *Amorimia kariniana* is especially similar to *A. camporum*, due to their branches with whitish lenticels, estipules 0.3–0.7 mm long, petiole longer than 2 mm long, and samaras with areoles narrowly ovate to ovate to elliptic. Nonetheless, it can be differentiated by its larger leaves with petioles (5–)7–10 mm long, sepals mostly appressed at anthesis, posterior petal strongly differentiated from lateral petals (with a much longer claw and smaller limb), limb of lateral petals 7.5–8.5 × 6–7 mm, and samaras with lateral wings 3–4.2 × 2–3 cm and with the dorsal wing extending to base of nut or nearly so.

2.5. *Amorimia pubiflora* (A.Juss.) Anderson (2006: 183). Basionym:—*Hiraea pubiflora* Jussieu (1833: 14) ≡ *Mascagnia pubiflora* (A.Juss.) Grisebach (1858: 91) ≡ *Mascagnia pubiflora* var. *typica* Niedenzu (1908: 23) *nom. illeg.* Lectotype (designated by Anderson 2006):—BRAZIL. Minas Gerais: near Mangahy (currently Municipality of Manga), 1816, fl. fr., *A. St.-Hilaire s.n.* (P barcode 02429221!; isolectotype: MPU barcode 020182!, P barcode 02429220!, P barcode 02429222!). Fig. 36–37.

= *Mascagnia parnahybensis* Glaziou (1905: 77) ≡ *Mascagnia pubiflora* var. *grandifolia* Niedenzu (1908: 23), *nom. illeg.* ≡ *Mascagnia pubiflora* var. *parnahybensis* (Glaziou) Niedenzu (1928: 115). Lectotype (designated by Anderson 2006):—BRAZIL. Goiás: border of Rio Parnahyba, January 1894, fl. fr., *A. Glaziou 20757* (P barcode 02429219!; Isotypes: G barcode 00352760!, K barcode 000427419!, P barcode 02429218!).

Woody vines to scandent shrubs; branches striated, sparsely lenticelate, lenticels brown, densely velutine to glabrescent at age; stipules 0.4–0.5 mm long, triangular, glabrous, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* opposite to subopposite, reduced in inflorescences; petioles 3–7 mm long, canaliculated, densely velutine to glabrous at age, eglandular to biglandular at apex; leaf blades 7.5–20.5 × 4–12 cm, plane, not bullate, elliptic to ovate, base cordate, rarely cuneate, margin revolute, apex acuminate to mucronate, both sides densely velutine to glabrescent at age, eglandular to 1 pair of glands, 0.3–0.5 mm diam., near base or up to 2.5 mm of margins; midvein adaxially impressed, abaxially prominent, 7–9 pairs of secondary veins, arching 45–50°, subopposite to alternate, adaxially bullate, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) or panicles*; axillary; main axis 12–32 cm long, slightly flattened, striated, densely velutine; cincinni 50–52, 1-flowered, decussate to alternate; reduced leaves elliptic, apex mucronate; bracts 4.5–5.5 × 1.5–2.5 mm, elliptic to lanceolate, plane, petiolate, leaf-like, parallel to peduncle, 1 pair of glandes at base to middle, both sides velutine; peduncle 7–8.5 × 0.7–1.2 mm, cylindrical, velutine; bracteoles 3–3.5 × 1–2 mm, elliptic to lanceolate, plane, petiolate, opposite to subopposite inserted bellow the apex of peduncles, parallel to the pedicel, 1 pair of basal glands, both sides velutine. *Flowers* 2–2.8 mm diam. at anthesis; floral buds 5.5–7 × 4.8–5.3 mm at anthesis; pedicels 8–12 × 1–1.2 mm, cylindrical, velutine. *Sepals* 3–3.5 × 1.5–2 mm, widely ovate, not appressed to the androecium, apex acute to obtuse, revolute at anthesis, adaxially glabrous, abaxially velutine; glands green turning yellow, 1.7–2.5 × 1–1.5mm. *Petals* yellow, margin sinuate, anterior-lateral petals not overlapping; lateral petals patent, limb 7–10 × 5.5–7.5 mm, elliptic to spatulate, base cuneate to obtuse; claws 2–2.5 × 0.5–0.55 mm, plane, adaxially glabrous, abaxially velutine; posterior petal erect, limb 8–8.5 × 3.5–5.5 mm, elliptic, base rounded, eglandular to 1-pair of glands, adaxially glabrous, abaxially velutine; claw 3.5–3.7 × 1–1.2 mm, plane, adaxially glabrous, abaxially velutine. *Stamens* 10, those opposite petals longer than those opposite sepals, those opposite the anterior-lateral sepals partially or completely fused to the adjacent filament; filaments 1.5–2.5 × 0.3–0.5 mm, connate ca. 0.1 mm long at base, filaments opposite to sepals larger than those opposite to petals shorter, glabrous; anthers monomorphic, straight, with a glandular connective, 1.5–2.5 × 0.3–0.5 mm, erect to reflexed, pubescent at base and apex. *Ovary* 1.5–2 × 1.5–2 mm, each carpel with primordial dorsal and lateral wings, velutine; styles 3, cylindrical at base, laterally flattened at apex, parallel at base, divergent at middle, apex uncinated, pubescent at base, glabrous at middle and apex, anterior style 1.2–1.8 mm long, posterior styles 1.5–2 mm long; stigma lateral, crateriform. *Samaras* bright yellow *in vivo*; dorsal wing 13–14 × 3–4 mm, depressed obovate, margin entire, sinuate, both sides velutine; lateral wings 1.8–2 × 2.7–3.2 cm, flabelliform, margin erose, sinuate, upper angle 55–60°, lower angle 60° from the nut, both sides velutine; nut 9–9.5 × 3.5–4 mm, ovoid, velutine; areole 9.4–10 × 3–3.5 mm, narrowly triangular. *Seeds* 7–8 × 5–5.5 mm, testa smooth; embryo ovoid, cotyledons folded.

Specimens analyzed:—BRAZIL. *sin. loc.*, *s.dat.*, fl., *Pohl s.n.* (F872521); *sin. loc.*, *s.dat.*, fl., *s.leg. 1545* (KH2013/0134821); **Bahia:** Porto, extremo Rio São Francisco, 27 July 1939, fl., *Mendes s.n.* (HUEFS 204341, SP); *loc. cit.*, 27 July 1939, fr., *Mendes s.n.* (HUEFS 204340, SP). **Goiás:** Mun. Piranhas, disturbed hillside, 700 m, 22 June 1966, fl., *Irwin 17573* (IAN, NY, UB); **Mato Grosso:** Mun. Cáceres, June 2011, fl., *Molleta s.n.* (UFMT); *loc. cit.*, 24 July 1972, fl., *Jesus 1745* (RB); Mun. Colniza, 16 July 2012, fl. fr., *Pereira s.n.* (UFMT43014). **Mato Grosso do Sul:** Mun. Aquidauana, nos arredores de Aquidauana, April 2001, fl., *Garcez s.n.* (CGMS, HUEFS207597); *loc. cit.*, Fazenda Santa Cruz, 17 July 1969, fl. fr., *Hatschbach 21887* (MBM, P); *loc. cit.*, Fazenda Cutepe, 6 September 1971, fl., *Dobereiner 803* (F, RB, US); Mun. Bodoquena, local próximo a sede da fazenda Rancho Branco, entorno leste do Parque Nacional da Serra de Bodoquena, S20°40’15’’ W56°45’55’’, 230 m, 30 August 2005, fl. fr., *Pott 13270* (CGMS, HMS, HUEFS); Mun. Brasilândia, entre Lagoa Sucuri-Duzão, S52º05’ W21º43’, 25 September 1996, fr., *Rezende 3556* (SPF, SJRP); Mun. Miranda, local sede da Fazenda Miranda, 4 September 2000, fl. fr., *Pott 4204* (CGMS, HMS, HUEFS, SP); *loc. cit.*, Fazenda Lacobe, April 1971, fl., *Dobereiner 795* (HUEFS, RB); Mun. Três Lagoas, local Chamflora, margem do rio Paraná, S21°00’55’’ W51°45’39’’, 260 m, 27 September 2002, fl. fr., *Pott 10411* (CEN, CGMS, CPAP, HMS, HUEFS, SP); *loc. cit.*, Porto Independência, 20 October 1994, fl., *Jacques 357* (CGMS, UB); *loc. cit.*, Lagoa Funda, 18 April 1971, fl., *Dobereiner 774* (HUEFS, RB); *loc. cit.*, Barra do Moeda, Reserva Florestal de Três Lagoas Agroflorestal Ltda, 18 June 1993, fl., *Caliente 609* (HISA, SP); *loc. cit.*, 27 August 1955, fl., *Ribeiro s.n.* (IAC18036). **Minas Gerais:** Jiquetahy in Rio São Francisco, *s.dat.*, fl., *Pohl 5778* (W0068976!; isolectotype: NY!; Mun. Araporã, Reserva Vegetal da Usina Alvorada, 12 October 2000, fr., *Arantes s.n.* (HUEFS211196, HUFU28411); *loc. cit.*, 7 June 2001, fr., *Arantes s.n.* (HUEFS 211197, HUFU); Mun. Itacarambi, *s.dat.*, fr., *Ferreira s.n.* (PAMG11405); Mun. Jaíba, APA Serra do Sabonetal, Fazenda Agropeva, 21 September 2006, fl. fr., *Marino 203* (BHCB); Mun. Januária, fazenda Santa Cecília, área de pastagem, 17 August 1994, fl., *Arbocz 656* (HUEFS, SP); *loc. cit.*, Vale do Peruaçu, Janelão, 25 October 1997, fl. fr., *Salino 3703*

(BHCB); *loc. cit.*, vale do Peruaçu, perto do Boqueirão, S15°07’23,9’’ W44°14’29’’, *s.dat.*, fl., *Costa 363* (BHCB56397); Mun. Santa Luzia, Fazenda São Sebastião, 26 October 1938, fr., Malheiros s.n. (HUEFS204343, SP39746); Mun. Tupaciguara, Fazenda Córrego Fundo, 1 September 1972, fl., *Dobereiner 901* (BHCB, PAMG, RB); Mun. Uberlândia, entre Uberlândia e Monte Alegre, 15 January 1980, fl. fr., *Parreira 01* (PAMG); **São Paulo:** *sin. loc.*, 16 August 1960, fl., *Silva s.n.* (IAC18641); *sin. loc.*, October 1961, fr., *Toledo s.n.* (IAC18708); Mun. Andradina, Fazenda Guanabara, 13 December 1939, fl., *Rocha-Silva s.n.* (SP012033); Mun. Araraquara, 20 September 1961, fl., *Vieira s.n.* (HUEFS203425, RB315272, SPF23655); Mun. Castilho, Estação Junqueira, Fazenda Itapura, 19 September 1941, fl., *Corbett s.n.* (HUEFS204337, SP45967); *loc. cit.*, entre estação Junqueira e Porto Jupiá, rio Paraná, 22 July 1961, fl. fr, *Jaccoud 68* (SP); *loc. cit.*, 20 August 1972, fl., *Melichenko s.n.* (IAC23057); Mun. Panorama, bairro de Itaziara, rio Paraná, 13 October 1998, fr., *Bicudo 88* (SP); Mun. Pereira Barreto, 12 August 1938, fl., *Lara s.n.* (HUEFS 204344, SP).

Distribution, habitat and phenology:—*Amorimia pubiflora* is known to semi-deciduous forests in the states of Bahia, Mato Grosso, Mato Grosso do Sul, Minas Gerais, and São Paulo (Fig. 33). Flowering from April to December and fruiting from June to October.

Conservation status:—*Amorimia pubiflora* originally possessesd a wide EOO of ca. 1,507,628.658 km². Nonetheless, as aforementioned, it has been the focus or Brazilian farmers, since it is the may cause of bovine sudden death in central Brazil. Farmers employ a wide range of control techniques, such as biological, manual and mechanical, and have been able to almost completely eradicate the species in some regions. This is supported by our complete lack of success in collecting *A. pubiflora* in the past four years, in different parts of Brazil, where once they were considered common. Thus, it should be regarded as Critically Endangered [CR, A3b+B1ab(v)+C2a(i, ii)+D1+E].

Etymology:—The epithet probably makes reference to its densely pubescent indumenta on both sides of leaf blades.

Taxonomy notes:—As aforementioned, *A. pubiflora* resembles *A. concinna* due to their similar fruit morphology, and because they are the only two species from *A.* subg. *Uncina* that possess densely velutine indumentum in several vegetative organs. *Amorimia pubiflora* is also similar to *A. septentrionalis* due to its glabrous anthers, being easily differentiated by its velutine stems, without lenticels, leaf-blades velutine, cordate or subcordate at base, and petals adaxially glabrous.

2.6. *Amorimia septentrionalis* Anderson (2006: 183). Holotype:—BRAZIL. Ceará: *Sin. loc.*, 22 June 1958, fl. fr., *J. Döbereiner 538* (MICH barcode 1244752!). Fig. 38, 40.

Woody vines to scandent shrubs; stem striated, densely lenticelate, lenticels whitish, sparsely sericeous-velutine to glabrescent at age; stipules 0.5–1.5 mm long, narrowly triangular, glabrous, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* opposite, reduced in inflorescences; petioles 3–4 mm long, canaliculated, sparsely sericeous-velutine to glabrous at age, eglandular; leaf blades 5–12 × 2.5–5.5 cm, plane, not bullate, narrow to wide-elliptic to obovate, base cuneate to rounded, margin plane, apex acute to acuminate to rounded, adaxially sericeous-velutine to glabrescent at age, abaxially persistently sericeous-velutine, eglandular to 1 pair of glands, 0.3–0.5 mm diam., near base or up to 1.4 mm of margins; midvein adaxially impressed, abaxially prominent, 4–6 pairs of secondary veins, arching 50°, subopposite to alternate, adaxially impressed, abaxially prominent, reticulum prominent on both sides. *Thyrses (pseudoracemes) to panicles*, axillary to terminal; main axis 4–20 cm long, slightly flattened, striated, sericeous-velutine; cincinni 10–50, 1-flowered, decussate to alternate; reduced leaves elliptic to obovate, apex mucronate; bracts 2–6 × 1–2 mm, lanceolate, plane, sessile, leaf-like, parallel to the peduncle, 1 pair of glands at base, both sides sericeous-velutine; peduncle 1–4 × 0.4–0.5 mm, cylindrical, sericeous-velutine; bracteoles 1.2–1.8 × 0.6–1 mm, elliptic, plane with revolute margins, sessile, inserted at the apex or below peduncles, parallel to the pedicel, eglandular to 1 pair of glands at base, both sides sericeous-velutine. *Flowers* 0.9–1.1 mm diam. at anthesis; floral buds 4.5–5 × 3–3.5 mm at anthesis; pedicels 3–4 × 0.4–0.5 mm, cylindrical, sericeous-velutine. *Sepals* 1.5–2.2 × 1.2–2 mm, triangular, not appressed to the androecium, apex acute, revolute at anthesis, adaxially glabrous, abaxially sericeous-velutine; glands yellow turning ocher, 6–10 × 2–2.8 mm. *Petals* yellow turning orange, margin sinuate, anterior-lateral petals not overlapping; lateral petals patent at anthesis, limb 3.2–6 × 2–2.7 mm, elliptic to spatulate, base cuneate, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claws 0.5–1.2 × 0.5–0.55 mm, plane, adaxially sericeous-velutine, abaxially sericeous-velutine; posterior petal erect, limb 3.3–4.2 × 2–2.5 mm, spatulate, base cuneate, eglandular, adaxially sericeous-velutine distally, abaxially sericeous-velutine; claw 0.7–1.5 × 1–1.2 mm, plane, adaxially sericeous-velutine, abaxially sericeous-velutine. *Stamens* 10, those opposite petals longer than those opposite sepals; filaments 1.5–2 × 0.4–0.5 mm, connate 0.15 mm long at base, glabrous; anthers monomorphic, recurved, with a glandular connective, 0.8–1.5 × 0.5–0.57 mm, erect at anthesis, pubescent at base and apex. *Ovary* 1.2–1.5 × 1.2–1.5 mm, each carpel with primordial dorsal and lateral wings, sericeous-velutine; styles 3, cylindrical at base, laterally flattened at apex, parallel at base, divergent at middle, apex uncinated, sericeous-velutine at base, glabrous at middle and apex, anterior style 1.4–1.42 mm long, posterior styles 1.5–1.6 mm long; stigma lateral, crateriform. *Samaras* green to ocher *in vivo*; dorsal wing 7–15 × 1.5–5 mm, depressed obovate, margin erose, sinuate, both sides sericeous-velutine; lateral wings 2–3.3 × 0.8–2 cm, flabelliform, margin dentate, sinuate, upper angle 45°, lower angle 75° from the nut, both sides sericeous-velutine; nut 6.5–7 × 4.5–5 mm, ovoid to suborbicular, sericeous-velutine; areole 4.5–7 × 4–5 mm, wide-ovate. *Seeds* 5–5.5 × 4–4.2mm, testa smooth; embryo ovoid, cotyledons folded.

Specimens analyzed:—BRAZIL. Alagoas: *sin. loc.*, November 1933, fl., *Kuhlmann 16053* (RB); Mun. Água Branca, 13 September 1954, fl., *Falcão 1070* (RB); *loc. cit.*, 25 August 1983, fl., *Staviski 649* (MAC, MG); Mun. Palmeira dos Índios, 7 February 1969, fl., *Dobereiner 496* (RB). **Bahia:** *sin. loc.*, *s.dat.*, fl., *Bondar 1245* (F). **Ceará:** *sin. loc.*, *s.dat.*, fl., *Loefgren 881* (RB); *sin. loc.***,** 6 July 1984, fr., *Ataíde 252* (HUEFS, IPA); *sin. loc.*, *s.dat.*, fl., *Richa 49* (RB); *sin. loc.*, 1928, fl., *Rolland 25* (K); Mun. Acarape, margem da estrada para Garapa, 27 August 1994, fr., *Silveira s.n.* (EAC21293, HUEFS203642); Mun. Alcântaras, sítio Algodões, Serra da Meruoca, 28 February 2000, fl., *Fernandes s.n.* (EAC29054, HUEFS203641); *loc. cit.*, 5 January 1962, fr., *Fernandes s.n.* (EAC, HUEFS 203648); *loc. cit.*, 10 December 1976, fr., *Fernandes s.n.* (EAC 3060, HUEFS 203644); Mun. Baturité, estrada da Serra do Vicente, 16 May 1980, fl. fr., *Martins s.n.* (EAC8652, HUEFS203645); *loc. cit.*, Serra do Baturité, perto do açude de Aacarape, 18 July 1939, fr., *Eugenio 1297* (HUEFS, RB); *loc. cit.*, Estação Baturité, beira da estrada nas colinas, 10 April 1909, fl., *Ducke 1960* (HUEFS, RB); *loc. cit.*, 17 December 1967, fl., *Dobereiner 406* (RB); Mun. Caridade, 8 March 2002, fl., *Fernandes s.n.* (EAC 21394); *loc. cit.*, Campos Belos, estrada de inhuporanga, 8 July 2008, fr., *Menezes 30* (EAC); *loc. cit.*, 12 km de Campos Belos, S04°10,9’49’’W38°59,7’73’’, 250 m, 17 March 2002, fl. fr., *Souza*

28690 (ESA, RB); Mun. Caucaia, 17 June 1985, fl., *Nunes s.n.* (EAC 13267); *loc. cit.*, 3 February 1996, fl., *Castro s.n.* (EAC 23955); Mun. Cratéus, Grajal, Serra das Almas, S05°06’00’’ W40°52’22’’, 250 m, 4 June 2002, fl., *Araújo 1550* (EAC, HUEFS, JPB); Mun. Cruz, para Campos Belos, 6 May 1909, fl., *Ducke 2244* (MG, RB); Mun. Fortaleza, Modubim, Av. Perimetral, 2 July 1974, fl., *Matos s.n.* (EAC5431, HUEFS204342); Mun. General Sampaio, Fazenda Natália, 29 April 2007, fl., *Moro 113* (EAC); Mun. Guaiúba, Fazenda Guaiúba, 12 September 1995, fl., *Pereira 1* (EAC); Mun. Itaitinga, Sererau, 10 April 2003, fl. *dos Santos s.n.* (EAC32666, HUEFS80820); Mun. Jaguaribe, Fazenda Mulungu, 9 June 1943, *Bezerra s.n.* (EAC624, HUEFS203649); Mun. Maranguape, a margem da estrada, Sítio Luís Montenegro, 1 May 1955, fl., *Bezerra s.n.* (EAC1163, HUEFS); *loc. cit.*, estrada para Pitaguari, 7 March 1996, fl., *Castro s.n.* (EAC23959); *loc. cit.*, pé da Serra de Aratanha, 13 July 1955, fl., *Ducke 2474* (EAC, HUEFS, IAN); *loc. cit.*, Hotel Pirapora, 15 August 1935, fr., *Drouet 2261*, *2279* (F, GH, NY); *loc. cit.*, Serra de Maranguape, October 1910, fr., *Ule 9040* (L, K); Mun. Novo Oriente, 25 October 1997, fl., *Fernandes s.n.* (EAC25940); Mun. Pacatuba, 10 April 1991, fl., *Bezerra s.n.* (EAC 27570); Mun. Pacujá, 15 June 2007, fl., *Andrade 3098* (HUEFS, HUVA); Mun. Quixadá, 27 June 1955, fl., *Black 55-18227* (EAC, IAN); Mun. Reriutaba, 14 June 2007, fl., *Teixeira 19* (HUEFS, HUVA); Mun. Santa Quitéria, estrada para Itatira a 13km da BR-020, 26 April 1979, fl., *Fernandes 5965* (EAC, UEFS); Mun. São Gonçalo do Amarante, 28 March 1936, fl., *Luetzelburg 27022* (K, NY); Mun. Senador Pompeu, December 1950, fl., *Dayton s.n.* (IAN 097706); Mun. Sobral, Centro Nacional de Caprinos, 29 July 1977, fl., *Mello s.n.* (BAH 2055). **Maranhão:** Mun. Vargem Grande, 20 May 1933, fl., *Luetzelburg 23600* (NY). **Paraíba:** *sin. loc.*, February 1933, fl., *von Ihering s.n.* (HUEFS 204345, SP 30234); Mun. Aguiar, sítio São Bento, areal aguiar, S07°06’22,6’’ W38°12’24,8’’, 273 m, 16 April 2014, fl., *Fontana 8002* (RB); Mun. Alagoa Grande, July 1922, fl., *Gusmão 26277* (RB); Mun. Araruna, entrada do Parque Estadual da Pedra da Boca, S06°26’26’’ W35°38’31’’, 220 m, 16 March 2003, fl. *Lima 1763* (HUEFS, JPB); Mun. Areia, 18 October 1958, fr., *Moraes s.n.* (CEPEC78956, HUEFS, IAN1943, RB104082); Mun. Cajazeiras, Engenheiros Ávidos, Serra de Santa Catarina, September 2009, fr., *Gadelha Neto 2649* (HUEFS, JPB, RB); Mun. Guarabira, Fazenda Boa Sorte, 19 September 1937, fl., *Deslandes 10* (HUEFS, SP); Mun. Juarez Távora, 5 September 1996, fl., *Barbosa 1532* (HUEFS, JPB); Mun. Souza, Fazenda Riacho da Taba, 11 June 1993, fr., *Gadelha Neto 32* (HUEFS, JPB); *loc. cit.*, 6 March 1994, fl., *Gadelha Neto 82* (HUEFS, JPB); *loc. cit.*, São Gonçalo, 1935, fl. fr., *Seccas 54*

(HUEFS, RB); *loc. cit.*, 12 June 1941, fl., *Vidal 17730* (HUEFS, IPA); Mun. Tacima, Pedra da Boca, 18 May 2002, fl., *Agra 5864* (HUEFS, JPB); **Pernambuco:** Mun. Betânia, Tapera, 14 June 1932, fl., *Pickel s.n.* (NY00476096); *loc. cit.*, August 1930, fl., *Pickel 26* (F); *loc. cit.*, September 1920, fl., *Pickel 278* (IAN, IPA, OUR); Mun. Bom Conselho, 07 February 1969, fr., *Dobereiner 498* (PAMG, RB, MO); Mun. Carpina, Mata do Engenho Trapuá, Usina Petribú, 10 August 1996, fl. fr., *Lucena 608* (HST, K, PEUFR); Mun. Limoeiro, 18 June, 1973, fl., *Foerster s.n.* (IAN); *loc. cit.*, F. Socorro, 29 June 1950, fl., *Leal 192* (HUEFS, RB); *loc. cit.*, 5 December 1972, fl., *Dobereiner 398, 399, 400, 401, 402, 403, 404* (RB); Mun. Mirandiba, estrada para Cacimba Nova, 31 March 2006, fl. fr., *Pinheiro 94* (CEPEC, UFP); *loc. cit.*, Fazenda Pau de Leite, 17 July 2008, fr., *Pinheiro 997, 998* (JPB, UFP); Mun. Nazaré da Mata, 24 October 1953, fl., *Moraes 938* (IAN, UB); Mun. Rio Formoso, 1983, fl., *Coelho 47896* (HUEFS, IPA); Mun. Paudalho, 22 December 1967, fl., *Dobereiner 405* (RB); Mun. São Lourenço da Mata, Estação Ecológica do Tapacurá, 10 October. 1999, fr., *Miranda 3606* (BHCB, HST); Mun. Serra Talhada, Estação Experimental do IPA, 26 March 1995, fl., *Miranda 2215* (HSTA, HUEFS, INPA, UEC); *loc. cit.*, Manga Pedra Branca, 15 May 1968, fl., *Lira 68-217* (HUEFS, IPA, OUR, PAMG); *loc. cit.*, próximo à estação da UFRPE, 12 July 1990, fr., *Bocage 53684* (HUEFS, IPA); Mun. Timbaúba, Fazenda Santa Luzia, 4 September 1972, fr. *Gomes s.n.* (IAN140059); Mun. Trindade, 36 km de Vitória, estrada em direção a Ipudi, 10 July 1994, fl., *Pinto 122* (EAC); Mun. Triunfo, na estrada para Princesa Isabel, 25 May 1971, fr., *Heringer 925* (HUEFS, IPA, R, RB); Mun. Vicência, Engenho Jundiá, 29 November 1957, fl. fr., *Andrade-Lima 2822* (HUEFS, IPA). **Piauí:** Mun. Conceição do Canindé, Fazenda Matroa, 5 May 1993, fl., *Passos s.n.* (EAC19709, TEPB6583); *loc. cit.*, Fazenda Porém Enquanto, 5 May 1993, fl., *Passos s.n.* (EAC19107, TEPB6582); Mun. Elasbão Veloso, Fazenda Santa Maria, 3 May 1993, fl., *Passos s.n.* (EAC19708, TEPB6581). **Rio Grande do Norte:** Mun. Açu, Baixa Verde, 18 May 1983, fl. fr., *Freitas Filho 182* (UFRN); Mun. Acari, Sítio Talhado, S06º19’53’’ W36º37’29’’, 26 February 2011, fl., *Roque 881* (HUEFS, RB, UFRN); Mun. Canguaretama, margem da estrada de acesso à Barra do Cunhaú, S06º19’37’’ W35º03’29’’, 16 July 2006, fl. fr., *Oliveira 1736* (IPA, MOSS, UFRN); Mun. Macaíba, Escola Agrícola de Jundiaí, Mata do Olho D’água, 26 August 2000, fr., *Cestaro 47* (UFRN); *loc. cit.*, 17 October 1952, fl., *Azevedo 13* (RB); Mun. Mossoró, Sítio Camurupim, S5º11’15’’ W37º20’39’’, 23 April 2008, fl., *Silva s.n.* (HUEFS, MOSS, UFRN); Mun. Natal, Macaíba, 16 September 1951, fl., *Alvarenga 5* (PAMG, RB); Mun. Riacho de Santana, Sítio Paul de Cima, 18 July 1987, fl. fr., *Carvalho*

4 (HRCB, RB, UB); Mun. Timbaú do Sul, 16 July 2006, fr., *Oliveira 1736* (ASE, HUEFS, MOSS, UFRN). **Sergipe:** Mun. Maruim, Fazenda Praia, 20 August 1971, fr., *Dobereiner 790* (ASE, HUEFS, RB); *loc. cit.*, Mata do Caititu, 22 May 2013, fl., *Gomes 1094* (ASE); *loc. cit.*, November 2015, fl. fr., *Almeida et al.* 800 (CEPEC, HUEFS, RB).

Distribution, habitat and phenology:—*Amorimia septentrionalis* is known from SDTF in the states of Alagoas, Bahia, Ceará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe (Fig. 33). Flowering and fruiting throughout the year.

Conservation status:—*Amorimia septentrionalis* possesses a wide EOO of ca. 499,881.756 km² and an AOO of ca. 28.000 km². However, it is endemic to the Caatinga domain, which has be greatly modified by human activities in the past few decades. Thus, it should be regarded as Endangered [EN, B1ab(iii, iv, v)+C2a(i, ii)+D2].

Etymology:—The epithet makes reference to its northern distribution within the genus in Eastern Brazil.

Taxonomic notes:—Two years after the description of the basionym of *Amorimia amazonica*, Niedenzu (1928) published his Malpighiaceae monograph. The author cited two additional collections for this species, besides the type specimen, from the municipalities of Baturité and Ipú, in the state of Ceará, Brazil. Almost 80 years later, Anderson (2006) published a new species of *Amorimia* based on a collection from an unknown locality also in the state of Ceará, *A. septentrionalis*. Due to its distribution be restricted to Northeastern Brazil, Anderson compared this new species to *Amorimia rigida*, a recently untangled species complex from Brazil. Unlike the comments made by Anderson, *A. septentrionalis* is not morphologically related to the *A. rigida* complex, but to *A. amazonica*, as previously stated by Niedenzu (1928). This species belongs to the subg. *Uncina*, due to sharing several morphological characters, such as abaxially glabrous sepals, obovate to spatulate petals, base cuneate, claws plane, and styles uncinated at apex. It is morphologically related to *A. pubiflora* and *A. tumida* due to their pubescent anthers. However, *A. septentrionalis* is morphologically more similar to *A. pubiflora* due to their leaf-blades with a pair of glands at base, inflorescences with more than 10 flowers, pedicel thin in fruit, filaments glabrous, styles glabrous near apex, and samaras pale green to ocher. *Amorimia septentrionalis* can be differentiated by its tomentose and lenticelate stems (*vs.* velutine without lenticels), leaf-blades cuneate or rounded at base, tomentose (*vs.* cordate or subcordate at base, velutine), and petals adaxially sparsely sericeous-velutine (*vs.* adaxially glabrous).

2.7. *Amorimia tumida* R.F.Almeida & A.C.Marques (in Almeida *et al.* in prep.). Holotype:—BRAZIL. Rio de Janeiro: Mun. Cardoso Moreira, Serra da Bandeira, Mata Estacional Semidecidual Baixo-Montana, 17 December 2013, fr., *M.N. Coelho & I.G. Costa 2794* (RB!; isotypes: CEPEC!, HUEFS!). Fig. 39–40.

Woody vines; branches striated, sparsely lenticelate, lenticels brown, sparsely sericeous-velutine to glabrous at age; stipules 0.5–0.6 mm long, narrowly triangular, sericeous, interpetiolar on branches, epipetiolar on inflorescences, persistent to deciduous. *Leaves* opposite, reduced in inflorescences; petioles 4.3–6.6 mm long, canaliculate, sparsely sericeous-velutine to glabrous at age, eglandular at apex; leaf blades 4–9.5 × 2.1–5.1 cm, plane, not bullate, elliptic, base obtuse, margin slightly revolute *in sicco*, apex acuminate, adaxially glabrous, abaxially sparsely sericeous-velutine to glabrescent at age, eglandular; midvein adaxially impressed, abaxially prominent, 8–9 pairs of secondary veins, arching 48–55°, opposite to subopposite, both sides impressed, reticulum impressed on both sides. *Thyrses (pseudoracemes)*, axillary; main axis 8.45–9.75 cm long, cylindrical, striated, sericeous-velutine; cincinni 6–8, 1-flowered, decussate; reduced leaves absent; bracts 1.3–3.3 × 1–1.6 mm, lanceolate, plane, petiolate, deflexed to the peduncle, 1 pair of marginal glands near base, both sides sericeous-velutine; peduncle 11–20 × 0.7–1 mm, laterally flattened, sericeous-velutine; bracteoles 1.1–1.8 × 0.5–0.6 mm, oblong, concave, sessile, subopposite, inserted 2.5–4 mm below the apex of peduncles, deflexed to the peduncle, eglandular, both sides sericeous-velutine. *Flowers* diameter unknown; floral buds (fragments) 5.5–8 × 5–6 mm; pedicels (in fruits) 6–8 × 1–1.5 mm, cylindrical, tumid, sericeous to glabrescent. *Sepals* 3.5–4 × 2.5–3 mm, narrowly oblong, not appressed to the androecium, apex obtuse to rounded, revolute at anthesis, both sides sericeous-velutine; glands greenish turning brown at age, 3–3.1 × 1.3–1.5 mm. *Petals* unknown. *Stamens* 10, those opposite to petals longer than those opposite to sepals?; filaments 1.8–2 × 0.5–0.7 mm, connate 1–1.5 mm long at base, both sides entirely pubescent; anthers unknown. *Ovary* unknown, probably each carpel with primordial dorsal and lateral wings, probably sericeous-velutine; styles 3, cylindrical at base and apex, parallel at base and middle, apex apiculate, entirely sericeous-velutine, anterior style 2–2.1 mm long, posterior styles 2.5–2.8 mm long; stigma lateral, crateriform. *Samaras* metallic green *in vivo* and *in sicco*; dorsal wing 10–15 × 5–6 mm, depressed ovate, margin entire, sinuate, both sides sericeous-velutine; lateral wings 1.6–2.3 × 1.8–3 cm, flabelliform, margin erose, sinuate, upper angle 15°, lower angle 55° from the nut, both sides sericeous-velutine; nut 5–6 × 5–6 mm, narrowly ovoid, sericeous-velutine; areole 8.6–10 × 2.6–3.5 mm, narrowly-ovoid. *Seeds* 6.1–9 × 3.5–6.5 mm, testa rugose with lateral crests; embryo ovoid, cotyledons folded.

Distribution, habitat and phenology:—*Amorimia tumida* is known only from Semi-deciduous forests in northern Rio de Janeiro state (Fig. 33), fruiting in December.

Conservation status:—Despite recent efforts on recollecting *Amorimia tumida* in its type locality on Northern state of Rio de Janeiro, we were unable to locate it on the field. The collector of the type specimen did not record geographic coordinates for this specimen, and little was written in the specimen's label about its habitat and gazetteer. Unfortunately, this species remains represented by a single collection from Semi-deciduous Forests associated to rocky outcrops within the Atlantic Forest of Serra da Bandeira, Northern state of Rio de Janeiro. Thus, this species should be regarded as Data Deficient (DD).

Etymology:—The epithet makes reference to its tumid pedicels in fruiting, a unique feature in the genus.

Taxonomic notes:—*Amorimia tumida* resembles *A. andersonii* (a member of *A.* subg. *Amorimia*) on the shape and position of bracts and bracteoles, disposition of sepals at anthesis, color of sepal glands in anthesis, indumenta of filaments, shape of styles, and shape of the dorsal wing of samaras. However, it differs of *A. andersonii* on leaf blade shape and presence of glands at base, fewer secondary veins, veins joining the primary vein in an acute angle, fewer flowers in inflorescences, pedicel tumid in fruits, filaments completely sericeous, styles completely sericeous, samaras sericeous. *Amorimia tumida* is also similar to *A. pubiflora* and *A. septentrionalis*, due to their pubescent anthers. Nonetheless, is can be easily differentiated by its leaf-blades without a pair of glands at base, inflorescences up to 8-flowered, pedicel thickened in fruit, filaments pubescent, style pubescent near apex, and samaras metallic green to ocher.

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Collectors' list

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(13), 2877 (6); **Linneo** 873 (1); **Lira** 68-217 (13); **Loefgren** 881 (13); **Lopes** 655 (12), 698 (9), 1340 (15); **Lordelo** 56-307 (10); **Lowrie** 259 (1); **Lucena** 608 (13); **Luetzelburg** 23600 (13), 27022 (13); **Macedo** 2112 (15); **Malheiros** s.n. HUEFS 204343 (11), s.n. SP 39746 (11); **Marchett** 155 (7); **Marinho** 31 (15), 396 (15), 654 (2), 676 (2); **Marino** 203 (11); **Martinelli** 2232 (9), 2240 (9); **Martins** s.n. EAC 8652 (13), HUEFS 203645 (13); **Matos** 84 (10), 325 (10), s.n. EAC 5431 (13), s.n. HUEFS 204342 (13); **Mattos** 22457 (7), 22640 (7); **Mattos-Silva** 3136 (9), 5117 (12); **Mauad** 128 (9); **Melichenko** s.n. IAC 23057 (11); **Mello** s.n. BAH 2055 (13); **Melo** 1334 (12), 3936 (4), 4790 (10), 6370 (10), 6372 (10), 8557 (4), 8563 (4); **Mendes** s.n. HUEFS 204340 (11), s.n. HUEFS 204341 (11); **Menezes** 30 (13); **Mentz** s.n. ICN 95118 (7); **Miranda** 2215 (13), 3606 (13), 6171 (10); **Molleta** s.n. UFMT (11); **Mojica** 1 (5); **Moraes** 938 (13), s.n. CEPEC 78956 (13), IAN 1943 (13), RB 104082 (13); **Mori** 14435 (10); **Moro** 113 (13); **Moura** 3 (4), s.n. HUEFS 69135 (10), s.n. HUEFS 69137 (10); **Nascimento** 38 (10), 83 (10); **Neves** 89 (10); **Nicolau** 1482 (7); **Noblick** 1839 (10), 3876 (10), 4228 (10); **Nunes** 266 (10), 1218 (10), s.n. EAC 13267 (13), s.n. RB 571 (10); **Oliveira** 299 (10), 658 (10), 751 (9), 1553 (10), 1554 (10), 1611 (15), 1736 (13); **Owlee** 1109 (8); **Pace** 350 (9); **Paixão** 676 (12); **Parreira** 01 (11); **Passos** s.n. EAC 19107 (13), s.n. EAC 19708 (13), s.n. EAC 19709 (13), s.n. TEPB 6581 (13), s.n. TEPB 6582 (13), s.n. TEPB 6583 (13); **Pennell** 4033 (5); **Pereira** 1 (13), 37-84, s.n. UFMT 43014 (11); **Pickel** 26 (13), 278 (13), s.n. NY 00476096 (13); **Pinheiro** 94 (13), 997 (13), 998 (13), 1132 (12); **Pinto** 05-1980 (4), 122 (13), s.n. ALCB 1929 (4), s.n. ALCB 17936 (4); **Pirani** 5462 (15), s.n. HUEFS 203426 (15); **Pohl** 5778 (11), 5780 (6), s.n. F 872521 (11), **Pott** 4204 (11), 10411 (11), 13270 (11); **Queiroz** 54 (10), 3259 (15), 4539 (15), 4590 (15), 4701 (15), 10607 (10), 10655 (10); **Rambo** 39952 (7), 41303 (7), 52768 (7); **Reis** s.n. CEPEC 99176 (9); **Rezende** 3556 (11); **Ribas** 8101 (7); **Ribeiro** s.n. IAC 18036 (11); **Richa** 49 (13); **Riedel** 503 (9); **Ritter** s.n. F 2111927 (7); **Rocha-Silva** s.n. SP 012033 (11); **Rodrigo** s.n. JPB 54379 (12), s.n. SP 337133 (12), VIC 23366 (12); **Rodrigues-Silva** 335 (12); **Rojas** 753 (1); **Rolland** 25 (13); **Roque** 881 (13); **Rubio** 2445 (8); **Rusby** 512 (1); **Saddi** 865 (12); **Salas** 1 (5), 418 (3); **Salino** 3703 (11), 3953 (12), 4658 (15), 4713 (15); **Salzmann** s.n. G barcode 00352762 (9); **Sampaio** 3219 (9); **Santana** 542 (10); **Santos** 21 (9), 354 (12), s.n. EAC 32666 (13), s.n. HUEFS 64423 (4), s.n. HUEFS 80820 (13); **SAP** 243 (15); **Schenkel** s.n. ICN 95120 (7); **Schlindwein** 532 (7), 534 (7); **Schuch** 5721 (6); **Schultz** 61 (7), 463 (7); **Schwacke** 3008 (1), 12939 (7); **Schwarz** s.n. W 68981 (1); **Seccas** 54 (13); **Sehnem** 1390 (7); **Seibert** 2171 (1); **Senna** 135 (7); **Shepherd** 4409 (8), **Silva** 85 (10), s.n. HST 17938

(10), s.n. HUEFS (13), s.n. IAC 18641 (11), s.n. MOSS (13), s.n. UFRN (13); **Silva-Filho** s.n. MPUC 17129 (7); **Silveira** s.n. EAC 21293 (13), s.n. HUEFS 203642 (13); **Simard** 12493 (12); **Siqueira** 561 (9); **Sobral** s.n. MBM 73963 (7); **Solomon** 6515 (1); **Souza** 5155 (15), 5254 (15), 26565 (10), 28690 (13), s.n. BAH 509 (12); **Souza-Silva** 15 (10), 20 (10), 612 (10), 650 (10); **Spruce** 4227 (1); **Stannard** 5312 (15); **Staviski** 649 (13); **Steinbach** 339 (1), 6606 (1); **Sucre** 1421 (6); **Teixeira** 19 (13); **Thomas** 11954 (12), 13476 (12); **Tiepolo** 632 (7); **Timaná** 2427 (1); **Toledo** s.n. IAC 18708 (11); **Torrend** s.n. ALCB 1928 (10), HUEFS 204347 (10); **Trieder** 33074 (7); **Ule** 9040 (13), 9478 (1); **Uribe** s.n. COL 423253 (5); **Valenzuela** 1062 (1); **Vandeman** 3309 (1); **Vanilda** 146 (10); **Vanni** 2903 (7); **Vásquez** 25843 (1); **Viana** 1397 (10); **Vianna** s.n. ICN 9660 (7), s.n. U 1367689 (7); **Vidal** 17730 (13); **Vidal-Senege** s.n. P 06173021 (1); **Vieira** 1401 (9), s.n. HUEFS 203425 (11), RB 315272 (11), SPF 23655 (11); **Vinha** 1204 (9); **von Ihering** s.n. HUEFS 204345 (13), s.n. SP 30234 (13); **Waechter** 1176 (7); **Warming** 838 (12); **Wasum** 914 (7); **Weigend** 5735 (1); **Woytkowski** 5459 (1); 7183 (3), 7200 (3), 7202 (3).

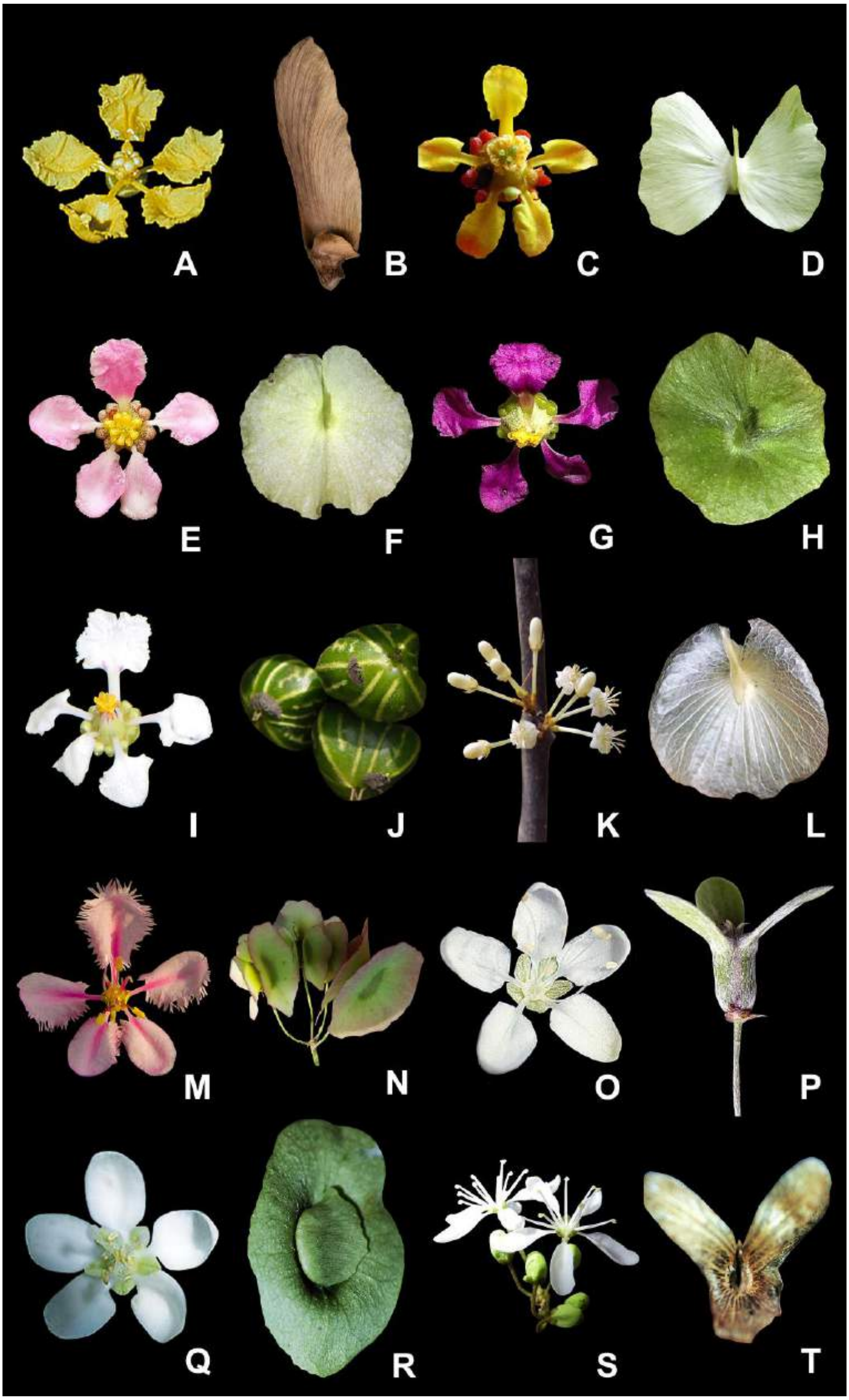


FIGURE 1. Morphological variation of flowers and fruits within the genera of the Malpighioid clade: A. flower in frontal view of *Ectopopterys soejartoii*; B. samara in side view of *Ectopopterys soejartoii*; C. flower in frontal view of *Amorimia maritima*; D.

samara in dorsal view of *Amorimia maritima*; E. flower in frontal view of *Mascagnia cordifolia*; F. samara in dorsal view of *Mascagnia sepium*; G. flower in frontal view of *Calcicola sericea*; H. samara in dorsal view of *Calcicola sericea*; I. flower in frontal view of *Malpighia fucata*; J. drupes in dorsal view of *Malpighia fucata*; K. flower in frontal view of *Aspidopterys canariensis*; L. samara in dorsal view of *Aspidopterys concava*; M. flower in frontal view of *Triaspis glaucophylla*; N. samara in dorsal view of *Triaspis glaucophylla*; O. flower in frontal view of *Rhynchophora phillipsonii*; P. samaras in side view of *Rhynchophora phillipsonii*; Q. flower in frontal view of *Madagasikaria andersonii*; R. samara in dorsal view of *Madagasikaria andersonii*; S. flower in side view of *Microsteira pluriseta*; T. samara in dorsal view of *Microsteira sp.* (photographs A-B by D.D. Soejarto; C-D by F. Flores; E by R. Sartin; F by M.O.O. Pellegrini; G-H by M.R. Pace; I-J by P. Acevedo-Rodriguez; K by D. Valke; L by L. Pok; M by B. Pilenaar; N. L. Ann; O-R, T by C.C. Davis; S. by L. Nusbaumer).

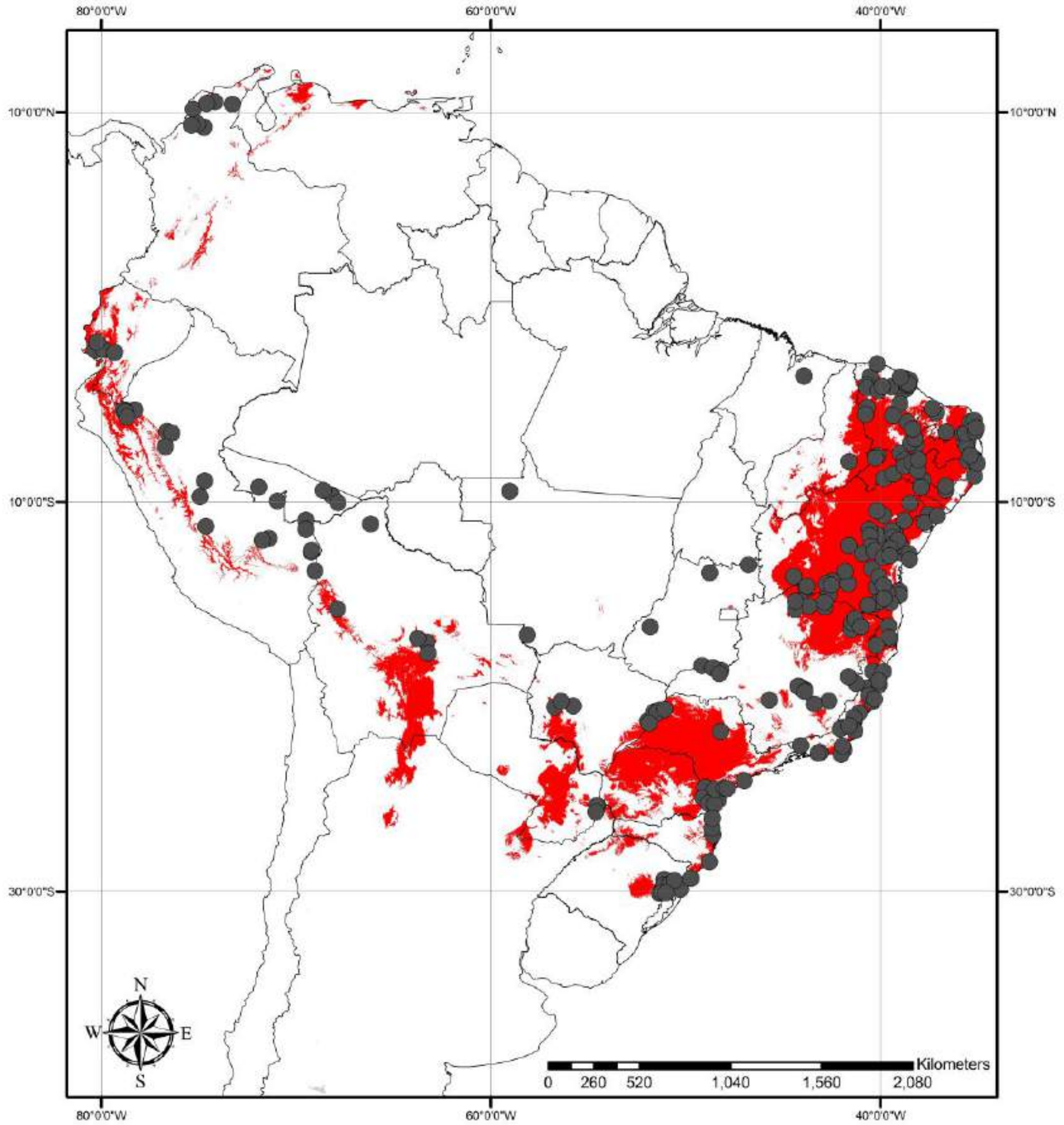


FIGURE 2. *Amorimia* distribution in Seasonally Dry Tropical Forests of South America.

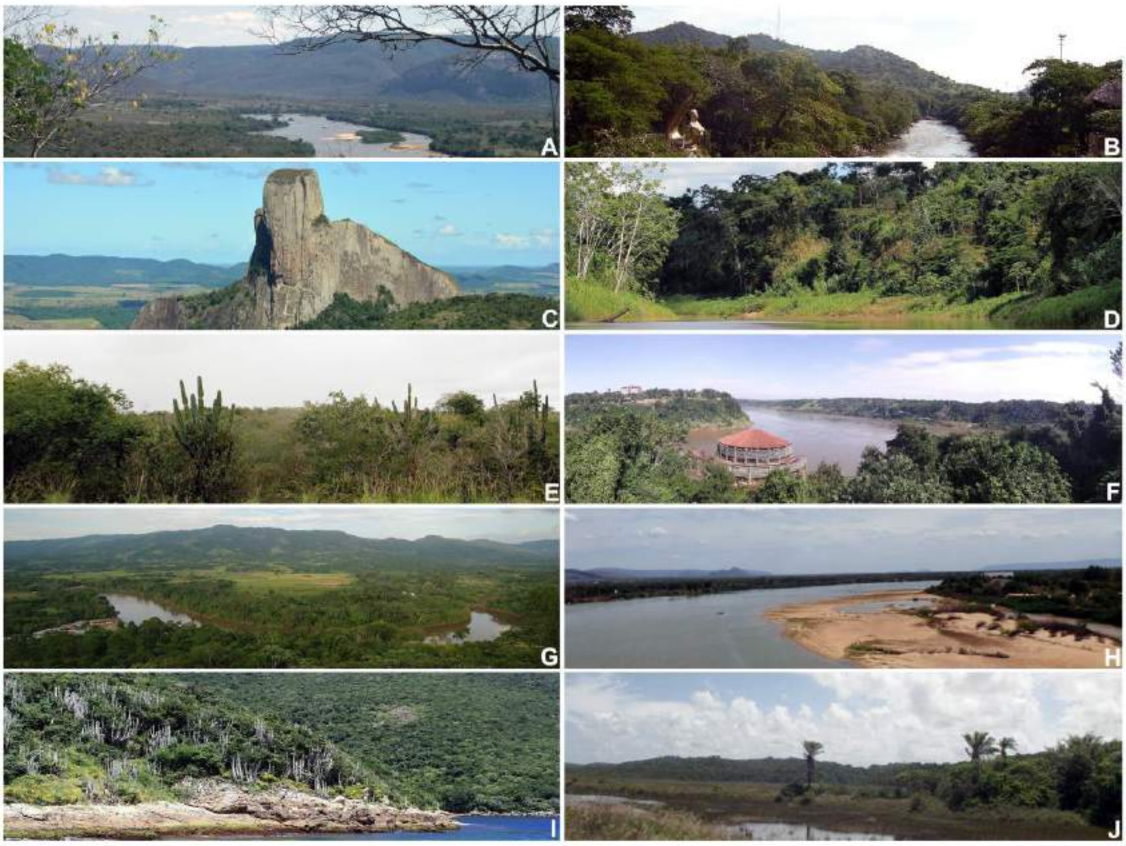


FIGURE 3. Several habitats occupied by species of *Amorimia* in South America: A. dry forests from the Jequitinhonha river, Minas Gerais, Brazil; B. dry forests from the Valledupar valey, Colombia; C. seasonally dry forests from Itamarajú, Bahia, Brazil; D. rainforests from Purus river basin, Acre, Brazil; E. dry forests from Itaberaba, Bahia, Brazil; F. seasonally dry forests from Paraná river, triple borders of Argentina, Brazil, and Paraguay; G. forests of Mayo river, Peru; H. dry forests of São Francisco river, Bahia, Brazil; I. dry forests from Cabo Frio, Rio de Janeiro, Brazil; J. rainforests from Ilhéus, Bahia, Brazil (photographs A, E, F, H, J by R.F. Almeida; B by G. Barros; C by A.M.A. Amorim; D by H. Medeiros; G by A.R. Silva; I by M.O.O. Pellegrini).

FIGURE 4. Natural populations of *Amorimia pubiflora* in pastures of Central Brazil: A. lianescent habit of an individual growing over a fence; B. resprouts growing on a pasture near cattle; C. stoloniferous roots; D. closer image of resprouts of the same individual growings near each other due to its stoloniferous roots (photographs by E. Moletta).

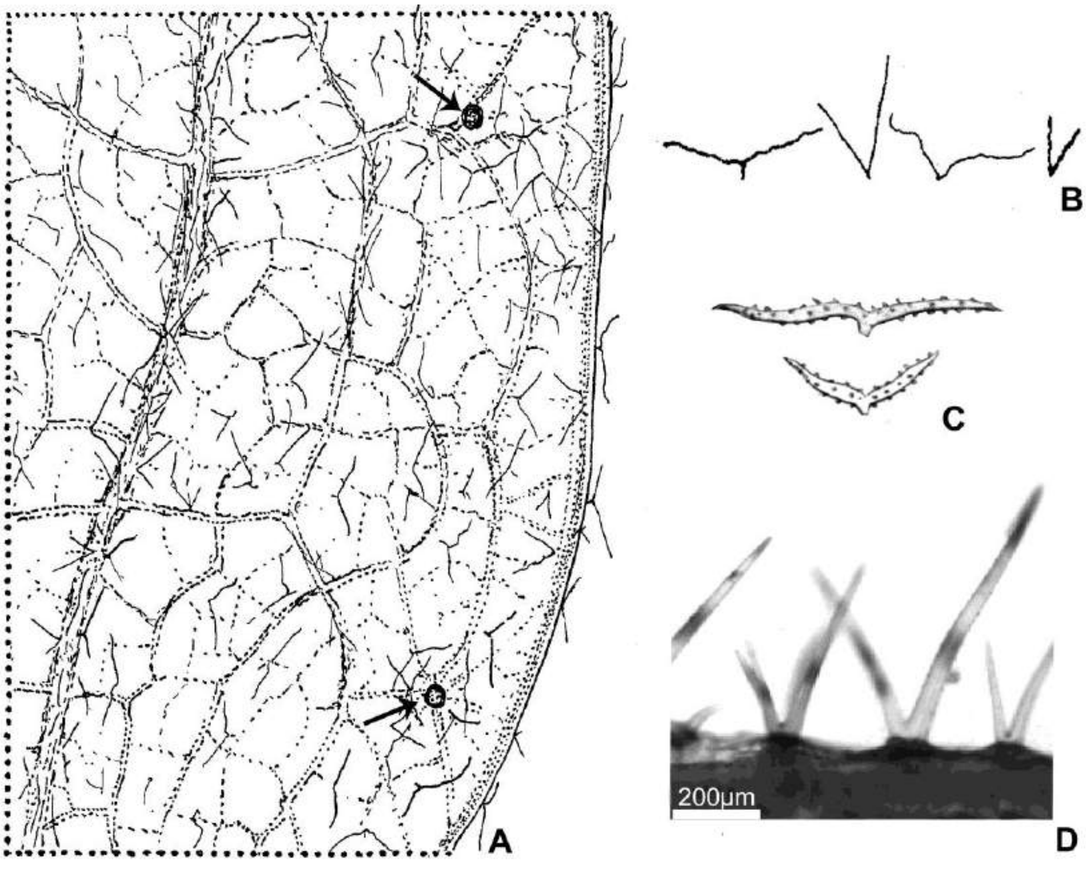


FIGURE 5. Indumentum and hair types in *Amorimia*: A. sericeous-velutine indumentum of *A. kariniana*, evidencing T and V-shaped hairs; B. different shapes of T and V hairs; C. unicellular hairs with rugae in their cell walls; D. longitudinal slide of V-shaped hairs (images A-B by Karin Weishaar Douthit; C by Grisebach 1858; and D by A.C. Marques).

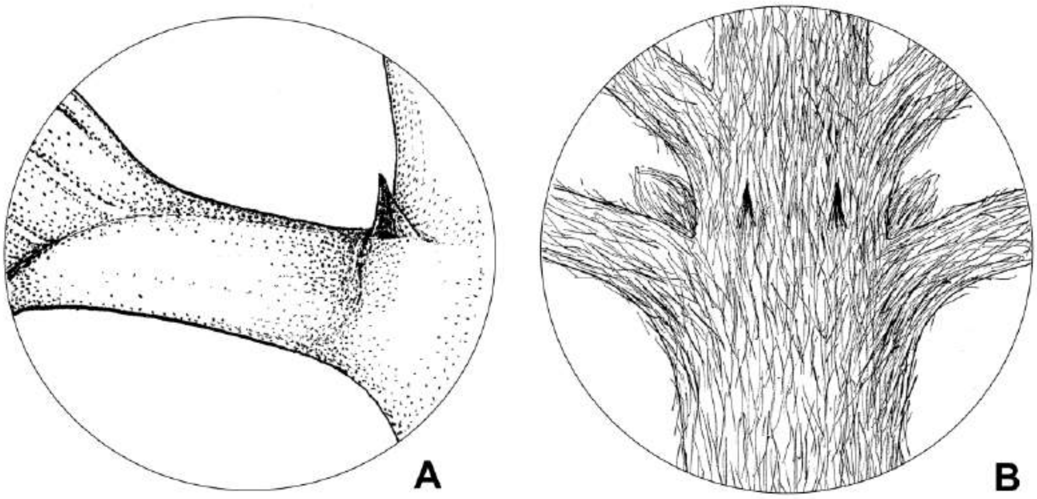


FIGURE 6. Position and shape of stipules in *Amorimia*: A. triangular, epipetiolar stipule; B. narrow-triangular, intrapetiolar stipules (drawings by Karin Weishaar Douthit).

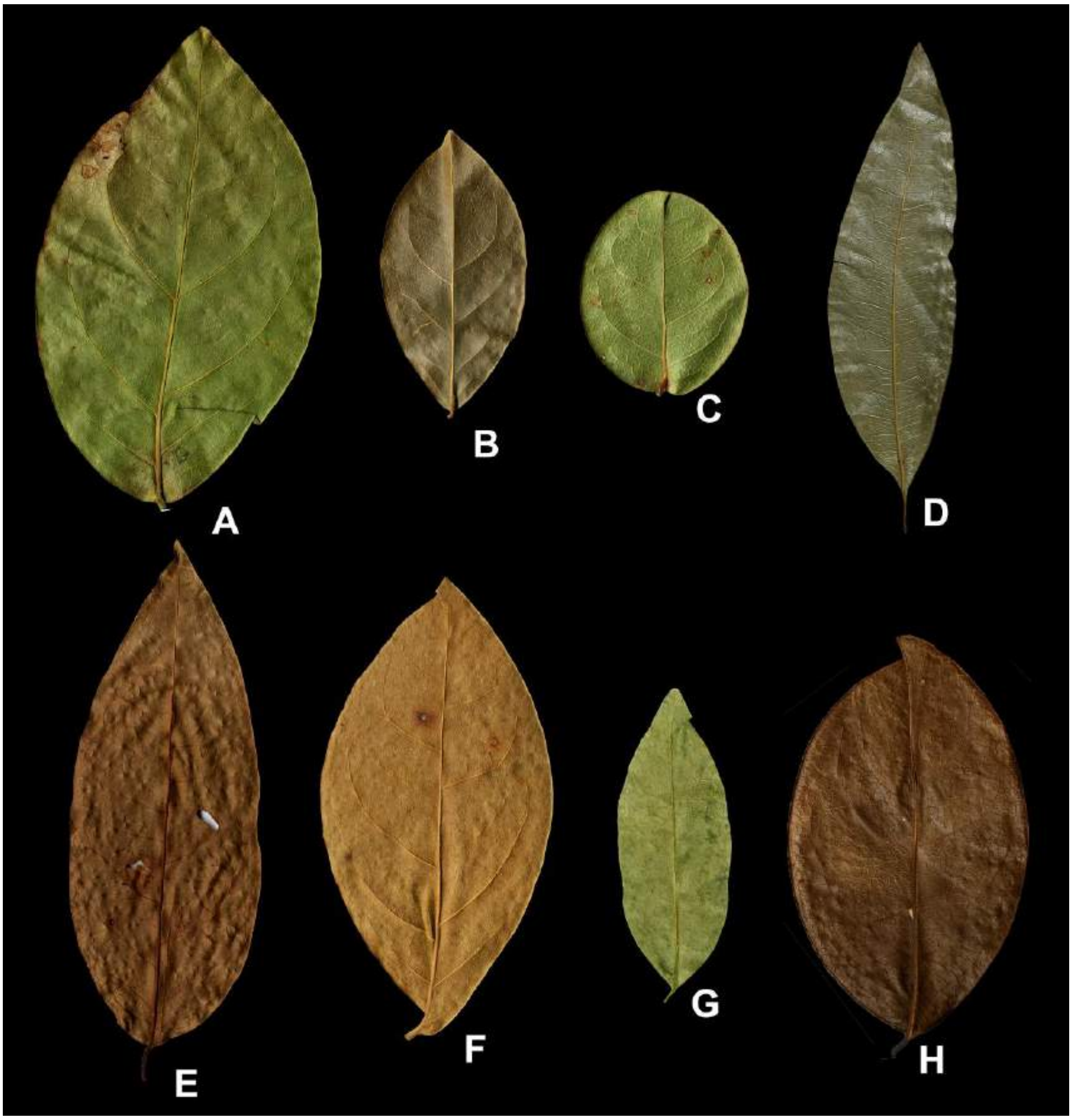


FIGURE 7. Leaf shapes in *Amorimia* subg. *Amorimia*: A. *Amorimia rigida* (R.F. Almeida 561, HUEFS); B. *Amorimia pellegrinii* (R.F. Almeida 614, HUEFS); C. *Amorimia candidae* (R.F. Almeida 594, HUEFS); D. *Amorimia andersonii* (L.C. Marinho 654, CEPEC); E. *Amorimia exotropica* (R.F. Almeida 549, HUEFS); F. *Amorimia velutina* (Shepherd 4409, UEC); G. *Amorimia coriacea* (R.F. Almeida 615, HUEFS); H. *Amorimia maritima* (P. Salzmann s.n., G).

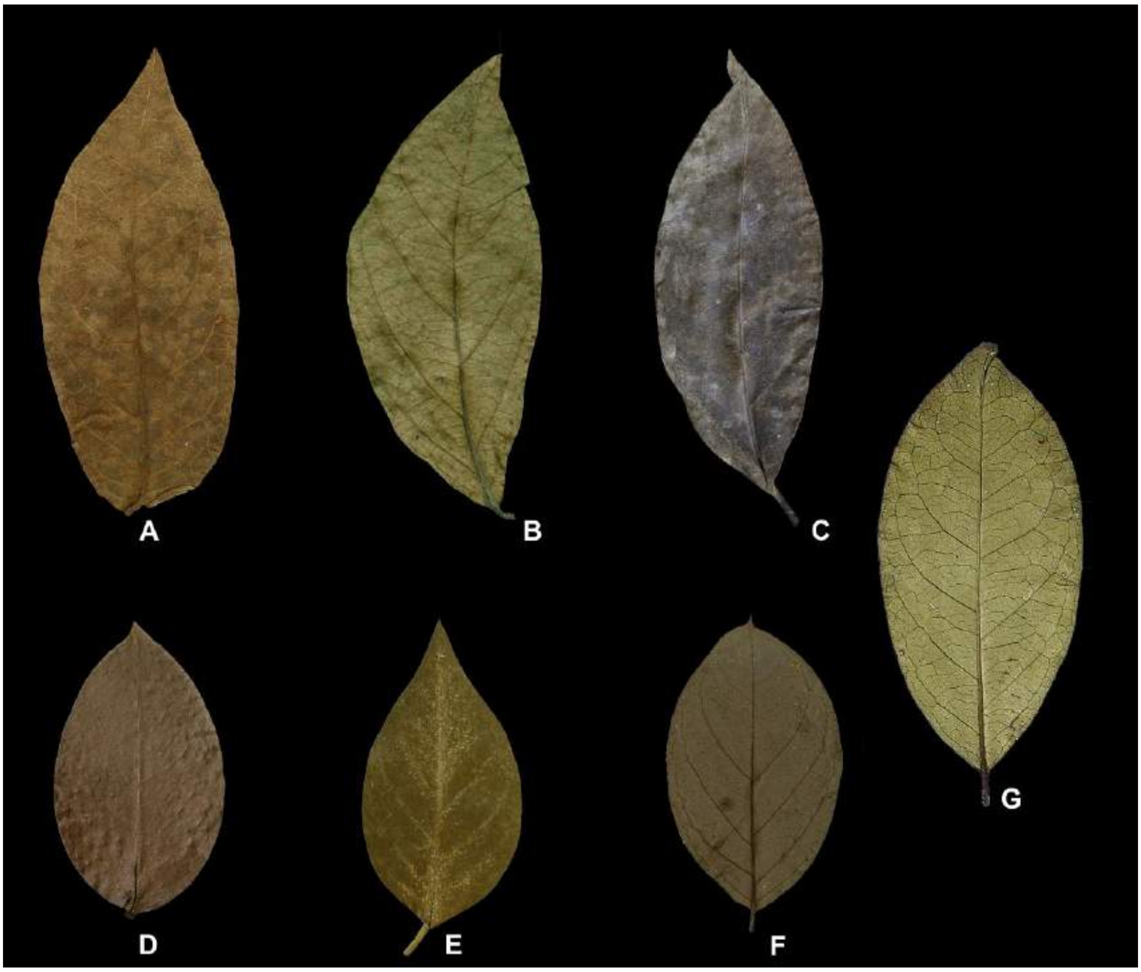


FIGURE 8. Leaf shapes in *Amorimia* subg. *Uncina*: A. *Amorimia pubiflora* (A. Pott 10411, CGMS); B. *Amorimia septentrionalis* (R.F. Almeida 800, HUEFS); C. *Amorimia amazonica* (P. Ule 9478, MG); D. *Amorimia camporum* (Campos 3266, NY); E. *Amorimia concinna* (Castaneda 9292, NY); F. *Amorimia kariniana* (Haught 3070, NY); G. *A. tumida* (M.N. Coelho 2794, HUEFS).

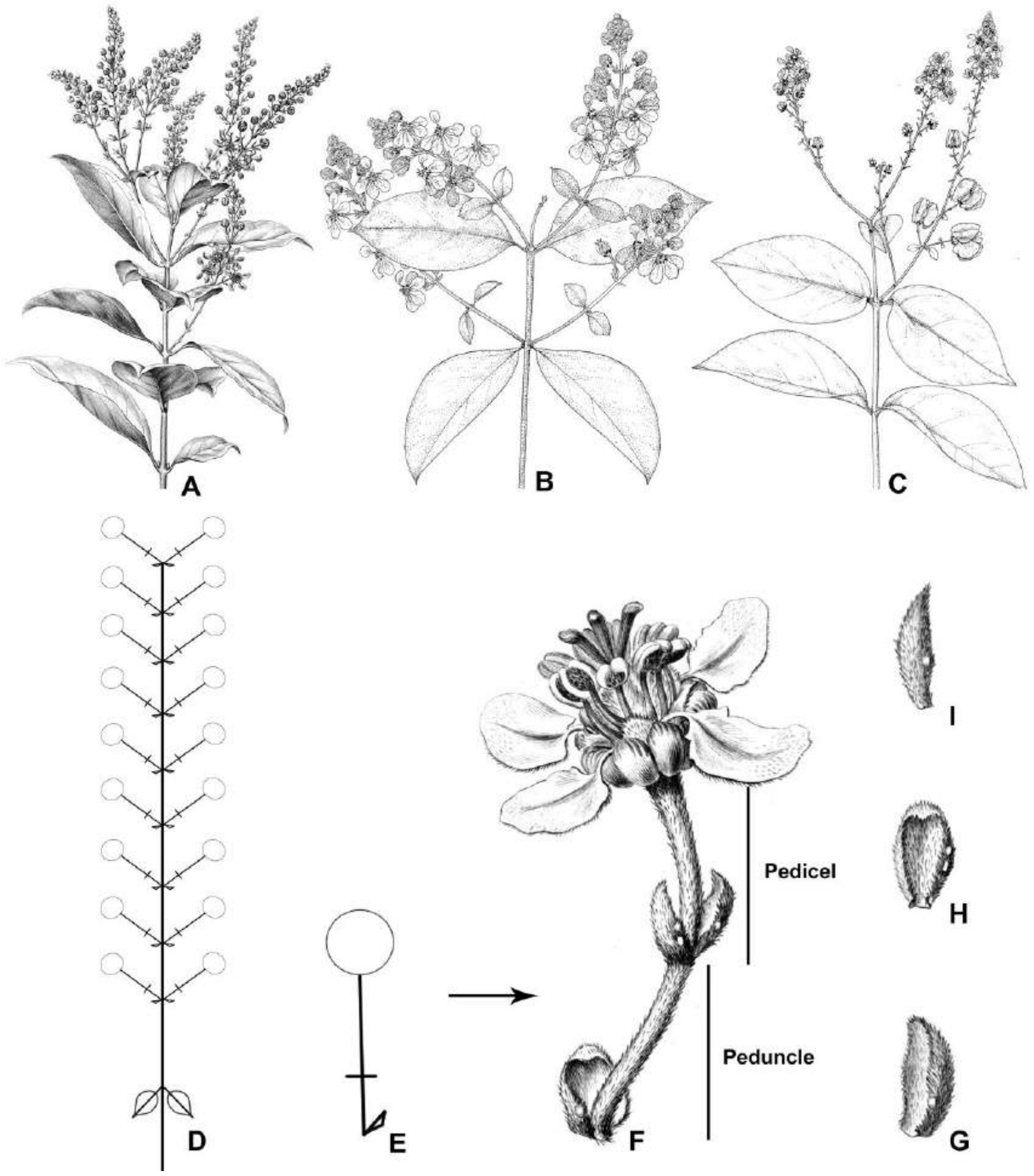


FIGURE 9. Inflorescence architecture in *Amorimia*: A. panicles of *A. coriacea*; B. thyses of *A. kariniana*; C. panicle and thyrses of *A. rigida*; D. thyrsus bearing a pair of reduced leaves at base, and opposite to spirally alternate 1-flowered cincinni; E. 1-flowered cincinnus; F. 1-flowered cincinnus showing the peduncle bearing a bract at base and a pair of bracteoles at apex, and the pedicel bearing the flower; G. side view of a bract with a gland; H. bracteole in adaxial view evidencing two glands; I. bracteole in side view showing a gland (drawings A, F-I by Grisebach; B-C by Karin Weishaar Douthit; D-E by R.F. Almeida).

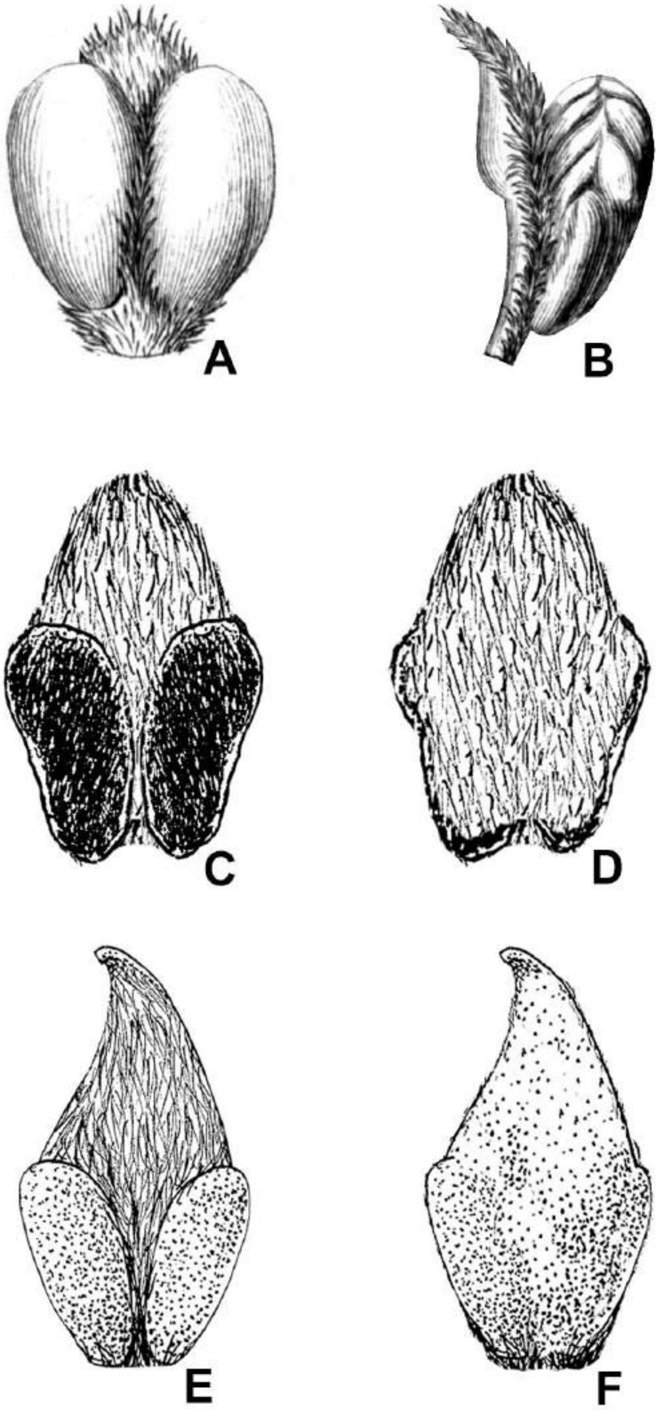


FIGURE 10. Indumenta and shape of sepals in *Amorimia*: A. sepal in abaxial view; B. sepal in side view showing an elaiophore; C. sepal in abaxial view showing rounded apex; D. sepal sericeous-velutine in adaxial view; E. sepal in abaxial view showing acute apex; F. sepal glabrous in adaxial view (drawings A-B by Grisebach; C-F by Karin Weishaar Douthit).

FIGURE 11. Color of elaiophores in *Amorimia* subg. *Amorimia*: A. green – *A. andersonii*; B. yellow – *A. coriacea*; C. orange – *A. candidae*; D. red – *A. maritima*. Color of elaiophores in *Amorimia* subg. *Uncina*: E. green – *A. amazonica*; F. ocher – *A. camporum*; G. green – *A. pubiflora*; H. green – *A. septentrionalis* (photo A by F. Michelangeli; B, H by M.O.O. Pellegrini; D by F. Flores; E by D. Daly; F by R.F. Almeida; G E. Moletta).

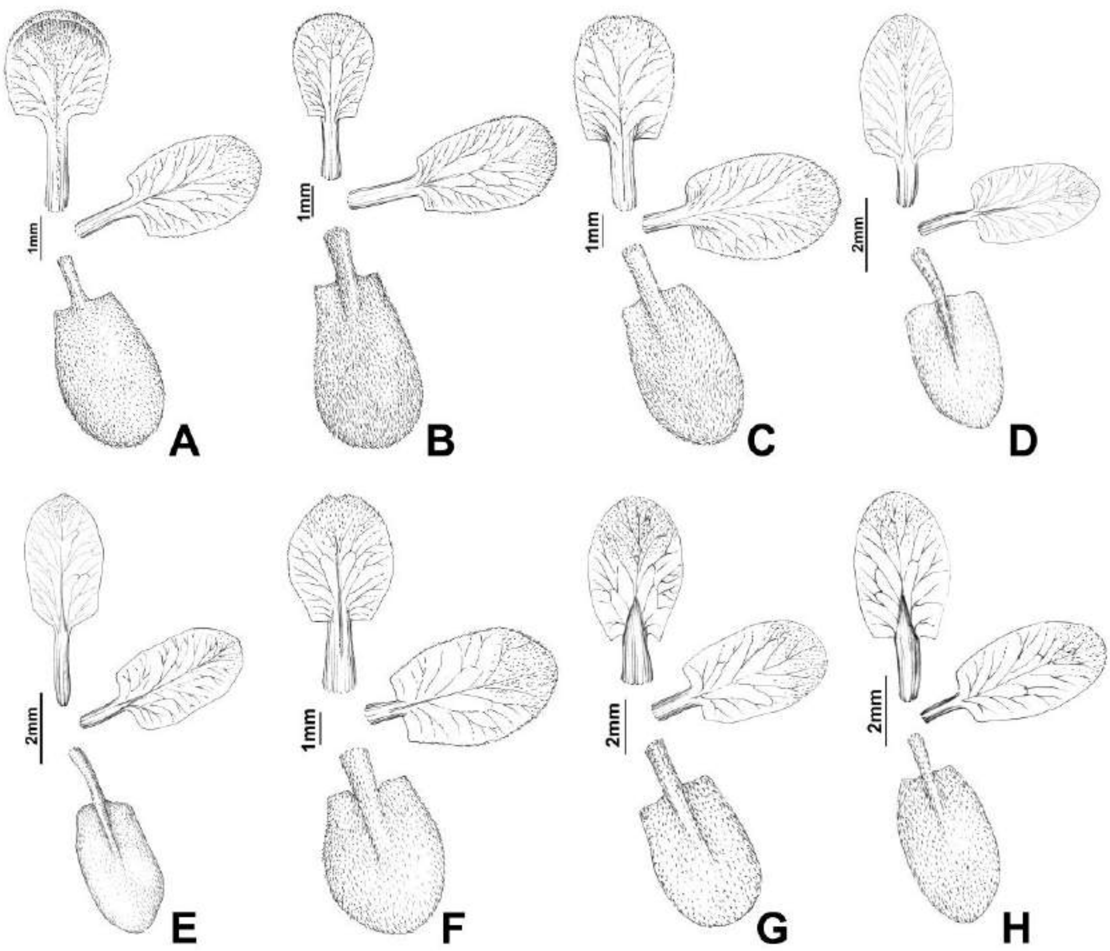


FIGURE 12. Shape of petals from *Amorimia* subgenus *Amorimia* (posterior petal/latero-posterior petal/latero-anterior petal): A. *A. andersonii*; B. *A. candidae*; C. *A. coriacea*; D. *A. exotropica*; E. *A. maritima*; F. *A. pellegrinii*; G. *A. rigida*; H. *A. velutina* (drawings by Klei Sousa).

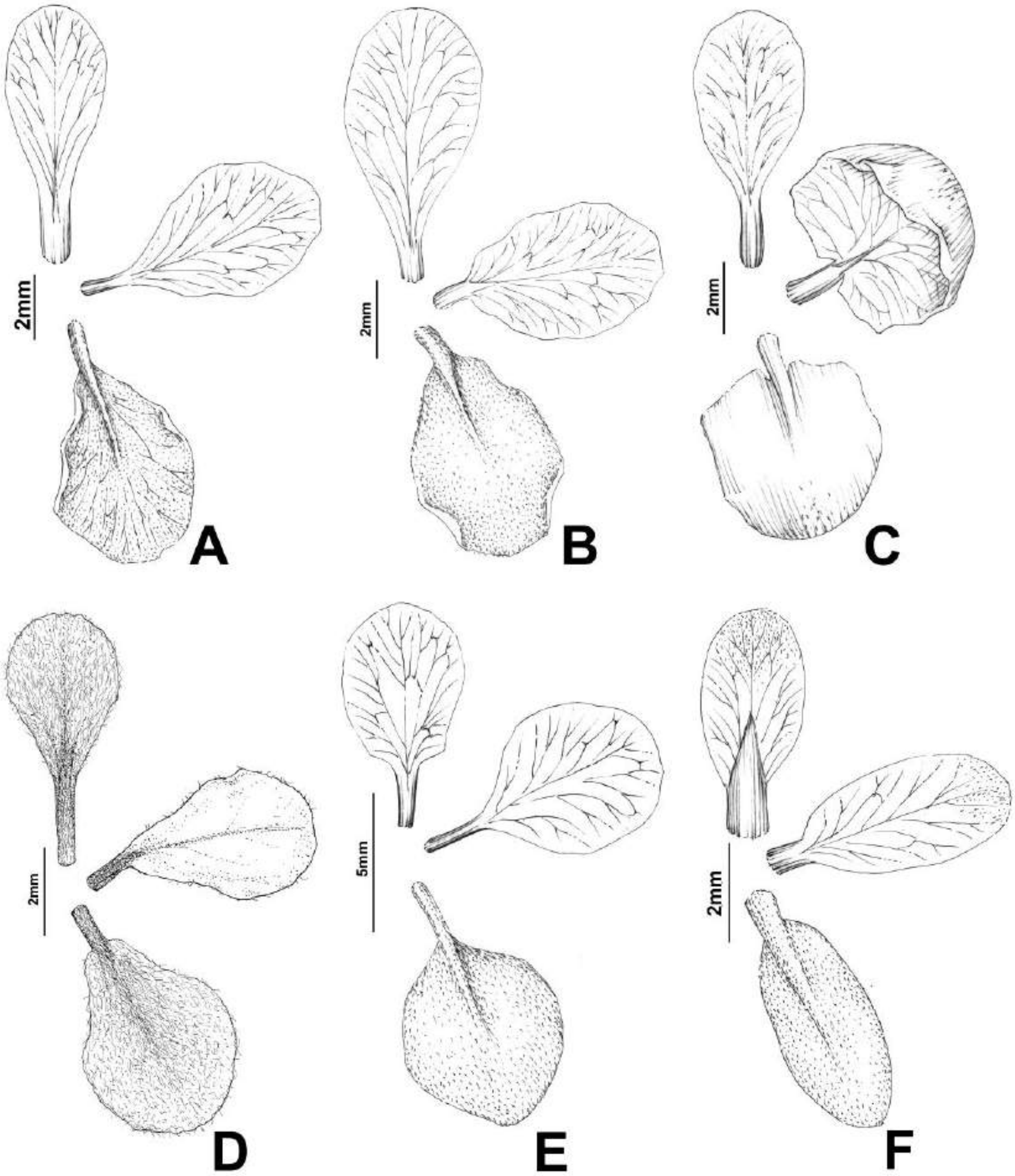


FIGURE 13. Shape of petals from *Amorimia* subgenus *Uncina* (posterior petal/latero-posterior petal/latero-anterior petal): A. *A. amazonica*; B. *A. camporum*; C. *A. concinna*; D. *A. kariniana*; E. *A. pubiflora*; F. *A. septentrionalis* (drawings A-C, E-F by Klei Sousa; D by Karin Weishaar Douthit).

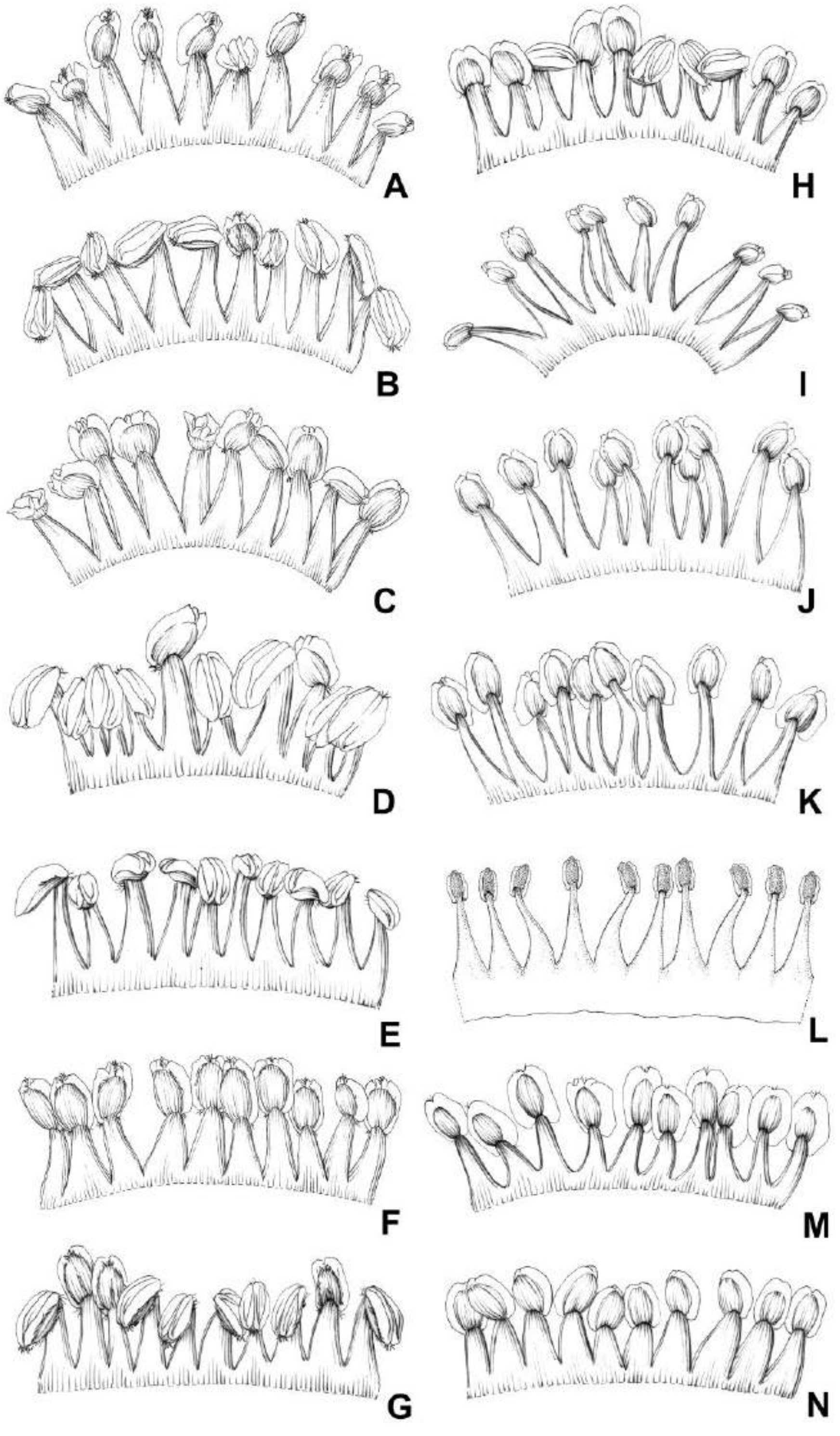


FIGURE 14. Androecium morphology in *Amorimia* subg. *Amorimia*: A. *A. andersonii*; B. *A. candidae*; C. *A. coriacea*; D. *A. exotropica*; E. *A. maritima*; F. *A. pellegrinii*; G. *A. rigida*; H. *A. velutina*. Androecium morphology in *Amorimia* subg. *Uncina*: I. *A. amazonica*; J. *A. camporum*; K. *A. concinna*; L. *A. kariniana*; M. *A. pubiflora*; N. *A. septentrionalis* (drawings A-K, M-N by Klei Sousa; L by Karin Weishaar Douthit).

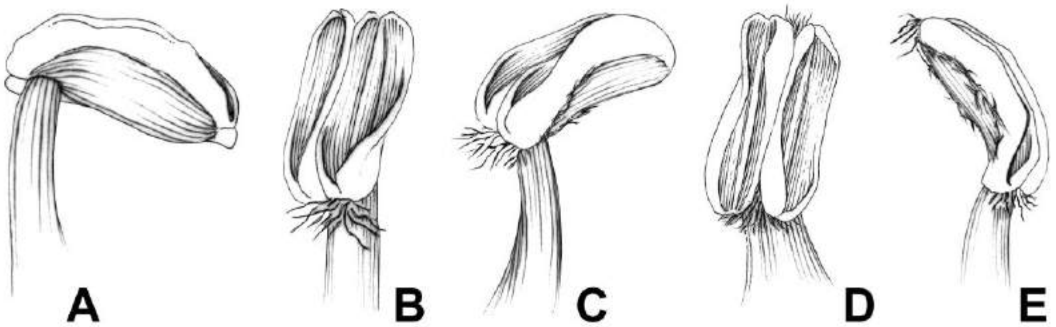


FIGURE 15. Indumentum arrangement in anthers: A. glabrous; B. pubescent at base; C. pubescent at base and apex; D. pubescent at base and apex; E. pubescent at base, connective and apex (drawings by Klei Sousa).

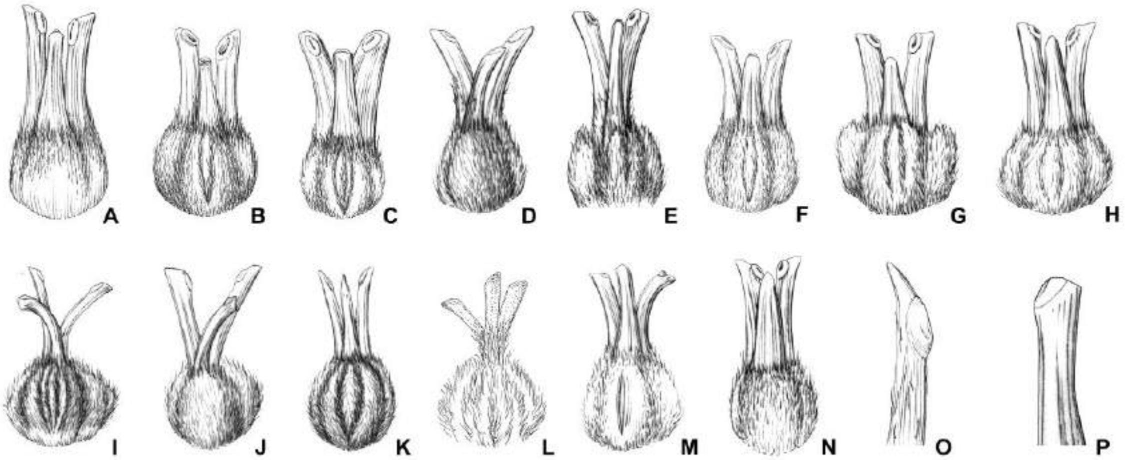


FIGURE 16. Gynoecium morphology of *Amorimia* subg. *Amorimia*: A. *A. andersonii*; B. *A. candidae*; C. *A. coriacea*; D. *A. exotropica*; E. *A. maritima*; F. *A. pellegrinii*; G. *A. rigida*; H. *A. velutina*. Gynoecium morphology of *Amorimia* subg. *Uncina*: I. *A. amazonica*; J. *A. camporum*; K. *A. concinna*; L. *A. kariniana*; M. *A. pubiflora*; N. *A. septentrionalis*; O. style with uncinate apex; P. style with truncate apex (drawings by Klei Sousa).

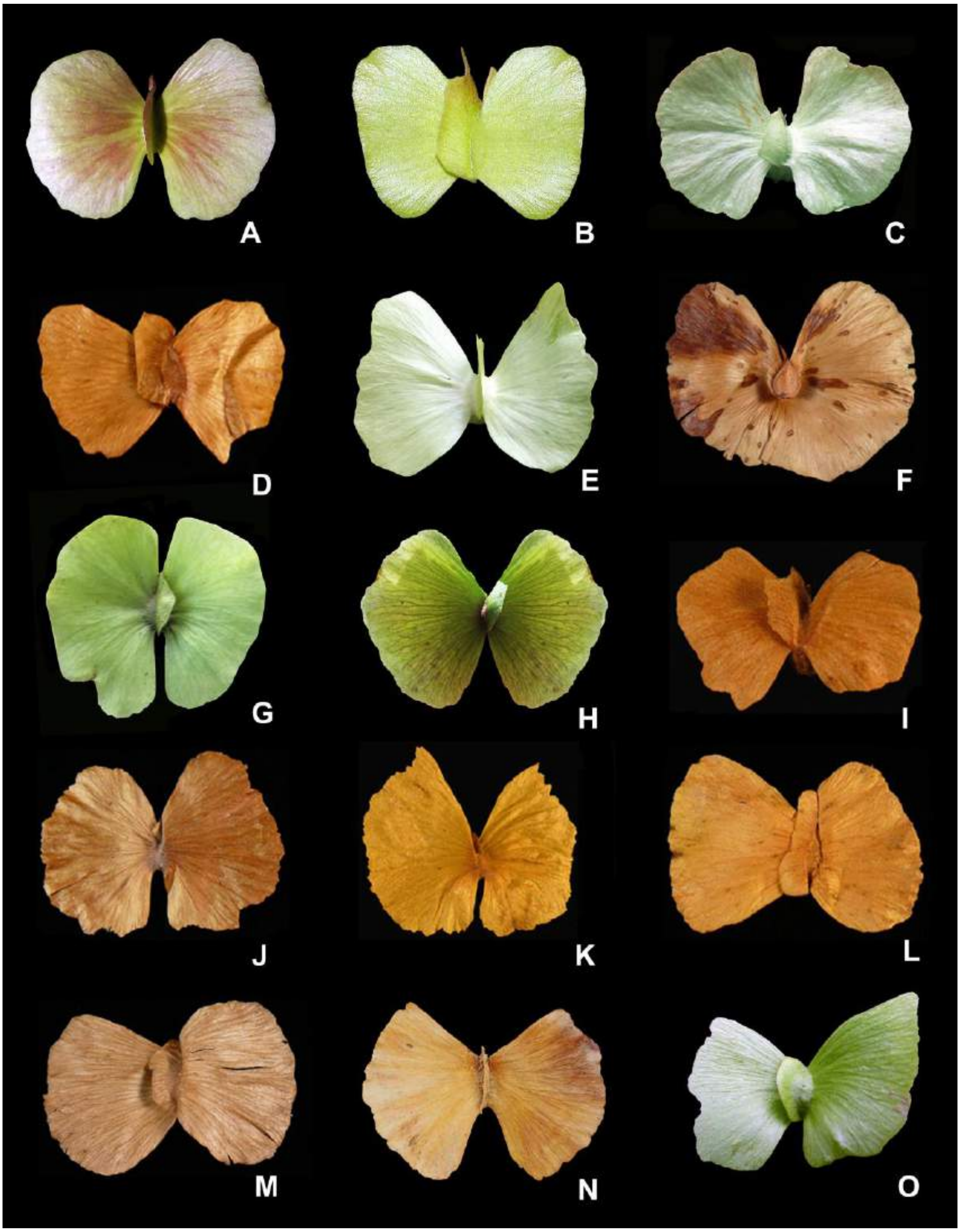


FIGURE 17. Samara morphology of *Amorimia* subg. *Amorimia*: A. *A. candidae*; B. *A. coriacea*; C. *A. exotropica*; D. *A. exotropica*; E. *A. maritima*; F. *A. maritima*; G. *A. pellegrinii*; H. *A. rigida*; I. *A. velutina*. Samara morphology of *Amorimia* subg. *Uncina*: J. *A. amazonica*; K. *A. camporum*; L. *A. concinna*; M. *A. pubiflora*; N. *A. septentrionalis*; O. *A. tumida* (photographs A, C, E, G, H, I by R.F. Almeida; D, F, J, K, L, M by W.R. Anderson; B. by C.N. Fraga; O by M.N. Coelho).

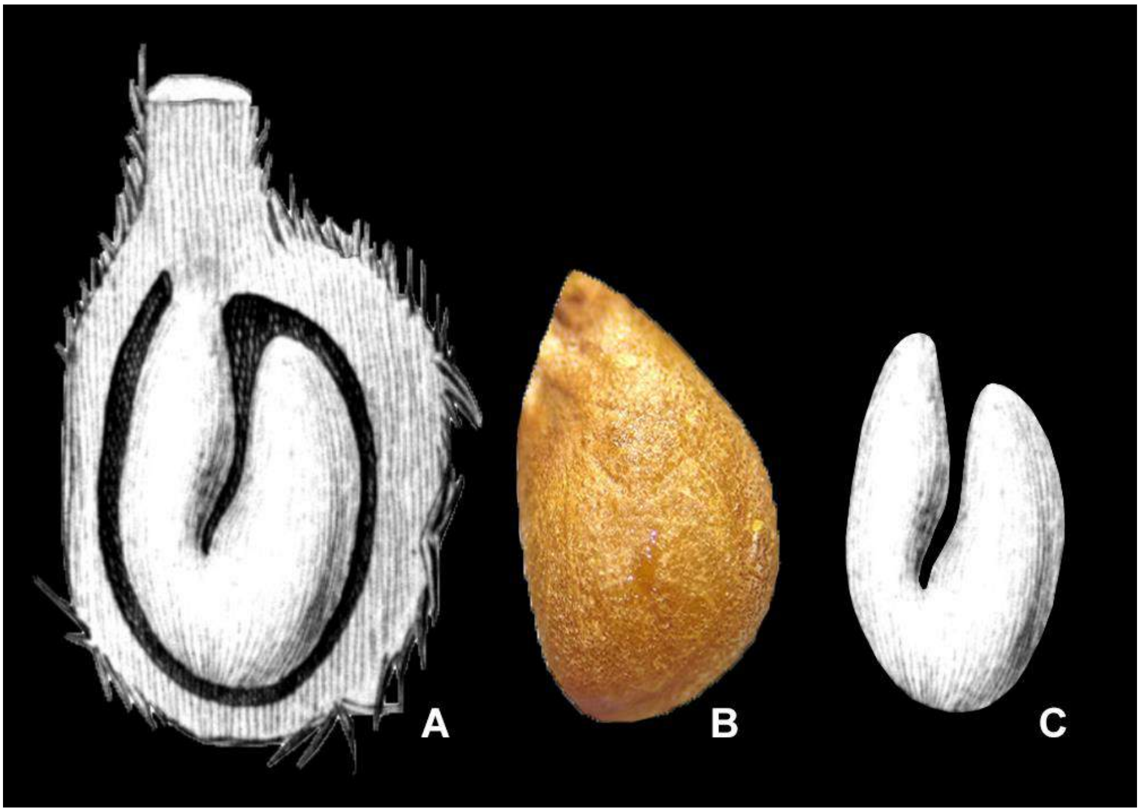


FIGURE 18. Seed and embryo morphology in *Amorimia*: A. a carpel in side view showing an embryo with cotyledons folded; B. seed in side view showing a smooth testa; C. embryo showing its cotyledons folded.

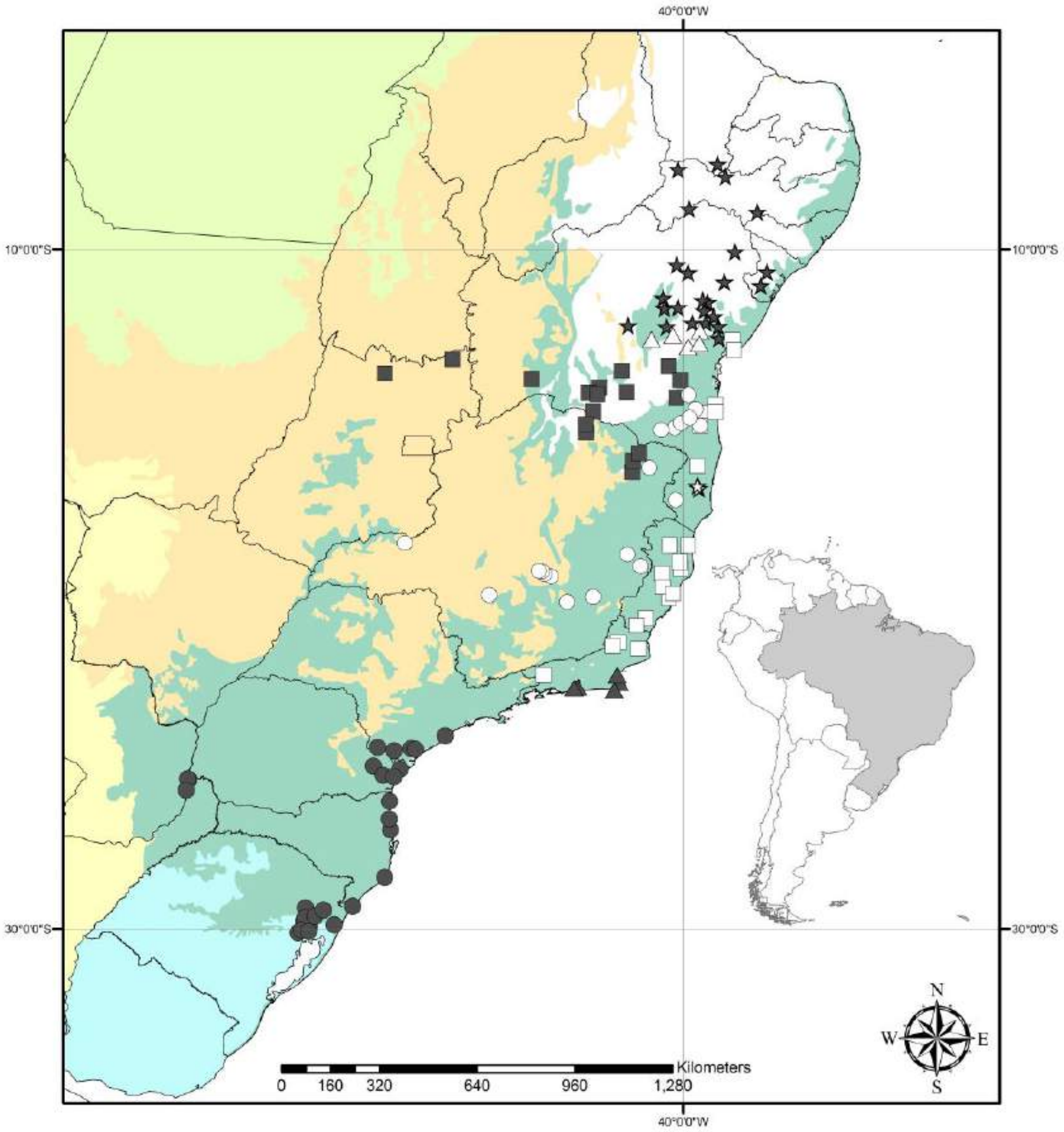


FIGURE 19. Distribution map of species from the *Amorimia* subg. *Amorimia*: ● – *A. exotropica*; ○ – *A. rigida*; ▲ – *A. coriacea*; ∆ – *A. candidae*; ■ – *A. velutina*; □ – *A. maritima*; ★ – *A. pellegrinii*;☆ – *A. andersonii*. Blue – Pampa, dark green – Atlantic Forest, white – Caatinga, light green – Amazon Forest, and yellow – Chaco/Pantanal.

FIGURE 20. ***Amorimia andersonii*** R.F.Almeida: A. leaf in abaxial view; B. leaf base showing a pair of glands; C. flowering branch; D. detail of flowers; E. detail of sepal glands; F. flower in frontal view; G. detail of the apex of a style (photographs B-F by F. Michelangeli; A, G by R.F. Almeida).

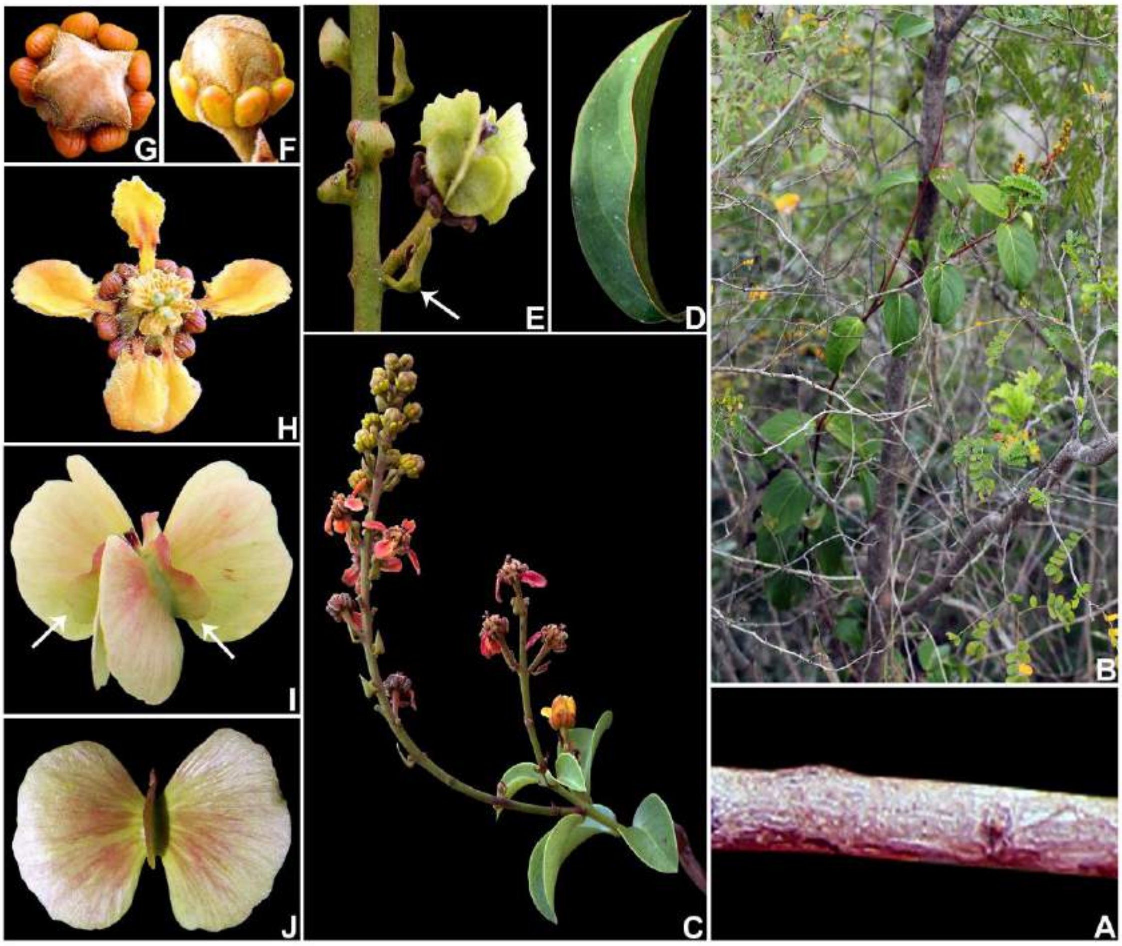


FIGURE 21. ***Amorimia candidae*** R.F.Almeida: A. stem; B. habit; C. flowering branch showing conduplicate leaves; D. leaf in side view; E. detail of a inflorescence in side view showing biglandular bracts (white arrow); F. floral bud in side view; G. floral bud in frontal view; H. flower in frontal view; I. winged mericarps showing the dorsal wing with rounded angles (white arrows); J. samara in frontal view (photographs by R.F.Almeida).

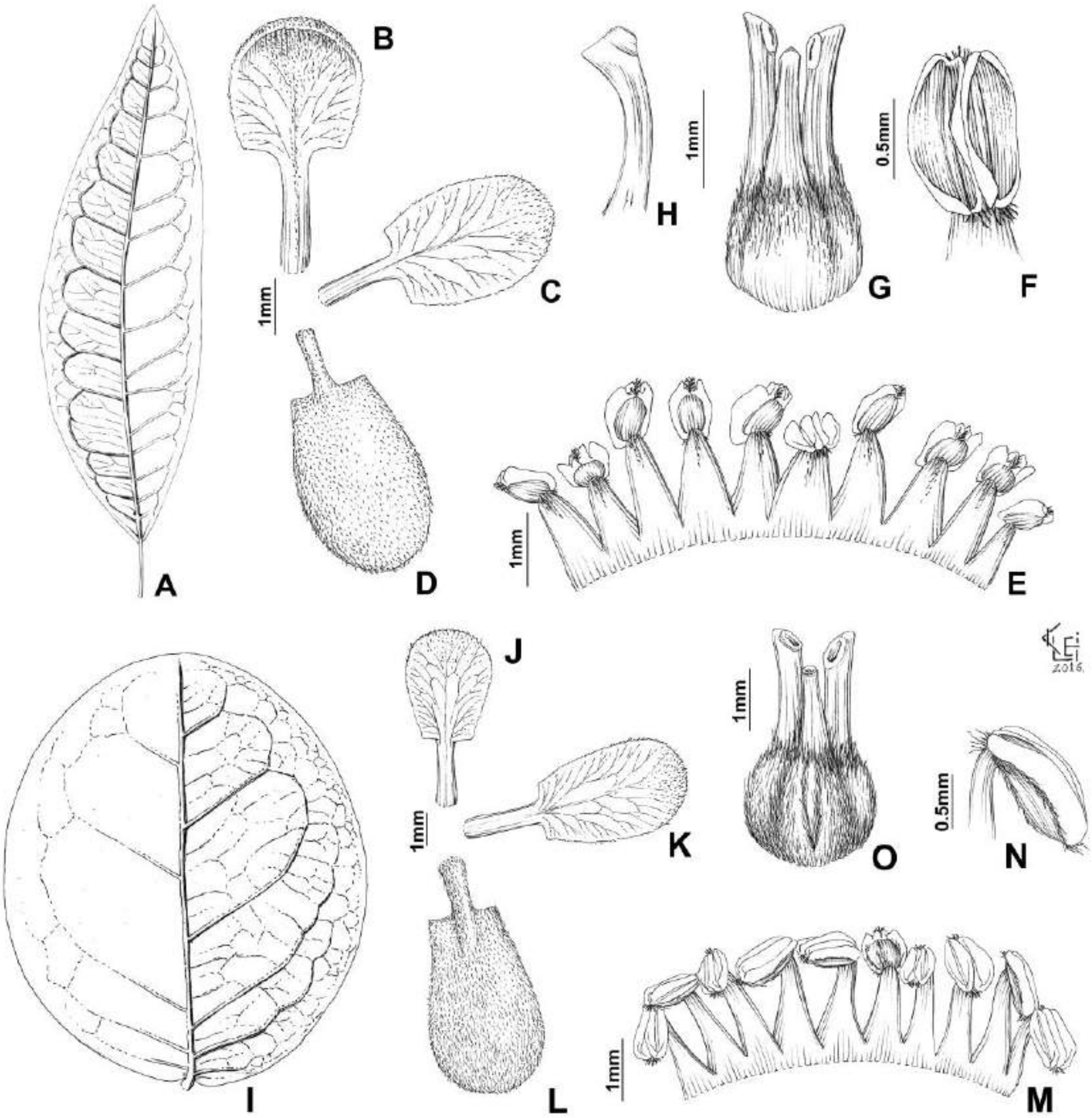


FIGURE 22. ***Amorimia andersonii*** R.F.Almeida: A. abaxial side of a leaf evidencing vein pattern; B. adaxial side of a posterior petal; C. adaxial side of a posterio-lateral petal; D. abaxial side of a anterio-lateral petal; E. androecium; F. detail a stamen evidencing anther' hairs; G. gynoecium (drawings by Klei Sousa). ***Amorimia candidae*** R.F.Almeida: H. abaxial side of a leaf evidencing vein pattern; I. adaxial side of a posterior petal; J. adaxial side of a posterio-lateral petal; K. abaxial side of a anterio-lateral petal; L. androecium; M. detail a stamen evidencing anther' hairs; N. gynoecium (drawings by Klei Sousa).

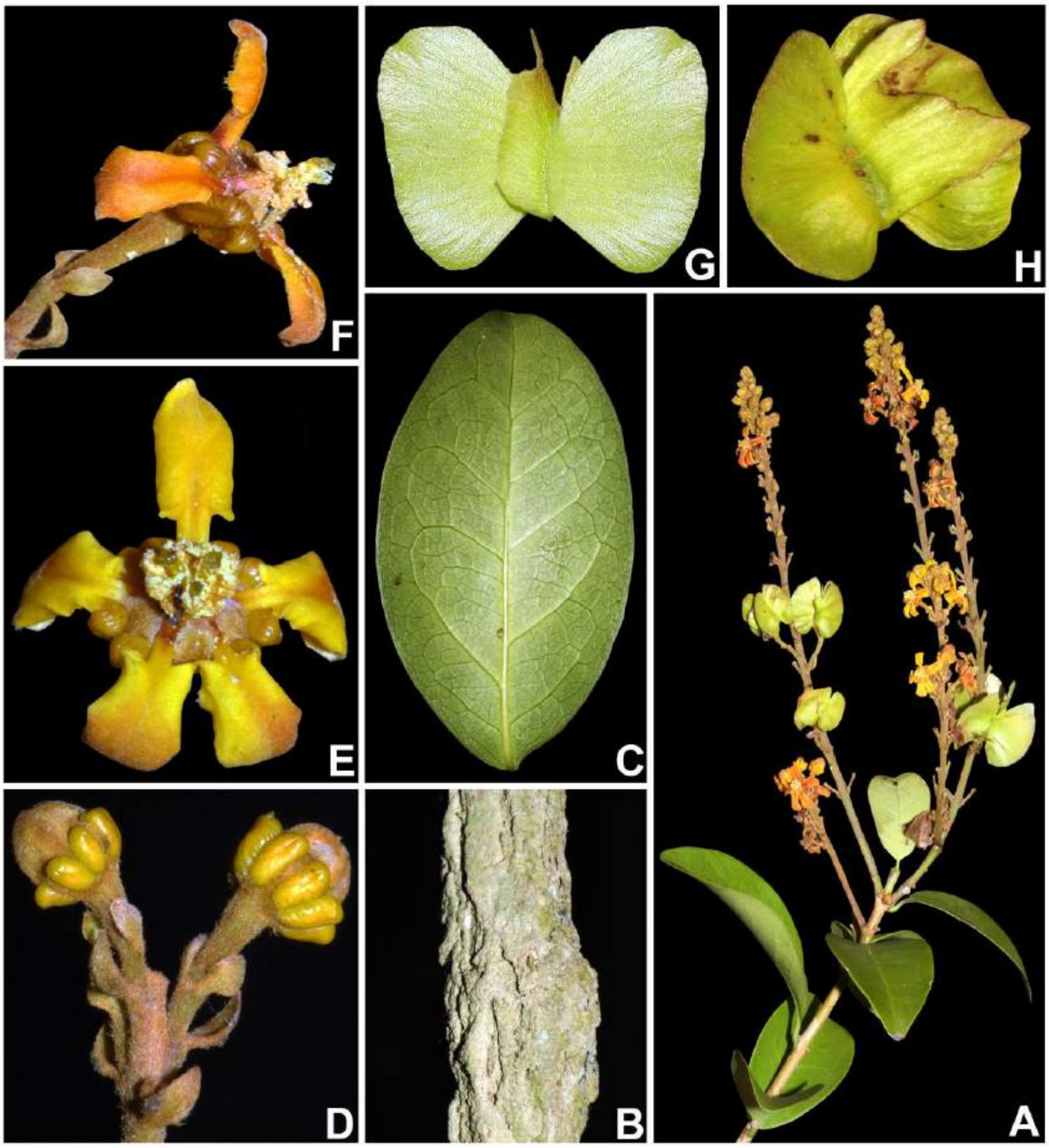


FIGURE 23. ***Amorimia coriacea*** (Griseb.) R.F.Almeida: A. habit; B. inflorescence and flowers in side view; C. inflorescence and flowers in frontal view; D. samaroid schizocarp in side view (photographs by M.O.O.Pellegrini).

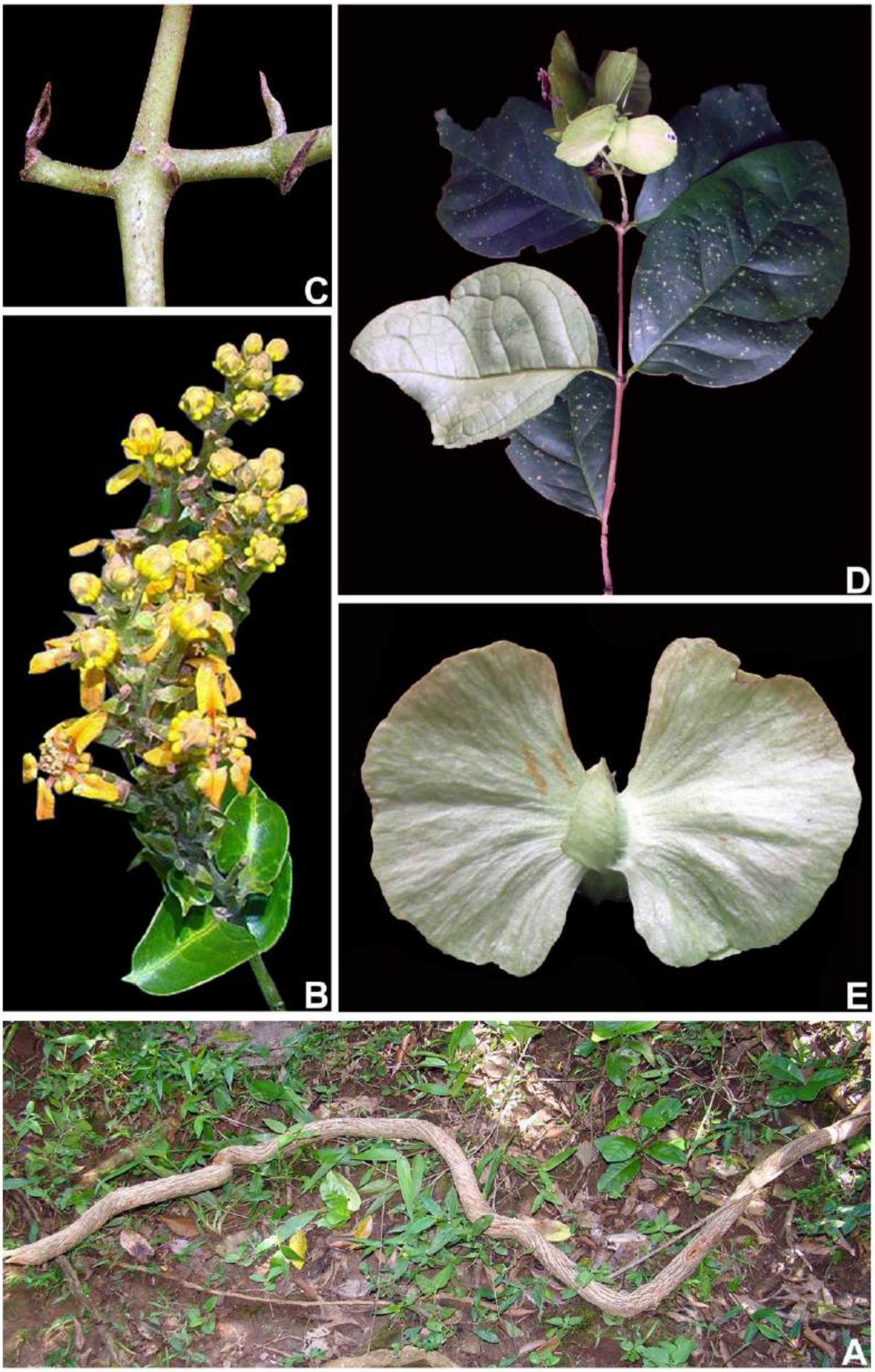


FIGURE 24. ***Amorimia exotropica*** (Griseb.) W.R.Anderson: A. habitat and stem; B. inflorescence; C. detail of inflorescence bracteoles; D. fruiting branch; E. fruit in frontal view (photographs A-B by A. Gava, and C-E by R.F. Almeida).

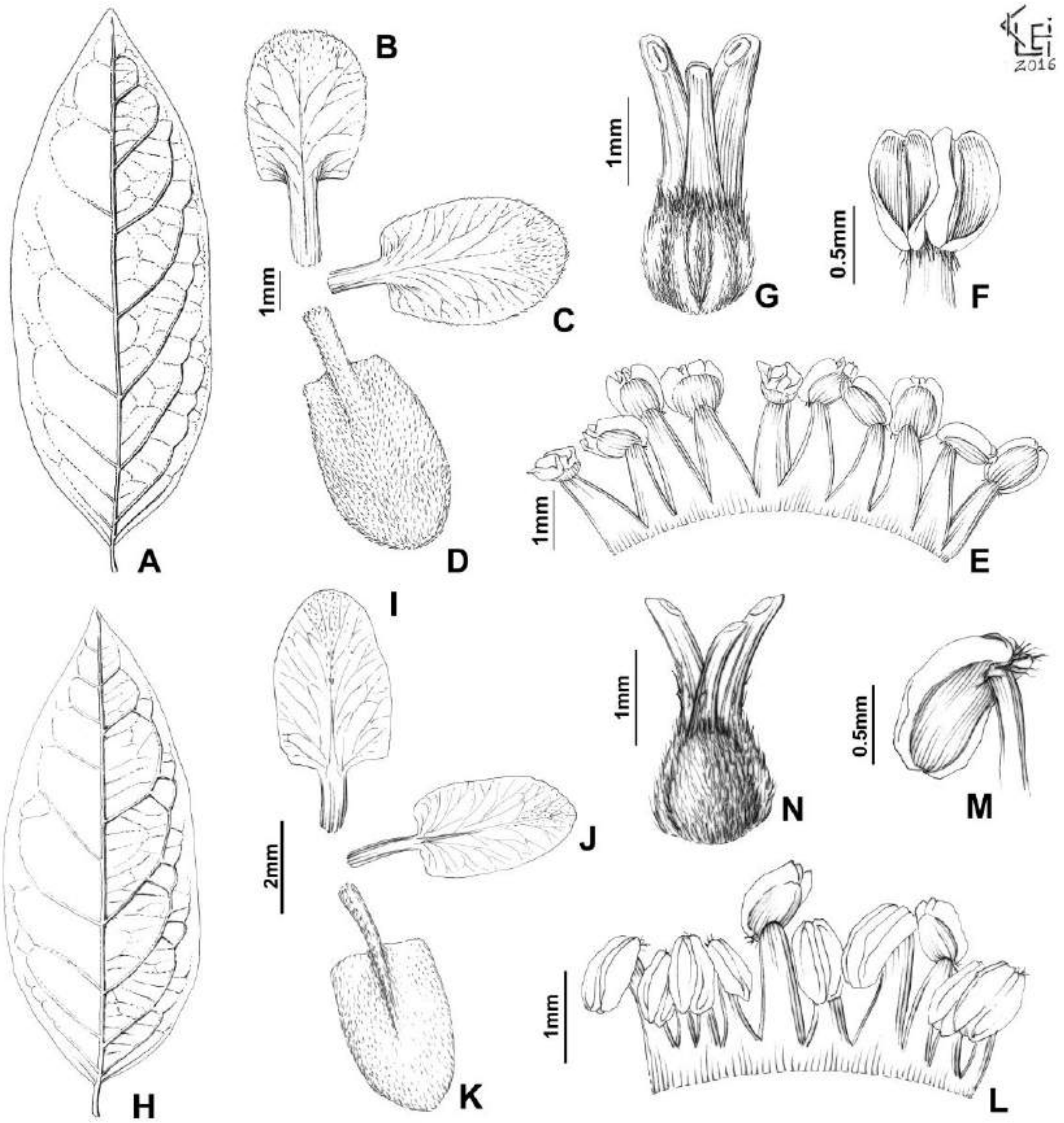


FIGURE 25. ***Amorimia coriacea*** (Griseb.) R.F.Almeida: A. abaxial side of a leaf evidencing vein pattern; B. adaxial side of a posterior petal; C. adaxial side of a posterio-lateral petal; D. abaxial side of a anterio-lateral petal; E. androecium; F. detail a stamen evidencing anther' hairs; G. gynoecium (drawings by Klei Sousa). ***Amorimia exotropica*** (Griseb.) W.R.Anderson: H. abaxial side of a leaf evidencing vein pattern; I. adaxial side of a posterior petal; J. adaxial side of a posterio-lateral petal; K. abaxial side of a anterio-lateral petal; L. androecium; M. detail a stamen evidencing anther' hairs; N. gynoecium (drawings by Klei Sousa).

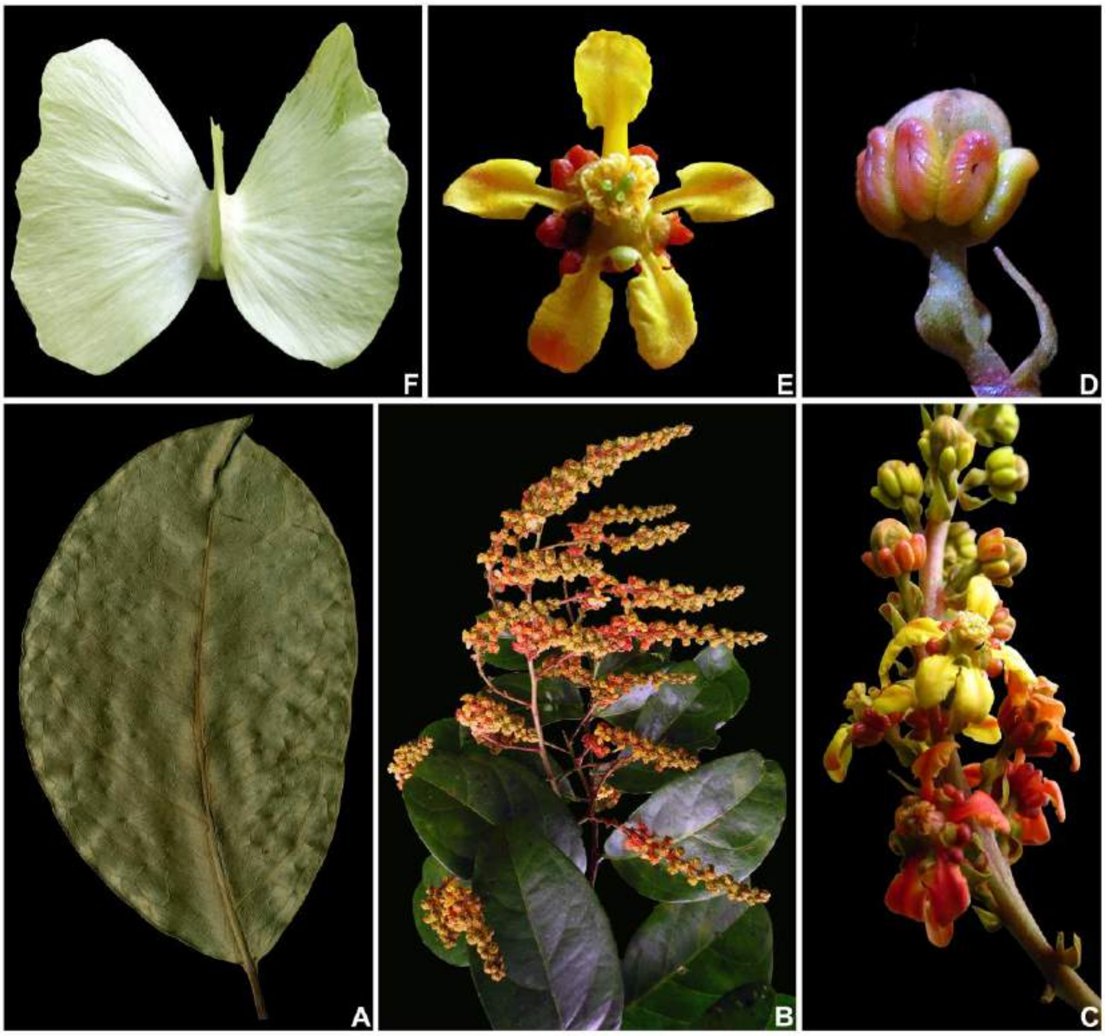


FIGURE 26. ***Amorimia maritima*** (A.Juss.) W.R.Anderson: A. leaf in abaxial view; B. flowering branch; C. detail of a inflorescence and flowers; D. floral bud in side view; E. flower in frontal view; F. samara in frontal view (photographs A, F by R.F. Almeida; B-E by F. Flores).

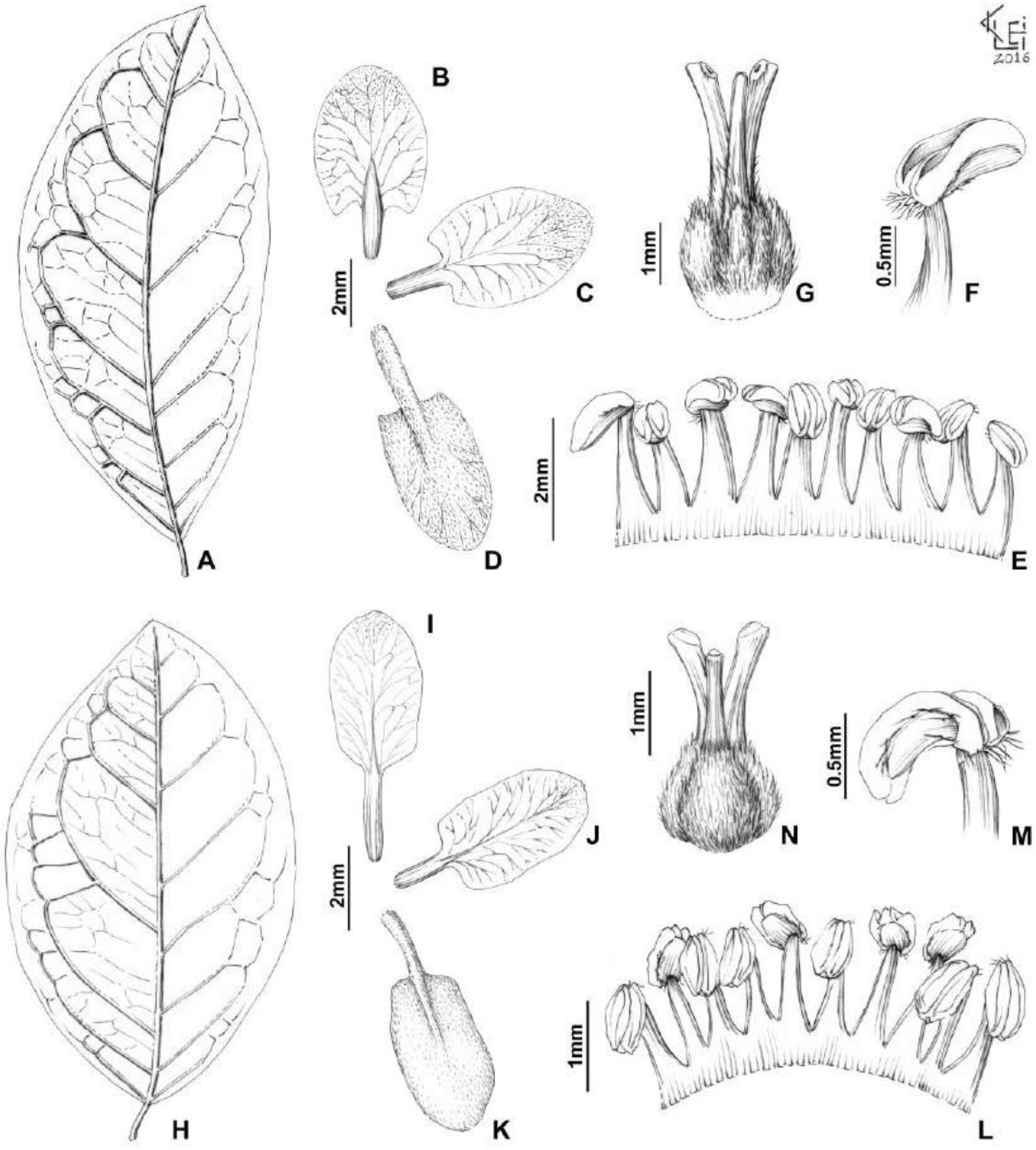


FIGURE 27. ***Amorimia maritima*** (A.Juss.) W.R.Anderson from state of Bahia: A. abaxial side of a leaf evidencing vein pattern; B. adaxial side of a posterior petal; C. adaxial side of a posterio-lateral petal; D. abaxial side of a anterio-lateral petal; E. androecium; F. detail a stamen evidencing anther' hairs; G. gynoecium (drawings by Klei Sousa). ***Amorimia maritima*** (A.Juss.) W.R.Anderson from state of Espírito Santo: H. abaxial side of a leaf evidencing vein pattern; I. adaxial side of a posterior petal; J. adaxial side of a posterio-lateral petal; K. abaxial side of a anterio-lateral petal; L. androecium; M. detail a stamen evidencing anther' hairs; N. gynoecium (drawings by Klei Sousa).

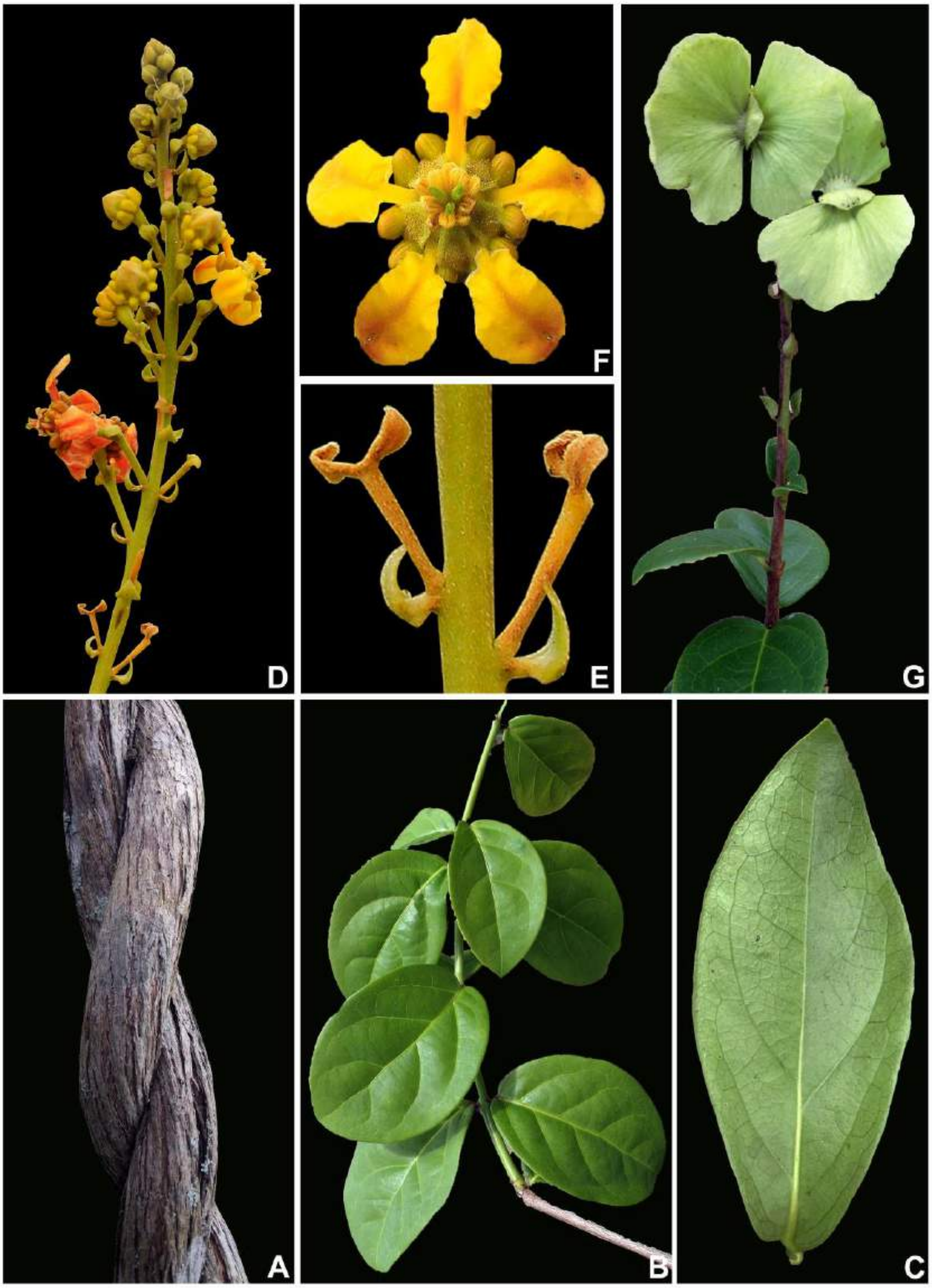


FIGURE 28. ***Amorimia pellegrinii*** R.F.almeida: A. wood; B. sterile branch; C. leaf in abaxial view; D. inflorescence and flowers; E. bract and bracteoles; F. flower in side view; G. fruiting branch (photographs by R.F.Almeida).

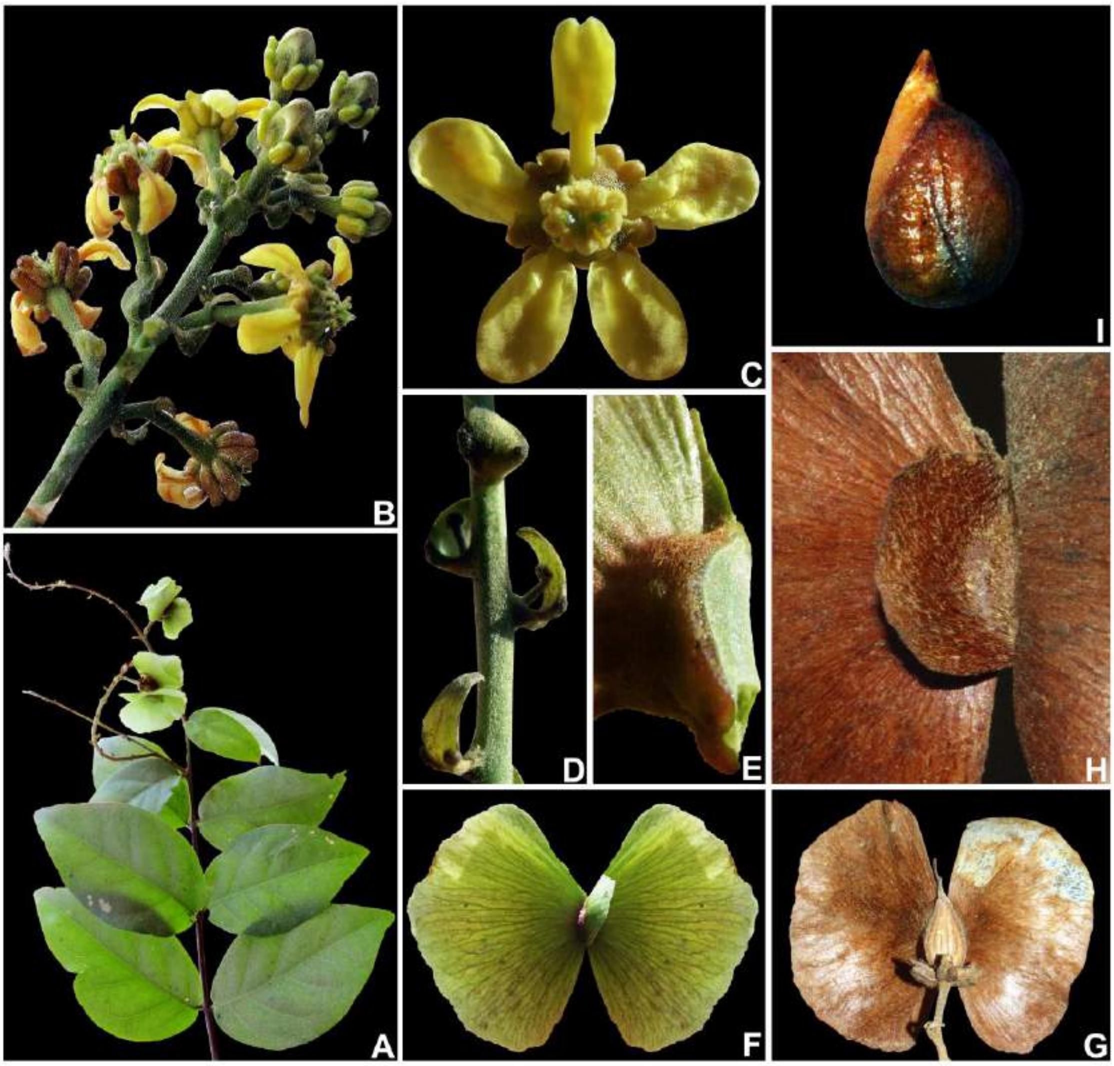


FIGURE 29. ***Amorimia rigida*** (A.Juss.) W.R.Anderson: A. fruting branch; B. inflorescence and flowers; C. flower in frontal view; D. floral bracts; E. areole in side view; F. samara in adaxial view; G. samara in abaxial view showing the areole; H. detail of the dorsal wing; I. seed (photographs by R.F.Almeida).

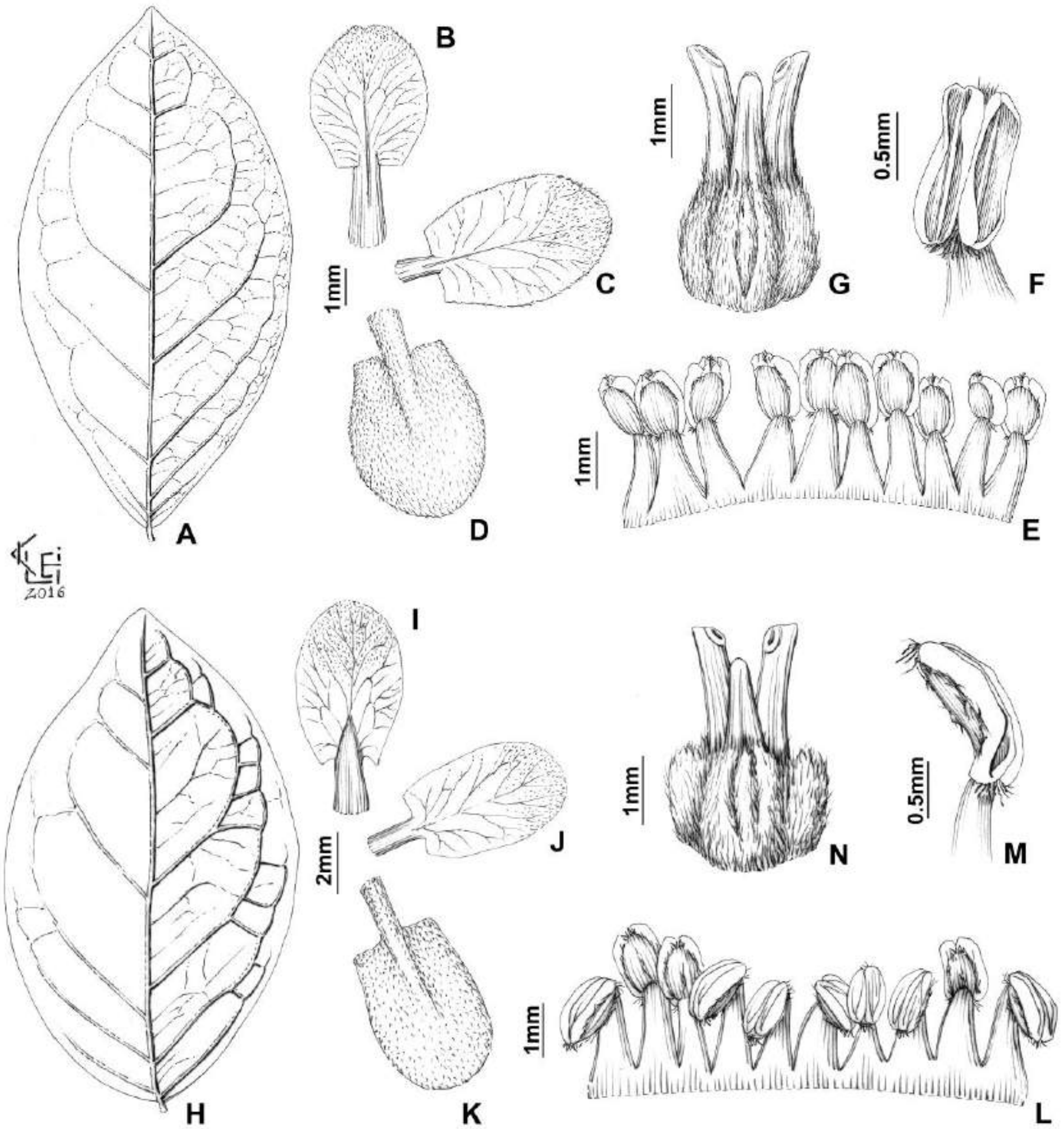


FIGURE 30. ***Amorimia pellegrinii*** R.F.almeida: A. abaxial side of a leaf evidencing vein pattern; B. adaxial side of a posterior petal; C. adaxial side of a posterio-lateral petal; D. abaxial side of a anterio-lateral petal; E. androecium; F. detail a stamen evidencing anther' hairs; G. gynoecium (drawings by Klei Sousa). ***Amorimia rigida*** (A.Juss.) W.R.Anderson: H. abaxial side of a leaf evidencing vein pattern; I. adaxial side of a posterior petal; J. adaxial side of a posterio-lateral petal; K. abaxial side of a anterio-lateral petal; L. androecium; M. detail a stamen evidencing anther' hairs; N. gynoecium (drawings by Klei Sousa).

FIGURE 31. ***Amorimia velutina*** W.R.Anderson: A. detail of the inflorescence and flowers; B. detail of a samaroid schizocarp (photographs A by L.C. Marinho; B from type specimen).

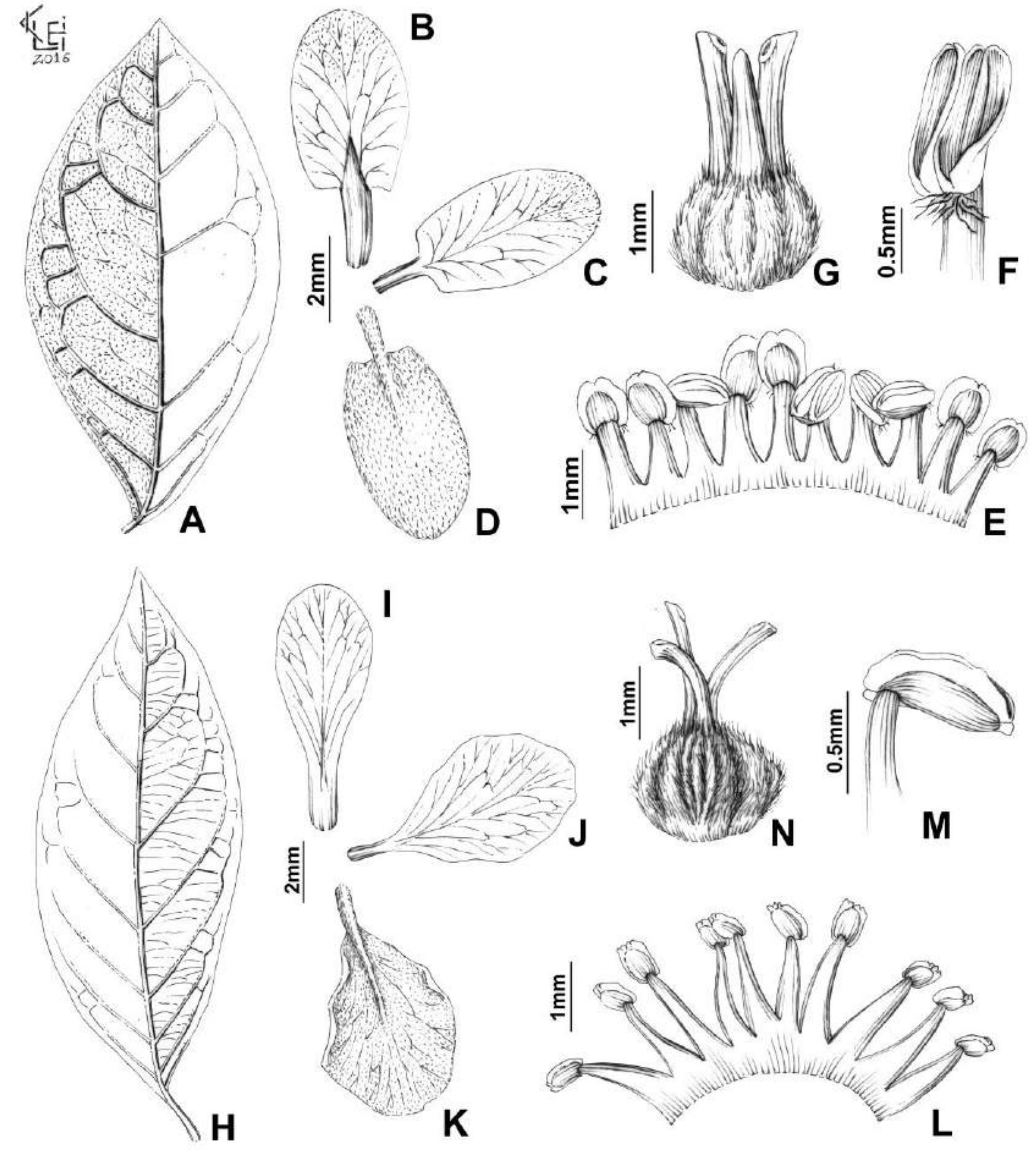


FIGURE 32. ***Amorimia velutina*** W.R.Anderson: A. abaxial side of a leaf evidencing vein pattern; B. adaxial side of a posterior petal; C. adaxial side of a posterio-lateral petal; D. abaxial side of a anterio-lateral petal; E. androecium; F. detail a stamen evidencing anther' hairs; G. gynoecium (drawings by Klei Sousa). ***Amorimia amazonica*** (Nied.) W.R.Anderson: H. abaxial side of a leaf evidencing vein pattern; I. adaxial side of a posterior petal; J. adaxial side of a posterio-lateral petal; K. abaxial side of a anterio-lateral petal; L. androecium; M. detail a stamen evidencing anther' hairs; N. gynoecium (drawings by Klei Sousa).

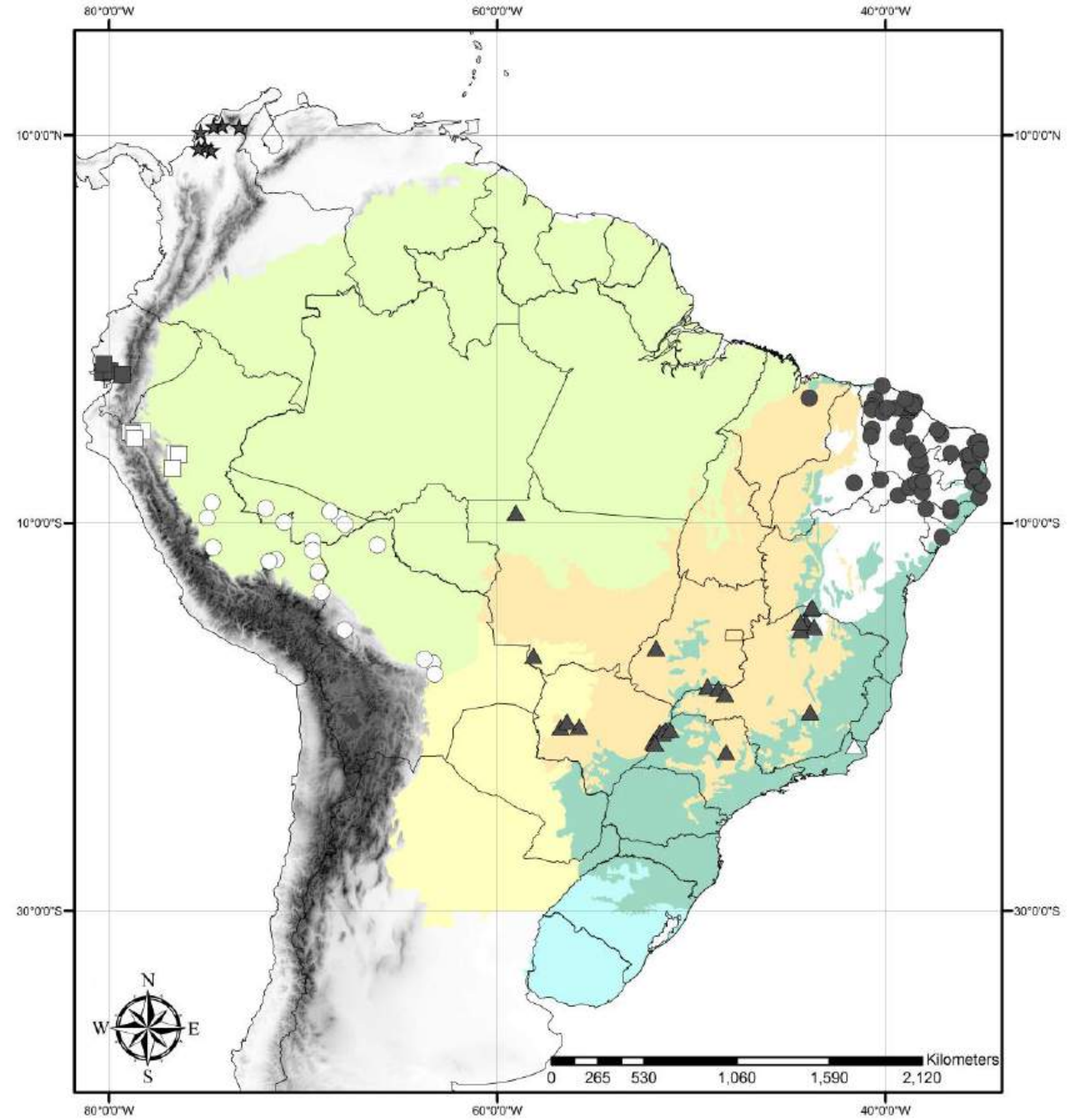


FIGURE 33. Distribution map of *Amorimia* subg. *Uncina*: ● – *A. septentrionalis*; ○ – *A. amazonica*; ▲ – *A. pubiflora*; Δ – *A. tumida*; ■ – *A. kariniana*; □ – *A. camporum*;★ – *A. concinna*. Blue – Pampa, dark green – Atlantic Forest, white – Caatinga, light green – Amazon Forest, and yellow – Chaco/Pantanal.

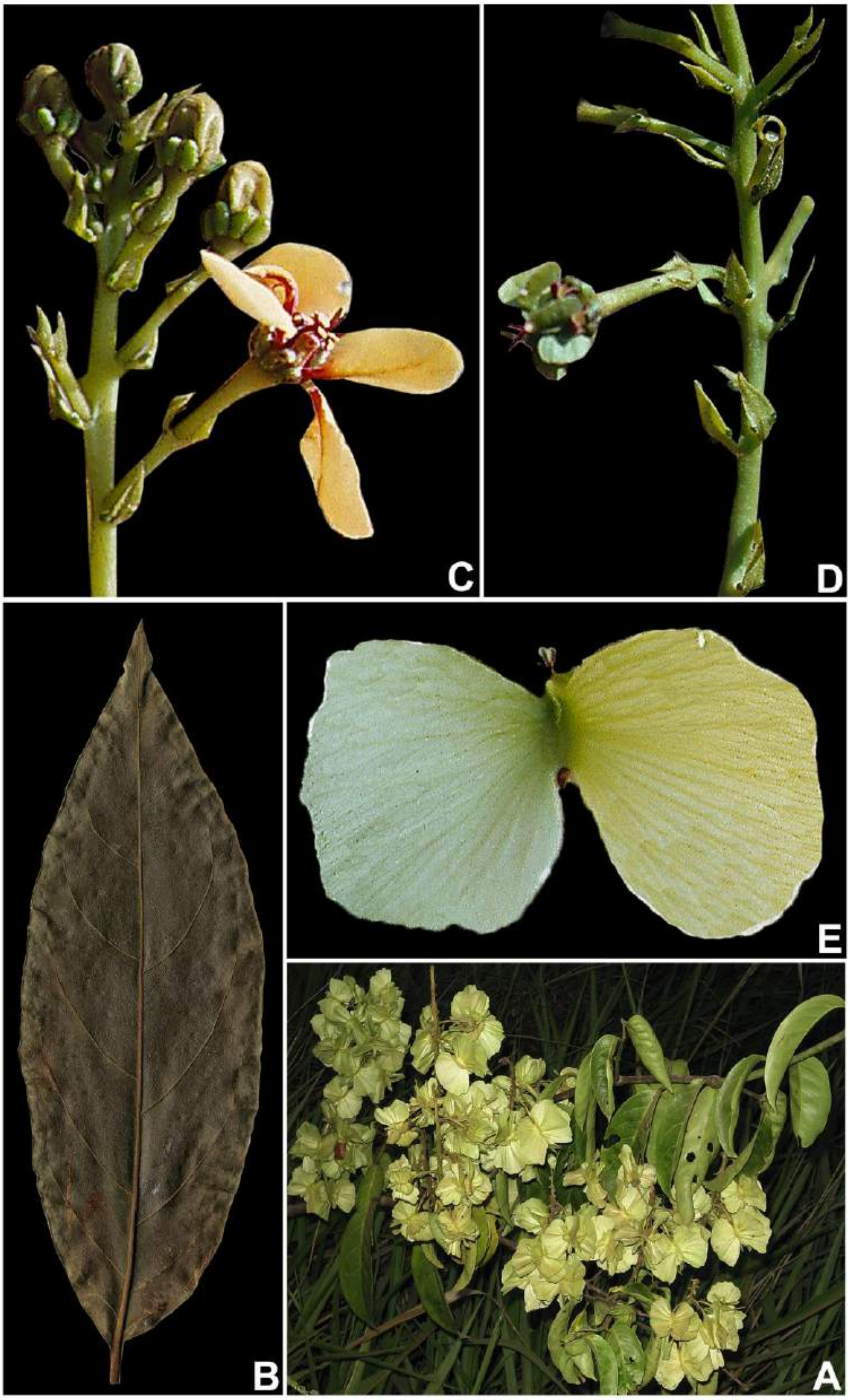


FIGURE 34. ***Amorimia amazonica*** (Nied.) W.R.Anderson: A. habit; B. leaf in abaxial view; C. inflorescence and flowers; D. detail of bracts and bracteoles; E. samaras in frontal view (photographs by D. Daly).

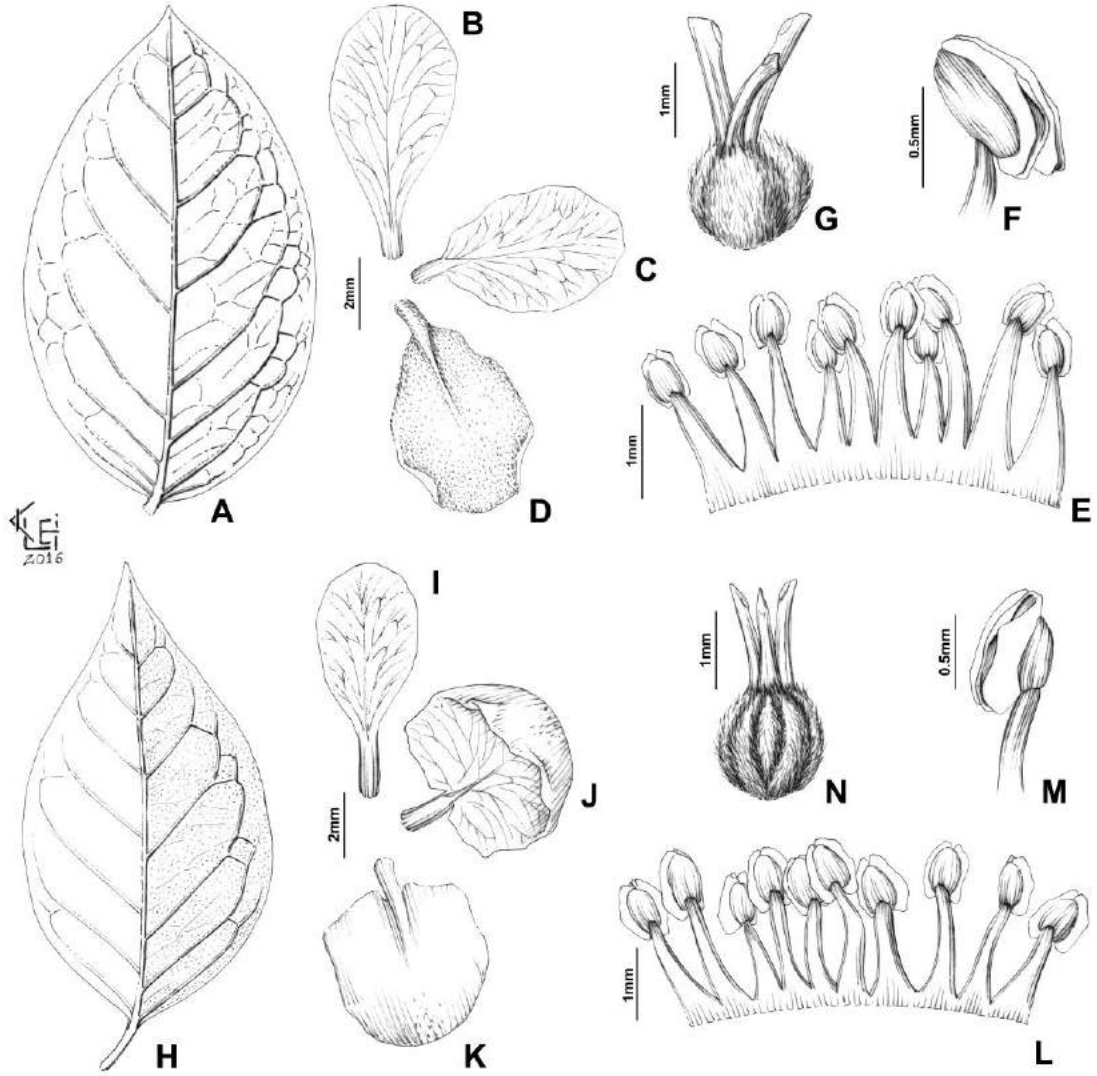


FIGURE 35. ***Amorimia camporum*** W.R.Anderson: A. abaxial side of a leaf evidencing vein pattern; B. adaxial side of a posterior petal; C. adaxial side of a posterio-lateral petal; D. abaxial side of a anterio-lateral petal; E. androecium; F. detail a stamen evidencing anther' hairs; G. gynoecium (drawings by Klei Sousa). ***Amorimia concinna*** (C.V.Morton) W.R.Anderson: H. abaxial side of a leaf evidencing vein pattern; I. adaxial side of a posterior petal; J. adaxial side of a posterio-lateral petal; K. abaxial side of a anterio-lateral petal; L. androecium; M. detail a stamen evidencing anther' hairs; N. gynoecium (drawings by Klei Sousa).

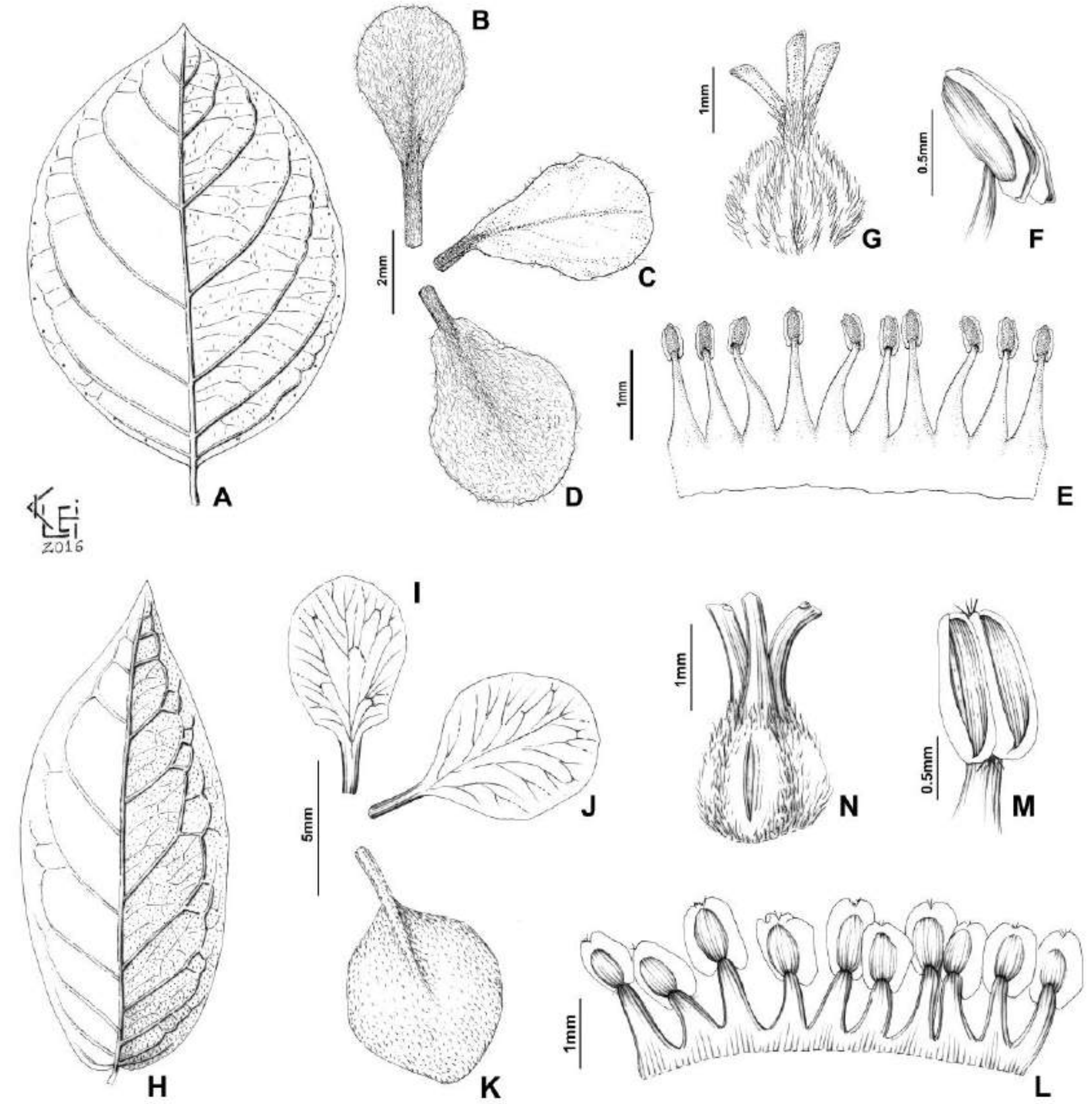


FIGURE 36. ***Amorimia kariniana*** W.R.Anderson: A. abaxial side of a leaf evidencing vein pattern; B. adaxial side of a posterior petal; C. adaxial side of a posterio-lateral petal; D. abaxial side of a anterio-lateral petal; E. androecium; F. detail a stamen evidencing anther’ hairs; G. gynoecium (drawings by Klei Sousa and Karin Weishaar Douthit). ***Amorimia pubiflora*** (A.Juss.) W.R.Anderson: H. abaxial side of a leaf evidencing vein pattern; I. adaxial side of a posterior petal; J. adaxial side of a posterio-lateral petal; K. abaxial side of a anterio-lateral petal; L. androecium; M. detail a stamen evidencing anther’ hairs; N. gynoecium (drawings by Klei Sousa).

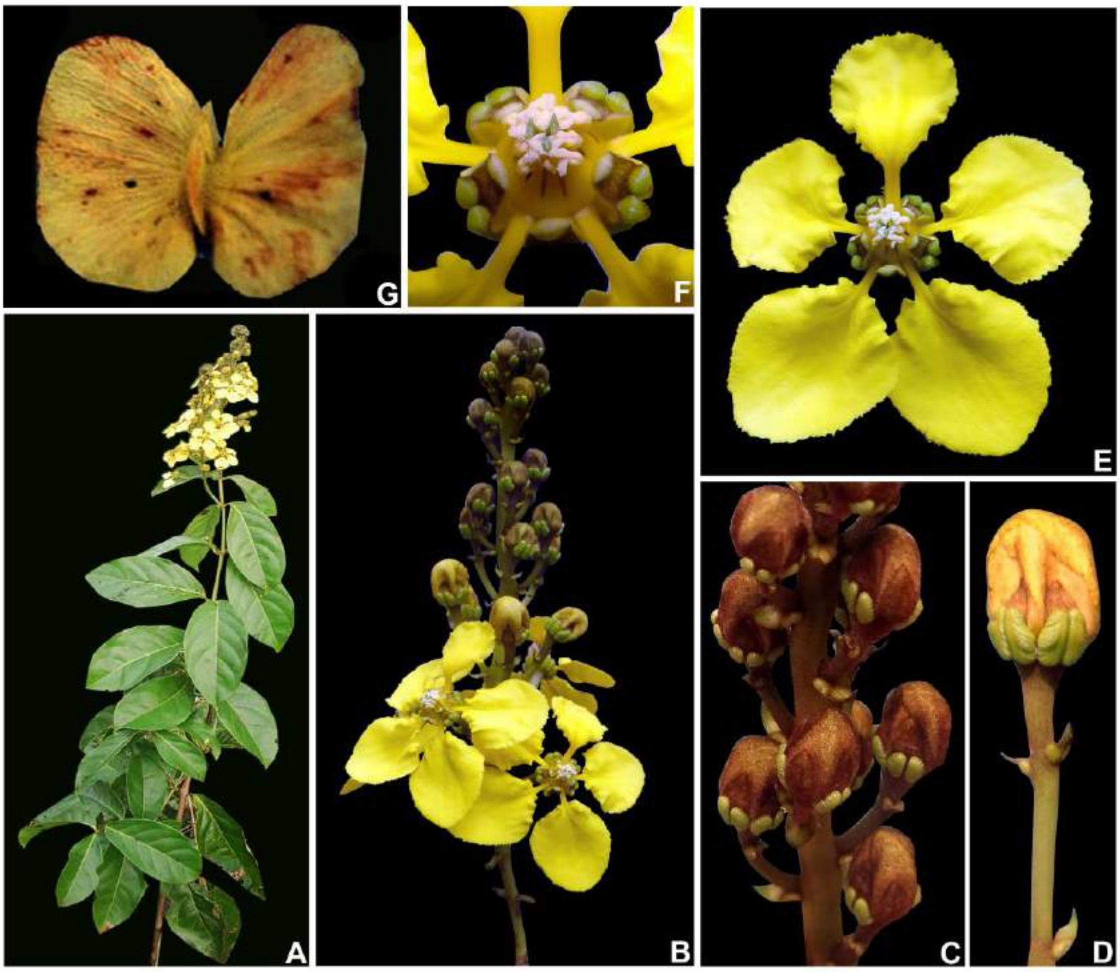


FIGURE 37. ***Amorimia pubiflora*** (A.Juss.) W.R.Anderson: A. flowering branch; B. inflorescences and flowers; C. floral buds with ocher indument; D. floral bud showing bract and bracteoles; E. flower in frontal view; F. detail of the androecium and gynoecium; G. samara in frontal view (photographs by E. Moletta).

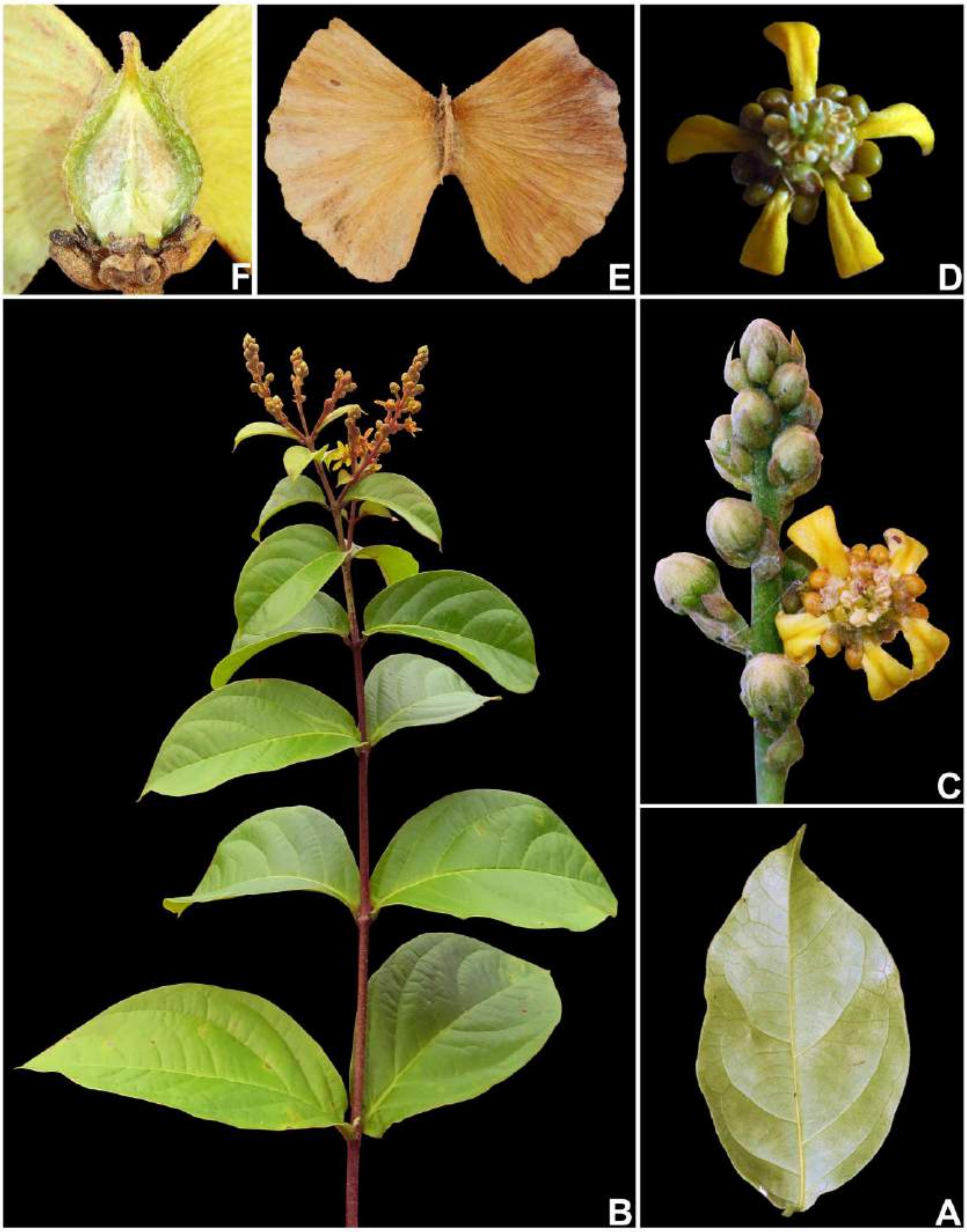


FIGURE 38. ***Amorimia septentrionalis*** W.R.Anderson: A. leaf in abaxial view; B. flowering branch; C. inflorescence; C. flower in frontal view; D. samara in frontal view; F. detail of the areole (photographs A, C-F by M.O.O. Pellegrini; B by M. Alves).

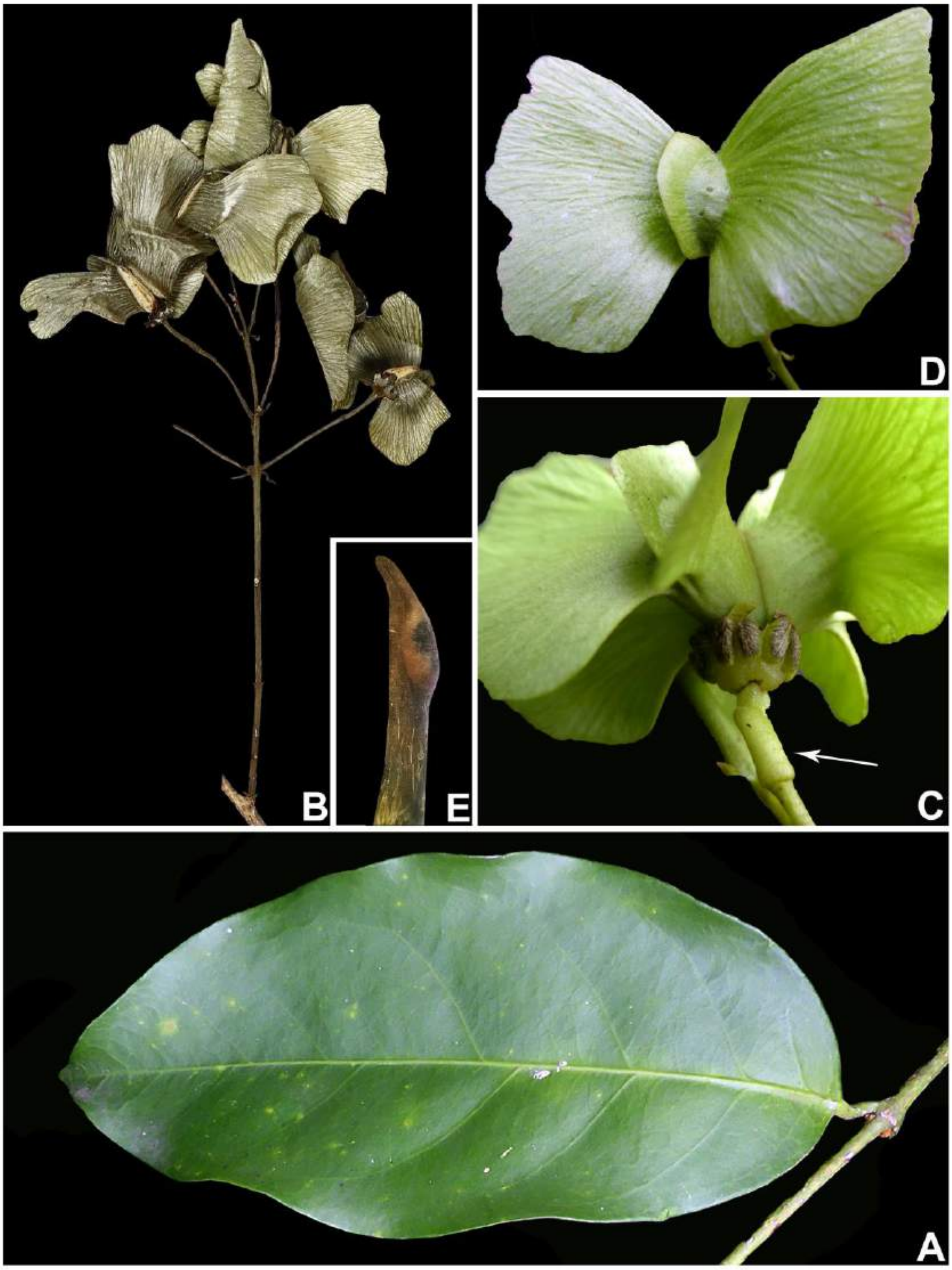


FIGURE 39. ***Amorimia tumida*** R.F.Almeida & A.C.Marques: A. leaf in adaxial view; B. inflorescence and fruits; C. samaras in side view showing the tumid pedicel; D. samara in frontal view; E. detail of the apex of a style (photographs by M.N. Coelho).

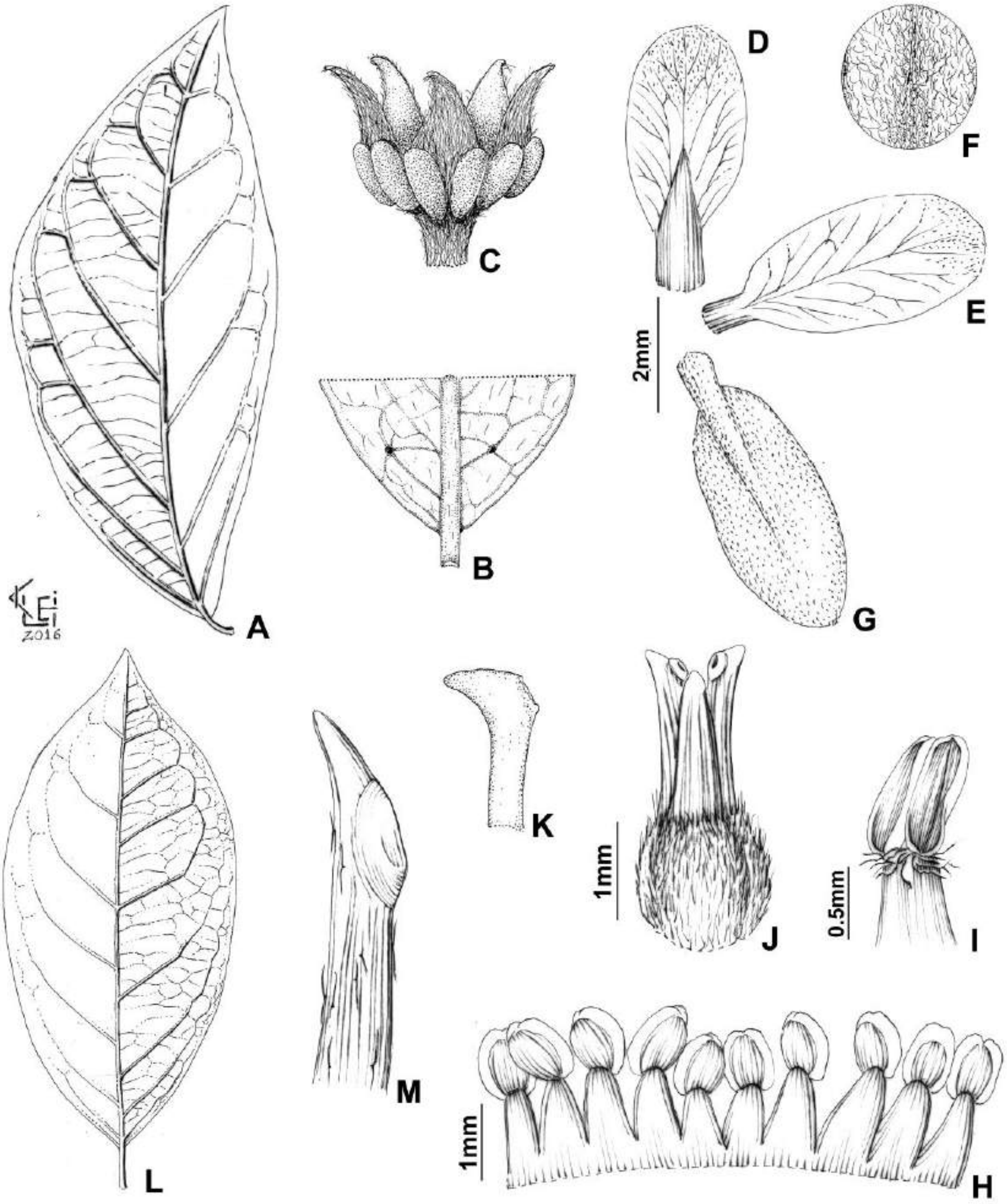
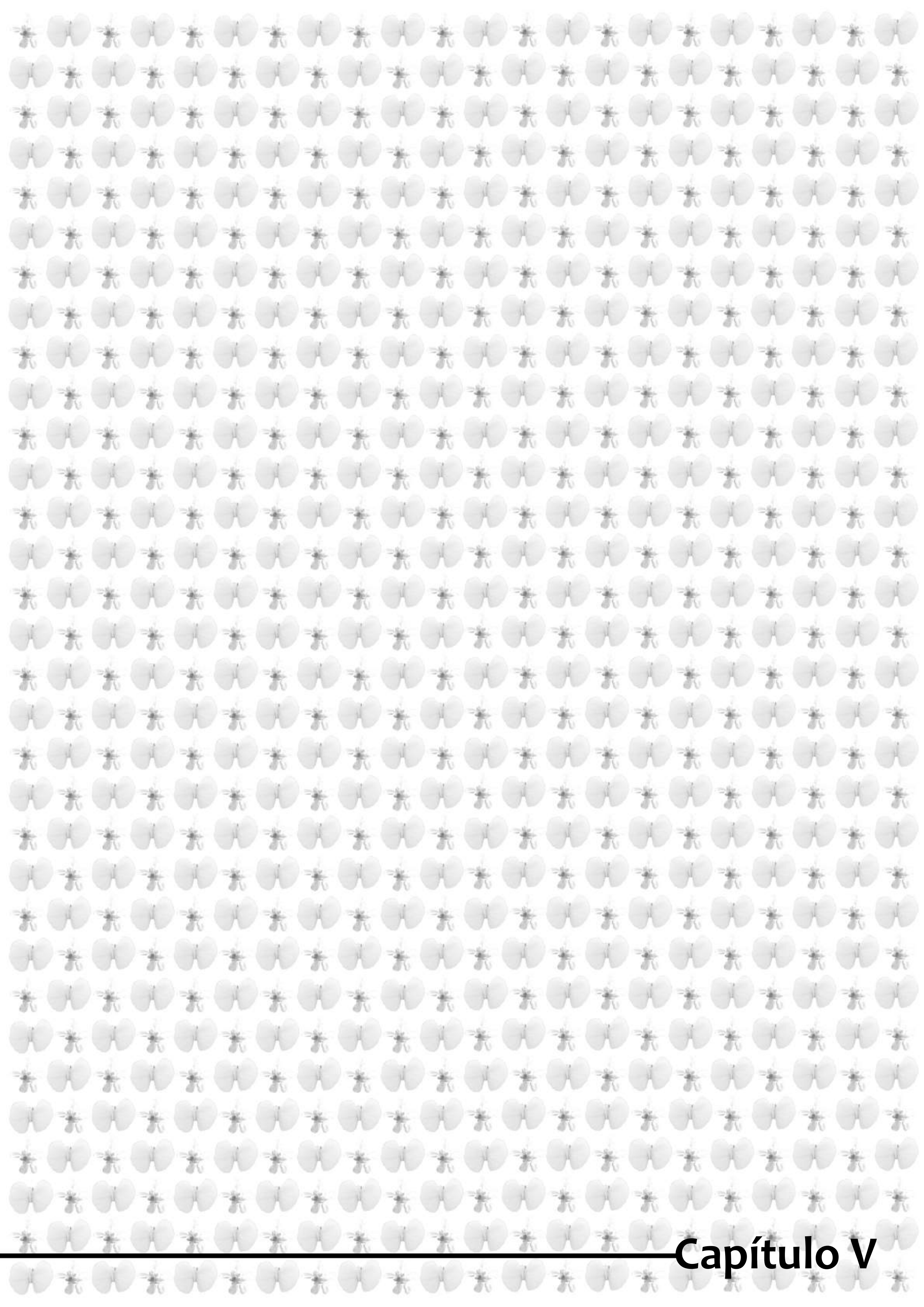


FIGURE 40. ***Amorimia septentrionalis*** W.R.Anderson: A. abaxial side of a leaf evidencing vein pattern; B. detail of the abaxial side of a leaf evidencing a pair of glands; C. detail of the sepals; D. adaxial side of a posterior petal; E. adaxial side of a posterio-lateral petal; F. detail of the indumentum on the abaxial side of lateral petals; G. abaxial side of a anterio-lateral petal; H. androecium; I. detail a stamen evidencing anther' hairs; J. gynoecium; K. detail of the uncinated apex of a style (drawings by Klei Sousa and Karin Weishaar Douthit). ***Amorimia tumida*** R.F.Almeida & A.C.Marques: L. abaxial side of a leaf evidencing vein pattern and a pair of glands; M. uncinated apex of a style (drawings by Klei Sousa).



Capítulo V

Early Miocene origin of *Amorimia* (Malpighiaceae) sheds light into liana diversification in Seasonally Dry Tropical Forests of South America

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ABSTRACT

We investigated the biogeographical history of *Amorimia,* a lianescent genus of Malpighiaceae restricted to South American STDFs, using a time-calibrated phylogenetic tree for ancestral area reconstructions. Phylogenetic relationships for all species de *Amorimia* were inferred based on three cDNA (*ndhF*, *rpl16*, and *trnQ-rps16*) and two rDNA (ETS, and ITS) regions using both parsimony and Bayesian methods. Our results show that: (1) the MRCA of *Amorimia* originated in Atlantic SDTFs around 22.0 Mya; (2) MRCAs of both *Amorimia* subgenera arose in Southern Brazilian SDTFs from 18.0 to 14.0 Mya; (3) the remaining lineages in the genera diversified from Mid-Miocene to the late-Pliocene; and (4) a history of two expansion events and several colonization events in different SDTFs nuclei of South America is suggested.

KEY WORDS: Ancestral area reconstruction, Biogeography, Malpighiales, Molecular clock, Phylogeny.

RESUMO

Investigamos a história biogeográfica de *Amorimia*, um gênero lianescente de Malpighiaceae restrito a Floresta Sazonalmente Secas na América do Sul, usando uma árvore filogenética datada e calibrada como base para reconstruções de áreas ancestrais. Relações filogenéticas para todas as espécies de *Amorimia* foram inferidas com base em três regiões de cDNA (*ndhF*, *rpl16* e *trnQ-rps16*) e duas regiões de rDNA (ETS e ITS) usando princípio bayesianos e de parcimônia. Nossos resultados demonstram que: (1) o ancestral comum mais recente (ACMR) de *Amorimia* surgiu nas Florestas Sazonalmente Secas do Atlântico em torno de 22.0 Ma; (2) o ACMR de ambos os subgêneros de Amorimia surgiram nas Florestas Sazonalmente Secas do Atlântico entre 18.0 e 14.0 Ma; (3) as demais linhagens no gênero se diversificaram a partir do Mioceno médio ao Plioceno tardio; e (4) uma história de dois eventos de expansão e vários eventos de colonização de diferentes núcleos de Florestas Sazonalmente Secas é sugerido na América do Sul.

PALAVRAS-CHAVE: Biogeografia, Filogenia, Malpighiales, Reconstrução de Áreas Ancestrais, Relógio Molecular.

1. INTRODUCTION

Seasonally Dry Tropical Forests (SDTFs) have been recently identified as one of the world's most neglected biomes, or global meta-communities, of tropical vegetation associated with erratic water availability (Pennington et al., 2009; Sarkinen et al., 2011). They commonly occur in discontinuous vegetation nuclei scattered throughout Central and South America, Africa, and Southeast Asia (Fig. 1) (Sarkinen et al., 2011; WWF, 2017). They are considered the most threatened tropical forest type globally, based on rates of deforestation and other threats (Pennington et al., 2009). The Neotropics hold 66.7% of world's SDTFs making them the most important region in terms of extension (Miles et al., 2006). In this region, the proportion of climber species increases from wet, through moist to dry forests, making lianas one of the most important components of several Neotropical SDTFs (Gentry, 1983; Bullock, 1985; Gentry and Dobson, 1987).

Malpighiaceae is one of major families of shrubs and lianas in the Neotropics (Xi et al., 2012), with ca. 85% of its species being confined to this region. This family has received broad phylogenetic and biogeographic attention (Cameron et al., 2001; Davis et al., 2001, 2002a,b, 2004; Davis and Anderson, 2010), including more focused investigations in the Old World species, especially in Africa and Madagascar (Davis et al., 2002a). Up to date, only a single biogeographic study from the Neotropics focusing on the origins of Malpighiaceae in STDFs of Mexico is available in the literature (Willis et al., 2014). Efforts to determine finer scale patterns of Malpighiaceae biogeography in the New World have been hampered by taxonomic sampling deficiencies, since it constitutes its main diversity center (Anderson, 1990). Consequently, no study has ever tested biogeographic hypothesis for the diversification of Malpighiaceae lineages in South America, especially in SDTFs.

Amorimia W.R.Anderson comprises 15 species of lianas and shrubs mostly confined to SDTFs of South America (Almeida et al., 2016). Its monophyly has been consistently corroborated in the past few years based on different datasets (Davis and Anderson, 2010; Almeida et al., in prep.). As a result, two main lineages have consistently been recovered (Davis and Anderson, 2010; Almeida et al., in prep.), and were recently recognized as subgenera (Almeida et al., in prep.). *Amorimia* subg. *Amorimia* is restricted to SDTFs of Eastern Brazil (herein called Atlantic SDTFs), with few species reaching the Atlantic Rainforest (i.e. *A. exotropica*, and *A. maritima*) (Almeida et al., 2016). On the other hand, *Amorimia* subg. *Uncina* is mostly restricted to SDTFs associated to the Andes Cordillera (herein called Andean SDTFs), with a single species reaching the Amazon Rainforest (i.e. *Amorimia amazonica*), two species confined to the South American Dry Arch (i.e. *Amorimia pubiflora*, and *A. septentrionalis*), and a single species reaching the Atlantic SDTFs of Southeastern Brazil (i.e. *Amorimia tumida*) (Anderson, 2006; Almeida et al., 2016).

In this study, we focus on a dated phylogeny of *Amorimia*, a lianescent genus of Malpighiaceae restricted to STDFs, and consistently nested within a clade of SDTF lineages worldwide (i.e. the Malpighioid clade) (Anderson et al., 2006; Davis and Anderson, 2010). We use a phylogenetic framework as the basis to further understand the patterns of historical biogeography in the genus. More specifically, we: (1) time-calibrate the phylogenetic tree; and (2) estimate the ancestral areas of *Amorimia*.

2. MATERIAL AND METHODS

2.1. Taxon sampling and plant material

We sampled a total of 23 taxa, including *Ectopopterys* W.R.Anderson as outgroup, *Mascagnia* (Bertero ex DC.) Bertero representing the remaining lineages of the Malpighioid clade as sister-group, and all species of *Amorimia* (Fig. 2). For DNA extraction, we used mainly silica-gel dried leaves (12–80 mg), and herbarium materials [for *A. amazonica* (Nied.) W.R.Anderson, *A. camporum* W.R.Anderson, *A. concinna*

(C.V.Morton) W.R.Anderson, *A. kariniana* W.R.Anderson, *A. pubiflora* (A.Juss.) W.R.Anderson, *A. tumida* R.F.Almeida & A.C.Marques and *E. soejartoi* W.R.Anderson] when necessary. All specimens used in this study are listed in Table 1.

2.2. Molecular protocols

Genomic DNA was extracted using the CTAB 2× protocol, modified from Doyle and Doyle (1987). Fragments were amplified by PCR (Polymerase Chain Reaction). We tested 16 regions suggested as potentially useful in phylogenetic reconstructions at the species level (Table 2). Three plastid (NADH dehydrogenase F gene, *rpl16* intron, and *trnQ-rps16*) and two nuclear regions (Internal and External Transcribed Spacers) were selected based on their variability and number of parsimony-informative characters (Table 2).

Protocols to amplify and sequence the plastid regions *trnL* intron, and the *trnT-L* and *trnL-F* intergenic spacers we followed Taberlet et al. (1991), as well as Shaw et al. (2005, 2006) for the *rpl16* intron, *rps16-trnK*, *trnQ-rps16*, and *trnT-L* intergenic spacers, and Davis et al. (2001) for NADH dehydrogenase F gene. In order to amplify the ITS region we followed Sun et al. (1994), and to sequence we followed Desfeux and Legendre (1996), and Baldwin and Markos (1998) for the ETS region. The amplification mix that achieved success for *rpl*16 intron, *trnQ-rps*16, and *trnT-L* regions consisted of 1 µL total DNA, 2.5µL buffer, 2.0 mM MgCl2, 0.2 mM dNTP, 0.2 mM primer, 10 ng BSA, Taq DNA polimerase (Phoenix) – 1.25 units for the plastid regions– complemented with ultrapure water to 25 L; for ETS, ITS, *ndhF*, and *trnL-F* amplification, a TopTaq (Quiagen) mix was used following the standard protocol in the kit manual, with the addition of 1.0 M betaine and 2% DMSO for ETS and ITS regions. PCR products were purified using PEG 11%(polyethylene glycol), and were sequenced directly with the same primers used for the PCR amplification. Sequence eletropherograms were produced in an automatic sequencer (ABI 3130XL Genetic

Analyzer) using Big Dye Terminator 3.1 (Applied Biosystem). Additional sequences for *ndhF* region were retrieved from genbank (see Table 1). Newly generated sequences were edited using Geneious (Biomatters, 2015), and aligned using Muscle (Edgar, 2004), with subsequent adjustments in the preliminary matrices made manually by eye. The complete data matrices will be submitted to Dryad or Treebase.

2.3. Phylogenetic analysis

All trees were rooted in *Ectopopterys*. Before we performed a combined analysis of plastid + nuclear regions, we performed the ILD test (Farris et al., 1994) to investigate incongruence between DNA data sets. Analyses using Maximum Parsimony (MP) in separate matrices were carried out with PAUP 4.0b10a (Swofford, 2002). The heuristic search was performed using the algorithm TBR (tree-bisection reconnection) and 1,000 random taxon-addition sequence replicates with TBR swapping limited to 15 trees per replicate in order to prevent extensive searches (swapping) in suboptimal islands, followed by TBR in the resulting trees with a limit of complete swapping in 1,000 trees. In all analyses, the characters were equally weighted and the states of characters were specified as unordered (Fitch, 1971). Relative support for individual branches was assessed using non-parametric bootstrapping (Felsenstein, 1985), with 1,000 bootstrap (BS) pseudoreplicates, TBR swapping, simple taxon addition and a limit of 15 trees per replicate. For the model-based approach, the model was selected using hierarchical likelihood ratio tests, using J Modeltest 2 (Darriba et al., 2012). Best fit models for all used regions are presented in Table 2. The Bayesian inference analysis (BI) was conducted with a mixed model and unlinked parameters, using MrBayes 3.1.2 (Ronquist and Huelsenbeck, 2003). The Markov Chain Monte Carlo (MCMC) was run using two simultaneous independent runs with four chains each (one cold and three heated), saving one tree every 1,000 generations, for a total of ten million of generations. We excluded 2,000 trees as ‘burn in’, and checked for a stationary phase of likelihood, checking for ESS values higher than 200 for all parameters on Tracer 1.6 (Rambaut et al., 2014). The posterior probabilities (PP) of clades were based on the majority rule consensus, using the remaining trees, calculated with MrBayes 3.1.2 (Ronquist and Huelsenbeck, 2003).

2.4. Calibration

Estimates were conducted based on a simplified ultrametric bayesian combined tree generated with BEAST 1.8.2 (Drummond et al., 2012). This analysis used a relaxed uncorrelated lognormal clock and Yule process speciation prior to inferring trees. The calibration parameters were based on previous estimates derived from a comprehensive study of the whole Malpighiaceae (Davis et al., 2014; Cai et al., 2016). We opted for calibrating at the root, using a normal prior with mean initial values of 44.0 Mya (representing the age estimated for the MCRA of the Stigmaphylloid clade), mean values of 35.0 Mya (representing the age estimated for the MCRA of the Malpighioid clade), and standard deviation of 5.0 (Davis et al., 2014; Cai et al., 2016). Two separate and convergent runs were conducted, with 10,000,000 generations, sampling each 1,000 steps and 2,000 trees as burn-in. We checked for ESS values higher than 200 for all parameters on Tracer 1.6 (Rambaut et al., 2014). Tree topology was assessed using TreeAnnotator and FigTree 1.4.0 (http://tree.bio.ed.ac.uk/software/figtree/).

2.5. Ancestral area reconstruction

Species distribution data were compiled from the taxonomic revision of *Amorimia* (Almeida, 2017), *Ectopopterys* (Anderson, 1980), and herbarium collections of *Mascagnia* from the herbaria MO, NY, and US (Fig. 3). Occurrences were categorized according to a modified version of the biogeographic areas adopted by Linares-Palomino et al. (2011), which reflects patterns of endemism in *Amorimia*, namely: (1) Andean SDTFs, (2) Amazon Rainforest, (3) Atlantic SDTFs (4) Atlantic Rainforest, and (5) Cerrado SDTFs (Fig. 3).

Ancestral areas of *Amorimia* and its relatives were estimated using a maximum likelihood analysis of geographic range evolution using software Lagrange (Ree and Smith, 2008) and S-Diva (Yu et al., 2010), both implemented in Rasp 3.2 (Yu et al., 2015). Estimates were conducted using the dispersal-extinction-cladogenesis (DEC) (Ree and Smith, 2008) and the dispersal-vicariance analysis (Yu et al., 2010).

3. RESULTS

3.1. Phylogenetic analysis

The nuclear characters represented 1,265 characters of the dataset, of which 204 characters were variable, and 318 characters were parsimony-informative (see Table 3 for a summary of regions and matrices). We did not record any evidence of paralogous copies for ETS during electrophoresis. The plastid characters represented 2,824 characters of the dataset, of which 156 were variable, and 172 were parsimony-informative (Table 3). The combined plastid + nuclear matrix includes 4,089 analyzed characters, of which 360 were variable, and 490 parsimony-informative.

Based on the nuclear dataset, the heuristic search found 36 trees (CI = 0.9090, RI = 0.9320) whose strict consensus (SC) presented 19 well-supported clades (BSP75% and >PP95%; Fig. 4). Based on the plastid dataset, the analysis found 22 trees (CI = 0.9008, RI = 0.9440) whose SC presented 14 well-supported clades (BSP75% and >PP95%; Fig. 4). Topologies produced by MP and BI analyses, based on the combined datasets, rejected incongruences according to the ILD test , and provided higher support for more clades than the results based on independent plastid or nuclear datasets (Fig. 4). Thus, based on the combined plastid + nuclear dataset, the maximum parsimony analysis found 5 trees (CI = 0.8060, RI = 0.7886) whose SC presented 19 well-supported clades (BSP75%). The Bayesian analysis recovered a fully resolved tree with 22 well-supported clades (>PP95%) (Fig. 5).

3.2. Divergence times estimation

Our divergence time analysis (Fig. 6; Table 4) suggest that the ancestral of *Amorimia* arose during the early Miocene [95% highest posterior density (HPD), 29.11–15.71 Mya]. It also suggests that the ancestral of both subgenera arose around mid-Miocene, with *Amorimia* subg. *Uncina* arising ca. 18 Mya [95% highest posterior density (HPD), 23.83–11.69 Mya], and *Amorimia* subg. *Amorimia* arising ca. 14 Mya [95% highest posterior density (HPD), 19.19–14.02 Mya]. Most lineages within *Amorimia* subg. *Amorimia* were established prior to 5.0 Mya. On the other hand, most lineages from *Amorimia* subg. *Uncina* were only established after 5.0 Mya.

3.3. Ancestral area reconstruction

The DEC and S-Diva reconstructions were highly congruent, suggesting that the most recent common ancestor (MRCA) of the Malpighioid clade was widespread in the Andean and Atlantic SDTFs ca. 37.0 Mya (Fig. 7). A vicariance event took place then, splitting the MRCA of the *Amorimia* + *Mascagnia* clade from *Ectopopterys* (Fig. 7). The latter remained associated to the western Amazon Rainforest, and the MRCA of the *Amorimia* + *Mascagnia* clade remained widespread and restricted to Atlantic SDTFs around 34.0 Mya (Fig. 7). The MRCA of *Mascagnia* was probably widespread in the Atlantic SDTFs ca. 19.0 Mya, and being followed by, at least, two dispersal events (Fig. 7). These events lead to the colonization of the Cerrado SDTFs, and the Amazon Rainforest from 13.0 to 8.0 Mya (Fig. 7). The MRCA of *Amorimia* was widespread in Atlantic SDTFs around 23.0 Mya, being followed by a split into two lineages (representing its current subgenera) occurring in Atlantic SDTFs, but also colonizing the Atlantic Rainforest from 18.0 to 14.0 Mya (Fig. 7).

The crown group of *Amorimia* subg. *Uncina* originated around 11.0 Mya, and was probably widespread in Atlantic and Andean SDTFs (Fig. 7). A vicariance event took place, splitting it into two main lineages: an Andean, and a Brazilian Dry Arch (BDA) lineage (Fig. 7). The BDA's MRCA originated around 4.0 Mya, occurring in Atlantic SDTFs, but also colonizing the Cerrado SDTFs (Fig. 7). On the other hand, the Andean lineage MRCA originated around 7.0 Mya in Andean SDTFs and diversified from 4.0 to 2.0 Mya confined in Andean SDTFs (Fig. 7). The MRCA of a single species, *A. amazonica*, in this clade colonized the western Amazon Rainforest ca. 2.0 Mya (Fig. 7). The crown group of *Amorimia* subg. *Amorimia* arose around 13.0 Mya, occurring in Atlantic SDFTs, but also colonizing the Cerrado SDTFs (Fig. 7). The MRCA of the remaining lineages was originated and diversified from 10.0 to 4.0 Mya in Atlantic SDTFs (Fig. 7). The MRCA of a single species, *A. maritima,* in this clade colonized the Atlantic Rainforest ca. 8.0 Mya (Fig. 7).

4. DISCUSSION

4.1. Phylogenetics of Amorimia

The topology recovered with the combined dataset corroborates the circumscription of *Amorimia* proposed by Anderson (2006) and Almeida et al. (in prep.), being also congruent with the phylogeny presented by Davis and Anderson (2010). These authors recovered a well-supported *Amorimia* with two main lineages, based on nuclear (ETS, and *phyC*) and on plastidial (*matK*, *ndhF* and *rbcL*) markers. These lineages are allopatric, one of them mainly restricted to northern South America, and the other mainly occurring on Eastern Brazil (Anderson, 2006; Almeida et al., in prep.). Additionally, it partially corroborates the circumscription of the *A. rigida* complex recently proposed by Almeida *et al.* (2016b, in prep.). This species complex comprises six species [*A. andersonii* R.F.Almeida, *A. candidae* R.F.Almeida, *A. coriacea* (Griseb.) R.F.Almeida, *A. pellegrinii* R.F.Almeida, *A. rigida* W.R.Anderson, and *A. velutina* W.R.Anderson] confined to Eastern Brazil. From those, *A. coriacea* and

A. velutina were recovered as early diverging lineages in the Eastern Brazil clade, and distantly related to the remaining species of the *A. rigida* complex. On the other hand, *A. tumida* was recovered as sister to the remaining species from *Amorimia* subg. *Uncina*, then here excluded from the *A. rigida* complex.

4.2. Divergence times of Amorimia and its relatives in South America

Our divergence time estimation for *Ectopopterys* (ca. 38.0 Mya) is similar to the age of 35.0 Mya estimated by Davis et al. (2014), and of 37.0 Mya estimated by Willis et al. (2014). However, it is quite different from the age of 50.0 Mya estimated by Cai et al. (2016). This might be due to the low resolution of the gene markers presented by these authors. Davis and Anderson (2010) reconstructed the first generic phylogeny of Malpighiaceae based on a single nuclear (*phyC*) and three plastid (*matK*, *ndhF*, and *rbcL*) markers. This dataset has been complemented with new sequences of Malpighiaceae, Elatinaceae, and Centroplacaceae over the last seven years by different authors (Willis et al., 2014; Cai et al., 2016). Nonetheless, the position of *Ectopopterys* remained doubtful depending on the species dataset used, sometimes placed as sister to the remaining Malpighioid clade (Davis and Anderson, 2010), Stigmaphylloid clade (Cai et al., 2016) or Tetrapteroid clade (Willis et al., 2014). Based on this, we decided to use different nuclear markers, since the position of *Ectopopterys* was of crucial importance in order to properly reconstruct the biogeographic history of *Amorimia*. Our dataset confidently placed *Ectopopterys* as sister to the remaining lineages of the Malpighioid clade.

Our mean divergence time estimation for the MRCA of *Amorimia* + *Mascagnia* (ca. 33.0 Mya) differs from the age of 40.0 Mya estimated by Davis et al. (2014) and the age of 26.0 Mya estimated by Willis et al. (2014). However, it is not statistically different, still within the range of confidence interval from our analysis [95% highest posterior density (HPD), 41.0 to 26.0 Mya]. On the other hand, our age estimation is quite different from the age of ca. 50.0 Mya estimated by Cai et al. (2016). These incongruent ages might be due to the low sampling of *Mascagnia* species and remaining lineages of the Malpighioid clade in most datasets (Davis et al., 2014; Cai et al., 2016; Almeida et al., in prep.), combined to the low resolution of internal clades in some datasets (Davis et al., 2014; Cai et al., 2016).

Our divergence time estimation for the MRCA of *Mascagnia* (ca. 19.0 Mya) differs from the age of 25.0 Mya estimated by Davis et al. (2014) and the age of 21.0 Mya estimated by Willis et al. (2014). However, it is still within the range values of confidence interval from our analysis [95% highest posterior density (HPD), 25.0 to 13.0 Mya]. On the other hand, our age estimation is quite different from the age of ca. 32.0 Mya estimated by Cai et al. (2016). This older origin for *Mascagnia* estimated by Cai et al. (2016) might be due to a larger sampling, including most lineages within in Elatinaceae and Centroplacaceae, sister-groups of Malpighiaceae.

Our divergence time estimation for the MRCA of *Amorimia* (ca. 22.0 Mya) differs from the age of 10.0 Mya estimated by Davis et al. (2014) and from the age of 12.0 Mya estimated by Willis et al. (2014). On the other hand, our age estimation and standard deviation perfectly matches the age of 25.0 Mya estimated by Cai et al. (2016). This older origin for *Amorimia* evidenced by our results and Cai et al. (2016) might be related to the correct adoption of an older outgroup. Our analysis confidently placed *Ectopopterys* as the *Amorimia* outgroup, with their MRCA arising at ca. 38.0 Mya, and Cai et al. (2016) adopted the Stigmaphylloid clade (ca. 57.0 Mya), including *Ectopopterys*, as outgroup.

4.3. Diversification of Amorimia and its relatives in South America

The MRCA of *Amorimia* (clade I), *Ectopopterys* (clade D), and *Mascagnia* (clade F) arose in SDTFs when mean global temperatures were ca. 4°C throughout the early Oligocene to the mid-Miocene (Zachos et al., 2001). *Amorimia* lineages diversified when mean global temperatures dropped below 4°C in the mid-Miocene (Zachos et al., 2001), following the expansion of seasonal phytophysiognomies, such as the Caatinga nucleus of STDFs and Neotropical savannas (Cerrado) expanded (Simon al., 2009).

Our ancestral area reconstructions suggest that the MRCA of *Ectopopterys* occurred in the Andean and Atlantic SDTFs ca. 37 Mya. This date is consistent with the early uplifting of Central Andes, between Colombia and Ecuador, and the retreat of the Pozo embayment (Hoorn et al., 2010). The Pozo embayment was a marine connection in western Amazon, extending from Northern Colombia to Central Peru, which started to retreat in the early Oligocene, being replaced by fluvial settings (Wesselingh and Hoorn, 2011). Since this marine incursion perfectly matches the current distribution of *Ectopopterys* and a vicariant event was recovered by our analysis, we hypothesize that its MRCA was widespread in Andean and Atlantic SDTFs. Later, it was isolated by the Central Andes uplifting in SDTFs from Ecuador and Colombia ca. 37 Mya. This vicariant event allied to the Pozo embayment retreat and the establishment of the Pebas system up to the late Miocene might have contributed to the restricted diversification of *Ectopopterys*.

Our ancestral area reconstructions suggest that the MRCA of *Amorimia*+ *Mascagnia* occurred in Atlantic SDTFs around 33.0 Mya. This date is consistent with the Sub-Andean river system established after the Pozo embayment retreat (Hoorn et al., 2010). The Central Andes was in its early uplifting process during the early Eocene, being a lower and discontinuous mountain range between northern Peru and Ecuador (Hoorn et al., 2010). Thus, we hypothesize that SDTFs from Northern Andes were isolated from Southern Andes and Atlantic SDTFs, confining the MRCA of *Amorimia*+ *Mascagnia* to this nucleus.

Our ancestral area reconstructions suggest that the MRCA of *Mascagnia* (clade F) and *Amorimia* (clade I) occurred in Atlantic SDTFs around 19.0 and 22 Mya, respectively. This date is consistent with the establishment of the Pebas system in the early Miocene (Hoorn et al., 2010). The Pebas system was a fluvial system of lakes and swamps in western Amazon, extending from Northern Colombia to Central Peru, which started to be replaced by the Acre system in the late-Miocene and, posteriorly, by the current Amazon river basin (Hoorn et al., 2010). Seasonal forests are recorded in western Amazon since the early Miocene, bordering the Pebas system (Hoorn, 1994; Wesselingh et al., 2006). We hypothesize that those early Andean SDTFs surrounding the Pebas system remained isolated until the complete uplift of Central Andes by the mid to late-Miocene. According to Willis et al. (2014), the MRCA of *Mascagnia* colonized Central America in the early Miocene (ca. 25.0 Mya). Our dataset does not comprise a representative sampling of *Mascagnia* lineages, but the ages estimated for the *M. divaricata* (Kunth) Nied. lineage (ca. 18.0 Mya), *M. cordifolia* (A.Juss.) Griseb. lineage (ca. 12.0 Mya), and the *M. australis* C.E.Anderson lineage (ca. 7.0 Mya) match those estimated by Willis et al. (2014). In South America, those lineages diversified in Southern Atlantic SDTFs (ca. 18.0 Mya), and later colonized and diversified in the Cerrado (ca. 12.0 Mya) and Caatinga SDTFs (ca. 7.0 Mya) nuclei.

Our ancestral area reconstructions suggest that the MRCA of *Amorimia* subg. *Uncina* (clade J) occurred in Atlantic SDTFs around 18.0 Mya. It first diversified in Southeastern Atlantic SDTFs, following a dispersal event to the Andean and Atlantic SDTFs. Posteriorly, a vicariant event took place around 10.0 Mya, splitting this lineage into two isolated lineages: an Andean SDTFs and a South America Dry Arch (SADA) lineage. This date matches the age of expansion of the SADA, currently represented by the Chaco/Pantanal, Cerrado and Caatinga domains (Simon et al., 2009). The Andean linage (clade K) then diversified around 6.0 Mya, splitting into two lineages that further diversified around 4.0 (clade N) and 2.0 (clade O) Mya. This date matches the period of complete uplift of Central Andes and the early uplift of Northern Andes (Hoorn et al., 2010). The SADA lineage posteriorly diversified around 4.0 Mya, following a dispersal event that lead to the colonization of the Cerrado SDTFs. At this time, secondary orogeny processes in Northeastern Brazil took place as a reflect of the Northern Andes uplift (Mabesoone, 1994). As a result, two different ridges (Serra Grande and Ibiapaba) uplifted between the borders of Bahia, Ceará, and Piauí states in Brazil, and drastically changed the course of the São Francisco River (Mabesoone, 1994). This river is the longest watershed in Northeastern Brazil, currently flowing to eastern Atlantic instead of to the equatorial Atlantic Ocean. It became stagnated, forming lakes due to lack of outflow in the Remanso-Petrolina region, and later changing to its present watercourse during the Pleistocene (Mabesoone, 1994). We hypothesize that this lake might have been a geographical barrier in the late Pliocene, driving the diversification of the MRCA of the SADA lineage by limiting its distribution to different sides of this paleo lake.

Our ancestral area reconstructions suggest that the MRCA of *Amorimia* subg. *Amorimia* (clade P) occurred in Atlantic SDTFs around 14.0 Mya. It first diversified in Southeastern Atlantic SDTFs and colonizing Southern Atlantic rainforests, following a dispersal event to Cerrado and Atlantic SDTFs around 12.0 Mya. This date matches the age of expansion of the South America Dry Arch, currently represented by the Chaco/Pantanal, Cerrado and Caatinga domains (Simon et al., 2009). Posteriorly, with the expansion of open dry vegetation in South America lead to the expansion of the Caatinga SDTF nucleus towards Southeastern Brazil around 10.0 Mya. Following a dispersal event around 8.0 Mya, the MRCA of *A. coriacea* diversified in the Central Atlantic SDTFs and colonized the Central Atlantic Rainforest. Finally, around 6.0 Mya the MRCA of the *A. rigida* complex s.s. (clade T) dispersed to the Caatinga SDTFs nucleus and diversified, originating four lineages from 6.0 to 4.0 Mya. At this time, secondary orogeny processes in Northeastern Brazil took place as a reflect of the Northern Andes uplift (Mabesoone, 1994). As a result, the Maracas and Chapada Diamantina ridges uplifted in Northern Espinhaço Mountain Range (Valadão, 2009), along with two different ridges (Serra Grande and Ibiapaba) in Northeastern Brazil (Mabesoone, 1994). These inland secondary orogeny processes lead to the stagnation of the São Francisco River, forming lakes due to lack of outflow in the Remanso-Petrolina region (Mabesoone, 1994). Since this river just acquired its present watercourse during the Pleistocene (Mabesoone, 1994), we hypothesize that this lake might have been a geographical barrier in the late Pliocene to the dispersal. This paleo lake might have limited the distribution of the MRCA of the *A. rigida* complex s.s. (clade T) and its lineages to Southern the Caatinga SDTF nucleus. A single species of this clade, *A. pellegrinii* R.F.Almeida, currently occurs near the northern border of the São Francisco River, probably as a result of Pleistocene dispersal events.

4.4. Time and Diversification of SDTFs in South America

Several implications for South American SDTFs might be postulated from the biogeographical study of *Amorimia* and its relatives. Our results suggest that both Andean and Atlantic SDTFs were connected at least twice around 37.0 and 10.0 Mya. The age of SDTFs nuclei in South America are still uncertain, but seasonal forests are recorded in western Amazon since the early Miocene, bordering the Pebas system (Hoorn, 1994; Wesselingh et al., 2006). Additionally, our results suggest an interesting pattern of dispersal and colonization of the different Atlantic SDTFs nuclei from mid to late Miocene. According to Linares-Palomino et al. (2011), the Eastern Brazil SDTFs nuclei might be divided into four different nuclei: the Caatinga, the Central Atlantic, the

Cerrado, and the Southern (or Austral) Atlantic SDTFs nuclei. The Caatinga nucleus was colonized at least three independent times around 12.0, 7.0, and 6.0 Mya, while the Central Atlantic nucleus was colonized at least twice around 10.0 and 4.0 Mya. On the other hand, the Cerrado SDTFs were colonized at least twice around 12.0 and 10.0 Mya.

Finally, the Amazon and the Atlantic Rainforests appeared to be colonized at least twice from early Oligocene to late Miocene. The Amazon Rainforest was first colonized around 37.0 Mya, and secondarily around 6.0 Mya. And the Atlantic Rainforest was first colonized around 14.0 Mya, and posteriorly around 8.0 Mya.

5. FINAL REMARKS

Our analyses denote a first step towards an understanding of the biogeographic history of lianas in SDTFs of South America. We showed that lineage diversification in *Amorimia* and its relatives occurred during a time period that was marked by important changes in Neotropical environments (e.g. Mabesoone, 1994; Hoorn, 1994; Hoorn et al., 2010). Andean uplift and the drying of climates are suggested by different authors and us, as important drivers of diversification in South America. Despite these general insights, a detailed understanding of the biogeographical processes that underlie diversity patterns in SDTFs lianas must be tested with thoroughly sampled phylogenies for different groups of flowering plants (e.g. Bignoniaceae, Leguminosae, and Sapindaceae). The generation of time calibrated phylogenetic trees for SDTFs groups, especially those with similar distributions in the Neotropics, is crucial. Only with these will it be possible to examine the relative importance of specific factors involved in the biogeographical and diversification history of Neotropical SDTFs.

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Table 1. Species and DNA regions sampled in this study. *Sequences obtained from genbank.

Species	**Voucher (herbarium acronym)**	**ETS**	**ITS**	***ndh*F**	***rpl*16**	***trn*Q-*rps*16**	***trn*L-F**	***trn*T-L**
Diplopterys pubipetala (A.Juss.) W.R.Anderson & C.C.Davis	A.Francener 1126 (SP)	KR092986	KY421908	HQ246821.1*	KY421896	KY421900	-	-
Stigmaphyllon paralias A.Juss.	R.F.Almeida 509 (SP)	KR054593	KY421909	AF351065.1*	-	KY421901	-	-
Peixotoa hispidula A.Juss.	S.S.Dutra 149 (VIES)	KR093002	KR093014	KM197421.1*	KY421897	KY421902	-	-
Ectopopterys soejartoi W.R.Anderson	Wurdach 2356 (US)	KR092910	-	AF351064.1*	KR092953	KY421903	KR259148.1	KR259148.1
Mascagnia australis C.E.Anderson	A.Francener 1177 (SP)	-	KR092931	HQ246886.1*	KR092954	KR092970	-	-
Mascagnia cordifolia (A.Juss.) Griseb.	A.Francener 1172 (SP)	KR092911	-	HQ246888.1*	KR092955	KR092971	-	-
Mascagnia divaricata (Kunth) Nied.	R.F.Almeida 547 (HUEFS)	KR092912	KR092932	HQ246890.1*	KR092956	KR092972	-	-
Mascagnia sepium (A.Juss.) Griseb.	R.A.Silva 2464 (HUEFS)	KR092913	AF436789.1*	AF351025.1*	KR092957	-	-	-
Amorimia amazonica (Nied.) W.R.Anderson	R.Rojas 753 (NY)	KR092914	KR092933	HQ246739.1*	-	KY421904	-	KR259149.1
Amorimia andersonii R.F.Almeida	L.C.Marinho 654 (CEPEC)	KR092924	KR092944	-	KR092964	KR092978	KR259145.1	-
Amorimia camporum W.R.Anderson	G.Klug 4259 (MO)	KR092915	KR092934	HQ246740.1*	KR092958	KY421905	-	-
Amorimia candidae R.F.Almeida	R.F.Almeida 594 (HUEFS)	KR092920	KR092941	KY271741	KR092960	KR092974	KR259143.1	KR259153.1
Amorimia concinna (C.V.Morton) W.R.Anderson	R.Romero-Castaneda 9292 (COL)	-	KR092935	-	-	KY421906	KR259141.1	-
Amorimia coriacea (Griseb.) R.F.Almeida	J.G.Jardim 4228 (CEPEC)	KR092922	KR092942	KR092951	KR092962	KR092976	KR259144.1	-
Amorimia exotropica (Griseb.) W.R.Anderson	R.F.Almeida 549 (HUEFS)	KR092923	KR092943	HQ246741.1*	KR092963	KR092977		-
Amorimia kariniana W.R.Anderson	O.Haught 3070 (NY)	-	KR092936	HQ246742.1*	KY421898	-	-	-
Amorimia maritima (A.Juss.) W.R.Anderson	Souza-Silva 15 (HUEFS)	KR092925	KR092945	KM197313.1*	KR092965	KR092979		-
Amorimia pellegrinii R.F.Almeida	R.F.Almeida 612 (HUEFS)	KR092926	KR092946	KY271742	KR092966	KR092980	KR259146.1	KR259154.1
Amorimia pubiflora (A.Juss.) W.R.Anderson	V.J.Pott 4204 (CGMS)	KR092916	KR092937	KY421894	KY421899	KY421907	-	KR259150.1
Amorimia rigida (A.Juss.) W.R.Anderson	R.F.Almeida 556 (HUEFS)	KR092928	KR092948	KY421895	KR092968	KR092982	-	KR259155.1
Amorimia septentrionalis W.R.Anderson	J.Costa-Lima 1161 (UNIVASF)	KR092918	KR092939	KM197314.1*	KR092959	KR092973	KR259142.1	KR259151.1
Amorimia tumida R.F.Almeida & A.C.Marques	M.N. Coelho 2794 (RB)	KY368391	KY421910	-	-	-	-	-
Amorimia velutina W.R.Anderson	G.J.Sheperd 4409 (UEC)	KR092930	KR092950	HQ246743.1*	-	KR092984	KR259147.1	-

Table 2. Regions of the plastid and nuclear genome tested for *Amorimia* species, its success in amplification (Ampl.) and sequencing (Seq.). Quantitative traits evaluated for choice of markers: L = length of the aligned sequences; N = number of species.

Regions	**Reference**	**Ampl.**	**Seq.**	**L(pb)**	**Best fitting model**	**N**
Nuclear						
ETS	Baldwin and Markos, 1998	**yes**	**yes**	**495**	**HKY+I**	**20**
ITS	Sun et al., 1994;	**yes**	**yes**	**769**	**HKY+G**	**21**
***phy*C**	Davis et al., 2002	no	no	-	-	-
Combined datasets	**-**	**-**	**-**	**1264**		**23**
Plastid						
***mat*K**	Cameron et al., 2001	no	no	-	-	-
***rbc*L**	Cameron et al., 2001	no	no	-	-	-
***ndh*F**	Davis et al., 2001	**yes**	**yes**	**706**	**HKY**	**20**
***trn*L-F**	Taberlet et al., 1991	yes	yes	1183	-	8
***trn*Q-*rps*16**	Shaw et al., 2007	**yes**	**yes**	**1097**	**HKY+G**	**23**
***rps*16-*trn*K**	Shaw et al., 2007	yes	no	-	-	-
***rpl*16**	Shaw et al., 2005	**yes**	**yes**	**1094**	**HKY+G**	**18**
***trn*T-L**	Shaw et al., 2007	yes	yes	512	-	7
***trn*D-T**	Shaw et al., 2005	no	no	-	-	-
***rpl*32-*trn*L**	Shaw et al., 2007	yes	no	-	-	-
***psb*A-*trn*H**	Shaw et al., 2005	no	no	-	-	-
***rpo*B-*trn*C**	Shaw et al., 2005	no	no	-	-	-
***trn*S-G**	Shaw et al., 2005	no	no	-	-	-
Combined datasets	**-**	**-**	**-**	**1800**	**-**	**20**
Combined Nuclear+Plastid datasets	**-**	**-**	**-**	**3064**	**-**	**25**

Table 3. Features of regions and combined molecular dataset

	Plastid dataset	**Nuclear dataset**	**Combined Nuclear+Plastid datasets**
Matrix length (bp)	2824	1265	4089
Analyzed characters	2824	1265	4089
Constant characters	2496	743	3239
Variable characters	156	204	360
Parsimony-informative characters	172	318	490
Consistency index	0.9008	0.9090	0.8060
Retention index	0.9440	0.9320	0.7886

Table 4. Standard deviations (in parenthesis) and mean heights values for each clade in the *Amorimia* chronogram. Ancestral area reconstructions based on the DEC and S-Diva analysis. Maximum likelihood probabilities recovered by the DEC analysis. Parsimony probabilities recovered by the S-Diva analysis.

Clades	Ages (Mya)	Ancestral area reconstruction	DEC	S-Diva
A	(50.0–) 42.0 (–33.0)	Inconclusive	0.05	0.20
B	(37.89–) 27.12 (–16.66)	Inconclusive	0.16	0.11
C	(30.35–) 20.45 (–10.86)	C	0.87	1.0
D	(45.29–) 37.12 (–29.43)	AD	0.87	0.33
E	(41.31–) 33.79 (–26.68)	D	0.75	1.0
F	(25.67–) 18.71 (–12.45)	D	1.0	1.0
G	(18.05–) 12.5 (–7.29)	D	0.87	1.0
H	(11.4–) 7.43 (–3.64)	D	0.87	1.0
I	(29.11–) 22.28 (–15.71)	D	0.67	1.0
J	(23.83–) 17.54 (–11.69)	D	0.59	1.0
K	(14.41–) 10.2 (–6.32)	AD	0.37	1.0
L	(5.66–) 3.2 (–1.28)	D	0.57	1.0
M	(8.83–) 6.03 (–3.42)	A	0.52	1.0
N	(5.68–) 3.61 (–1.59)	A	1.0	1.0
O	(3.15–) 1.66 (–0.39)	A	0.61	1.0
P	(19.19–) 14.02 (–9.05)	D	1.0	1.0
Q	(17.29–) 12.46 (–8.08)	D	1.0	1.0
R	(13.47–) 9.58 (–6.11)	D	1.0	1.0
S	(10.09–) 7.23 (–4.45)	D	1.0	1.0
T	(8.35–) 5.84 (–3.59)	D	1.0	1.0
U	(7.29–) 4.96 (–2.98)	D	1.0	1.0
V	(5.27–) 3.38 (–1.7)	D	1.0	1.0

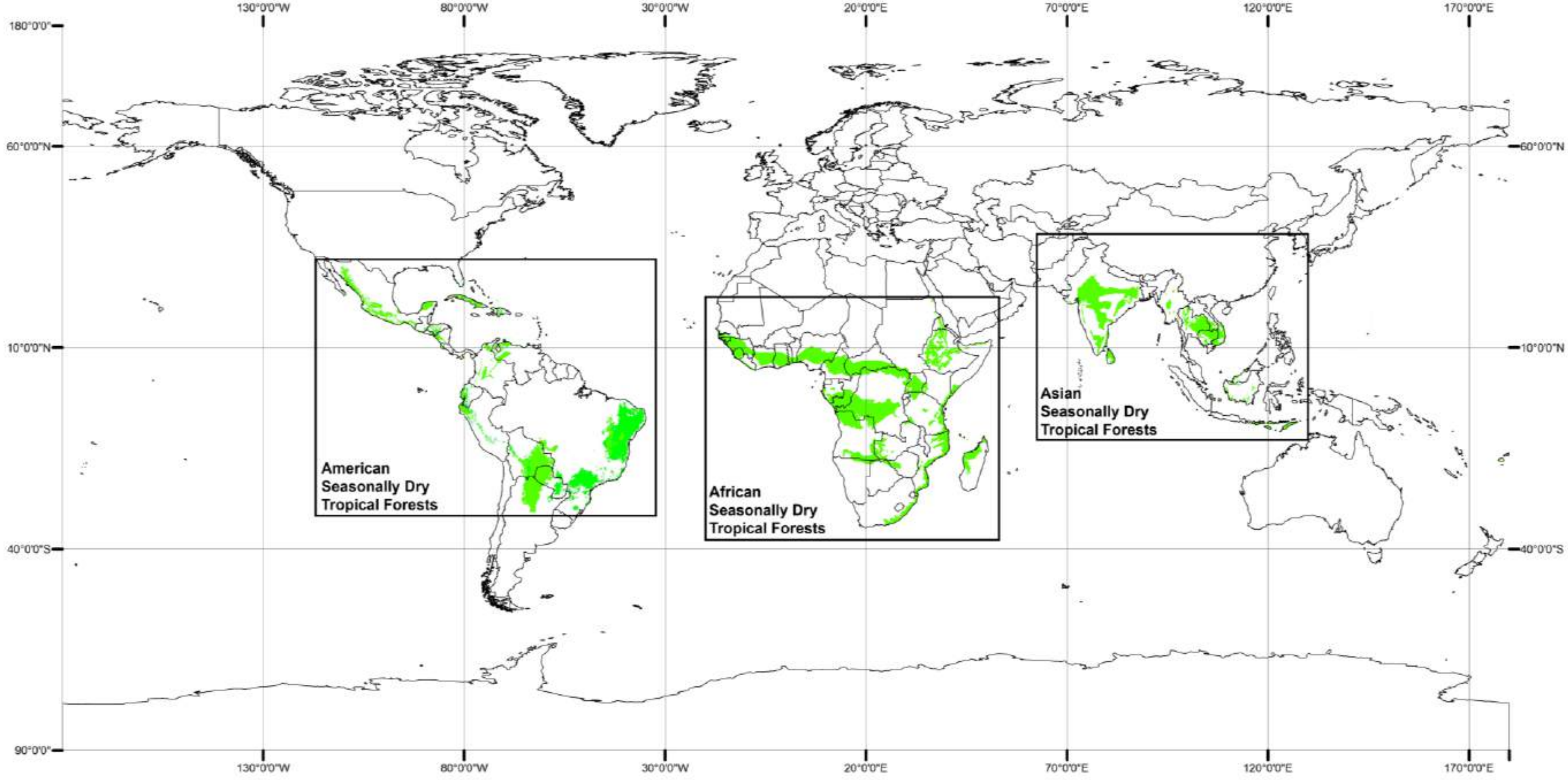


Fig. 1. Distribution of Seasonally Dry Tropical Forests Worldwide (modified from White, 1983; Sarkinen et al., 2011; and WWF, 2017).

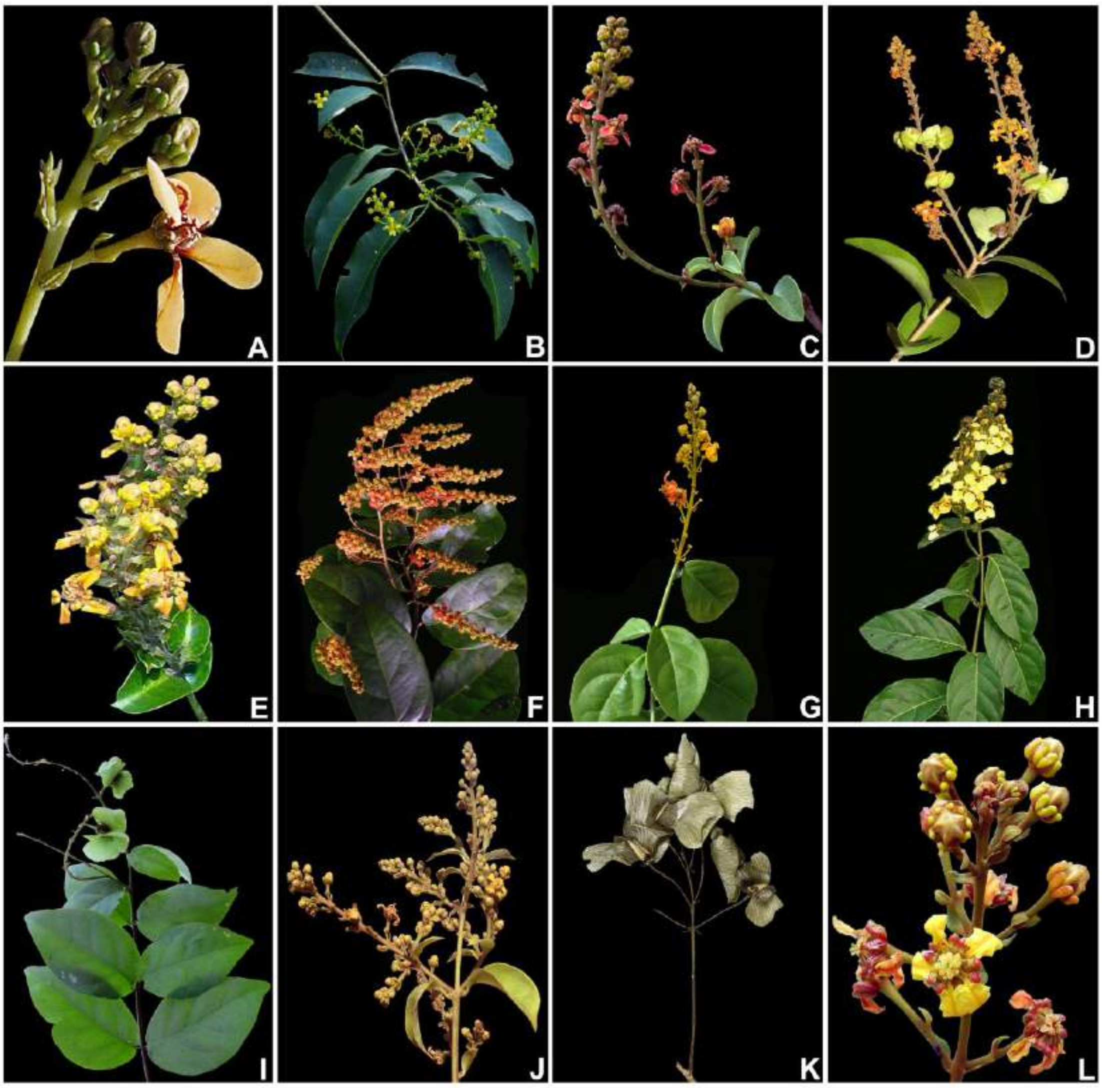


Fig. 2. Some species of *Amorimia* sampled in this study: A. *A. amazonica* (photograph by D. Daly); B. *A. andersonii* (photograph by A.M.A. Amorim); C. *A. candidae* (photograph by R.F. Almeida); D. *A. coriacea* (photograph by M.O.O. Pellegrini); E. *A. exotropica* (photograph by A. Gava); F. *A. maritima* (photograph by F. Flores); G. *A. pellegrinii* (photograph by R.F. Almeida); H. *A. pubiflora* (photograph by E. Moleta); I. *A. rigida* (photograph by R.F. Almeida); J. *A. septentrionalis* (photograpjn nh by M.O.O. Pellegrini); K. *A. tumida* (photograph by M.N. Coelho); L. *A. velutina* (photograph by L.C. Marinho).

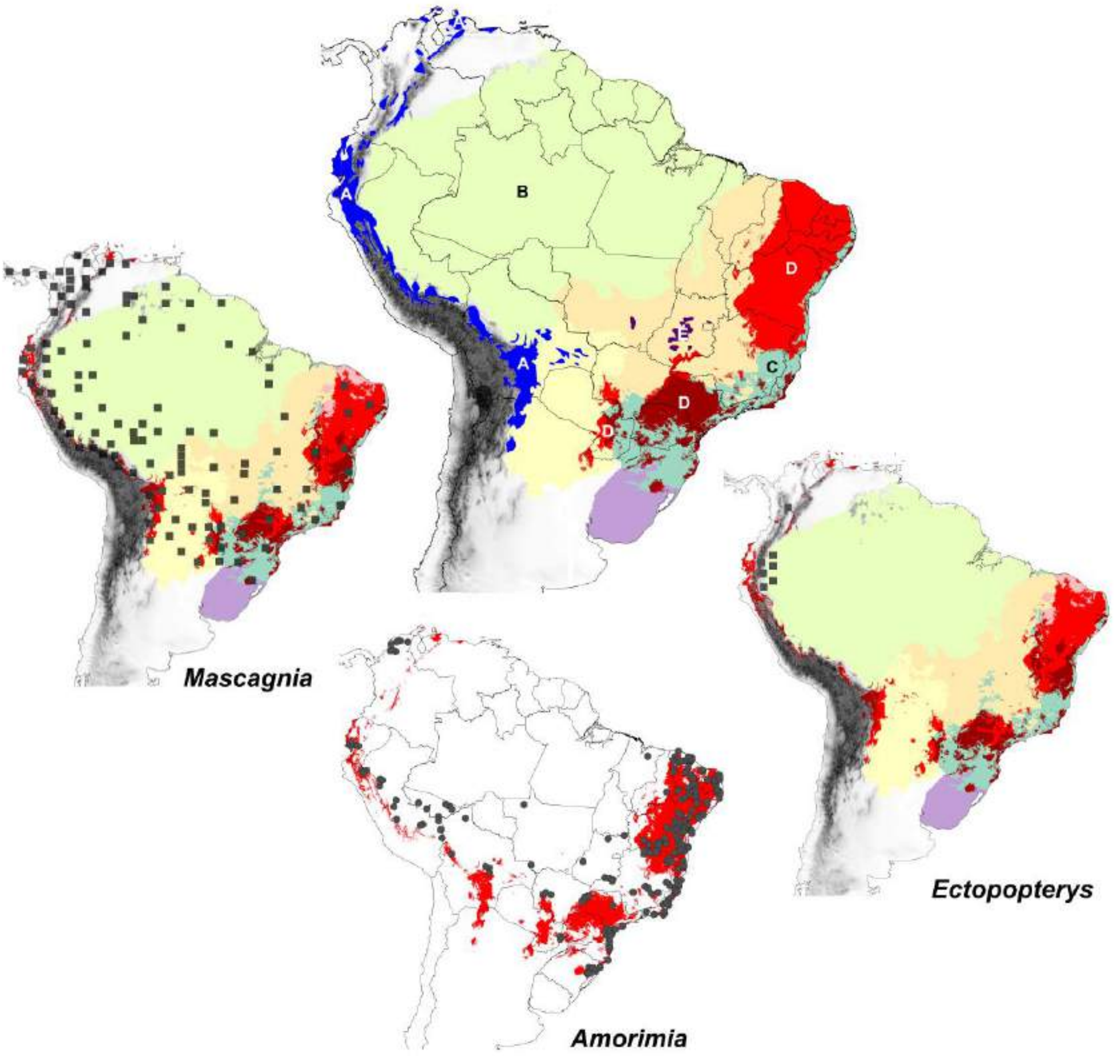
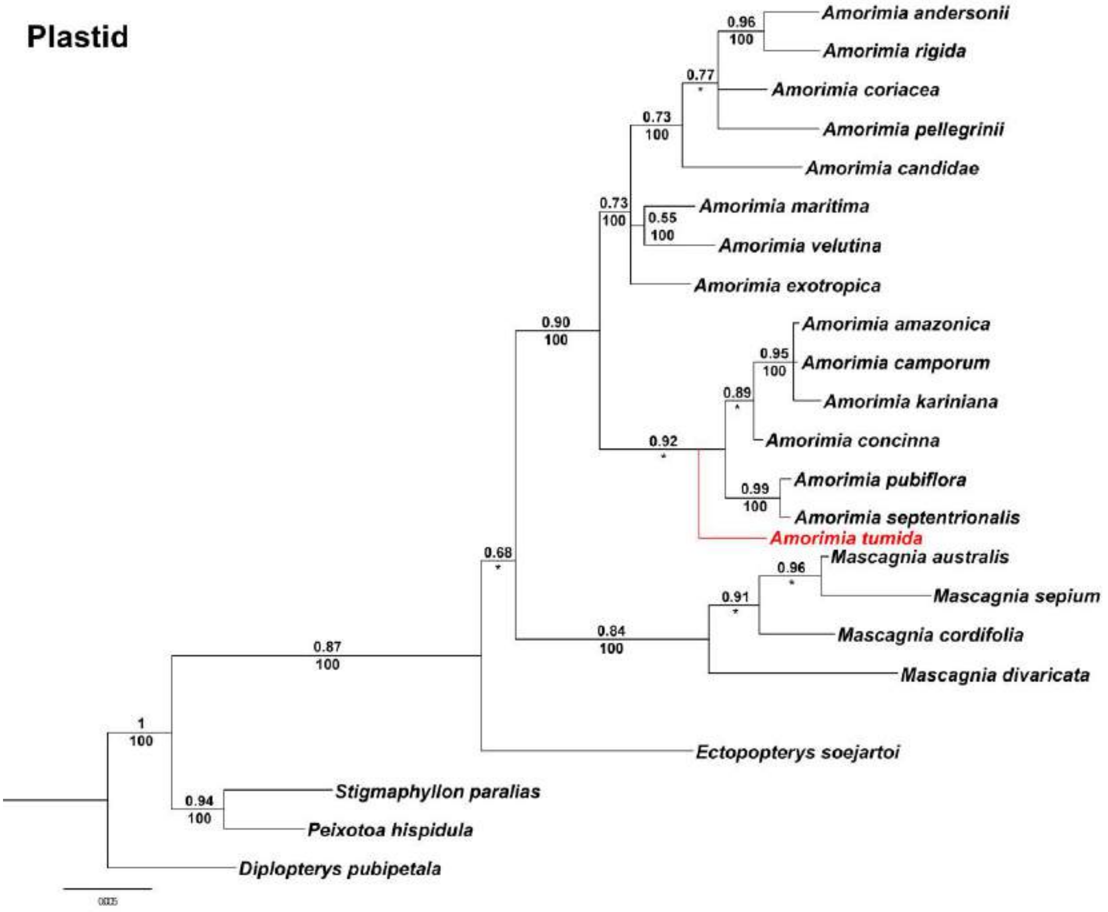


Fig. 3. Biogeographic areas adopted in this study (center): A. Andean SDTFs, B. Amazon Rainforest, C. Atlantic Rainforest, D. Atlantic SDTFs, and E. Cerrado SDTFs. Light green: Amazon Rainforest; dark green: Atlantic Rainforest; yellow: Chaco/Pantanal; orange: Cerrado; red: Atlantic SDTFs; purple: Pampas; blue: Andean SDTFs. Distribution of *Amorimia* (bellow), *Ectopopterys* (right) and *Mascagnia* (left) in South America.


Plastid
0.96
100
Amorimia andersonii
Amorimia rigida
0.77
*
Amorimia coriacea
0.73
100
Amorimia pellegrinii
Amorimia candidae
0.73
100
Amorimia maritima
0.55
100
Amorimia velutina
Amorimia exotropica
0.90
100
Amorimia amazonica
0.95
100
Amorimia camporum
0.89
*
Amorimia kariniana
0.92
*
Amorimia concinna
0.99
100
Amorimia pubiflora
Amorimia septentrionalis
Amorimia tumida
0.68
*
Mascagnia australis
0.96
*
Mascagnia sepium
0.91
*
Mascagnia cordifolia
0.84
100
Mascagnia divaricata
0.87
100
1
100
Ectopopterys soejartoi
0.94
100
Stigmaphyllon paralias
Peixotoa hispidula
Diplopterys pubipetala

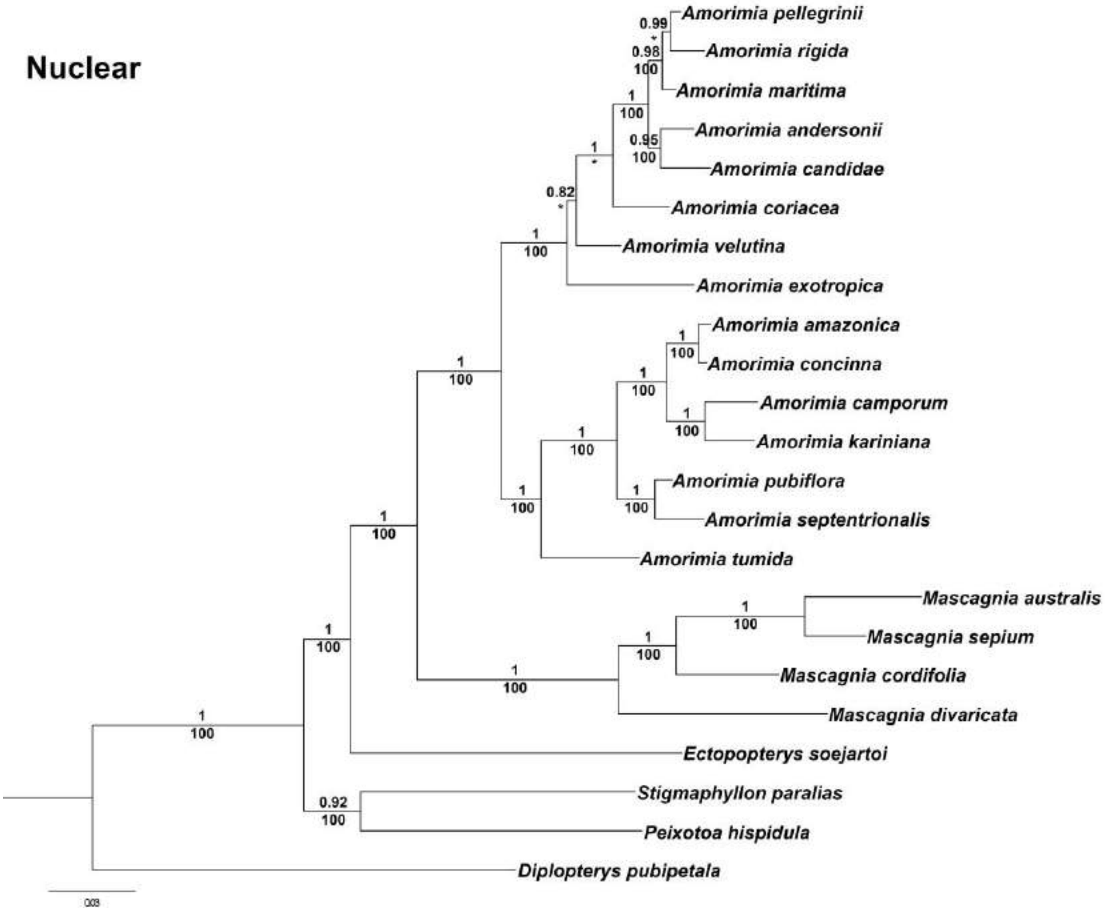

Nuclear
0.99
*
Amorimia pellegrinii
0.98
100
Amorimia rigida
1
100
Amorimia maritima
0.95
100
Amorimia andersonii
Amorimia candidae
1
*
Amorimia coriacea
0.82
*
Amorimia velutina
1
100
Amorimia exotropica
1
100
Amorimia amazonica
Amorimia concinna
1
100
Amorimia camporum
1
100
Amorimia kariniana
1
100
1
100
Amorimia pubiflora
Amorimia septentrionalis
1
100
Amorimia tumida
1
100
1
100
Mascagnia australis
Mascagnia sepium
1
100
Mascagnia cordifolia
1
100
Mascagnia divaricata
1
100
Ectopopterys soejartoi
1
100
0.92
100
Stigmaphyllon paralias
Peixotoa hispidula
Diplopterys pubipetala

Fig. 4. Best tree produced by the Bayesian Inference and Maximum Parsimony based on the plastid and nuclear datasets. Clade support for BI/MP are above/bellow branches.

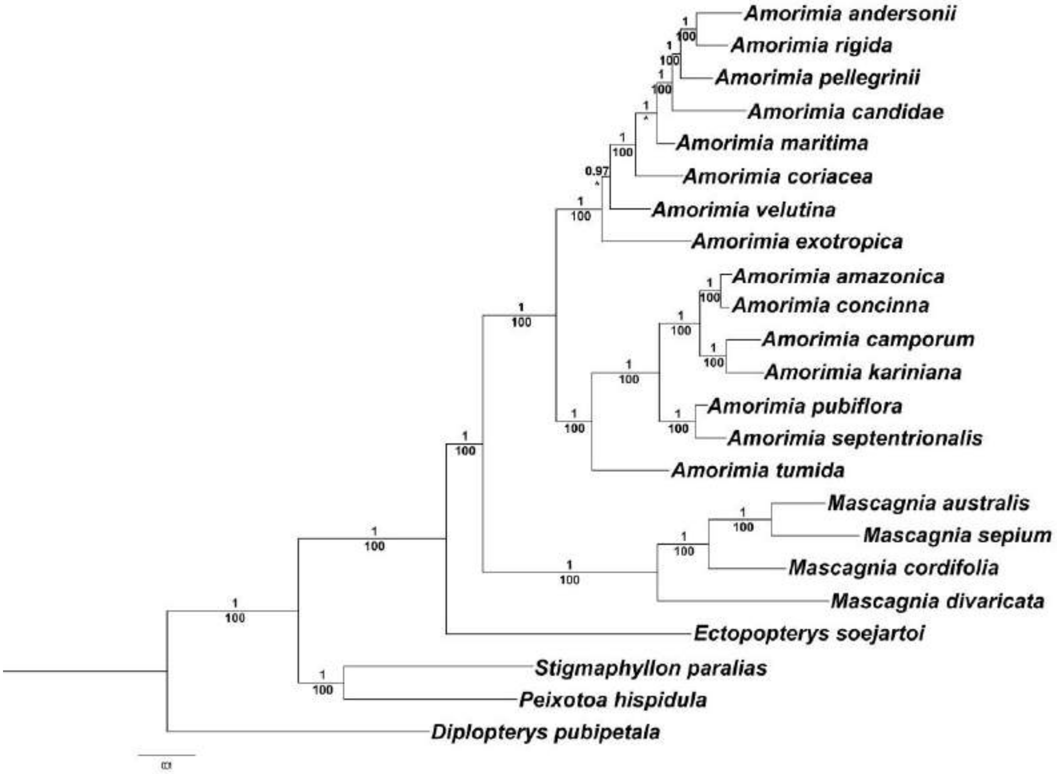


Fig. 5. Best tree produced by the Bayesian Inference and Maximum Parsimony based on the combined plastid and nuclear datasets. Clade support for BI/MP are above/bellow branches.

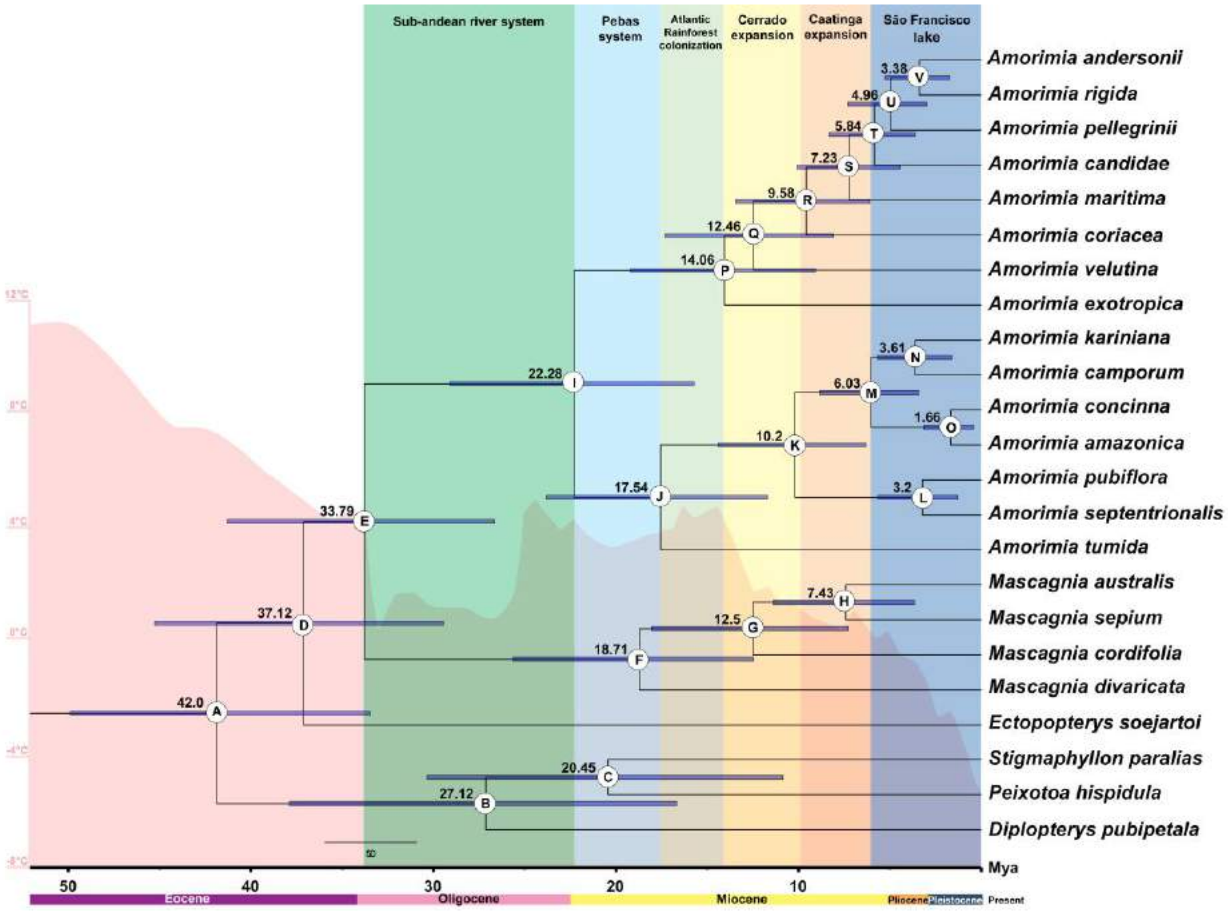


Fig. 6. Maximum clade credibility tree for *Amorimia*. Branch lengths are proportional to time, with blue bars indicating 95% highest posterior densities and mean heights for each node. Red Line in the background represents temperature fluctuation from 52 Mya to present (modified from Zachos et al., 2001).

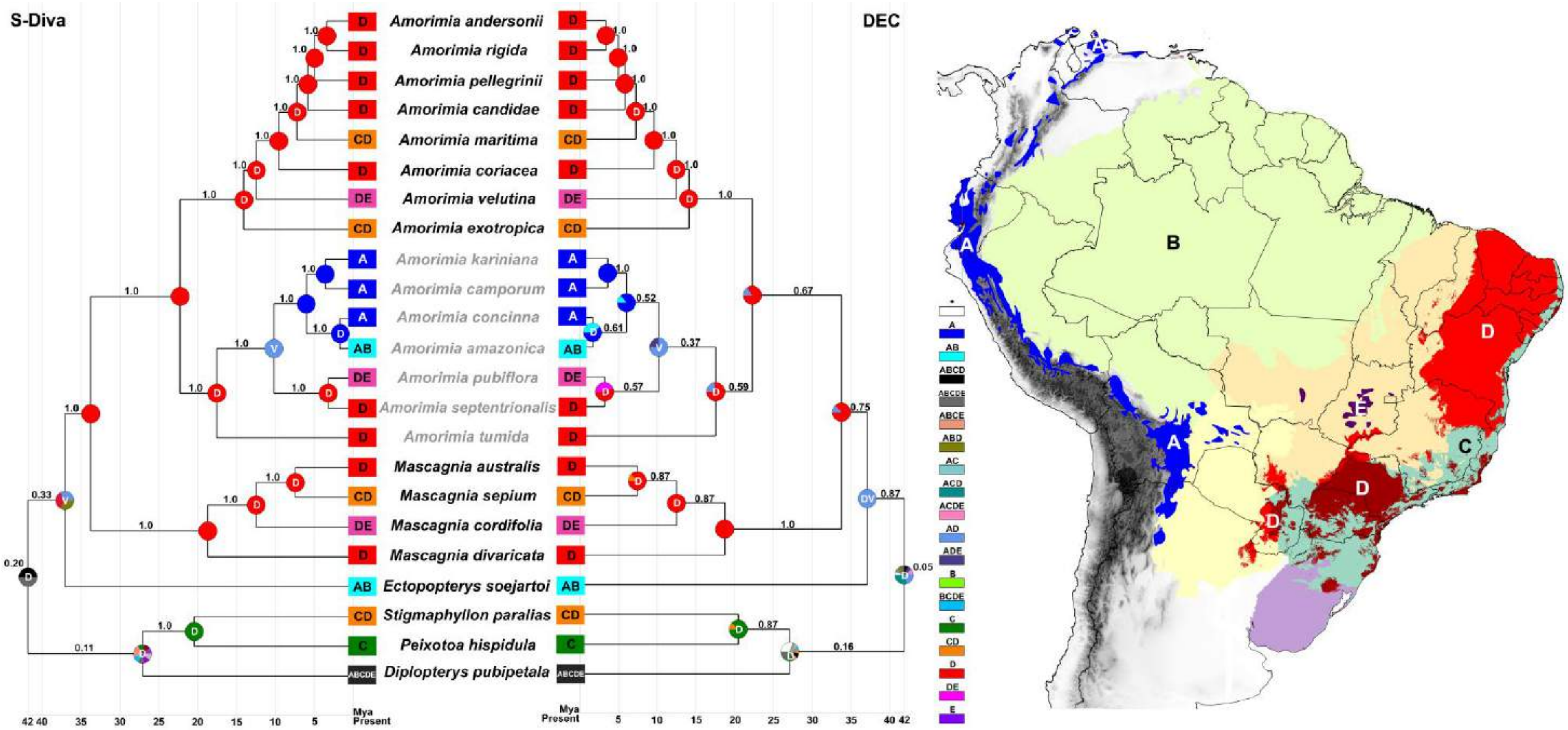


Fig. 7. Ancestral area reconstructions for *Amorimia*: left tree shows results from the S-Diva analysis, and right tree shows results from the DEC analysis. Branch values represents MRCA probabilities. Letter D inside the pie chart represents a dispersal event and the letter V represents a vicariance event. Species names in gray belong to *Amorimia* subg. *Uncina*. Species names in black in *Amorimia* represent *Amorimia* subg. *Amorimia*.

Capítulo VI

BRASIL – AMÉRICA DO SUL

Amorimia (Malpighiaceae) do Brasil

Rafael Felipe de Almeida[1], Cássio van den Berg[1] & André Marcio Araújo Amorim[1,2,3]

1.Universidade Estadual de Feira de Santana, Programa de Pós-Graduação em Botânica. **2**. Universidade Estadual de Santa Cruz. **3**. Centro de Pesquisas do Cacau, Herbário CEPEC.

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[http://fieldmuseum.org/IDtools] **Color Guide #** versão **1** 03/2017


1 **Amorimia** amazonica

Foto: D.Daly


2 **Amorimia** amazonica

Foto: D.Daly


3 **Amorimia** amazonica

Foto: D.Daly


4 **Amorimia** amazonica

Foto: D.Daly


5 **Amorimia** andersonii


6 **Amorimia** andersonii

Foto: F.Michelangeli


7 **Amorimia** andersonii

Foto: F.Michelangeli


8 **Amorimia** andersonii

Foto: F.Michelangeli


9 **Amorimia** candidae


10 **Amorimia** candidae


11 **Amorimia** candidae


12 **Amorimia** candidae


13 **Amorimia** candidae


14 **Amorimia** candidae


15 **Amorimia** candidae


16 **Amorimia** coriacea

Foto: M.O.O.Pellegrini


17 **Amorimia** coriacea

Foto: M.O.O.Pellegrini


18 **Amorimia** coriacea

Foto: M.O.O.Pellegrini


19 **Amorimia** coriacea

Foto: M.O.O.Pellegrini


20 **Amorimia** coriacea

Foto: M.O.O.Pellegrini

BRASIL – AMÉRICA DO SUL

Amorimia (Malpighiaceae) do Brasil

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21 **Amorimia** coriacea
Foto: M.O.O.Pellegrini


22 **Amorimia** coriacea
Foto: M.O.O.Pellegrini


23 **Amorimia** coriacea
Foto: M.O.O.Pellegrini


24 **Amorimia** exotropica
Foto: A.Gava


25 **Amorimia** exotropica
Foto: A.Gava


26 **Amorimia** exotropica


27 **Amorimia** exotropica


28 **Amorimia** exotropica


29 **Amorimia** exotropica


30 **Amorimia** maritima
Foto: C.Pessoa


31 **Amorimia** maritima
Foto: F.Flores


32 **Amorimia** maritima
Foto: F.Flores


33 **Amorimia** maritima
Foto: F.Flores


34 **Amorimia** maritima
Foto: F.Flores


35 **Amorimia** maritima


36 **Amorimia** maritima


37 **Amorimia** maritima


38 **Amorimia** pellegrinii


39 **Amorimia** pellegrinii


40 **Amorimia** pellegrinii

BRASIL – AMÉRICA DO SUL

Amorimia (Malpighiaceae) do Brasil

Rafael Felipe de Almeida[1], Cássio van den Berg[1] & André Marcio Araújo Amorim[1,2,3]

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[http://fieldmuseum.org/IDtools]

Color Guide # versão **1** 03/2017

41 **Amorimia** pellegrinii

42 **Amorimia** pellegrinii

43 **Amorimia** pellegrinii

44 **Amorimia** pellegrinii

45 **Amorimia** pellegrinii

46 **Amorimia** pellegrinii

47 **Amorimia** pellegrinii

48 **Amorimia** pubiflora

Foto: E.Molleta

49 **Amorimia** pubiflora

Foto: E.Molleta

50 **Amorimia** pubiflora

Foto: E.Molleta

51 **Amorimia** pubiflora

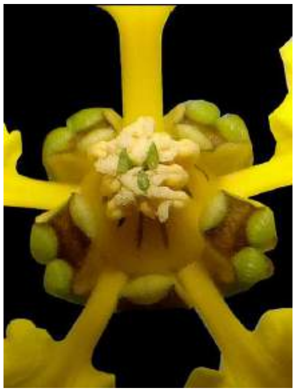
Foto: E.Molleta

52 **Amorimia** pubiflora

Foto: E.Molleta

53 **Amorimia** pubiflora

Foto: E.Mol



54 **Amorimia** pubiflora

Foto: E.Molleta

55 **Amorimia** pubiflora

Foto: E.Molleta

56 **Amorimia** rigida

57 **Amorimia** rigida

58 **Amorimia** rigida

59 **Amorimia** rigida

60 **Amorimia** rigida

BRASIL – AMÉRICA DO SUL

Amorimia (Malpighiaceae) do Brasil

Rafael Felipe de Almeida[1], Cássio van den Berg[1] & André Marcio Araújo Amorim[1,2,3]

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[http://fieldmuseum.org/IDtools] **Color Guide #** versão **1** 03/2017

61 **Amorimia** rigida

62 **Amorimia** rigida

63 **Amorimia** rigida

Foto: M.O.O.Pellegrini

64 **Amorimia** rigida

65 **Amorimia** rigida

Foto: M.O.O.Pellegrini

66 **Amorimia** septentrionalis

Foto: M.Alves

67 **Amorimia** septentrionalis

Foto: M.O.O.Pellegrini

68 **Amorimia** septentrionalis

Foto: M.O.O.Pellegrini

69 **Amorimia** septentrionalis

Foto: M.O.O.Pellegrini

70 **Amorimia** septentrionalis

Foto: M.O.O.Pellegrini

71 **Amorimia** septentrionalis

Foto: M.O.O.Pellegrini

72 **Amorimia** septentrionalis

Foto: M.O.O.Pellegrini

73 **Amorimia** septentrionalis

Foto: M.O.O.Pelleg

74 **Amorimia** tumida

Foto: M.N.Coelho

75 **Amorimia** tumida

Foto: M.N.Coelho

76 **Amorimia** tumida

Foto: M.N.Coelho

77 **Amorimia** velutina

78 **Amorimia** velutina

79 **Amorimia** velutina

Foto: L.C.Marinho

80 **Amorimia** velutina

Anexos

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Article

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Stigmaphyllon caatingicola (Malpighiaceae), a new species from Seasonally Dry Tropical Forests in Brazil

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Abstract

Stigmaphyllon caatingicola is described and illustrated. We also provide a distribution map, and comments on species distributions, conservation and taxonomy. This species is distinguished from *Stigmaphyllon urenifolium* by its deciduous leaves when flowering, lamina membranaceous, entire to apically trilobed, abaxially tomentose, with hairs deciduous in patches, one latero-anterior petal with reddish macula, sepals with darkish hairs, styles glabrous, stigma foliolate, and samaroid mericarps densely sericeous, with a dorsal wing horizontally orientated.

Key words: Caatinga, Malpighiales, *Ryssopterys*, Taxonomy

Resumo

Stigmaphyllon caatingicola é descrito e ilustrado. Em adição, nós fornecemos mapa de distribuição e comentários sobre distribuição, conservação e taxonomia da espécie. Esta espécie é distinta de *Stigmaphyllon urenifolium* por suas folhas decíduas na floração, lâmina membranácea, inteiras ou apicalmente tri-lobadas, face abaxial tomentosa, com tricomas desprendendo-se em regiões, uma pétala latero-anterior com mácula avermelhada, sépalas com tricomas enegrecidos, estiletes glabros, ápice dos estiletes com folíolos reduzidos e samarídeos densamente seríceos, com ala dorsal orientada horizontalmente.

Palavras-chave: Caatinga, Malpighiales, *Ryssopterys*, Taxonomia

Introduction

Stigmaphyllon A.Juss. (1833: 37) comprises 112 species occurring worldwide within the tropics (Anderson 2011). Most species are woody vines with long-petioled, elliptical to cordate leaves, clusters of yellow flowers arranged in dichasia, and styles with lateral appendages at their apices (stigma foliolate). The fruit is a schizocarp that splits into three samaroid mericarps with large dorsal wings (Anderson 1997). The genus is currently divided into two subgenera, subg. *Stigmaphyllon* with 92 species restricted to the Neotropics, except for *S. bannisterioides* (L.) C.E.Anderson (1992: 328) which reaches West Africa; and subg. *Ryssopterys* (A.Juss.) C.E.Anderson (2011: 76) with 20 species restricted to Southeast Asia and Oceania. Both subgenera were regarded as separate by different authors (Anderson 1997; Niedenzu 1928), but recent phylogenetic studies support their combination (Davis & Anderson 2010). Monographs for both groups were presented by Anderson (1997, 2011).

Stigmaphyllon is represented in Brazil by 46 species, occurring mostly along streams in the Amazon and Atlantic Forests (Anderson 1997; Mamede *et al.* 2014), with only a few species occurring in dry habitats, such as *Caatinga* (dryland) and *Cerrado* (neotropical savanna) vegetation (Mamede *et al.* 2014). Caatinga vegetation is included within the Seasonally Dry Tropical Forests Domain in South America (Santos *et al.* 2012), being a mosaic of thorn scrub and seasonally dry forests (Leal *et al.* 2005, Moro *et al.* 2014) and holding more than 2000 species of vascular plants, fishes, reptiles, amphibians, birds, and mammals. Endemism levels vary from 7% to 57% within these groups (Leal *et al.* 2005).

Accepted by Zhi-Qiang Zhang: 18 Jun. 2014; published: 9 Jul. 2014

Lythrum junceum Banks & Sol.
Punica granatum L. **Exót.**

Magnoliaceae

Miriam Kaehler

1 gên. e 7 spp. Nativas: 1 sp. Exóticas: 6 spp.

Magnolia champaca (L.) Baill. ex Pierre **Exót.**
Magnolia figo (Lour.) Spreng. **Exót.**
Magnolia grandiflora L. **Exót.**
Magnolia liliiflora Desr. **Exót.**
Magnolia obovata Thunb. **Exót.**
Magnolia ovata (A.St.-Hil.) Spreng.
Magnolia soulageana Hort. **Exót.**

Malpighiaceae

Rafael Felipe de Almeida

André Amorim

24 gên. e 91 spp. Nativas: 84 spp. Exóticas: 7 spp.

Alicia anisopetala (A.Juss.) W.R.Anderson
Amorimia exotropica (Griseb.) W.R.Anderson
Aspicarpa pulchella (Griseb.) O’Donell & Lourteig
Banisteriopsis adenopoda (A.Juss.) B.Gates
Banisteriopsis campestris (A.Juss.) Little
Banisteriopsis laevifolia (A.Juss.) B.Gates
Banisteriopsis malifolia (Nees & Mart.) B.Gates
Banisteriopsis muricata (Cav.) Cuatrec.
Banisteriopsis nummifera (A.Juss.) B.Gates
Banisteriopsis parviflora (A.Juss.) B. Gates
Banisteriopsis pseudojanusia (Nied.) B.Gates
Banisteriopsis variabilis B.Gates
Bronwenia ferruginea (Cav.) W.R.Anderson & C.C.Davis
Bunchosia armeniaca (Cav.) DC. **Exót.**
Bunchosia maritima (Vell.) J.F.Macbr.
Bunchosia nitida (Jacq.) DC. **Exót.**
Bunchosia pallescens Skottsb.
Byrsonima brachybotrya Nied.
Byrsonima clausseniana A.Juss.
Byrsonima coccolobifolia Kunth
Byrsonima crassifolia (L.) Kunth
Byrsonima cydoniifolia A.Juss.
Byrsonima guilleminiana A.Juss.
Byrsonima intermedia A.Juss.
Byrsonima ligustrifolia A.Juss.
Byrsonima myricifolia Griseb.
Byrsonima niedenzuiana Skottsb.
Byrsonima paulista A.Juss.
Byrsonima psilandra Griseb.
Byrsonima sericea DC.
Byrsonima subterranea Brade & Markgr.
Byrsonima verbascifolia (L.) DC.
Callaeum psilophyllum (A.Juss.) D.M.Johnson
Camarea affinis A.St.-Hil.
Dicella bracteosa (A.Juss.) Griseb.
Dicella nucifera Chodat
Diplopterys pubipetala (A.Juss.) W.R.Anderson & C.C.Davis
Galphimia australis Chodat
Galphimia brasiliensis (L.) A.Juss. **Exót.**
Heteropterys aenea Griseb.
Heteropterys argyrophaea A.Juss.
Heteropterys banksiifolia Griseb.

10TH ANNIVERSARY ISSUE

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NOTES ON GEOGRAPHIC DISTRIBUTION

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ISSN 1809-127X

New records of *Stigmaphyllon puberulum* Griseb. (Malpighiaceae) from the Atlantic Forest, northeastern Brazil

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Abstract: New records of *Stigmaphyllon puberulum* from the Atlantic Forest, northeastern Brazil, are presented, extending its distribution in the states of Alagoas, Paraíba and Rio Grande do Norte.

Key words: Malpighiales, *Stigmaphyllon*, *Ryssopterys*

Stigmaphyllon A.Juss. is one of the wing-fruited genera of Neotropical Malpighiaceae. Most species are woody vines with long-petioled, elliptical to cordate leaves, clusters of yellow flowers arranged in dichasia and styles holding lateral appendages in the apex, the folioles. The fruit is a schizocarp that splits into three samaras with a large dorsal wing (Anderson 1997).

The genus is pantropical, occurring in Africa, Southeastern Asia, Australasia, and in the West Indies and from southern Mexico to northern Argentina within the Neotropics (Anderson 2011). In Brazil it is represented by 46 species, occurring mostly along water streams on the Amazon and Atlantic Forests. At least 34 species are distributed within the Atlantic Forest, 24 are endemic to this biome (Mamede *et al*. 2014) and nine are currently threatened (Almeida *et al*. 2014; Canhos *et al*. 2014).

During visits to herbaria of northeastern Brazil (acronyms according to Thiers 2014) it was found new records of *S. puberulum*, a rare species previously know just for Bahia and Pernambuco states. I present new data that extends the distribution of *S. puberulum* to the northern portion of Brazil.

Stigmaphyllon puberulum Griseb., *Linnaea* 13: 205. 1839.

It is easily recognized by its cordate leaves, with prominent veins and reticulum usually reddish abaxially, flowers with rudimentary peduncles and fruits with lateral winglets absent.

This species was first described to the lowland forests from state of Bahia and Pernambuco. *S. puberulum* extends its distribution to the States states of Alagoas, Bahia, Paraíba and Rio Grande do Norte, occurring in lowland forests over Tertiary sediments of the Barreiras Formation, known as *Tabuleiros* (Figures 1 and 2).

A few misidentified records of *S. puberulum* from southern Brazil can be found within Brazilian Herbaria Database (SpeciesLink 2014). These specimens predate the year of 1997, when a taxonomic revision for Neotropical *Stigmaphyllon* became available (Anderson 1997). Thus, before this work, the name *S.puberulum* was mistakenly applied to two different species in the Atlantic Forest, *Stigmaphyllon alternifolium* A.Juss. and *Stigmaphyllon arenicola* C.E.Anderson. The first occurs from states of Espírito Santo to Rio de Janeiro in Seasonally Dry Forests and the later occurs from states of São Paulo to Santa Catarina in Restinga vegetation (Anderson 1997).

SPECIMENS EXAMINED: BRAZIL. **Alagoas:** Arapiraca, Serra da Microondas, 10/V/1982, fl., R.P. Lyra-Lemos 464 (MAC); Maceió, Usina Cachoeira, 15/X/2004, fl., A.C.Martins-Monteiro 108 (MAC); Paripueira, 30/XI/2006, fl., R.P. Lyra-Lemos 10031 (MAC); Piaçabucu, AL-212 em direção a Penedo, 21/X/1987, fl., I.S.Moreira 18 (MAC). **Bahia:** Gongogi, 22/

Figure 1. Images of *Stigmaphyllon puberulum* (photos by A. Miranda): A. Habit, B. detail of abaxial veins, C. detail of inflorescence and flowers.

MALPIGHIACEAE I

Coordenador: Andre Marcio Araujo Amorim[1,2,4]

Árvores, arbustos, subarbustos a lianas, perenes; tricomas unicelulares, em formato de T, Y ou V, raramente estrelados. Folhas opostas, raramente verticiladas, subopostas ou alternas, glândulas frequentes no pecíolo e na lâmina; lâmina foliar inteira, raramente lobada, margem inteira, denticulada ou ciliada com glândulas marginais; estípulas intra ou interpeciolares, livres ou conadas, grandes a diminutas, persistentes ou caducas. Flores zigomórficas, sépalas 5, livres ou parcialmente adnatas ao receptáculo; elaióforos 5(-4) pares, às vezes ausentes; pétalas 5, livres, unguiculadas, alternas às sépalas, imbricadas, amarelas, róseas ou brancas, pétala posterior diferenciando-se das 4 laterais. Estames 10, raramente 5 ou 6 em alguns gêneros, estames iguais ou heteromórficos. Gineceu tricarpelar, carpelos livres ou conados, às vezes 2, muito raramente 4, cada carpelo contendo 1 óvulo pêndulo, anátropo; estiletes 1 por carpelo, raramente conados ou reduzidos em número. Fruto deiscente ou indeiscente, noz, drupa ou esquizocarpo samaróide; semente sem endosperma (Anderson 1981).

Malpighiaceae inclui ca. 77 gêneros e 1300 espécies de distribuição tropical e subtropical, com cerca de 90% de suas espécies restritas à região Neotropical (Davis & Anderson 2010). No Brasil abrange 44 gêneros e ca. 561 espécies distribuídas por todos os biomas, sendo especialmente diversa no Cerrado, Floresta Amazônica e Atlântica (Mamede *et al.* 2014). Em Sergipe é representada por 20 gêneros e ca. 50 espécies ocorrendo em diferentes fitofisionomias no estado (Figuras 1-2).

Chave para identificação dos gêneros de **Malpighiaceae** de Sergipe

Rafael Felipe de Almeida[2]
Augusto Francener[3]
Cleiton Pessoa[4]
Andre Marcio Araujo Amorim[1,2,4]

1. Frutos drupas ou cocas, inflorescências simples, racemos 2
2. Frutos cocas, elaióforos ausentes 3

---

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14'. Estípulas intrapeciolares livres e diminutas, seis estames, três estaminódios ou ausentes, gineceu com um estilete .... **12. *Janusia***
7'. Alas laterais dos samarídeos mais desenvolvidas do que a ala dorsal 15
15. Samarídeos com duas alas laterais 16
16. Alas laterais conadas e orbiculares, inflorescências em corimbos ....**13. *Mascagnia***
16'. Alas laterais livres e trapezoidais, inflorescências em umbelas ou racemos 17
17. Pecíolo com um par de estipelas, alas laterais membranáceas e arredondadas .... **11. *Hiraea***
17'. Pecíolo sem estipelas, alas laterais coriáceas e trapezoidais.............................18
18. Brácteas e bractéolas eglandulosas, umbelas .... **7. *Callaeum***
18'. Brácteas e bractéolas com um à dois pares de glândulas, racemos ....**1. *Amorimia***
15'. Samarídeos com quatro alas laterais (duas posteriores e duas anteriores) 19
19. Bractéolas triangulares, com ápice agudo sépalas recobrindo o botão floral na antese, alas laterais curtas e largas, alas latero-posteriores tão longas quanto as latero-anteriores .... **15. *Niedenzuella***
19'. Bractéolas elípticas, com ápice arredondado, sépalas não recobrindo o botão floral na antese, alas laterais longas e estreitas, alas latero-posteriores geralmente mais longas que as alas latero-anteriores.. **19. *Tetrapterys***

18. *Stigmaphyllon* A. Juss.

Bárbara Conceição Santos Lima[1]
Rafael Felipe de Almeida[2]
Ana Paula do Nascimento Prata[1]

Trepadeiras herbáceas a lenhosas ou arbustos escandentes a eretos. Folhas opostas, reduzidas na inflorescência; pecíolo com 1 par de glândulas apicais ou subapicais; lâminas inteiras ou lobadas, 1-várias glândulas marginais. Umbelas 2-30 floras, solitárias ou reunidas em dicásios ou panículas de dicásios. Flores com *cálice* biglanduloso; corola amarela, glabra em ambas as faces. Androceu com 10 estames conados na base, estames opostos a sépala anterior e as pétalas latero-posteriores (e aos estiletes) geralmente férteis, maiores que aqueles opostos as sépalas laterais; filetes geralmente mais finos, conectivos proeminentes, lóculos reduzidos ou ausentes. Gineceu com estiletes heteromórficos, paralelos ou divergentes, retos ou arqueados, ápice foliáceo desenvolvido ou ausente; estigma lateral. Samarídeo esquizocárpico com uma ala dorsal mais desenvolvida que as laterais, espessada na margem superior; núcleo seminífero liso ou com 1 par de alulas laterais reduzidas.

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An Unexpected *Mcvaughia* (Malpighiaceae) Species from Sandy Coastal Plains in Northeastern Brazil

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Abstract*—*Mcvaughia sergipana is described and illustrated. It differs from the single other species in the genus by the metallic-sericeous, and soon deciduous indumentum on the leaves, small glands scattered throughout the lamina, lateral cincinni with 1–2 flowers, and larger posterior petal. This new species is only known from sandy coastal plains in Sergipe State, Brazil, and is critically endangered. Its distribution is estimated to be less than 100 km^2 in a region of extremely disturbed environments.

***Keywords*—**Atlantic Forest, *Burdachia*, *Glandonia*, Malpighiales, Sergipe State.

Mcvaughia W. R. Anderson is a genus of Malpighiaceae endemic to northeastern Brazil (Anderson 1979), previously with only a single species: *M. bahiana* W. R. Anderson. The genus can be easily recognized by its shrubby habit, anterior petals nested inside one another, horseshoe-shaped anthers, and nuts with the epicarp twisted a 180-degree angle (Anderson 1979). *Mcvaughia bahiana* is found only in dry, open habitats of Caatinga (dryland) vegetation in northeastern Bahia State, Brazil (Anderson 1979), with only a few collections near the type locality.

Mcvaughia represents an intriguing case of geographic disjunction within Malpighiaceae, due to its placement as sister-group to two Amazonian lineages, *Burdachia* A. Juss. and *Glandonia* Griseb., the so called *Mcvaughia clade* (Davis and Anderson 2010). These two latter genera are widely distributed throughout the Amazon Basin with *Burdachia* reaching the Guyanas, but absent in northeastern Brazil, from where *Mcvaughia* was first described 35 yr ago (Anderson 1979).

During recent fieldwork, and through examination of collections at the most important herbaria in Sergipe State, Brazil, we were surprised by finding a new species of *Mcvaughia*. This species is apparently endemic to sandy coastal plains (restinga vegetation) in the Atlantic Forest biome. With one exception, all specimens of the new species described here were collected within the last four years.

MATERIALS AND METHODS

The description and illustrations of the new species presented here are based on field collections and studies of herbarium specimens. Information concerning the plant height, habit, presence of color on the hairs, lamina surface, glands, sepals, petals, fruits, and other informative traits were noted while examining fresh material in the field or transcribed from the collection labels of the herbarium specimens. Descriptions, morphological illustrations, and maps are based only on plant material from field collections and additional specimens from the ALCB, ASE, CEPEC, and HUEFS herbaria. The maps were generated using Arcgis software (ESRI 2010) and the geographical coordinates obtained from herbarium specimens.

TAXONOMIC TREATMENT

Mcvaughia sergipana Amorim & R. F. Almeida, sp. nov.—TYPE: BRAZIL. Sergipe: Mun. Pirambu, Estrada para Lagoa Redonda, restinga sobre tabuleiro, 10°41′79″S, 36°50′90.2″W, 96 m, 7 Oct 2013 (fl, fr), *A. M. Amorim, L. C. Marinho, & R. F. Almeida 8393* (holotype: CEPEC!; isotypes: ASE!, HUEFS!, MBM!, NY!, MICH!, P!, RB!, SP!).

Mcvaughia sergipana differs from *M. bahiana* by the former having the abaxial leaf surface sericeous, lateral cincinni with 1–2 flowers, and posterior petal limb 4.5–8.5 mm long, with the latter having the abaxial leaf surface densely tomentose or lanuginose, lateral cincinni with 2–7 flowers, and the posterior petal limb ca. 3 mm long.

Shrubs 1.5–2 m tall, basal stems 4–8 cm diam.; stipules 3–5 mm long, densely sericeous, persistent. Leaves mostly straight, opposite; petiole (0.3–)0.7–1.2 cm long, canaliculate, initially sericeous and later glabrescent, eglandular; lamina of larger leaves 8.4–10.7(–12) × (2.7–)3–5.8(–6.5) cm, chartaceous to subcoriaceous, elliptic to ovate, rarely elliptic-lanceolate, apex acute or slightly acuminate, base acute or cuneate, margins slightly revolute, rarely flattened; lamina with 2 prominent abaxial glands at base, on each side of the midrib, with other smaller impressed glands scattered throughout lamina, adaxial surface green, initially sericeous and very soon glabrescent, abaxial surface initially densely metallic sericeous and soon glabrescent, thinly sericeous proximally on and near midrib and veins. Inflorescence a terminal raceme of cincinni, (6.5–)8–11.4 cm long, 15–30 lateral cincinni, opposite to subopposite, rachis striated, densely sericeous, with brown hairs, 1–2 flowers per cincinnus; bract 5–6.5 mm long, lanceolate, spreading; bracteoles 2.5–3 mm long, triangular, subopposite, spreading, one having a conspicuous green gland at base; peduncle 4–5 mm long, sparsely sericeous; pedicel 2–3 mm long, sparsely sericeous. Flowers with sepals 2.5–3 × 1–1.5 cm, brown, straight, carinate, covering most of the androecium, apex rounded, margin short ciliate, adaxial surface glabrous, abaxial surface sericeous, glabrescent near the margin; lateral 4 sepals biglandular, anterior sepal eglandular, glands ca. 2.5 × 1 mm, yellow, obovate; petals golden yellow, soon deciduous; anterior lateral petals orbicular, cucullate, limb ca. 4 × 5 mm, margin erose, eglandular, claws 2–2.5 × ca. 0.25 mm; posterior lateral petals obovate, spreading, limb 4–6 × 4–6 mm, margin erose, eglandular, claws 1.5–2 × ca. 0.35 mm; posterior

Notes on *Stigmaphyllon* (Malpighiaceae) from Southeastern Brazil

Rafael Felipe de Almeida[1]*, Ana Carolina Dal Col[2]
& André Marcio Araujo Amorim[1,3,4]

ABSTRACT: New data on two Atlantic Forest endemic and endangered species of *Stigmaphyllon* (Malpighiaceae) are provided. We present an amended description of *Stigmaphyllon crenatum*, including leaf morphology variation, and new details of floral and fruit morphology, the latter described for the first time. We extend the distribution range of *Stigmaphyllon vitifolium* into Espírito Santo State.

Keywords: Atlantic Forest, Espírito Santo State, Malpighiales, *Ryssopterys*, *Stigmaphyllon,* Taxonomy.

RESUMO: **(Notas sobre *Stigmaphyllon* (Malpighiaceae) do Sudeste do Brasil**) Novos dados sobre duas espécies de *Stigmaphyllon* (Malpighiaceae) endêmicas e ameaçadas da Floresta Atlântica são apresentados. Incluímos uma redescrição de *Stigmaphyllon crenatum*, abrangendo a variação morfológica de folhas, e novos detalhes sobre a morfologia floral e do fruto, este último descrito aqui pela primeira vez, e ampliamos a distribuição geográfica de *Stigmaphyllon vitifolium* para o estado do Espírito Santo.

Palavras-chave: Espírito Santo, Floresta Atlântica, Malpighiales, *Ryssopterys*, *Stigmaphyllon,* Taxonomia.

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LISTS OF SPECIES

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An illustrated checklist of Malpighiaceae from the Chapada dos Veadeiros region, Goiás, Brazil

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Abstract: An updated checklist of Malpighiaceae from the Chapada dos Veadeiros region, Goiás, Brazil, is presented. We recorded 78 species of this family of plants, which represent a higher diversity than previously reported for the region. About one third of all the Malpighiaceae species recorded for the Cerrado are found within the area, which shows the important role of the Chapada dos Veadeiros region in the conservation of this family in Central Brazil.

Key words: *Banisteriopsis*, *Byrsonima*, Cerrado, Chapada dos Veadeiros National Park, floristic studies, *Heteropterys*, Malpighiales

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INTRODUCTION

Malpighiaceae is one of the most diverse families of tropical and subtropical lianas and shrubs worldwide (Anderson 2004). It is easily recognized by the presence of malpiguiaceous hairs (unicellular hairs that bear a foot and two branches), a pair of oil secreting glands at the base of each sepal (elaiophores), and unguiculate petals with a very conspicuous claw (Anderson 1981). The family comprises approximately 75 genera and 1,300 pantropical species, predominantly distributed within the Neotropics, which holds 90% of this family's diversity (Davis and Anderson 2010; Anderson 2013). In Brazil, Malpighiaceae is represented by 44 genera and approximately 561 species distributed throughout the country. However, the family is especially diverse within the Cerrado region, a hotspot for conservation priorities that possesses 233 species (Mittermeyer et al. 2005; Mamede et al. 2015).

The Cerrado is a tropical savanna that covers approximately 23% of the Brazilian territory and shows different soil types, phytophysiognomies and geological formations (Eiten 1972; IBGE 2012). Although the Cerrado is not an exclusive phytogeographic domain in Brazil, a high rate of endemism is present in the majority of its extent within Brazil (Forzza et al. 2012). Likewise, the Cerrado is regarded as a hotspot for conservation priorities due to its great biological diversity and high number of endemics species, approximately 44% of its species, some of which are endangered (Mittermeyer et al. 2005). One of the most important remnants of the Cerrado vegetation in Brazil is the Chapada dos Veadeiros region, situated next to crop farms in Central Brazil, with most of its diversity confined to the Chapada dos Veadeiros National Park. The area within this federal conservation unit comprises a great number of endemic species (Silva and Bates 2002) and different Cerrado phytophysiognomies such as rocky fields (Campos Rupestres), grasslands and swampy grasslands (Veredas; Munhoz and Felfili 2006; Felfili et al. 2007)

Although the family Malpighiaceae is diverse within the Cerrado vegetation in Brazil (Mamede et al. 2015), few checklists and taxonomic studies focusing on this group are available in the literature. Most of these studies considered the diversity of species that occur along the Espinhaço Mountain Range (Mamede 1987, 1990, 2004; Juncá et al. 2005; Volpi 2006), with the exception of Felfili et al. (2007), who presented a checklist for the Chapada dos Veadeiros region mainly based on herbaria specimens.

The Malpighiaceae is diverse in the Cerrado, and the Chapada dos Veadeiros National Park remains as a major continuous fragment of the Cerrado in Central Brazil. Thus, we present an updated checklist of the Malpighiaceae within the Chapada dos Veadeiros region.

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Stigmaphyllon mikanifolium (Malpighiaceae), a new species from Espírito Santo State, Brazil

Rafael Felipe de Almeida[1] **& André Márcio Amorim**[1,2,3]

Summary. *Stigmaphyllon mikanifolium* is described and illustrated and its distribution, conservation status, and taxonomy are presented. *S. mikanifolium* can be distinguished from *S. auriculatum* and *S. macedoanum* by its leaf laminas with lobate margins, and filiform glands on the apex of each lobule, sessile discoid glands between the lobules, a petiole apex with a pair of cupulate glands, yellow posterior petals with reddish veins, and the styles parallel and straight.

Resumo. *Stigmaphyllon mikanifolium* é descrito e ilustrado, e sua distribuição, status de conservação e taxonomia da espécie são apresentados. *S. mikanif*olium é distinta de *S. auriculatum* e *S. macedoanum* pelas folhas com margens lobuladas e com uma glândula filiforme no ápice de cada lóbulo e glândulas discoides sésseis entre cada lóbulo, ápice do pecíolo com um par de glândulas cupuliformes, pétalas posteriores amarelas com veias avermelhadas e estiletes paralelos e retos.

Key Words. Malpighiales, *Ryssopterys*, semideciduous forest, taxonomy.

Introduction

Stigmaphyllon A. Juss. is one of the largest genera of Malpighiaceae, comprising 112 species that are restricted to the pantropics (Anderson 2011). Most species are woody vines with long-petiolate, elliptical to cordate leaves, with clusters of yellow flowers arranged in a dichasium, and styles with lateral appendages at their apices (foliolate stigmas). The fruit is a schizocarp that splits into three samaroid mericarps having large dorsal wings (Anderson 1997). The genus is divided into two subgenera: subg. *Stigmaphyllon* with 92 species that is restricted to the Neotropics and West Africa; and subg. *Ryssopterys* (A. Juss.) C. E. Anderson which includes 20 species restricted to Southeast Asia and Oceania. The subgenera have been regarded as separate by different authors (Anderson 1997; Niedenzu 1928), but recent phylogenetic studies support their combination (Davis & Anderson 2010). Monographs for both groups were presented by Anderson (1997, 2011).

Stigmaphyllon is represented in Brazil by 47 species (Almeida & Amorim 2014; Mamede *et al.* 2014) that occur mostly along streams in the Amazon and Atlantic forests (Anderson 1997). At least 31 species are distributed within Atlantic Forest, 24 of which are endemic to it (Mamede *et al.* 2014). Fifteen species of *Stigmaphyllon* occur in the Atlantic Forest of Espírito Santo state, most of them in Inselberg vegetation (Almeida & Mamede 2014). In the last two decades four new species of *Stigmaphyllon* have been recorded for Espírito Santo (Anderson 1993, 1997, 2009), suggesting that the region is more diverse with respect to this genus. Additional fieldwork and the analysis of herbarium collections from Brazil have revealed a new species, described here.

Materials and Methods

Field and herbarium collections from the most representative herbaria in Brazil (ALCB, BHCB, CESJ, CEPEC, CVRD, ESA, GUA, HB, HRB, HUEFS, IAC, MBM, MBML, PAMG, PMSP, R, RB, SP, SPF, SPSF, UEC, UPCB, US and VIES) were reviewed (acronyms according to Thiers 2014). All collections and type specimens were examined using a stereomicroscope, and, when available, images of types were also examined; specialised literature on the family was consulted. Maps were elaborated using Arcgis software (ESRI 2010) and geographical coordinates of *Stigmaphyllon auriculatum* (Cav.) A. Juss. were obtained

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Synopsis of *Bunchosia* Kunth (Malpighiaceae) from the Atlantic Forest

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Abstract

As part of the ongoing revision of Malpighiaceae from the Atlantic Forest, an extensive review of Vellozo's *Flora fluminensis* and the names associated to the *Bunchosia maritima* complex was carried out. We conclude that seven species should be recognized, with four of them related to the morphological complex. Each of the seven species can be distinguished by the number of glands on the abaxial side of the leaf blade, venation pattern, inflorescence, androecium and drupe morphology, and number of carpels. Thus, we redefine *B. maritima* to a much narrower sense. In order to determine proper nomenclature for the recognized species, the typification of all names was investigated. We designate a lectotype and an epitype for *B. maritima*, a lectotype for *B. apiculata* and a neotype for *B. fluminensis*. Furthermore, we present an identification key for the *Bunchosia* species from the Atlantic Forest domain.

Key Words: *Flora fluminensis*, Malpighiales, Neotropical flora, Species complex, Taxonomy

Introduction

The name *Bunchosia maritima* (Vellozo 1829: 194) Macbride (1950: 860) [= *B. fluminensis* (Grisebach 1839: 48) Griseb. (in Martius 1858: 31)] is the earliest name applied to seven species of *Bunchosia* occurring in the Atlantic Forest domain. Even though six species have been segregated from *B. maritima s.l.* throughout the years, just four of them belong to this morphological complex. *Bunchosia maritima* was first described in *Malpighia* by Vellozo (1829) in *Flora fluminensis* and later transferred to *Bunchosia* Kunth (1822: 153) by Macbride (1950). *Flora fluminensis* was the first work to include descriptions and illustrations of 1,640 plants from the Atlantic Forest domain. It was completed by Vellozo in 1790, with one volume of descriptions and 11 volumes of plates, which were only partially published in 1825, and distributed in 1829 (Borgmeier 1961, Carauta 1973, Cervi & Rodrigues 2010). The printing of the plates was completed in 1827, but the distribution of the volumes did not occur until 1831 (Carauta 1973). A complete version of the text was only issued in 1881 (Borgmeier 1961, Lima 1995). Nevertheless, two centuries later, some names of Malpighiaceae described by Vellozo still have not been properly reviewed. This is due to the historical difficulty associated with accessing physical copies of this publication, its complicated publishing history, and the overall dismissal of Vellozo's work as non-scientific by European naturalists (Borgmeier 1961, Carauta 1969, 1973, Valle 1985).

Although some researchers assume that Vellozo did not make vouchers of the plants he described, he did build a herbarium. In fact, Vellozo's original specimens were sent to the Museu Real de Lisboa between 1797 and 1798 (Bocage 1862, Borgmeier 1937). These specimens were lost during the Napoleonic Wars, and were taken from Lisbon to Paris by the Saint-Hilaire brothers and disappeared, probably being relabeled by the duo. Thus, it is believed that several new species described by them were actually based on Vellozo's specimens, iconographs and text (Borgmeier 1937). Despite repeated attempts by botanists over many years to locate Vellozo's collection, no original material has ever been found in Portugal or in Paris (e.g., Lima 1995, Pastore 2013). Due to the lack of plant specimens, the iconographies have frequently been used by botanists for the purpose of reviewing the taxa described by Vellozo (Carauta 1969, Mello Filho 1975, Lima 1995, Cervi & Rodrigues 2010, Buzatto *et al.* 2013, Pastore 2013, Pellegrini *et al.* 2015, Pellegrini 2015). Nevertheless, it is not uncommon that the iconographies of different groups do not illustrate

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A generic synopsis of Malpighiaceae in the Atlantic Forest

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Malpighiaceae is one of the major families of tropical and subtropical lianas, easily recognized in the field due to its remarkable flower conservatism. The family has been the subject of different phylogenetic studies over the past fifteen years, which have demonstrated the paraphyly of its subfamilies, most of its tribes, and some of its largest genera. Some of the most drastic changes have occurred in *Mascagnia* and *Tetrapterys*, where ten genera were segregated (eight of them new) making it difficult for general botanists to reassign many commonly known species. As a first attempt to clarify most of the recent generic changes within the family, we present a taxonomic synopsis of Malpighiaceae from the Atlantic Forest in Brazil and Argentina, including an illustrated key, morphological generic descriptions, an updated checklist of species for each genera, and figures of all genera found in this biome.

Malpighiaceae is one of the most diverse families of tropical and subtropical lianas and shrubs worldwide (Anderson W. R. 2004, Davis and Anderson 2010). It is easily recognized by the presence of malpighiaceous hairs (unicellular hairs bearing a stalk and two branches), a pair of oil-secreting glands at the base of each sepal (elaiophores), and conspicuous, unguiculate petals (Anderson 1981). The family is pantropical and comprises about 77 genera and 1300 species that are predominantly (85%) distributed within the neotropics (Davis and Anderson 2010).

The remarkable flower conservatism in neotropical lineages of Malpighiaceae makes family identification easy in the field (Anderson W. R. 1990). On the other hand, for English speaking botanists, genera and species identification is quite challenging since the classic taxonomic studies were published in Latin and German (Jussieu 1843, Grisebach 1858, Niedenzu 1928). In addition, the family has been the subject of different phylogenetic studies over the past fifteen years (Cameron et al. 2001, Davis et al. 2001, Davis and Anderson 2010), which have demonstrated the paraphyly of its subfamilies, most of its tribes, and some of its largest genera, such as *Banisteriopsis*, *Heteropterys*, *Mascagnia*, *Stigmaphyllon* and *Tetrapterys* (Cameron et al. 2001, Davis et al. 2001, Davis and Anderson 2010). Some of the most drastic taxonomic changes have occurred in *Mascagnia* and *Tetrapterys*, where ten genera have been segregated (eight of them new) making it difficult for general botanists to reassign many commonly known species (Anderson W. R. 2006, Anderson and Davis 2007).

As a first attempt to clarify most of the recent generic changes within the family, we present a taxonomic synopsis of Malpighiaceae from the Atlantic Forest, including an illustrated key, morphological generic descriptions, an updated checklist of species for each genus, and figures of all genera found in this biome.

Material and methods

Study area

The Atlantic Forest is mainly distributed on the eastern edge of the Brazilian shield (Fig. 1), an area with complex topography over short geographical distances shaped by tectonic activity during the Tertiary and by sea level changes during the Quaternary (Martins and Coutinho 1981, Suguio et al. 2005). This domain encompasses part of Argentina and fifteen Brazilian states, such as Alagoas, Bahia, Ceará, Espírito Santo, Goiás, Minas Gerais, Paraíba, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina, São Paulo and Sergipe (IBGE 2014). It is characterized by strong seasonality, sharp environmental gradients (stemming from the topography), and orographic-driven rainfall, as a result of easterly winds from the tropical Atlantic Ocean (IBGE 2014). Due to these complex factors, the Atlantic Forest constitutes a diverse landscape that includes open, mixed, and closed evergreen, semi-deciduous and deciduous forests (IBGE 2014).

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Taxonomic Revision of *Coleostachys* (Malpighiaceae)

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Abstract

Coleostachys is a monospecific genus of Neotropical Malpighiaceae, known in the literature from only two collections. After a thorough analysis of Brazilian and International herbaria, we present a taxonomic revision of *Coleostachys*. This work includes a complete morphological description of the genus and its single species, *C. genipifolia*, along with line drawings and photograph plates, a distribution map, and comments on taxonomy, ecology and conservation of this obscure Amazonian genus.

Keywords: Amazon Rainforest, Byrsonimoids, Malpighiales, Neotropical flora, Taxonomy

Introduction

Coleostachys Jussieu (1840: 329) is a monospecific genus of Neotropical Malpighiaceae, known in the literature from just two collections in lowland forests of Brazil and French Guiana (Jussieu 1840, Niedenzu 1928, BFG 2015). It can be easily recognized by its spicate inflorescences, with white showy flowers and poricidal anthers, the latter a unique feature in Neotropical Malpighiaceae (Niedenzu 1928).

The genus was first described by Jussieu (1840), comprising a single species, *C. genipifolia* Jussieu (1840: 329), endemic to lowland forests of French Guiana. Eight years later, Bentham published two new names in the genus for two species from the mountains of British Guiana, *C. hypoleuca* Bentham (1848: 125) and *C. vestita* Bentham (1848: 124). Right after Bentham's publication, Grisebach (1849) combined *C. hypoleuca* in a newly monospecific genus, *Blepharandra* Grisebach (1849: 7), in order to accommodate this species. Grisebach (1849) published *Blepharandra* based on its flowers arranged in thyrsi, and bearing rimose anthers, differing from *Coleostachys* which flowers are arranged in spikes and bearing poricidal anthers. Later, Jacks (1895) combined *C. vestita* in *Diacidia* Grisebach (1858: 119), based on its anthers with apex biaristate.

The most recent taxonomic treatment for *Coleostachys* is that by Niedenzu (1928), which includes an incomplete morphological description based on the study of only two collections (*Ducke 228*, and *Martin s.n.*). Here, we revise *Coleostachys*, including a complete morphological description of the genus and its single species, *C. genipifolia*, along with line drawings and photograph plates, a distribution map, and comments on taxonomy, ecology and conservation of this obscure Amazonian genus.

Material and Methods

Morphological descriptions and phenology of the studied species were based on herbaria vouchers from BHCB, F, IAN, INPA, K, MFS, MG, MICH, NY, P, R, RB, and US. Herbaria acronyms according to Thiers (2016). The indumenta terminology follows Anderson (1981), structure shapes follows Radford *et al*. (1974), the inflorescence terminology and morphology follows Weberling (1965, 1989), and fruit terminology follows Spjut (1994) and Anderson (1981). The conservation status was proposed following the recommendations of IUCN Red List Categories and Criteria, Version

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Taxonomic revision of Neotropical *Murdannia* Royle (Commelinaceae)

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Abstract

This study provides a taxonomic revision for the Neotropical species of the genus *Murdannia*. Six species are recognized as native, including a new species and a new combination, while two Asian species are recognized as invasive. We present an identification key, a table summarizing the morphologic differences among the species, a new synonym, six lectotypifications, a distribution map, and descriptions, comments and photographic plates for each species. We also provide comments on the morphology of the Neotropical species of *Murdannia*, comparing them with the Paleotropical species, and a discussion of inflorescence architecture in the genus as a whole.

Keywords

Aquatic plants, Brazil, Commelinales, Commelineae, dewflower, Neotropical flora, spiderwort

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Rediscovery, identity and typification of *Dichorisandra picta* (Commelinaceae) and comments on the short-stemmed *Dichorisandra* species

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Abstract

Dichorisandra picta has been considered a name of dubious application due to the lack of known herbarium specimens, and consequently lack of a type specimen, and information regarding its natural distribution. Recent field, herbaria and literature studies, focusing on the species of Commelinaceae from Rio de Janeiro state, clarified the identity and application of this enigmatic name. As a result, the typification of the names related to *D. picta* is presented, along with the first complete description for this species, field photographs and a distribution map. *Dichorisandra picta* is also compared with the remaining species of the *D. acaulis* morphological group.

Key words: Atlantic Forest, Dichorisandrinae, endemism, IUNC Red List, Neotropical flora, Rio de Janeiro

Introduction

Dichorisandra Mikan (1820: 7) is one of the largest genera in Commelinaceae, comprising ca. 60 species mostly distributed throughout rainforests in the Neotropics and greatly diverse in the Atlantic Forest (Faden & Hunt 1991; Aona 2008). It can be characterized by truly poricidal to functionally poricidal anthers (i.e. introrsely rimose), anthers 3 to 4 times longer than the filaments, fruits with thickened walls, and arillate seeds (Faden 1998; Hardy & Faden 2004; Aona 2008). According to Faden (1995), the diversity of habits found in the species of *Dichorisandra* might only be compared to its Paleotropical counterpart, the much smaller and distantly related genus *Palisota* Rchb. ex Endlicher (1836: 125). *Dichorisandra* has been recovered as monophyletic by different morphological and phylogenetic studies. It is closely related to *Siderasis* Rafinesque (1837: 67), a monospecific genus in the Brazilian Atlantic Forest (Evans *et al.* 2000; Hardy 2001; Evans *et al.* 2003; Wade *et al.* 2006; Burns *et al.* 2011; Hertweck & Pires 2014).

Commelinaceae is economically important due to the ornamental value of many genera, with its species being cultivated since early days due to their beautiful foliage and flowers (Hunt 2001). *Dichorisandra* is especially appealing because of its non-deliquescent and showy flowers, large leaves and for being easy to cultivate. For these reasons, during the 19th century, many specimens of *Dichorisandra* were introduced in greenhouses and Botanical Gardens throughout Europe. Several new species were described, often solely based on sterile specimens, and sometimes without preparing herbarium specimens (e.g. Loddiges 1826, 1828, 1830; Hooker 1854; Koch 1866; Moore 1957). This situation is pointed as the probable origin of the misapplication of several names and the consequent exclusion of many of them (e.g. Aona 2008; Aona-Pinheiro *et al.* 2014).

Dichorisandra picta was described by Loddiges (1830: t. 1667) based on a cultivated specimen from Leiden Botanical Garden. The species was characterized by the brown macules in the young leaves, and said to be native from South America. Due to its obvious ornamental value, the species was distributed and commercialized throughout Europe. A specimen was eventually acquired by the Royal Botanical Gardens, Kew, and described by Hooker (1854). Unaware that the species had already been previously published, Hooker adopted the name used by the grower (Mr. Low, of Clapton Nursery) and published the homonym *D. picta* Hooker (1854: t. 4760), saying the species was native to Brazil. After the description of both names, little attention was ever given to this enigmatic species, with the single

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Stigmaphyllon occidentale (Malpighiaceae), a new endemic species from Central Brazil

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Abstract

Stigmaphyllon occidentale is described and illustrated. This species belongs to the *S. paralias* complex and can be differentiated by indumentum, leaf, floral and fruit morphology. This work includes a full morphological description for the new species, along with illustrations, a distribution map, comments on conservation assessment, ecology and taxonomy, and a table distinguishing *S. occidentale* from *S. bannisterioides*, *S. harleyi* and *S. paralias*.

Keywords: Cerrado, Jalapão region, Malpighiales, Stigmaphylloid, *Stigmaphyllon paralias* complex, Taxonomy

Introduction

Stigmaphyllon Jussieu (1833: 37) is one of the largest genera of vining lianescent Malpighiaceae, comprising ca. 120 pantropical species (Anderson 2011). The genus is currently divided into two subgenera: *S.* subg. *Stigmaphyllon* with ca. 92 species restricted to the Neotropics, except for *S. bannisterioides* (Linnaeus 1775: 9) Anderson (1992: 328) which reaches West Africa; and *S.* subg. *Ryssopterys* (Jussieu in De Lessert 1838: 21) Anderson (2011: 76) with 20 species restricted to Southeast Asia and Oceania. Monographs for both subgenera were presented by Anderson (1997, 2011).

Most Neotropical species of *Stigmaphyllon* are woody vines to shrubs with long-petiole (rarely short), elliptical to cordate leaves, clusters of yellow flowers commonly arranged in dichasially branched inflorescences, styles with leaf-like apical appendages (foliole), and schizocarpic fruits splitting into three mericarps, each bearing a large dorsal wing (sometimes very reduced) (Anderson 1997). One of the more widespread species of *Stigmaphyllon* in the Neotropics is *S. paralias* Jussieu (1833: 59), commonly found in the Atlantic Forest, Caatinga (Seasonally Dry Tropical Forests) and Cerrado (Neotropical Savannas) domains, throughout Northeastern Brazil (BFG 2015). At the time that the last revisionary study for Neotropical *Stigmaphyllon* was published, a single collection (*G. Hatschbach 39058*) of *S. paralias* growing in sandy soils from Central Brazil's Cerrado was recorded (Anderson 1997). This specimen showed deeply cordate leaves and eglandular posterior petals, but was retained as part of *S. paralias*, probably due to the lack of enough material.

After a careful analysis of specimens from Brazilian herbaria, I found additional specimens from the states of Bahia, Goiás, Piauí and Tocantins matching this peculiar morphotype, which I describe here as a new species endemic to Central Brazil.

Material and Methods

Morphological and phenological data were based on herbaria samples (CEN, CEPEC, HUEFS, IBGE, MBM, MICH, RB, SP, SPF, TEPB, and UB; herbaria acronyms according to Thiers, continuously updated). The indumentum terminology follows Anderson (1981), structure shapes follows Radford *et al.* (1974), the inflorescence terminology and morphology follows Weberling (1965, 1989), and fruit terminology follows Spjut (1994) and Anderson (1981). Measurements from herbarium images (MICH) were taken using tpsdig2 software (Rohlf 2016). The conservation

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Sinopse de Malpighiaceae no Estado do Espírito Santo, Brasil: *Stigmaphyllon* A. Juss.

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ABSTRACT - (Synopsis of Malpighiaceae in the State of Espírito Santo, Brazil: *Stigmaphyllon* A. Juss.). Fieldwork and the analysis of herbarium collections resulted in the recognition of 19 *Stigmaphyllon* species in the State of Espírito Santo. This study presents an identification key to species, brief diagnoses, lists of examined specimens, taxonomic notes, distribution maps, and illustrations of the studied species.

Keywords: Atlantic Forest, Malpighiales, *Stigmaphyloids*, taxonomy

RESUMO - (Sinopse de Malpighiaceae no Estado do Espírito Santo, Brasil: *Stigmaphyllon* A. Juss.). Estudos de campo e análise de coleções de herbários permitiram a identificação de 19 espécies de *Stigmaphyllon* (Malpighiaceae) no Estado do Espírito Santo. Este trabalho contém uma chave de identificação para espécies, uma breve diagnose, materiais selecionados, listas de materiais examinados, notas taxonômicas, além de mapas de distribuição geográfica e ilustrações das espécies estudadas.

Palavras-chave: Floresta Atlântica, Malpighiales, *Stigmaphyloides*, taxonomia

Introdução

Stigmaphyllon A. Juss. é um dos maiores gêneros de Malpighiaceae compreendendo ca. 120 espécies pantropicais (Anderson 2011). Grande parte de suas espécies são trepadeiras lenhosas com longos pecíolos biglandulosos no ápice, folhas elípticas a cordadas, umbelas de flores amarelas dispostas em dicásios, estiletes com apêndices laterais no ápice (estigma foliáceo), e frutos esquizocárpicos separando-se em três mericarpos alados com uma ala dorsal desenvolvida (Anderson 1997). O gênero é dividido em dois subgêneros (subg. *Ryssopterys* C.E.Anderson e *Stigmaphyllon*) tradicionalmente tratados como gêneros distintos (Anderson 1997, Niedenzu 1928), cuja combinação foi somente corroborada por estudos filogenéticos recentes (Davis & Anderson 2010).

No Brasil é representado somente pelo subg. *Stigmaphyllon*, com 48 espécies (Almeida & Amorim 2014 e 2015, BFG 2015) ocorrendo principalmente ao longo de corpos d'água nas florestas Amazônica e Atlântica (Almeida *et al*. 2016, Anderson 1997, BFG 2015). Deste total, 31 espécies são registradas para a Floresta Atlântica, das quais 24 são endêmicas a este domínio (Almeida & Amorim 2015, Almeida *et al*. 2016, BFG 2015). Uma descrição para Malpighiaceae e chave de identificação para gêneros ocorrendo na Floresta Atlântica é apresentada por Almeida *et al*. (2016).

Apresentamos a sinopse taxonômica de *Stigmaphyllon* A. Juss. para o Espírito Santo, a primeira de uma série de estudos focados na taxonomia de Malpighiaceae neste Estado. Este estudo contém uma chave de identificação, uma breve diagnose, listas de materiais examinados, comentários sobre distribuição e taxonomia, mapas de distribuição geográfica, pranchas de fotos e ilustrações para as espécies estudadas.

Material e métodos

Foram analisadas as coleções dos herbários ALCB, BHCB, CEPEC, CESJ, CRVD, ESA, FLOR, GUA, IAC, HB, HUEFS, MBM, MBML, MO, R, RB, RBR,

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Taxonomic novelties in *Byrsonima* (Malpighiaceae) from the state of Minas Gerais, Brazil

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Abstract

A new species of *Byrsonima* (Malpighiaceae), and a replacement name, along with a status change are proposed. These taxonomic novelties are endemic to rocky fields in the southwest of Minas Gerais state, Brazil. We present full morphological descriptions, illustrations, distribution maps and comments on conservation, distribution, and taxonomic affinities of both species.

Key words: Byrsonimoids, Cerrado, Malpighiales, Plant taxonomy, Rocky Fields

Resumo

Uma nova espécie de *Byrsonima* (Malpighiaceae), e um novo nome com mudança de status são propostos. Estas novidades taxonômicas são endêmicas dos campos rupestres do sudoeste do estado de Minas Gerais, Brasil. São apresentadas descrições morfológicas completas, ilustrações, mapas de distribuição e comentários sobre conservação, distribuição e afinidades taxonômicas de ambas as espécies.

Palavras-chave: Byrsonimoides, Campo Rupestre, Cerrado, Malpighiales, Taxonomia Vegetal

Introduction

Byrsonima Rich. ex Kunth (1822: 147) is easily recognized by its shrub or tree habit, intrapetiolar stipules, leaves, bracts and bracteoles eglandular, elongated thyrsi of usually 1-flowered cincinni, slender styles subulate at apex, minute stigmas, and drupes bearing 3-locular pyrenes (Anderson 1981, Mamede 1987). It is the second largest genus in Malpighiaceae, comprising ca. 140 species endemic to the Neotropical region (Anderson 1981, Anderson *et al.* 2006). Brazil has the largest number of species of this genus, with about 97 species found across its phytogeographical domains, but it is especially diverse in the Cerrado (Neotropical savannas) (BFG 2015).

Espinhaço Range is the most important mountain chain within the Cerrado from Eastern Brazil (Giulietti *et al.* 1987, Harley 1995, Rapini *et al.* 2008). This region has a high rate of plant endemism, especially above 800 m where rocky fields are the predominant feature in the landscape (Giulietti *et al.* 1987, Harley 1995, Rapini *et al.* 2008).

During the taxonomic revision of *Byrsonima* sect. *Eriolepis* Niedenzu (1897: 206), we visited several Brazilian herbaria and came across a new species of *Byrsonima*. Also, the need of a replacement name with status change for another species of *Byrsonima* became evident. Both taxonomic novelties are endemic to rocky fields from Southwestern Espinhaço Range, in state of Minas Gerais, Brazil.

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Conclusões Gerais

CONCLUSÕES GERAIS

Ao longo dos quatro anos de execução deste trabalho enfrentamos diferentes adversidades de ordem financeira, interpessoal e pessoal. Muitas mudanças e adaptações foram contempladas para que nossos resultados pudessem ser apresentados no formato de seis capítulos. A sistemática e história biogeográfica de *Amorimia* eram ainda obscuras, principalmente devido à ser um gênero proposto somente há dez anos atrás. Nas mais de 50 coleções de herbários visitadas ao longo destes quatro anos pudemos notar que grande parte da comunidade científica ainda não aplica corretamente a nova classificação para os gêneros segregados de *Mascagnia*, incluindo *Amorimia*. Em consequência disto, nenhum dos nomes validamente publicados no gênero até então eram aplicados corretamente em grande parte das coleções brasileiras.

O primeiro passo para elucidar a sistemática do gênero foi a publicação de uma proposta de resolução do complexo *Amorimia rigida*, incluindo uma nova combinação, três novas espécies e a redescrição de *A. rigida* e *A. velutina*. Estes táxons novos ou reestabelecidos são endêmicos do escudo brasileiro, podendo ser diferenciados de *A. rigida s.s.* por detalhes da morfologia de folhas, indumento, flores e frutos. Este estudo contemplou descrições morfológicas para todos os táxons amostrados, além de uma chave de identificação, tabela de comparação, mapa de distribuição, status de conservação e comentários sobre ecologia, nomenclatura e taxonomia destas espécies.

Quando pensávamos que o complexo *Amorimia rigida* estava resolvido, uma possível nova espécie pertencente a este complexo surgiu nos últimos meses de desenvolvimento desta tese. Este material apresentava somente três duplicatas com folhas e frutos e tivemos nos obrigando a adotarmos métodos adicionais àquele da taxonomia alfa para resolução deste enigma. Assim, apresentamos a descrição de uma espécie nova de *Amorimia* baseado em anatomia foliar e taxonomia alfa. Esta nova espécie é endêmica no norte do estado do Rio de Janeiro, podendo ser diferenciada das demais espécies do complexo *A. rigida* pela ausência de glândulas na lâmina foliar, pelo formato das lâminas foliares, ângulo de divergência das nervuras secundárias, número de flores, espessura do pedicelo nos frutos e pelo indumento dos filetes, estiletes e frutos. Este estudo incluiu descrições micro e macro morfológicas, além de uma chave de identificação atualizada para as espécies deste complexo, ilustrações, mapa de distribuição, status de conservação e comentários sobre ecologia e taxonomia.

Após a publicação de todas as novidades taxonômicas em *Amorimia* pudemos dar continuidade na elaboração de uma matriz morfológica com mais de cem caracteres binários ou multiestados codificados. Esta matriz serviu de base para a elaboração da revisão taxonômica e aliada a uma nova filogenia molecular para *Amorimia* permitiu a proposição de uma nova classificação infragenérica para o mesmo. Relações filogenéticas para 14/15 espécies de *Amorimia* foram inferidas baseadas na região *ndhF* do DNA plastidial e na região ETS do DNA ribossomal utilizando o critério bayesiano e da parcimônia. Nossos resultados corroboraram o monofiletismo de *Amorimia* com a nova circunscrição do complexo *A. rigida*, identificaram vários caracteres macro, micro morfológicos e fitoquímicos que suportam *Amorimia* e suas duas principais linhagens. Ainda, estas duas linhagens foram propostas como novos subgêneros em *Amorimia*.

Em seguida, pudemos concluir a revisão taxonômica de *Amorimia*, incluindo tipificações e redescrições de *A. amazonica*, *A. camporum*, *A. concinna*, *A. exotropica*, *A. kariniana*, *A. maritima*, *A. pubiflora* e *A. septentrionalis*. O gênero é endêmico de Florestas Sazonalmente Secas e Ombrófilas da América do Sul, com suas espécies sendo distintas por detalhes na morfologia foliar, indumento, flores e frutos. Este estudo incluiu descrições morfológicas completas para todas as 15 espécies de *Amorimia*, além de uma chave de identificação para seus subgêneros e espécies, ilustrações, mapas de distribuição, status de conservação e comentários sobre ecologia, nomenclatura e taxonomia. Adicionalmente, apresentamos uma chave de identificação para diferenciar *Amorimia* dos demais gêneros do clado Malpighioide.

Com a revisão taxonômica completa, pudemos prosseguir com o estudo biogeográfico de *Amorimia*. Este gênero lianescente de Malpighiaceae é praticamente restrito à Florestas Sazonalmente Secas na América do Sul, se mostrando um ótimo modelo para reconstrução da história biogeográfica de lianas em Florestas Secas Neotropicais. Relações filogenéticas foram estimadas para todas as espécies de *Amorimia* com base em três regiões do DNA plastidial (*ndhF*, *rpl16* e *trnQ-rps16*) e duas regiões do DNA ribossomal (ETS e ITS) usando inferência Bayesiana e parcimônia. Nós datamos e calibramos esta filogenia molecular como base para as reconstruções de áreas ancestrais usando S-Diva e DEC. Nossos sugerem que o ancestral comum mais recente do gênero teria surgido em Florestas Sazonalmente Secas do Atlântico por volta de 22 Ma. Os ancestrais comuns mais recentes dos subgêneros de *Amorimia* teriam surgido em Florestas Secas no Sul do Brasil por volta de 18 a 14 Ma e as demais linhagens no gênero teria se diversificado a partir do Mioceno médio ao Plioceno tardio. Ainda, recuperamos uma história complexa para *Amorimia* em Florestas Secas, incluindo dois eventos de expansão e colonização de diferentes núcleos de Florestas Secas na América do Sul.

Por fim, elaboramos um Guia Rápido de Campo à Cores do Field Museum (EUA) incluindo todas as espécies de *Amorimia* do Brasil, visando o auxílio na correta identificação em campo destas espécies.