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FLORA DE PERNAMBUCO (BRASIL): LYTHRACEAE J. ST.-HIL.

RECIFE, PE

2020

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À natureza, dedico.

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RESUMO

Lythraceae está compreendida em Myrtales como grupo irmão de Onagraceae. Lythraceae apresenta cerca de 30 gêneros e 600 espécies sendo amplamente distribuída nas regiões tropicais e subtropicais. No Brasil, são reconhecidos 11 gêneros e 216 espécies, com 160 endêmicas. A região Nordeste é a terceira com maior riqueza registrada (57 spp. em 7 gêneros). Em Pernambuco são encontrados quatro gêneros e 16 espécies, representando o segundo estado mais rico da região. Apesar da representatividade da família para a região, há uma escassez de estudos sobre a família, comprometendo o conhecimento relativo à riqueza taxonômica e distribuição geográfica de suas espécies. Este trabalho teve como objetivo realizar o estudo taxonômico das espécies de Lythraceae ocorrentes em Pernambuco (Brasil). Para isso, foram realizadas expedições de campo e análises dos materiais dos herbários CEN, HESBRA, HST, HTSA, HUEFS, HVASF, IPA, JPB, PEUFR e UFP entre 2018 e 2020. Foram reconhecidas 12 espécies e cinco gêneros (*Ammannia* L., *Cuphea* P. Br., *Lafoensia* Vand., *Pleurophora* D. Don. e *Rotala* L.). As espécies encontradas predominam em ambientes de Caatinga no estado. Descrições morfológicas completas, uma chave de identificação, informações de estado fenológico, distribuição geográfica, notas taxonômicas, pranchas de fotografias e ilustrações dos caracteres diagnósticos são apresentados. Os caracteres morfológicos relevantes para a identificação das espécies são: indumento do ramo; inserção e filotaxia da folha, forma, base e ápice da lâmina, tipo de indumento e venação; tipo e posição da inflorescência, presença ou ausência de bractéolas; ausência ou presença do cálcio, bem como a forma dessa estrutura; ausência ou presença de pétalas, assim como cor e tamanho das mesmas. Também é apresentado o artigo intitulado “Flora of Usina São José, Igarassu, Pernambuco (Brazil): Lythraceae J. St.-Hil. and Onagraceae Juss.”, o qual aborda as famílias nos fragmentos de Mata Atlântica da Usina São José, Pernambuco, que sofrem ações antrópicas, resultando em implicações para conservação. O tratamento taxonômico identificou seis espécies e três gêneros, *Cuphea*, *Rotala* (Lythraceae) and *Ludwigia* L. (Onagraceae). *Rotala ramosior* (L.) Koehne é um novo registro para o Brasil. Os caracteres considerados para a delimitação das espécies foram: filotaxia, indumento do ramo, forma e indumento da folha, cor e ápice da pétala, forma da cápsula, arranjo das sementes e tamanho da rafe. Resultados dessas pesquisas fornecem subsídios para a compreensão da importância ecológica

dessas espécies, além de contribuir para diminuir o impedimento taxonômico e servir como base para estudos futuros de evolução, ecologia e conservação da flora brasileira.

Palavras-chave: *Cuphea*; Flora do Brasil; *Ludwigia*; Myrtales; Taxonomia.

ABSTRACT

Lythraceae is comprised in Myrtales as sister group of Onagraceae. Lythraceae comprises about 30 genera and 600 species being widely distributed in tropical and subtropical regions. In Brazil, 11 genera and 216 species are recognized, with 160 endemic. The Northeast region is the third with the highest recorded richness (57 spp. in 7 genera). In Pernambuco four genera and 16 species are found, representing the second richest state of the region. Despite the family's representativeness for the region, there is a lack of studies about the family, compromising the knowledge related to the taxonomic richness and geographical distribution of its species. This work aimed to perform the taxonomic study of Lythraceae species occurring in Pernambuco (Brazil). For this, field expeditions and analysis of the materials from CEN, HESBRA, HST, HTSA, HUEFS, HVASF, IPA, JPB, PEUFR and UFP herbaria between 2018 and 2020 were conducted. Were recognized 12 species and five genera (*Ammannia* L., *Cuphea* P. Br., *Lafoensia* Vand., *Pleurophora* D. Don. and *Rotala* L.). The species found predominate in Caatinga environments in the state. Complete morphological descriptions, an identification key, phenological period information, geographical distribution, taxonomic notes, photographs and illustrations of the diagnostic characters are presented. The morphological characters relevant to the identification of the species are: branch indumentum; leaf insertion and phyllotaxy, blade, base and apex shapes, indumentum type and venation; inflorescence type and position, presence or absence of bracteoles; presence or absence of spur, as well as the shape of this structure; presence or absence of petals, as well as their color and size. Also presented is the article entitled “Flora of Usina São José, Igarassu, Pernambuco (Brazil): Lythraceae J. St.-Hil. and Onagraceae Juss.”, which is about the families in the Atlantic Forest fragments of Usina São José, Pernambuco, which undergo anthropic actions, resulting in implications for conservation. The taxonomic treatment identified six species and three genera, *Cuphea*, *Rotala* (Lythraceae) and *Ludwigia* L. (Onagraceae). *Rotala ramosior* (L.) Koehne is a new record for Brazil. The characters considered for the delimitation of the species were: phyllotaxy, branch indumentum, leaf shape and indumentum, petal color and apex, capsule shape, seed arrangement and raphe size. Results of these works provide

subsidies for understanding the ecological importance of these species, in addition to helping to reduce the taxonomic impediment and serve as a basis for future studies of evolution, ecology and conservation of Brazilian flora.

Key words: *Cuphea*; Flora do Brasil; *Ludwigia*; Myrtales; Taxonomy.

INTRODUÇÃO GERAL

A pesquisa realizada e apresentada nessa dissertação foi motivada pela ausência de trabalhos taxonômicos sobre as espécies de Lythraceae em Pernambuco, apesar do número registrado de representantes da família no estado e da expressividade nas coleções dos herbários da região Nordeste. Uma consequência dessa condição é encontrada nos próprios herbários, visto que muitos materiais estão identificados incorretamente ou não identificados, além de espécimes não pertencentes ao grupo que estão incluídos no material. Dessa forma, o conhecimento sobre as espécies de Lythraceae que realmente ocorrem em Pernambuco e onde são encontradas encontra-se prejudicado.

Este trabalho teve como objetivo realizar o estudo taxonômico das espécies de Lythraceae ocorrentes em Pernambuco (Brasil). Para isso, foram analisados espécimes coletados em 11 expedições de campo, além de cerca de 700 materiais dos herbários CEN, HESBRA, HST, HTSA, HUEFS, HVASF, IPA, JPB, PEUFR e UFP entre 2018 e 2020. As espécies foram identificadas através da consulta de imagens das coleções *typus* e protólogos de cada espécie.

A dissertação compreende o capítulo intitulado “Flora of Pernambuco (Brazil): Lythraceae J. St.-Hil.”, a ser submetido ao periódico *Rodriguésia*. Nesse estudo é apresentado o tratamento taxonômico de Lythraceae de Pernambuco, com descrições morfológicas completas, chave de identificação, informação do período fenológico, distribuição geográfica, notas taxonômicas, fotografias e ilustrações de caracteres diagnósticos.

Além disso, como material suplementar, o artigo intitulado “Flora of Usina São José, Igarassu, Pernambuco (Brazil): Lythraceae J. St.-Hil. and Onagraceae Juss.”, publicado no periódico *Acta Brasiliensis*. Essa pesquisa foi realizada em parceria com a Ms. Amanda Rocha e integrou a série de monografias publicadas sobre as famílias nos fragmentos de Mata Atlântica da Usina São José, que sofrem ações antrópicas, resultando em implicações para conservação.

A partir de estudos taxonômicos também é possível descobrir características morfológicas importantes para a delimitação de espécies, facilitando assim, sua identificação. Resultados desses trabalhos fornecem subsídios para a compreensão da importância ecológica dessas espécies, além de contribuir para o conhecimento da importância econômica, medicinal, e diminuir o impedimento taxonômico, servindo como base para estudos futuros de evolução, ecologia e conservação da flora brasileira.

REVISÃO DE LITERATURA

Lythraceae Jaume Saint-Hilaire

1. Riqueza taxonômica, distribuição geográfica e caracterização morfológica

Lythraceae é amplamente distribuída em regiões tropicais e subtropicais, com poucos registros de espécies herbáceas ocorrendo em regiões temperadas (Cavalcanti, 2007). A família compreende cerca de 30 gêneros e 600 espécies (Graham & Graham, 2014), com quase 70% dos gêneros incluindo uma ou duas espécies (Graham & Graham, 1971). Porém, *Cuphea* P. Br. compreende cerca de 250 espécies, sendo responsável por quase 42% da riqueza da família (Graham, 2017), e *Diplusodon* Pohl, 102 espécies, sendo o segundo mais rico de Lythraceae (Cavalcanti, 2015).

No Brasil, são reconhecidos 11 gêneros e 216 espécies, das quais 160 são endêmicas, distribuídas principalmente em áreas de Cerrado, seguido de Mata Atlântica e Caatinga. As regiões Nordeste e Norte ocupam a terceira posição com maior número de espécies registradas, ambas com 56 spp. em sete gêneros. A lista é liderada pela região Sudeste, com 112 spp. em nove gêneros, seguida da Centro-Oeste, com 103 spp. em nove gêneros.

Em Pernambuco, são encontrados quatro gêneros (*Ammannia* L., *Cuphea* P. Br., *Lafoensia* Vand. e *Pleurophora* D. Don.) e 16 espécies, representando o segundo estado mais rico da região, com uma espécie endêmica do estado, *Pleurophora pulchra* J.C. Siqueira, Cotarelli, J.F.B. Pastore & T.B. Cavalc., e três do Nordeste, *Lafoensia glyptocarpa* Koehne, *C. campestris* Koehne e *C. mimuloides* Cham. & Schltdl.. A Bahia corresponde ao estado mais rico da região, com seis gêneros (*Ammannia*, *Crenea* Aubl., *Cuphea*, *Diplusodon*, *Lafoensia* e *Pleurophora*) e 51 espécies (Flora do Brasil 2020, em construção). Entre as 109 espécies de Lythraceae citadas na Lista Vermelha, cerca de 34% (37 spp.) estão enquadradas em alguma categoria de ameaça (IUCN, 2020).

Os representantes de Lythraceae ocupam diversos habitats, incluindo áreas brejosas, dunas, florestas tropicais úmidas e mais especialmente, cerrados, campos áridos e pedregosos. Podem ser árvores, arbustos, subarbustos, ou, mais raramente, ervas. Caracterizam-se por apresentar folhas simples, comumente oposto-cruzadas, margens inteiras; inflorescências racemosas ou cimeiras; flores bissexuadas, perígina a epígina, diclamídeas, raro monoclamídeas, actinomorfas, raro zigomorfas, tubo floral persistente, pétalas crespas, 4–16, livres; fruto cápsula (Cavalcanti & Graham, 2002).

2. Histórico de classificação taxonômica

Lythraceae foi descrita por Saint-Hilaire (1805) baseando-se em *Lythrum* L. Desde a publicação da família até o século XX, a única classificação completa foi realizada por Koehne em 1903, que a dividiu em duas tribos, *Lythreae* Koehne e *Nesaeae* Koehne, cada uma com duas subtribos (Graham, 2007).

Os gêneros *Sonneratia* L.f., *Duabanga* Buch.-Ham. e *Punica* L., que pertenciam às famílias monogenéricas Sonneratiaceae, Duabangaceae e Punicaceae, respectivamente, foram considerados por Thorne (1976) e Dahlgren & Thorne (1984) como subfamílias de Lythraceae (Graham, 2007). Essa classificação foi corroborada por Johnson & Briggs (1984), confirmando essa circunscrição como um clado dentro de Myrtales (Graham *et al.*, 2005).

A família monogenérica Trapaceae, constituída pelo gênero *Trapa* L., foi incluída em Lythraceae por estudos filogenéticos de sequências múltiplas de genes. Porém, os agrupamentos de Koehne (1903) não foram suportados em estudos moleculares (Graham *et al.*, 2005).

Há evidências que indicam que a linhagem Lythraceae + Onagraceae constitui um dos grandes clados em Myrtales que divergiram de um ancestral combretáceo, considerando que Combretaceae R. Br. é irmã de todas as outras Myrtales (Graham, 2007). Lythraceae está inserida na classificação mais recente em Myrtales e é grupo irmão de Onagraceae Jussieu. A ordem inclui mais sete famílias, Combretaceae R. Brown, Vochysiaceae A. Saint-Hilaire, Myrtaceae Jussieu, Melastomataceae Jussieu, Crypteroniaceae A.-L. de Candolle, Alzateaceae S. Graham e Penaeaceae Guillemain (APG IV, 2016).

3. Potencialidades de Lythraceae

Lythraceae é um importante componente dos ecossistemas no geral, a exemplo de *Lagerstroemia indica* L., conhecida popularmente como extremosa ou flor de São Sebastião, utilizada por abelhas *Apis mellifera* como fonte de néctar e pólen (Almeida *et al.*, 2003). *Punica granatum* L., conhecida popularmente como romã, e espécies de *Cuphea* P. Br. são utilizadas nas indústrias químicas, de cosméticos e alimentícias. As sementes de *Cuphea* contêm altas porcentagens de ácidos graxos, similares em sua composição, ao óleo de coco, sendo fontes de antioxidantes que retardam a degradação das gorduras e dos óleos nos produtos alimentares armazenados, prolongando o período de validade dos produtos (Graham, 1991).

Muitos representantes possuem valor ornamental, como *Lafoensia acuminata* (Ruiz & Pav.) DC. e *Physocalymma scaberrimum* Pohl, amplamente utilizadas no paisagismo de ruas, parques e arboretos. *Cuphea hyssopifolia* Kunth, é usada em jardins e casas por seu pequeno porte, assim como *C. ignea* DC., e por produzir flores durante quase todo ano, enquanto *Lagerstroemia indica* L. e *L. speciosa* (H.B.K.) DC., são árvores com flores abundantes e vistosas nas cores rosa ou branca (Cavalcanti & Graham 2002; Graham 1991). Outras espécies de *Cuphea* têm sua importância concentrada nos óleos produzidos nas sementes, como a híbrida *C. viscosissima* x *C. lanceolata*, matéria-prima de biocombustíveis renováveis, atóxico e biodegradável (Knothe *et al.*, 2009).

Na área medicinal, os extratos de *Cuphea* apresentam propriedades antimicrobianas e anti-inflamatórias (Avancini *et al.*, 2008; Barbosa *et al.*, 2007), que são eficazes, também, na indução de vasodilatação (Krepsky *et al.*, 2012). *Cuphea carthagenensis* (Jacq.) J.F. Macbr., é usada no tratamento e prevenção de doenças cardiovasculares (Schuldt *et al.*, 2000). A espécie arbustiva *Heimia salicifolia* Link possui propriedades anti-inflamatórias devido a seus alcaloides (Graham, 1991).

Para a indústria cosmética, *Lawsonia inermis* L. é fonte da conhecida henna, tinta vermelha utilizada por séculos na África e Ásia para pintar cabelo, pele e roupas, além de ser cultivada na América tropical como um arbusto ou cerca viva pelas suas delicadas flores brancas que exalam aroma doce (Graham, 1991; Cavalcanti & Graham, 2002).

4. Estudos taxonômicos de Lythraceae no Brasil

Os estudos taxonômicos da família no Brasil são mais expressivos nas regiões Centro-Oeste e Sudeste. Destacam-se as floras da Serra do Cipó, Minas Gerais (Cavalcanti, 1990), na qual são registradas 11 espécies de *Cuphea* P. Br., quatro de *Diplusodon* Pohl e duas de *Lafoensia* Vand. e do estado de São Paulo (Cavalcanti & Graham, 2002), com 19 de *Cuphea*, três de *Diplusodon*, uma de *Heimia* Link, duas de *Lafoensia* e duas de *Rotala* L.. Além desses, há o trabalho de revisão com o gênero *Diplusodon* Pohl no Cerrado brasileiro (Cavalcanti, 2007).

Na região Nordeste, o único tratamento taxonômico é o do gênero *Cuphea* para a Chapada Diamantina, Bahia (Brauner, 2017). Ademais, a família é registrada em levantamentos florísticos, como no Parque Estadual das Dunas de Natal, no Rio Grande do Norte (Freire, 1990), com a espécie *C. flava* Spreng.. Na Paraíba, em um inselbergue no agreste do estado (Porto *et al.*, 2008), há uma espécie não identificada de *Cuphea*, na Mata do

Pau-Ferro (Barbosa *et al.* 2004), a espécie *C. campestris* Mart. ex Koehne e no Pico do Jabre (Agra, Barbosa & Stevens, 2004), *Lafoensia glyptocarpa* Koehne.

Na Bahia, na caatinga de Jussiape, Morro do Chapéu e Rio de Contas (Queiroz *et al.* 2005), é registrada uma espécie. No semiárido do estado (França *et al.* 2003), as espécies *Ammannia latifolia* L. e *Pleurophora anomala* Koehne. Nas restingas de São João (Queiroz, 2007), as espécies *C. brachiata* Koehne, *C. flava* e *C. sessilifolia* Mart.. Na caatinga do rio São Francisco (Cavalcanti, 2012), quatro espécies e na Chapada Diamantina cinco espécies (Cavalcanti, 1995).

No estado de Pernambuco, na RPPN de Maracaípe (Almeida Jr. *et al.*, 2009), em Tamandaré (Silva, Zickel & Cestaro, 2008), nas restingas do estado (Zickel *et al.*, 2007), em uma área de restinga em Itamaracá (Almeida Jr., Pimentel & Zickel, 2008) e na restinga da Área de Proteção Ambiental (APA) de Guadalupe (Cantarelli *et al.*, 2012), todos registraram a espécie *Cuphea flava* para a família. No planalto da Borborema (Rodal *et al.*, 2005) e na Reserva Biológica de Serra Negra (Rodal & Nascimento, 2002), *C. racemosa* (L.f.) Spreng. Em Mirandiba (Cavalcanti, 2009), também foi registrada apenas uma espécie. No Parque Ecológico João Vasconcelos-Sobrinho (Rodal & Sales, 2007), as espécies *C. carthagenensis* (Jacq.) J.F. Macbr., *C. punctulata* Koehne e *C. racemosa* (L.f.) Spreng. e na Usina São José (Melo *et al.*, 2012), *C. callophylla* Cham & Schl., *C. campestris*, *C. flava* e *Rotala ramosior* (L.) Koehne.

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CAPÍTULO 1

FLORA OF PERNAMBUCO (BRAZIL): LYTHRACEAE J. ST.-HIL.

TAINÁ LACERDA & MARIA TERESA BURIL

A ser submetido ao periódico *Rodriguésia*

Flora of Pernambuco (Brazil): Lythraceae J. St.-Hil.

Flora de Pernambuco (Brasil): Lythraceae J. St.-Hil.

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Abstract

Lythraceae comprises about 30 genera and 600 species being widely distributed in tropical and subtropical regions. In Brazil, 11 genera and 216 species are recognized, with 160 endemic. The Northeast region is the third with the highest recorded richness (57 spp. in 7 genera). In Pernambuco four genera and 16 species are found, representing the second richest state of the region. Despite the family's representativeness for the region, there is a lack of studies about the family, compromising the knowledge related to the taxonomic richness and geographical distribution of its species. This work aimed to perform the taxonomic study of Lythraceae species occurring in Pernambuco (Brazil). For this, field expeditions and analysis of the materials from CEN, HESBRA, HST, HTSA, HUEFS, HVASF, IPA, JPB, PEUFR and UFP herbaria between 2018 and 2020 were conducted. Were recognized 12 species and five genera (*Ammannia* L., *Cuphea* P. Br., *Lafoensia* Vand., *Pleurophora* D. Don. and *Rotala* L.). The species found predominate in Caatinga environments in the state. Complete morphological descriptions, an identification key, phenological period information, geographical distribution, taxonomic notes, photographs and illustrations of the diagnostic characters are presented. The morphological characters relevant to the identification of the species are: branch indumentum; leaf insertion and phyllotaxy, blade, base and apex shapes, indumentum type and venation; inflorescence type and position, presence or absence of bracteoles; presence or absence of spur, as well as the shape of this structure; presence or absence of petals, as well as their color and size.

Key words: *Cuphea*; Flora do Brasil; Myrtales; Taxonomy.

Resumo

Lythraceae apresenta cerca de 30 gêneros e 600 espécies sendo amplamente distribuída nas regiões tropicais e subtropicais. No Brasil, são reconhecidos 11 gêneros e 216 espécies, com 160 endêmicas. A região Nordeste é a terceira com maior riqueza registrada (57 spp. em 7 gêneros). Em Pernambuco são encontrados quatro gêneros e 16 espécies, representando o segundo estado mais rico da região. Apesar da representatividade da família para a região, há

uma escassez de estudos sobre a família, comprometendo o conhecimento relativo à riqueza taxonômica e distribuição geográfica de suas espécies. Este trabalho teve como objetivo realizar o estudo taxonômico das espécies de Lythraceae ocorrentes em Pernambuco (Brasil). Para isso, foram realizadas expedições de campo e análises dos materiais dos herbários CEN, HESBRA, HST, HTSA, HUEFS, HVASF, IPA, JPB, PEUFR e UFP entre 2018 e 2020. Foram reconhecidas 12 espécies e cinco gêneros (*Ammannia* L., *Cuphea* P. Br., *Lafoensia* Vand., *Pleurophora* D. Don. e *Rotala* L.). As espécies encontradas predominam em ambientes de Caatinga no estado. Descrições morfológicas completas, uma chave de identificação, informações de estado fenológico, distribuição geográfica, notas taxonômicas, pranchas de fotografias e ilustrações dos caracteres diagnósticos são apresentados. Os caracteres morfológicos relevantes para a identificação das espécies são: indumento do ramo; inserção e filotaxia da folha, forma, base e ápice da lâmina, tipo de indumento e venação; tipo e posição da inflorescência, presença ou ausência de bractéolas; ausência ou presença do cálcio, bem como a forma dessa estrutura; ausência ou presença de pétalas, assim como cor e tamanho das mesmas.

Palavras-chave: *Cuphea*; Flora do Brasil; Myrtales; Taxonomia.

Introduction

Lythraceae is widely distributed in tropical and subtropical regions, with few records in temperate ones (Cavalcanti 2007). It comprises about 30 genera and 600 species (Graham & Graham 2014). In Brazil, 11 genera and 216 species are recognized, predominantly distributed in Cerrado, Atlantic Forest and Caatinga domains, and 160 are reported as endemic to the country (Flora do Brasil 2020 under construction).

In Brazilian Northeast, 56 species and seven genera, *Adenaria* Kunth, *Ammannia* L., *Crenea* Aubl., *Cuphea* P. Brown, *Diplusodon* Pohl, *Lafoensia* Vand. and *Pleurophora* D. Don. are recorded. In a previous floristic inventory, 16 species in four genera (*Ammannia* L., *Cuphea* P. Br., *Lafoensia* Vand. and *Pleurophora* D. Don.) are reported to Pernambuco state, a small portion of this region, representing the second state with the largest number of species, almost 30% of the total reported for that (Flora do Brasil 2020 under construction).

Lythraceae species occur in several habitats, including swamps, dunes, humid tropical forests but more frequently in savannah, arid and rocky fields. They can be trees, shrubs, or rarely herbs, with simple leaves, commonly decussate, margins entire; Inflorescence a raceme or a cyme; Flowers bisexual, dichlamydeous, rarely monochlamydeous, actinomorphic, rarely zygomorphic, floral tube persistent, petals curly, 4–16, dialipetalous; Fruit capsule (Cavalcanti & Graham 2002).

Lythraceae constitutes an important component of the ecosystems in general, being used as nectar and pollen source, for example, the melitophilic *Lagerstroemia indica* L. (São Sebastião flower) (Almeida *et al.* 2003). *Lafoensia acuminata* (Ruiz & Pav.) DC. is widely used as ornamental (Cavalcanti & Graham 2002). While *Punica granatum* L., popularly known as pomegranate, is used as food and medicinal. *Cuphea carthagenensis* (Jacq.) J.F. Macbr., either is indicated for prevention and treatment of cardiovascular diseases (Schuldt *et*

al. 2000). *Cuphea* seeds are antioxidant sources that delay the fat and oil degradation in stored food products, extending the validity of products (Graham 1991).

Taxonomic studies of the family in Brazil are more expressive in the Midwest and Southeast regions. The Serra do Cipó, Minas Gerais (Cavalcanti, 1990) and São Paulo state (Cavalcanti & Graham, 2002) researches stand out. In addition to these, there is the revision work with the genus *Diplusodon* Pohl in the Brazilian Cerrado (Cavalcanti, 2007). In the Northeast region, the unique taxonomic treatment is that of the genus *Cuphea* for Chapada Diamantina, Bahia (Brauner, 2017). In addition, the family is registered in floristic surveys.

Despite the Lythraceae representativeness for the Brazilian Northeast and in the herbaria collections, it lacks studies about the family, which reflects in materials incorrectly or unidentified, compromising the knowledge relative to taxonomic richness and geographical distribution of its species. In addition, the development of taxonomic studies may present new useful characters for the delimitation of the family species. In this study is presented the taxonomic treatment of Lythraceae from Pernambuco, with complete morphological descriptions, an identification key, phenological period information, geographic distribution, taxonomic notes, photographs and illustrations of diagnostic characters.

Material and Methods

Study area

Pernambuco is located in the center-east of the Northeast region of Brazil, between the coordinates 7°15'45" and 9°28'18" South and 34°48'35" and 41°19'54" West. It has an area of 98.311 km², with greater extension from east to west and is limited by Atlantic Ocean and by the states of Alagoas, Bahia, Ceará, Paraíba and Piauí. The state has heterogeneous climate,

soil and phytophysiognomies, with fragments of ombrophilous and seasonal forests, forested highlands, restingas, mangrove bodies, dunes, associated ecosystems and Caatinga. Caatinga stands out as predominating about 80% of the total area of the state, with semi-arid climate and is divided into hyperxerophilic and hypoxerophilic areas (Andrade-Lima, 1960).

Material collection

Were conducted 11 field expeditions, including the municipalities of Belo Jardim, Buíque, Cabo de Santo Agostinho, Cabrobó, Camaragibe, Ibimirim, Igarassu, Inajá, Ipojuca, Jaboatão dos Guararapes, Pesqueira, Petrolina, Recife, São Lourenço da Mata and Tamandaré, between 2018 and 2020 to collect fertile material of Lythraceae species. The selected areas for the fieldworks included areas considered priority according to occurrence records to obtain data on the ecological conditions of the species, preserved areas, extension, in order to encompass the largest possible number of municipalities in Pernambuco. The collected specimens were dehydrated, flowers and fruits were stored in 70% alcohol and leaves stored in silica gel for future studies. The collection and herborization process was based on conventional techniques for taxonomic studies (Bridson & Forman 1998). The specimens are deposited in the PEUFR herbarium, and duplicates will be sent to HVASF, CEN, MO and K (herbaria acronyms follow Thiers, continuously updated).

Collection from ten herbaria were analyzed: Pernambuco (HESBRA, HST and HTSA - not indexed -, HVASF, IPA, PEUFR, UFP), Paraíba (JPB), Bahia (HUEFS) and Brasília (CEN) with a total of about 700 analyzed specimens of Lythraceae from Pernambuco.

Morphological analysis

The species were identified from comparisons to species previously identified by specialist, to *typus* materials available *online* (REFLORA (Brazil), Missouri Botanical Garden

(MO), The New York Botanical Garden (NY) and JSTOR (United States of America)) and in the herbaria and/or based on specific bibliography (Graham 1975; Graham 1985; Lourteig 1986; Cavalcanti & Graham 2002; Siqueira-Filho *et al.* 2015; Graham 2017; Brauner 2017; Flora do Brasil 2020 under construction).

For the morphological descriptions materials obtained from the fieldworks and the ones deposited in the herbaria were used. Specific terminologies for vegetative and reproductive structures followed mostly Gonçalves & Lorenzi (2011), and seeds shape follows Harris & Harris (2001). Due to the large amount of examined materials, the best quality fertile specimens from each phytogeographic domain (Caatinga and/or Atlantic Forest) and that represent the phenological period were selected and presented as “selected material”. The remaining specimens analyzed are included in an overall list as “examined material”. A taxonomic treatment with complete morphological descriptions, an identification key for the genera and species, phenological state information, geographic distribution, taxonomic notes, photographs and illustrations was produced.

Results and Discussion

In this study, it was found that the richness of Lythraceae for Pernambuco was overestimated. Were recognized 12 species in five genera, *Ammannia* L., *Cuphea* P. Br., *Lafoensia* Vand., *Pleurophora* D. Don. e *Rotala* L. (Tab. 1). According to Flora do Brasil (2020 under construction), 16 species of Lythraceae are listed for Pernambuco. Specimens identified as *Cuphea campestris* Koehne, *C. impatientifolia* A. St.-Hil., *C. micrantha* Kunth, *C. mimuloides* Cham. & Schldl. and *C. strigulosa* Kunth in this list, were misidentified, and we do not confirm them occurrence in Pernambuco.

Rotala ramosior (L.) Koehne is a new record for Caatinga of Pernambuco. *Cuphea* is the most representative genus, with six species, followed by *Ammannia* and *Pleurophora*, with two species each. Two species cited in the IUCN Red List as Least Concern (LC) occur in Pernambuco, *A. auriculata* Willd. and *R. ramosior* (IUCN, 2020).

Seven species are endemic from Brazil, *L. glyptocarpa* Koehne is found only in Bahia and Pernambuco and *P. pulchra* J.C. Siqueira, Cotarelli, J.F.B. Pastore & T.B. Cavalc. is considered rare because it has a restricted distribution to Caatinga of Pernambuco and there are few specimens in the herbaria. The most frequent species in the area were: *A. latifolia* L., *C. flava* Spreng. and *P. anomala* Koehne.

In Pernambuco, six species are found in Caatinga and Atlantic Forest. Most species (10) are recorded in Caatinga (vs. eight in Mata Atlântica) (Fig. 5), instead of occurs in Brazil when compared the same biomes, where 50 are found in Atlantic Forest and 32 in Caatinga (Flora do Brasil 2020 under construction), which can be justified by the percentage (80%) of total area occupied by Caatinga in the state (Andrade-Lima, 1960).

Relevant morphological characters for species identification are: branch indumentum; leaf insertion and phyllotaxy, blade, base and apex shapes, indumentum type and venation; inflorescence type and position, presence or absence of bracteoles; presence or absence of spur, as well as the shape of this structure; presence or absence of petals, as well as their color and size. Few cultivated species were found in the study area, but are not included in this taxonomic treatment, as *Lagerstroemia indica* L., largely used as ornamental.

Taxonomic treatment

Lythraceae J. St.-Hil., Expos. Fam. Nat. 2: 175, 1805.

Terrestrial or aquatic. Herbs or shrubs, branches quadrangulate or cylindrical, glabrous, pubescent or pilose. Leaves distichous opposite, decussate or verticillate, sessile or petiolate, blade narrow-triangular, ovate, elliptic, narrow-elliptic, oblong or oblanceolate, margins flat or revolute, membranaceous, papiraceous or chartaceous, venation camptodromous, brochidodromous or hyphodromous. Flowers solitary, cymes, dichasium or racemes axillary or racemes terminal, sessile or pedicellate, bracteoles absent or present, narrow-triangular, lanceolate, ovate, linear or narrow-elliptic. Floral tube persistent or caducous, campanulate, urceolate or tubular, flat or plicate. Spur absent or present, truncate, horizontal or descending. Stamens 4–20, homodynamous, didynamous, tridynamous or heterodynamous, included or exserted, anthers basifixed or dorsifixed, elliptic, oblong, reniform or concavo-convex, vesicles absent or 5. Style included or exserted. Capsule pyriform, globose, fusiform or cylindrical. Seeds numerous, flat, globose or concavo-convex.

Identification key for Lythraceae species from Pernambuco

1. Branches glabrous.
 2. Branches cylindrical; leaves petiolate; racemes terminal 10. *Lafoensia glyptocarpa*
 - 2'. Branches quadrangulate; leaves sessile; flowers solitary, cymes or dichasium.
 3. Leaves base decurrent, apex obtuse; flowers solitary 13. *Rotala ramosior*
 - 3'. Leaves base cordate, apex acute or cuneate; cymes or dichasium.
 4. Dichasium; stamens and style exerted 1. *Ammannia auriculata*
 - 4'. Cymes; stamens and style included 2. *A. latifolia*
- 1'. Branches pubescent or pilose.
 5. Leaves oblanceolate; flowers solitary; spur absent.
 6. Floral tube completely green, ca. 5 mm long; petals white, light pink to lilac, 2 petals ca. 3×2 mm 11. *Pleurophora anomala*
 - 6'. Floral tube green at the base and becoming red towards the apex, 14–15 mm long; petals red, 2 petals $5-7 \times 5-6$ mm 12. *P. pulchra*
 - 5'. Leaves narrow-triangular, ovate, elliptic or oblong; flowers solitary or racemes; spur present.
 7. Leaves verticillate, blade narrow-triangular, venation hypodromous 5. *Cuphea ericoides*
 - 7'. Leaves distichous opposite or decussate, blade ovate, elliptic or oblong, venation camptodromous or brochidodromous.
 8. Leaves sessile or short petiolate; petals absent or yellow.
 9. Leaves blade pubescent on both faces; racemes terminal; petals absent 7. *C. pulchra*

- 9'. Leaves blade pilose on the margins, glabrous or glabrescent on the veins and glabrous on both faces; flowers solitary; petals yellow 6. *C. flava*
- 8'. Leaves petiolate; petals rose to purple.
10. Leaves distichous opposite; spur horizontal 4. *C. circaeoides*
- 10'. Leaves decussate; spur truncate or descending.
11. Leaves venation brochidodromous; racemes axillary, bracteoles present 3. *C. carthagenensis*
- 11'. Leaves venation camptodromous; racemes terminal, bracteoles absent 8. *C. racemosa*

Ammannia L., Sp. Pl. 1: 119, 1753.

Terrestrial or aquatic. Herbs or shrubs completely glabrous, branches quadrangulate. Leaves decussate, sessile, blade narrow-triangular, margins flat, base cordate, apex acute or cuneate, membranaceous or papiraceous, venation brochidodromous. Cymes or dichasium, axillary, pedicellate, bracteoles present, narrow-triangular or lanceolate. Floral tube persistent, urceolate, plicate, appendages of size nearly equal to the sepals, spur absent. Petals absent or 4. Stamens 4, homodynamous, included or exserted, inserted at the middle third of the floral tube, anthers ca. 0.5×0.5 mm, dorsifixed, reniform, vesicles absent. Style included or exserted. Capsule globose. Seeds ca. 0.5×0.5 mm, concavo-convex.

Ammannia is represented by about 25 species and is distributed in Temperate and Tropical zones, occurring primarily in Africa (Graham 1985). According to Flora do Brasil

(2020 under construction), in Brazil are recognized three species, of which two, *A. auriculata* Willd. and *A. latifolia* L., are found for the Northeast region, including Pernambuco. The Atlantic Forest stands out for its diversity of genre in the country.

1. *Ammannia auriculata* Willd., Hort. Berol. 1: 7, pl.7. 1803. (Fig. 1a-c)

Herbs or shrubs, 20–50 cm tall. Blade 0.9–6 × 0.1–0.8 cm, membranaceous. Dichasium, pedicel 1–5 mm long, bracteoles ca. 1 mm long, lanceolate, inserted at the inferior third of the pedicel. Floral tube 2–3 mm long, color not seen, sepals ca. 1 mm long, apex acute. Petals 4, pink or magenta, ca. 2 × 2 mm, wide-elliptic, base subcordate, apex rounded. Stamens exerted, inserted at the middle third of the floral tube. Style ca. 3 mm long, exerted. **Selected material:** BRAZIL. Pernambuco: Carnaíba, Fazenda Cacimba Velha, 08 may 2008, fl. fr., *Ferreira, C.* 83883 (IPA!); Recife, Campus da UFRPE, 16 oct 2013, fl. fr., *Gomes, H. C.* 5; *Miranda, A. M.* (IPA!).

Distribution, ecology, and conservation status: It is pantropical (GBIF, 2020). In Brazil, the species can be found in the Midwest (MT and MS) and in the Northeast (BA, CE and PE) growing in Cerrado, Atlantic Forest and Pantanal environments (Flora do Brasil 2020 under construction). In the study area, it was found in Atlantic Forest and Caatinga. It can be identified by the inflorescence a dichasium with stamens and style exerted.

Phenology period: The material with flowers and fruits was collected in January to October.

2. *Ammannia latifolia* L., Sp. Pl. 1: 119–120, 1753. (Figs. 1b, d-e; 2a)

Herbs or shrubs, 20–150 cm tall. Blade 1.4–12.7 × 0.3–1.9 cm, papiraceous. Cymes, pedicel ca. 1 mm long, bracteoles ca. 2 mm long, narrow-triangular, inserted at the superior third of the pedicel. Floral tube ca. 5 mm long, green to vinaceous, sepals ca. 1 mm long, apex cuneate. Apetalous. Stamens included, inserted at the middle third of the floral tube. Style ca. 1 mm long, included.

Selected material: BRAZIL. Pernambuco: Ipojuca, RPPN Nossa Senhora do Oiteiro de Maracaípe, Mangrove of Ipojuca River, 28 jan 2007, fl. fr., *Leite, M. S. 295; Oliveira, J. B. (UFP!)*; Fernando de Noronha, Pedreira, 10 jun 1999, fl. fr., *Miranda, A. M. 3490 (HUEFS!)*; Petrolina, bank of São Francisco River, 21 feb 2019, fl. fr., *Lacerda, T. 26; Santos, D.; Mendes, J.*

Distribution, ecology, and conservation status: It is endemic from Americas, occurring from the United States of America to Argentina (GBIF, 2020). In Brazil, the species can be found in the Northeast (BA, CE, PB and PE) growing in Caatinga, Cerrado and Atlantic Forest areas (Flora do Brasil 2020 under construction). In Pernambuco, it was found in Atlantic Forest and Caatinga. *A. latifolia* is morphologically related to *Rotala ramosior* by the branches glabrous and quadrangulate, leaves sessile, short pedicel and stamens and style included. *A. latifolia* is distinguished from *R. ramosior* by the leaves narrow-triangular (*vs.* narrow-elliptic), base cordate (*vs.* decurrent), apex acute or cuneate (*vs.* obtuse) and cymes (*vs.* flowers solitary).

Phenology period: The material with flowers and fruits was collected along the year.

Cuphea P. Browne, Civ. Nat. Hist. Jamaica 216–217, 1756.

Terrestrial. Herbs or shrubs, branches cylindrical, pubescent or pilose. Leaves distichous opposite, decussate or verticillate, sessile or petiolate, blade narrow-triangular, ovate, elliptic or oblong, margins flat, membranaceous, papiraceous or chartaceous, venation camptodromous, brochidodromous or hyphodromous. Flowers solitary or racemes, axillary or terminal, pedicellate, pedicel pubescent, bracteoles absent or present, narrow-triangular, ovate or linear, trichomes simple. Floral tube persistent, tubular, plicate, appendages of size less than half of the sepals, trichome simple, spur present, truncate, horizontal or descending. Petals absent or 6, yellow or rose to purple. Stamens 11, heterodynamous, included or exerted, inserted at the superior third of the floral tube, filaments pubescent, pilose or hirsute, anthers dorsifixed, elliptic or oblong, vesicles absent or 5. Style included or exerted, glabrous, glabrescent or pilose. Capsule cylindrical or fusiform. Seeds globose.

Cuphea is the most representative genus of Lythraceae with about 250 species, and is endemic from Americas, occurring primarily in the tropics and subtropics (Graham 2017). In Brazil, 108 species are recognized, among which 71 are endemic. They are distributed throughout the country, with a greater predominance in the Southeast (60 spp.), followed by the Midwest (43 spp.) and Northeast (38 spp.). Cerrado and Atlantic Forest stand out for covering the greatest richness of the genus in the country. However, representatives of this taxon can also be found in the Amazon Rainforest, Caatinga, Pampa and Pantanal (Flora do Brasil 2020 under construction). In Pernambuco occur six species, *C. carthagenensis* (Jacq.) J.F. Macbr., *C. circaeoides* Sm. ex Sims, *C. ericoides* Cham. & Schltdl., *C. flava* Spreng., *C. pulchra* Moric. and *C. racemosa* (L. f.) Spreng.

3. *Cuphea carthagenensis* (Jacq.) J.F. Macbr., Publ. Field Mus. Nat. Hist., Bot. Ser. 8(2): 124, 1930. (Figs. 1f-h; 2b)

Basionym: *Lythrum carthagenense* Jacq., Enum. Syst. Pl. 22, 1760.

Herbs or shrubs, 10–50 cm tall, branches pubescent, trichomes simple. Leaves decussate, petiolate, petioles 0.5–2 mm long, blade 0.8–3.7 × 0.3–1.5 cm, elliptic, base cuneate, apex cuneate, papiraceous, pubescent on both faces, trichomes simple, venation brochidodromous. Racemes axillary, pedicel 1–3 mm long, trichomes simple, bracteoles present, ca. 1 mm long, narrow-triangular, pubescent on the margins, inserted at the superior third of the pedicel. Floral tube persistent, 5–7 mm long, purple, sepals ca. 0.5 mm long, apex cuneate, spur descending, outer surface pubescent, trichomes simple and glandular, inner surface pubescent above and glabrescent below stamen insertion, trichomes simple and glandular. Petals 6, rose to purple, 2 petals ca. 3 × 2 mm, 4 petals ca. 3 × 1 mm, elliptic, base cuneate, apex cuneate. Stamens included, filaments pubescent, trichomes simple and glandular, anthers ca. 0.5 × 0.5 mm, oblong, vesicles 5. Style ca. 1.5 mm long, included, glabrous. Capsule cylindrical. Seeds ca. 2 × 2 mm.

Selected material: BRAZIL. Pernambuco: Igarassu, Usina São José, 23 aug 1997, fl. fr., Luz, A. S. *s/n* (HST!, IPA!, ALCB).

Distribution, ecology, and conservation status: According to Graham (2017), this species is the one most widely distributed of the genus, occurring from the United States of America to Argentina. In Brazil, the species can be found in all regions, except in the MA, PI, PB, RN and RR states, growing in Amazon Rainforest, Caatinga, Cerrado, Atlantic Forest, Pampa and Pantanal environments (Flora do Brasil 2020 under construction). In the study area, it was

found only in Atlantic Forest. It can be distinguished from the other species by its unique combination of leaves presenting venation brochidodromous, inflorescence racemes axillary and bracteoles present.

Phenology period: The material with flowers and fruits was collected from February to November.

4. *Cuphea circaeoides* Sm. ex Sims, Bot. Mag. 48: , t. 2201, 1820. (Fig. 1i-l)

Herbs or shrubs, 10–40 cm tall, branches pubescent, trichomes simple. Leaves distichous opposite, petiolate, petioles 2–27 mm long, blade 2.7–5.6 × 1–2.1 cm, ovate, base rounded, apex acute, membranaceous, pubescent on both faces, trichomes simple, venation brochidodromous. Racemes terminal, pedicel 2–8 mm long, trichomes simple, bracteoles present, ca. 0.5 mm long, linear, pubescent, inserted at the middle third of the pedicel. Floral tube persistent, 5–6 mm long, color not seen, sepals ca. 0.5 mm long, apex acute, spur horizontal, outer surface pubescent, trichomes simple, inner surface pilose above and glabrescent below stamen insertion, trichomes simple. Petals 6, pink or lilac to purple, 2 petals ca. 2 × 1 mm, obovate, 4 petals ca. 2 × 0.5 mm, narrow-elliptic, base acute, apex obtuse. Stamens included, filaments pilose, trichomes simple, anthers ca. 0.5 × 0.5 mm, elliptic, vesicles absent. Style ca. 1 mm long, included, glabrous. Capsule fusiform. Seeds ca. 2 × 2 mm.

Selected material: BRAZIL. Pernambuco: between Afrânio and Caboclo, 21 apr 1971, fl. fr., *Academia Brasileira de Ciências 240* (IPA!); Goiana, Usina Santa Teresa, 27 jun 2013, fl. fr., *Miranda, A. M. 6572* (HUEFS!).

Distribution, ecology, and conservation status: It is endemic to Brazil, occurring in the Northeast (AL, BA, CE, PB, PE and SE) and in the Southeast (MG) growing in Caatinga, Cerrado and Atlantic Forest areas (Flora do Brasil 2020 under construction). In Pernambuco, it was found in Atlantic Forest and Caatinga. It can be identified by the leaves distichous opposite and spur horizontal.

Phenology period: The material with flowers and fruits was collected from March to November.

5. *Cuphea ericoides* Cham. & Schltdl., *Linnaea* 2: 366, 1827. (Figs. 2c; 3a-d)

Terrestrial. Herbs or shrubs, 15–150 cm tall, branches pubescent, trichomes simple. Leaves verticillate, sessile, blade 0.2–0.6 × 0.1–0.2 cm, narrow-triangular, base truncate, apex acute, chartaceous, pubescent on both faces, trichomes simple, venation hypodromous. Flowers solitary, axillary, pedicel 5–6 mm long, trichomes simple, bracteoles present, ca. 1 mm long, ovate, pubescent, inserted at the superior third of the pedicel. Floral tube persistent, 5–8 mm long, purple, sepals ca. 1 mm long, apex acute, spur descending, outer surface pubescent, trichomes simple, inner surface pilose above and pubescent below stamen insertion, trichomes simple. Petals 6, pink or lilac to purple, 2 petals ca. 4 × 3 mm, 4 petals ca. 3 × 0.2 mm, obovate, base cuneate, apex rounded. Stamens included, filaments pilose, trichomes simple, anthers ca. 0.5 × 0.5 mm, oblong, vesicles absent. Style ca. 3 mm long, included, glabrescent, trichomes simple. Capsule cylindrical. Seeds ca. 2 × 2 mm.

Selected material: BRAZIL. Pernambuco: Brejo da Madre de Deus, Fazenda Bituri, 03 mar 2005, fl. fr., *Borba, E. L. 2186* (HUEFS!).

Distribution, ecology, and conservation status: It is endemic to Brazil, occurring from Maranhão to Minas Gerais (Flora do Brasil 2020 under construction) in the Northeast (BA and PE) and in the Southeast (MG) growing in Caatinga and Cerrado environments (Flora do Brasil 2020 under construction). In the study area, it was found only in Caatinga. It can be distinguished from the other species by the following set of characters: leaves verticillate, blade narrow-triangular and venation hyphodromous.

Phenology period: The material with flowers and fruits was collected along the year.

6. *Cuphea flava* Spreng., Novi Provent. 14, 1818. (Figs. 2d-e; 3e-h)

Terrestrial. Herbs or shrubs, 30–150 cm tall, branches pubescent, trichomes simple. Leaves decussate, sessile or short petiolate, petioles 0–0.5 mm long, blade 0.5–2.3 × 0.2–0.8 cm, ovate, base subcordate, apex cuneate, papiraceous, pilose on the margins, glabrous or glabrescent on the veins and glabrous on both faces, trichomes simple, venation brochidodromous. Flowers solitary, axillary, pedicel 1–4 mm long, trichomes simple, bracteoles present, ca. 1 mm long, ovate, pilose on the margins, inserted at the middle third of the pedicel. Floral tube persistent, ca. 8 mm long, green, sepals ca. 1 mm long, apex acute, spur descending, outer surface pubescent, trichomes simple, inner surface pilose above stamen insertion and pubescent at the base of the ovary, trichomes simple. Petals 6, yellow, 2 petals ca. 4 × 2 mm, 4 petals ca. 3 × 1 mm, obovate, base cuneate, apex rounded. Stamens included or exserted, filaments pilose, trichomes simple, anthers ca. 0.5 × 0.5 mm, oblong, vesicles absent. Style ca. 5 mm long, exserted, glabrous. Capsule cylindrical. Seeds ca. 2 × 2 mm.

Selected material: BRAZIL. Pernambuco: Cabo de Santo Agostinho, 23 sep 2018, fl. fr., Lacerda, T. 12.

Distribution, ecology, and conservation status: It is endemic to Brazil, occurring in the North (PA), in the Northeast (AL, BA, PB, PE, RN and SE) and in the Southeast (ES and RJ) growing only in Atlantic Forest areas (Flora do Brasil 2020 under construction), as it was found in Pernambuco. It can be recognized by the following set of characters: leaves blade pilose on the margins, glabrous or glabrescent on the veins and glabrous on both faces, flowers solitary and being the only one with yellow petals.

Phenology period: The material with flowers and fruits was collected during the whole year.

7. *Cuphea pulchra* Moric., Pl. Nouv. Amer. 168, pl.98. 1847. (Figs. 2f, 3i-l)

Shrubs, ca. 80 cm tall, branches pubescent, trichomes simple and glandular. Leaves decussate, sessile, blade 0.9–2.9 × 0.3–1.2 cm, oblong, base cordate, apex acute or cuneate, chartaceous, pubescent on both faces, trichomes simple and glandular, venation brochidodromous. Racemes terminal, pedicel 7–8 mm long, trichomes simple and glandular, bracteoles present, ca. 1 mm long, ovate, pubescent, inserted at the middle third of the pedicel. Floral tube persistent, 17–22 mm long, red, sepals ca. 1 mm long, apex cuneate, spur descending, outer surface pubescent, trichomes simple and glandular, inner surface hirsute above and pubescent below stamen insertion, trichomes simple. Apetalous. Stamens included or exserted, filaments hirsute, trichomes simple, anthers ca. 1 × 1 mm, oblong, vesicles absent. Style ca. 14 mm long, exserted, pilose, trichomes simple. Capsule fusiform. Seeds ca. 3 × 3 mm.

Selected material: BRAZIL. Pernambuco: Ouricuri, bank of BR-316, 24 mar 1987, fl. fr.,
Lima, J. L. S. 371 (HUEFS!).

Distribution, ecology, and conservation status: It is endemic to Brazil, occurring in the Northeast (BA, PE and SE) and in the Southeast (MG) growing in Caatinga and Cerrado environments (Flora do Brasil 2020 under construction). In the study area, it was collected in Caatinga. It can be identified by the leaves blade pubescent on both faces, racemes terminal and petals absent.

Phenology period: The material with flowers and fruits was collected in March.

8. *Cuphea racemosa* (L. f.) Spreng., Syst. Veg. [Sprengel] 2: 455, 1825. (Fig. 3m-p)

Basionym: *Lythrum racemosum* L. f., Suppl. Pl. 250, 1781.

Herbs or shrubs, 20–100 cm tall, branches pilose, trichomes simple. Leaves decussate, petiolate, petioles 3–30 mm long, blade 0.9–7 × 0.5–4.5 cm, elliptic, base cuneate, apex cuneate, papiraceous, pubescent on both faces, trichomes simple, venation camptodromous. Racemes terminal, pedicel 5–10 mm long, trichomes simple, bracteoles absent. Floral tube persistent, 6–18 mm long, color not seen, sepals ca. 0.5 mm long, apex cuneate, spur truncate, outer surface pubescent, trichomes simple, inner surface hirsute above and glabrescent below stamen insertion, trichomes simple. Petals 6, pink or lilac to purple, 2 petals ca. 3 × 1 mm, 4 petals ca. 2.5 × 0.5 mm long, obovate, base acute, apex rounded. Stamens included or exserted, filaments hirsute, trichomes simple, anthers ca. 0.5 × 0.5 mm, elliptic, vesicles absent. Style ca. 3 mm long, included, pilose, trichomes simple. Capsule cylindrical. Seeds ca. 1 × 1 mm.

Selected material: BRAZIL. Pernambuco: Brejo da Madre de Deus, Bituri farm, 03 mar 2005, fl. fr., *Borba, E. L. 2189* (HUEFS!).

Distribution, ecology, and conservation status: According to Cavalcanti & Graham (2002), this species occurs from Mexico to Argentina. In Brazil, it can be found in the Northeast (AL, BA, PE and SE), in the Midwest (DF, GO and MS), in the Southeast (ES, MG, RJ and SP) and in the South (PR, RS and SC) growing in Amazon Rainforest, Caatinga, Cerrado, Atlantic Forest, Pampa and Pantanal areas (Flora do Brasil 2020 under construction). In Pernambuco, it was found in Atlantic Forest and Caatinga. It can be recognized by the leaves venation camptodromous, racemes terminal and bracteoles absent.

Phenology period: The material with flowers and fruits was collected during the whole year.

Lafoensia Vand., Fl. Lusit. Bras. Spec. 33, 1788.

Lafoensia is represented by six endemic species from Americas, occurring five in South America (Lourteig 1986). In Brazil are recognized five species, of which three are found for the Northeast region and the Cerrado stands out for its diversity of genre in the country (Flora do Brasil 2020 under construction). In Pernambuco occurs the species *L. glyptocarpa* Koehne.

9. *Lafoensia glyptocarpa* Koehne, Fl. Bras. 13(2): 353, 1877. (Figs. 2g; 4a-c)

Terrestrial. Shrubs completely glabrous, ca. 150 cm tall, branches cylindrical. Leaves decussate, petiolate, petioles ca. 5 mm long, blade 2.7–3.4 × 1.8–2 cm, elliptic, margins flat, base obtuse or rounded, apex cuspidate, chartaceous, venation brochidodromous. Racemes

terminal, pedicellate, pedicel ca. 30 mm long, bracteoles absent. Floral tube caducous, ca. 25 mm long, vinaceous, campanulate, flat, sepals ca. 8 mm long, apex acute, appendages and spur absent. Petals number not seen, white, ca. 20×5 mm, obovate, base decurrent, apex cuneate. Stamens 20, homodynamous, exerted, inserted at the base of the floral tube, anthers ca. 1×5 mm, concavo-convex, vesicles absent. Style ca. 75 mm long, exerted. Capsule pyriform. Seeds ca. 20×10 mm, flat.

Selected material: BRAZIL. Pernambuco: Garanhuns, 06 nov 2010, fl. fr., *Oliveira, M. 5265; Mattos, M. R.* (IPA!).

Distribution, ecology, and conservation status: It is endemic from the Brazilian Northeast, so far known only to Bahia and Pernambuco, growing only in Cerrado environments (Flora do Brasil 2020 under construction). In the study area, it was found in Caatinga. It can be identified by being completely glabrous, branches cylindrical, leaves elliptic and inflorescence raceme terminal.

Phenology period: The material with flowers and fruits was collected from February to November.

Pleurophora D. Don, Edinburgh New Philos. J. 12: 112, 1837.

Terrestrial or aquatic. Herbs or shrubs, branches cylindrical, pubescent, trichomes simple. Leaves verticillate, sessile or short petiolate, petioles 0–1 mm long, blade oblanceolate, margins revolute, base acute, apex cuneate, papiraceous, pubescent on both faces, trichomes simples, venation brochidodromous. Flowers solitary, axillary, pedicellate, pedicel pubescent, trichomes simple, bracteoles present, narrow-elliptic or linear, pubescent, trichomes simple. Floral tube persistent, green or green to red, tubular, plicate, sepals apex

acute, appendages of size less than half of the sepals, trichome simple, spur absent, outer surface pubescent, trichomes simple, inner surface glabrous. Petals 6, white, light pink to lilac or red. Stamens 6, tridynamous, exserted, inserted at the base of the floral tube, filaments glabrescent, trichomes simple, anthers dorsifixed, reniform, vesicles absent. Style exserted, glabrescent or pubescent, trichomes simple. Capsule cylindrical. Seeds concavo-convex.

Pleurophora is represented by six species currently accepted and in use, although more than twice as many have been described. It is endemic from Americas, occurring in Argentina, Bolivia, Brazil, Chile and Paraguay (Siqueira-Filho *et al.* 2015). According to Flora do Brasil (2020 under construction), in Brazil are recognized three species, of which two are found for the Northeast region and the Caatinga stands out for its diversity of genre in the country. In Pernambuco were found the species *P. anomala* (A. St.-Hil.) Koehne and *P. pulchra* J.A. Siqueira, V.M. Cotarelli, J.F.B. Pastore & T.B. Cavalcanti.

10. *Pleurophora anomala* (A. St.-Hil.) Koehne, *Fl. Bras.* 13(2): 307, pl.57. 1877. (Figs. 2h; 4d-e)

Basionym: *Lythrum anomalum* A. St.-Hil., *Fl. Bras. Merid.* (quarto ed.) 3(24): 130, pl.186. 1832.

Terrestrial or aquatic. Herbs or shrubs, 20–100 cm tall. Blade 0.5–3.3 × 0.1–0.7 cm. Pedicel ca. 1 mm long, bracteoles ca. 1 mm long, inserted at the superior third of the pedicel. Floral tube ca. 5 mm long, green, sepals ca. 1 mm long. Petals white, light pink or lilac to purple, 2 petals ca. 3 × 2 mm, obovate, base obtuse, apex rounded, 4 petals ca. 2 mm long,

narrow-elliptic, base cuneate, apex cuneate. Anthers ca. 0.5×1 mm. Style ca. 4 mm long, pubescent. Seeds ca. 0.5×0.5 mm.

Selected material: BRAZIL. Pernambuco: Pesqueira, Rosário settlement, 09 apr 2019, fl. fr., *Lacerda, T. 31; S. L. C.; S. C. N.*; Recife, Curado, 15 aug 1958, fl. fr., *Andrade-Lima 585962* (IPA!).

Distribution, ecology, and conservation status: It is endemic to Brazil, occurring in the Northeast (AL, BA, CE, PB, PE, PI, RN and SE) and in the Southeast (MG) growing only in Caatinga areas (Flora do Brasil 2020 under construction). In Pernambuco, it was found in Atlantic Forest and Caatinga. It can be distinguished by the green color of floral tube and white, light pink to lilac petals, floral tube ca. 5 mm long and dorsal petals ca. 3×2 mm.

Phenology period: The material with flowers and fruits was collected from January to November.

11. *Pleurophora pulchra* J.C. Siqueira, Cotarelli, J.F.B. Pastore & T.B. Cavalc., Syst. Bot. 40(1): 185, 2015. (Fig. 4f-g)

Terrestrial. Shrubs, 30–100 cm tall. Blade $0.6\text{--}2.5 \times 0.2\text{--}0.5$ cm. Pedicel 1–3 mm long, bracteoles 2–3 mm long, inserted at the middle third of the pedicel. Floral tube 14–15 mm long, green at the base and becoming red towards the apex, sepals 2–4 mm long. Petals red, 2 petals $5\text{--}7 \times 5\text{--}6$ mm, wide-elliptic, base decurrent, apex emarginate, 4 petals 1–2 mm long, narrow-triangular, base truncate, apex acute. Anthers ca. 1×1 mm. Style ca. 20 mm long, glabrescent. Seeds $0.4\text{--}1 \times 0.5\text{--}0.8$ mm.

Selected material: BRAZIL. Pernambuco: Cabrobó, Serra do Bendó, 22 sep 2009, fl. fr., *Fontana, A. P. 6195* (UFP!).

Distribution, ecology, and conservation status: It is endemic to Pernambuco, growing in Caatinga environments (Flora do Brasil 2020 under construction), as it was found in the study area. It can be recognized by the green to red color of floral tube and red petals, floral tube ca. 15 mm long and dorsal petals ca. 7×6 mm.

Phenology period: The material with flowers and fruits was collected from January to September.

Rotala L., Mant. Pl. 2: 143–144, 175, 1771.

Rotala is represented by about 45 species predominantly from Africa and Asia, besides few species from Americas (Cook 1979). In Brazil are recognized two species (*R. mexicana* Cham. & Schlttdl. e *R. rotundifolia* (Roxb.) Koehne), which are found, until now, just in the Southeast (two spp.), Midwest and North (one sp.) growing in Atlantic Forest and Amazon Rainforest areas (Flora do Brasil 2020 under construction). In Pernambuco occurs the species *R. ramosior* (L.) Koehne.

12. *Rotala ramosior* (L.) Koehne, *Fl. Bras.* 13(2): 194, 1877. (Fig. 4h-j)

Basionym: *Ammannia ramosior* L., *Sp. Pl.* 1: 120, 1753.

Terrestrial or aquatic. Herbs completely glabrous, 7–40 cm tall, branches quadrangulate. Leaves decussate, sessile, blade $0.4\text{--}2.7 \times 0.1\text{--}0.6$ cm, narrow-elliptic, margins flat, base decurrent, apex obtuse, membranaceous, venation brochidodromous. Flowers solitary, axillary, sessile or short pedicellate, pedicel 0–0.5 mm long, bracteoles present, 2–3

mm long, linear, inserted at the base of the floral tube. Floral tube persistent, 2–4 mm long, color not seen, urceolate, plicate, sepals ca. 0.5 mm long, apex cuneate, appendages of size nearly equal to the sepals, spur absent. Petals white, light pink or lilac to purple not seen. Stamens 4, didynamous, included, inserted at the middle third of the floral tube, anthers ca. 0.5×0.5 mm, basifixed, reniform, vesicles absent. Style ca. 0.5 mm long, included. Capsule globose. Seeds ca. 0.5×0.5 mm, concavo-convex.

Selected material: BRAZIL. Pernambuco: Cabo de Santo Agostinho, between the Engenhos Megahype and Cayango, Pedra do Cayango, 14 sep 2008, fl. fr., Sobral-Leite, M. 873; Wanderley, A. M. (UFP!); Serra Talhada, Parque Estadual Mata da Pimenteira, Lagoa Pimenteira II, 22 mar 2012, fl. fr., *Cordeiro, W. 223* (HESBRA!).

Distribution, ecology, and conservation status: It is distributed in Americas (GBIF, 2020). According to Flora do Brasil (2020 under construction), it does not occur in Brazil, but it was recently recorded for the first time in Atlantic Forest of Pernambuco (Lacerda, Rocha & Buriel, 2020) and in this study we confirm the occurrence also in Caatinga of the state. The genus is considered naturalized, since two species were recorded in São Paulo (Cavalcanti & Graham 2002). Therefore, this species was considered also naturalized, since it was found growing spontaneously in Atlantic Forest and Caatinga. *R. ramosior* is morphologically related to *Ammannia latifolia*, the differences between *R. ramosior* and *A. latifolia* were discussed under the comments of that species.

Phenology period: The material with flowers and fruits was collected from April to December.

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Legends

Figure 1 – a-c. *Ammannia auriculata* – a. flowering branches; b. leaf; c. flower. b, d-e. *A. latifolia* – b. leaf; d. flowering branches; e. flower. f-h. *Cuphea carthagenensis* – f. habit; g. indumentum; h. flower. i-l. *C. circaeoides* – i. flowering branches; j. indumentum; k. leaf; l. flower.

Figure 2 – a. *Ammannia latifolia* – flowering branches. b. *Cuphea carthagenensis* – flowering branches. c. *C. ericoides* – flowering branches. d-e. *C. flava* – d. habit; e. flower. f. *C. pulchra* – flowering branches. g. *Lafoensia glyptocarpa* – flowering branches. h. *Pleurophora anomala* – flowering branches.

Figure 3 – a-d. *Cuphea ericoides* – a. flowering branches; b. indumentum; c. leaf; d. flower. e-h. *C. flava* – e. flowering branches; f. indumentum; g. leaf; h. flower. i-l. *C. pulchra* – i. flowering branches; j. indumentum; k. leaf; l. flower. m-p. *C. racemosa* – m. flowering branches; n. indumentum; o. leaf; p. flower.

Figure 4 – a-c. *Lafoensia glyptocarpa* – a. flowering branches; b. leaf; c. flower. d-e. *Pleurophora anomala* – d. flowering branches; e. flower. f-g. *P. pulchra* – f. habit; g. flower. h-j. *Rotala ramosior* – h. flowering branches; i. leaf; j. flower.

Figure 5 – Distribution of species found in Pernambuco according to the biome.

Figures

Figure 1

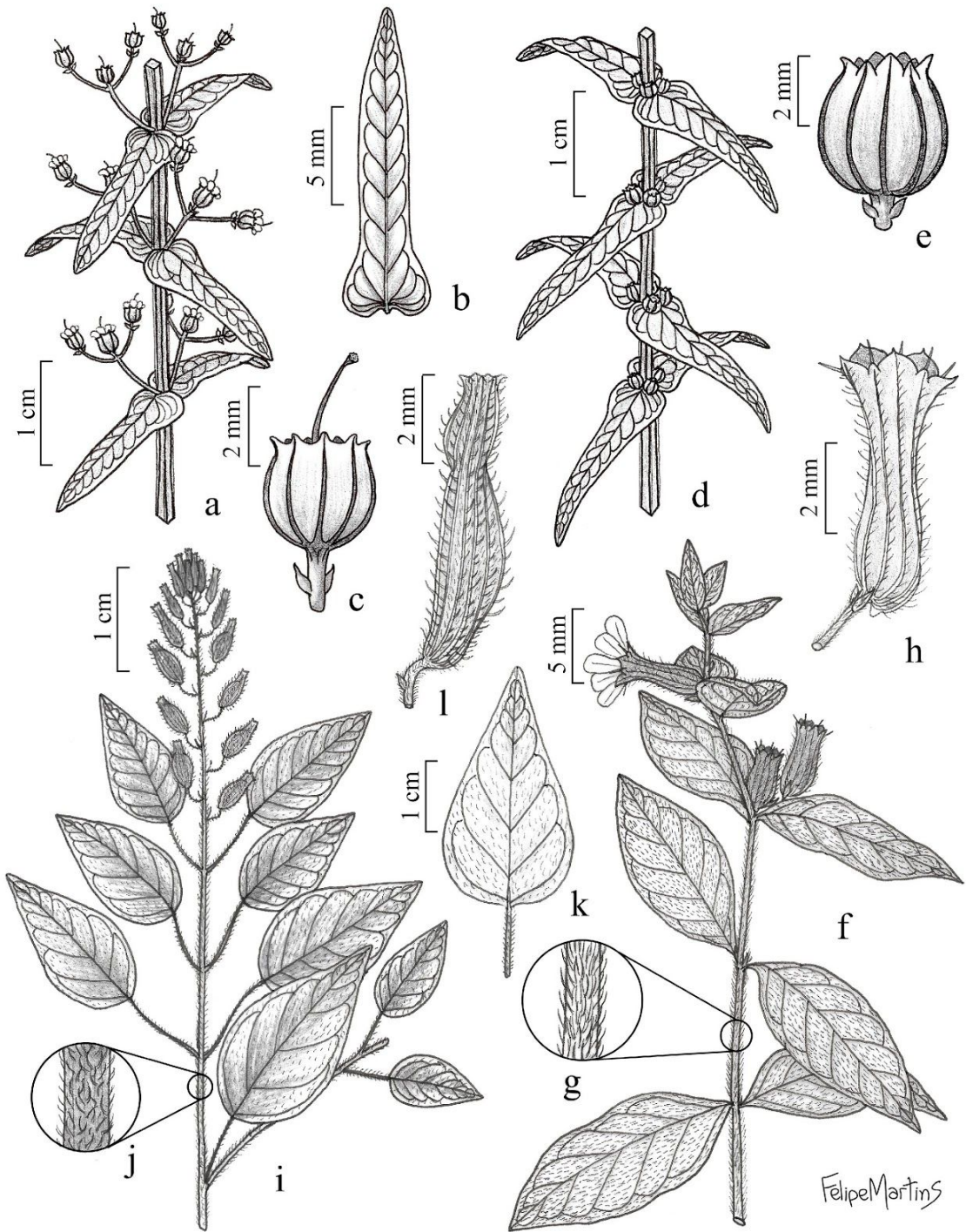


Figure 2

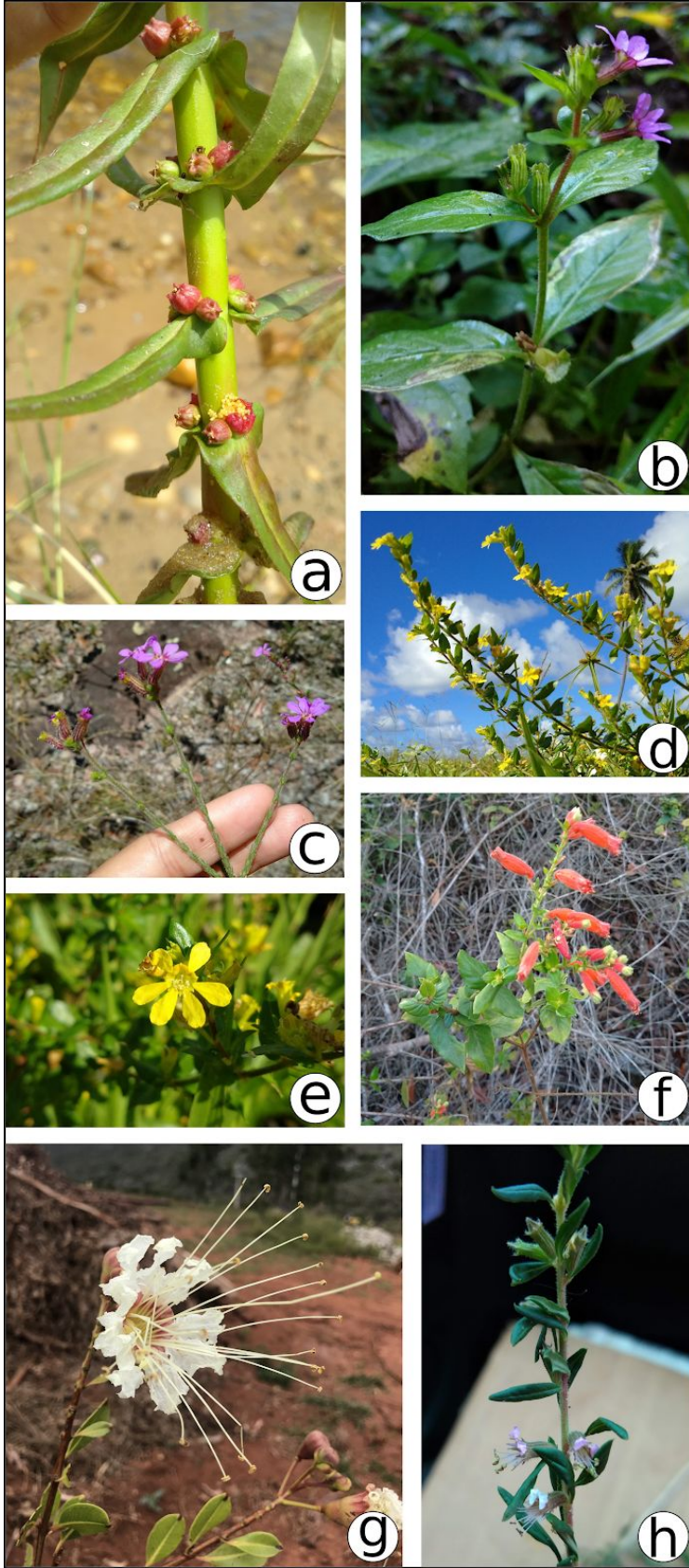


Figure 3

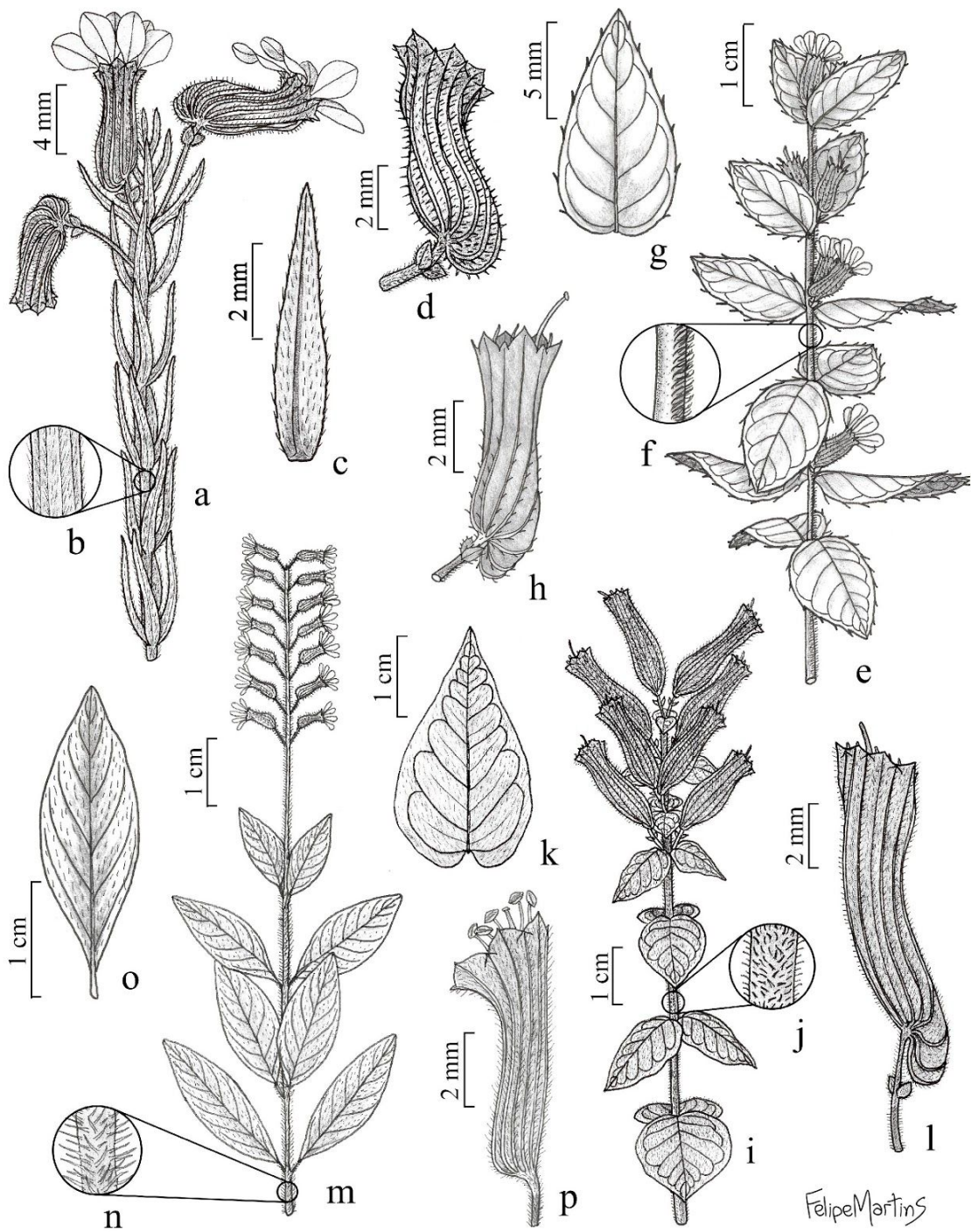


Figure 4

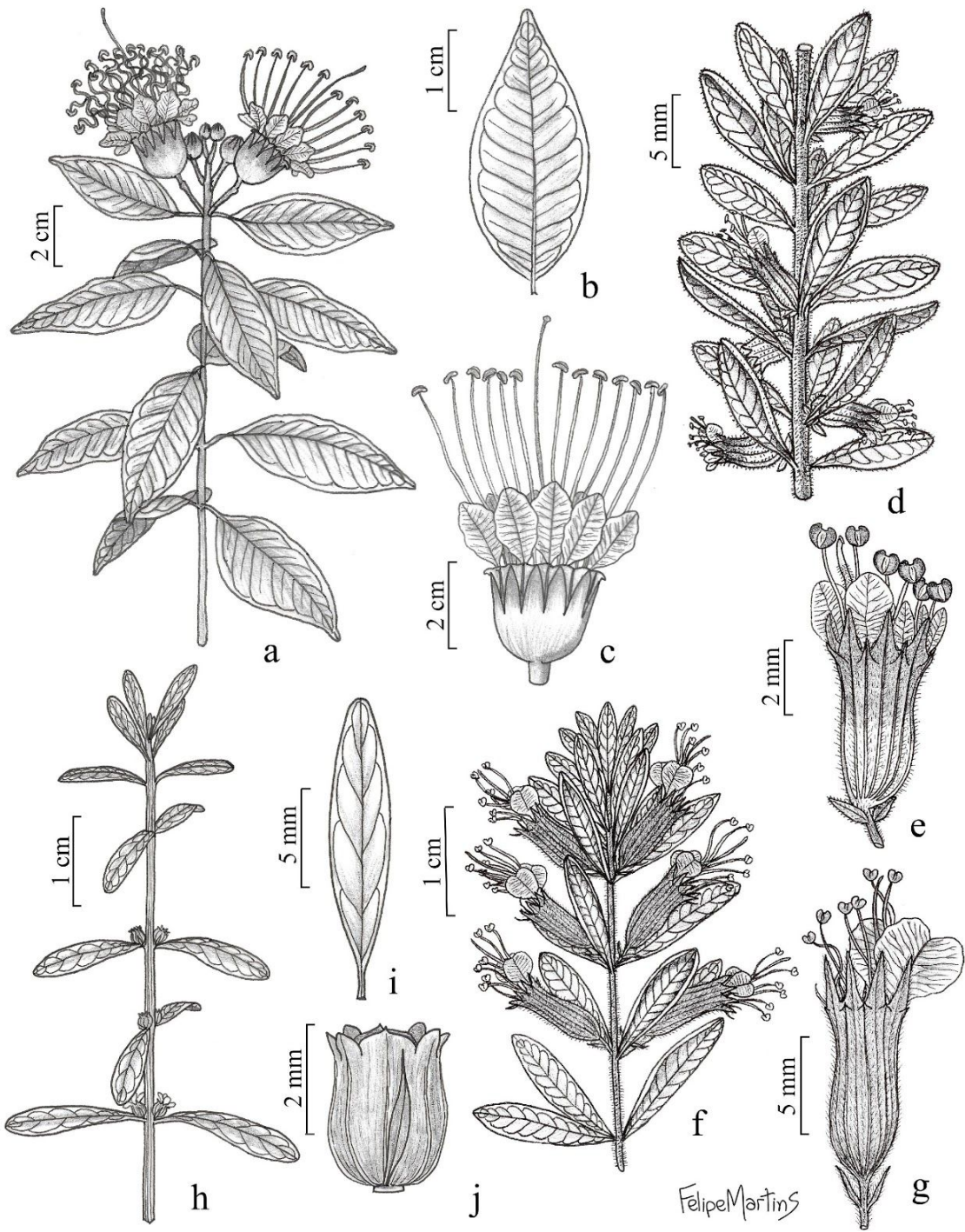
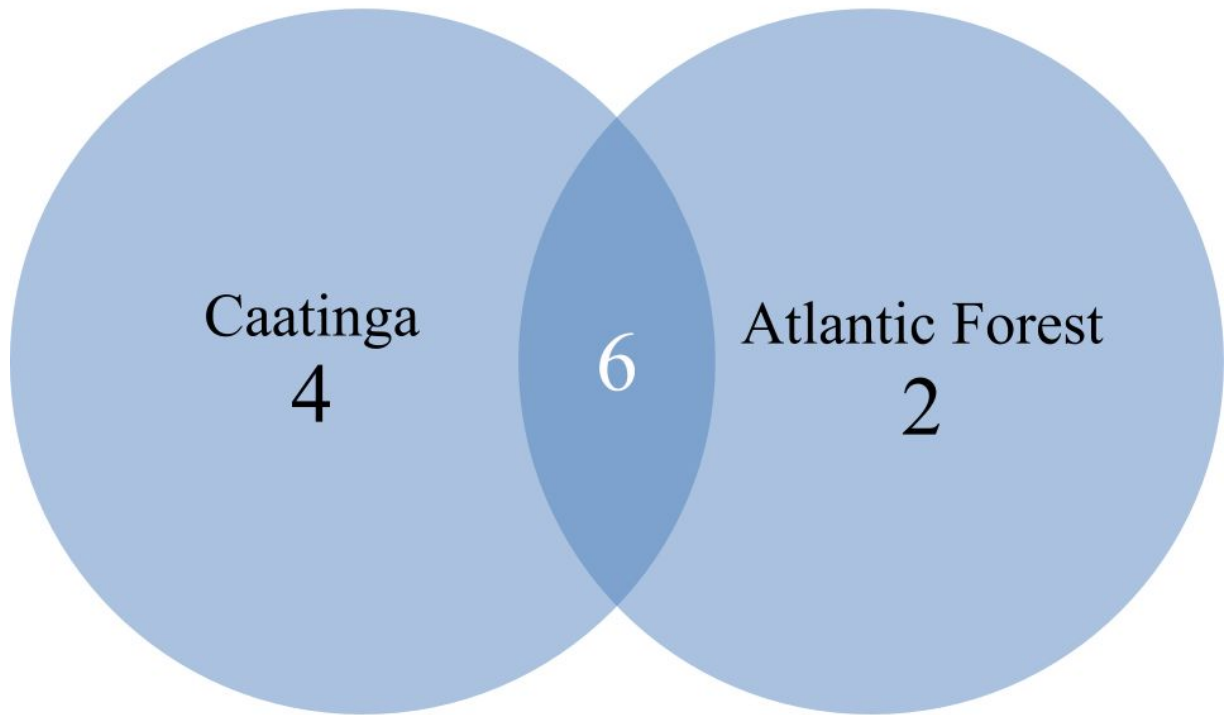


Figure 5



Tables**Table 1** – Table 1: Lythraceae species found in Pernambuco.

Species	Geographic distribution	Phytogeographical Domains	
		Caatinga	Atlantic Forest
<i>Ammannia auriculata</i> Willd.	Extra brazilian	X	X
<i>Ammannia latifolia</i> L.	Extra brazilian	X	X
<i>Cuphea carthagenensis</i> (Jacq.) J.F. Macbr.	Extra brazilian		X
<i>Cuphea circaeoides</i> Sm. ex Sims	Endemic in Brazil	X	X
<i>Cuphea ericoides</i> Cham. & Schltdl.	Endemic in Brazil	X	
<i>Cuphea flava</i> Spreng.	Endemic in Brazil		X
<i>Cuphea pulchra</i> Moric.	Endemic in Brazil	X	
<i>Cuphea racemosa</i> (L. f.) Spreng.	Extra brazilian	X	X
<i>Lafoensia glyptocarpa</i> Koehne	Endemic to the Northeast	X	
<i>Pleurophora anomala</i> (A. St.-Hil.) Koehne	Endemic in Brazil	X	X
<i>Pleurophora pulchra</i> J.A. Siqueira, V.M. Cotarelli, J.F.B. Pastore & T.B. Cavalcanti	Endemic in Pernambuco	X	
<i>Rotala ramosior</i> (L.) Koehne	Extra brazilian	X	X
Total: 12 species		10 species	8 species

Examined material

List of material examined

Academia Brasileira de Ciências 151 (4), 279 (10), 426 (4), 713 (10); **Alcântara, G. D.** 51 (5); **Alves-Araújo, A.** 1027 (12), 1037 (1), 1034 (10), 860 (6), 543 (12); **Alves, J.** 20 (8), 546 (8), 692 (6); **Alves, J. L. H.** s/n (6); **Alves, M.** s/n (8); **Andrade-Lima** 48-144 (6), 56-2589 (4), 61-3998 (5), 65-4287 (5), 65-4288 (5), 49-357 (9), 66-4884 (5), 68-5401 (9), 68-5439 (9), 585965 (1), 716487 (8), 716561 (5), 737489 (5), s/n (9), 718103 (5), 75-8124 (5), 80-8927 (2), 78-8530 (10), 78-8534 (10), 552066 (6), 552215 (2), 552245 (2), 7719 (6), 79-9190 (10), 79-9550 (8); **Andrade, I. M.** 57 (5); **Araújo, D.** 1687 (6), 848 (2), 878 (10), 884 (2); **Araújo, D. A.** 1687 (6); **Araújo, F.** 54 (4); **Araújo, M. J.** 13 (10); **Ataíde, M.** 27 (10); **Baracho, G. S.** 267 (5), 278 (9); **Barreto, R.** 12 (4); **Barros, I. C. L.** 132 (6), s/n (6); **Belo, D.** s/n (8); **Bocage, A.** 1155 (9), -73424 (9), -73382 (9); **Brito, Z.** 58 (10); **Campelo, C. R.** s/n (10); **Campelo, L.** 15 (5); **Cantarelli, J.** 449 (10), 595 (6); **Carvalho-Sobrinho, J. G.** 1905 (10), 2163 (4), 2245 (10), 2302 (4); **Carvalho, H.** 3868 (10); **Cavalcanti, D.** 278 (10), 279 (4), 146 (6), 601 (2); **Coelho, A.** s/n (6); **Coelho, M. M.** 51 (2), 67 (10), 103 (2), 194 (4); **Coelho, P.** s/n (6); **Cordeiro, W.** 726 (12), 439 (2), 145 (2), 261 (2), 174 (2), 303 (12), 62 (12), 58 (10), 99 (10); **Correia, M.** 269 (8), 273 (8); **Costa e Silva, M. B.** 2147 (10); **Costa, A. C. G.** 9 (5); **Costa, K. C.** 377 (4), 344 (4); **Cotarelli, V. M.** 860 (10), 1065 (11), 1552 (11), 1830 (11), 1831 (11), 1832 (11), 1833 (11), 1866 (10), 1967 (10), 1987 (10), 2017 (10), 2019 (2), 2112 (2), 2172 (11), 2312 (2), 2536 (2); **Cruz, J.** 11 (4); **Diniz, R. E. M.** 36 (10); **Duarte, R. F.** 41 (2); **Falcão, J. I. A.** 958 (6), 1005 (10); **Falcão, M.** 114 (6); **Félix, L. P.** s/n (9), 6640 (6), 7966 (2); **Ferrari, I. S.** 3 (2); **Ferrucci, M. S.** 1134 (6); **Filardi, F. L. R.** 914 (8), 916 (5); **Filho, J. B.** s/n (6); **Fonseca, A.S.S.** 37 (2); **Fontana, A. P.** 6080 (10), 6125 (10), 6259 (9), 6730 (10); **Fotius, G.** 3473 (10), 3462 (2), 3343 (10); **França, F.** 5243 (10); **Francisco, L. V.** 64 (1); **Freire, E.** 121 (8), 127 (8); **Gallindo, F.** 201 (6); **Gardner** 1001 (1), 1000 (2), s/n (4), 1002 (10), s/n (10), 1003 (6); **Giulietti, A.** s/n (10); **Giulietti, A. M.** 2127 (9), s/n (10); **Gomes de Lima, J. E.** 217 (8), 141 (4), 142 (10), 149 (10), 58 (6); **Gomes-Silva, F.** 589 (6); **Gomes, A. P. S.** 451 (8); **Gomes, M. L.** 200 (10); **Guedes, M. L.** 1685 (8); **Heringer, E. P.** s/n (4); **Jesus, M.** 3 (8); **Krause, L.** 170 (4); **Lacerda, T.** 38 (2), 25 (10), 28 (6), 30 (10), 32 (10); **Laurênio, A.** 959 (6), 583 (12), 1140 (10); **Leite, M. S.** 163 (2), 130 (12), 583 (2), 588 (8), 13 (8), 130 (2); **Lima, A.** s/n (4), s/n (12), 56-2589 (4), 57-2714 (8); **Lima, J. C.** -11788 (1); **Lima, J. L. S.** 4628 (10); **Lima, O.** 2007 (6); **Lima, R.** 732 (8), s/n (8); **Lima, V. C.** 1986 (10), 453 (9), 56 (8), 183 (4); **Lins e Silva, A. C. B.** 225 (4); **Lira, O. C.** s/n (10), 105 (9), s/n (4), 228 (10), s/n (10), s/n (6); **Lira, S. S.** 572 (6), 530 (6), 378 (6); **Locatelli, E.** s/n (8); **Lourteig, A.** 563 (6); **Lucena, M. F. A.** 1402 (10), 75 (8), 728 (6), 152 (6); **Luiz, J.** s/n (6); **Machado, I. C.** s/n (5); **Maciel-Júnior, L.** 272 (4); **Maciel, J. R.** 625 (2), 661 (10), 1317 (10), 59 (8); **Marcon, A. B.** 193 (8); **Mariz, G.** 3085 (6), 503 (6); **Marques, J. S.** 186 (6); **Melo, A. V.** 567 (8); **Melo, J. I. M.** 100 (8); **Melo, M. R. C. S.** 47 (8), 201 (8), 109 (8), 9 (10), 169 (8); **Menezes, T. G. C.** 137 (10), 75 (10); **Miranda, A. M.** 2037 (6), 1932 (10), 6081 (1), 2768 (10), 3558 (2), 2800 (9), 2673 (10), 2670 (12), 2259 (10), 1786 (5), s/n (9), 576 (6), 2222 (4); **Moura, A.C. A.** 301 (9); **Moura, F.** 301 (9); **Nádia, T. C. L.** s/n (6); **Nascimento, L. M.** 313 (5), 359 (5), 435 (8); **Nascimento, R. M.** 2 (4); **Oliveira, A. C. P.**

2473 (10), 2909 (4), 3137 (10); **Oliveira, C. R. S.** 176 (5), 207 (5), 331 (5); **Oliveira, L. B.** 21 (4); **Oliveira, M.** 268 (6), 288 (8), 536 (6), 5355 (12), 5646 (10), 5656 (10), 5689 (4), 3580 (9), 3691 (3), 3692 (9), 3789 (10), 3874 (10), 3939 (4), 4274 (4), 4414 (10), 4827 (10), 250 (3), 5143 (8); **Pereira, R.** 2110 (5), 2806 (10), 327 (6), s/n (8), 358 (6), s/n (9), 1125 (9); **Pessoa, L. M.** 232 (10); **Pessoa, M. C.** 163 (10); **Pick, R. A.** 220 (5), 1221 (5); **Pickel, B.** 568 (2), 2788 (2), 20 (6), 3327 (6), 542 (10), 3575 (4), 1949 (6), 965 (4), 792 (6); **Pontual, I.** 338 (5), 68-834 (6), 1669 (5); **Pontual, I. B.** 1332 (8); **Primo, L. M.** s/n (6); **R. L.** 18 (2); **Ramos, T.** 27 (10); **Rocha, E. A.** 1496 (5); **Rodal, M. J. N.** 210 (8), 695 (8), 620 (8); **Rodrigues-Lima, L.** 46 (10); **Rodrigues, E.** 47 (8), 20 (8); **S/C** s/n (9); **Sacramento, A.** 73 (6), 370 (6), 81 (6), 402 (6), 31 (6), 136 (6), 193 (6); **Sales, M.** 2011 (5), 232 (8), 1080 (10); **Santos, A. P. B.** 20 (10), 32 (10); **Santos, E. A.** 4 (8); **Santos, L. L.** 355 (10); **Santos, V.** 36 (6); **Sevilha, A. C.** 2478 (6), 2399 (3); **Silva, A. M.** 16 (8); **Silva, E. I.** 31 (8); **Silva, L. B.** 108 (12), 23 (2); **Silva, L. R.** 445 (6); **Silva, M. J.** 493 (5); **Silva, S. I.** 255 (8); **Silva, V. C.** 18 (5); **Silva, V. D.** 46 (10), 11 (12); **Siqueira Filho, J. A.** 267 (5), 2529 (10), 2554 (2), 492 (8), 2696 (5), 3414 (5), 2253 (12); **Soares, C. M. C.** 115 (8); **Sobral-Leite, M.** 130 (12), 446 (12), 484 (10), 510 (12), 1011 (12), 1181 (12), 1190 (8), 588 (8), 797 (12), 483 (2), 1200 (2), 1149 (2), 1153 (2), 583 (2), 880 (2); **Sousa, L. G.** 59 (10); **Souza, E.** 41 (10), 53 (2); **Souza, E. B.** 60 (3); **Souza, M.** s/n (6); **Souza, S. A. O.** 2394 (4); **Tadeu, J.** s/n (6); **Tavares, S.** 20 (6), 37 (6), 606 (3), 751 (3); **Tenório, E.** 52 (8); **Tonizza, M. C.** s/n (1), s/n (2); **Vicente, A.** 11 (6); **Villarouco, F. M. O.** 65 (8), 188 (8); **Xavier, L. P.** JPB2055 (10), JPB295 (6), JPB381 (10).

CONSIDERAÇÕES FINAIS

Nesse estudo, verificamos que a riqueza de Lythraceae para o estado de Pernambuco estava superestimada, sendo citadas 16 espécies, de acordo com dados referente a sua riqueza na flora brasileira, e aqui identificadas 12, distribuídas entre os gêneros *Ammannia* L., *Cuphea* P. Br., *Lafoensia* Vand., *Pleurophora* D. Don. e *Rotala* L.. O gênero mais representativo na área de estudo foi *Cuphea*. As espécies com maior ocorrência na área foram: *A. latifolia* L., *C. flava* Spreng. and *P. anomala* Koehne.

Dentre as espécies encontradas, sete são endêmicas do país, com *L. glyptocarpa* Koehne ocorrendo apenas nos estados da Bahia e Pernambuco e *P. pulchra* J.C. Siqueira, Cotarelli, J.F.B. Pastore & T.B. Cavalc. considerada rara por apresentar distribuição restrita à Caatinga de Pernambuco e poucos exemplares nas coleções dos herbários. Levantamentos prévios da família para a área de estudo, indicavam a ocorrência de quatro gêneros e 16 espécies, dessas, cinco não foram encontradas e, portanto, não incluídas nesse estudo. O motivo pelo qual essas espécies estão citadas para a área de estudo em banco de dados *online* e listagens florísticas é a interpretação taxonômica equivocada da delimitação desses táxons. Por outro lado, foi encontrado um novo registro para o Brasil, *R. ramosior* (L.) Koehne, ocorrendo nos biomas Mata Atlântica e Caatinga.

Os principais caracteres morfológicos considerados para a identificação das espécies foram: indumento do ramo; inserção e filotaxia da folha, forma, base e ápice da lâmina, tipo de indumento e venação; tipo e posição da inflorescência, presença ou ausência de bractéolas; ausência ou presença do cálcio, bem como a forma dessa estrutura; ausência ou presença de pétalas, assim como cor e tamanho das mesmas. Em Pernambuco, a maioria das espécies (10) são registradas na Caatinga (*vs.* oito na Mata Atlântica), ao contrário do que ocorre no Brasil quando comparado os mesmos biomas, onde são encontradas 50 na Mata Atlântica e 32 na Caatinga, o que pode ser justificado pelo percentual (80%) de área total ocupada pela Caatinga no estado.

Apesar da representatividade de Lythraceae para o Nordeste brasileiro, ainda há uma carência de estudos taxonômicos sobre a família na região, o que compromete o conhecimento da riqueza e distribuição geográfica de suas espécies. Esse trabalho teve como objetivo realizar o estudo taxonômico das espécies de Lythraceae ocorrentes em Pernambuco (Brasil). Resultados dessas pesquisas fornecem subsídios para a compreensão da importância ecológica

dessas espécies, além de contribuir para diminuir o impedimento taxonômico e servir como base para estudos futuros de evolução, ecologia e conservação da flora brasileira.

NORMAS DAS REVISTAS

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Rodriguésia – <https://rodriguesia.jbrj.gov.br>

MATERIAL SUPPLEMENTAR

**FLORA OF USINA SÃO JOSÉ, IGARASSU, PERNAMBUCO (BRAZIL):
LYTHRACEAE J. ST.-HIL. AND ONAGRACEAE JUSS.
TAINÁ LACERDA, AMANDA ROCHA & MARIA TERESA BURIL**

Publicado pelo periódico *Acta Brasiliensis*

Flora of Usina São José, Igarassu, Pernambuco (Brazil): Lythraceae J. St.-Hil. and Onagraceae Juss.

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Abstract

Lythraceae comprises about 30 genera and 600 species widely distributed in tropical and subtropical regions, while Onagraceae comprises 22 genera and about 660 species distributed in temperate and subtropical areas, predominantly in Americas. The aim of this work was to realize the taxonomic study of Lythraceae and Onagraceae species from Usina São José, Igarassu, Pernambuco (Brazil), an Atlantic forest remnant. Fieldworks and visits to herbaria HST, HUEFS, IPA, JPB, PEUFR and UFP were conducted between 2018 and 2019. Three Lythraceae species were recognized: *Cuphea carthagenensis* (Jacq.) J.F. Macbr., *C. flava* Spreng. and *Rotala ramosior* (L.) Koehne, and three Onagraceae species: *Ludwigia erecta* (L.) H. Hara, *L. hyssopifolia* (G. Don) Exell and *L. octovalvis* (Jacq.) P.H. Raven. *Rotala ramosior* is a new record for Brazil. Morphological descriptions, an identification key, phenological period, geographic distribution, taxonomic notes, photographs and illustrations of diagnostic characters are presented herein. The relevant morphological characters for species identification are phyllotaxy, indumentum of stems, shape and indumentum of leaves, petals color and apex, capsule shape, seeds arrangement and raphe size.

Keywords: Atlantic Forest, diversity, flora do brasil, myrtales, taxonomy.

Flora da Usina São José, Igarassu, Pernambuco (Brasil): Lythraceae J. St.-Hil. e Onagraceae Juss.

Resumo

Lythraceae apresenta cerca de 30 gêneros e 600 espécies amplamente distribuídas nas regiões tropicais e subtropicais, enquanto Onagraceae compreende 22 gêneros e cerca de 660 espécies distribuídas nas regiões temperadas e subtropicais, predominantemente nas Américas. Este trabalho teve como objetivo realizar o estudo taxonômico das espécies de Lythraceae e Onagraceae ocorrentes na Usina São José, Igarassu, Pernambuco (Brasil), um remanescente de Mata Atlântica. Para isso, foram realizadas expedições de campo e visitas aos herbários HST, HUEFS, IPA, JPB, PEUFR e UFP entre 2018 e 2019. Foram reconhecidas três espécies de Lythraceae: *Cuphea carthagenensis* (Jacq.) J.F. Macbr., *C. flava* Spreng. e *Rotala ramosior* (L.) Koehne, e três espécies de Onagraceae: *Ludwigia erecta* (L.) H. Hara, *L. hyssopifolia* (G. Don) Exell e *L. octovalvis* (Jacq.) P.H. Raven. *Rotala ramosior* é um novo registro para a flora do Brasil. Descrições morfológicas, uma chave de identificação, período fenológico, distribuição geográfica, notas taxonômicas, pranchas de fotografias e ilustrações dos caracteres diagnósticos são apresentadas. Os caracteres morfológicos relevantes para a identificação das espécies são filotaxia, indumento dos ramos, forma e indumento das folhas e cor e ápice das pétalas, forma da cápsula, arranjo das sementes e tamanho da rafe.

Palavras-chave: Mata atlântica, diversidade, flora do brasil, myrtales, taxonomia.

Introduction

Myrtales is comprised in Malvidae clade with nine families, including Lythraceae J. St.-Hil. and Onagraceae Juss. that constitute one of the largest clades within the order (Stevens, 2001 onwards; Graham, 2007). Both families present leaves simple, margin entire and frequently opposite, flowers generally hermaphrodite and actinomorphic (Judd, Campbell, Kellogg, Stevens & Donoghue, 2009).

Lythraceae is widely distributed in tropical and subtropical

regions, with few records of herbaceous species occurring in temperate regions (Cavalcanti, 2007). The family comprises about 30 genera and 600 species (Graham & Graham, 2014). In Brazil, 11 genera and 216 species are recognized, predominantly distributed in Cerrado and Atlantic Forest areas, where 160 species are endemic. *Cuphea* P. Browne is the most representative genus with 108 species, where 70 are endemic. According to Flora do Brasil (2020, under construction), seven genera and 57 species can be found in

the Northeast region.

They occur in several different environments and phytogeographical domains, including swamps, dunes, humid tropical forests but more frequently in Cerrado, arid and rocky fields. Are represented by trees, shrubs, or rarely herbs, with simple leaves, commonly decussate, margins entire; inflorescence a raceme or a cyme; flowers bisexual, diclamide, rarely monoclamiide, actinomorphic, rare zygomorphic, floral tube persistent, petals 4–16, dialipetals, curly; fruit capsule (Cavalcanti & Graham, 2002). A family representative popularly known as pomegranate, *Punica granatum* L., is used as food and medicinal.

Onagraceae comprises about 660 species and 22 genera distributed in temperate and subtropical areas, predominantly in Americas (Wagner, Hoch & Raven, 2007). In Brazil, the family is recorded with 62 species and four genera, occurring mainly in Atlantic Forest areas, where 18 species are endemic. *Ludwigia* L. is the most representative genus with 45 species known, being 10 endemic. According to Flora do Brasil (2020, under construction), two genera and 18 species can be found in the Northeast region.

Onagraceae representatives can be found mostly in swamp areas, but also associated to high altitudes and coastal regions (Micheli, 1872). They can be herbs or trees, easily recognized by the petals 4 (occasionally 5-7 or 2), often with floral tube, ovary inferior, stamens usually the double of the petals number and positioned in two series, epipetals shorter than episepals and pollen connected by viscin (Munz, 1947; Raven, 1963). The family is widely used as ornamental, because of the beautiful flowers, especially the species of *Clarkia* L., *Fuchsia* L. and *Oenothera* L. (Judd et al., 2009).

In Brazil, the taxonomic treatments focusing Lythraceae are most significant in the Midwest and Southeast regions (Cavalcanti, 1990; Cavalcanti & Graham, 2002; Cavalcanti, 2004), while Onagraceae ones were made from South and Southeast regions (Duarte & Esteves, 2001; Grillo & Giulietti, 2004; Pesamosca, 2015).

In the Atlantic Forest of Pernambuco, the families were recorded in floristic inventories with one species (Zickel et al., 2007; Almeida Jr., Pimentel & Zickel, 2008; Almeida Jr., Olivo, Araújo & Zickel, 2009; Melo, Amorim, Pessoa, Maciel & Alves, 2016). In addition to the work by Melo et al. (2011) that recognized four Lythraceae and none Onagraceae species in the Usina São José.

The Usina São José is located in Atlantic Forest domain and presents forestry fragments that suffer anthropic actions due to the cane plantations that surround them, resulting in implications for conservation (Trindade, Lins-e-Silva, Silva, Figueira & Schessl, 2008). This study aim to provide the taxonomic treatment of Lythraceae and Onagraceae from Usina São José (USJ), increasing the knowledge about the families in Atlantic Forest in the north of São Francisco River.

Material and methods

Study area

The Usina São José is situated in Zona da Mata Norte region, situated in the municipalities of Igarassu, Goiânia,

Itaquitinga, Itapissuma, Abreu e Lima and Araçoiaba, with it greater territorial extension located in Igarassu, among the coordinates 7°40'21,25''–7°55'50,92''S, 34°54'14,25''–35°05'21,08''W, about 30 km from Recife, Pernambuco. USJ occupies a total area of 280 km² of Atlantic Forest domain and presents about 110 forestry fragments which vary from 20 to 400 ha, surrounded by sugar cane plantations (Trindade et al. 2008), which five are represented in this study, Chave fragment, Mata dos Macacos, Mata de Piedade, Mata de Santa Helena and Mata da Zambana, the largest ones.

Material collect

Fieldworks were conducted in the study area between July 2018 and July 2019, however, we did not find any Lythraceae and Onagraceae individuals. The selected areas for the fieldworks included the areas considered priority according to their extension. Six herbaria were visited: HST, HUEFS, IPA, JPB, PEUFR and UFP (herbarium acronyms follow Thiers, continuously updated), totalizing 24 analyzed specimens of Lythraceae and eight of Onagraceae.

Morphological analysis

We identified the species based on comparisons to species previously identified by specialist, to *typus* materials and specialized bibliography (Lythraceae: Graham, 1975; Cavalcanti & Graham, 2002; Graham, 2017; Flora do Brasil 2020, under construction; Onagraceae: Micheli, 1872; Munz, 1947; Raven, 1963; Zardini & Raven, 1997; Goldblatt & Raven, 1997; Grillo & Giulietti, 1998, 2004; Wagner et al., 2007). We also consulted the *online* collections from Virtual Herbarium REFLORE (Brazil), Missouri Botanical Garden (MO) and The New York Botanical Garden (NY). Morphological terminology for vegetative and reproductive structures followed mostly Gonçalves & Lorenzi (2011), but seeds shape follows Harris & Harris (2001) for Lythraceae, and for Onagraceae followed mostly Harris & Harris (2001), but stigma shape follows Radford, Dickison, Massey & Bell (1974) and leaves shape follows Rizzini (1977). An identification key, phenological state information, geographic distribution, taxonomic notes, photographs and illustrations are provided.

Results and Discussion

In Usina São José we identified two genera, *Cuphea* and *Rotala*, and three species of Lythraceae and one genus, *Ludwigia*, and three species of Onagraceae. *Rotala ramosior* (L.) Koehne is a new record for Brazil (Flora do Brasil 2020, under construction). Besides that, *Cuphea carthagenensis* (Jacq.) J.F. Macbr. and *C. flava* Spreng. were identified in the study area. According with Melo et al. (2011), four species of Lythraceae and none of Onagraceae are listed to USJ. Specimens identified as *C. calophylla* Cham. & Schltldl., *C. campestris* Koehne and *C. micrantha* Kunth in this list, were misidentified and herein updated to *C. carthagenensis* (Jacq.) J.F. Macbr.

Taxonomic treatment

Identification key for Lythraceae and Onagraceae species from Usina São José, Igarassu, Pernambuco:

1. Leaves decussate. Petals white, yellow or rose to purple Lythraceae
 2. Stems glabrous. Leaves sessile, glabrous on both faces 3. *Rotala ramosior*
 - 2'. Stems pubescent. Leaves sessile or petiolate, glabrous or pilose.
 3. Leaves ovate, base subcordate. Floral tube green and petals yellow 2. *Cuphea flava*
- 3'. Leaves elliptic, base cuneate. Floral tube purple and petals rose to purple 1. *C. carthagenensis*
- 1'. Leaves alternate. Petals yellow Onagraceae
 4. Capsule with seeds plurisseriate in the superior and unisseriate in the inferior region 5. *Ludwigia hyssopifolia*
 - 4'. Capsule with seeds plurisseriate in all regions.
 5. Petals apex rounded. Capsule linear-oblong, 4-angulate. Seeds with raphe narrower than the body of the seed 4. *L. erecta*
 - 5'. Petals apex emargined. Capsule cylindrical, 8-ribbed. Seeds with raphe inflated equal in size to the body of the seed 6. *L. octovalvis*

Relevant morphological characters for species identification are phyllotaxy, indumentum of stems, shape and indumentum of leaves, petals color and apex, capsule shape, seeds arrangement and raphe size.

Lythraceae J. St.-Hil.

Herbs or shrubs, stems glabrous or pubescent. Leaves decussate, sessile or petiolate, elliptic, narrow-elliptic or ovate, base cuneate, decurrent or subcordate, apex cuneate or obtuse, glabrous, glabrescent, pubescent or pilose. Flowers solitary or raceme, bracteoles linear, narrow-triangular or ovate, glabrous, pubescent or pilose. Floral tube persistent, tubular or urceolate, plicate, glabrous or pubescent, spur absent or present, descending. Petals white, yellow or rose to purple. Stamens 4 or 11, included or exserted, vesicles absent or 5. Style included or exserted. Capsule cylindrical or globose. Seeds concavo-convex or globose.

In Brazil are recognized 11 genera and in Usina São José occurs two, *Cuphea* and *Rotala*.

Cuphea P. Browne, Civ. Nat. Hist. Jamaica 216–217. 1756.

Herbs or shrubs, stems pubescent. Leaves sessile or petiolate, blade elliptic or ovate, base cuneate or subcordate, apex cuneate, glabrous, glabrescent, pubescent or pilose. Flowers solitary or raceme, pedicel pubescent, trichomes simple, hyaline, bracteoles ca. 1 mm long, narrow-triangular or ovate, pubescent or pilose on the margin, trichomes simple, hyaline. Floral tube green or purple, tubular, appendages of size nearly half of the calyx lobes, trichome simple, hyaline, spur present, descending. Petals 6, yellow or rose to purple, elliptic or obovate, base cuneate, apex cuneate or rounded. Stamens 11, included or exserted, vesicles absent or 5. Style included or exserted. Capsule cylindrical. Seeds ca. 2 x 2 mm, globose.

Cuphea is the most representative genus of Lythraceae with about 250 species, and is endemic from Americas, occurring primarily in the tropics and subtropics (Graham, 2017). In Usina São José occurs two species, *C. carthagenensis* (Jacq.) J.F. Macbr. and *C. flava* Spreng.

1. Cuphea carthagenensis (Jacq.) J.F. Macbr., Publ. Field

Mus. Nat. Hist., Bot. Ser. 8(2): 124. 1930. (Figure 1a-d)

Basionym: *Lythrum carthagenense* Jacq., Enum. Syst. Pl. 22. 1760.

Herbs or shrubs, 10–50 cm tall, stems pubescent, trichomes simple, hyaline. Leaves petiolate, petioles 0.5–2 mm long, blade 0.8–3.7 × 0.3–1.5 cm, elliptic, base cuneate, pubescent on both faces, trichomes simple, hyaline. Raceme, pedicel 1–3 mm long, bracteoles narrow-triangular, pubescent on the margins, inserted at the superior third of the pedicel. Floral tube 5–6 mm long, purple, calyx lobes ca. 0.5 mm long, apex cuneate, outer surface pubescent, trichomes simple or glandular, hyaline to yellowish, inner surface pubescent above and glabrescent below stamen insertion, trichomes simple or glandular, hyaline to whitish. Petals rose to purple, 2 petals ca. 3 × 2 mm, 4 petals ca. 3 × 1 mm, elliptic, apex cuneate. Stamens 2 shorter, 9 longer, included, vesicles 5. Style ca. 1.5 mm long, included.

At the study area, *C. carthagenensis* was collected with flowers and fruits between February and November. According to Graham (2017), this is the most widely distributed species of the genus, occurring from United States to Argentina. In USJ, it was found in the edge of Mata dos Macacos and Mata de Piedade. It can be distinguished from *C. flava* by the indumentum only on one side of the stems and pedicel (vs. on whole surface), leaves elliptical, base cuneate (vs. leaves ovate, base subcordate) and petals rose to purple (vs. yellow).

Examined material: Brazil. Pernambuco: Igarassu, Usina São José, 23 Aug 1997, fl. fr., A. S. Luz s.n. (HST!, IPA!, ALCB); Mata do Engenho Piedade, 16 Oct 2002, fl. fr., G. J. Bezerra & M. J. Silva 37 (PEUFR!); Mata do Engenho Piedade, 16 Oct 2002, fl. fr., G. J. Bezerra & M. J. Silva 59 (PEUFR!); Mata do Engenho Piedade, 24 Apr 2003, fl. fr., A. Melquíades & G. J. Bezerra 180 (PEUFR!, UFP!); Mata de Piedade, 29 Jul 2007, fl. fr., D. Araújo et al. 378 (UFP!, IPA!); Mata dos Macacos, 15 Aug 2007, fl. fr., D. Araújo et al. 417 (IPA!, UFP!); Mata de Piedade, 05 Nov 2007, fl. fr., N. A. Albuquerque et al. 477 (IPA!); Mata de Piedade, 06 May 2008, fl. fr., J. Irapuan 25 (UFP!, IPA!); Mata de Piedade, 07 Feb 2009, fl. fr., E. Pessoa 66 (UFP!, MAC!); Mata de Piedade, 27 Jul 2010, fl. fr., J. L. Viana & S. O. Santos 16 (JPB!); Mata de Piedade, 08 Oct 2013, fl. fr., R. Barbosa et al. 2 (UFP!).

2. *Cuphea flava* Spreng., *Novi Provent.* 14. 1818. (Figure 1e-h)

Herbs or shrubs, ca. 40 cm tall, stems pubescent, trichomes simple, hyaline, yellowish to purplish. Leaves sessile or short petiolate, petioles 0–0.5 mm long, blade 0.5–1.2 × 0.2–0.5 cm, ovate, base subcordate, pilose on the margin, glabrous or glabrescent on the veins and glabrous on both faces, trichomes simple, hyaline to yellowish. Flowers solitary, pedicel 3–4 mm long, bracteoles ovate, pilose on the margin, inserted at the middle third of the pedicel. Floral tube ca. 8 mm long, green, calyx lobes ca. 1 mm long, apex acute, outer surface pubescent, trichomes simple, hyaline to yellowish, inner surface pilose above stamen insertion and pubescent at the base of the ovary, trichomes simple, hyaline to whitish. Petals yellow, 2 petals ca. 4 × 2 mm, 4 petals ca. 3 × 1 mm, obovate, apex rounded. Stamens 2 shorter, included, 9 longer, included or exerted, vesicles absent. Style ca. 5 mm long, exerted.

It was collected at USJ with flowers and fruits in February and July. This species is endemic from Brazil, occurring from Rio Grande do Norte to Rio de Janeiro (Flora do Brasil, 2020 under construction). At the study area was found in the inland of Mata dos Macacos and in the edge of Mata da Zambana. The differences between *C. flava* and *C. carthagenensis* were discussed under the comments of that species.

Examined material: Brazil. Pernambuco: Igarassu, Usina São José, Mata dos Macacos, 06 Jul 2007, fl., *J. S. Marques & N. A. Albuquerque 186* (IPA!); Mata da Zambana, 14 Feb 2008, fl. fr., *A. Alves-Araújo & J. S. Marques 860* (UFP!).

Rotala L., *Mant. Pl.* 2: 143–144, 175. 1771.

Rotala is represented by about 45 species predominantly from Africa and Asia, besides few species from Americas (Cook, 1979). In Usina São José occurs only one species.

3. *Rotala ramosior* (L.) Koehne, *Fl. Bras.* 13(2): 194. 1877. (Figure 1i-l)

Basionym: *Ammannia ramosior* L., *Sp. Pl.* 1: 120. 1753.

Herbs, ca. 20 cm tall, stems glabrous. Leaves sessile, blade 0.4–1.6 × 0.1–0.4 cm, narrow-elliptic, base decurrent, apex obtuse, glabrous on both faces. Flowers solitary, sessile or short pedicellate, pedicel 0–0.5 mm long, glabrous, bracteoles 2–3 mm long, linear, glabrous, inserted at the base of the floral tube. Floral tube 2–3 mm long, colour not seen, urceolate, calyx lobes ca. 0.5 mm long, apex cuneate, appendages of size nearly equal to the calyx lobes, glabrous, spur absent, outer and inner surfaces glabrous. Petals white not seen. Stamens 4, each pair is positioned at a different level, included, vesicles absent. Style ca. 0.5 mm long, included. Capsule globose. Seeds ca. 0.5 × 0.5 mm, concavo-convex.

Rotala ramosior was collected with flowers and fruits in September at USJ. This species is distributed in Americas (GBIF, 2019), but according to Flora do Brasil (2020, under construction), it does not occur in Brazil. The genus was considered naturalized, since two species were recorded in São Paulo (Cavalcanti & Graham, 2002). Therefore, we considered this species also naturalized in Brazil, since it was found growing spontaneously in Mata da Zambana, on the edge of sugar cane plantation. *Rotala ramosior* is distinguished easily

from *Cuphea* species by being completely glabrous, with petals white.

Examined material: Brazil. Pernambuco: Igarassu, Usina São José, Mata da Zambana, 04 Sep 2007, fl. fr., *A. Alves-Araújo et al. 543* (UFP!).

Onagraceae Juss.

Herbs, stems glabrous, glabrescent, pubescent or strigose. Leaves alternate, sessile or short petiolate, elliptic, linear-lanceolate or lanceolate, base acute or decurrent, apex acute or attenuate, glabrous, glabrescent, pubescent or strigose. Flowers solitary, sessile. Hypanthium persistent. Sepals green, lanceolate or ovate, apex acute, glabrous, pubescent, hirsute or strigose. Petals 4, yellow. Capsule cylindrical, linear or linear-oblong, 4-locular, glabrous, glabrescent, pubescent or strigose. Seeds smaller than 1 mm long.

In Brazil are recorded four genera and in Usina São José occurs one, *Ludwigia*.

Ludwigia L., *Sp. Pl.* 1: 118. 1753.

The vegetative structures of *Ludwigia* are inconsistent for identification, since the species present phenotypic plasticity according to the environment where they are inserted (Zardini, Peng & Hoch, 1991). The genus is pantropical and the most representative of Onagraceae with about 83 species (Raven, 1963; Wagner et al., 2007). In Brazil Northeast are recorded 17 species in the different vegetation types (Flora do Brasil 2020, under construction). In Usina São José occurs three species, *L. erecta* (L.) H. Hara, *L. hyssopifolia* (G. Don) Exell and *L. octovalvis* (Jacq.) P.H. Raven.

4. *Ludwigia erecta* (L.) H. Hara, *J. Jap. Bot.* 28(10): 292. 1953. (Figure 2a-d)

Basionym: *Jussiaea erecta* L., *Sp. Pl.* 1: 388. 1753.

Herbs, stems strigose. Leaves sessile, blade 3.5–5.0 × 0.8–0.11 cm, elliptic or lanceolate, base decurrent, apex acute, margin and nerves of abaxial face strigose. Hypanthium ca. 8 mm long. Sepals 4 × 2 mm, lanceolate, outer face strigose. Petals 2 × 1 mm, obovate, apex rounded. Style ca. 1 mm long, stigma capitate. Stamens 8. Nectariferous disk flat. Capsule ca. 15 mm long, linear-oblong, 4-angulate, strigose. Seeds plurisseriesiate in all regions and not embedded in endocarp, raphe narrower than the body of the seed.

It was collected at USJ with flowers and fruits in January. This species is widely distributed in the Neotropics, occurring from Florida to Brazil (Goldblatt & Raven 1997). At the study area was found on the edge of Mata de Santa Helena. It can be identified by the petals with apex rounded, capsule linear-oblong, 4-angulate and seeds plurisseriesiate in all regions not embedded in endocarp.

Examined material: BRAZIL. Pernambuco: Igarassu, Usina São José, Mata de Santa Helena, 28 Jan 2009, fl. fr., *E. Pessoa & T. Arruda 39* (UFP!).

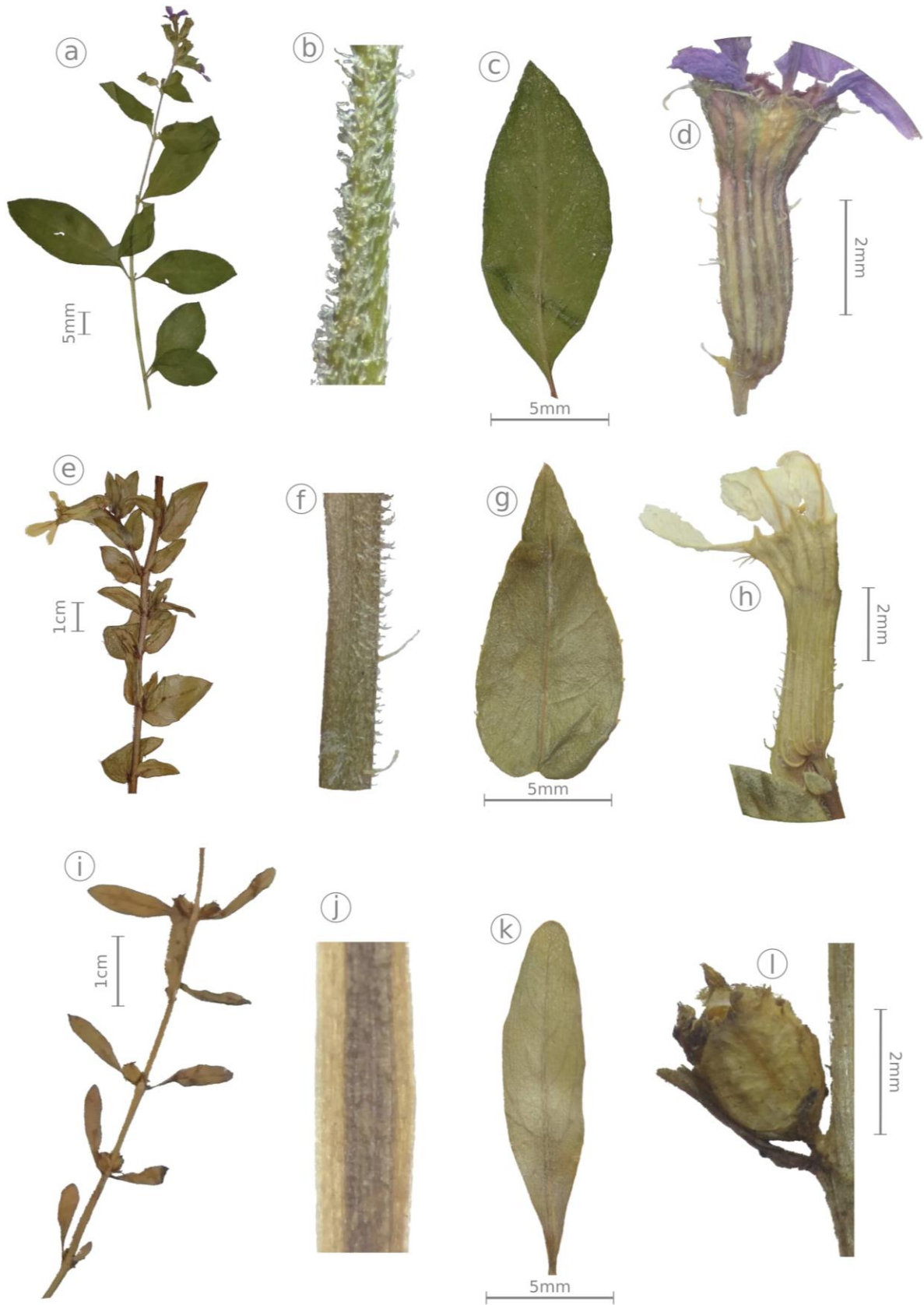


Figure 1. *Cuphea carthagenensis* a. Flowering stems. b. Indumentum of the stems. c. Leaf. d. Flower. *C. flava* e. Flowering stems. f. Indumentum of the stems. g. Leaf. h. Flower. *Rotala ramosior* i. Flowering stems. j. Stems glabrous. k. Leaf. l. Flower.

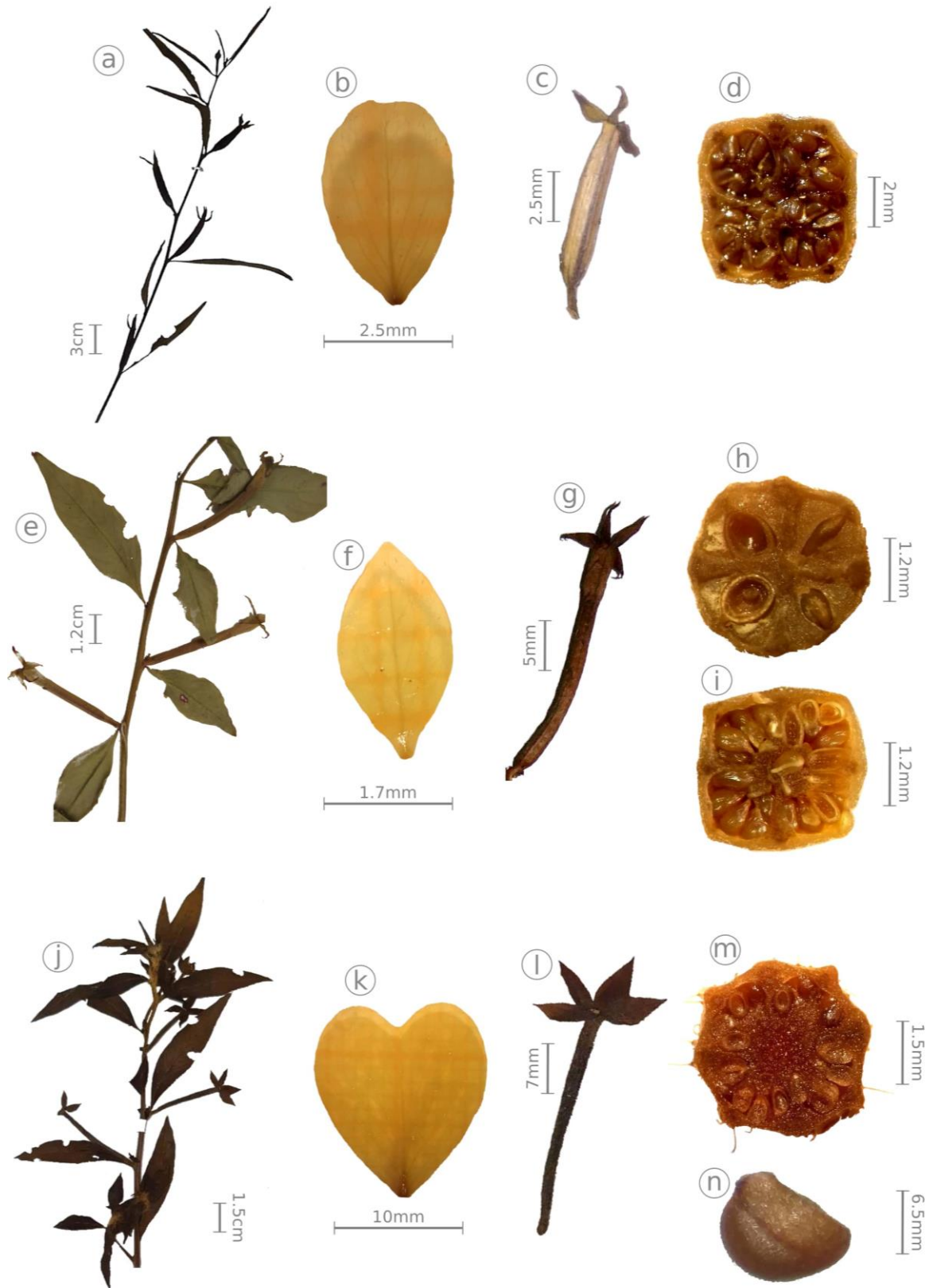


Figure 2. *Ludwigia erecta* a. Flowering stems. b. Petal. c. Hypanthium 4-angular. d. Transversal cut of the hypanthium. *L. hyssopifolia* e. Flowering stems. f. Petal. g. Fruit. h. Transversal cut of the inferior region of the fruit. i. Transversal cut of the superior region of the fruit. *L. octovalvis* j. Flowering stems. k. Petal. l. Hypanthium. m. Transversal cut of the hypanthium. n. Seeds with inflated raphe.

5. *Ludwigia hyssopifolia* (G. Don) Exell, Garcia de Orta 5: 471. 1957. (Figure 2e-i)

Basionym: *Jussiaea hyssopifolia* G. Don, Gen. Hist. 2: 693. 1832.

Herbs, stems glabrous. Leaves sessile, blade 1.3–2.8 × 0.35–0.5 cm, lanceolate, base decurrent, apex attenuate, glabrous on both faces. Hypanthium not seen. Sepals 4.5 × 1 mm, lanceolate, glabrous on both faces.

Petals not seen. Style and stigma not seen. Stamens not seen. Nectariferous disk not seen. Capsule 17–20 mm long, linear, slightly enlarged in the superior region, glabrous. Seeds plurisseriate and free in the superior region, unisseriate and embedded in cortical endocarp in the inferior region, raphe narrower than the body of the seed.

It was collected at USJ with flowers and fruits in November. This species is pantropical (Zardini & Raven, 1997). At the study area was found in *Chave* fragment. It can be distinguished from the other species by the position of the seeds in the capsule, free and plurisseriate in the superior region and embedded in cortical endocarp and unisseriate in the inferior region.

Examined material: Brazil. Pernambuco: Igarassu, Usina São José, Fragmento Chave, 24 Nov 2009, fl. fr., *E. M. Pessoa & J. A. N. Souza 123* (JPB!, UFP!).

6. *Ludwigia octovalvis* (Jacq.) P.H. Raven, Kew Bull. 15(3): 476. 1962. (Figure 2j-n)

Basionym: *Oenothera octovalvis* Jacq., Enum. Syst. Pl. 19. 1760.

Herbs, ca. 60 cm tall, stems glabrescent or pubescent. Leaves short petiolate, petioles ca. 0.5 mm long, blade 5.5–7.1 × 1.6 cm, linear-lanceolate or lanceolate, base acute, apex acute, glabrescent or pubescent. Hypanthium 20–35 mm long. Sepals 10–12 × 4.5–5 mm, ovate, outer face hirsute or pubescent. Petals 12 × 8 mm, obovate, apex emarginate. Style ca. 2 mm long, stigma capitate. Stamens 8. Nectariferous disk convex. Capsule ca. 42 mm long, cylindrical, 8-ribbed, glabrescent or pubescent. Seeds plurisseriate in all regions and not embedded in endocarp, raphe inflated equal in size to the body of the seed.

It was collected at USJ with flowers and fruits in April, August and November. This species is pantropical, occurring predominantly in Americas (Raven, 1963; Grillo & Giuletti, 2004). At the study area was found in Fragmento Chave and in the edge of Mata de Piedade. It can be identified from the other species by the petals with apex emarginate, capsule 8-ribbed, seeds with raphe inflated equal or superior in size to the body of the seed, plurisseriate in all regions and not embedded in endocarp.

Examined material: Brazil. Pernambuco: Igarassu, Usina São José, 06 Apr 1983, *R. Barreto & A. Chiappeta 482* (PEUFR!, IPA); Fragmento Chave, 24, Nov 2009, fr., *E. Pessoa & J. A. N. Souza 185* (UFP!); Mata de Piedade, 21 Aug 2010, fl. fr., *J. L. Viana et al. 79* (UFP!, JPB!, NYBG!).

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