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MYRTACEAE JUSS. EM UMA ÁREA DE TRANSIÇÃO DO NORDESTE BRASILEIRO:

riqueza, aspectos taxonômicos e distribuição geográfica potencial

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“De modo suave, você pode sacudir o mundo”

Mahatma Gandhi

RESUMO GERAL

Myrtaceae é uma grande família de angiospermas bem distribuída em toda América Tropical, porém pouco conhecida na Amazônia brasileira, com cerca de 264 espécies reconhecidas. O presente trabalho teve como objetivo apresentar um estudo taxonômico da família na Amazônia Maranhense, bem como conhecer o padrão de distribuição e a riqueza de espécies na região. Os resultados obtidos são apresentados em dois capítulos. O primeiro, com o tratamento taxonômico, teve como base materiais coletados entre agosto de 2019 e fevereiro de 2020 e a análise *in loco* das coleções dos herbários HST, IAN, IPA, MAR, MG, NY, PEUFR e SLUI, e de imagens das coleções ASU, BHCB, CEN, EAC, INPA, HBRA, HUEFS, K, MBM, NL-U, SP, SPF, RB, RON, US e U. Foram reconhecidas 37 espécies de Myrtaceae na Amazônia Maranhense, sendo *Myrcia* e *Eugenia*, respectivamente com 16 e 15 espécies, os gêneros mais ricos, seguidos de *Myrciaria* e *Psidium*, com duas espécies cada, e *Campomanesia* e *Calycolpus*, com uma espécie cada. Sete espécies foram citadas pela primeira vez para o estado do Maranhão, e tiveram, portanto, sua distribuição geográfica estendida: *Eugenia dittocrepis*, *E. lambertiana*, *E. muricata*, *E. patrisii*, *Myrcia bracteata*, *M. eximia*, e *Psidium acutangulum*. No segundo capítulo, foram compilados dados de ocorrência das 37 espécies aceitas no primeiro capítulo, obtidos nas bases de dados online do INCT-Herbário Virtual e Herbário Virtual Reflora, e das coleções estudadas *in loco.* Vite e uma espécies apresentam padrão de distribuição amplo, ocorrendo em mais de duas províncias fitogeográficas e 16 apresentam padrão restrito. As províncias mais frequentes, além da Amazônica, foram: Cerrado (22 spp.), Caatinga (20) e Atlântica (19). A maior riqueza de espécies e também o maior número de coletas de Myrtaceae está próximo à Ilha do Maranhão, uma área que atualmente é coberta, principalmente, por culturas agrícolas ou vegetação perturbada, com poucos remanescentes de florestas. A maior lacuna de dados está no sul e oeste da Amazônia Maranhense, área dos maiores fragmentos florestais conservados. Devido a essa lacuna, as espécies apresentaram baixa adequabilidade para essas áreas, sendo este um alerta de que desconhecemos a composição florística das Unidades de Conservação localizadas nessa porção.

Palavras-chave: Myrtales; *Myrcia*; *Eugenia*; padrão de distribuição; floresta tropical; nordeste brasileiro.

ABSTRACT

Myrtaceae are a large family of angiosperms well distributed in tropical America, but not well known in the Brazilian Amazon, where approximately 264 species are recognized. The present work presents a taxonomic study of Myrtaceae for Amazonian Maranhão and the species distribution patterns and richness in the region. The results obtained are presented in two chapters. The first was based on material collected between August 2019 and February 2020, and the *in loco* study of specimens at HST, IAN, IPA, MAR, MG, NY, PEUFR and SLUI as well as images of specimens at ASU, BHCB, CEN, EAC, INPA, HBRA, HUEFS, K, MBM, NL-U, SP, SPF, RB, RON, US and U. Thirty-seven species of Myrtaceae were recognized in Amazonian Maranhão, with *Myrcia* and *Eugenia*, with *16* and 15 species, being the most diverse genera, followed by *Myrciaria* and *Psidium*, with two species each, and *Campomanesia* and *Calycolpus*, with one each. Seven species are registered for the first time as occurring in the state of Maranhão, and have their geographic distribution extended: *Eugenia dittocrepis*, *E. lambertiana*, *E. muricata*, *E. patrisii*, *Myrcia bracteata*, *M. eximia*, and *Psidium acutangulum*. (2) In the second chapter, we compiled and cleaned all the occurrence data of the 37 accepted species from INCT-Virtual Herbarium, Virtual Herbarium Reflora, and the collections studied *in loco* and online. Twenty-one species presented widespread distribution patterns, occurring in three or more phytogeographic provinces, and 16 a restricted one, occurring in only one or two. The most represented provinces, besides Amazon, were: Cerrado (22 spp.), Caatinga (20) and Atlantic (19). The greatest species richness and number of collections of Myrtaceae is close to Maranhão Island, an area that is currently covered mainly by agricultural or disturbed areas, with few remnants of forest fragments. We observed the largest data gap in the south and west of Amazonian Maranhão, where the largest conserved forest fragments are located. Due to this lack of data, the species showed low suitability for these conserved areas, demonstrating that we have little information about the floristic composition of these Conservation Units.

Keywords: Myrtales; *Myrcia*; *Eugenia*; distribution pattern; tropical forest; northeastern Brazil.

LISTA DE ILUSTRAÇÕES

Synopsis of the family Myrtaceae in Amazonian Maranhão, Brazil

Species richness and distribution in Amazonian Maranhão, Brazil: the case of Myrtaceae

LISTA DE TABELAS

Species richness and distribution in Amazonian Maranhão, Brazil: the case of Myrtaceae

SUMÁRIO

1 INTRODUÇÃO

A família Myrtaceae tem distribuição pantropical, com centros de diversidade na Austrália, sudeste da Ásia, sul da América tropical e ainda uma pequena representação na África (WILSON et al., 2005; VASCONCELOS et al., 2017). Na região Neotropical compreende cerca de 2.500 espécies, com alta representatividade em vários biomas dessa região (LUCAS et al., 2007; LUCAS; BÜNGER, 2015; VASCONCELOS et al., 2019). Em sua atual classificação, Myrtaceae compreende duas subfamílias, Psiloxyloideae e Myrtoideae, representadas por duas e 15 tribos, respectivamente (WILSON et al., 2001; WILSON et al., 2005; LUCAS et al., 2007). A tribo Myrteae, a qual pertencem todos os gêneros da América Tropical, com exceção de um monoespecífico restrito ao Chile, e é a mais diversa da família (WILSON et al., 2001; LUCAS et al., 2007; VASCONCELOS et al., 2017).

A maior diversidade de Myrteae está na América do Sul, particularmente, ao longo da costa leste do Brasil e no Escudo das Guianas (LUCAS et al., 2005; LUCAS et al., 2007). Suas espécies são ecologicamente importantes por apresentarem flores que proporcionam pólen e outros recursos, como néctar, às abelhas (GRESSLER et al., 2006); por proporcionarem frutos carnosos que servem de alimentos para vertebrados frugívoros e estarem associadas a um grupo diversificado de dispersores de sementes (PIZO, 2002; VASCONCELOS et al., 2017); e economicamente importantes por apresentarem espécies de uso medicinal, ornamental e alimentício (MARCHIORI; SOBRAL, 1997). A tribo Myrteae engloba os dois maiores gêneros da família que ocorrem na região neotropical, *Eugenia s.l.*, (sensu MAZINE et al., 2014) e *Myrcia s.l* (sensu LUCAS et al., 2011).

No Brasil a família é bem representada nos domínios predominantemente florestais. Para a Mata Atlântica, um domínio complexo, caracterizado por grandes variações em sua biota, marcado por uma ampla variação climática e diversos centros de endemismo (THOMAS; BARBOSA, 2008; SILVA; GARDA, 2016), são reconhecidas 690 espécies (PROENÇA et al., 2020). Contudo, para a Amazônia, uma das áreas de maior biodiversidade do mundo, que abriga cerca de 10% das espécies do planeta (SILVA; GARDA, 2016; LEITE; ROGERS, 2013), são reconhecidas apenas 266 espécies (PROENÇA et al., 2020). No Brasil os estudos das Myrtaceae amazônicas ainda são limitados e as principais contribuições incluem levantamentos florísticos,

sinopses e atualizações taxonômicas realizadas por Souza et al. (1999), Rosário e Secco (2006, 2013), Rosário et al. (2004, 2005, 2014a, 2014b, 2017) e Trindade et al. (2018).

A Amazônia brasileira contempla todos os estados da região Norte, além de uma porção dos estados do Maranhão e Mato Grosso (IBGE, 2020). O Maranhão, localizado na porção mais oriental do bioma (MARTINS, 2011), apresenta uma vegetação que, devido ao seu clima e condições edáficas, é caracterizada como área de transição (MUNIZ, 2006). O reduzido número de estudos desenvolvidos na Amazônia maranhense demonstra uma desatenção com as áreas florestais no estado. Essa desatenção causa um efeito direto na modificação da paisagem amazônica (MARTINS, 2011). Em consequência, o Maranhão apresenta a menor quantidade de áreas protegidas em relação aos demais estados da Amazônia brasileira (ARAÚJO et al., 2011).

O desconhecimento sobre a biodiversidade de uma área ou região tem sido um dos principais problemas para o direcionamento dos esforços de conservação (BRANDON et al. 2005; GIARETTA et al., 2015). Estudos da flora e de distribuição geográfica, por sua vez, fornecem informações sobre a biodiversidade regional e podem fornecer subsídios para que medidas de mitigação do impacto ambiental sejam adotadas (COSTA et al., 2016).

Na Amazônia maranhense, Myrtaceae é citada, nos poucos estudos florísticos e estruturais disponíveis, como uma das famílias mais representativas em número de espécies arbóreas (MUNIZ et al., 1994a, b; MARQUES et al., 2011). Não há, contudo, estudos taxonômicos suficientes que confirmem esta representatividade na região. Para todo o Maranhão são reconhecidas 69 espécies de Myrtaceae, sendo 43 delas indicadas para a Amazônia (Flora do Brasil 2020). Dessa forma, considerando o reduzido volume de estudos sobre a flora da Amazônia Maranhense (MUNIZ, 2006; MUNIZ, 2011), esta dissertação pretende contribuir para o conhecimento da flora regional e sua conservação. Em vista disto, selecionamos a família Myrtaceae devido a sua representatividade em áreas florestais da América Tropical.

Os resultados estão organizados da seguinte forma:

Capítulo 1: Synopsis of the family Myrtaceae in Amazonian Maranhão, Brazil – Neste capítulo são confirmadas 37 espécies de Myrtaceae na Amazônia Maranhense, sendo os gêneros *Myrcia* e *Eugenia* os de maior riqueza. Sete espécies são citadas pela primeira vez para o estado do Maranhão, e tem, portanto, sua distribuição geográfica estendida. O trabalho inclui um tratamento taxonômico com chave de identificação, dados fenológicos, distribuição geográfica, comentários sobre semelhanças taxonômicas e ilustrações das espécies.

Capítulo 2: Species richness and distribution in Amazonian Maranhão, Brazil: the case of Myrtaceae – Este capítulo é uma análise do padrão de distribuição e riqueza das espécies de Myrtaceae que ocorrem na Amazônia Maranhense. A fim de elucidar como essas espécies estão representadas na área, buscamos responder a três perguntas: (1) Qual o padrão de distribuição das espécies de Myrtaceae que ocorrem na Amazônia Maranhense? (2) Como estão distribuídos a riqueza e o esforço de coleta (mensurado como número de coleções) de Myrtaceae na Amazônia Maranhense? (3) Essas espécies de Myrtaceae já foram coletadas ou poderiam ser encontradas em áreas protegidas na Amazônia Maranhense?

2 FUNDAMENTAÇÃO TEÓRICA

2.1 MYRTACEAE JUSS.: HISTÓRICO E SISTEMÁTICA

Myrtaceae é uma grande família de Angiospermas, que teve sua origem na Gondwana oriental e tem distribuição Pantropical, compreendendo aproximadamente 6.000 espécies, 144 gêneros e 17 tribos, cujo maior diversidade encontra-se na região Neotropical (WILSON et al., 2005; VASCONCELOS et al., 2017; LUCAS et al., 2019; VASCONCELOS et al., 2019). A família foi descrita pela primeira vez por Antoine Laurent Jussieu (1789) e se caracteriza por apresentar folhas simples, opostas ou alternas, com presença de glândulas oleíferas (contendo terpenóides e/ou outros compostos resinosos e/ou aromáticos), tricoma unicelular, simples ou em forma de "T", venação camptódroma-broquidódroma, nervuras secundárias anastomosadas, tronco quase sempre desprendendo a periderme (ritidoma), flores bissexuais, de simetria radial, polistêmones, com hipanto desenvolvido ou não, ovário ínfero ou semi-ínfero e frutos tipo bagas ou cápsulas (LANDRUM; KAWASAKI, 1997; CONTI et al., 1997; WILSON et al., 2001, 2011).

O primeiro estudo sistemático para o grupo foi realizado por Candolle (1828) que subdividiu a família em cinco tribos: Chamaelaucieae, Leptospermeae, Myrteae, Barringtonieae e Lecythideae. Posteriormente, Niedenzu (1893) estabeleceu duas subfamílias: Leptospermoideae, com plantas de folhas alternas e frutos tipo cápsula, e Myrtoideae, com folhas opostas e frutos tipo baga. Na subfamília Leptospermoideae foram incluídas as tribos Chamaelaucieae e Leptospermeae, caracterizadas, respectivamente, por fruto seco, unilocular e indeiscente, e multilocular e deiscente; e em Myrtoideae a tribo Myrteae, com fruto do tipo baga e multilocular. As subfamílias Barringtonieae e Lecythideae foram transferidas para Lecythidaceae (SCHMID, 1980).

No século XIX novos estudos taxonômicos foram realizados com as Myrtaceae americanas e auxiliaram na delimitação morfológica de vários gêneros e espécies, como: a "*Revisio Myrtacearum Americae*" (BERG, 1855-1856) e a "*Flora Brasiliensis*" (BERG, 1857-1859), ambos realizados por Otto Von Berg que apresentou descrições de espécies exclusivamente americanas; e o estudo de Kiaerskou (1893) que apresentou a descrição de 121 espécies novas para o Brasil. No século seguinte, Rogers McVaugh publicou grandes floras que atualmente são a base para a identificação de espécies amazônicas, como: a "*Flora of Peru*" (McVAUGH, 1958); "*Tropical American Myrtaceae*" (McVAUGH, 1963); e "*The Genera of American Myrtaceae: An Interim*

Report" (McVAUGH, 1968). Essa última trata-se de uma importante revisão da tribo Myrteae, que contém descrição dos seus principais caracteres e discussões sobre sua complexidade.

Os estudos de cladística tiveram importantes implicações para o grupo e foram realizados anos depois com Johnson e Briggs (1984), que estudaram a ordem Myrtales e com base em caracteres morfológicos e anatômicos notaram que as subfamílias de Myrtaceae não eram monofiléticas e deveriam ser abandonadas. Essa hipótese foi a base para os novos estudos sistemáticos. Utilizando o marcador molecular matK, em adição à análise de caracteres morfológicos, Wilson et al. (2001; 2005) revelaram uma extensa homoplasia dentro do grupo e reconheceram uma nova classificação para as subfamílias: Psiloxyloideae e Myrtoideae (WILSON et al., 2005). Wilson et al. (2005) caracterizaram os representantes de Psiloxyloideae como plantas dióicas com folhas dispostas em espiral, presença de cavidade secretora, não contendo óleos essenciais em *Psiloxylon*, antera tetralocular e número de cromossomo base x = 12; e Myrtoideae como plantas monóicas, folhas dispostas em espiral ou opostas, presença de cavidade secretora contendo óleos essenciais, antera bilocular e número de cromossomo base x = 11, contendo duas e quinze tribos, respectivamente.

Em Myrtoideae, Myrteae é a maior tribo e compreende metade das espécies da família. É bastante diversa em espécies nas florestas e savanas da América do Sul e contempla todas as espécies de Myrtaceae que ocorrem na América Tropical, com exceção de *Metrosideros stipularis* (Hook. & Arn.) Hook.f. (WILSON et al., 2001; WILSON et al., 2005; LUCAS et al., 2007; LUCAS; BÜNGER, 2015; LUCAS et al., 2019; VASCONCELOS et al., 2019). Myrteae se distingue das demais tribos de Myrtoideae por apresentar fruto carnoso indeiscente, sistema vascular transeptal e tricomas uni-multi-celulares (LUCAS et al. 2007). Este grupo compreende os quatro maiores gêneros da família, *Eucalyptus* L'Hér., *Eugenia* P. Micheli ex L., *Syzygium* Gaertn. e *Myrcia* DC. ex Guill., sendo *Eugenia* e *Myrcia* os dois maiores gêneros na região neotropical (VASCONCELOS et al., 2017; LUCAS et al., 2018).

Inicialmente para Myrteae foram reconhecidos três grupos informais por De Candolle, cujo principal caráter de distinção era a morfologia do embrião, e posteriormente, esses grupos foram caracterizados como subtribos por O. Berg, que segundo as atuais regras de nomenclatura são denominados Myrciinae (Myrcioideae), Eugeniinae (Eugenioideae) e Myrtinae (Pimentoideae) (McVAUGH, 1968; LANDRUM, 1981; LUCAS et al., 2005; VASCONCELOS et al., 2019). Entretanto, os caracteres usados não davam um bom suporte para separação das subtribos que

morfologicamente eram pouco compreendidos (LUCAS et al., 2007). Vários autores propuseram novas classificações, como McVaugh (1968) que na obra "*The Genera of American Myrtaceae: An Interim Report*", propôs o agrupamento de Myrteae em seis grupos informais, sendo um dos primeiros estudos que divergiu da classificação proposta por De Candolle para tribo Myrteae.

E essas propostas foram dando base para novas discussões. As análises preliminares publicadas por Lucas et al. (2005) forneceram pouco suporte para os grupos informais propostos por McVaugh (1968). Nesse estudo as subtribos Myrtinae, Eugeniinae e Myrciinae tiveram as relações entre os gêneros dentro delas analisadas de forma mais detalhada. As análises preliminares mostraram que a subtribo Myrciinae podia ser monofilética, enquanto que Myrtinae e Eugeniinae podiam ser polifiléticas (LUCAS et al., 2005). Posteriormente, Lucas et al. (2007) propuseram sete grupos informais para a tribo Myrteae, gerados pela análise combinada de análises moleculares e caracteres morfológicos. Só a partir dos estudos filogenéticos de Lucas et al. (2019), Myrteae passou a compreender nove subtribos, a saber Myrciinae, Blepharocalycinae, Pliniinae, Luminae, Eugeniinae, Decasperminae, Ugninae, Pimentinae e Myrtinae, que são as aceitas atualmente.

Considerada como a terceira família com maior diversidade de espécies arbóreas nos biomas tropicais, Myrtaceae apresenta alta significância ecológica por ser um importante componente florístico nas áreas florestais (BEECH et al., 2017; LUCAS et al., 2019). A maioria das espécies que ocorre na região neotropical tem frutos carnosos que servem de alimento para vertebrados frugívoros (PIZO, 2002; VASCONCELOS et al., 2017) e flores brancas que proporcionam pólen e néctar a diferentes espécies de abelhas (GRESSLER et al., 2006). No Brasil, é representada por aproximadamente 1.025 espécies, circunscritas a 27 gêneros, dentre as quais 690 reconhecidas na Mata Atlântica e 264 na Amazônia (PROENÇA et al., 2020).

Na Amazônia brasileira o número de estudos direcionado à família ainda é limitado, com as identificações das espécies brasileiras, em sua maioria, sendo realizadas com base em tratamentos extra-brasileiros (SOBRAL et al., 2015). Na Amazônia maranhense as informações sobre o grupo são ainda mais escassas. O volume de estudos para a flora do estado ainda é reduzido e aqueles que são direcionados à família se limitam a um estudo taxonômico realizado para as dunas e restinga da Ilha do Maranhão (AMORIM; ALMEIDA Jr. *prelo*), e ao levantamento das coleções de herbários, com um panorama sobre a riqueza da família no Cerrado (ARAGÃO; CONCEIÇÃO, 2008; CONCEIÇÃO; ARAGÃO, 2010; MORAIS et al., 2014).

2.2 DOMÍNIO AMAZÔNIA

O Domínio Fitogeográfico Amazônico se estende além das fronteiras brasileiras, avançando na direção oeste até Cordilheira dos Andes e na direção norte até a costa do Mar do Caribe, contemplando nove países da América Tropical (NUSBAUMER et al., 2015). É uma região rica em biodiversidade que abriga 1/3 das florestas tropicais do mundo, e tem, portanto, a maior assembleia de espécies vegetais (STEEGE et al., 2013; BARBER et al., 2014). A maior parte territorial está no Brasil, e se estende por 4.2 milhões km^2 (IBGE, 2020), ao longo de nove Unidades Federativas (Acre, Amapá, Amazonas, Maranhão, Mato Grosso, Pará, Rondônia, Roraima e Tocantins), se apresentando como um mosaico com diferentes áreas de endemismos (MALINGREAU; TUCKER, 1988; SILVA et al., 2005; IBGE, 2004; CELENTANO et al., 2017). As áreas de endemismo são separadas por grandes rios, cada uma com suas próprias relações evolutivas e assembleias bióticas, sendo quatro delas parcialmente ou inteiramente dentro do território brasileiro (Rondônia, Tapajós, Xingu e Belém) (SILVA et al., 2005).

A Floresta Amazônica provém diversos serviços ecossistêmicos como a mitigação do aquecimento global, a manutenção da biodiversidade, regulação do ciclo da água, entre outros benefícios (FEARNSIDE, 2005, 2012; CELENTANO et al., 2017). Segundo Rizzini (1997) a floresta Amazônica, inclui vários tipos de florestas úmidas como: mata de várzea; das aluviões fluviais; mata de terra firme; igapó; além de outros tipos de vegetação como as “caatingas” do Rio Negro e ainda pequenas manchas de savana esparsas.

O conhecimento sobre a diversidade e distribuição das espécies da flora Amazônica tem sido crescente, porém, ainda são necessários mais esforços para documentar toda essa diversidade, pois é um bioma de grande extensão e com altas taxas de desmatamento, o que ocasiona grande perda da biodiversidade (SILVA et al., 2005; STEEGE et al., 2013; BARBER et al., 2014; BROWN et al., 2016; BRAZ et al., 2016). Políticas implementadas no Brasil na década de 1960 ocasionaram muitas mudanças sociais e ambientais, que tiveram impactos diretos na Floresta Amazônica, ocasionando o aumento do desmatamento, consequência de um sistema de rápida urbanização e industrialização capitalista, que lucrava com base na exploração da natureza e do trabalho das classes menos favorecidas (BROWN et al., 2016). Esses desmatamentos se tornaram ainda mais frequentes após a inauguração da rodovia Transamazônica, em 1970, e apesar de ainda existirem extensas áreas que permaneceram intactas, a maior perda de floresta está no “arco do desmatamento”, ao longo das bordas sul e leste da Amazônia (FEARNSIDE, 2005).

O desmatamento junto à fragmentação das florestas ocasiona mudanças na estrutura das paisagens, transformando-as em áreas isoladas e contribuindo para mudança nos processos ecológicos, perda de biodiversidade (JESUS et al., 2012) e de cobertura vegetal, antes que se tenha o conhecimento da real riqueza dessas florestas (SOUZA et al., 2006). Outro fator que agrava esse cenário é o enorme déficit no conhecimento biológico sobre a Floresta Amazônica que, consequentemente, ocasiona um baixo volume de informações nas coleções biológicas (HOPKINS, 2007; MALHADO et al., 2013). Sobral et al. (2015) associam esta lacuna na região norte do Brasil a um baixo esforço amostral. O que vale também para a Amazônia Maranhense, onde o número de estudos até então realizados sobre a flora é reduzido (FROIS, 1953; MUNIZ et al., 1994a, b; MUNIZ, 2008; MARQUES et al., 2011; ROLIM et al., 2011; MUNIZ, 2011; CELENTANO et al., 2017).

2.3 AMAZÔNIA MARANHENSE

O estado do Maranhão está localizado em uma região de transição entre o clima úmido da Amazônia e o semiárido do Nordeste brasileiro (ARAÚJO et al., 2011; MARTINS, 2011; MUNIZ, 2011). Segundo Araújo et al. (2011), o Maranhão apresenta sete microrregiões: litoral, baixada maranhense, Cerrados, Cocais, Amazônia, Chapadões e Planalto. A Amazônia maranhense se situa na porção mais oriental da Amazônia e compreende aproximadamente 81.208,40 km^2, formada pela alternância de mata densa e aberta, apresentando uma transição gradual de florestas úmidas até semidecíduas (MARTINS, 2011; MUNIZ, 2011; SILVA JR. et al. 2020). Esta área compreende 116 cidades e tem a maior densidade demográfica do Domínio Amazônico, com poucas informações sobre a sua biodiversidade (ARAÚJO et al., 2006; ZEE, 2020). O clima é Tropical, zona A, incluindo dois tipos climáticos, de acordo com os critérios de Koppen: Aw (com inverno seco) e Am (monção) (ALVARES et al., 2013).

Essa região está sob alto grau de ameaça com sua vegetação original bastante reduzida, resultado da ausência de mecanismos efetivos de regulação e controle do desmatamento e de políticas de assistência técnica ao trabalhador rural, o que gera um permanente conjunto de malefícios a vegetação e sociedade, entre elas a exploração dos recursos ambientais (MOURA et al., 2006). Atualmente, grande parte dos remanescentes florestais se limita às florestas secundárias, à REBIO do Gurupi e às terras indígenas (CELENTANO et al., 2017). Estima-se que cerca de 19.9

mil km^2 da Amazônia Maranhense sejam de floresta secundária, que são totalmente desprotegidas no estado (CELENTANO et al., 2018).

Segundo Muniz (2006) o Maranhão apresenta uma transitoriedade que o caracteriza como um ecótono. Esse aspecto transicional se dá, principalmente, pelas áreas de tensão ecológica entre os domínios da Amazônia e Cerrado, devido às inúmeras reentrâncias e interpenetrações de formações savânicas que existem no território da Amazônia Legal (HAIDAR et al., 2013). A extensa faixa de transição, inclui áreas de ecótonos no entorno da Amazônia maranhense, um contato brusco do planalto maranhense com a zona dos Cocais, e do leste do planalto com as matas de galerias (Cerrado) (AB´SABER, 2002).

Para Françoso et al. (2016) o baixo esforço amostral na floresta Amazônica dificulta identificar um padrão de distribuição para suas espécies, até mesmo a sua relação com o Cerrado, com o qual apresenta uma grande margem de contato. Esses mesmos autores também afirmam que estudar áreas de transição pode ajudar a entender a distribuição das espécies que habitam essas áreas. Nas áreas de transição do Maranhão ainda não há um número significativo de estudos florísticos, estruturais e taxonômicos que forneçam informações suficientes para determinar qual domínio tem maior influência na vegetação, se há predominância de espécies endêmicas ou se as espécies dessas áreas apresentam uma distribuição ampla.

3. RESULTADOS

Original Article

The family Myrtaceae in Amazonian Maranhão, Brazil

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Abstract

Myrtaceae are a large angiosperm family distributed in all tropical regions, but still poorly known in Brazilian Amazonia. The state of Maranhão is an ecotone between the forests of Amazonia and the drier vegetation of the northeastern part of the country. The study area comprises a fragmented landscape known as Amazonian Maranhão where botanical collections were made from August 2019 to February 2020. Other collections were studied in loco at HST, IAN, IPA, MAR, MG, NY, PEUFR, and SLUI, and some others online at virtual herbaria. Myrtaceae are represented in Amazonian Maranhão by 37 species. The most diverse genera are *Myrcia* with 16 species and *Eugenia* with 15 species, followed by *Myrciaria* and *Psidium* with two species each, and *Campomanesia* and *Calycolpus* with one each. Some of the species are cited here from Maranhão for the first time, and have their geographic distribution extended, including *Eugenia dittocrepis*, *E. lambertiana*, *E. muricata*, *E. patrisii*, *Myrcia bracteata*, *M. eximia*, and *Psidium acutangulum*. A taxonomic treatment of the family in the region, with an identification key to the species, and detailed descriptions and taxonomic comments for each species is presented.

Keywords: vascular flora, taxonomy, Myrtales, *Myrcia*, *Eugenia*, tropical forest, northeastern Brazil.

Introduction

Myrtaceae comprise ca. 6000 species distributed in all tropical regions, with centers of diversity in Australia, Southeast Asia and Tropical America (Wilson *et al.* 2005, Lucas *et al.* 2019, Vasconcelos *et al.* 2019). In tropical America two tribes occur, Metrosidereae Benth. and Myrteae DC., with the latter, the most diverse, comprising nine subtribes and ca. 2000 species (Wilson *et al.* 2005, Lucas *et al.* 2019, Vasconcelos *et al.* 2019). The species of Myrteae have high ecological

significance due to their fleshy fruits eaten by vertebrate frugivores (Pizzo 2002, Vasconcelos *et al.* 2017), and their white flowers that supply pollen and other resources to bee species (Gressler *et al.* 2006, Staggemeier *et al.* 2017).

The species of Myrtaceae in Brazil are distinguished by entire, opposite, simple leaves containing oil glands, flowers which are often white, with 4–5-parted calyx and corolla, numerous stamens, a half-inferior to inferior ovary, and fruits forming 1 to many-seeded berries (Landrum & Kawasaki 1997). Brazil encompasses most of the world's remaining areas of tropical forests (primarily in the Amazon) and is home to 1027 species of Myrtaceae, but the highest diversity of species is found in the Atlantic Forest and the savannas of central Brazil (Fiaschi & Pirani 2009, Vasconcelos *et al.* 2017, Proença et al. 2020).

Our current knowledge of the species of Myrtaceae in the Brazilian Amazonia is based on studies by McVaugh (1958, 1969), Souza *et al.* (1999, 2015), Holst *et al.* (2002), Rosário & Secco (2006, 2013), Rosário *et al.* (2004, 2005, 2014a, 2014b, 2017), Sobral & Souza (2015, 2017), Sobral *et al.* (2015), Trindade *et al.* (2018), Souza & Sobral (2019), Gaem et al. (2020) and Amorim & Almeida Jr. (in press). These studies provide morphological characters, identification keys, illustrations of the species, and description of new species.

Several regions in Brazil, especially Amazonian Brazil, have their species richness underestimated due to the low numbers of collections (Sobral *et al.* 2015). This is also true in Amazonian Maranhão, a transition zone between the tropical moist forests and the savannas of northeastern Brazil, where few botanical studies have been carried out in forest area (Fróis 1953, Muniz *et al.* 1994a, 1994b, Muniz 2008, Marques *et al.* 2011, Rolim *et al.* 2011, Muniz 2011, Celentano *et al.* 2017). To contribute to the knowledge of the flora of Amazonian Maranhão, we propose to study the species of Myrtaceae present in the region.

Methods

The study area comprises a fragmented landscape of agricultural lands, forests and savannas known as Amazonian Maranhão (02° 31' 30" – 05° 33' S and 43° 46' 30" – 46° 19' W) (Fig. 1). It comprises ca. 110,400 km^2 (Celentano *et al.* 2017), less than 23% of the total area of Maranhão (IBGE 2020). This area has the highest demographic density in all Amazonia and includes 116 cities, mostly located in the northwestern portion of Maranhão, near the coast (ZEE 2020, Alvares et al. 2013). Currently, Amazonian Maranhão has less than 24% of its original forest cover (Silva Jr. *et al.* 2020). According to Alvares *et al.* (2013), there are two types of climate in northwestern Maranhão, based on Koppen's (cite) criteria: Aw (tropical with dry winter) and Am (tropical monsoon).

Botanical collections in the region were made from August 2019 to February 2020, in forested areas in the municipalities of Bequimão, Maracassumé, and São José de Ribamar (Fig. 1). The specimens collected were deposited in UFP, JPB, MAR, MG, and NY (herbarium acronyms following Thiers, 2020). Specimens deposited in HST, IAN, IPA, MAR, MG, NY, PEUFR, and SLUI were analyzed in loco, and images of other collections (ASU, BHCB, CEN, EAC, INPA, HBRA, HUEFS, K, MBM, NL-U, SP, SPF, RB, RON, US and U) were studied online in the Virtual Herbarium Reflora and on INCT-Brazilian Virtual Herbarium of Flora and Fungi.

Taxonomic identifications of specimens were based on McVaugh (1956, 1958, 1963, 1968), Landrum (1986, 2010, 2017), Landrum & Kawasaki (1997), Rosario *et al.* (2014b, 2017), Souza *et al.* (1999), and Trindade *et al.* (2018), as well as original descriptions, study of type specimens, and comparisons with herbarium collections previously identified by specialists. The morphological terminology followed Radford *et al.* (1974) and Harris & Harris (1994). Information about geographical distributions was obtained from Flora do Brasil 2020 (reflora.jbrj.gov.br), Plants of the World Online (powo.science.kew.org), and specialized literature. The flowering and

fruiting periods of the species were obtained from herbarium collections, using only specimens from Amazonian Maranhão and observations noted in the field. In the description of the flowers, information about petals was not included because they are present on only a few specimens.

The type of inflorescence is an important structure in the delimitation of Myrtaceae genera. The basic inflorescence in Myrtaceae is a solitary flower with two bracteoles, usually subtending the hypanthium (Landrum & Kawasaki 1997). These flowers may also be aggregated in dichasia, bracteate shoots (= "racemes"), or panicles. If all first and second order branches of the inflorescence are elongated, we consider it a simple raceme (Endress 2010). When the main axis is much reduced, it becomes a fascicle (flowers pedicellate) or a glomerule (flowers sessile) (Landrum & Kawasaki 1997). In the racemes, we can also find auxotelic growth, in which the apical bud, in both second and higher-orders of seasonal growth units, maintains the capacity for continued vegetative growth, rather than ending in a flower or bracteate shoot (Briggs & Johnson 1979).

Panicles can encompass several branching orders, without limitation in branching or the number of flowers produced within one branching order (Endress 2010). The same author describes the case of thyrsoids, like an inflorescence has a racemose primary branch and cymose secondary branches and is closed i.e., ending by a flower.

While the flower is basically 5-merous with numerous stamens and two at four carpels, there are several features that are unusual (Lucas et al. 2007, Pimentel et al. 2014). The calyx lobes may be free or fused in the bud, and then opening by tearing or along the sutures of the calyptra (Lucas et al. 2019). The petals are often ephemeral and are seldom found in herbarium collections.

Results and discussions

Myrtaceae are represented in Amazonian Maranhão by 37 species and 6 genera. The richest genera are *Myrcia* with 16 species and *Eugenia* with 15 species. *Myrciaria* and *Psidium*

present two species each, and *Campomanesia* and *Calycolpus* one species. While the Flora do Brasil 2020, lists 43 species as occurring in the Amazon Domain in Maranhão, we confirmed only 37 species.

Campomanesia grandiflora (Aubl.) Sagot, *Eugenia inundata* DC., *Myrcia crebra* (McVaugh) A. R. Lourenço & E. Lucas, *M. neolucida* A. R. Lourenço & E. Lucas, *Psidium riparium* Mart. ex DC. *P. striatulum* Mart. ex DC. are listed in Flora do Brasil 2020 as species that occur in the Amazon, but the specimens found in the state of Maranhão were collected only in savanna areas, thus, we did not include them in this study. In the case of *Eugenia coffeifolia* DC. and *E. excelsa* O. Berg it was not possible to determine the location accurately. Although listed in Flora do Brasil 2020, *Eugenia gomesiana* O.Berg, specimens of *Eugenia heterochroma* Diels and *Psidium densicomum* Mart. ex DC. were not found in any of the herbarium collections studied.

Among the species found, 13 are widely distributed in Tropical America: *Campomanesia aromatica* (Aubl.) Griseb., *Eugenia flavescens* DC., *E. florida* DC., *E. punicifolia* (Kunth) DC., *E. stictopetala* Mart. ex DC., *Myrcia amazonica* DC., *M. guianensis* (Aubl.) DC., *M. multiflora* (Lam.) DC., *M. splendens* (Sw.) DC., *M. selloi* (Spreng.) N. Silveira, *M. sylvatica* (G. Mey.) DC., *M. tomentosa* DC., *Myrciaria floribunda* (H. West ex Willd.) O. Berg, *M. tenella* (DC.) O. Berg and *Psidium guineense* Sw. Seven other species are endemic to the Amazon: *Eugenia caducibracteata* Mazine, *E. cupulata* Amshoff, *E. muricata* DC., *E. polystachya* Rich., *E. protenta* McVaugh, *E. wullschlaegeliana* Amshoff, *Myrcia cuprea* (O.Berg) Kiaersk, *M. grandis* McVaugh, *M. fasciculata* (O.Berg) K.Campbell & K.Samra, *M. neospeciosa* A.R.Lourenço & E.Lucas and *M. pullei* (Burret ex Amshoff) A.R.Lourenço & E.Lucas.

Calycolpus goetheanus (Mart. ex DC.) O. Berg and *Eugenia densiracemosa* Mazine & Faria are distributed in the Amazon and Central Brazilian Savanna (cerrado). Only *Eugenia biflora*

(L.) DC. occurs in the Amazon, Caatinga and Cerrado domains. *Myrcia neoclusiifolia* A.R.Lourenço & E. Lucas occurs in the Cerrado and the Atlantic forest.

Seven species are being registered here for the first time as occurring in Maranhão, and are having their geographic distributions extended: *Eugenia dittocrepis* O. Berg, *E. lambertiana* DC., *E. muricata*, *E. patrisii* Vahl, *Myrcia bracteata* (Rich.) DC., *M. eximia* DC., and *Psidium acutangulum* DC.

Taxonomic treatment

Myrtaceae Juss., Genera Plantarum: 322-323. 1789.

Trees or shrubs, twigs glabrescent or densely pubescent, grayish, rarely reddish. **Leaves** simple and opposite, margin entire, venation brochidodromous, stipules absent, glands present. **Inflorescence** axillary, terminal or subterminal, cauliflorous, a single flower, panicles, thyrsoid, glomerules, fascicles, dichasium, or simple or auxotelic racemes; flowers radially symmetric, bisexual, dichlamydeous, sessile or pedicellate; bracts and bracteoles caducous or persistent; flowers bud constricted or not below ovary; calyx 4–5–merous, the lobes free, partially fused in the lower third of the bud or completely fused and opening by tearing or along the suture of a calyptra; corolla 4–5–merous, often ephemeral; stamens numerous. **Fruit** subglobose, globose or ellipsoid, seeds few to numerous.

Key to the species to Myrtaceae in the Amazonian Maranhão

1.Inflorescence a panicle or thyrsoid…….……..…2

1’.Inflorescence a single flower, glomerule, fascicle, dichasium, or a simple or auxotelic raceme … …….....17

2. Calyx-lobes free or partially fused in the lower third of the bud and 5-merous……....3

2’.Calyx-lobes completely fused, opening by tearing or as a calyptra……...…….…14

3.Flower buds constricted beneath ovary and calyx reflexed ……..……..…..……..4

3’. Flower buds not constricted beneath ovary and calyx not reflexed ……...……...……5

4.Leaves with petioles unchanneled, leaf discolorous and flowers sessile.…….... ***Myrcia tomentosa***

4’.Leaves with petioles channeled, leaf concolorous and flowers pedicellate, 2.5–3.5 mm long …….…….…….***Myrcia selloi***

5.Midvein adaxially prominent; ovary 3-locular ……..***Myrcia guianensis***

5’.Midvein adaxially flat, impressed or sulcate; ovary 2-locular …….……....6

6. Leaf apex long-caudate; lateral veins prominent abaxially, arched …….. ***Myrcia minutifolia***

6’. Leaf apex acute, acuminate, long acuminate, attenuate, rounded, obtuse rarely cuspidate; lateral veins not prominent abaxially and not arched …….…….7

7. Inflorescence a thyroid with congested flowers; aggregated in dichasia, the first branch ca. 1.5 cm above the base; bracteoles 7–8 × 3 mm ……. ***Myrcia bracteata***

7’.Inflorescence a panicle with lax flowers, the first branch more than 1.5 cm above the base; bracteoles more or less 0.5–1.5 × 2 mm …….……...……...8

8.Margin revolute; lateral veins strongly marked …….……..… ***Myrcia eximia***

8’.Margin flat; lateral veins not marked ……..……...……..…….9

9. Leaf pubescent abaxially; fruits pubescent……..……10

9’. Leaf glabrous or glabrescent abaxially; fruits glabrous …….……..……..12

10. Flower bud campanulate; fruit globose…….…….***Myrcia cuprea***

10’. Flower bud globose; fruit oblong or ellipsoid…….11

11.Leaf with petioles unchanneled and blades slightly discolorous, lustrous adaxially; midvein adaxially sulcate ……..……..……..... ***Myrcia sylvatica***

11’.Leaf with channeled petiole and blades concolorous; midvein adaxially flat ……..……. ***Myrcia splendens***

12. Leaf membranaceous, concolorous..... ***Myrcia multiflora***

12’. Leaf chartaceous or coriaceous, discolorous……..…….……13

13. Branches and inflorescence axis reddish; panicle with the main-axis glabrous …….....…….…… ***Myrcia amazonica***

13’. Branches and inflorescence axis grayish; panicle with the main -xis pubescent, the hairs whitish ….……... ***Myrcia grandis***

14. Leaf membranaceous; panicle with main-axis 0.5-0.7 mm… ……..…..…. ***Myrcia fasciculata***

14’. Leaves chartaceous or coriaceous; panicle with the main axis more than 2.3 cm long ….… 15

15. Intramarginal vein present .....***Myrcia neoclusiifolia***

15’.Intramarginal vein absent 16

16. Leaf with margin revolute; panicle and fruit pubescent..... ***Myrcia neospeciosa***

16’. Leaf with margin flat; panicle and fruit glabrous ……...……..… ***Myrcia pullei***

17. Calyx 4-merous; ovary 2-3-locular……...…..……..…….……..18

17’. Calyx 4-5-merous; ovary plurilocular….……..……..…….34

18. Pedicels more than 1 mm long; calyx-lobes persistent in the fruit...……...…..…..……....19

18’. Pedicels absent; calyx-lobes caducous in the fruit together with the petals and hypanthium as a unit …….…….33

19. Flowers arranged in fascicles, sometimes only two flowers per axis …….……..…….20

19’. Flowers arranged in racemes.…….……..…....26

20. Intra-marginal vein present ……..…….……..…....21

20’. Intra-marginal vein absent ……...…….……..…….23

21. Leaves membranaceous, discolorous; the margin revolute; bracts caducous after anthesis ……...……...……..…... ***Eugenia lambertiana***

21'. Leaves chartaceous or coriaceous, concolorous; the margin flat; bracts persistent in the fruit ……..…….…….22

22. Twigs pubescent; the hairs whitish; bracts lanceolate and bracteoles orbicular……..…. ***Eugenia punicifolia***

22'. Twigs glabrous; bracts orbicular and bracteoles elliptic or oblong…....… ***Eugenia stictopetala***

23. Leaf pubescent …….. ….…… ***Eugenia wullschlaegeliana***

23'. Leaves glabrous ……...……..……..……24

24.Midvein adaxially sulcate ……..…...……..……. ***Eugenia protenta***

24'.Midvein adaxially impressed, prominent or flat..…….……..…..……....25

25.Leaf discolorous; the margin revolute…….. ***Eugenia dittocrepis***

25'.Leaf concolorous; the margin flat…….……..…… ***Eugenia flavescens***

26.Raceme auxotelic with cataphylls at the base…….……. ***Eugenia patrisii***

26'.Raceme simple ……..….…….……....27

27.Intra-marginal vein present….....…... 28

27'. Intra-marginal vein absent …….....……...29

28. Petioles pubescent , channeled; leaf blades membranaceous or subcoriaceous, concolorous; calyx-lobes ovate and glabrous……..... ***Eugenia florida***

28'. Petioles glabrous , unchanneled; leaf blades chartaceous, discolorous; calyx-lobes orbicular and pubescent ……..…***Eugenia cupulata***

29. Bracts caducous before anthesis; fruit oblong to ellipsoid……..…***Eugenia caducibracteata***

29'. Bracts caducous after anthesis or persisting in the fruit; fruit globose or subglobose……30

30. Calyx-lobes partially fused in the lower third of the bud; fruit glabrous……..……. ***Eugenia densiracemosa***

30’. Calyx-lobes free; fruit pubescent…….31

31. Leaves concolorous; leaf margin revolute……...……....….. ***Eugenia biflora***

31. Leaves discolorous; leaf margin flat……..32

32. Bracts caducous after anthesis; fruit with ridged surface …….……...…...… ***Eugenia muricata***

32’. Bracts persisting in the fruit; fruit with smooth surface ..... ***Eugenia polystachya***

33. Leaves 4.4–7.3 × 2.8–3 cm, apex leaf acuminate …….……..... ***Myrciaria floribunda***

33’. Leaves 1–2.5 × 0.5–1.2 cm, apex leaf acute……..……..… ***Myrciaria tenella***

34. Marginal vein 1–2 mm from the margin; bracts and bracteoles persistent in the fruit……..…. ***Calycolpus goetheanus***

34’. Marginal vein absent; bracts and bracteoles caducous after anthesis …….…….35

35.Calyx-lobes partially fused in the lower third of the bud; fruit with smooth surface …….....…..... ***Campomanesia aromatica***

35’. Calyx-lobes completely fused, opening by irregular tearing; fruit with surface marked with glands ……36

36. Leaf apex always apiculate; midvein adaxially sulcate; flower buds globose.…….……..….... ***Psidium acutangulum***

36’. Leaf apex never apiculate; midvein adaxially impressed; flower buds pyriform.…….……..……..… ***Psidium guineense***

1. *Calycolpus goetheanus* (Mart. ex DC.) O. Berg, Linnaea 27: 381 (1856). *Myrtus goetheana* Mart. ex DC., Prodr. [A. P. de Candolle] 3: 240 (1828). Type: BRAZIL. “in Brasilia ad Rio-Negro,” *Martius 2762* (lectotype designated by Landrum [2010, p. 381]: M).

Trees 1–12 m. Twigs glabrous or glabrescent, the hairs whitish or reddish-brown. Leaves with petioles 1–7 mm long, glabrous or glabrescent, unchanneled or shallowly channeled; blades elliptic to broadly so, lanceolate, ovate or obovate, 3.3–14.4 × 2.4–5.5 cm, glabrous, membranaceous or chartaceous, discolorous; glands conspicuous; apex acuminate, rarely attenuate or cuneate; base cuneate, acute or rounded; midvein adaxially sulcate or impressed; lateral veins moderately visible, 10 to 20 pairs; marginal vein 1–2 mm from the margin, intra-marginal vein absent, the margin flat. Inflorescence axillary or terminal, fascicle, the main-axis ca. 3 mm long, sometimes inconspicuous, glabrous; bracts deltate, 0.3–0.5 × 0.6 mm, puberulent adaxially, glabrous abaxially, persistent in the fruit; pedicels 9–40 mm long, glabrous; bracteoles triangular to narrowly so, or deltate, 0.5–2 × 0.2–0.7 mm, glabrous, persistent in the fruit; flower buds globose, 7 × 12 mm, not constricted beneath ovary; calyx-lobes free, 5–merous, narrowly triangular, deltate to broadly so, 5–10 × 3–6 mm, glabrous, not reflexed, persistent in the fruit; ovary 3–5-locular. Immature fruits subglobose or globose, 0.4–0.7 × 0.5–1.1 cm, glabrous, surface smooth.

Calycolpus goetheanus may be recognized by its glabrous leaves, inflorescence in fascicles; buds with five free calyx-lobes (5 – 10 × 3 – 6 mm); ovary 3–5-locular; and glabrous fruit subglobose or globose.

Distribution and habitat: Known from Colombia, French Guiana, Guyana, Suriname, Trinidad-Tobago, Venezuela and northeastern and northwestern Brazil (Amazonas, Maranhão, Pará and Roraima states). In Amazonian Maranhão, *C. goetheanus* was found growing along a road, and in both “terra firme" and flooded forests.

Phenology: Flowering in January, February, May and October to December, and fruiting in January, February and October.

Specimens Examined. — **MARANHÃO**: Alcântara: Piriuaçú, 11 Apr 1954 [st], *R. L. Fróes 30771* (IAN). Cururupu: Maracassumé River Region, Campo de Boa Esperança, 22 Oct 1932 [fl, fr], *R. Fróes 1977* (NY). São José de Ribamar: Sítio Aguahy, 28 Oct 2017 [fl], *G. S. Amorim 378* (MAR); 20 Feb 2018 [fr], *G. S. Amorim 467* (MAR). São Luís: Alumar, 29 Nov 1994 [fl], *N. Figueiredo 7* (MAR); 18 Jan 1995 [fl], *N. Figueiredo 4* (MAR); 13 Nov 1995 [fl], *K. B. Ferreira & E. C. Gimos s.n.* (MAR); Estrada que vai do Rio Anil para Maioba, 10 Jan 1950 [fl], *R. L. Fróes 25652* (U); Reserva Florestal do Sacavém [Mata da Caema], 03 Dec 1988 [fl], *R. C. Reis 57* (MAR); 22 Jan 1992 [fl], *F.H. Muniz 17* (RB); 26 fev 1992 [fl], *F. H. Muniz 196* (RB); 27 May 1992 [fl], *F.H. Muniz 256* (HUEFS); 21 Jan 1993 [fr], *F.H. Muniz 287* (INPA); Rio Anil, 13 Jan 1951 [fl, fr], *B. E. Franz 26348* (ASU); Sede da Cemar, 27 Nov 1985 [fl], *G.T. Prance & R. Henriques 29886* (US); Sítio Santa Eulália, 29 Jan 2018 [fl], *G. S. Amorim 414, 419* (MAR); 26 Feb 2018 [fr], *G. S. Amorim 491* (MAR).

2. *Campomanesia aromatica* (Aubl.) Griseb., Fl. Brit. W.I. [Grisebach] [3]: 242 (1860). *Psidium aromaticum* Aubl., Hist. Pl. Guiane 1: 485, t. 191 (1775). Type: FRENCH GUIANA. "Habitat in sylvis Caiennae & Guianae", *Aublet s.n.* (holotype: BM! [953694] [web]).

Shrubs 1.5–3.5 m. Twigs glabrous or sparsely pubescent, the hairs whitish. Leaves with petioles 7–13 mm long, glabrous or sparsely pubescent, the hairs whitish, channeled or shallowly channeled on the basal half; blades elliptic to broadly so, ovate or obovate, 5.6–10.8 × 2.9–5.1 cm, glabrous or sparsely pubescent, pubescent when young, the hairs whitish, membranaceous or chartaceous, discolorous; glands conspicuous, dark; apex acute or acuminate; base cuneate, rounded, or obtuse; midvein adaxially impressed; lateral veins impressed and covered with hairs whitish abaxially and prominent adaxially, 5 to 12 pairs; marginal vein absent, intra-marginal vein absent, the margin flat. Inflorescence axillary, a single flower, the main axis inconspicuous; bracts lanceolate, ovate

or oblong, 5–7 × 1 mm, puberulent, caducous after anthesis; pedicels 12–42 mm long, puberulent; bracteoles linear, 1.5–3 × 0.1–0.2 mm, pubescent, caducous after anthesis; flower buds globose, 3.2–3.9 × 3–3.5 mm, not constricted beneath ovary; calyx-lobes partially fused in the lower third of the bud, 5-merous, obovate or obtriangular, 1–2 × 1 mm, sparsely pubescent or pubescent, not reflexed, persistent in the fruit; ovary 3–7–locular. Immature fruits globose, 0.4–1.1 × 0.4–1 cm, sparsely pubescent, surface smooth.

Campomanesia aromatica may be recognized by having leaves with 5 to 12 lateral veins on each side, and covered with whitish hairs abaxially and veins that are impressed; and an absent marginal vein; the flowers are single with pedicels 12–42 mm long; and a 5-merous calyx with free lobes and a 3–7–locular ovary.

Distribution and habitat: Known from Bolivia, French Guiana, Guyana, Suriname, Trinidad-Tobago, Venezuela and widely distributed in Brazil. In Amazonian Maranhão, *C. aromatica* was found growing along a road, and in “terra firme” and secondary forests.

Phenology: Flowering in January and fruiting in January and February.

Specimens Examined. — **MARANHÃO**: Alcântara: 04 Feb 1984 [fr], *A. M. V. Carvalho 2078* (SPF). São Luís: Estrada do Tirirical, Feb-Mar 1939 [fr], *R. L. Fróes 11526* (NY); Sítio Andiroba, 07 Aug 1980 [st], *M. G. Silva 5693* (MG); Sítio Santa Eulália, 20 Jan 1988 [fl], *E. Barroso 47* (SLUI); 29 Jan 2018 [fr], *G. S. Amorim 417* (MAR); 26 Feb 2018 [fr], *G. S. Amorim 490* (MAR).

Additional Specimens Examined. — **MARANHÃO**: São José de Ribamar, praia de Caúra, 13 Jan 2017 [fl], *G.S. Amorim 507* (MAR).

3. *Eugenia biflora* (L.) DC., Prodr. [A. P. de Candolle] 3: 276 (1828). *Myrtus biflora* L., Syst. Nat., ed. 10. 2: 1056 (1759). Type: JAMAICA. *P. Browne s.n.* (lectopyte designated by Fawcett & Rendle 1926 [p. 338]: LINN 637,6).

Trees or shrubs 1–4 m. Twigs densely pubescents, the hairs whitish. Leaves with petioles 2–4 mm long, pubescent, channeled; blades elliptic to narrowly so, lanceolate or ovate, 3–7.8 × 1.2–4.1 cm, pubescent or densely pubescent, the hairs whitish, chartaceous, concolorous; glands conspicuous; apex acuminate, long acuminate, almost caudate, generally apiculate, rarely acute; base rounded, cuneate or attenuate; midvein adaxially impressed or sulcate; lateral veins sometimes not visible in dried material or evident abaxially only, 12 to 20 pairs; marginal vein ca. 1 mm from the margin, intra-marginal vein absent, the margin revolute. Inflorescence axillary, a raceme simple, the main-axis 1.5–4.9 cm long, pubescent, the hairs whitish; bracts triangular to narrowly so, or lanceolate, 2–3 × 1–3 mm, pubescent, persisting in the fruit; pedicels 3–9 mm long, sparse to densely pubescent, the hairs brownish or whitish; bracteoles deltate to broadly so, ovate or lanceolate, 1–2 × 1–5 mm, pubescent, persisting in the fruit; flower buds globose, 3 × 4 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, ovate, oblong or deltate, orbicular, 2 × 3 mm, pubescent, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruit subglobose or globose, 0.6–0.8 × 0.4–0.7 cm, pubescent, surface smooth.

Eugenia biflora may be recognized by its pubescent or densely pubescent leaves with whitish hairs; revolute margins; and a pubescent simple raceme; and subglobose or globose flowers buds; and densely pubescent fruits.

Distribution and habitat: Throughout tropical America, and widely distributed in central, northeastern and northwestern Brazil. In Amazonian Maranhão, *E. biflora* was found growing in gallery forest edges and secondary forest.

Phenology: Flowering all year and fruiting in January, March, November and December.

Specimens Examined. — **MARANHÃO**. Anajatuba: 14 Aug 2008 [fl], *M. Vidigal 03a* (IAN); 29 Sept 2008 [st], *M. Ribeiro 02* (IAN); Afoga, 18 Oct 2008 [fl], *M. Vidigal 01* (IAN); Margem da Estrada Colombo-Anajatuba, 27 Jan 1976 [fr], *B. G. S. Ribeiro & G. S. Pinheiro 1246* (JAN); 21 Nov 1978 [fl], *L. R. Marinho & G. S. Pinheiro 608* (IAN); São Benedito, 28 Jun 2008 [fl], *A. Araújo 84* (IAN). Bacabal: 18 Feb 1983 [fl], *G. T. Prance 28150* (NY). Bom Jardim: Posto Indígena Pindaré (Funai Post Guajajara Indians), along Rio Pindaré, c. 15km W of Santa Inês, 01 Nov 1983 [fl], *M. J. Balick et al. 1501* (SP). Cândido Mendes, 02 Nov 2017 [fl], *G. S. Amorim 526* (MAR). Itapecuru Mirim: Fazenda Serra, 24 Sept 1975 [fl], *D. P. Lima 13398* (PEUFR). Santa Helena: Próximo do Lugarejo Queimadas, 09 Jul 1978 [fl], *N. A. Rosa & O. Cardoso 2560* (IAN). Santa Luzia: Alzilândia, Rio Pindaré, 30 Mar 1979 [fl, fr], *J. Jangoux 1025* (NY). São Luís: Alumar, 08 Oct 1995 [fl], *K. B. Ferreira s.n* (MAR); Anil, Jan 1940 [fl], *R. L. Fróes 11705* (NY); Reserva Florestal do Sacavém, 20 Dec 1988 [fl], *J. C. Silva Jr. 55* (MAR); Sítio Santa Eulália, 16 Sept 2017 [fl, fr], *G. S. Amorim 454*, 452 (MAR); 26 Fev 2018 [fr], *G. S. Amorim 492* (MAR); Vinhas, 08 Jan 1998 [fr], *A. Salino 3876* (SP). São Luiz Gonzaga do Maranhão: 01 Oct 1980 [fl], *D. C. Dale 404 et al.* (NY). São José de Ribamar: Estrada carroçal, 27 Dec 1997 [fr], *H. C. Nakakura s.n.* (EAC); Sítio Aguahy, 13 Oct 2015 [fl], *G. S. Amorim 259* (MAR); 07 May 2016 [fl], *G. S. Amorim 272* (MAR); 26 Aug 2017 [fl], *G. S. Amorim 369* (MAR); 28 Oct 2017 [fl], *G. S. Amorim 377* (MAR); 20 Feb 2018 [fl], *G. S. Amorim 467* (MAR). Serrano do Maranhão: Porto do Pindobal, 19 Aug 2014 [fl], *G. P. Lima 495* (MAR). Viana, between Vitoria do Mearim and Viana, 16 Jan 1980 [fl], *D. C. Dale et al. 628* (IAN).

4. *Eugenia caducibracteata* Mazine, Kew Bull. 64(1): 149 (2009). Type: BRAZIL, Pará, Almeirim, Gleba Monte Dourado, floresta secundária de terra firme, *J. M. Pires & N. T. Silva 2015* (holotype: MG)

Shrubs 2–17 m. Twigs glabrous, sparsely pubescents when young, the hairs whitish. Leaves with petioles 3–8 mm long, glabrous or puberulent, channeled or shallowly channeled; blades elliptic to broadly so, lanceolate, ovate or oblong, 5.2–14 × 2.5–6.3 cm, glabrous or sparsely pubescent, the hairs brownish, chartaceous, concolorous; glands conspicuous; apex acute or attenuate, rarely acuminate; base rounded, cuneate or acute; midvein abaxially sulcate; lateral veins visible, 8 to 10 pairs; marginal vein 1–3 from the margin, intra-marginal vein absent, the margin revolute. Inflorescence axillary or terminal, a raceme simple, the main-axis 4.2–10.4 cm long; bracts not seen, caducous before anthesis; pedicels 2–9 mm long, glabrous; bracteoles ovate to broadly so, or deltate, 1–2 × 1–3 mm, glabrous, persistent in the fruit; flower buds globose, 5 × 5 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, orbicular, 2–3.5 × 3–4 mm, glabrous, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruits oblong or ellipsoid, 1.4–1.7 × 1.1–1.3 cm, glabrous or puberulent, surface smooth.

Eugenia caducibracteata may be recognized by its adaxially sulcate leaf midvein; a simple raceme with a long main-axis; large flower buds (5 × 5 mm); and bracts that are caducous before anthesis.

Distribution and habitat: Known from northeastern and northwestern Brazil (Amazonas, Maranhão and Pará states). *E. caducibracteata* can be found growing in unflooded tropical moist forest (Mazine & Souza 2009) and in Amazonian Maranhão was found growing in secondary forest.

Phenology: Flowering in February and December and fruiting in August.

Specimens Examined. — **MARANHÃO.** Açailândia: Estrada BR-222, entre Santa Inês e Açailândia, 17 Dec 1978 [fl], *J. Jangoux 559* (NY). Alto Alegre do Pindaré: Alzilândia, Rio Pindaré, 11 Dec 1978 [fl], *J. Jangoux & R. P. Bahia 304* (BHCB). Buriticupu: Reserva Florestal da CVRD, 08 Feb 1996 [fl], *F. H. Muniz B2378* (SP). Santa Luzia: Alzilândia, Rio Pindaré, 11 Dec 1978 [fr], *J. Jangoux 304* (NY). São Luís: Feb-Mar 1939 [fl], *R. L. Fróes 11773* (NY). São José de Ribamar: Sítio Aguahy, 03 Feb 2018 [fl], *G. S. Amorim 448* (MAR); 03 Feb 2018 [fl], *G. S. Amorim 447* (MAR); 26 Aug 2017 [fr], *G. S. Amorim 373* (MAR). Turiaçu: Palmeirinha, 27 Feb 1983 [fl], *J. U. Santos 994* (MG).

5. *Eugenia cupulata* Amshoff, Recueil Trav. Bot. Néerl. 39: 160, fig (1942). Type: SURINAME. Brokopondo, Brownsberg, *C. J. Zaandam 6428* (holotype: U [0005014]).

Trees or shrubs 5.4–10 m. Twigs glabrous. Leaves with petioles 8–22 mm long, glabrous, unchanneled; blades elliptic to broadly so, lanceolate, ovate or oblong, 12.9–22.4 × 5–10 cm, glabrous adaxially and glabrous or sparsely pubescent abaxially, the hairs brownish-red, chartaceous, discolorous, sometimes lustrous adaxially, darker abaxially; glands not seen; apex acute, cuneate, obtuse or cuspidate; base cuneate, rounded or obtuse; midvein adaxially flat; lateral veins prominent abaxially, 12 to 15 pairs; marginal vein ca. 1 mm from the margin, intra-marginal vein 4–6 mm from the margin, the margin flat. Inflorescence axillary, a raceme simple, the main axis 2.7–4.8 cm, pubescent, the hairs brownish-red, bracts not seen, caducous before anthesis; pedicels 5–6 mm long, pubescent; bracteoles deltate, 1.5–2 × 1–2 mm, pubescent, persistent in the fruit; flower buds globose, 4–7 × 5 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, orbicular, 1.5–2 × 1.8–3 mm, pubescent, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruits globose, 0.5–0.8 × 0.6–0.9 cm, glabrous or sparsely pubescent, surface smooth.

Eugenia cupulata may be recognized by its adaxially flat midvein; a marginal vein ca. 1 mm from the margin; and an intra-marginal vein 4–6 mm from the margin; racemes with red-brownish pubescence; globose flower buds (4–7 × 5 mm); and free, pubescent calyx-lobes.

Distribution and habitat: Known from Bolivia, French Guiana, Suriname, Venezuela, central, northeastern and northwestern Brazil (Acre, Amazonas, Maranhão, Pará and Rondônia states). In Amazonian Maranhão, *E. cupulata* was found growing in "terra firme" forest on rocky soil.

Phenology: Flowering in February and March and fruiting in April and June.

Specimens Examined. — **MARANHÃO**: São Luís: Feb-Mar 1939 [fl], *R. L. Fróes 11789* (NY); 1940 [fr], *R. L. Froes 11864* (NY). Arredores de Estiva, 08 Aug 1980 [st], *M. G. Silva 5738* (MG).

Additional Specimens Examined. — **MARANHÃO**: Carolina: 12 Mar 2016 [fr], *A. C. Sevilha 5811* (CEN). Lorêto: "Ilha das Balsas", 01 Jun 1962 [fr], *G. Eiten 4810* (NY). **PARÁ**: Santarém: Km 35 da estrada do Palhao, arredores do Acampamento do Igarapé Curupira, 04 Sept 1969 [fl], *M. B. Silva 2493 with R. Souza* (NY).

6. *Eugenia densiracemosa* Mazine & Faria, Phytotaxa 151(1): 53 (2013). Type: BRAZIL. Mato Grosso. Chapada dos Guimarães, Parque Nacional da Chapada dos Guimarães, Véu da Noiva, ao longo do rio Coxipozinho, trilha para a base da cachoeira, *F. F. Mazine et al. 1072* (holotype: ESA; isotype: K! [001018882] [web]).

Shrubs 3–15 m. Twigs densely pubescent, the hairs whitish. Leaves with petioles 2–13 mm long, glabrous, channeled; blades oblanceolate, oblong, obovate or elliptic, 2.5–20 × 1.8–8.5 cm, glabrous, chartaceous or subcoriaceous, discolorous; glands conspicuous; apex acute, acuminate or cuspidate; base cuneate, acute or obtuse; midvein adaxially flat; lateral veins visible, 8 to 13 pairs; marginal vein 1–3 mm from the margin, intra-marginal vein absent, the margin revolute.

Inflorescence axillary, a raceme simple, the main-axis 1.8–6 cm long, sparsely pubescent or densely pubescent, the hairs whitish; bracts ovate to broadly so, or deltate, 0.1–0.2 × 0.3 mm, pubescent, persisting in the fruit; pedicels 2–10 mm long, pubescent; bracteoles ovate or deltate, 0.2 × 0.5 mm, glabrescent or densely pubescent; persisting in the fruit; flowers buds globose, 1–2 × 2 mm, not constricted beneath ovary; calyx-lobes partially fused in the lower third of the bud, 4–merous, orbicular, 0.3–2 × 0.5–1.9 mm, glabrescent or densely pubescent, not reflexed, persistent in the fruits; ovary 2–3–locular. Immature fruits globose, 0.6–1.1 × 0.5–1.7 cm, glabrous, surface smooth.

Eugenia densiracemosa may be recognized by its chartaceous or subcoriaceous leaves; with a marginal vein 1–3 mm from the margin; long, simple racemes (1.8–6 cm), generally with a long pedicel (2–10 mm long). This species is morphologically related to *E*. *florida*, but can be distinguished by its 8 to 13 pairs of unarched lateral veins (vs. arched) that are visible adaxially and abaxially (5 to 8 pairs, visible abaxially).

Distribution and habitat: Known from French Guiana and central, northeastern and northwestern Brazil (Acre, Ceará, Goiás, Maranhão, Mato Grosso, Pará and Tocantins states). *E*. *densiracemosa* grows in forest formations along rivers and streams borders, in Cerrado and Amazonia biomes (Mazine & Faria 2013). In Amazonian Maranhão it was found in “terra firme” and secondary forests.

Phenology: Flowering in January, August and October to December and fruiting in March and August.

Specimens Examined. — **MARANHÃO**. Alto Alegre do Pindaré: Mineirinho, 26 May 1979 [fr], *J. Jangoux & R. P. Bahia 875* (NY). Santa Luzia: Margem direita da Rod. BR-222, a altura do km

124, que liga Santa Inês a Açailândia na Belém-Brasília, 16 Dec 1978 [fl], *N. A. Rosa 3014* (NY); Mineirinho, 26 Mar 1979 [fr], *J. Jangoux 875* (NY). São Luís: Estrada do Tirirical, Feb-Mar 1989 [fr], *R. L. Fróes 11534* (NY); Granja Barreto, 04 Jan 1950 [fl], *R. L. Fróes 25619* (IAN); Estrada da Maioba, 10 Jan 1950 e[fl], *R. L. Fróes 25654* (IAN); Reserva Florestal do Sacavem [Mata da Caema], 27 Feb 1992 [fl], *F. H. Muniz 36* (INPA), *37* (RB); 15 Sept 1992 [fr], *F. H. Muniz 159* (INPA); 07 Oct 1992 [fl], *F. H. Muniz 168* (RB); 10 Feb 1993 [fl], *F. H. Muniz 216* (RB). São José de Ribarmar. Sítio Aguahy, 25 Ago 2017 [fr], *G. S. Amorim 359*; 28 Oct 2017 [fl], *G. S. Amorim 379* (MAR); 25 Ago 2017 [fl], *G. S. Amorim 359* (MAR).

Additional Specimens Examined. — **PARÁ**: Jacundá. Jatobal, area to be flooded by Tucurui dam; margin of Rio Tocantins, 21 Oct 1977 [fl], *A. S. Silva 96 et al.* (NY).

7. *Eugenia dittocrepis* O. Berg, Fl. Bras. (Martius) 14(1): 292 (1857). Type: BRAZIL. Amazonas, *Pöppig 3109* (syntypes: P! [01902445] [web], G! [00223425] [web], BM! [000953773] [web]).

Shrubs ca. 1.5 m. Twigs glabrous. Leaves with petioles 9–10 mm long, glabrous, unchanneled or shallowly channeled, in the dried material yellowish-green; blades elliptic, oblong or oval, 10–12.1 × 3.6–5.1 cm, glabrous, chartaceous, discolorous, in the dried material green-yellowish adaxially and dark reddish-brown abaxially; glands not seen; apex acute, cuneate, rarely rounded; base cuneate or rounded; midvein adaxially flat; lateral veins visible, 10 to 15 pairs; marginal vein 1–3 mm from the margin, intra-marginal vein absent, the margin revolute. Inflorescence axillary, a fascicle, the main-axis 1–2 mm, glabrescent; bracts orbicular, 0.5 × 0.5 mm, glabrous, persistent in the fruit; pedicels 4–9 mm long, glabrous; bracteoles ovate, 1.5 × 1 mm, glabrous, persistent in the fruit; flower buds globose, 3–4 × 5–6 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, orbicular, 1.4–2 × 1–2 mm, glabrous, not reflexed, persistent in the fruit; ovary not seen. Immature fruit globose, ca. 1 cm diameter, glabrous, surface smooth.

E. *dittocrepis* may be recognized by its leaves, which are green-yellowish adaxially and reddish-brown abaxially with revolute margins; its inflorescence, which is a glabrescent fascicle with persistent bracteoles in fruit; and its globose, glabrous, and smooth fruits. This species is morphologically related to *E. stictopetala* but can be distinguished by its absent intra-marginal vein (vs. intra-marginal vein 4–5 mm from the margin) and its discolorous leaves (vs. concolorous leaves).

Distribution and habitat: Known from Colombia, Ecuador, Peru, Venezuela and northeastern and northwestern Brazil (Acre, Amazonas, Maranhão, Mato Grosso and Pará states). In Amazonian Maranhão, *E*. *dittocrepis* was found growing along rivers.

Phenology: Fruiting in April.

Specimens Examined. — **MARANHÃO**. Cândido Mendes: Maracassumé River Region, 30 Apr 1932 [fr], *R.L. Fróes 1709* (NY). Viana: 1958 [st], *O. Carvalho 5* (RB).

8. *Eugenia flavescens* DC., Prodr. [A. P. de Candolle] 3: 272 (1828). Type: BRAZIL. Habitat inter fructices et dumeta in deserto; Crescit in Brasiliae prov. Bahiens, *C. F. P. Martius s.n.* (holopype: M [0137665]; isotype: M [0137666] M [0137667]).

Shrubs 0.35–15 m. Twigs glabrous or sparsely pubescent, the hairs whitish. Leaves with petioles 2–7 mm long, glabrous, channeled; blades elliptic to broadly so, or oblong, 4.3–7 × 1.3–3.4 cm, glabrous, chartaceous or coriaceous, concolorous, in the dry material turn yellowish; glands conspicuous; apex acute, acuminate or long acuminate; base cuneate or rounded; midvein adaxially flat to prominent; lateral veins visible and slightly elevated, 6 to 12 pairs; marginal vein 1–2 mm from the margin, intra-marginal vein absent, the margin flat. Inflorescence cauliflorous, a fascicle, the main-axis absent or 1–1.5 mm long, glabrous, turning yellow in dry material; bracts orbicular,

0.7 × 1.5 mm, glabrous, persistent in the fruit; pedicels 2–5 mm long, glabrous; bracteoles orbicular, 0.5 × 0.7 mm, glabrous, persistent in the fruit; flower buds globose, 3 × 4 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, deltate or orbicular, 0.5–2 × 1–1.5 mm, glabrous, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruit globose, 0.4–0.6 × 0.2–0.9 cm, glabrous or sparsely pubescent, surface with glands marked.

Eugenia flavescens may be recognized by its leaves, with an adaxially flat to prominent midvein and slightly elevated lateral veins; its inflorescence, which is a cauliflorous fascicle with a main axis which is absent or up to 1–1.5 mm long; its small flowers (3 × 4 mm); and its globose fruits, which are glabrous or sparsely pubescent with glands marking the surface.

Distribution and habitat: Known from Bolivia, Colombia, Ecuador, French Guiana, Guyana, Suriname, Venezuela and widely distributed in Brazil. In Amazonian Maranhão, *E. flavescens* was found growing in “terra firme” forest, on rocky soil, and in old clearings.

Phenology: Flowering from January to April and June and fruiting in July.

Specimens Examined. — **MARANHÃO**: Estrada BR 222, entre Santa Inês e Açailândia, 17 Dec 1978 [fr], *J. Jangoux 543* (NY). Barão de Grajaú, 25 Jan 2012 [fr], R. M. Harley 56478 (HUEFS). São Luís: 8ºBatalhão da Policia Militar, 15 Jun 2018 [fr], *G. S. Amorim 510* (MAR); Estrada do Olho d'Agua, Feb–Mar 1939 [st], *R. L. Fróes 11624* (NY); Estrada de S. Luis para o Rio Anil, 07 Jan 1950 [fl], *R. L. Fróes 25635* (IAN); Granja Barreto, 04 Jan 1950 [fl], *R. L. Fróes 25621* (IAN). São Bento: Contagem em campo de São Bento, 02 Jul 1979 [fr], *N. A. Rosa & O.C. Nascimento 2581*. Turiaçu: Ilha Trauira, 05 Apr 1987 [fl], *M. R. Santos 700* (IAN).

Additional Specimens Examined. — **MARANHÃO**: Barão de Grajaú: ca. 50 Km da cidade na BR 230, 21 Jan 2012 [fr], *R. M. Harley 56478* (NY). Carolina: Fazenda Palestina, 01 Mar 2015 [fr], *G. Pereira-Silva 9746* (CEN). Estreito: Margem direita do rio Tocantins/foz do rio Feio, 14 Jan 2008 [fr], *G. Pereira-Silva 12608* (CEN).

9. *Eugenia florida* DC., Prodr. [A. P. de Candolle] 3: 283 (1828). Type: BRAZIL. Amazonas, "in Brasilia ad ripam flum. Amazonum", *C.F.P. Martius s.n.* (holotype: M [0137662]; isotype: M [0137663]).

Shrubs 1–2.5 m. Twigs sparsely pubescent, the hairs whitish. Leaves with petioles 4–10 mm long, pubescent, channeled; blades elliptic to broadly so, or oblanceolate, 11–15.3 × 4.3–5.1 cm, glabrous, membranaceous or subcoriaceous, concolorous; glands not seen; apex acute, acuminate or attenuate; base cuneate or rounded; midvein adaxially sulcate; lateral veins visible abaxially, arched, 5 to 8 pairs; marginal vein ca. 1 mm or less from the margin, intra-marginal vein 1.5–3 mm from the margin, the margin flat. Inflorescence axillary, a raceme simple, the main-axis 1.9–4.1 cm long, glabrescent; bracts lanceolate, 4–6 × 0.5–1 mm, persistent in the fruit, glabrous; pedicels 2–4 mm long, sparsely pubescent; bracteoles deltate, 2–6 × 0.5–2 mm, persistent in the fruit, glabrous; flower buds globose, 2 × 3.5 mm, not constricted beneath ovary; calyx-lobes free, 4-merous, ovate, ca. 2 mm, glabrous, not reflexed, persistent in the fruit; ovary not seen. Immature fruit globose, 2.7–3 x 2–2.8 cm, pubescent, surface smooth.

Eugenia florida may be recognized by its leaves with arched lateral veins and the first vein not confluent with the marginal vein; its glabrescent, simple raceme; and its globose fruits, which are pubescent and have a smooth surface. This species is morphologically related to *E. densiracemosa*, but can be distinguished by its concolorous leaves (vs. discolorous), and its arched lateral veins

(vs. not arched), with 5 to 8 pairs, visible abaxially (vs. 8 to 13 pairs, visible adaxially and abaxially).

Distribution and habitat: Known from Argentina, Bolivia, Colombia, Costa Rica, Ecuador, French Guiana, Guyana, Nicaragua, Panamá, Paraguay, Peru, Suriname, Venezuela, and widely distributed in Brazil. In Amazonian Maranhão, *E. florida* was found growing in "terra firme" forest.

Phenology: Flowering in January and November and fruiting in March.

Specimens Examined. — **MARANHÃO.** Santa Luzia: Fazenda Cacique, 25 Mar 1983 [fr], *E.L. Taylor E1058 et al.* (MG).

Additional Specimens Examined. — **MARANHÃO.** Mirador: Lugarejo Boné, 16 Nov 1988 [fl], *F. Noberto 11* (SLUI). São Pedro dos Crentes: Margem direita do rio Farinha, próximo à cidade, 11 Jan 2008 [fr], *G. Pereira-Silva 12506* (CEN). **PARÁ**. Peixe-Boi, colônia do Salgado, arredores do igarapé do Ubim, 22 Jan 1977 [fl], *M. G. da Silva 2854* (NY).

10. *Eugenia lambertiana* DC. Prodr. [A. P. de Candolle] 3: 270 (1828). Type: Saint Vicent [and the Grenadines]. *Lambert s.n.* (B as F negative 33490).

Trees or shrubs 4 m. Twigs glabrous. Leaves with petioles 5–10 mm long, glabrous, channeled; blades elliptic or lanceolate, rarely ovate, 4.1–12.2 × 1.3–5 cm, puberulent adaxially and glabrous abaxially, the hairs whitish, membranaceous, discolorous; glands not seen; apex acute or acuminate; base attenuate, cuneate or rounded; midvein adaxially sulcate; lateral veins visible, 8 to 20 pairs; marginal vein ca. 1 mm or less from the margin, intra-marginal vein ca. 2 mm from the margin, the margin revolute. Inflorescence axillary, a fascicle, the main-axis 2–7 mm long, sparsely pubescent, the hairs brownish-red; bracts deltate, 0.5 × 0.4 mm, caducous after anthesis, glabrous; pedicels 2–5.9 mm long, glabrous; bracteoles deltate, ca. 1 mm, glabrous, persistent in the fruit;

flower buds globose 2–3 × 3 mm, not constricted beneath ovary; calyx-lobes free, 4-merous, orbicular, 1.5 × 2 mm, glabrous, not reflexed, persistent in the fruit; ovary not seen. Immature fruit globose, 0.8–1 × 0.7 cm, glabrous, surface smooth.

Eugenia lambertiana may be recognized by its elliptic or lanceolate, rarely ovate leaves, which are discolorous, brown adaxially and green abaxially; with the marginal vein ca. 1 mm or less from the margin and the intra-marginal vein ca. 2 mm from the margin. This species is morphologically related to *E. protenta*, but can be distinguished by its leaves, which are puberulent adaxially and glabrous abaxially (vs. glabrous), the revolute margins (vs. flat), and the pubescent fruit (vs. glabrous).

Distribution and habitat: Known from Bolivia, Colombia, Ecuador, French Guiana, Guyana, Leeward Is., Peru, Suriname, Trinidad-Tobago, Venezuela, Windward Is. and widely distributed in central, northeastern and northwestern Brazil. In Amazonian Maranhão, *E. lambertiana* was found growing in open field.

Phenology: Flowering in November and fruiting in March.

Specimens Examined. — **MARANHÃO**. Maracaçumé River Region, 08 Sept 1932 [fl], *R.L. Fróes 1872* (NY).

Additional Specimens Examined. — **AMAPÁ.** Serra do Navio, Rio Amapari, 23 Nov 1954 [fr], *R. S. Cowan 38547* (NY). **PARÁ.** Oriximiná. Rio Trombetas, margem esquerda do lago Erepecu, ao longo do lago, 16 Jul 1980 [fr], *C. A. Cid Ferreira 1522 et al.* (NY).

11. *Eugenia muricata* DC., Prodr. [A. P. de Candolle] 3: 283 (1828). Type: BRAZIL. “Crescit in Brasiliae prov. Rio Negro ad Topinambarana”, *C.F.P. Martius s.n* (holotype: M [M0170975]; isotype: K! [000276598] [web], K! [000276597] [web]).

Trees or shrubs 4 m. Twigs sparsely pubescent, the hairs reddish-brown. Leaves with petioles 6–9 mm long, pubescent, channeled; blades elliptic to broadly so, or oblong, 10.5–16.2 × 3.8–5.3 cm, glabrous or sparsely pubescent, the hairs whitish, chartaceous, discolorous; glands conspicuous; apex acute or acuminate; base rounded, attenuate or cuneate; midvein adaxially sulcate; lateral veins visible adaxially, 19 to 22 pairs; marginal vein ca. 1 mm from the margin, intra-marginal vein absent, the margin flat. Inflorescence axillary, a raceme simple, the main-axis 9.8–12.6 cm long, pubescent; bracts not seen, caducous before anthesis; pedicels 5–15 mm long, pubescent; bracteoles deltate, 8 × 5 mm, pubescent adaxially and glabrous abaxially, caducous after anthesis; flower buds globose ca. 3 mm, not constricted beneath ovary; calyx-lobes free, 4-merous, orbicular or oblong, 2–3 × 3–4 mm, pubescent, not reflexed, persistent in the fruit; ovary not seen. Immature fruit globose, 1–1.3 × 1.3–1.5 cm, pubescent, surface ridged.

E. muricata may be recognized by its discolorous, elliptic to broadly elliptic, or oblong leaves, with an adaxially sulcate midvein; and the globose fruit that are pubescent and have a ridged surface. This species is morphologically similar to *E. polystachya* from which it is distinguished by its fruit with ridged surface (vs. smooth) and glabrous or sparsely pubescent leaves (vs. densely pubescent).

Distribution and habitat: Known from Bolivia, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname and northeastern and northwestern Brazil (Acre, Amazonas, Amapá, Maranhão, Pará and Rondônia states). In Amazonian Maranhão, *E. muricata* was found growing in “terra firme” forests and secondary forests.

Phenology: Flowering and fruiting in October.

Specimens Examined. — **MARANHÃO.** Bequimão: Pontal 12 Jan 2020 [fr], *G. S. Amorim* (601); Monção: Ka'apor Indian Reserve, 07 Oct 1986 [fl], *W. Balée 2684* (NY). Mineirinho, Rio Pindaré, 26 Oct 1979 [fl; fr], *J. Jangoux 937* (MG).

12. *Eugenia patrisii* Vahl, Eclog. Amer. 2: 35 (1798). Type: FRENCH GUIANA, s. l., *J.P.B. Rohr, s.n.* (holotype: C [10015707]).

Trees 2.5–8 m. Twigs pubescents, the hairs reddish-brown. Leaves with petioles 1–7 mm long, pubescent, channeled or shallowly channeled; blades elliptic to broadly so, obovate or ovate, 6.2–14.4 × 3.1–6 cm, glabrous, pubescent on young blades, the hairs reddish-brow, membranaceous or chartaceous, concolorous; glands conspicuous; apex acute or cuneate, rarely cuspidate; base cuneate or abruptly rounded; midvein adaxially flat to impressed; lateral veins slightly visible, arched, 5 to 9 pairs; marginal vein ca. 1 mm or less from the margin, intra-marginal vein 3–6 mm from the margin, the margin flat. Inflorescence axillary, raceme auxotelic, with cataphylls in base, the main axis 0.6–1.3 cm long, pubescent, the hairs reddish-brown; bracts deltate, 3–3.5 × 1–1.6 mm, glabrous adaxially and pubescent abaxially, caducous after anthesis; pedicels 15–30 mm long, glabrous or pubescent; bracteoles linear, 1.5 × 1.5 mm, pubescent, caducous after anthesis; flower buds globose 2–3 × 5 mm, not constricted beneath ovary; calyx-lobes free, 4-merous, orbicular or oblong, 2 × 1.5 mm, pubescent, not reflexed, persistent in the fruit; ovary not seen. Immature fruits globose, ca. 2 cm diameter, glabrous, surface with glands marked.

Eugenia patrisii may be recognized by its pubescent auxotelic raceme with cataphylls at the base; long-pedicellate flowers; its leaves with arched lateral veins, a marginal vein ca. 1 mm or less from the margin, an intra-marginal vein 3–6 mm from the margin; and its globose fruit which are glabrous and have marked glands on the surface.

Distribution and habitat: Known from Bolivia, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Venezuela and widely distributed in northeastern and northwestern Brazil. In Amazonian Maranhão, *E. patrisii* was found growing in flooded forests.

Phenology: Flowering in September and fruiting in November and December.

Specimens Examined. — **MARANHÃO**. Alzilândia, Rio Pindaré, 11 Dec 1978 [fr], *J. Jangoux & R. P. Bahia 368* (MG); Bacabal: Fazenda São Francisco, 25 Sept 1980 [fl], *D. C. Daly D257* (NY). Carutapera: Gurupiuna, Ka'apor Indian Reserve, 05 Nov 1986 [st], *W. L. Balée 2904* (NY). Monção: Bacia do Rio Turiaçu, 22 Sept 1985 [fl], *W. L. Balée 1047* (MG); 31 May 1987 [st], *W. L. Balée 3312* (NYBG); Catutapera, Gurupiuna, Ka'apor Indian Reserve, 09 May 1986 [st], *W. L. Balée 2293* (NY); 05 Nov 1986 [fr], *W. L. Balée 2904* (MG). São Luís: Alumar, 10 Nov 1995 [fr], *K. B. Ferreira & E. C. Girnos s.n* (MAR).

13. *Eugenia polystachya* Rich., Actes Soc. Hist. Nat. Paris 1: 110 (1792)**.** Type: FRENCH GUIANA. “in sylvis Guy”, *L. C. Richard 77* (syntypes: P! [01902611], P! [01902610] [web]).

Trees 3–5.4 m. Twigs densely pubescents, the hairs whitish. Leaves with petioles 4–6 mm long, pubescent, channeled; blades elliptic to broadly so, 4.9–7.5 × 1.5–5 cm, densely pubescent, the hairs whitish, chartaceous, discolorous; glands not seen; apex acute or acuminate, rarely cuspidate; base cuneate or rounded; midvein adaxially impressed; lateral veins visible, 31 to 35 pairs; marginal vein 1–2 mm from the margin, intra-marginal vein absent, the margin flat. Inflorescence terminal, a raceme simple, the main-axis 10–16 cm long, pubescent, the hairs whitish; bracts lanceolate, 1–2 × 2 mm, densely pubescent, persistent in the fruit; pedicels 6–13 mm long, pubescent; bracteoles deltate or orbicular, 2–3 × 1 mm, pubescent, persistent in the fruit; flower buds globose, 2–3 × 2 mm, not constricted beneath ovary; calyx-lobes free, 4-merous, orbicular or

oblong, 2 × 3 mm, pubescent, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruits globose, 4–7 × 3–5 cm, pubescent, surface smooth.

Eugenia polystachya may be recognized by its densely pubescent, elliptic to broadly elliptic leaves; its globose buds; and its globose fruit, which are pubescent and have a smooth surface. This species is morphologically similar to *E. muricata* from which it is distinguished by its fruit with a smooth surface (vs. ridged surface) and its densely pubescent leaves (vs. glabrescent or sparsely pubescent).

Distribution and habitat: Known from Bolivia, Colombia, Ecuador, French Guiana, Guyana, Peru and northeastern and northwestern Brazil (Acre, Amazonas, Amapá, Maranhão Pará and Roraima states). In Amazonian Maranhão, *E. polystachya* was found growing in "terra firme" forest and flooded forest.

Phenology: Flowering from October to December and fruiting in January, May, October and November.

Specimens Examined. — **MARANHÃO**. Maracassumé River Region, 06 May 1932 [fr], *R. L. Fróes 1737* (NY). Anajatuba: 24 Jan 1976 [fr], *B. G. S. Ribeiro & G. S. Pinheiro 1198* (IAN); 26 Jan 1976 [fr], *B. G. S. Ribeiro & G. S. Pinheiro 1215* (IAN); Estrada de Anajatuba, 21 Nov 1978 [fl], *L. R. Marinho & G. S. Pinheiro 611* (IAN). Santa Inês: Margem direita do Rio Pindaré, 13 Dec 1978 [fl], *N. A. Rosa 2953* (NY). São Luís: Estrada do Sacavem, Feb-Mar-1939 [fl], *R. L. Fróes 11565* (NY). São Vicente Ferrer: Banderante N to Pinheiro, 17 Oct 1980 [fl], *D. C. Daly D671* (NY). Vitória do Mearim: Rio Mearim, 16 Jan 1976 [fr], *N. T. Silva 4201* (IAN). Turiaçu: km 6 da BR 106 Maracaçumá-Sta. Helena, 01 Dec 1978 [fl], *N. A. Rosa 2803* (NY).

14. *Eugenia protenta* McVaugh, Mem. New York Bot. Gard. 18: 204 (1969). *Eugenia protracta* O. Berg, Linnaea 31(2): 254 (1863), nom. illeg. Type: VENEZUELA. “Prope San Carlos, ad Rio Negro, Brasiliae borealis”, *R. Spruce 3816* (holotype: BR! [5260492] [web]).

Trees 4 m. Twigs glabrous. Leaves with petioles 3–6 mm long, glabrous or sparsely pubescent, channeled or shallowly channeled; blades elliptic to broadly so, 4.9–11.5 × 1.9–2.4 cm, glabrous, chartaceous, discolorous; glands conspicuous; apex acute, acuminate or long acuminate; base rounded or cuneate; midvein adaxially sulcate; lateral veins visible adaxially, 10 to 13 pairs; marginal vein ca. 1 mm from the margin, intra-marginal vein absent, the margin flat. Inflorescence axillary, a fascicle, the main-axis 2–4 mm long, pubescent, the hairs reddish-brown; bracts orbicular, 2 × 5 mm, pubescent adaxially and glabrous abaxially, caducous after anthesis; pedicels 5–10 mm long, glabrous or sparsely pubescent; bracteoles orbicular, 0.5 × 1.2 mm, pubescent adaxially and glabrous abaxially, persistent in the fruits; flower buds globose, 3 × 2 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, obovate, 1.2–2.7 × 1.2–3 mm, glabrous or pubescent, not reflexed, persistent in the fruit; ovary not seen. Immature fruit globose, 0.6–1 × 0.6–0.8 cm, pubescent, surface with glands marked.

Eugenia protenta may be recognized by its elliptic to broadly elliptic leaves, the acute or acuminate leaf apex; and the globose fruit, which are pubescent and with marked glands on the surface. This species is morphologically related to *E. lambertiana*, but can be distinguished by its glabrous leaves (vs. puberulent adaxially), the flat margin (vs. revolute) and glabrous fruits (vs. pubescent).

Distribution and habitat: Known from Venezuela and northeastern and northwestern Brazil (Acre, Amazonas, Maranhão, Pará and Rondônia states). In Amazonian Maranhão, *E. protenta* was found growing in “terra firme" forest.

Phenology: Fruiting was registered in March.

Specimens Examined. — **MARANHÃO**. São José de Ribamar: Sítio Aguahy, 25 Aug 2017 [fl], *G. S. Amorim 362* (MAR). São Luís: Anil, 14 Mar 1949 [fr], *R. L. Fróes 24270* (IAN).

Additional Specimens Examined. — **AMAZONAS.** Cuieiras Campina, Rio Cuieiras near mouth of Rio Branchinho, 2 Jul 1975 [fl], *A. B. Anderson 145* (US); Presidente Figueiredo: Represa de Balbina on rio Uatumã: ca. 4 km NW of dam on D-1 road, 4 Jul 1986 [fr], *W. W. Thomas et al. 5342* (NY).

15. *Eugenia punicifolia* (Kunth) DC., Prodr. [A. P. de Candolle] 3: 267 (1828). *Myrtus punicifolia* Kunth, Nov. Gen. Sp. [H.B.K.] 6: 149 (1823). Type: VENEZUELA. Monte Impossible, *F. W. H. Humboldt & A. Bonpland 273* (holotype: P! [00679193] [web]).

Shrubs 0.9–2.5 m. Twigs pubescents, the hairs whitish. Leaves with petioles 3 mm long, glabrous or sparsely pubescent, shallowly channeled; blades elliptic to broadly so, obovate or oblong, 4.7–8.9 × 2.2–4.5 cm, glabrous, chartaceous, concolorous; glands conspicuous; apex acute, acuminate or cuneate; base cuneate or rounded; midvein adaxially impressed; lateral veins visible, 6 to 12 pairs; marginal vein ca. 1 mm or less from the margin, intra-marginal vein 1–3 mm from the margin, the margin flat. Inflorescence axillary, a fascicle, sometimes visible only two flowers per axis, the main-axis frequently inconspicuous, when visible ca. 1 mm long; bracts lanceolate, 0.6 × 4 mm, pubescent, persistent in the fruit; pedicels 18–26 mm long, glabrous; bracteoles orbicular, 0.3 × 2 mm, glabrescent, persistent in the fruit; flower buds globose, 3–4 × 3–6 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, orbicular or oblong, 1.5–2 × 1–2 mm, glabrous, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruit subglobose or ellipsoid, 0.5–1 × 0.7–0.8 cm, glabrous, surface smooth.

Eugenia punicifolia may be recognized by its glabrous leaves with a marginal vein ca. 1 mm or less from the margin, an intra-marginal vein 1–3 mm from the margin; the inflorescence forming a fascicle with a very short axis (ca. 1 mm long), sometimes with only two flowers visibles; its orbicular or oblong calyx lobes; it's subglobose or ellipsoid fruits, which are glabrous and have a smooth surface.

Distribution and habitat: Widely distributed in South America, including Brazil, where it occurs in all states. In Amazonian Maranhão, *E. punicifolia* was found growing in secondary and flooded forests.

Phenology: Flowering in June, July and September and fruiting in January, November and December.

Specimens Examined. — **MARANHÃO.** Maracassumé–Sta. Helena, Fazenda Maracaçumé, 01 Dec 1978 [fr], *N. A. Rosa 2824* (NY). Bequimão: Pontal, 12 Jan 2020 [fr], *G. S. Amorim* (602). Grajaú, Estrada do Arame, 15 May 1983 [fr], *M. F. Silva & E. L. Taylor 1146* (IAN). São Luís: 08 May 1989 [fl;fr], *M. Ferreira 97* (ESA); Reserva Florestal da Sacavém, 09 Jan 1992 [fr], *F. H. Muniz 03* (RB); 05 May 1992 [fr], *F. H. Muniz 87* (INPA); 07 May 1992 [fl], *F. H. Muniz 99* (RB); Sede do CEMAR, 27 Nov 1985 [fl; fr], *G. T. Prance & R. Henrique 29896* (MAR); Sítio Santa Eulália, 16 Setp 2017 [fr], *G. S. Amorim 401* (MAR); *G. S. Amorim 455* (MAR); 8º Batalhão da Polícia Militar, 07 Apr 2018 [st], *G. S. Amorim 487* (MAR);15 Jun 2018 [fl, fr], *G.S. Amorim 508* (MAR).

Additional Specimens Examined — **PARÁ.** Serra do Cachimbo, BR 163, Cuiabá-Santarém Highway, Cachoeira de Curuá, 04 Nov 1977 [fl], *G. T. Prance P24782* (NY). **RORAIMA.** Ilha de

Maracá, on road between SEMA Estação and Boa Vista, 14 km from Island, Alto Alegre, 17 Jun 1986 [fl], *M. J. G. Hopkins 825* (NY).

16. *Eugenia stictopetala* Mart. ex DC., Prodr. [A. P. de Candolle] 3: 270 (1828). Type: BRAZIL. Habitat in campis inter. Provinciae Minar, *C. F. P. Martius s.n*. (holotype: M [0171122]).

Shrubs 0.2–8 m. Twigs glabrous. Leaves with petioles 8–10 mm long, glabrous, channeled; blades elliptic to broadly so, oblong, oval or rounded, 6.5–13.1 × 4.3–6.4 cm, glabrous, chartaceous, concolorous; glands conspicuous and dark; apex acute or rounded; base cuneate or rounded; midvein adaxially impressed; lateral veins visible, 5 to 15 pairs; marginal vein 1 mm or less from the margin, intra-marginal vein 4–5 mm from the margin, the margin flat. Inflorescence axillary, a fascicle, the main axis ca. 1 mm long or less; bracts orbicular, 0.6 × 2.4 mm, glabrous, persistent in the fruit; pedicels 5–19 mm long, glabrous or sparsely pubescent; bracteoles elliptic or oblong, 0.7–1 × 2–5 mm, glabrous, persistent in the fruit; flower buds globose, 4–6 × 2–5 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, orbicular or oblong, 0.5–2.5 × 1.5–3 mm, glabrous, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruit globose, 0.9–1 × 0.6–0.8 cm, glabrous, surface with glands marked.

Eugenia stictopetala may be recognized by its glabrous chartaceous leaves with dark glands visible; and its orbicular or oblong calyx-lobes; and globose fruit. This species is morphologically related to *E. dittocrepis*, but can be distinguished by its intra-marginal vein 4–5 mm from the margin (vs. intra-marginal vein absent) and concolorous leaves (vs discolorous leaves).

Distribution and habitat: Known from Costa Rica, French Guiana, Guyana, Panamá, Peru, Suriname, Trinidad-Tobago, Venezuela and Brazil, where it is widely distributed. In Amazonian Maranhão, *E. stictopetala* was found growing in secondary forests and along roads.

Phenology: Flowering from March to July and fruiting in April.

Specimens Examined. — **MARANHÃO.** Funai a 40 Km da cidade de Arame, 14 Mar 1983 [fl], *R. Vilhena et al. 1005* (MG). Rio Maracaçumé, 01 Jul 1958 [fl], *R. L. Fróes 34408* (IAN). Alcântara: 10 Apr 1954 [fr], *R. L. Fróes 30741* (IAN). Grajaú: rodovia a 6 Km da cidade de Grajaú, 21 May 1983 [fr], *M. F. F. da Silva 1153* (NY); Mondelandia, 23 May 1983 [fl], *E. L. Taylor E1324*. São Luís: Granja Barreto, 10 May 1949 [fl], *R. L. Fróes 24292* (IAN); Reserva Florestal do Sacavém, 03 Apr 1992 [fr], *F. H. Muniz 50-423* (RB); Sítio São Raimundo, 08 Apr 1954 [fl], *R. L. Fróes 30711* (IAN); *R. L. Fróes 30694* (IAN).

17. *Eugenia wullschlaegeliana* Amshoff, Natuurw. Stud. Suriname & Curação 2: 20 (1948). Type: SURINAME. Paramaribo, *H. R. Wullschlägel 193* (holotype: BR! [5288649] [web]; isotype: MICH! [1109613] [web]).

Trees or shrubs 15.2 m. Twigs glabrous. Leaves with petioles 3–5 mm long, pubescent, unchanneled; blades elliptic to broadly so, or ovate, 6.2–11.1 × 3.1–4.7 cm, pubescent adaxially and densely pubescent abaxially, the hairs whitish or brownish, membranaceous or chartaceous, discolorous; glands not seen; apex acute or attenuate; base cuneate or rounded; midvein adaxially impressed; lateral veins visible, 8 to 9 pairs; marginal vein 1 mm or less from the margin, intra-marginal vein absent, the margin flat. Inflorescence axillary, a fascicle, the main-axis ca. 3 mm long, pubescent, the hairs yellowish; bracts deltate, 0.5 × 0.5 mm, pubescent, caducous after anthesis; pedicels 2–4 mm long, pubescent; bracteoles deltate, 0.5 × 0.5 mm, pubescent, caducous after anthesis; flower buds globose, 5 × 3 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, deltate, 1 × 1.3 mm, pubescent adaxially and glabrous abaxially, not reflexed, persistent in the fruit; ovary not seen. Immature fruit ellipsoid, 1.5–1.9 × 0.8 cm, glabrous, surface with glands marked, no mature fruits examined.

Eugenia wullschlaegeliana may be recognized by its leaves, which are ovate, elliptic, or broadly elliptic; its inflorescence forming a pubescent fascicle, with yellowish hairs; and its glabrous, ellipsoid fruit, with marked glands on the surface.

Distribution and habitat: Known from French Guiana, Suriname and northeastern and northwestern Brazil (Amazonas, Maranhão and Pará states). In Amazonian Maranhão, *E. wullschlaegeliana* was found growing in flooded forests and in open fields.

Phenology: Flowering in October and fruiting in September.

Specimens Examined. — **MARANHÃO**. Maracassumé River Region, Igarapé do Urubuquara, 09 Sept 1932 [fr], *R. L. Fróes 1885* (NY); 22 Oct 1932, [fl], *R. L. Fróes 1967* (NY).

Additional Specimens Examined. — **PARÁ.** Genipapo trail, Basin of Rio Xingu, Gleba Bacaja, lote 88, just below mouth of Rio Bacaja, 01 Dec 1980 [fl], *G. T. Prance P26566* (NY).

18. *Myrcia amazonica* DC., Prodr. [A. P. de Candolle] 3: 250 (1828). Type: BRAZIL. Amazonas: Solimoes, s.d., *C.F.P. Martius s.n.* (lectotype designated by McVaugh 1969 [p. 110]: M).

Shrubs 2–10 m. Twigs glabrous or sparsely pubescent, the hairs brownish, the branches and inflorescence reddish. Leaves with petioles 2–4 mm long, pubescent, channeled; blades elliptic, lanceolate or ovate, 3.7–6.7 × 1.9–3.2 cm, glabrous, chartaceous, discolorous; glands conspicuous adaxially and strongly marked; apex acute or acuminate, rarely cuspidate; base cuneate or rounded; midvein adaxially impressed of flat; lateral veins visible, 8 to 12 pairs; marginal vein 1–2 mm from the margin, intra-marginal vein absent, the margin flat. Inflorescence terminal or subterminal, a panicle, pyramidal, flowers laxas, the main-axis 7.8–13.8 cm long, glabrous, the first branching 4.2–6.8 cm long; bracts linear, ca. 2 mm, caducous before anthesis, pubescent; pedicels 1–3 mm long or absent, sparsely pubescent; bracteoles lanceolate or linear, 0.7–2 × 0.2 mm, caducous

before anthesis, glabrous or sparsely pubescent; flower buds obovate, 2 x 1.5 mm, not constricted beneath ovary; calyx-lobes free, 5–merous, orbicular, 0.5 × 1 mm, glabrous, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruit globose, 0.5 cm diameter, glabrous, surface smooth.

Myrcia amazonica may be recognized by its reddish branchlets and inflorescence, and its pyramidal panicle with small, lax buds This species is morphologically similar to *M. guianensis* from which it is distinguished by its reddish branches and inflorescence (vs. grayish), leaves with an adaxially impressed or flat midvein (vs. prominent) and 2-locular ovary (vs. 3-locular).

Distribution and habitat: Known from south Central America, Bolivia, Brazil, French Guiana, Suriname and Venezuela. In Brazil it is widely distributed. In Amazonian Maranhão, *M. amazonica* was found growing in "terra firme" and secondary forests.

Phenology: Flowering from May to August and fruiting in August.

Specimens Examined. — **MARANHÃO.** São José de Ribamar: Sítio Aguahy, 28 Aug 2017 [fr], *G. S. Amorim 374* (MAR). São Luís: Granja Barreto, 12 May 1950 [fl], *R. L. Fróes* 24260 (IAN); Reserva Florestal do Sacavem [Mata da Caema], 1958 [fl], *J. Ferreira et al. 58* (MAR); 01 Jul 1992 [fl], *G. M. Barroso 61* (UEC); 27 May 1992 [fl], *F. H. Muniz 103* (RB); 14 Aug 1992 [fl], *F. H. Muniz 26* (INPA); 26 Jun 1993 [fl], *F. H. Muniz 392* (INPA); 28 Jun 1993 [fl], *F. H. Muniz 378* (INPA). Turiaçu: Fazenda Vila Palmares, 23 Jul 1977 [fl], *A. E. Silva 131* (PEUFR); 25 Jul 1977 [fl], *s.c. 131* (IPA).

Additional Specimens Examined —**AMAZONAS.** Manaus: Igarapé do Passarinho, 21 Ago 1956, *D. F. Coêlho, INPA4109* (INPA). **PARÁ.** Santarém: Comunidade São Brás, 12 Oct 2012 [fl], *V. Y. P. Calao s.n.* (INPA). **RONDÔNIA.** Porto Velho: Jaci-Paraná., 13 Jul 2008 [fl], *G Pereira-Silva*

13547 (RON); Fragmento de floresta próximo a margem direita do, Floresta estacional semidecidual com relevo plano e afloramento rochoso, 26 Jun 2012 [fl], *M. F. Simon 1557* (RON).

19. *Myrcia bracteata* (Rich.) DC., Prodr. [A. P. de Candolle] 3: 245 (1828). *Eugenia bracteata* Rich., Actes Soc. Hist. Nat. Paris 1: 110 (1792). Type: BRAZIL. Amazonas, Pöppig 2819 (syntypes: LE [00007135], K! [000261991] [web]).

Shrubs 1–3 m. Twigs pubescent, the hairs yellowish. Leaves with petioles 2–5 mm long, pubescent, channeled; blades elliptic or lanceolate, 4–7.3 ×1.8–2.6 cm, glabrous or sparsely pubescent adaxially and pubescent abaxially, the hairs yellowish, chartaceous, concolorous; glands conspicuous; apex acuminate; base cuneate or rounded; midvein adaxially impressed; lateral veins visible, 12 to 15 pairs; marginal vein 1–2 mm from the margin, intra-marginal vein absent, the margin slightly revolute. Inflorescence axillary, a thyrsoid, flowers congested, the main axis 2.5–2.7 cm long, pubescent, the hairs yellowish; the first branching ca. 1.5 cm; bracts lanceolate, 0.8–1.2 ×4–5 mm, pubescent abaxially and glabrous adaxially, persistent in the fruit; pedicels 3–5 mm long, pubescent; bracteoles lanceolate, 7–8 × 3 mm, pubescent abaxially and glabrous adaxially, persistent in the fruit; flower buds campanulate, 4 × 4–7 mm, not constricted beneath ovary; calyx-lobes free, 5–merous, lanceolate, 2–4 ×1.5–2 mm, pubescent abaxially and glabrous adaxially, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruit ellipsoid, 0.6–0.8 × 0.8–1 cm, densely pubescent, surface smooth.

Myrcia bracteata may be recognized by its elliptic or lanceolate leaves, which are glabrous or sparsely pubescent adaxially and pubescent abaxially, the thyrsoid inflorescence, with yellowish hairs, and long bracteoles (7–8 × 3 mm) with long yellowish hairs, which are persistent, and the densely pubescent, ellipsoid fruit.

Distribution and habitat: Known from Bolivia, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Venezuela and central, northeastern and northwestern Brazil (Acre, Amazonas, Maranhão, Mato Grosso, Pará and Rondônia states). In Amazonian Maranhão, *M. bracteata* was found growing in "terra firme" forests.

Phenology: Flowering in February.

Specimens Examined. — **MARANHÃO**. Maracassumé: Fazenda 7 irmãos 16 Feb 2020 [fl], G. S. Amorim (617); G. S. Amorim (624).

Additional Specimens Examined. —**AMAZONAS**. Manaus: Reserva Florestal Ducke, 24 Jan 1996 [fr], M. A. D. Souza et al. 208 (SP). **PARÁ**. Santarém Novo: Bacuriteua, capoeira sul de Bacuriteua, 2010 [fl], M. P. M. Menezes 567 (HBRA). **RONDÔNIA**. Porto Velho: Estrada de acesso ao alojamento provisório, 07 Jan 2009 [fr], G. Pereira-Silva 14019 0 (RON).

20. *Myrcia cuprea* (O. Berg) Kiaersk., Enum. Myrt. Bras.: 95 (1893). *Aulomyrcia cuprea* O. Berg, Fl. Bras. (Martius) 14(1): 77 (1857). Type: BRAZIL. "Flor. Amazon. Insula Colares. In littore", E. F. Poeppig 2937 (lectotype designated by McVaugh [1969, p. 290]: W! [0033248] [web]).

Trees or shrubs 3–7 m. Twigs pubescent, the hairs brownish-red. Leaves with petioles 5–7 mm long, pubescent, channeled; blades elliptic to broadly so, or oval, 3.8–6.7 × 3–5 cm, pubescent adaxially and densely pubescent abaxially, the hairs brownish-red, chartaceous or coriaceous, concolorous; glands conspicuous; apex acute, rounded or obtuse; base rounded or cuneate; midvein adaxially impressed or flat; lateral veins visible, 8 to 12 pairs; marginal vein ca. 1 mm or less from the margin, intra-marginal vein absent, the margin flat. Inflorescence terminal or subterminal, a panicle, pyramidal, flowers lax, the main axis 3.6–6 cm long, pubescent, the hairs brownish-red, the first branching 1.9–4 cm; bracts lanceolate, 4 × 2 mm, pubescent, caducous before anthesis;

pedicels 0.5–1 mm long, pubescent; bracteoles lanceolate, 0.5 × 2 mm, pubescent, caducous before anthesis; flower buds campanulate, 2–3 × 2 mm, not constricted beneath ovary; calyx-lobes free, 5–merous, orbicular, 0.5 × 1 mm, pubescent, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruit globose, 0.6–0.8 × 0.4–0.6 cm, pubescent, surface smooth.

Myrcia cuprea may be recognized by its leaves, which are elliptic to broadly elliptic, or oval, with brownish-red hairs; campanulate flower buds; and globose fruits, which are pubescent and have a smooth surface. This species is morphologically related to *M. guianensis* from which it is distinguished by its pubescent branches and leaves (vs. glabrous), campanulate flower buds (vs. globose or obovate) and 2-locular ovary (vs. 3-locular).

Distribution and habitat: Known from French Guiana, Suriname and northeastern and northwestern Brazil (Amazonas, Amapá, Maranhão and Pará states). In Amazonian Maranhão, *M. cuprea* was found growing in secondary and "terra firme" forests.

Phenology: Flowering in May, July, August and November and fruiting in January.

Specimens Examined. — **MARANHÃO**. Ao longo do rio. Rio Gurupi, 15 Aug 1958 [fl], R. L. Fróes 34555 (IAN). Anajatuba: 26 Jan 1976 [fr], B. G. S. Ribeiro & G. S. Pinheiro 1228 (IAN). Cândido Mendes, 02 Nov 2017 [fl], G. S. Amorim 525 (MAR); Maracassumé River region, Ilha do Trauira, 31 Aug 1932 [fl], R. L. Fróes 1842 (NY). Cururupu: Faz. Sto Antonio, Aug 1914 [fl], A. Lisboa 56 (NYBG); Perto do Palacete, 21 Aug 2014 [fl], M. A. Machado 14 (MAR). Maracassumé: Santa Helena. Próximo do Lugarejo Queimadas, 09 Jul 1978 [fl], N. A. Rosa & O. Cardoso 2547 (IAN). São Luís: Alumar, 13 Nov 1995 [fl], K. B. Ferreira & E. C. Girnos s.c (MAR); Anil, Arredores da estiva. Sitio Andiroba, 06 Aug 1980 [fl], M. G. SIiva 5676 (MG); Granja Barreto, 03 Sept 1952 [fl], R. L. Fróes 28549 (IAN); Granja Federal, 12 May 1949 [fl], R. L. Fróes

24247 (IAN); Sítio Santa Eulália, 16 Sept 2017 [fr], G. S. Amorim 399 (MAR), G. S. Amorim 400 (MAR), G. S. Amorim 451 (MAR); 29 Jan 2018 [fr], G. S. Amorim 428 (MAR), G. S. Amorim 429 (MAR); Parque Ambiental Alumar, 07 Sept 1999 [fl], G. Richardson s.n (MAR). Reserva Florestal do Sacavem, 17 Jul 1992 [fl], F. H. Muniz 141 (INPA); 30 Aug 1995 [fl], J. Ferreira & E. Barroso 92 (MAR).

21. *Myrcia eximia* DC., Prodr. [A. P. de Candolle] 3: 248 (1828). Type: BRAZIL. Minas Gerais, "Crescit in Brasiliae prov. Minas Geraes in desertis" C.F.P. Martius s.n. (holotype: M [0136862]).

Trees 5 m. Twigs glabrescent or sparsely pubescent, the hairs yellowish. Leaves with petioles 4–7 mm long, pubescent, channeled; blades elliptic, oblong or oval, 7–11.1 x 2.8–5.2 cm, pubescent, the hairs whitish, chartaceous, concolorous; glands conspicuous; apex acuminate or long acuminate; base cuneate or rounded; midvein adaxially sulcate; lateral veins visible and strongly marked, 12 to 16 pairs; marginal vein 1–2 mm from the margin, intra-marginal vein absent, the margin revolute. Inflorescence terminal or subterminal, a panicle, pyramidal, sometimes two per axis, flowers laxas, the main axis 7–11.1 cm long, pubescent, the hairs whitish, the first branching 1–6.5 cm; bracts not seen, caducous before anthesis; pedicels ca. 0.5 mm long or absent, glabrous; bracteoles lanceolate, 1.5 × 0.5 mm, glabrous, caducous after anthesis; flower buds globose, 2 × 3 mm, not constricted beneath ovary; calyx-lobes free, 5–merous, orbicular 0.5–1 × 0.5–1.5 mm, glabrous, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruit globose or ellipsoid, 0.8–1 × 0.6–1.2 cm, glabrous, surface smooth.

Myrcia eximia may be recognized by its elliptic, oblong or oval leaves, which are pubescent with whitish hairs; the visible lateral veins, which are strongly marked; and the pubescent panicle. This species is morphologically related to *M. splendens* from which it is distinguished by its sulcate

adaxially midvein (vs. impressed adaxially), and the lateral veins that are strongly marked adaxially and abaxially (vs. not marked).

Distribution and habitat: Known from central and northeastern Brazil (Bahia, Goiás, Maranhão, Mato Grosso, Minas Gerais and Piaui states). In Amazonian Maranhão, M. *eximia* was found growing in "terra firme" forest.

Phenology: Flowering in February.

Specimens Examined. — **MARANHÃO**. Maracassumé, Fazenda 7 irmãos, 16 Fev 2020 [fl], G. S. Amorim (619).

Additional Specimens Examined. — **MATO GROSSO**: Xavantina. c. 6 km S. of Xavantina, 15 Sept 1967 [fl], G. C. G. Argent et al. 6409 (NL-U). **PARÁ**. Altamira: Sete Palmeiras, 12 Dec 1986 [fr], S. M. Athie de Souza, et al. 673 (US); Salvaterra: Condeixas, 10 Jan 1982 [fl], C. S. Rosáro & E. Taylor 124 (MBM). **PIAUÍ**. Uruçuí: estrada Waldemar Bertozzolo, 19 Nov 2005 [fl], A.M. Miranda 5222 (HUEFS).

22. *Myrcia fasciculata* (O. Berg) K. Campbell & K. Samra, Phytotaxa 406 (3): 148 (2019). *Calyptranthes fasciculata* O. Berg, Linnaea 27(1): 31 (1855). Type: GUYANA. 1841, R. H. Schomburgk 979 (lectotype designated by McVaugh [1989, p. 475]: G).

Shrubs ca. 6 m. Twigs pubescent, the hairs brownish-red. Leaves with petioles 4–5 mm long, sparsely pubescent, channeled or shallowly channeled; blades elliptic to broadly so, or ovate, 4.7–8.7 × 2–4 cm, glabrous adaxially and pubescent abaxially, the hairs brownish-red, membranaceous, discolorous; glands not seen; apex long acuminate or cuneate; base rounded; midvein adaxially slightly sulcate; lateral veins slightly visible, 16 to 20 pairs; marginal vein 1 mm or less from the margin, intra-marginal vein absent, the margin flat. Inflorescence axillary or subterminal, a panicle,

umbeliform, flowers congest, the main-axis 0.5–0.7 cm long, sometimes inconspicuous, pubescent, the hairs brownish-red; bracts not seen, caducous before anthesis; pedicels 8 mm long, pubescent, the hairs brownish-red; bracteoles not seen, caducous before anthesis; flower buds globose, 4 x 5 mm, not constricted beneath ovary; calyx-lobes completely fused, opening by calyptra, caducous in the fruit; ovary not seen. Immature fruits globose, 0.7 × 0.8 cm, pubescent, surface smooth.

Myrcia fasciculata may be recognized by its leaves, which are elliptic to broadly elliptic, or ovate, with slightly visible lateral veins; an umbeliform panicle; and globose fruits which are pubescent and have a smooth surface.

Distribution and habitat: Known from Guyana and northeastern and northwestern Brazil (Amazonas, Pará, Maranhão, Mato Grosso, Rondônia and Roraima states) (Rosário et al. 2014). In Amazonian Maranhão, M. fasciculata was found growing in flooded forests.

Phenology: Fruiting in December.

Specimens Examined. — **MARANHÃO**. Pinheiro: Rio Alto Turiaçu, Nova Esperança, 04 Dec 1978 [fr], J. Jangoux 213 (NY).

Additional Specimens Examined. —**AMAZONAS**. Santa Isabel do Rio Negro: Margem direita do Rio Negro, serra do Jacamin, 11 Out 1987 [fl], C. A. C. Ferreira et al. 9347 (US). **RONDONIA**. Espigão do Oeste: BR-364, rodovia Cuiabá-Porto Velho, estrada da FUNAI, km 05, 20 Jun 1984 [fr], C. A. C. Ferreira 4678 (NY); Estrada Boa Vista-Venezuela, Rio Surumu, 01 Dec 1977 [fr], W. C. Steward 161 (NY). **RORAIMA**. Ilha de Maracá: Sema Ecological Reserve, 28 Apr 1987 [fr], W. Milliken M.129 (NY).

23. ***Myrcia grandis*** **McVaugh**, Mem. New York Bot. Gard. 18(2): 114 (1969). Type: VENEZUELA. Amazonas: Rio Siapa, Casiquiare, Maguire et al. 37617 (holotype: MICH [1109512]).

Trees. Twigs glabrous. Leaves with petioles 4–6 mm long, glabrous, channeled; blades elliptic or lanceolate, 4–6 × 1.9–2.4 cm, glabrous, chartaceous or coriaceous, discolorous, more lustrous adaxially; glands not seen; apex acute or acuminate, often long acuminate; base subacute or cuneate; midvein adaxially impressed; lateral veins numerous and slightly visible, 15 to 20 pairs; marginal vein 1 mm or less from the margin, intra-marginal vein absent, the margin flat. Inflorescence terminal or subterminal, a panicle, pyramidal, flowers laxas, the main-axis 4.2–6.6 cm long, pubescent, the hairs whitish, the first branching 2.4–5.8 cm long; bracts lanceolate, 2–4× 2 mm, pubescent, caducous before anthesis; pedicels 1 mm long, glabrous; bracteoles lanceolate, 1–2 × 1 mm, pubescent, caducous before anthesis; flower buds campanulate, 2–2.3 × 1.5 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, orbicular, 0.5–1 mm, glabrous, not reflexed; ovary not seen. Immature fruits globose, 0.4–0.6 × 0.6–0.8 cm, glabrous, surface smooth.

Myrcia grandis may be recognized by its elliptic or lanceolate leaves, which are more lustrous adaxially; the pubescent panicle; and the campanulate and glabrous calyx-lobes. This species is morphologically related to *M*. *sylvatica* from which it is distinguished by its glabrous leaves (vs. abaxially pubescent) and adaxially impressed midvein (vs. adaxially sulcate).

Distribution and habitat: Known from Bolivia, Colombia, Guyana, Panamá, Venezuela and northeastern and northwestern Brazil (Amazonas, Maranhão, Pará, Rondônia and Roraima states). In Amazonian Maranhão, *M*. *grandis* was found growing on riversides.

Phenology: Flowering in December.

Specimens Examined. — **MARANHÃO**. Pinheiro: Rio Alto Turiaçu, Nova Esperança, 01 Dec 1978 [fl], J. Jangoux et al. 128 (NY).

Additional Specimens Examined. —**AMAZONAS**. Igarapé Lobisomen, Rio Cuieras, 22 Jul 1991 [fl], S. A. Mori 21827 (NY); Casiquiare: Savanna Hechimoni on left bank of Caño Hechimoni, 8 km. above mouth, 09 Feb 1954 [fl], B. Maguire 37617 (NY).

24. *Myrcia guianensis* (Aubl.) DC., Prodr. [A. P. de Candolle] 3: 245 (1828). *Eugenia guianensis* Aubl., Hist. Pl. Guiane 1: 506 (1775). Type: BRITISH GUIANA. 'Habitat in silvis propè montem Serpent dictum', s.d., Aublet s.n. (holotype BM! [000953654] [web]; isotype LINN [HS883-22]).

Trees or shrubs 3–10 m. Twigs glabrous. Leaves with petioles 2–5 mm long, glabrous, channeled; blades elliptic, obovate, oval or oblong, 2.2–7.2 × 2–4 cm, glabrous, chartaceous or coriaceous, concolorous; glands conspicuous; apex acute, rounded or obtuse; base rounded or cuneate; midvein adaxially prominent or flat; lateral veins visible, 13 to 17 pairs; marginal vein 1–2 mm from the margin, intra-marginal vein absent, the margin flat. Inflorescence terminal or subterminal, a panicle to thyrsoid, flowers laxas, the main-axis 4–6.1 cm long, puberulent, the hairs brownish, the first branching 2.7–3.1 cm long; bracts lanceolate, 0.5 × 1 mm, glabrous, caducous after anthesis; pedicels 0.5–2 mm long, glabrous; bracteoles lanceolate, 0.5 × 1 mm, glabrous, caducous after anthesis; flower buds globose or obovate, 2 × 1 mm, not constricted beneath ovary; calyx-lobes free, 5–merous, orbicular, 0.5–1 × 1–2.5 mm, glabrous, not reflexed, persistent in the fruit; ovary 3-locular. Immature fruit globose, 0.4–0.7 × 0.5–0.6 cm, glabrous, smooth surface.

Myrcia guianensis may be recognized by its glabrous leaves, the globose or obovate flower buds, and the 3-locular ovary. This species is morphologically related to *M. amazonica* from which it is distinguished by its grayish branches and inflorescence (vs. reddish) and adaxially prominent or

flat midvein (vs. adaxially impressed). It is also morphologically related to *M. cuprea* from which it is distinguished by its glabrous branches and globose or obovate flower buds (vs. pubescent branches and campanulate flower buds).

Distribution and habitat: Bolivia, Colombia, Ecuador, French Guiana, Guyana, Panamá, Paraguay, Peru, Suriname, Trinidad-Tobago and Venezuela and widely distributed in Brazil. In Amazonian Maranhão, *Myrcia guianensis* was found growing in "terra firme" and secondary forest.

Phenology: Flowering in August to December and fruiting in October.

Specimens Examined. — **MARANHÃO**. Old capoeira on hillside W. of road, appr. 45km. S. of Itauna on road from Pinheiro, 18 Oct 1980 [fl; fr], D. C. Daly & D. G. Campbell 686 (IAN). São Luis: Alumar, 13 Nov 1995 [fl], K. B. Ferreira & E. Girnos s.n. (MAR). Pinheiro: Nova Esperança, Rio Alto Turiaçu, 04 Dec 1978 [fl], J. Jangoux 199 & R. P. Bahia (NY).

Additional Specimens Examined. — **PARÁ**. Santarém: along E side of road to Punta Piedra, about 3.4 km from where the road departs to the NW from the Santarém–Alter do Chão road (PA-457), ca. 21.5 km E and somewhat S of Santarém, 24 Nov 2011 [fr], B. M. Torke 1292 (NY); Oriximiñã: Mina Saracá, Mineração Rio do Norte, Porto Trombetas, 1999 [fl], E. M. Barbosa 324 (INPA).

25. *Myrcia minutiflora* Sagot, Ann. Sci. Nat., Bot. sér. 6, 20: 185 (1885). *Aulomyrcia minutiflora* (Sagot) Amshoff, Bull. Torrey Bot. Club 75: 532 (1948). Type: FRENCH GUIANA. Maroni, E. M. Mélinon 442 (holotype: P! [00163092] [web]).

Shrubs 3 m. Twigs pubescent, the hairs yellowish. Leaves with petioles ca. 4 mm long, pubescent, channeled; blades elliptic or broadly so, 7–9.5 × 2.9–4 cm, glabrous adaxially and sparsely pubescent abaxially, the hairs yellowish, membranaceous or chartaceous, discolorous, darker adaxially than abaxially, glands conspicuous; apex long-caudate; base cuneate or rounded; midvein

adaxially sulcate; lateral veins visible and prominent abaxially, arched, 7 to 11 pairs; marginal vein 4–6 mm from the margin, intra-marginal vein absent, the margin flat. Inflorescence axillary or terminal, a thyrsoid, sometimes much-reduced, a single flower, flowers congests, the main-axis 2.9–4.2 cm, sometimes inconspicuous, glabrous, the first branching 0.9–1.7 cm long, with two lateral branches; bracts lanceolate 1.5 × 1.5 mm, glabrous, caducous after anthesis; pedicels 4 mm long, pubescent; bracteoles not seen, caducous before anthesis; flower buds globose, 1 × 1 mm, not constricted beneath ovary; calyx-lobes free, 4–merous, deltate, 0.5 × 0.5 mm, glabrous adaxially and pubescent abaxially, not reflexed, persistent in the fruit; ovary not seen. Immature fruit globose, 1 cm diameter, sparsely pubescent, surface smooth.

Myrcia minutiflora may be recognized by its discolorous, elliptic to broadly elliptic leaves with a long-caudate leaf apex; visible lateral veins and a prominent abaxially, arched, marginal vein 4–6 mm from the margin; and a thyrsoid inflorescence, sometimes reduced to a single flower.

Distribution and habitat: Known from, French Guiana, Guyana, Peru, Suriname, Venezuela and central, northeastern and northwestern Brazil (Acre, Amazonas, Amapá, Maranhão, Mato Grosso and Pará states). In Amazonian Maranhão, *M. minutiflora* was found growing in disturbed forests.

Phenology: Fruiting in September.

Specimens Examined. — **MARANHÃO**. Monção: Basin of the Rio Turiaçu, 16 May 1985 [st], W. L. Balée 883 (NY). Nova Olinda do Maranhão: S. of Fazenda Guarany, Km 133 of Br 316, 21 Sept 1980 [fr], D. C. Daly D162 (NY).

Additional Specimens Examined. — **AMAZONAS**. Manaus-Itacoatiara: Reserva Florestal Ducke, 30 Dec 1997 [fl], P. A. C. L. Assunção 759 (NY).

26. *Myrcia multiflora* (Lam.) DC., Prodr. [A. P. de Candolle] 3: 244 (1828). *Eugenia multiflora* Lam., Encycl. [J. Lamarck & al.] 3(1): 202 (1789). 106. Type: FRENCH GUIANA. s.l., Leprieur, s.n. (syntype: P! [P00163142]).

Trees or shrubs 2–10 m. Twigs glabrescent, the young branchlets pubescent, the hairs whitish. Leaves with petioles 2–4 mm long, glabrous, pubescent on young branches, channeled; blades elliptic, lanceolate or ovate, 3.8–6 × 1–3.8 cm, glabrescent, membranaceous, concolorous, glands conspicuous and abundant; apex acute or acuminate; base cuneate or rounded; midvein adaxially impressed; lateral veins dark, flat to impressed, with numerous intermediates veins, 10 to 21 pairs; marginal vein 1–2 mm from the margin, intra-marginal vein absent, the margin flat. Inflorescence terminal or subterminal, a panicle, pyramidal, flowers laxas, the main-axis 12–31 mm long, glabrescent, the first branching 1.5 cm; bracts lanceolate 1–2 × 1–2 mm, glabrous, caducous after anthesis; pedicels 1–3 mm long, glabrous; bracteoles lanceolate, 1 × 1 mm, glabrous, caducous after anthesis; flower buds globose, 1–2.5 × 1–2 mm, not constricted beneath ovary; calyx-lobes free, 5–merous, orbiculate, 0.5–1 × 0.5–1 mm, glabrous adaxially and pubescent abaxially, not reflexed; ovary 2-locular. Immature fruits globose, 0.5 cm diameter, glabrous, surface smooth.

Myrcia multiflora may be recognized by its elliptic, lanceolate or ovate leaves, which are concolorous and with abundant glands, and the dark lateral veins with numerous intermediate veins. This species is morphologically related to *M. selloi*, from which it is distinguished by its lateral veins, which are flat abaxially and not arched (vs. prominent abaxially and arched) and erect calyx-lobes (vs. calyx-lobes reflexed).

Distribution and habitat: Known from northeastern Argentina, Bolivia, French Guiana, Guyana, Paraguay, Peru, Suriname, Trinidad-Tobago, Uruguay and Venezuela and widely distributed in

Brazil. In Amazonian Maranhão, *M. multiflora* was found growing in “terra firme” and secondary forests.

Phenology: Flowering in May and September.

Specimens Examined. — **MARANHÃO**. Fazenda São Francisco, 11km. N. of km. 337 of BR-316, 25 Sept 1980 [fl], D. C. Daly & D. G. Campbell 268 (IAN). Bacabal: Fazenda São Francisco, 25 Sept 1980 [fl], D. C. Daly D268 (NY). Cândido Mendes, 02 Nov 2017 [fl], G. S. Amorim 524 (MAR). São José de Ribamar: Sítio Aguahy, 07 May 2016 [fl], G. S. Amorim 271 (MAR). Santa Helena: próximo do Lugarejo Queimadas, 09 Sept 1978 [fl], N. A. Rosa & O. Cardoso 2559 (IAN).

Additional Specimens Examined. — **PARÁ**. Marajás: Carajás, Serra Norte. Estrada H-7,30 km do acampamento, 04 Ago 1982 [fl], U. N. Maciel 742 (NY): Serra dos Carajás, 25-30 km NW of Serra Norte mining camp Pará, 05 Dec 1981 [fr], D. C. Daly et al. 1739 (NY).

27. *Myrcia neoclusiifolia* A. R. Lourenço & E. Lucas, Phytotaxa 373 (1): 78 (2018). *Calyptranthes clusiifolia* O. Berg, Linnaea 27: 19 (1854). Type: BRAZIL. Minas Gerais, Widgren 536 U (lectotype designated by A.C. Araujo & E. Lucas [2013, p. 434]).

Shrubs 2–4 m. Twigs glabrous or sparsely pubescent, the hairs ochraceous. Leaves with petioles 9–14 mm long, pubescent, unchanneled; blades elliptic or broadly so, ovate or oval, 7–11.5 × 3.5–6.5 cm, glabrous adaxially and sparsely pubescent abaxially, the hairs ochraceous, chartaceous or coriaceous, slightly discolorous, glands not seen; apex acute or rounded; base rounded, rarely acute; midvein adaxially impressed or sulcate distally, densely covered with hairs; lateral veins visible, 11 to 14 pairs; marginal vein 1 mm from the margin, intra-marginal vein 3 mm from the margin, the margin flat. Inflorescence terminal or subterminal, a panicle, pyramidal, flowers laxas, the main-axis 5.4–9.3 cm long, pubescent, the hairs ochraceous, with two lateral branches, opposite,

2.9–3 cm long; bracts not seen, caducous before anthesis; pedicels absent; bracteoles lanceolate or deltate, 2–4 × 2–4 mm, pubescent, caducous before anthesis; flower buds obovoid, 2 × 2 mm, not constricted beneath ovary; calyx-lobes completely fused, opening by calyptra, not reflexed, caducous in fruit; ovary not seen. Immature fruit globose, 0.5 cm diameter, densely pubescent, surface smooth.

Myrcia neoclusiifolia may be recognized by its slightly discolorous elliptic to broadly elliptic, or ovate leaves; the pubescent panicle with two lateral branches; the ochraceous hairs; the calyx-lobes, which are completely fused and opening by calyptra; and the globose fruits, which are densely pubescent and have a smooth surface.

Distribution and habitat: Known from Bolivia, Venezuela and central and northeastern Brazil (Bahia, Distrito Federal, Maranhão, Minas Gerais, Pernambuco and São Paulo states). In Amazonian Maranhão, *M. neoclusiifolia* was found growing in "terra firme" and secondary forests.

Phenology: Flowering and fruiting in January and December.

Specimens Examined: — **MARANHÃO**. São Luís: Feb-Mar 1939 [st], R. L. Fróes 11732 (NY); 10 Jan 1950 [fl; fr], R. L. Fróes 25656 (IAN) Reserva Florestal do Sacavém [Mata da Caema], 15 Jan 1951 [fl; fr], R. L. Fróes 26819 (IAN); 27 Dec 1951 [fl; fr], R. L. Fróes 27809 (IAN).

28. *Myrcia neospeciosa* A. R. Lourenço & E. Lucas, Phytotaxa 373(1): 79 (2018). *Calyptranthes speciosa* Sagot, Ann. Sci. Nat., Bot. sér. 6, 20: 187 (1885). Type: FRENCH GUIANA. M. Mélinon 488 P! (type: P! [00723171] [web]).

Trees 6–8 m. Twigs glabrous. Leaves with petioles 13–25 mm long, pubescent, unchanneled; blades ovate-lanceolate, oblong, rarely elliptic, 14.5–31.4 × 6–10 cm, glabrous adaxially and pubescent abaxially, the hairs brownish-red, chartaceous, discolorous, more lustrous adaxially;

glands not seen; apex acute or long acuminate; base rounded; midvein adaxially impressed or sulcate; lateral veins slightly visible, 30 to 38 pairs; marginal vein 1 mm or less from the margin, intra-marginal vein absent, nearly straight, very close the margin, the margin revolute. Inflorescence axillary, a panicle, pyramidal, flowers laxas, the main-axis 2.3–3 cm long, pubescent, the hairs brownish-red, with two lateral branches, opposite, 3.7–6.6 cm long; bracts not seen, caducous before anthesis; pedicels 3 mm long or sessile, pubescent; bracteoles not seen, caducous before anthesis; flower buds not seen; calyx-lobes completely fused, opening by calyptra, not reflexed, caducous in fruit; ovary not seen. Immature fruit subglobose to globose, 0.6–0.8 × 0.7–0.9 cm, pubescent, surface smooth.

Myrcia neospeciosa may be recognized by its ovate-lanceolate or oblong, rarely elliptic leaves, which are more lustrous adaxially; the nearly straight marginal vein, which is 1 mm or less from the margin the calyx-lobes, which are completely fused and opening by calyptra; and the subglobose or globose fruits, which are pubescent and have a smooth surface.

Distribution and habitat: Known from Bolivia, Colombia, Ecuador, French Guiana, Peru, Suriname, Venezuela and northeastern and northwestern Brazil (Acre, Amapá, Maranhão, Pará and Rondônia states). In Amazonian Maranhão, *M. neospeciosa* was found growing in “terra firme” forest.

Phenology: Fruiting in December.

Specimens Examined: — **MARANHÃO**: Rio Maracassumé, 03 Jul 1958 [st], R. L. Fróes 34439 (IAN).

Additional Specimens Examined — **PARÁ**: Ilha de Marajó. Rio Anajas, 28 Oct 1987 [fr], H. T. Beck 209 (INPA). **AMAZONAS**: Manaus, Reserva Florestal Ducke, 06 Aug 1997 [fr], M. A. D. Souza 395 (INPA).

29. *Myrcia pullei* (Burret ex Amshoff) A. R. Lourenço & E. Lucas, Phytotaxa 373(1): 81 (2018). *Calyptranthes pullei* Burret ex Amshoff, Recueil Trav. Bot. Néerl. 42: 4 (1950). Type: SURINAME. "Raleigh Falls, in saxis Raleighvallen fluv. Coppenam", A. A. Pulle, 341 (holotype: U [0004963]).

Trees ca. 5 m. Twigs glabrous, sometimes the branches terminal and the main-axis of inflorescence are reddish. Leaves with petioles 2–4 mm long, glabrous, unchanneled, dark; blades broadly elliptic or ovate 2–3.8 × 1.8–3.3 cm, glabrous, chartaceous, slightly discolorous; glands not seen; apex rounded or obtuse, rarely acute; base obtuse, rounded or subcordate; midvein adaxially impressed; lateral veins slightly visible, ca. 15 pairs; marginal vein 1 mm or less from the margin, intra-marginal vein absent, the margin flat. Inflorescence terminal or subterminal, a panicle, pyramidal, flowers congest, the main axis 3–6.7 cm long, glabrous, with two lateral branches, opposite, 1.9–2.1 cm long; bracts not seen, caducous before anthesis; pedicels 0.2–0.7 mm long or sessile, glabrous; bracteoles not seen, caducous before anthesis; flower buds not seen; calyx-lobes completely fused, opening by calyptra, not reflexed, caducous in fruit; ovary not seen. Immature fruit globose, 0.3 × 0.5 cm, glabrous, surface smooth.

Myrcia pullei may be recognized by its terminal branches and reddish main-axis of the inflorescence; the chartaceous, broadly elliptic or ovate leaves; the midvein of the leaf, which is adaxially slightly sulcate at the base and impressed distally; and the completely fused calyx-lobes, opening by calyptra.

Distribution and habitat: Known Colombia, Guyana, Peru, Suriname, Venezuela and from northeastern Brazil (Amazonas, Amapá, Maranhão and Pará states). In Amazonian Maranhão, *M. pullei* was found growing along a river.

Phenology: Fruiting in April and February.

Specimens Examined: — **MARANHÃO**: Turiaçú, Rio Maraçumé, Cachoeira Grande, 04 Apr 1981 [fr], M. R. Santos 697 (IAN).

Additional Specimens Examined: — **AMAPÁ**: Rio Oiapoque. Cachoeira Grande Roche, 11 Ago 1960 [fl], H. S. Irwin 47412 (NY).

30. *Myrcia selloi (*Spreng.) N. Silveira, Loefgrenia 89: 5 (1986*)*. *Myrtus selloi* Spreng., Syst. Veg., ed. 16 [Sprengel] 2: 482 (1825). Type: BRAZIL. "Brasilia", Sellow s.n. (neotype designated by L. C. Lannoy, R. Goldenberg & D. F. Lima [2019, p. 112]: K [000344138]). BRAZIL. "Brasil", Sellow s.n. (holotype unknown).

Shrubs 1.5–3 m. Twigs sparsely pubescent or pubescent, the hairs whitish. Leaves with petioles 2 mm long, pubescent, channeled; blades elliptic, lanceolate, oval or ovate, 3–10.2 × 1.2–5.1 cm, glabrescent, membranaceous, concolorous; glands conspicuous and dark abaxially; apex acute or acuminate; base cuneate or rounded; midvein adaxially flat; lateral veins visible and prominent abaxially, arched, 14 to 21 pairs; vein marginal 3–4 mm from the margin, intra-marginal vein absent, the margin flat. Inflorescence terminal or subterminal, a panicle, pyramidal, flowers laxas, the main-axis 3–4.3 cm long, puberulent, the hairs whitish, the first branching 1.7–2.7 cm long; bracts lanceolate, 0.5 × 1 mm, glabrescent, caducous before anthesis; pedicels 2.5–3.5 mm long, glabrescent; bracteoles lanceolate, 0.5–1 × 1 mm, glabrescent, caducous before anthesis; flower buds globose or obovate, 1 × 3 mm, constricted beneath ovary; calyx-lobes free, 5–merous,

triangular, 1 × 1 mm, glabrous, reflexed, persistent in the fruit; ovary 2–locular. Immature fruit globose, 0.3 × 0.5 cm, glabrous, surface with glands marked.

Myrcia selloi may be recognized by its leaves with glands visible on both sides and abaxially dark and the globose or obovate flower buds constricted beneath ovary and with reflexed calyx-lobes. This species is morphologically related to *M. multiflora*, from which it is distinguished by its prominent abaxially lateral veins arched (vs. flat and not arched), and reflexed calyx-lobes (vs. not reflexed). It is also morphologically related to *M. tomentosa* from which it is distinguished by its glabrescent and concolorous leaves (vs. glabrescent or sparsely pubescent adaxially and densely pubescent abaxially and discolorous), channeled petiole (vs. unchanneled), pedicellate flowers (vs. sessile flowers), and glabrous calyx-lobes (vs. pubescent).

Distribution and habitat: Known from northeastern Argentina, Bolivia, Paraguay and Uruguay and widely distributed in Brazil. In Amazonian Maranhão, *Myrcia selloi* was found growing in secondary forests.

Phenology: Flowering in January and October and fruiting in January.

Specimens Examined. — **MARANHÃO**. Gururupú: Dec 1957 R. L. Fróes 33998 (IAN). São José de Ribamar: Sítio Aguahy, 28 Oct 2017 [fl], G. S. Amorim 385 (MAR). São Luís: Sítio Santa Eulália, 29 Jan 2018 [fr], G. S. Amorim 421 (MAR); 11 Jan 1988 [fl], R. Nina 3 (SLUI); 20 Jan 1988 [fl], E. Barroso 46 (SLUI); Reserva da Caema [Reserva Florestal do Sacavém - Mata da Caema], 15 Jan 1992 [fl], J. Azevedo 11 (SLUI). Palmeirândia: 07 Jan 2007 [fl], C. M. Vieira 77 (IAN).

31. *Myrcia splendens* (Sw.) DC., Prodr. [A. P. de Candolle] 3: 244 (1828). *Myrtus splendens* Sw., Prodr. [O. P. Swartz] 79 (1788). Type: HISPANIOLA, Olof Swartz s.n. (type: S! [S-R-3706] [web]).

Trees 2–13 m. Twigs pubescent, the hairs yellowish. Leaves with petioles 2–4 mm long, glabrous or pubescent, channeled; blades elliptic, lanceolate or ovate-lanceolate, 3–12.8 × 1.3–3.8 cm, glabrous or sparsely pubescent adaxially and pubescent abaxially, the hairs yellowish, chartaceous, concolorous; glands inconspicuous; apex acute or acuminate; base cuneate or rounded; midvein adaxially flat; lateral veins slightly visible, 21 to 34 pairs; marginal vein 1 mm or less from the margin, intra-marginal vein absent, the margin flat. Inflorescence terminal or subterminal, a panicle, pyramidal, flowers laxas, the main axis 4.9–8.5 cm long, pubescent, the hairs yellowish, the first branching 2.5–3.9 cm long; bracts lanceolate, 1 × 2 mm, pubescent, caducous after anthesis; pedicels 1–4 mm long, pubescent; bracteoles not seen, caducous before anthesis; flower buds globose, 1–4 × 1–4 mm, not constricted beneath ovary; calyx-lobes free, 5–merous, orbicular, 0.5–1 × 2.1–3 mm, densely pubescent adaxially and pubescent or sparsely pubescent abaxially, not reflexed, persistent in the fruit; ovary 2–locular. Immature fruit ellipsoid, 0.5–1 × 0.4–0.7 cm, pubescent, surface with glands marked.

Myrcia splendens may be recognized by its elliptic, lanceolate to ovate-lanceolate leaves, which are adaxially glabrous or puberulent and abaxially pubescent with yellowish hairs, and its ellipsoid fruits, which are pubescent and have the surface marked with glands. This species is morphologically related to *M. sylvatica*, from which it is distinguished by its adaxially flat midvein (vs. adaxially sulcate) and channeled petiole (vs. unchanneled).

Distribution and habitat: Known from northeastern Tropical America, including all Brazilian states. In Amazonian Maranhão, *M. splendens* was found growing in secondary and lowland forests.

Phenology: Flowering in May, June, August and October and fruiting in January.

Specimens Examined. — **MARANHÃO**. between Viana & Bandeirante, back road from Viana to Pinheiro, 17 Oct 1980 [fl], D. C. Daly & D. G. Campbell, 637 (IAN). Rio Maracassumé, 01 Jan 1958 [fr], R. L. Fróes 34418 (IAN). Anajatuba: São Benedito, 30 May 2008 [fl], A. Araújo 48 (INA). Grajaú: estrada do Arame, 15 May 1983 [fr], M. F. F. da Silva 1145 (INPA). São Luís: 8º Batalhão da Polícia Militar, 15 Jun 2018 [fl], G. S. Amorim 509 (MAR); Estação Ecológica do Rangedor, 30 Oct 2010 [fl], S. M. Santos s.n (MAR); Granja Federal, 12 May 1949 [fl], R. L. Fróes 24253 (IAN). Palmeirândia: [s.l], 16 Aug 2011 [fl], M. Ribeiro PM25 (IAN).

32. *Myrcia sylvatica* (G. Mey.) DC., Prodr. [A. P. de Candolle] 3: 244 (1828). *Myrtus sylvatica* G. Mey., Prim. Fl. Esseq. 191 (1818). Type: BRAZIL. "In silvis continentis, inprimis circa rivum Arowabischkreek"], E. K. Rodschied 296 (holotype: GOET! [GOET008254]).

Shrubs 2 m. Twigs glabrous or sparsely pubescent, the hairs yellowish. Leaves with petioles 2–3 mm long, sparsely pubescent, unchanneled; blades elliptic or lanceolate, 1–5.1 × 1–1.6 cm, glabrous adaxially and pubescent abaxially, the hairs yellowish, chartaceous, slightly discolorous, lustrous adaxially; glands conspicuous and marked; apex attenuate or long-acuminate; base cuneate or attenuate; midvein adaxially sulcate; lateral veins slightly visible, 17 to 22 pairs; marginal vein 1 mm or less from the margin, intra-marginal vein absent, the margin flat. Inflorescence terminal or subterminal, a panicle, pyramidal, flowers laxas, the main axis 2.2–5.3 cm long, pubescent, the hairs yellowish, the first branching 1.4–2.5 cm long; bracts not seen, caducous before anthesis; pedicels 1–2 mm long, pubescent; bracteoles not seen, caducous before anthesis; flower buds globose, 1.5 × 2 mm, not constricted beneath ovary; calyx-lobes free, 5–merous, deltate, 0.5–1 × 0.3–1 mm, pubescent adaxially and glabrous abaxially, not reflexed, persistent in the fruit; ovary

2–locular. Immature fruit oblong or ellipsoid, 0.8–1 × 0.3–0.6 cm, pubescent, surface with glands marked.

Myrcia sylvatica may be recognized by its adaxially sulcate midvein and slightly visible lateral veins, and the oblong or ellipsoid fruits which are pubescent and have the surface marked with glands. This species is morphologically related to *M. splendens,* from which it is distinguished by its adaxially sulcate midvein (vs. adaxially flat) and the unchanneled petiole (vs. channeled).

Distribution and habitat: Known from Tropical America, widely distributed in central, northeastern and northwestern Brazil. In Amazonian Maranhão, *M. sylvatica* was found growing in secondary forest.

Phenology: Flowering in January, November and December and fruiting in January and December.

Specimens Examined. — **MARANHÃO**. Carutapera: Gurupiuna, Ka'apor Indian Reserve, 04 Nov 1986 [fl], W. L. Balée 2839 (NY). São Luís: Alumar, 18 Jan 1995 [fl], N. Figueiredo s. n (MAR); 20 Dec 1994 [fl], N. Figueiredo 89 (MAR); Reserva Florestal do Sacavém [Mata da Caema], 03 Apr 1991, [fr], J. Ferreira & E. Barroso 56 (MAR); 03 Dec 1973 [fl; fr], L. F. Gomes 56 (MAR). Alto Turiaçu: Carutapera. Gurupiuna, Ka'apor Indian Reserve, affluent of Rio Gurupi, 04 Nov 1986 [fl], W. L. Balée 2839 with B. Ribeiro (NY).

Additional Specimens Examined. — **MARANHÃO**. Carolina: Parque Nacional Chapada das Mesas, 20 Oct 2015 [fl], A. C. Sevilha 5504 (CEN). **PARÁ**: Tucuruí: 25 km S of Tucuruí, just off old BR-422 at junction with old railroad bed, 30 Oct 1981 [fl], D. C. Daly 1071 (NY).

33. *Myrcia tomentosa* (Aubl.) DC., Prodr. [A. P. de Candolle] 3: 245 (1828). *Eugenia tomentosa* Aubl., Hist. Pl. Guiane 1: 504 (1775). Type: FRENCH GUIANA. “Habitat ad ripam fluvii Sinemariensis tribus milliaribus à maris littore”, 1775, Aublet s.n. (holotype: BM! [000953642]).

Trees 1.5–8 m. Twigs glabrous or densely pubescent, the hairs yellowish. Leaves with petioles 8–17 mm long, densely pubescent, unchanneled; blades elliptic to broadly so, lanceolate or oblong, 6.8–10.1 × 3–4.1 cm, glabrescent or sparsely pubescent adaxially and densely pubescent abaxially, the hairs yellowish, membranaceous or chartaceous, discolorous; glands inconspicuous; apex acute, rarely acuminate; base cuneate or attenuate; midvein adaxially impressed; lateral veins visible, 6 to 10 pairs, prominent abaxially, arched; marginal vein absent, intra-marginal vein absent, the margin flat. Inflorescence terminal or subterminal, a panicle, pyramidal, flowers congest, the main axis 4.7–10 cm long, densely pubescent, the hairs yellowish, the first branching 0.7–1.1 cm long; bracts lanceolate, 5 × 5 mm, pubescent, caducous after anthesis; pedicels absent; bracteoles linear 0.2 × 0.2 mm, pubescent, caducous after anthesis; flower buds ovate, 2–2.5 x 1.5 mm, constricted beneath ovary; calyx-lobes free, 5–merous, pubescent, ovate or triangular, 0.5 × 0.5 mm, reflexed; ovary 2–locular. Immature fruit globose, 0.3 × 0.4 cm, glabrous or sparsely pubescent, surface with glands marked.

Myrcia tomentosa may be recognized by its midvein, which is abaxially densely pubescent and an adaxially impressed; the arched lateral veins; and the densely pubescent panicle with ovate flower buds. This species is morphologically related to *M. selloi*, from which it is distinguished by its discolorous leaves, which are glabrescent or sparsely pubescent adaxially and densely pubescent abaxially (vs. glabrescent and concolorous); the unchanneled petiole (vs. channeled); the sessile flowers (vs. pedicelate); and the pubescent calyx-lobes (vs. glabrous).

Distribution and habitat: Known from Bolivia, Colombia, Ecuador, French Guiana, Guyana, Panamá, Peru, Suriname, Trinidad-Tobago and Venezuela and widely distributed in Brazil. In Amazonian Maranhão, *M. tomentosa* was found growing in secondary forest.

Phenology: Flowering in February and November.

Specimens Examined. — **MARANHÃO**. São José de Ribamar: Sítio Aguagy, São Luís. Alumar, 02 Feb 2018 [fl], G. S. Amorim 434 (MAR); 13 Nov 1995 [fl], K. B. Ferreira & E. C. Girnos s.n (MAR).

Additional Specimens Examined. —**AMAZONAS**. Southern ridge of Pico Rondon, perimetral norte highway km 211, 03 Fev 1984 [fr], G. T. Prance 28776 (NY). **MARANHÃO**. Estreito: Margem direita do rio Tocantins (área de mata úmida próximo à sua foz), 06 Dec 2008 [fr], G. P. Silva 13888 (CEN). **PARÁ**. SEMA, Estaç ão Ecoló gica do Jari, Projeta Reserva Gené tica, 15 Dec 1987 [fl], H. T. Beck 13 (NY).

34. *Myrciaria floribunda* (H. West ex Willd.) O. Berg, Linnaea 27(2-3): 330 (1856). *Eugenia floribunda* H.West ex Willd., Sp. Pl., ed. 4, 2: 960 (1799). Type: UNITED STATES. Virgin Islands, Ins. St. Crucis [St. Croix], Vahl, M. s.n. (syntype: HAL! [0089630] [web]).

Trees 3–4 m. Twigs puberulent, the hairs whitish. Leaves with petioles 2–4 mm long, puberulent, unchanneled; blades elliptic or lanceolate, 4.4–7.3 × 2.8–3 cm, glabrous, membranaceous, concolorous; glands not seen; apex long acuminate; base cuneate; midvein adaxially flat, sometimes prominent; lateral veins inconspicuous; marginal vein 1 mm or less from the margin, intra-marginal vein absent, the margin flat. Inflorescence glomerule clustered in axils, the main axis inconspicuous; bracts not seen, caducous before anthesis; pedicels absent; bracteoles orbicular, ca. 0.5 × 0.5 mm, glabrous, caducous after anthesis; flower buds ovate 1.5 × 1.5 mm; calyx-lobes free, 4-merous, glabrous, ovate, 1–1.5 × 1 mm, not reflexed; the fruit falling as a unit together with the calyx, corolla and hypanthium; ovary not seen. Immature fruit globose, 0.5–0.7 × 0.5–0.9 cm, glabrous, surface with glands marked.

Myrciaria floribunda may be recognized by its elliptic or lanceolate leaves with inconspicuous lateral veins, the long-acuminate leaf apex, the inflorescence of glomerules clustered in leaf axils, and the fruit, which falls as a unit together with the petals and hypanthium. This species is related to *M. tenella,* from which it is distinguished by leaves 4.4–7.3 × 2.8–3 cm (vs. 1–2.5 × 0.5–1.2 cm), the long-acuminate leaf apex (vs. acute leaf apex), and the 2–4 mm long petiole (vs. 1–2 mm).

Distribution and habitat: Widely distributed from Mexico to tropical America. In Amazonian Maranhão, *M. floribunda* was found growing in secondary forests and along roads.

Phenology: Flowering in May.

Specimens Examined. — **MARANHÃO**. Nova Esperança: Rio Alto Turiaçú, 17 May 1979 [fl] I. J. Jangoux & R. P. Bahia 689 (MG). Santa Inês: Colônia Três Satubas, margem da estrada de terra, a 12 km da BR-316, cruzamento à direita a 20 km de Araguaná, 13 May 1979 [st], J. Jangoux 587 & R. P. Bahia (NY). Santa Luzia: Faz. Agripec-Varig; caminho para o Rio Mutum; margem esquerda do Rio Pindaré, 05 Apr 1983 [fl], M. F. F. Silva 1008 (INPA); Km20 da estrada Santa Luzia/ Santa Inez, 29 Jul 1977 [fl], D. Thomaz 406 (PEUFR). São Luís: Reserva Florestal do Sacavem, 07 May 1992 [fl], F. H. Muniz 95 (INPA); Rio Anil, 14 May 1949 [fl], R. L. Fróes 24281 (IAN); Granja Federal, 12 May 1949 [fl], R. L. Fróes 24243 (IAN).

Additional Specimens Examined. — **AMAZONAS**. Manaus: Manaus - Porto Velho Highway, Km. 25, 19 Mar 1974 [fr], G. T. Prance 20735 (NY). PARÁ. Serra dos Carajás, 07 Jun 1982 [fr], C. R. Sperling 5952 (NY).

35. *Myrciaria tenella* (DC.) O. Berg, Linnaea 27: 328 (1856). *Eugenia tenella* DC., Prodr. [A. P. de Candolle] 3: 272 (1828). Type: BRAZIL. C. Martius 47 (holotype: BR; isotype: MO [313601], P! [K000001445]).

Trees 2–6 m. Twigs pubescent, the hairs whitish. Leaves with petioles 1–2 mm long, pubescent, channeled; blades elliptic or lanceolate, 1–2.5 × 0.5–1.2 cm, glabrous, chartaceous, discolorous; glands inconspicuous; apex acute; base cuneate; midvein adaxially flat; lateral veins few visible, 10 to 26 pairs, marginal vein 0.5 mm or less from the margin, intra-marginal vein absent, the margin flat. Inflorescence glomerules clustered in axils, the main axis inconspicuous; bracts deltate, 0.5 × 0.5 mm, glabrous, caducous after anthesis; pedicels absent; bracteoles deltate, 0.5 × 0.5 mm, glabrous, caducous after anthesis; flower buds ovate, 1.5 × 1.5 mm; calyx-lobes free, 4–merous, glabrous, ovate, 1 × 1 mm, not reflexed; the fruit falling as a unit together with the calyx, corolla and hypanthium; ovary 2–locular. Immature fruit globose, 0.5 cm diameter, glabrous, surface with glands marked, no mature fruits examined.

Myrciaria tenella may be recognized by its elliptic or lanceolate leaves with acute leaf apex, the few visible lateral veins, the inflorescence glomerules clustered in leaf axils, and the fruit falling as a unit together with the calyx, corolla and hypanthium. This species is related to *M. floribunda,* from which it is distinguished by leaves 1–2.5 × 0.5–1.2 cm (vs. 4.4–7.3 × 2.8–3 cm), leaf apex acute (vs. long-acuminate and petiole with 1–2 mm (vs. 2–4 mm).

Distribution and habitat: Known from Argentina, Bolivia, Dominican Republic, French Guiana, Haiti, Paraguay, Peru, Uruguay and Venezuela and widely distributed in Brazil. In Amazonian Maranhão, M. tenella was found growing in secondary and “terra firme” forests.

Phenology: Flowering in May and August and fruiting in August.

Specimens Examined. — **MARANHÃO**. Colônia Três Satubas, 16 May 1979 [fl], I. J. Jangoux & R. P. Bahia 639 (MG). Rio Alto Turiaçú, Nova Esperança, 07 Dec 1978 [fl], I. J. Jangoux & R. P. Bahia 288 (MG). Rio Gurupi, 13 Aug 1958 [fl; fr], R. L. Fróes 34525 (IAN). Monção: Guajá, Rio

Turiaçu, 24 Apr 1887 [st], W. L. Balée 3343 (NYBG); 25 Jun 1987 [st], W. L. Balée 3486 (NYBG); 29 Jun 1988 [st], W. L. Balée 3514 (NYBG); Lago do Junco: Fazenda Bacaba, 05 Out 1980 [fr], D. C. Daly D493 (NY). São Luís: Base do Carbral, 06 Jan 1988 [st], R. Nina 39 (SLUI); Reserva Florestal do Sacavém, 07 May 1992 [fr], F. H. Muniz 276 (UEC); Rio Anil, 10 May 1949 [fl], R. L. Fróes 24211 (IAN).

36. *Psidium acutangulum* DC., Prodr. [A. P. de Candolle] 3: 233 (1828). Type: BRAZIL. "Provinciae Rio Negro", C.F.P. Martius 2931 (holotype: M [0032369]).

Shrubs ca. 2 m. Twigs glabrous. Leaves with petioles 0.5–1 mm long, densely pubescent, unchanneled; blades elliptic to broadly so, 3.9–6 × 2.9–3 cm, glabrous, membranaceous or chartaceous, discolorous; glands conspicuous; apex acute, apiculate; base attenuate or rounded; midvein adaxially sulcate; lateral veins visible, arched, 5 to 7 pairs; marginal vein absent, intra-marginal vein absent, the margin flat. Inflorescence axillary, a single flower, rarely raceme auxotelic, the main-axis inconspicuous, glabrous; bracts not seen, caducous before anthesis; pedicels 2.1–5.3 mm long; bracteoles not seen, caducous before anthesis; flower buds globose, apiculate, 4–9 × 6–7 mm; calyx-lobes completely fused, 4–5–merous, opening by irregular tearing, glabrous, ovate, 0.5 × 0.5 mm, not reflexed, persisting in the fruit; ovary not seen. Immature fruit globose, 1–2 × 1.5–2.3 cm, glabrous, surface marked with glands.

Psidium acutangulum may be recognized by its glabrous, elliptic to broadly elliptic leaves with an apiculate leaf apex; a single flower sometimes with an auxotelic raceme; the 4–5–merous calyx opening by irregular tearing; and the globose fruits which are glabrous and have the surface marked with glands.

Distribution and habitat: Known from Bolivia, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Venezuela and central, northeastern and northwestern Brazil (Acre, Amazonas, Amapá, Maranhão, Mato Grosso, Pará, Rondônia, Roraima, and Tocantins states). In Amazonian Maranhão, *P. acutangulum* was found growing in flooded forest and along rivers.

Phenology: Flowering in February and October and fruiting in November.

Specimens Examined. — **MARANHÃO**. Maracassumé River Region, 08 Oct 1932 [fl], R. L. Fróes 1927 (NY). Monção: Urutawy, Ka' apor Indian Reserve, basin of Rio Turiaçu, 05 Nov 1986 [fl], W. L Balée & B. G. Ribeiro 2904 (MG). Pinheiro: Rio Alto Turiaçu, Nova Esperança, 29 Nov 1978 [fr], J. Jangoux 78 & R. P. Bahia (NY). São Luis: Alumar, 20 Feb 1985 [fl], M. Salgado & R. M. G. Cardoso 69 (IAN).

Additional Specimens Examined. —**ACRE**. Sena Madureira: Riozinho do Andirá, colocaçao Curitiba, 10 Jun 1995 [fl], A. R. S. de Oliveira 572 (NY). **PARÁ**. Oriximiná: Rio Paru do Oeste, Cachoeira Chuvisco, 07 Nov 1980 [fl], C. A. C. Ferreira 2247 (NY).

37. *Psidium guineense* Sw., Prodr. [O. P. Swartz] 77 (1788). Type: "Culta in Hispaniola," "ex Africa". Presumably Swartz s.n. (holotype: S-r-5302).

Shrubs 2 m. Twigs sparsely pubescent or pubescent, hairs brownish-red. Leaves with petioles 0.5–0.7 mm long, densely or sparsely pubescent, channeled; blades elliptic, elliptic-oblong, oblong or oval, 4–13.5 × 1.8–6.8 cm, densely pubescent, the hairs reddish-brown, chartaceous, discolorous; glands not seen; apex acute, mucronate or obtuse; base cuneate or rounded; midvein adaxially impressed; lateral veins visible, 7 to 10 pairs; marginal vein absent, intra-marginal vein absent, the margin flat. Inflorescence axillary, a single flower or dichasium, 1–3 flowers, the main-axis 0.9–1.2 mm long, pubescent; bracts not seen, caducous before anthesis; pedicels 0.5–0.7 mm long or

absent; bracteoles linear, 1 × 1 mm, pubescent, caducous after anthesis; flower buds pyriform, 4–5 × 7–9 mm; calyx-lobes completely fused, 4–5–merous, opening by irregular tearing, pubescent, ovate, 5 × 3–5 mm, not reflexed, persisting in the fruit; ovary 3–5–locular. Immature fruit globose, ca. 1.1 × 1.4 cm, glabrous, surface marked with glands.

Psidium guineense may be recognized by its densely pubescent, elliptic, oblong or oval leaves, ; the acute, mucronate or obtuse leaf apex; the inflorescence, which is a single flower or dichasium; and the completely fused calyx lobes, opening by irregular tearing.

Distribution and habitat: Known from Tropical America, and widely distributed in Brazil. In Amazonian Maranhão, *P. guineense* was found growing in flooded forests and along roads.

Phenology: Flowering in January, February and December.

Specimens Examined. — **MARANHÃO**. Anajatuba: São Bento 09 Feb 2008 [fl] 2008, A. Araujo 10 (IAN). Bequimão: Pontal, 12 Jan 2020 [fl], G. S. Amorim (605). Pameirândia: 28Jan 2007 [fl], C. M. Vieira 87 (IAN). Turiaçu: Km 6 da BR 106 Maracaçumé-Sta. Helena, fazenda Maracaçumé Agro Industrial Grupo Mesbla, 01 Dec 1978 [fl], N. A. Rosa 2819 & H. Vila (NY).

Additional Specimens Examined. — **PARÁ**. Vigia: 17km southeat of Vigia along road (PA-140) to Belém, 30 Mar 1980 [fr], G. Davidse et al. 17655 (US).

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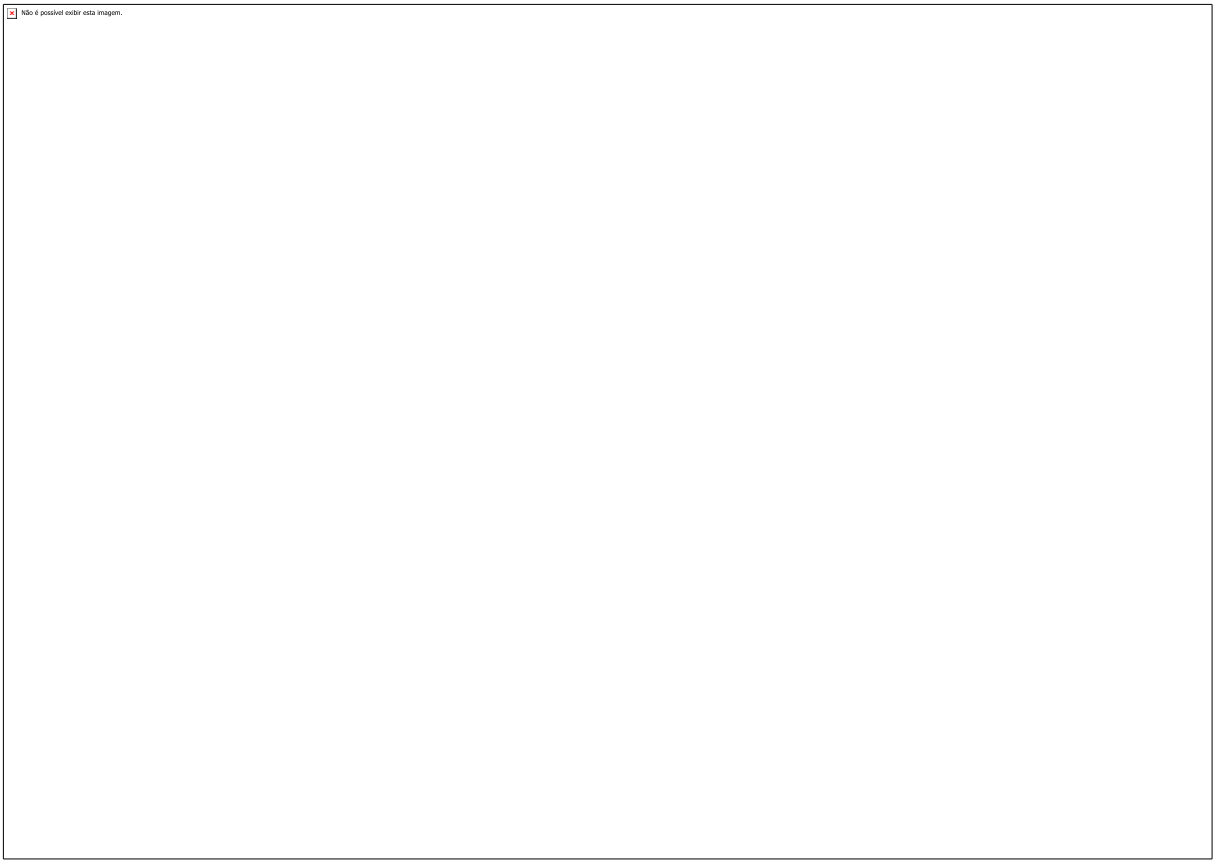

Figure 1: Limits of Amazonian Maranhão and collection areas.

Original Article

Species Richness and distribution in Amazonian Maranhão, Brazil: the case of Myrtaceae

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Abstract

The highest deforestation rates in the Amazon are in the state of Maranhão, Brazil, where there are few studies of the flora, including Myrtaceae, the family with the third highest diversity of species in Tropical America. The aim of this study is to analyses species richness, collection efforts, and present and potential geographic distribution of species of Myrtaceae in Amazonian Maranhão. We compiled geographic occurrences for 37 species of Myrtaceae from the online databases of the INCT-Virtual Herbarium of Brazilian Flora and Funga, the RefloraVirtual Herbarium, and from other collections studied in loco and online. Outside of the Amazon, these species were most represented in the biogeographic provinces of Cerrado (22 species), Caatinga (20) and Atlantic Forest (19). The widespread distribution pattern was the most prevalent. While fourteen species are restricted to the Amazon. Myrtaceae species are distributed in 45 municipalities in Amazonian Maranhão and the region with the greatest species richness and number of collections is near Maranhão Island, in the north, an area now covered mostly by agricultural or disturbed areas, with few remnants of forest fragments. Most of the species present in Amazonian Maranhão are well-adapted to the bioclimatic conditions of the northern region. This region, however, is largely deforested and converted to pasture and small fragments of secondary vegetation. The species are apparently less suitable to the south and west regions, where the largest forest remnants remain, due to the lack of collects for these areas. There an undersampling in the southern and eastern of Amazonian Maranhão, while are an oversampling in the region near the capital. These data gaps in the largest forest fragments in Amazonian Maranhão are caused by factors such as difficult access, lack of logistics, conflicts, etc.

Keywords: *Eugenia*; *Myrcia*; species distribution models; deforestation; secondary vegetation

Introduction

The Amazon is home to more than half of the remaining tropical forest areas in the world (Silva Jr. et al. 2018), and one of the most diverse forests on Earth (Steege et al. 2015). However, it is now less than ~ 80% of its original area (MapBiomas 2019). The forest has undergone a continuous loss of habitat, due to deforestation which alters the original configuration and leads to fragmentation (Silva Jr. et al. 2018). According to Reydon et al. (2019), deforestation in the Amazon is mainly the result of the clearing of forested areas without legal licenses, logging, the introduction of livestock and the development of agriculture. The highest rates of deforestation in the region are in the state of Maranhão (Celentano et al. 2017).

Amazonian Maranhão occupies approximately 81.208 km^2, and was originally covered by open and dense, moist and dry forests (Martins 2011, Muniz 2011, Silva Jr. *et al.* 2020). Nowadays, Amazonian Maranhão is severely degraded and has already lost 75% of its original vegetation and continues losing ca. 5% per year (Celentano *et al.* 2017, Reydon *et al.* 2019). This scenario is more aggravating because there are few floristic studies in the area. In order to provide an overview of the biodiversity of Amazonian Maranhão and help to protect its flora, it is important to determine if the species in this region have a wide distribution or if there is a predominance of endemic species, and whether they occur in protected areas and, therefore, to what extent they are protected and where.

Here we present an analysis of the distribution of Myrtaceae species in Amazonian Maranhão, to elucidate how these species are represented in this area. In this study, we will address the following questions: (1) What is the geographic distribution of Myrtaceae species in Amazonian Maranhão? (2) How is the species richness of Myrtaceae and the collection effort (measured as number of collections) distributed in the region? (3) Do the species occur in or can they be found in protected areas in Amazonian Maranhão?

Materials and methods

Study area and Brazilian Biomes

The state of Maranhão is located in northeastern Brazil (331,937 km^2) (IBGE 2019) and comprises parts of three different Brazilian Biomes: the Amazon forest (35%), the Cerrado (savanna) (64%), and the Caatinga (xeric thorn scrub) (1%) (Maranhão 2013). The Amazon region of Maranhão (02° 31' 30" – 05° 33' S and 43° 46' 30" – 46° 19' W), is located in the Belém center of endemism, and comprises 116 municipalities (ZEE 2020). According to Alvares *et al.* (2013), there are two types of climate in this region, based on Koppen's criteria: Aw (tropical with dry winter) and Am (tropical monsoon).

We adopted here the biogeographic proposal of Cabrera & Willink (1980) that recognizes 26 biogeographic provinces in South America. Brazil comprises eight provinces (Amazon, Atlantic, Cerrado, Caatinga, Paranaense, Pampeana, Chaqueña e Guayana) which have limits similar to those of the Brazilian biomes adopted by IBGE (see Fig. S1).

Species occurrence data

A list of 37 species of Myrtaceae occurring in Amazonian Maranhão was extracted from Amorim *et al.* (*unpublished data*). For these species we compiled a database of geographic occurrence records from INCT-Herbário Virtual (http://inct.splink.org.br/), Virtual Herbarium Reflora (http://reflora.jbrj.gov.br), and from collections studied in loco (HST, IAN, IPA, MAR, MG, NY, PEUFR, and SLUI) (herbarium acronyms following Thiers, 2020). For data obtained from online databases, whenever it was not possible to verify the species identifications, we kept for analysis only those records which were collected or identified by specialists in Myrtaceae. We also checked and removed: (a) records that don't occur in Brazil; (b) records without information

about the collection location; (c) records identified as potentially problematic using "CoordinateCleaner v. 2.0-9" (Zicka *et al.* 2018); (d) duplicate records; (e) records without correct identifications; (f) multiple records of the same species from the same locality. Whenever possible, we acquired geographic coordinates using the Geoloc (splink.cria.org.br/geoloc) and Google Earth (https://www.google.com/earth/). Coordinates analysis were carried out in R (R Core Team, 2019).

Species richness and collection effort

To analyze species richness and collection effort, were plotted all distribution records of the species of Myrtaceae found in Amazonian Maranhão in a map using Diva-Gis 7.5 software (Hijmans *et al.* 2012). We divided the Amazonian Maranhão into grids of 0.5° × 0.5° (approximately corresponding to 50 × 50 km grids) representing our Operating Geographic Units (OGU). We calculated, for each grid, species richness as the total number of Myrtaceae species present. Additionally, using the same grid for collection effort analysis, we determined the number of collections made there. The differences are indicated in colors.

Geographic distribution

To analyze geographic distribution, we used all occurrence records of the species for Brazil. Maps of geographic distribution were developed using Quantum GIS software (QGIS 3.16.0, 2020). The analysis considered the species distribution in the biogeographic provinces of Brazil (*sensu* Cabrera & Willink, 1980). We classified as "widespread" species occurring in three or more provinces and as "restricted" species found in only one or two provinces. For vegetation types we adopted the Brazilian Vegetation Classification System (IBGE 2012).

Distribution modeling

Distribution modeling of the species was developed using R (R Core Team, 2019). We obtained 19 Bioclimatic variables (Table S1), including minimum temperature (°C), maximum temperature (°C), average temperature (°C), precipitation (mm) and elevation from WorldClim

version 2.1 (http://www.worldclim.org/) with climate data for 1970-2000, at a spatial resolution of 2.5 arcsec (~5km^2). We calculated the Spearman correlation and all environmental variables with the correlation index ≥0.6 were not selected. We used different algorithms: Bioclim (Hijmans & Graham 2006); Domain (Carpenter *et al.* 1993); Generalized Linear Models (GLM) (Austin *et al.* 1994); Mahalanobis distance (MAH) (Farber & Kadmon 2003), and Support Vector Machines (SVM) (Schölkopf *et al.* 2001, Tax & Duin 2004) and generated various models for each species with a distribution restricted to the Amazon province. Species with distributions in more than one province were not analyzed. For each algorithm, 10 replicates were carried out, for a total of 50 models for each species.

We create two groups of randomly selected data, of which 70% of the data was used for calibration and 30% for internal evaluation (data testing). For evaluation of the models, we calculated the area under the curve (AUC), with satisfactory models having AUC values close to 1. We considered the models with the best predictive performance those with AUC values above 0.75. When necessary, we generated a pseudo-absence point. After selecting the algorithm, we elaborated the "ensemble" (Araújo & New 2007) with threshold limits of: >10%, 30% and 50% (Liu *et al.* 2005).

Results

Geographic distribution

After data cleaning, there were 9609 Brazilian records for the 37 species of Myrtaceae registered in Amazonian Maranhão. Considering their entire distribution in Brazil, besides the Amazon, the species were registered more frequently in the Cerrado (22), Caatinga (20) and Atlantic (19) provinces (Table 1). The widespread distribution pattern was the most prevalent,

comprising 21 species, i.e., the majority of species occur in three or more provinces and, thus have high ecological amplitude.

Fourteen species are restricted to the Amazon province. *Calycolpus goetheanus* (Fig 1A), *Myrcia bracteata* (Fig. 1B) and *M. cuprea* have many records. *Myrcia bracteata* is well distributed in the Amazon province, and was registered for the first time in Maranhão. Despite having a great abundance of records in the Amazon province, *Myrcia cuprea* has a limited distribution, occurring only in the states of Pará and Maranhão, mainly in the north, close to the coast (Fig. 2A). *Eugenia caducibracteata, E. dittocrepis, E. muricata, E. protenta, E. polystachya, E. wullschlaegeliana, Myrcia fasciculata, M. grandis, M. minutiflora, M. neospeciosa* and *M. pullei* have fewer than 42 records. *Eugenia wullschlaegeliana* is the species with the fewest specimens collected in Brazil, which makes it difficult to determine its distribution pattern. The specimens, however, were collected in the states of Amazonas, Maranhão and Pará.

Eugenia florida, E. punicifolia (Fig. 2B), *Myrcia guianensis, M. multiflora, M. selloi, M. splendens, Myrciaria tenella* and *M. floribunda*, are the most widespread species, occurring in all provinces and with records in all Brazilian states. Eleven species are distributed in five provinces (Amazon, Atlantic, Cerrado, Caatinga, Chaqueña e Guayana provinces): *Campomanesia aromatica, Eugenia densiracemosa, E. flavescens, E. lambertiana, E. stictopetala, Myrcia amazonica, M. eximia, M. neoclusiifolia, M. sylvatica, M. tomentosa, Psidium acutangulum,* and *P. guineense*.

Other species are common in certain provinces: *Campomanesia aromatica* and *Eugenia densiracemosa* are common in Atlantic and Caatinga provinces, *E lambertiana* in Amazon provinces, and *Psidium acutangulum* in Cerrado and Paranaense provinces. Only *Eugenia biflora* (Fig. 3A) occurs in four provinces (Amazon, Cerrado, Caatinga and Chaqueña). *Eugenia cupulata* (Fig. 3B) and *E. patrisii* occur in only two provinces (Amazon and Cerrado).

Species Richness and Collection Effort

The 37 Myrtaceae species collected in Amazonian Maranhão, are distributed in 45 municipalities (39% of the total). We noticed that most records are from the north and central regions of the state, from three environmental protection areas: Baixada Maranhense, Reentrâncias Maranhense, and Upaon-Açu-Miritiba-Alto Preguiças.

The grid with the highest species richness (12 - 24 species) in the state comprises the Maranhão Island (Fig. 5A), which is composed of four municipalities. The second grid with high richness covers three municipalities and presents 8 to 12 species. In 24 grids, species richness was lower (1 - 5 species). The north region was both the one with the highest species richness and with the highest number of specimens collected (50 - 150 specimens) (Fig. 5B). In 25 grids the number of specimens collected (1 - 10) was also low.

Modelling distribution

Twelve species restricted to the Amazon province were modeled. *Eugenia wullschlaegeliana*, with only three records available, was not. The 12 species totaled 593 valid records, with *Myrcia cuprea* presenting the highest number of records (152 occurrences) and only two species having less than 20, *Myrcia neospeciosa* (17) and *Myrcia pullei* (9).

For each map a different algorithm was used, in accordance with the ACU value (> 0.75) that indicates the best performance in the prediction for each species (Figure S2 and S3). After calculating the Spearman correlation, we selected five environmental variables: isothermality (Bio3), precipitation seasonality (Bio15), precipitation (prec3 and prec10) and maximum temperature (tmax12). In the models of *Eugenia dittocrepis* and *Myrcia minutiflora* ACU value was < 0.75, which indicated a low predictive capacity and, therefore, were not used in the analyses.

Calycolpus goetheanus and *Eugenia polystachya* which occur in some Amazon coastal areas showed high suitability for coastal areas in the northeastern states of Ceará and Rio Grande

do Norte (Fig 6; 7). The models for these species also showed high suitability for all coastal Maranhão, northern Amapá, northern Pará, and central Amazonas. *E. polystachya* also showed high suitability for the savannas of Maranhão and Tocantins.

Eugenia caducibracteata has few records in Maranhão, in the northern part of the state, but the models show high suitability for the western region of the state, where the protected areas are found (Fig. 6). The models also showed high suitability of the species for the states of Acre and Amazonas. *Eugenia muricata* also showed high suitability for Amazonas and for a northern and west for in Amazonian Maranhão, but low suitability for south and east areas in Maranhão, where did not had records (Fig. 6). *Eugenia protenta* has high suitability for northern Pará and western Amazonas, and in the Maranhão state only northern Amazonian Maranhão (Fig. 7).

Myrcia bracteata was well distributed in all Amazon, but presented only a single record for Maranhão, thus generating very little information for the models (Fig. 7). In contrast, *M. cuprea*, also with many records, was found only in northern Pará and Maranhão and, therefore, presented high suitability only for this area (Fig. 7). The models of *Myrcia fasciculata*, *M. grandis* and *M. neospecio*sa (Fig. 8) present high suitability for all Amazon region. *Myrcia fasciculate* and *M. grandis* also present high suitability to some areas along the northeastern coast and, in Maranhão, for the Amazonian and Savanna areas. *Myrcia pullei* (Fig. 9) has high suitability for coastal Amapá, Pará and Maranhão.

Discussion

Geographical distribution

Most species of Myrtaceae from Amazonian Maranhão have wider distribution and are well represented in the Atlantic and Paranaense provinces. Both provinces comprise the Atlantic Forest biome, according to the IBGE (2019). The Atlantic Forest is a center of diversification of

Myrtaceae, from where many species may have diversified and then dispersed to other habitats (Mori *et al.* 1983). This is probably due to the important relationship of Myrtaceae species with small dispersers and pollinators who inhabit the Atlantic Forest and aid their distribution along the environmental gradient (Bünger *et al.* 2014).

The species with wide distribution can be found along almost all the Brazilian coast, both in the north and eastern coast. As a result, these species present high phenotypic plasticity, including good adaptive responses to different environmental conditions. *Campomanesia aromatica*, *Eugenia florida, E. punicifolia*, *Myrcia guianensis*, *M. multiflora*, *M. selloi*, *M.splendens*, *M. sylvatica*, *Myrciaria tenella* and *M. floribunda* are species with wide distribution in Tropical America. These species are well distributed in the Atlantic coast of Northeast Brazil in different vegetation types.

Campomanesia aromatica, *Eugenia punicifolia*, *Myrcia guianensis* and *M.splendens* are also well distributed in transition areas between the Atlantic and Caatinga provinces. This transitional zone, regionally known as “agreste”, is characterized by intermediate rainfall amounts, between the dry *caatinga* and the semi-deciduous forest (Moro *et al.* 2016). These areas are environmentally milder than those of the *caatinga* and include the "brejos de altitude", which present more abundant rainfall (up to 1000 mm / year) (Prado 2003). Are also abundant in areas of campo rupestre, savannas and forests in the states of Bahia and Minas Gerais.

In the Amazon province, species occur mainly in "terra firme" (non-flooded) and "várzea" (flooded) forests, in the states of Amazonas and Pará, and along the coast in Pará and Maranhão. According to Rosário *et al.* (2005), Amazonian Myrtaceae are common in secondary forests, capoeiras and coastal plains, mainly in restingas and coastal savannas. The species most widely distributed in the Amazon province is *Myrcia bracteata* with many records in northern Pará, central

Amazonia and Acre. *Myrcia cuprea* presents a more restricted distribution, being common in the restingas of Pará and Maranhão and in forested areas of these states.

Despite its low diversity in the Amazon forest, compared to the Atlantic Forest, Myrtaceae are listed among the richest families in the region and *Eugenia* is among the most diverse genera (Hopkins 2005, Luize et al. 2018). However, these studied species have few collections and, therefore, a great lack of data.

Species Richness and Collection Effort

The highest richness of Myrtaceae in Amazonian Maranhão is mainly in unprotected areas, close to Maranhão Island (and the city of São Luís), where there is a concentration of researchers, financial resources and easier access to forest fragments. Maranhão Island was originally covered by rainforests, but today, it is predominantly an anthropic area, with only remnants of forest fragments and secondary vegetation (IBGE 2020).

The grid with the highest species richness was the same with the highest number of collections. This indicates an oversampling near the capital (São Luís) and an undersampling in the less accessible areas, which are further south and west. As the distance from the capital increases, the numbers of collections drop dramatically. However, these numbers may not be indicative of the true richness of species, but an over-sampling bias near São Luis. The main fragments of forest, however, are located in the west and southeast regions, including fourteen protected areas (indigenous land and other conservation units) (Fig. 4), where there are almost no collections.

The original vegetation cover in Amazonian Maranhão was an ombrophilous forest (moist tropical forest), but now it is mostly deforested (Fig 4), with fragments of secondary vegetation and large areas of pasture (IBGE 2020). The protected areas are the large remaining fragments of ombrophilous forest in Amazonian Maranhão (Fig 4). The Gurupi Biological Reserve is the largest protected area, but there is no collection record of Myrtaceae species from the Reserve. Only the

Indigenous reserve of Alto Turiaçu has collection records of Myrtaceae (Fig. 4), with seven records from the basin of the Rio Turiaçu, collected between 1986 and 1987 by W. L. Balée

The least accessible areas are also home to the largest forest remnants in Amazonian Maranhão. Here we have a large gap in data, with the records of occurrence of Myrtaceae almost absent. The data gap in these areas is a warning of how much we do not know about the flora of Amazonian Maranhão, and indicates that, probably, the richness of Myrtaceae in the region is much higher than that currently known.

The information about Myrtaceae in Amazonian Maranhão comes mainly from records in floristic, phytosociological, and phenological studies (Muniz 1998, Muniz *et al.* 1996a, b, Marques *et al.* 2011, Amorim *et al.* 2016, Serra *et al.* 2016, Silva *et al.* 2016, Almeida Jr. *et al.* 2020, Costa & Almeida Jr. 2020, Correia *et al.* 2020, Lima & Almeida Jr. 2018, Nascimento 2019), of forest fragments and coastal vegetation in Maranhão Island. Despite that, collections of D. C. Daly, J. Jangoux, N. Figueiredo, R. L. Fróes and W. L. Balée were important records documenting the distribution of species in the central areas of Amazonian Maranhão.

Modelling distribution

According to Batalha-Filho *et al.* (2013) there were two connection pathways for species migration between the Amazonian and Atlantic forests in northeastern Brazil: one along the coastal zones of Maranhão, Piauí, Ceará, and Rio Grande do Norte and another through Tocantins and western Bahia. *Calycolpus goetheanus* (Fig. 6) and *Eugenia polystachya* (Fig. 7) that occur in coastal Amazon and showed suitability for the northeastern coast, probably had their distributions extend to the Atlantic province along the northern coast.

Eugenia polystachya, *Myrcia fasciculata* (Fig. 8) and *M. grandis* (Fig. 8) also have high suitability for the Cerrado, mainly in Maranhão and Tocantins, in zones of ecological tension between the Amazonian Forest and the Cerrado (Haidar *et al.* 2013). Gallery forests across the

Cerrado are similar to those in eastern Amazonian and northern Atlantic Forest (Sobral-Sousa *et al.* 2015).

Most species have a potential distribution greater than their current known distribution, which indicate gaps in collections or a fragmented landscape. For non-deforested areas, the gaps in knowledge can be explained by difficult access, lack of logistics, and lack of interest in exploring these areas (Alvez-Valles *et al.* 2018). These gaps distort and misrepresent our understanding of biodiversity, impede accurate mapping of species distribution, and prevent identifying regions of endemism (Hopkins 2007).

In the Amazonian Maranhão, we observed high adequacy of Myrtaceae species for the northern region due to oversampling. The high number of collections for this region allows a greater amount of data to analyze the potential distribution. However, currently in the north of Amazonian Maranhão there is a large deforested area, with pastures and degraded areas, which has been increasing in size since the late 1960s (Porro 2005, Silva Jr. et al. 2020). Currently with only small fragments of secondary forest remaining (IBGE 2020).

Only a few species were suitable for the southern and eastern regions, where the protected areas are, due to undersampling for these regions of Amazonian Maranhão. These forest fragments in the south and east can be a source of knowledge of the Amazon flora in the Maranhão if conserved and floristic explored. Therefore, we emphasize that the conservation of the remaining vegetation of Amazonian Maranhão should be a priority for primary, not yet explored, and secondary vegetation, which plays a key role in nature conservation and must be preserved (Celentano et al. 2017, 2018).

Conclusion

Most species of Myrtaceae that occur in Amazonian Maranhão have a widespread distribution pattern in the Brazilian territory. While others are endemic to the Amazon and are being cited for the first time in the state. The species richness of Myrtaceae in the Amazonian Maranhão is greater close to the state capital, due to several factors such as the concentration of researchers, financial resources and easy access to forest fragments, however, these are unprotected areas, covered, mainly for secondary vegetation and pasture. The great richness of species near the capital evidences an oversampling in this region at the expense of undersampling in the southern and eastern of Amazonian Maranhão, where the main Conservation Units and Indigenous Lands are located, therefore, the protected areas.

These data gaps in the largest forest fragments in Amazonian Maranhão are caused by factors such as difficult access, lack of logistics, conflicts, etc. Because of these gaps, the potential distribution model of some species shows low suitability for areas such as Rebio Gurupi and greater suitability for areas close to the capital, where there is a greater number of records. Therefore, we emphasize that currently large forest remnants of Amazonian Maranhão are without data, but as they are conserved areas, they may contain greater species richness than the other areas already sampled, and even contain species not yet described or with occurrences not yet confirmed for the state. Therefore, these areas, even with models indicating low suitability of the species, should be priorities in future collections and/or botanical expeditions.

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Table 1: Pattern of the geographical distribution of species in the Myrtaceae occurring in the Amazonian Maranhão, Brazil.

Pattern	Distribution in the Provinces	Species
Widespread	Amazon, Atlantic, Cerrado, Caatinga and Chaqueña	*Campomanesia aromatica* (Aubl.) Griseb.
		Eugenia densiracemosa Mazine & Faria
		Eugenia flavescens DC.
		Eugenia lambertiana DC.
		Eugenia stictopetala DC.
		Myrcia eximia DC.
		Myrcia sylvatica (G.Mey.) DC.
		Psidium acutangulum DC.
		Psidium guineense Sw.
	Amazon, Atlantic, Cerrado, Caatinga, Paranaense, Pampeana and Chaqueña	*Eugenia florida* DC.
		Eugenia punicifolia (Kunth) DC.
		Myrcia amazonica DC.
		Myrcia guianensis (Aubl.) DC.
		Myrcia multiflora (Lam.) DC.
		Myrcia neoclusiifolia A.R.Lourenço & E.Lucas
		Myrcia selloi (Spreng.) N.Silveira
		Myrcia splendens (Sw.) DC.
		Myrcia tomentosa (Aubl.) DC.
		Myrciaria tenella (DC.) O. Berg
		Myrciaria floribunda (H.West ex Willd.) O.Berg
	Amazon, Cerrado, Caatinga and Chaqueña	*Eugenia biflora* (L.) DC.
Restricted	Amazon and Cerrado	*Eugenia cupulata* Amshoff
		Eugenia patrisii Vahl
	Amazon	*Calycolpus goetheanus* (Mart. ex DC.) O.Berg
		Eugenia caducibracteata Mazine
		Eugenia dittocrepis O.Berg
		Eugenia muricata DC.
		Eugenia polystachya Rich.
		Eugenia protenta McVaugh
		Eugenia wullschlaegeliana Amshoff
		Myrcia bracteata (Rich.) DC.
		Myrcia cuprea (O.Berg) Kiaersk.
		Myrcia fasciculata (O.Berg) K.Campbell & K.Samra
		Myrcia grandis McVaugh
		Myrcia minutiflora Sagot
		Myrcia neospeciosa A.R.Lourenço & E.Lucas
		Myrcia pullei (Burret ex Amshoff) A.R.Lourenço & E.Lucas

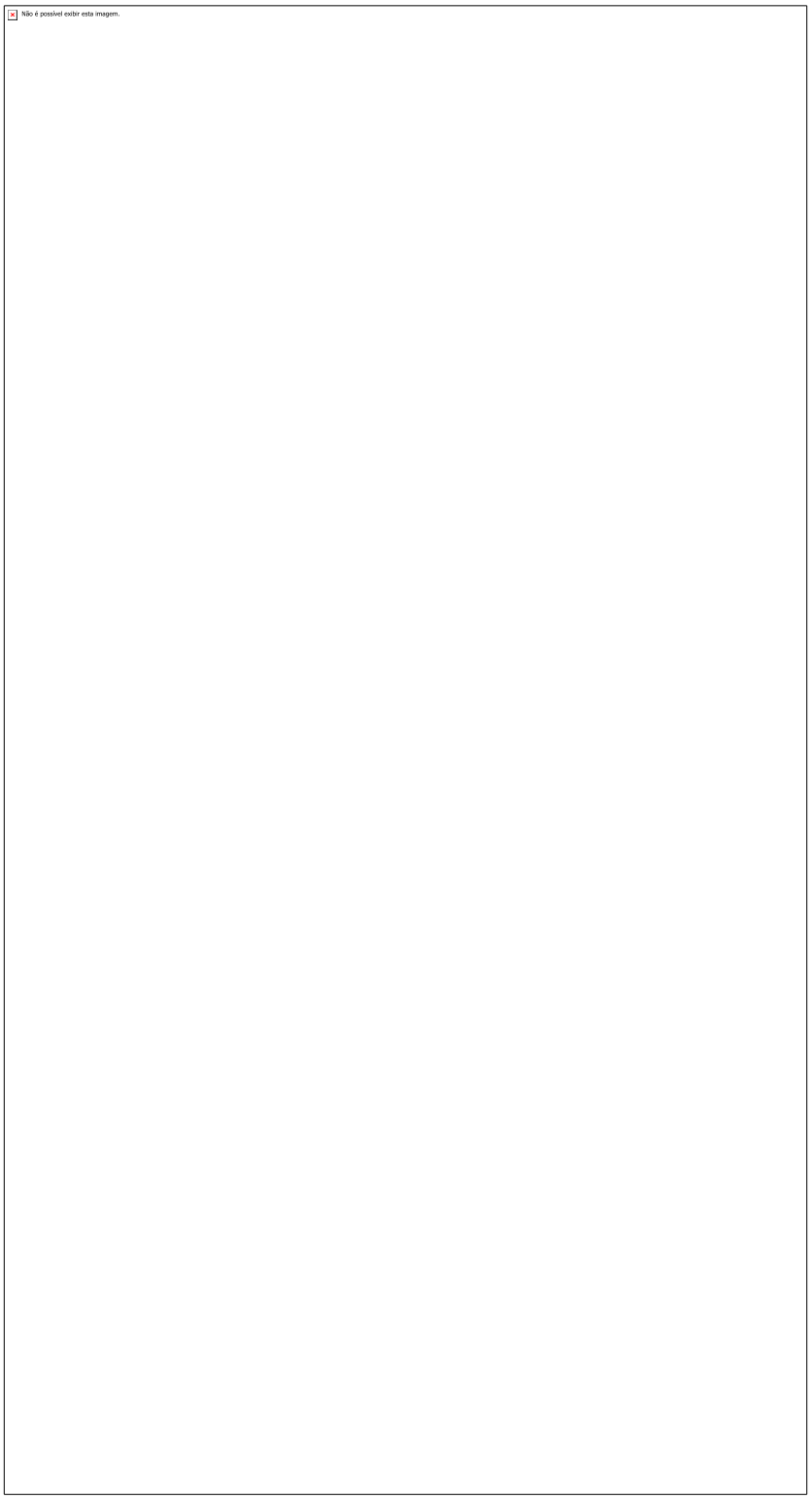


Figure 1: Pattern of the geographical distribution of species in the Myrtaceae in the Provinces (*sensu* Cabrera & Willink, 1973). A-B. Restricted pattern. A. Distribution of *Calycolpus goetheanus*. B. Distribution of *Myrcia bracteata*.

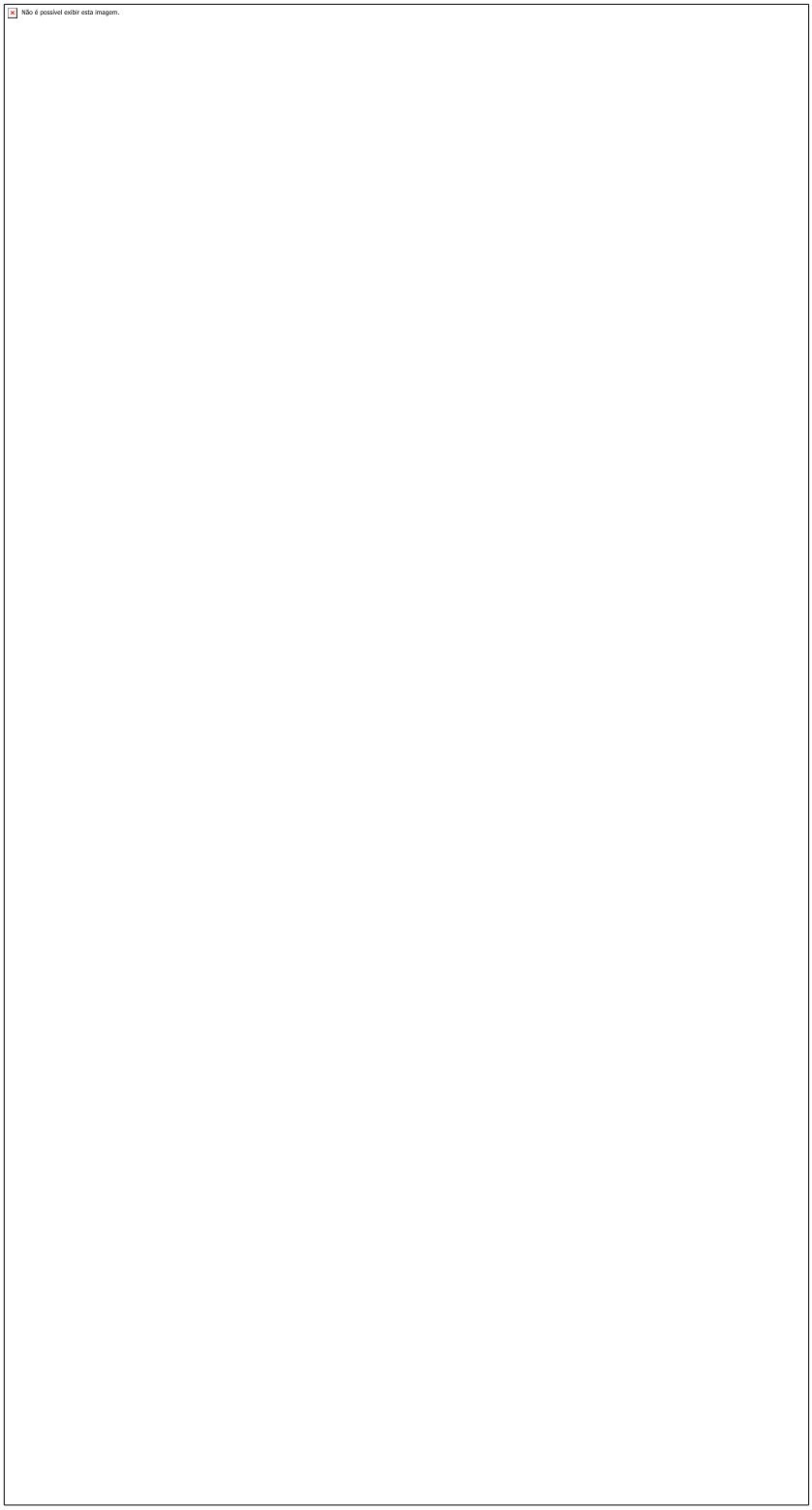


Figure 2: Pattern of the geographical distribution of species in the Myrtaceae in the Provinces (*sensu* Cabrera & Willink, 1973). A-B. Widespread pattern. A. Distribution of *Myrcia cuprea*. B. Distribution of *Eugenia punicifolia*.

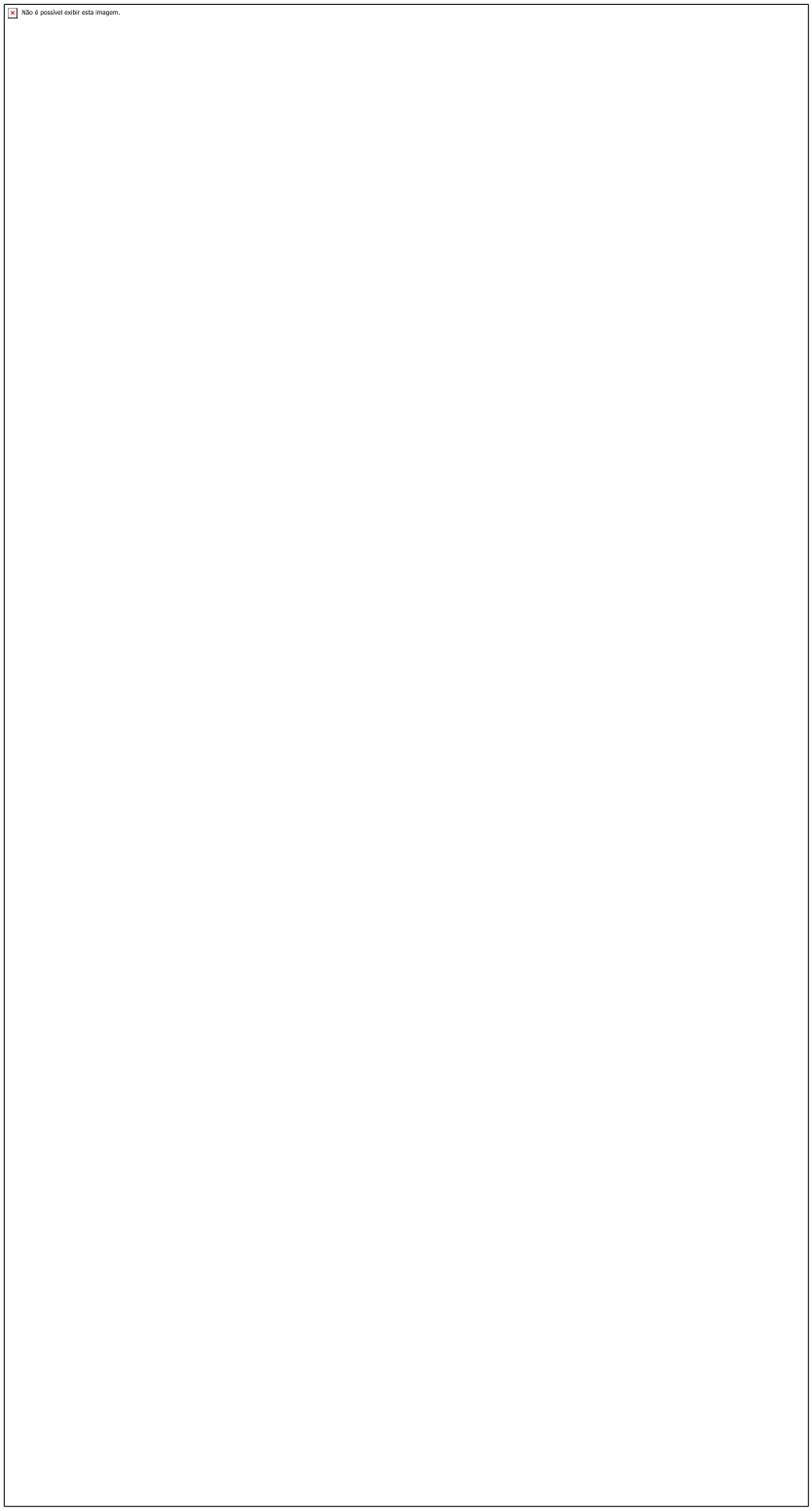


Figure 3: Pattern of geographical distribution of species in the Myrtaceae in the Provinces (*sensu* Cabrera & Willink, 1973). A. Widespread pattern - Distribution of *Eugenia biflora*. B. Restricted pattern - Distribution of *Eugenia cupulata*.

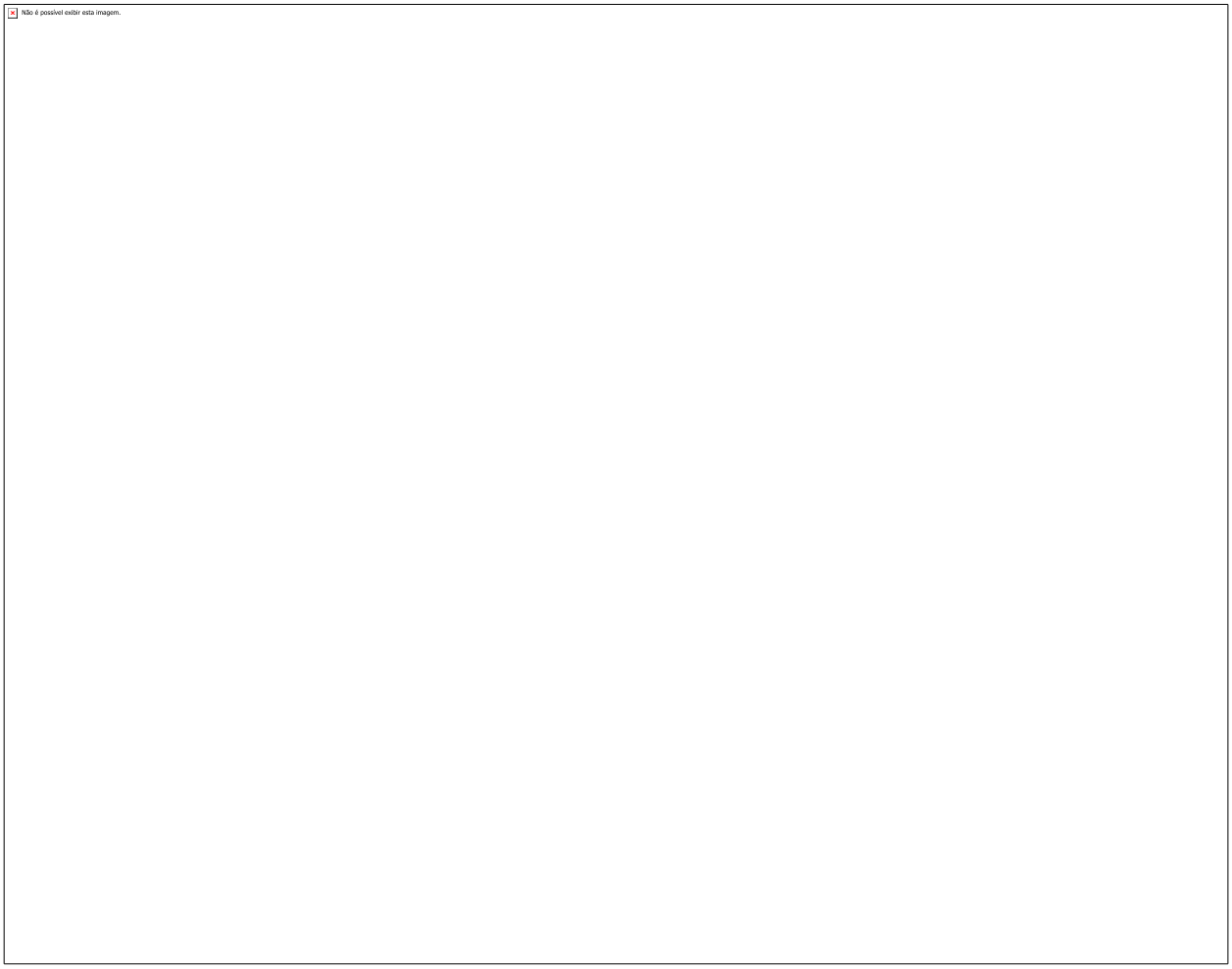


Figure 4: Distribution of records of occurrence of 37 Myrtaceae species in the vegetation types in the Amazonian Maranhão.

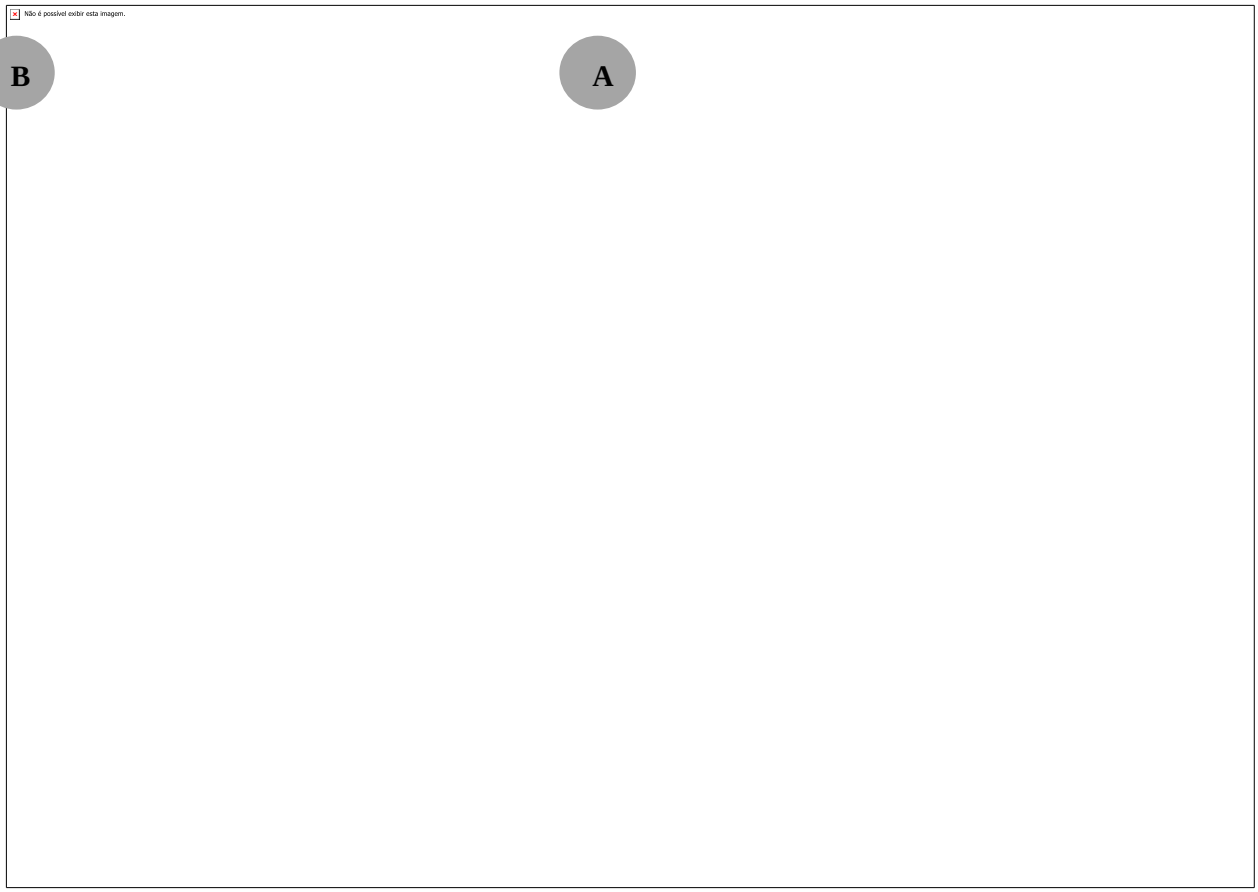


Figure 5: A-B. Richness and collection number of Myrtaceae in Amazonian Maranhão. A**.** Species richness of Myrtaceae in grid squares of 0.5º x 0.5º in Amazonian Maranhão. B. Collection number of Myrtaceae in grid square of 0.5º x 0.5º in Amazonian Maranhão. Using software DIVA-GIS 7.5.

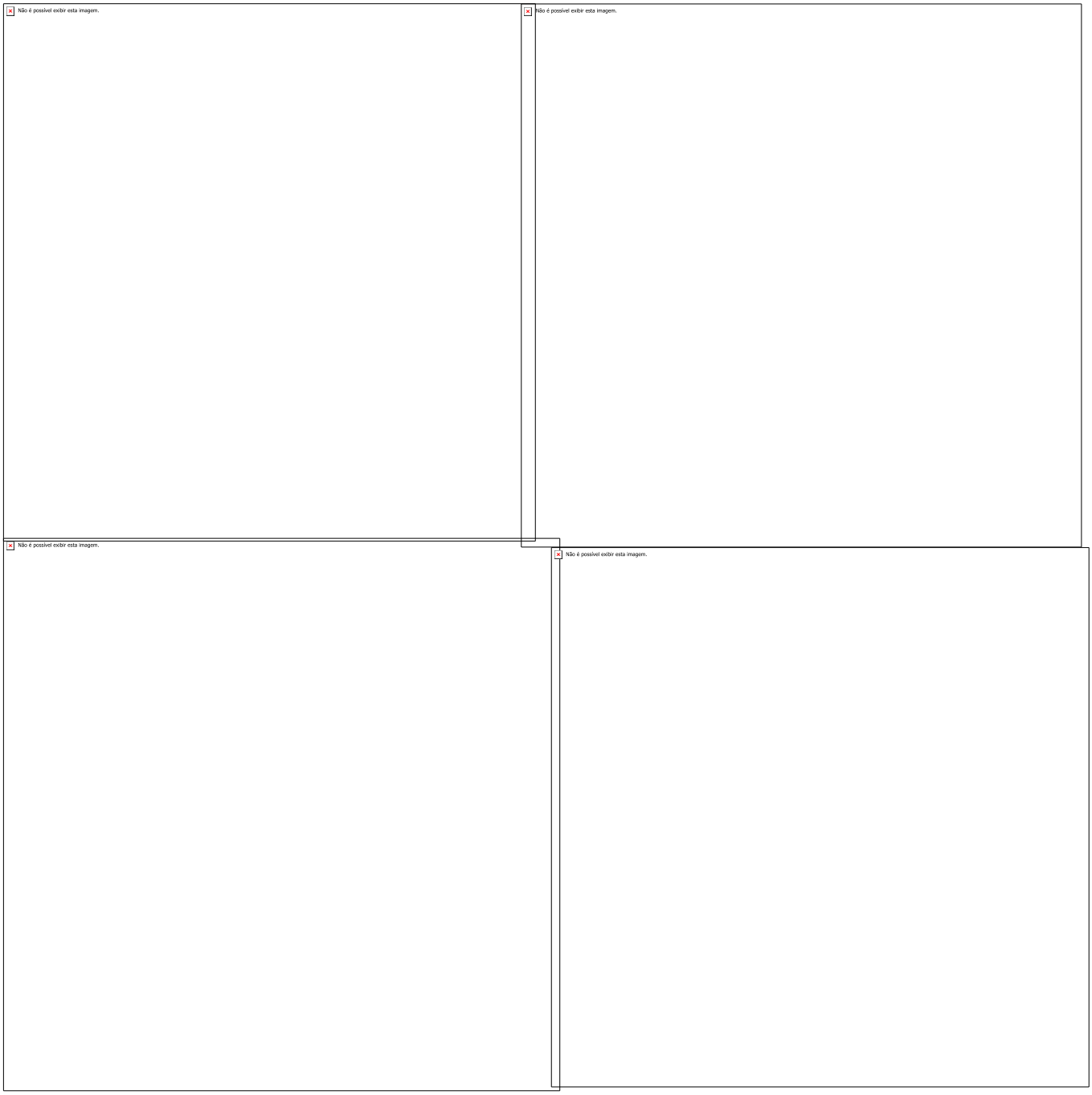


Figure 6: Model of distribution of species *Calycolpus goetheanus*, *Eugenia caducibracteata*, *E.dittocrepis*, E.*muricata.*

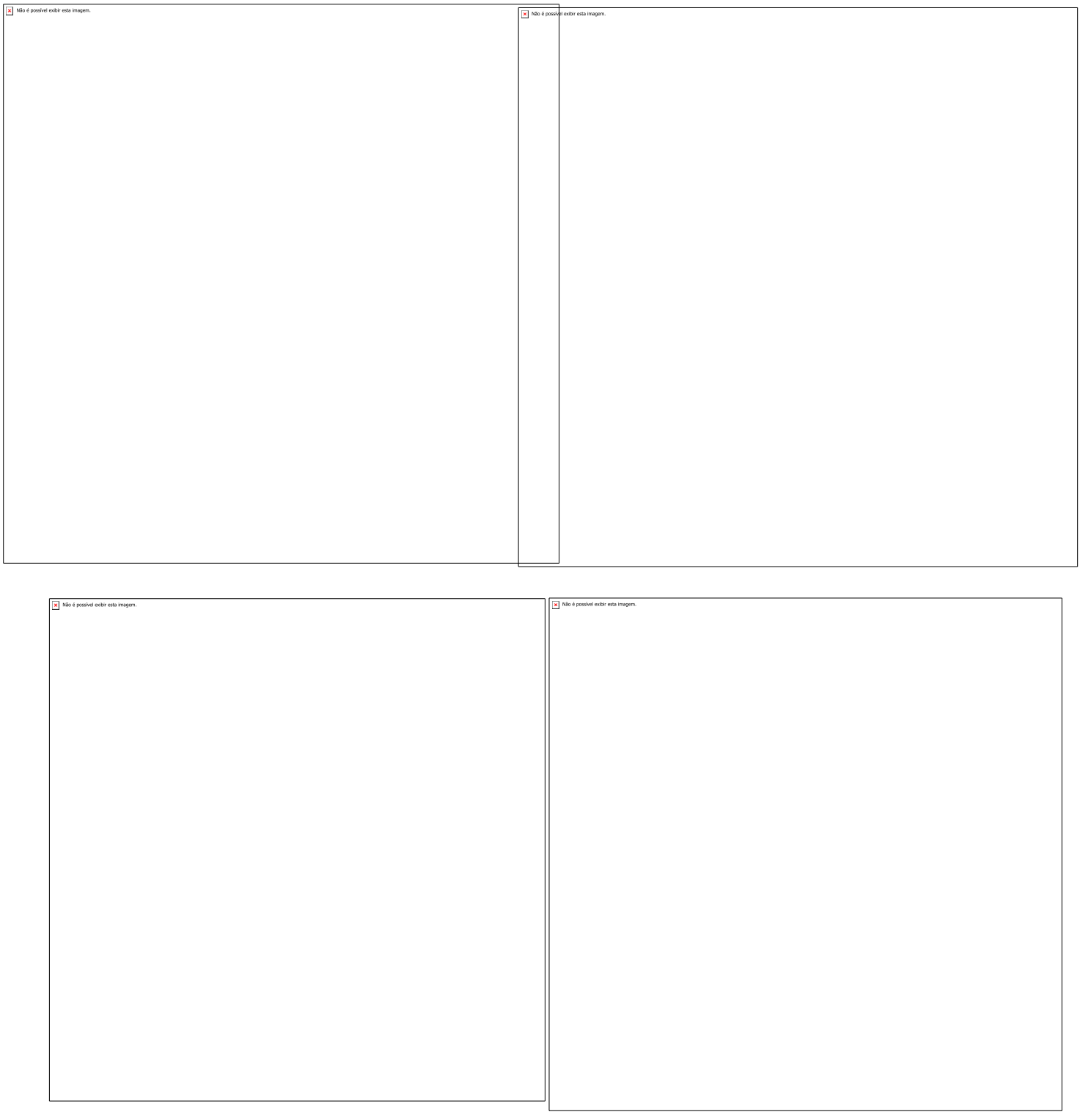


Figure 7: Model of distribution of species *Eugenia polystachya* e *E. protenta*, *Myrcia bracteata* e *M. cuprea*.

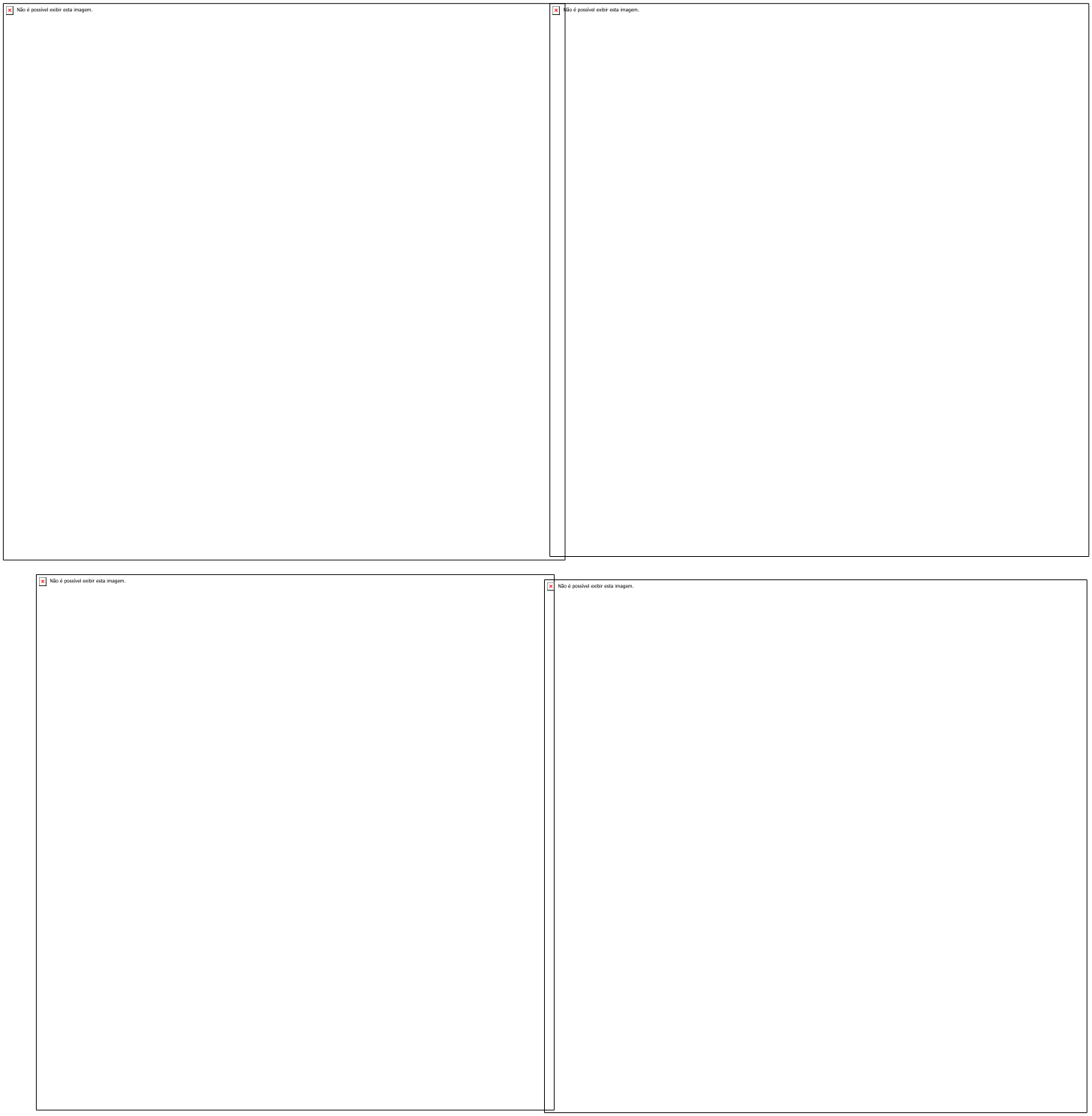


Figure 8: Model of distribution of species *Myrcia fasciculata*, *M. grandis*, *M. minutiflora and M. neospeciosa.*

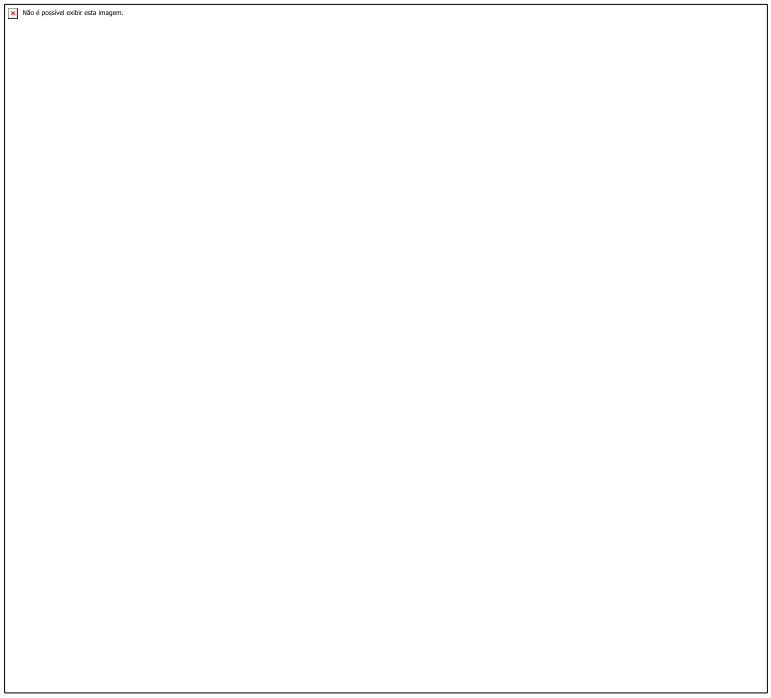
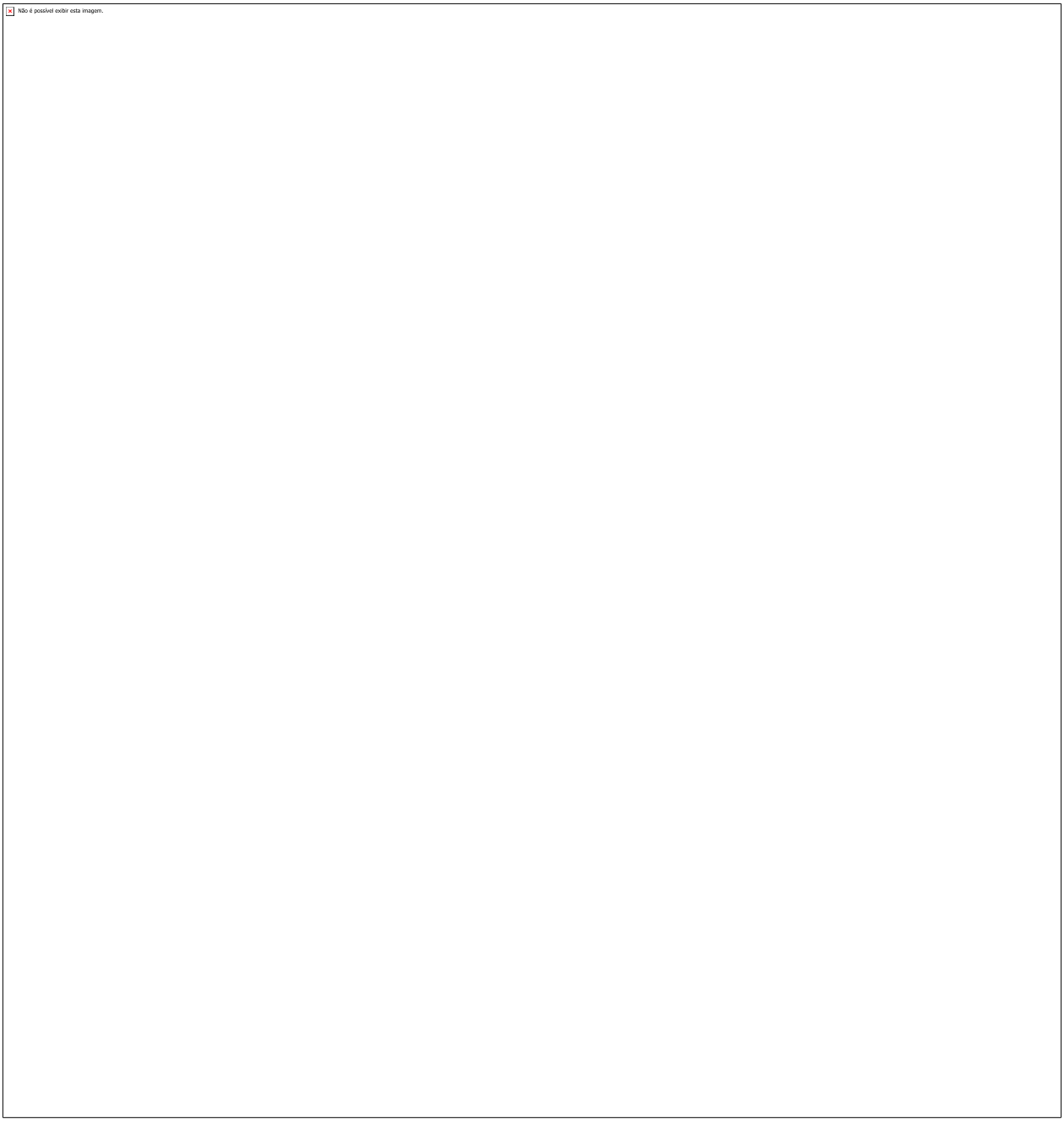


Figure 9: Model of distribution of species *Myrcia pullei*.

Supplementary Figure 1: A. Biogeographic provinces, following Cabrera & Willink 1980 (Adapted). B. Phytogeographic domains of Brazil, following IBGE (2019).

Supplementary Figure 2: Evaluation of the algorithms used in the elaboration of the models of *Calycolpus goetheanus, Eugenia caducibracteata, E. dittocrepis, E. muricata, E. polystachya, E. protenta* e *Myrcia bracteata*. (AUC = Area Under the ROC Curve).



Supplementary Figure 3: Evaluation of the algorithms used in the elaboration of the models of *Myrcia cuprea*, *M. fasciculata*, *M. grandis*, *M. minutiflora*, *M. neospeciosa*, *M. pullei*. (AUC = Area Under the ROC Curve).

Supplementary Tables 1: Bioclimatic variables used in the elaboration of distribution models extracted from WordClim.

Bioclimatic variables	**Code**
Annual Mean Temperature	BIO1
Mean Diurnal Range (Mean of monthly (max temp - min temp))	BIO2
Isothermality (BIO2/BIO7) (×100)	BIO3
Temperature Seasonality (standard deviation ×100)	BIO4
Max Temperature of Warmest Month	BIO5
Min Temperature of Coldest Month	BIO6
Temperature Annual Range (BIO5-BIO6)	BIO7
Mean Temperature of Wettest Quarter	BIO8
Mean Temperature of Driest Quarter	BIO9
Mean Temperature of Warmest Quarter	BIO10
Mean Temperature of Coldest Quarter	BIO11
Annual Precipitation	BIO12
Precipitation of Wettest Month	BIO13
Precipitation of Driest Month	BIO14
Precipitation Seasonality (Coefficient of Variation)	BIO15
Precipitation of Wettest Quarter	BIO16
Precipitation of Driest Quarter	BIO17
Precipitation of Warmest Quarter	BIO18
Precipitation of Coldest Quarter	BIO19
Minimum temperature (°C)	tmin 2.5m
Maximum temperature (°C)	tmax 2.5m
Average temperature (°C)	tavg 2.5m
Precipitation (mm)	prec 2.5m
Elevation	elev 2.5m

Supplementary Tables 2: Result of the evaluation of the models for each algorithm (AUC and TSS) and the number of records for each species. The AUC values were calculated based on the average of 10 replicates elaborate for each algorithm.

species	records	algorithm	tss_mean	tss_sd	auc_mean	auc_sd
Calycolpus goetheanus (Mart. ex DC.) O.Berg	29	Bioclim	0.567	0.248	0.776	0.162
		Domain	0.822	0.175	0.905	0.104
		GLM	0.844	0.15	0.944	0.054
		MAH	0.756	0.164	0.891	0.086
		SVM	0.811	0.149	0.91	0.078
Eugenia caducibracteata Mazine	19	Bioclim	0.4	0.306	0.7	0.161
		Domain	0.667	0.222	0.817	0.17
		GLM	0.533	0.153	0.658	0.147
		MAH	0.75	0.142	0.833	0.133
		SVM	0.55	0.158	0.744	0.111
Eugenia dittocrepis O.Berg	14	Bioclim	0.15	0.242	0.494	0.185
		Domain	0.45	0.197	0.672	0.212
		GLM	0.525	0.184	0.706	0.193
		MAH	0.475	0.219	0.662	0.151
		SVM	0.55	0.23	0.688	0.174
Eugenia muricata DC.	20	Bioclim	0.6	0.251	0.786	0.128
		Domain	0.75	0.196	0.857	0.115
		GLM	0.667	0.157	0.8	0.116
		MAH	0.683	0.123	0.844	0.089
		SVM	0.817	0.146	0.867	0.111
Eugenia polystachya Rich.	22	Bioclim	0.414	0.184	0.719	0.09
		Domain	0.643	0.168	0.847	0.076
		GLM	0.514	0.235	0.731	0.163
		MAH	0.814	0.136	0.929	0.063
		SVM	0.686	0.188	0.804	0.138
Eugenia protenta McVaugh	18	Bioclim	0.4	0.283	0.678	0.154
		Domain	0.76	0.184	0.87	0.142

		GLM	0.84	0.207	0.912	0.116
		MAH	0.88	0.14	0.932	0.08
		SVM	0.9	0.141	0.944	0.095
		Bioclim	0.439	0.117	0.748	0.079
	78	Domain	0.474	0.103	0.745	0.065
Myrcia bracteata (Rich.) DC.		GLM	0.548	0.051	0.742	0.03
		MAH	0.6	0.096	0.834	0.053
		SVM	0.622	0.074	0.844	0.041
		Bioclim	0.592	0.173	0.796	0.096
		Domain	0.75	0.124	0.877	0.08
Myrcia cuprea (O.Berg) Kiaersk.	41	GLM	0.742	0.182	0.908	0.079
		MAH	0.667	0.088	0.869	0.054
		SVM	0.717	0.131	0.869	0.071
		Bioclim	0.28	0.193	0.624	0.12
		Domain	0.84	0.263	0.91	0.15
Myrcia fasciculata (O.Berg) K.Campbell & K.Samra	18	GLM	0.76	0.184	0.9	0.118
		MAH	0.82	0.22	0.9	0.139
		SVM	0.8	0.189	0.904	0.118
		Bioclim	0.455	0.113	0.687	0.089
		Domain	0.518	0.105	0.729	0.095
Myrcia grandis McVaugh	38	GLM	0.482	0.096	0.688	0.096
		MAH	0.591	0.137	0.796	0.074
		SVM	0.618	0.072	0.795	0.054
		Bioclim	0.317	0.266	0.636	0.16
		Domain	0.367	0.189	0.637	0.123
Myrcia minutiflora Sagot	21	GLM	0.383	0.209	0.608	0.142
		MAH	0.433	0.179	0.639	0.148
		SVM	0.467	0.153	0.658	0.137
		Bioclim	0.42	0.257	0.71	0.129
Myrcia neospeciosa A.R.Lourenço & E.Lucas	15	Domain	0.64	0.207	0.826	0.113
		GLM	0.68	0.193	0.828	0.146

Myrcia pullei (Burret ex Amshoff) A.R.Lourenço & E.Lucas	8	MAH	0.76	0.184	0.896	0.085
		SVM	0.9	0.105	0.952	0.059
		Bioclim	0.15	0.242	0.575	0.121
		Domain	0.75	0.354	0.863	0.208
		GLM	0.7	0.35	0.75	0.289
		MAH	0.85	0.242	0.9	0.175
		SVM	1	0	1	0

4. CONSIDERAÇÕES FINAIS

O tratamento taxonômico da família Myrtaceae na Amazônia Maranhense é o primeiro estudo taxonômico desenvolvido em áreas florestais do estado e apresenta sete espécies citadas pela primeira vez para o estado. As espécies de Myrtaceae estudadas apresentam dois padrões de distribuição: amplo e restrito. As espécies de distribuição restrita, ocorrem apenas para província Amazônica, e apresentam um menor número de registros de ocorrência, sem registros em algumas regiões e em consequência temos uma grande lacuna de dados que dificulta a análise da distribuição dessas espécies.

Na Amazônia Maranhense o esforço de coleta (número de registros) tem sido direcionado a áreas próximo a capital (São Luís), que fica localizado na região norte, enquanto que, outras áreas mais ao centro e leste ainda estão mal amostradas e as áreas ao oeste e sul ainda são desconhecidas floristicamente. Na Amazônia Maranhense as espécies de Myrtaceae estão em áreas desprotegidas. Os principais fragmentos florestais em áreas protegidas estão na parte sul e oeste, e embora Myrtaceae seja uma família de espécies arbóreas que são encontradas em áreas florestais, não há registros da família para essas áreas. Contudo, acreditamos que a maior riqueza pode estar nesses fragmentos ainda não amostrados, que infelizmente estão no arco do desmatamento e em áreas de grandes conflitos.

A escassez de dados e o baixo de esforço de coleta para essas áreas coloca em risco o conhecimento da biodiversidade do Maranhão. Isso limita também o conhecimento da distribuição das espécies, uma vez que não conseguimos compreender se essas espécies são bem distribuídas no estado ou se restringem a uma fisionomia, pois a maioria apresentava poucos registros, dificultando também prever a sua distribuição potencial. As espécies que mostraram uma alta adequabilidade para a região sul e oeste da Amazônia Maranhense foram aquelas que tinham um maior número de registros, coletadas em diferentes áreas. Entretanto, é possível que muitas outras também seja encontrada nas áreas protegidas do estado.

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ANEXO - Normas de submissão na Acta Botanica Brasilica

Instructions

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If English is not your first language, it is strongly recommended to have your manuscript edited for language before submission. This is not a mandatory step, but may help to ensure that the academic content of your paper is fully understood by journal editors and reviewers. Language editing does not guarantee that your manuscript will be accepted for publication. Authors are liable for all costs associated with such services.

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All manuscripts must follow these guidelines: the text should be in Times New Roman font, size 12, double-spaced throughout and with 25 mm margins; the paper size should be set to A4 (210 x 297 mm). All pages should be numbered sequentially. Each line of the text should also be numbered, with the top line of each page being line 1. For text files .doc, .docx and .rtf are the only acceptable formats. Files in Adobe® PDF format (.pdf files) will not be accepted. When appropriate, the article file should include a list of figure legends and table heads at the end. This article file should not include any illustrations or tables, all of which should be submitted in separate files. Do not include field code either.

The first page should state the type of article (Original Article, Review, Viewpoint, Method or Short communication) and provide a concise and informative full title followed by the names of all authors. Each name should be followed by the Orcid number and an identifying superscript number (1, 2, 3 etc.) associated with the appropriate institutional address to be entered further down the page. Only one corresponding author should be indicated with an asterisk and should always be the submitting author. The institutional address(es) of each author should be listed next, each address being preceded by the superscript number where appropriate. The address must be synthetic and in English with institution, postal code, city, state and country. Do not translate laboratory, department and university. Titles and positions should not be mentioned. This information is followed by the e-mail address of the corresponding author.

The second page should contain a structured Abstract not exceeding 200 words in a single paragraph without references. The Abstract should outline the essential content of the manuscript, especially the results and discussion, highlighting the relevance of main findings.

The Abstract should be followed by between five and ten Keywords. Note that essential words in the title should be repeated in the key words.

Original articles should be divided into sections presented in the following order:

Title page
Abstract
Introduction
Materials and methods
Results
Discussion

Acknowledgements
References
Tables and Figures legends
Supplementary Data (if applicable)

Materials and methods and Results should be clear and concise. The Discussion section should avoid extensive repetition of the results and must finish with some conclusions. This section can be combined with results (Results and Discussion), however, we recommend authors consult the Editoral Board for a previous evaluation.

Plant names must be written out in full in the abstract and again in the main text for every organism at first mention but the genus is only needed for the first species in a list within the same genus (e.g. Hymenaea stigonocarpa e H. stilbocarpa). The authority (e.g., L., Mill., Benth.) is required only in Materials and methods section. Use The International Plant Names Index (www.ipni.org) for correct plants names. Cultivars or varieties should be added to the scientific name (e.g. Solanum lycopersicum 'Jumbo'). Authors must include in Materials and methods a reference to voucher specimen(s) and voucher number(s) of the plants or other material examined.

Abbreviations must be avoid except for usual cases (see recent issues) and all terms must be written out in full when used to start a sentence. Non-conventional abbreviations should be spelled out at first mention.

Units of Measurement. Acta bot. bras. adopts the Systéme International d'Unités (SI). For volume, use the cubic metre (e.g. 1 × 10–5 m3) or the litre (e.g. 5 μL, 5 mL, 5 L). For concentrations, use μM, μmol L–1 or mg L–1. For size and distance use meters (cm, mm, um, etc) and be consistent in the manuscript.

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Research papers

Alves MF, Duarte MO, Oliveira PEAM, Sampaio DS. 2013. Self-sterility in the hexaploid Handroanthus serratifolius (Bignoniaceae), the national flower of Brazil. Acta Botanica Brasilica 27: 714-722.

Papers in press (ahead of print)

Alves JJ, Sampaio MTY. 2015. Structure and evolution of flowers. Acta Botanica Brasilica (in press). doi: 10.1590/0102-33062015abb3339.

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Acknowledgements should be in fewer than 80 words. Be concise: “we thank…” is preferable to “The present authors would like to express their thanks to…”. Funding information should be included in this section.

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