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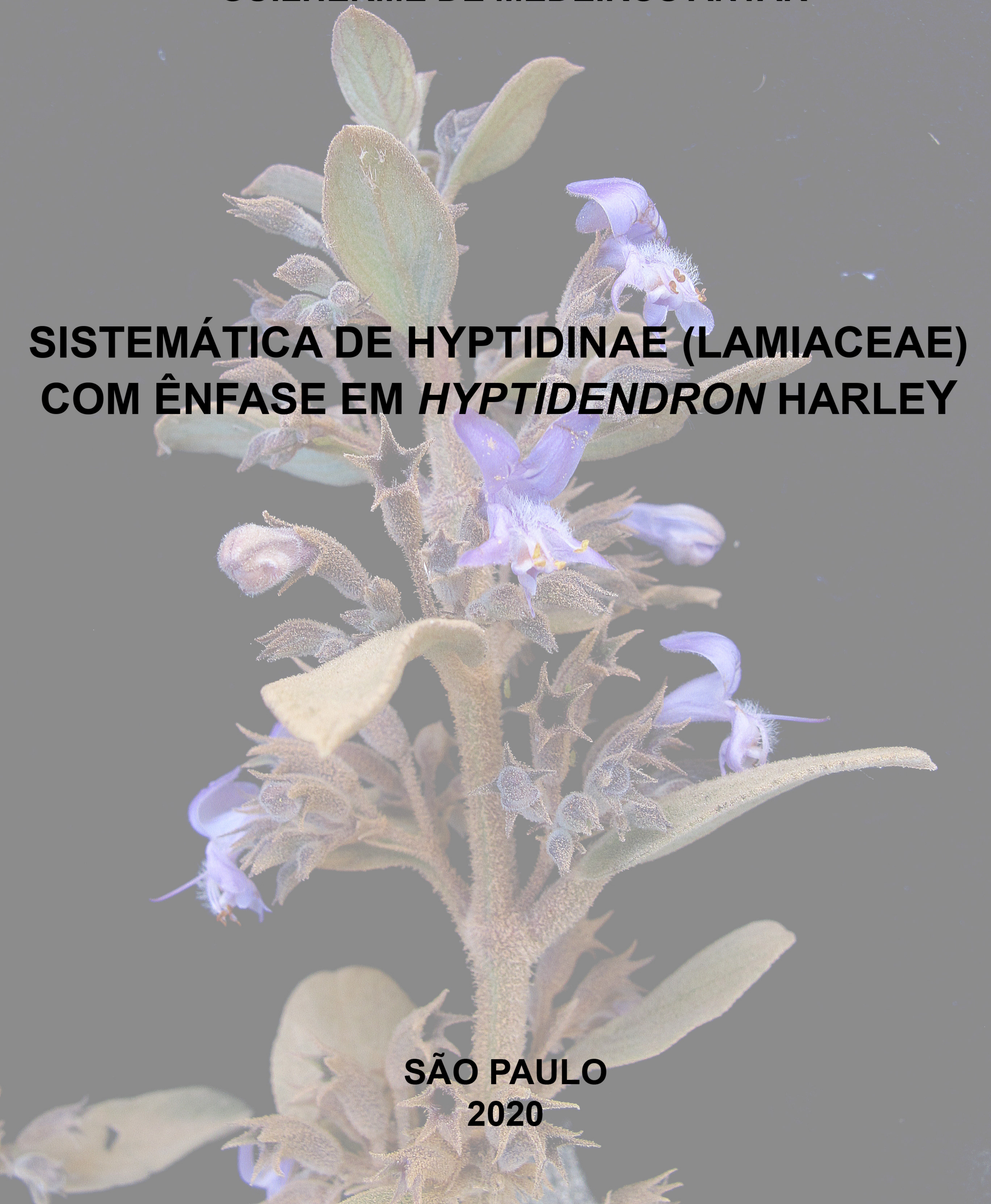

SISTEMÁTICA DE HYPTIDINAE (LAMIACEAE) COM ÊNFASE EM *HYPTIDENDRON* HARLEY

SÃO PAULO
2020

Guilherme de Medeiros Antar

Sistemática de Hyptidinae (Lamiaceae) com ênfase em *Hyptidendron* Harley

Systematics of Hyptidinae (Lamiaceae) with emphasis on *Hyptidendron* Harley

Tese apresentada ao Instituto de Biociências da Universidade de São Paulo, para a obtenção de Título de Doutor em Ciências Biológicas, na Área de Botânica.

Orientador(a): Paulo Takeo Sano

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Prof. Dr. Paulo Takeo Sano
Orientador

Dedico a meus pais,
Jorge e Heloisa.

Se não houver frutos, valeu a beleza das flores,
Se não houver flores, valeu a sombra das folhas,
E se não houver folhas, valeu a intenção da semente.

Autor desconhecido

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Índice

Resumo

Hyptidinae (Lamiaceae) é majoritariamente neotropical com cerca de 400 espécies. A subtribo, originalmente descrita com quatro gêneros, sofreu diversas modificações genéricas baseadas em análises morfológicas e duas filogenias moleculares obtidas por sequenciamento Sanger, sendo atualmente reconhecida com 19 gêneros. Mesmo com esses avanços, as filogenias produzidas ainda não apresentaram suportes robustos em todas as relações genéricas, além de problemas no reconhecimento de alguns gêneros, principalmente *Hyptidendron*. O gênero foi revisado pela última vez por Carl Epling em 1949, quando ainda era parte de *Hyptis*, e apresenta atualmente 19 espécies, necessitando de avaliação na circunscrição de seus táxons e na sua nomenclatura, além do teste de hipótese de seu monofiletismo. Esse projeto tem o objetivo de colaborar no conhecimento desses temas. A partir de material obtido por expedições de coleta e visita a herbários, uma nova filogenia da subtribo foi produzida com 353 marcadores nucleares e 67 terminais de Hyptidinae. Uma revisão taxonômica de *Hyptidendron* é proposta, juntamente com trabalhos taxonômicos e nomenclaturais com integrantes da subtribo, um trabalho de venação de *Hyptidendron* e um *data paper* com o banco de dados construído durante a revisão. A nova filogenia recuperou Hyptidinae como monofilético e todos os gêneros da subtribo, com exceção de *Hyptis* e *Hypenia*. *Hyptidendron* emergiu pela primeira vez como monofilético com três clados bem suportados, os quais foram classificados como sessões. Como consequência dos resultados filogenéticos, foram necessárias recircunscrições na taxonomia da subtribo, com novas combinações e a criação de novos táxons, destacando-se o novo gênero monotípico *Myriohyptis*. Como resultado da revisão de *Hyptidendron*, 22 espécies são reconhecidas e são apresentadas descrições, mapas de distribuição, ilustrações, pranchas fotográficas, além de comentários sobre ecologia, conservação e reconhecimento das espécies. Essa tese traz um avanço para a taxonomia de Hyptidinae e *Hyptidendron*, demonstrando a necessidade de estudos na Flora Neotropical, a qual ainda não é suficientemente conhecida.

Palavras-chave: *Hyptis, Hyptidendron*, Lamiaceae, Neotrópico, Taxonomia

Abstract

Hyptidinae (Lamiaceae) is mostly neotropical with ca. 400 species. The subtribe, firstly described with four genera, has been subjected to various generic modifications based on morphological analyses and in two molecular phylogenies obtained by Sanger sequencing, being currently recognized with 19 genera. Although much progress has been made, the previous phylogenies did not show robust support in all generic relationships, together with problems in some genera recognition, which is especially true for *Hyptidendron*. The genus, which was last revised by Carl Epling in 1949 when it was still part of *Hyptis*, currently contains 19 species, which need updating in their circumscription and nomenclature, as well testing its monophyly. This project aims to collaborate in the knowledge of these issues. From material obtained during field expeditions and herbarium studies, a new phylogeny for the subtribe was constructed, based on 353 nuclear markers and 67 Hyptidinae terminals. A taxonomic revision of *Hyptidendron* is here proposed, together with taxonomic and nomenclatural notes of subtribal taxa, a study of the venation pattern in *Hyptidendron* and a paper reporting on the database constructed for the revision. The new phylogeny recovered Hyptidinae as monophyletic as well as all genera of the subtribe with the exception of *Hyptis* e *Hypenia*. *Hyptidendron* was recognized as monophyletic for the first time, with three well-supported clades, which are here treated as sections. As a result of the phylogenetic results obtained, various taxonomic recircumscriptions within the subtribe were needed, with new combinations and new taxa created, highlighting the description of a new monotypic genus, *Myriohyptis*. For the revision of *Hyptidendron* 22 species were recognized, with descriptions, distributions maps, illustrations and photographic plates provided, together with comments on the ecology, conservation and species recognition. This thesis advances the systematic knowledge of Hyptidinae and *Hyptidendron*, also showing the need for further studies on the Neotropical flora, which is not yet sufficiently well known.

Keywords: *Hyptis*, *Hyptidendron*, Lamiaceae, Neotropics, Taxonomy.

O Brasil é detentor da maior diversidade vegetal do mundo (Forzza *et al.* 2012), com cerca de 35.500 espécies de espermatófitas nativas (Flora do Brasil 2020 em construção), das quais mais de 50% são endêmicas (Forzza *et al.* 2012; BFG 2015). Apesar disso, o país ainda possui lacunas de conhecimento sobre sua diversidade (Morim & Lughadha 2015) e, como agravante, seus domínios fitogeográficos vêm perdendo área progressivamente. Nesse contexto, há necessidade de, por um lado, seguir gerando dados sobre riqueza e diversidade da flora brasileira. Por outro lado, contudo, é imprescindível compreender a diversidade numa perspectiva evolutiva, que permita estabelecer hipóteses elucidativas sobre a origem de tal diversidade, que por sua vez justifiquem, ainda mais, a necessidade de sua conservação.

É nesse contexto que se insere esta tese, no qual Lamiaceae Martinov, a subtribo Hyptidinae Endl., e o gênero *Hyptidendron* Harley constituem modelos de estudo bastante propícios.

Lamiaceae Martnov.

Lamiaceae (ou Labiatae Juss.) possui distribuição cosmopolita, excetuando locais de maiores latitude e altitude (Harley *et al.* 2004). São reconhecidas 7.280 espécies, distribuídas em 236 gêneros (Stevens 2020) com ocorrência concentrada em formações vegetacionais abertas, em climas tropicais ou subtropicais (Harley *et al.* 2004). A família possui grande diversidade morfológica e seus representantes majoritariamente podem ser reconhecidos por apresentar caule quadrangular, folhas simples, opostas, serreadas, sem estípulas, flores zigomorfas, bilabiadas, estilete ginobásico e presença de óleos essenciais, que conferem, a muitas espécies da família, propriedades aromáticas relacionadas ao principal uso econômico da família. Plantas como o alecrim (*Rosmarinus officinalis* L.), a hortelã (*Mentha* spp.), o orégano (*Origanum vulgare* L.), o manjericão (*Ocimum* spp.) e a lavanda (*Lavandula angustifolia* Mill.) são muito importantes para a indústria da culinária e perfumaria mundial (Harley *et al.* 2004). Destacam-se também outros representantes da família pelo seu potencial ornamental, como a sálvia (*Salvia splendens* Sellow ex Roem. & Schult.) e espécies do gênero *Clerodendrum* L. (Souza & Lorenzi 2012), bem como representantes conhecidos pelo seu potencial madeireiro, como a teca (*Tectona grandis* L.f.) e espécies dos gêneros *Gmelina* L. e *Vitex* L. (Harley *et al.* 2004).

Devido às características morfológicas marcantes que possui, mesmo com a ampla distribuição, Lamiaceae tradicionalmente é reconhecida como grupo natural, proximamente relacionado a Verbenaceae (Harley *et al.* 2004). Análises filogenéticas (Cantino 1992; Wagstaff *et al.* 1998), apoiadas por estudos micromorfológicos (Junnel 1934), somente suportariam o monofiletismo do grupo caso alguns gêneros tradicionalmente reconhecidos dentro das Verbenaceae, como *Vitex* e *Aegiphila* Jacq., fossem incorporados a Lamiaceae, levando assim a uma nova circunscrição da família. Atualmente, considera-se que Lamiaceae não se encontra evolutivamente tão próxima a Verbenaceae, sendo posicionada mais proximamente do clado formado pelas famílias Mazaceae, Phrymaceae, Paulowniaceae e Orobanchaceae (Stevens 2020).

Lamiaceae é dividida em 10 subfamílias, segundo a classificação mais recente (Li *et al.* 2016; Li & Olmstead 2017): Symphorematoideae Briquet; Viticoideae Briquet; Ajugoideae Kosteletzky; Prostantheroideae Luerssen; Nepetoideae (Dumortier) Luerssen; Scutellarioideae (Dumortier) Caruel; Premnoideae B.Li, R.G.Olmstead & P.D. Cantino; Peronematoideae B.Li, R.G.Olmstead & P.D.Cantino; Cymarioideae B.Li, R.G.Olmstead & P.D.Cantino; e Lamioideae Harley. No Brasil, podem ser encontradas 576 espécies (Flora do Brasil 2020, em construção), destacando-se os representantes da subfamília Nepetoideae, principalmente espécies da tribo Ocimeae Dumort., subtribo Hyptidinae.

Hyptidinae Endl.

Hyptidinae emerge como grupo monofilético (Pastore *et al.* 2011; Pastore *et al.* in press) e possui cerca de 400 espécies (Harley *et al.* 2004; Pastore *et al.* 2011), distribuídas quase exclusivamente nas Américas (do sul dos Estados Unidos até a Argentina). Há duas espécies ocorrentes na África, além de outras, invasoras na África, Ásia e Oceania (Pastore *et al.* 2011; Harley *et al.* 2012). As plantas são encontradas em florestas estacionais e principalmente em formações savânicas, nas quais estão relacionados a ambientes úmidos e áreas mais elevadas (Pastore *et al.* 2011).

Hyptidinae é morfologicamente caracterizada pelo mecanismo explosivo de polinização (Harley 1971), exclusivo do grupo e presente em todos os gêneros da subtribo, com exceção de *Asterohyptis* Epling. Tal mecanismo talvez tenha sido significativo no contexto da evolução da subtribo: o lábio anterior da corola mantém os estames sob pressão e as anteras são direcionadas explosivamente para o abdome do polinizador ao forçar sua entrada na flor (Pastore *et al.* 2011), liberando o pólen. Além dessa característica, Hyptidinae possui inflorescências bracteoladas e núculas com uma aréola expandida (Harley *et al.* 2004; Pastore *et al.* 2011).

Taxonomicamente, a primeira grande monografia incluindo espécies atualmente circunscritas em Hyptidinae foi realizada por Bentham (1833), que reconheceu os gêneros *Peltodon* Pohl*, Hyptis* Jacq.*, Marsypianthes* Mart. ex Benth. e *Eriope* Bonpl. ex Benth. formando um grupo; entretanto, foi Endlicher (1838) quem cunhou o nome Hyptidinae para esse grupo. Os trabalhos mais importantes com a subtribo foram publicados pelo norte-americano Carl Epling, destacando-se a sinopse de Lamiaceae para a América do Sul (Epling 1935-1937) e a revisão de *Hyptis* (Epling 1949). Seguiram-se, então, os estudos do britânico Raymond Harley, desenvolvidos desde 1968 até a atualidade, destacando-se a proposição de dois novos gêneros (Harley 1988): *Hyptidendron,* a partir de *Hyptis* sect. *Umbellaria* Benth. e

Hyptis sect. *Buddleioides* Benth.; e *Hypenia* Harley, elevado a partir de *Hyptis* sect. *Hypenia*.

Pastore e colaboradores (2011) conduziram análises filogenéticas com a subtribo, utilizando método Sanger com 180 terminais amostrados para o marcador nuclear ITS, e, dentre esses, 69 terminais nos quais foram amostradas seis regiões: os marcadores nucleares ITS e ETS e os plastidiais trnL-F, trnD-T, TrnS-G e matK. As principais relações entre os táxons amostrados foram recuperadas com suporte alto, destacando-se o parafiletismo de *Hyptis*; entretanto, algumas relações entre gêneros (como a baixa sustentação de *Mesosphaerum* e *Hyptidendron* ou o posicionamento de *Physominthe* dentro de Hyptidinae), e a classificação dentro de alguns gêneros (principalmente *Hyptis* e *Eriope*) não apresentaram alto suporte, tendo assim posicionamento incerto.

Visando reconhecer apenas grupos monofiléticos e organizar a taxonomia da subtribo, foi proposta uma nova circunscrição, com a criação de gêneros segregados do parafilético *Hyptis* (Harley *et al.* 2012).

Posteriormente, uma nova filogenia (Pastore *et al.* in press) com uma maior amostragem foi produzida, incluindo 153 terminais para os marcadores nucleares nrITS, nrETS e região Waxy region e plastidiais *trnL-F, trnS-G, trnD-T, matK* markers. Essa segunda filogenia melhorou o suporte de diversos clados, revelando também a necessidade de combinações de algumas espécies e novas sessões do gênero *Hyptis*. Entretanto, relações genéricas e o reconhecimento de alguns gêneros, como o monofiletismo de *Hyptidendron*, ainda se mantiveram pouco resolvidos. Dessa maneira, percebeu-se que, mesmo com uma maior amostragem, uma análise baseada em sequenciamento SANGER não poderia produzir uma filogenia robusta em Hyptidinae, sendo necessária uma abordagem diferente.

Atualmente, Hyptidinae é composta por 19 gêneros: *Asterohyptis* Epling*, Physominthe* Harley & J.F.B.Pastore*, Hypenia, Eriope, Eriopidion* Harley*, Marsypianthes, Rhaphiodon* Schauer*, Oocephalus* (Benth.) Harley & J.F.B.Pastore*, Medusantha* Harley & J.F.B.Pastore*,* *Hyptis, Cyanocephalus* (Pohl ex Benth.) Harley & J.F.B.Pastore*, Martianthus* Harley & J.F.B.Pastore*, Leptohyptis* Harley & J.F.B.Pastore*, Condea* Adans.*, Eplingiella* Harley & J.F.B.Pastore*, Gymneia* (Benth.) Harley & J.F.B.Pastore*, Cantinoa* Harley & J.F.B.Pastore*, Mesosphaereum* P.Browne *e Hyptidendron.*

***Hyptidendron* Harley**

Hyptidendron possui 19 espécies, exclusivamente neotropicais, ocorrendo no Escudo das Guianas, na região andina, na Bolívia e no Brasil Central, com limite meridional no norte do Estado de São Paulo. Habitam margens de formações florestais em altitudes ligeiramente mais elevadas, interior de matas e, principalmente, o Cerrado brasileiro (Harley *et al.* 2004; Harley & Pastore 2012; Harley & Antar 2017; Antar *et al.* 2019). Para o Brasil, das 19 espécies, 15 são endêmicas (Flora do Brasil 2020, em construção).

O gênero é caracterizado morfologicamente pelo hábito arbóreo, arbustivo ou, mais raramente, subarbustivo, com indumento foliar e caulinar constituído de tricomas simples ou dendríticos. As folhas são coriáceas, cartáceas ou membranáceas e majoritariamente aromáticas. A inflorescência possui, como unidade, cimas agrupadas em dicásios ou monocásios, comumente laxos, que possuem brácteas foliáceas muitas vezes conspícuas na axila, essas cimas podem estar organizadas em uma estrutura tirsoide terminal bem definida, ou +- isoladas. As flores são curtamente pediceladas, com bractéolas lineares, inconspícuas. O cálice é cilíndrico ou infundibuliforme, reto, com simetria +- actinomorfa ou zigomorfa, 5-lobado, com lobos subiguais ou desiguais. A corola é infundibuliforme ou cilíndrica, de coloração arroxeada a lilás. Os estames são epipétalos e didínamos. No gineceu, existe um estilopodio acima do ovário. As núculas são elipsoides ou ovoides, levemente achatadas ou estreitamente aladas.

Hyptidendron foi dividido em *Hyptidendron* sect. *Hyptidendron* Harley, caracterizada pelo tubo da corola cilíndrico, de 6-11 mm compr. e núculas estreitamente aladas; e *Hyptidendron* sect. *Umbellaria* Harley, caracterizada pelo tubo da corola menor que 7 mm compr., com formato infundibuliforme e núculas sem alas (Harley 1988). Nos últimos 30 anos, não foram desenvolvidos trabalhos taxonômicos mais detalhados com o grupo nem estudos revisionais atualizados, que incluam dados de natureza diversa, além dos morfológicos, sendo que a última revisão do gênero é de Epling (1949), quando este ainda era parte de *Hyptis*.

Em análises filogenéticas recentes, o gênero não emergiu monofilético (Pastore *et al.* 2011; Pastore *et al.* in press.). Apesar de possuir unidade morfológica, o "grupo" emerge parafilético na filogenia que utiliza apenas o marcador ITS, ou monofilético com a inclusão de *Physominthe* e com baixo suporte, na análise combinada com 6 marcadores (Pastore et al. 2011); ou ainda parafilético com a formação de dois clados na segunda filogenia da subtribo (Pastore *et al.* in press). Ainda, as seções previamente reconhecidas para o gênero não se mostraram bem definidas. Harley & Pastore (2012), visando estabelecer uma estrutura taxonômica básica para Hyptidinae, reconheceram *Hyptidendron* como gênero distinto, colocando *Physominthe* como grupo irmão, preferindo não efetuar nenhuma classificação infragenérica.

Desse modo, *Hyptidendron*, apesar de sua forte unidade morfológica e seu fácil reconhecimento taxonômico, ainda não possui evidências de sustentação filogenética. Além disso, o posicionamento de *Hyptidendron* em Hyptidinae também não se encontra resolvido.

Desta maneira, esta tese tem como objetivo o aprofundamento dos estudos na subtribo, pela maior amostragem de táxons, utilização de técnicas mais recentes em sistemática molecular, e ampliação do número de marcadores, a fim de esclarecer melhor as relações do gênero na subtribo e entre as espécies de *Hyptidendron*. Neste contexto, a utilização de métodos como o Sequenciamento de Nova Geração (NGS), associada a uma ampla amostragem de táxons, pode ser muito útil para a melhor resolução de filogenias que contavam com incertezas e baixo suporte (Peloso *et al*. 2015). Ainda, objetiva-se atualizar o conhecimento sistemático de *Hyptidendron*, com a resolução da classificação infragenérica, o reconhecimento de espécies novas e estudos detalhados da circunscrição, reconhecimento, distribuição e status de conservação das espécies do gênero.

No capítulo 1 é apresentada uma nova filogenia de Hyptidinae, baseada em dados de genômica nuclear, com o reconhecimento de um novo gênero, *Myriohyptis*.

No capítulo 2 é apresentada a descrição do padrão de venação em *Hyptidendron*, com a descrição de uma nova espécie, *Hyptidendron cerradoense*, reconhecida pela venação única no gênero.

No capítulo 3 é apresentada a revisão taxonômica de *Hyptidendron*.

No capítulo 4 é apresentado um *data paper* com o banco de dados construído para a revisão de *Hyptidendron*.

No capítulo 5 é apresentada uma compilação de trabalhos realizados durante o doutorado com a taxonomia da subtribo, incluindo a descrição de três espécies de *Hyptidendron*, uma espécie de *Cyanocephalus*, uma espécie de *Hyptis* e um artigo com tipificações de espécies de Hyptidinae descritas por Pilger no início do século XX.

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A New Phylogeny with nuclear genomic data updates the taxonomy of Hyptidinae (Lamiaceae) and supports a new monospecific genus *Myriohyptis*

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A new phylogeny with nuclear genomic data updates the taxonomy of Hyptidinae (Lamiaceae: Ocimeae) and supports the new monospecific genus *Myriohyptis*

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Abstract

Hyptidinae is a mostly neotropical subtribe with 19 genera and ca. 400 species. Two phylogenies based on Sanger sequencing established a new classification for the subtribe, however the recognition of some genera, and the relationships between taxa remained poorly supported and problematic. We present a new phylogeny for the subtribe based on a broad sampling and high-throughput sequencing with a target-capture methodology based on the Angiosperms353 probe kit. We recovered sequences for 67 samples, covering all Hyptidinae genera, plus nine outgroups obtained via PAFTOL project or available transcriptomic data. The species tree was inferred using multispecies coalescence (in Astral), based on individual gene trees inferred with maximum likelihood. Our results support the subtribe as monophyletic and most of genera proposed on previous studies with the exception of *Hyptis* and *Hypenia*. *Hyptidendron* is recognized as monophyletic for the first time and the backbone relationships between genera are improved. Based on all the phylogenies produced and morphological data, we provide a new key to genera of the subtribe as well as an update to the taxonomic status of Hyptidinae, with the proposition of the new monospecific genus *Myriohyptis*. Additionally, three new species combinations and one reestablishment are proposed. Our results highlight the potential of genomic data to resolve poorly supported phylogenies and the need of a solid morphological base to propose taxonomic decisions based on phylogenetic results.

Keywords: *Hyptidendron, Hyptis*, Labiatae; *Mesosphaerum*, phylogenomics, Angiosperms353, South America

1. Introduction

Two major strategies have been used to better resolve phylogenies: expand sampling and add data (Peloso et al. 2016). Within the second approach, genomic data is recognized as a good tool for enhancing support and resolving poorly defined phylogenies (Peloso et al. 2016; Zhai et al. 2019), in which high-throughput sequencing can have a good cost-effective ratio for diverse and morphologically closely related taxa (Murphy et al. 2020).

For Hyptidinae, high-throughput sequencing could be very much useful to produce a robust phylogeny. The subtribe is almost exclusively Neotropical, ranging from southern United States to Argentina, with two species extending their natural ranges to Africa and a few species naturalized in other Tropical areas (Harley et al. 2004; Harley & Pastore 2012), being an important component of grasslands and savanna formations, mostly in the Cerrado, the Brazilian savanna (Harley & Pastore 2012). The group was first studied by Bentham (1833, 1848) who recognized four genera: *Eriope* Humb. & Bonpl. ex Benth., *Marsypianthes* Mart. ex Benth., *Peltodon* Pohl and *Hyptis* Jacq., the latter highly diverse and composed of 20 sections. Further morphological studies (Schauer 1844; Epling 1933; Harley 1976; Harley 1988) segregate some species of *Hyptis* in the genera *Rhaphiodon* Schauer, *Asterohyptis* Epling, *Eriopidion* Harley, *Hypenia* Harley and *Hyptidendron* Harley leaving the subtribe with nine genera (Harley 1988). However, *Hyptis* remained highly diverse with 24 sections recognized (Epling 1949; Harley 1986).

The phylogeny of the subtribe was first examined by Pastore et al. (2011), who sampled ca. 15% of the species for 6 nuclear and plastidial markers and ca. 45% of the subtribe species just for nuclear ITS. The study recovered Hyptidinae as monophyletic but *Hyptis* as polyphyletic. These results supported a new taxonomic circumscription of the subtribe (Harley & Pastore 2012) with the recognition of 19 genera within. Although much progress was made, some generic relationships and genera circumscription remained poorly supported and problematic, as *Mesosphaerum* P. Browne and *Hyptidendron*. Various criticisms of the new classification were criticized (e.g. Gonzales-Gallegos et al. 2014a, 2014b; Martínez-Gordillo et al. 2017).

Pastore *et al*. (in press), in order to improve the resolution and support in the group, produced a second phylogeny with a broader sampling with 153 terminals for three nuclear regions (nrITS, nrETS and waxy), and four plastidial markers (*trnL-F, trnS-G, trnD-T, matK*). This second phylogeny shed light on some taxonomic rearrangements between genera, however, some generic relationships, such as the monophyly of *Hyptidendron* and the backbone relationship between genera remained poorly supported, showing that, even with more terminals, several markers could not be enough to produce an extremely robust evolutionary hypothesis for the relationships in the group.

After these two phylogenetic studies and associated taxonomic updates (Harley & Pastore 2012; Pastore et al. 2011, in press), Hyptidinae is currently recognized with 19 genera: *Asterohyptis* Epling*, Cantinoa* Harley & J.F.B.Pastore*, Condea* Adans.*, Cyanocephalus* (Pohl ex Benth.) Harley & J.F.B.Pastore*, Eplingiella* Harley & J.F.B.Pastore*, Eriope, Eriopidion, Gymneia* (Benth.) Harley & J.F.B.Pastore*, Hypenia, Hyptidendron, Hyptis, Leptohyptis* Harley & J.F.B.Pastore*, Marsypianthes, Martianthus* Harley & J.F.B.Pastore*, Medusantha* Harley & J.F.B.Pastore*, Mesosphaerum, Oocephalus* (Benth.) Harley & J.F.B.Pastore*, Physominthe* Harley & J.F.B.Pastore *Rhaphiodon* (Fig. 1), and *Hyptis*. This last, the largest genus of the subtribe, currently possesses 12 sections: *Hyptis* sect. *Apodotes, Hyptis* sect. *Axillares, H.* sect. *Cyrta, H.* sect. *Eriosphaeria, H.* sect. *Hilaria, H.* sect. *Hyptis, H.* sect. *Marrubiastrae, H.* sect. *Myriocephala, H.* sect. *Peltodon, H.* sect. *Plagiotis, H.* sect. *Rhytidea* and *H.* sect. *Xylodontes.*

Attempting a more robust and well-resolved phylogenetic hypothesis for the subtribe, we have produced a new phylogeny for Hyptidinae based on high-throughput sequencing and sequence capture, using the low-copy nuclear genes probe set Angiosperms353 (Johnson et al. 2019). Additionally, we provide an update to the taxonomic status of Hyptidinae with the

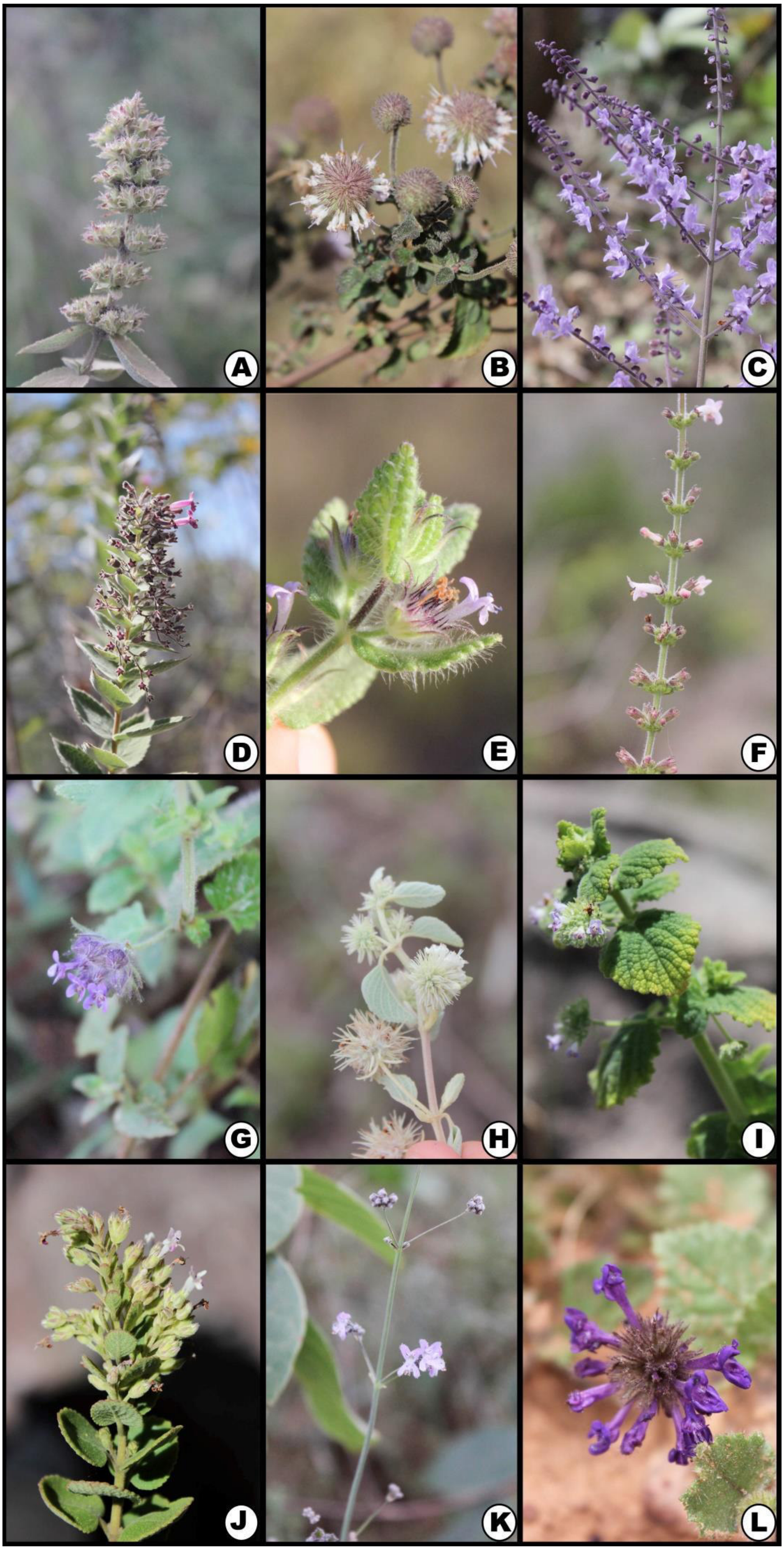
A
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Fig. 1. Morphological heterogeneity of the inflorescence in different genera of Hyptidinae. **A.** *Cantinoa carpinifolia* (Benth.) Harley & J.F.B.Pastore; **B.** *Cyanocephalus rugosus* (Benth.) Harley & J.F.B.Pastore; **C.** *Eriope macrostachya* Mart. ex Benth.; **D.** *Hyptidendron roseum* Antar, Harley & J.F.B.Pastore; **E.** *Hyptis* sp.; **F.** *Leptohyptis* sp. **G.** *Marsypianthes chamaedrys* (Vahl) Kuntze; **H.** *Medusantha* sp.; **I.** *Mesosphaerum irwinii* (Harley) Harley & J.F.B.Pastore; **J.** *Oocephalus* sp.; **K.** *Physominthe vitifolia* (Pohl x Benth.) Harley & J.F.B.Pastore; **L.** *Rhaphiodon echinus* Schauer. All photos by G.M. Antar.

necessary additions, notes on recognition of genera and novelties recently published, together with the description of the new monotypic genus *Myriohyptis* Antar, Harley & J.F.B.Pastore. Finally, an updated key to recognize genera is presented.

2. Material and Methods

2.1 Taxon Sampling

Thirteen field expeditions were made by the first author, and with other authors, throughout Brazil, in order to obtain leaf samples in silica gel. Several additional field expeditions were conducted by AdeSS, JFBP and especially RMH, who has collected in most of the countries where Hyptidinae is native. The remaining samples were taken from herbarium specimens housed at the University of São Paulo (SPF) and RBG Kew (K), following results obtained by Brewer et al. (2019).

The aim of our sampling strategy was to represent all 19 genera of Hyptidinae and all 12 sections of *Hyptis*, computing a total of 67 samples, with special attention to the groups that presented poorly resolved relations based on previous phylogenies (Pastore et al. 2011; in press). Only *H.* sect. *Rhytidea* and the monotypic *Hyptis* sect. *Hilaria* could not be sampled. Nine outgroup samples were extracted from data available via Plant and Fungal Trees of

Life project (PAFTOL) (www.paftol.org; Baker et al. in prep.) or transcriptome data available at GenBank.

Members of subfamily Nepetoideae, mostly from tribe Ocimeae, were selected as outgroups following broader phylogenetic studies (Li *et al*. 2016), especially the genera *Isodon* (Schrad. ex Benth.) Spach, which was hypothesized as the closest related genera to Hyptidinae (Li et al. 2016; Pastore et al. 2011). The outgroups selected were: *Elsholtzia splendens* Nakai ex. F.Maek. (tribe Elsholtzieae), *Isodon amethystoides* (Benth.) H.Hara (tribe Ocimeae, subtribe Hanceolinae), *Lavandula angustifolia* Mill. (tribe Ocimeae, subtribe Lavandulinae Endl.), *Mentha* × *piperita* L. (tribe Mentheae, subtribe Menthinae), *Ocimum tenuiflorum* L. (tribe Ocimeae, subtribe Ociminae), *Platostoma coloratum* (D.Don.) A.J.Paton (tribe Ocimeae, subtribe Ociminae), *Plectranthus scutellarioides* (L.) R.Br. (tribe Ocimeae, subtribe Plectranthinae), *Salvia rosmarinus* Schleid. (tribe Mentheae subtribe Salviinae) and *Siphocranion macranthum* (Hook.f.) C.Y.Wu (tribe Ocimeae, subtribe Siphocranioninae – sensu Zhong et al. 2010). *Hanceola* Kudô, although taken as one of the most related groups to Hyptidinae (Pastore et al. in press) could not be sampled. Details of all sampled material are provided in Appendix 1.

2.2 DNA Extraction and library preparation

DNA was extracted from ca. 20 mg of dried leaf tissue using a modified cetyl-tri-methylammonium bromide (CTAB) method, with Chloroform:Isoamyl alcohol 24:1 (SEVAG) separation and isopropanol overnight precipitation at -20ºC (Doyle and Doyle 1987). Additional cleaning was performed using Agencourt AMPure XP paramagnetic cleanup beads (Beckman Coulter, High Wycombe, UK), at x1.5 concentration. All DNA extracts were quantified using a Quantus™ fluorometer (Promega Corporation, Madison, WI, USA). Average fragment size was estimated by running 3µl per extract on a 1% agarose gel electrophoresis or, when on low concentration, with Agilent 4200 TapeStation (Agilent

Technologies, Palo Alto, California, USA). Samples with fragment sizes >600 bp (all silica-dried samples) were then sonicated in Covaris AFA Fiber Pre-Slit Snap-Cap microTUBEs with a Covaris ME220 Focused-ultrasonicator (Woburn, Massachusetts, USA) for 60 seconds with peak power set to 50W and duty factor at 20% to reduce most fragments closer to an average size of ca. 350 bp. Samples with 400 to 600 were sonicated with the same protocol but for 40 seconds. Other samples with lower fragment size, mostly extracted from herbarium material, were not sonicated.

Sequencing libraries were prepared from the fragmented genomic DNA using the NEBNext Ultra™ II Library Prep Kit (New England BioLabs, Ipswich, MA, USA). Samples were then submitted to double-end size selection with Ampure beads for 550 bp. For highly degraded samples we used single-end size selection, discarding long fragments. Libraries were prepared in half volumes to maximize reagents and indexes use, with 200 ng (or minimum 50 ng) of fragmented DNA concentrated to a volume of 25 µL. Seven cycles of PCR amplification were used initially for all libraries, with more cycles, up to a total of 12, attempted for some herbarium samples. Further cleaning was conducted to remove adapter-primer-dimers with AMPure XP magnetic beads. All library concentrations were quantified using a Quantus fluorometer and their size measured using D1000 ScreenTape on the TapeStation system (Agilent Technologies, Santa Clara, CA, USA).

Prior to pooling, libraries were normalized to 10nM, using 10mM Tris. Roughly 10–20µl normalized volumes per library DNA were then pooled in batches of 10–20 samples for hybridization, separating different sizes libraries per batch, to the biotinylated probes using the myBaits® Expert Angiosperms353 v 1 target capture kit (Johnson et al. 2019). Hybridization was then performed for 24 hours at 65 °C, followed by 12 cycles of PCR using NEBNext Ultra II Q5 Master Mix (New England BioLabs, Ipswich, MA, USA), using the primers IS5_reamp.P5 and IS6_reamp.P7 (Meyer and Kircher 2010). Thereafter, hybridized pools were cleaned using Agencourt AMPure XP magnetic beads at 0.9x and quantified using the Quantus fluorometer. Finally, a 4200 TapeStation System using D1000 ScreenTapes was used to assess average fragment size and quality.

Hybridized pools normalization to 6nM was performed followed by the combination into sequencing batches in equimolar amounts, with around 200 libraries per sequencing batch, and sequenced in a HiSeq platform (Illumina, San Diego, CA, USA) at Macrogen (Seoul, Republic of Korea). Technical replicate samples were included for one sample by using the same extraction of genomic DNA to create two separate libraries with different index combinations, which were then pooled and sequenced together. These were used to ascertain the potential sequence variability arising due to differential allele amplification or artefacts from the library preparation steps.

2.3 Data analyses

The data analysis follows the method described in Zuntini et al. (in prep.) Raw sequencing reads with adaptors were cleaned with Trimmomatic 0.39 (Bolger et al. 2015). The following settings were used based on experimentation and previous works with other taxa: Leading end trim threshold = 1; trailing end trim threshold = 30; sliding window trimming threshold = 30 averaged over 4 base pairs; and minimum read length = 36 base pairs.

To recover sequences from the enrichment with the Angiosperms353, probe set, we used HybPiper 1.3.1 (Johnson et al. 2016). This was carried out using the published translated target file for the hybridization kit (Angiosperms353.FAA, found at https://github.com/mossmatters/Angiosperms353) and standard parameters, except for minimum coverage, which was set to x4. BLASTx (Camacho *et al.* 2009) was used to bin trimmed reads to genes, following a *de novo* assembly with the target file using SPAdes 3.13.1 (Bankevich *et al.* 2012). After that, exonerate 2.2 (Slater and Birney 2005) was used to extract coding sequences and remove flanking non-coding regions. To calculate summary statistics from the recovery, we used HybPiper scripts get_seq_lengths.py, gene_recovery heatmap.R, and hybpiper_stats.py. The Transcriptomic data used for outgroups was mined from NCBI SRA data, using the fastqer-dump tool (available at https://ncbi.github.io/sra-tools/), and resulting raw data was treated as described above.

2.4 Phylogenetic reconstruction

A dataset was constructed by coding sequences for each of the 353 nuclear loci probe set recovered from hybridized genomic libraries for the ingroup plus transcriptomes (from NCBI SRAs) for the outgroup. Just genes with ≥10 sequences were kept for downstream analyses. Two iterations of alignment, trimming, and gene tree inference (under maximum likelihood; ML) were performed in the pipeline, together with an automated outlier-taxa removal step after the first iteration. Subsequently to the second iteration, species trees were inferred either under the multispecies coalescent (MSC) from individual ML gene trees, or from a partitioned concatenated data matrix. MAFFT 7.310 (Katoh 2013) was used for the alignment of both iterations in each set of gene sequences with the L-INS-i method and with maximum iterations set to 1000. After that, sites with < 30% occupancy were trimmed using Phyutility 2.2.6 (Smith and Dunn 2008). IQ-tree 2.1.0 (Minh et al. 2020) was used to infer ML gene trees from the trimmed alignments, with model selection implemented via ModelFinder (Kalyaanamoorthy et al. 2017) and branch support calculated from 1000 replicates of UltraFast Bootstrap (Hoang et al. 2017). TreeShrink (Mai and Mirarab 2018) was used after the first interaction to automatically detect and remove excessively long branches among the ML gene trees, using the default false positive error (0.05). Following that, the list of samples to be removed per gene tree was used to filter out the sequences from the original set. Filtered gene sets were re-aligned and trimmed, with the same parameters as the first iteration. Newick Utilities 1.6 (Junier and Zdobnov 2010) was used to collapse bipartition with low support (<10% BS) from the ML gene tree estimation. A multispecies coalescent tree was reconstructed by the set of gene trees with collapsed bipartitions in ASTRAL-III 5.7.3 (Zhang et al. 2018), with full annotation of branches (-t 2 flag). Clade support was assessed by estimating local posterior probability (LPP).

We have recovered two phylogenies depending on the dataset selected. Our Supercontig dataset (including coding sequences plus concatenated intron fragments) phylogeny presented more robust supports and is here presented. The exon dataset phylogeny is presented in Appendix 2.

The support of the trees will be those described as: full or maximum support (1.0 LPP), high (1.0>LPP≥0.9), moderate (0.9>LPP≥0.7), and weak or low (LPP<0.7).

All figures were plotted in R (R Core Team 2020) using the following packages: ape (Paradis and Schliep 2019), ggimage (Yu 2020), ggplot2 (Wickham 2016), ggtree (Yu et al. 2017), treeio (Yu 2019) and their dependencies.

3. Results

3.1 Sequencing results

Novel data was produced for 67 species of Hyptidinae, including seven taxa that were never sequenced before (Appendix 1).

The recovery of the 353 nuclear genes was constantly high, ranging from 136 to 326 loci (with at least 50% of total target length) for enriched samples, and from 310 to 343 loci for SRA transcriptomic data. On average (at 50% target length thresholds), 297 genes were recovered from Hyptidinae enriched samples, while 332 recovered genes from outgroup transcriptomes (Table S1).

3.2 Phylogenetic results

Hyptidinae was recovered as monophyletic with a strong support (LPP=1.00). *Platostoma* was recovered as the sister group of Hyptidinae and a clade formed by *Isodon*, *Ocimum* and *Plectranthus* was recovered as the sister group of Hyptidinae + *Platostoma* (Fig. 2).

All genera of the subtribe as currently recognized were recovered as monophyletic, except for *Hyptis* and *Hypenia*. *Hyptis odorata* Benth. was recovered as sister to *Cantinoa* and *Hypenia* was recovered as paraphyletic with a clade formed by *Hypenia reticulata* (Mart. ex Benth.) Harley and *Hypenia salzmannii* (Benth.) Harley sister to *Eriope* and *Eriopidion,* which forms a sister clade to *Hypenia simplex* (A. S.-Hil. ex Benth.) Harley & J.F.B. Pastore.

Hyptidendron was recovered as monophyletic with a strong support (LPP=1.00) and three well-supported clades emerged within it.

All genera except *Martianthus, Mesosphaerum* and *Physominthe* presented robust supports (LPP=1.00). *Mesosphaerum* and *Physominthe* presented moderate support (84% LPP and 80% LPP, respectively), *Martianthus* presented low support (61% LPP). Most of the backbone relationships within the subtribe were robustly recovered with the exception of relationships between *Hyptidendron* and the clade formed by *Mesosphaerum, Physominthe, Hypenia, Eriope* and *Eriopidion*.

Within *Hyptis*, 2 larger clades were robustly recognized and most of the inner clades represent the sectional delimitation of Epling (1949) with adjustments (Harley and Pastore 2012, Pastore et al. in press). The taxa *Hyptis* sect. *Apodotes*, *H.* sect. *Eriosphaeria* (including *H.* sect. *Eriosphaeria* subsect. *Pulegioides*), *H.* sect. *Cyrta*, *H.* sect. *Hyptis*, *H.* sect. *Peltodon*, *H.* sect. *Xylodontes, H.* sect. *Axillares* and *H.* sect. *Marrubiastrae* were recovered as monophyletic, as well as the clade of *Hyptis* sect. *Cephalohyptis* subsect. *Latibracteatae*, represented by *Hyptis bahiensis* Harley.

The exon dataset phylogeny differs from the supercontig dataset by the position of *Lavandula* in the outgroup, and the paraphyly of *Physominthe* and *Martianthus*. Additionally, the exon dataset phylogeny presents lower supports, mostly for the generic relationships, except by the clade formed by *Hyptidendron, Mesosphaerum, Physominthe, Hypenia,*

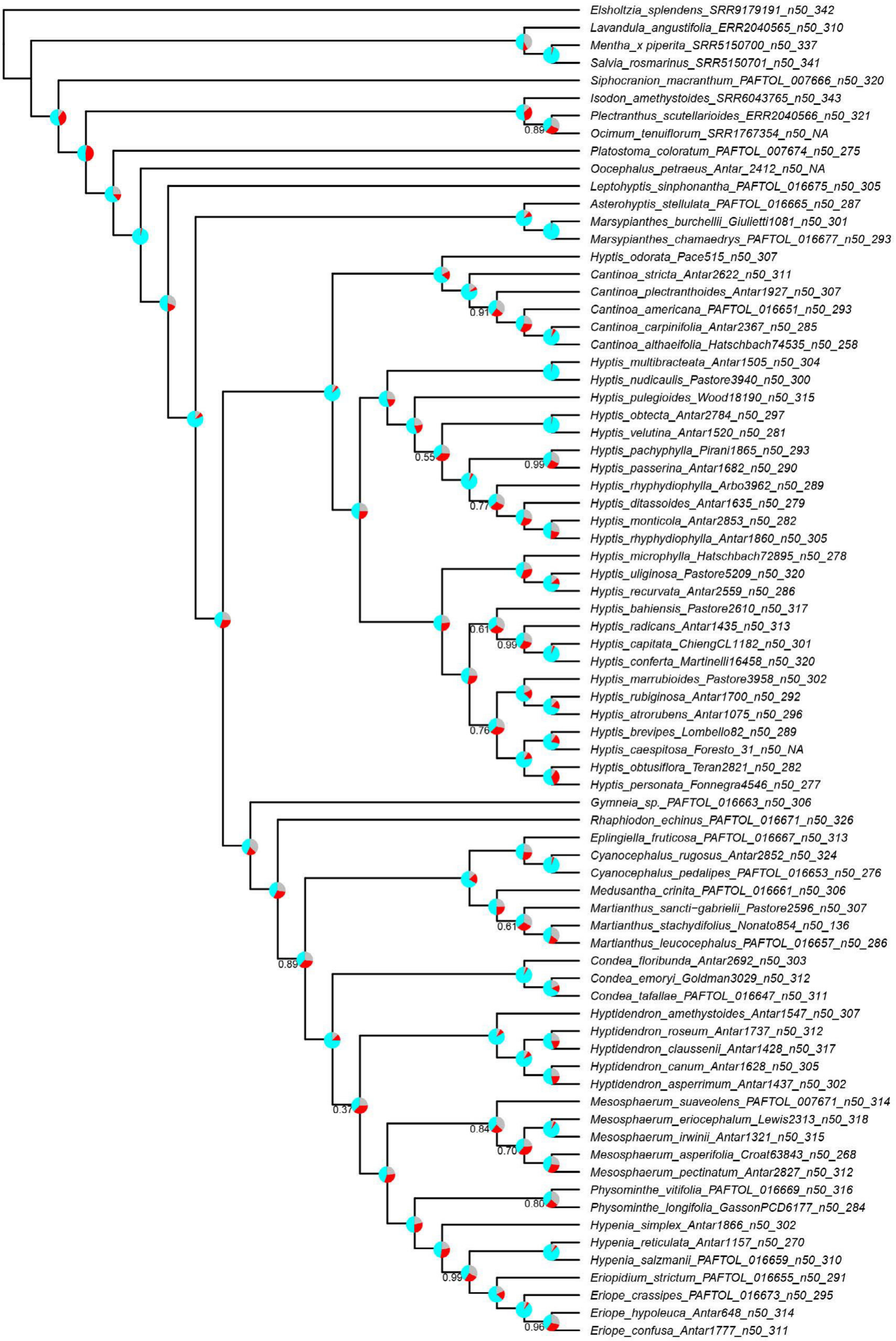

Fig. 2. Phylogenetic relationships in Hyptidinae inferred from the coalescent-based analyses of 353 genes recovered using target enrichment with Angiosperms353 probe kit, using the Supercontig dataset. Values next to branches are local posterior probabilities (LPP).

Eriopidion and *Eriope*, in which it presents slightly better supports (50% LPP support in exon dataset phylogeny vs. 37% LPP support in supercontig dataset phylogeny).

4 Discussion

The read percentage obtained showed great results, culminating in a mostly robustly supported well-defined phylogeny. Our study supports the use of the Angiosperms353 nuclear loci probe set to recover lower hierarchical level taxa, as obtained also for a species-level phylogeny of the genus *Nepenthes* L. (Murphy et al. 2020). Most of samples were from silica material which contributed to this high number of reads and gene recovery, nonetheless, the 25 ingroup samples obtained from herbarium specimen, dating up to 32 years, also yielded good sequences, as previously demonstrated by Brewer et al. (2019).

In this study we used high-throughput sequencing of 353 nuclear genes for 67 Hyptidinae terminals. Pastore et al. (2011) used sanger-sequencing for six markers in 69 terminals and Pastore et al. (in press.) used seven markers and 135 Hyptidinae terminals. With the different method and increase in data use, for the first time the low support in part of the backbone of Hyptidinae found in Pastore et al. (2011) and Pastore et al. (in press) was significantly improved. Additionally, novelties as the recognition of *Hyptidendron* as monophyletic, and the recovery of *Hyptis odorata* as a distinct lineage from *Hyptis* were detected. The improved results for using high-throughput sequencing rather than sanger-sequencing in phylogenies were already reported for other studies with angiosperms (Fragozo-Martínez et al. 2017; Léveille-Bourret et al. 2018), however, it is remarkable that most of the phylogenetic results previously found and the subsequent taxonomic update were mostly confirmed, showing that, Sanger sequencing can produce reliable generic-level phylogenies, as reported by Léveille-Bourret et al. (2018). Additionally, a solid base of morphology for past taxonomic decision was key for making sound updates (Harley and Pastore 2012). For example, after the results of the first phylogeny (Pastore et al. 2011)

Hypenia vitifolia (Pohl ex Benth.) Harley [=*Physominthe vitifolia* (Pohl ex Benth.) Harley & J.F.B.Pastore] could had been combined into *Hyptidendron*, as they emerged together in a clade, however, based on morphology, it was transferred to a new genus, *Physominthe* (Harley and Pastore 2012). Our phylogeny as well as the one made by Pastore et al. (in press), supports these two genera as distinguished, separated lineages, corroborating the decision taken.

The results of the monophyly of Hyptidinae agree with previous studies (Pastore et al. 2011; Li et al. 2016; Yu et al. 2014; Zhong et al. 2010; Pastore et al. in press). The sister group of Hyptidinae, *Platostoma*, disagrees with all previous known phylogenies which included Hyptidinae terminals. Previous phylogenies recovered *Isodon* (Paton et al. 2004; Pastore et al. 2011; Li et al. 2016), *Hanceola* (Pastore et al. in press), Plectranthinae, *Orthosiphon* and *Isodon* (Paton *et al*. 2018), *Orthosiphon* and *Ocimum* (Yu et al. 2014), or *Ocimum* (Chen et al. 2016) as sister group to Hyptidinae. Our exon dataset phylogeny recovered *Ocimum* plus *Plastotoma* as sister group to Hyptidinae. Although Hyptidinae is undoubtedly placed within Ocimeae, the relationships between genera in the tribe are still mostly undetermined and this level of variation show that low taxa coverage phylogenies will not be able to provide solid evidence to solve this issue. Therefore, new phylogenies based on genomic data from a much wider sample are required to better define generic relations within Ocimeae genera.

When comparing the generic relationships in this phylogeny and the previous ones (Pastore et al. 2011, in press), *Oocephalus* was recovered as the sister group to all other Hyptidinae, while in other phylogenies *Leptohyptis* was recovered as such, which in the present study was recovered as sister to all Hyptidinae minus *Oocephalus*. *Asterohyptis* was recovered as sister to *Marsypianthes* and sister to Hyptidinae minus *Oocephalus* and *Leptohyptis*. The relationship between *Asterohyptis* and *Marsypianthes* was recovered in both past phylogenies (Pastore et al. 2011, in press), however, it was for the first time recovered as an isolated clade. Two big clades were formed: 1) composed of *Hyptis* and *Cantinoa*, with *Hyptis odorata* as sister to *Cantinoa*. This clade was already robustly recovered in both previous phylogenies (Pastore et al. 2011; in press.) but without clear definition of the position of *H. odorata*, which was recovered in a polytomy with *Cantinoa* and *Hyptis* (Pastore et al. in press); and 2) a clade, for the first time recovered, formed by *Gymneia, Rhaphiodon, Eplingiella, Cyanocephalus, Medusantha, Martianthus, Condea, Hyptidendron, Mesosphaerum, Physominthe, Eriope, Hypenia* and *Eriopidion*. These two clades do not present any evident morphological or biogeographical uniqueness, with some morphological taxonomically important features as the presence of a stylopodium or inflorescence type being present in taxa of both clades. Homoplasies and biogeographical dispersions probably occurred several times within the subtribe and should be further investigated. However, smaller clades as *Physominthe, Eriope, Hypenia* and *Eriopidion*, already recovered in Pastore et al. (in press), possesses unique features for the subtribe as the cymes usually 1-flowered (rarely up to 3−6-flowered), flowers with often inconspicuous paired bracteoles at base of calyx and flowering stems often waxy with inflated internodes.

Hyptidendron was recovered for the first time as monophyletic, as in both previous phylogenies it was recovered in an unresolved clade, with *Physominthe* nested inside it (Pastore et al. 2011) or recovered as paraphyletic in two different clades (Pastore et al. in press). Three clades were robustly recovered within *Hyptidendron*. These results agree with the morphology which, since its creation (Harley 1988), robustly support *Hyptidendron* as a distinct and natural entity. Within this last and largest clade of Hyptidinae, much of the support in relationships between genera was improved from past phylogenies. However, the relationship between *Hyptidendron* and the clade formed by *Mesosphaerum, Physominthe, Eriope, Hypenia* and *Eriopidion* is still poorly supported and needs further investigation.

Within *Hyptis*, eight of the current ten sampled accepted sections recognized were recovered as distinctive clades. *Hyptis* sect. *Cyrta* was recovered as paraphyletic with *H*. sect.

Plagiotis, represented solely by *Hyptis uliginosa*, falling within the two terminals of *H*. sect. *Cyrta*, and *H*. sect. *Myriocephala* emerged as sister to *Cantinoa*. Additionally, *Hyptis* sect. *Cephalohyptis* subsect. *Latibracteata* was recovered as a clade and needs to be combined into a section. Although the sampling within *Hyptis* with 25 terminals is much smaller than the one presented by Pastore et al. (in press) with 75 terminals, our results recovered mostly of the currently recognized sections as monophyletic, while Pastore et al. (in press) recovered *H*. sect. *Xylodontes* as paraphyletic.

For *Hyptis odorata*, we have decided to recognize a new genus, *Myriohyptis*, as the species could not be placed within *Cantinoa*, the only other possibility in view of the phylogeny. These taxa are clearly different especially in the type of inflorescence, one of the major features to determine genera identification and recognition in Hyptidinae. *H. odorata* possesses lax, multi-capitulate, non-leafy terminal panicle with a recurving calyx tube and *Cantinoa* possesses ovoid cymes not forming capitula and calyx with straight tube. It is remarkable that both Bentham (1848) and Epling (1933, 1949) placed *H. odorata* in a monotypic section, already showing the uniqueness of this taxon, and now recognized as a monotypic genus. The only other taxonomic decision possibility would be to merge all of the genera of Hyptidinae in a single genus named *Hyptis*, what, as already discussed by Harley and Pastore (2012) and Pastore et al. (in press) would be taxonomically impractical. Further studies with character evolution may shed light on the drivers of evolution and the homoplasies that occurred in the group.

Future phylogenetic studies in the tribe are still needed. Although our supercontig phylogeny supports the monophyly of *Martianthus*, as documented by Pastore et al. (2011, in press.), we recovered weak support (61% LPP) and our exon dataset phylogeny recovered it as paraphyletic with *Medusantha* nested within. In the description of *Hyptis sancti-gabrieli* Harley (=*Martianthus sancti-gabrieli* (Harley) Harley & J.F.B.Pastore), Harley (2001) discussed the uncertainty of placing it in *H.* sect. *Leucocephala* (= *Martianthus*), based on morphological characters, as the former species possess the style with a knob-like appearance, similar to that found in *Cyanocephalus*, and differently from the distinctly spreading stigma-lobes typical of other species of *Martianthus*. Further molecular studies with different approaches and adding sequences of *Martianthus elongatus* (Benth.) Harley & J.F.B.Pastore, are needed to better understand the relationship between the four species that compose this genus and *Medusantha*.

Additionally, a reassessment of the position of *Hypenia simplex* is desirable as the species did not group with other *Hypenia*. *Hypenia simplex* was transferred from *Eriope* to *Hypenia* in the first generic rearrangement of the subtribe (Harley and Pastore 2012) after the first phylogeny (Pastore et al. 2011) recovered it related to the former. Nevertheless, its position and recognition is still on debate. Additionally, further phylogenies focussing on genera are desired as well as morphological and biogeographical studies for the subtribe. Furthermore, studies focused on hybridization, a pattern already shown for the group (Harley 1986, 1992, 1999), could provide better understanding of the processes that moulded such a diverse group of plants.

Finally, as suggested by Pastore et al. (2011), Hyptidinae, may have suffered a rapid diversification event related to a shift in seasonally dry tropical forest habitat to savanna biome habitat, mostly in the Cerrado Domain, where the group is more diverse (Harley and Pastore 2012). We believe that fire may have played an important role in this pattern, as described for other groups by Simon et al. (2009). Future studies deeply addressing biogeographical and evolutionary questions with the group (Soares et al. in prep), may shed light in this questions and help in the discussion of the role of fire in the evolution of the biodiversity of the Cerrado.

With the cumulative knowledge obtained from the three phylogenetic hypotheses proposed (Pastore et al. 2011, in press) and the current phylogeny, a revision of the bibliography and the ongoing studies led by the senior author who has worked with the subtribe since 1968, we here update the taxonomy of the subtribe with adjustments, commenting on the current knowledge and updates for each genus, and the future work needed (see Taxonomic treatment below).

5. Taxonomic account

5.1. Key to the genera of Hyptidinae (adapted from Harley and Pastore 2012)

1. Anterior lip of corolla not thickened at base and straight at anthesis (without the explosive pollination system to release stamens); inflorescence spiciform, flowers sessile; plants of Mexico and Central America ....*Asterohyptis*

1'. Anterior lip of corolla thickened at base and reflexing at anthesis (with explosive system to release the stamens); inflorescence thyrsoid, spiciform, paniculiform, capitulate or with isolated cymes, flowers pedicellate or sessile; plants of tropical and subtropical America 2

2. Cymes usually 1-flowered, rarely up to 3−6-flowered, then flowering stems waxy with often inflated internodes; flowers with often inconspicuous paired bracteoles at base of calyx; inflorescence terminal, thyrsoid or raceme-like 3

2'. Cymes usually many-flowered; flowering stems never waxy or inflated; flowers without paired bracteoles at base of calyx; inflorescence terminal or axillary, thyrsoid, spiciform, paniculiform, capitulate, fasciculate or with isolated cymes.. 6

3. Cymes up to 3−6-flowered; peduncle conspicuous; inflorescence thyrsoid; calyx lacking inconspicuous paired bracteoles at base ....*Physominthe*

3'. Cymes uniflorous, rarely 3-flowered (then pedicels long, slender); peduncle conspicuous or reduced; inflorescence raceme-like or thyrsoid; calyx with inconspicuous paired bracteoles at base... 4

4'. Calyx in fruit actinomorphic to subactinomorphic, lobes subequal; corolla at anthesis with tube not abruptly contracted at base, lilac or pale blue, cream, yellow, orange, pale pink or red ....*Hypenia*

4. Calyx in fruit zygomorphic, lobes unequal, posterior lip rounded or with posterior lobes partly connate; corolla at anthesis with tube abruptly contracted near base, lilac, pink or violet, sometimes yellowish in bud 5

5. Calyx throat open, sometimes closed by dense white hairs; corolla tube often broadly campanulate or infundibuliform; stylopodium present; nutlets broad, slightly flattened or rarely winged .... *Eriope*

5'. Calyx throat closed by upper lobes when dry, lobes with a row of rigid hairs within; corolla tube shortly and narrowly cylindrical; stylopodium absent; nutlets elongate, ± triquetrous ....*Eriopidion*

6. Calyx lobes triangular, often conspicuously reflexing in fruit; gynoecium with persistent stylopodium attached to the nutlets; nutlets cymbiform with an involute, laciniate margin and concave inner face.. *Marsypianthes*

6'. Calyx lobes linear or triangular, not reflexing in fruit; stylopodium if present not attached to the nutlets; nutlets ovoid or flattened, never concave nor with margin laciniate 7

7. Flowers sessile to subsessile, in a pedunculate or rarely sessile capitulum or capituliform head; bracteoles forming a distinct involucre of filamentous, ligulate to ovate bracteoles, which can be obscured when capitula globose at anthesis.. 8

7'. Flowers subsessile to long-pedicellate, not forming a capitulum; bracteoles not forming an involucre, or if involucre present, bracteoles usually slender and enclosing a 10–15-flowered cymule or obscured in a dense, elongate broadly spiciform inflorescence 14

8. Capitula dropping as a unit in fruit; corolla tubular, deep purple; calyx with 5--10 unequal spines .... *Rhaphiodon*

8'. Capitula not dropping as a unit in fruit; calyx lobes 5, not spinose, but sometimes subulate and rigid at apex 9

9. Capituliform head ovoid, often enclosed by broad concave bracteoles when immature; corollas long tubular, with short lobes, not spotted or marked on upper lip .... *Oocephalus*

9'. Capitula hemispherical to globose, with an involucre of ovate to ligulate, subulate or filamentous bracteoles not enclosing the head; corollas various, often spotted on upper lip 10

10. Calyx lobes 3–4 times longer than the slender tube and terminating in a long filamentous apex; capitula globose with long filamentous involucral bracteoles .... *Medusantha*

10'. Calyx lobes shorter, filamentous to ovate or dentate; capitula hemispherical or globose 11

11. Capitula globose > 10 mm diam.; involucre of filamentous or narrowly linear bracteoles; calyx tube usually strongly deflexed at maturity; peduncles usually longer than adjacent internode 13

11'. Capitula hemispherical, rarely globose, if globose less than 10 mm diam; involucre of subulate, ligulate or lanceolate to ovate bracteoles; calyx tube not reflexing at maturity, rarely deflexed, then peduncles shorter than adjacent internode 12

12. Flowering capitula 4-6 mm diam., pedunculate; Inflorescence terminal, paniculiform, lax, non-leafy, multi-capitulate; bracts reduced, linear, inconspicuous; involucral bracteoles linear, inconspicuous, never surpassing the capitula; calyx tube recurving...*Myriohyptis*

12'. Flowering capitula 4-20 mm diam, pedunculate or sessile; Inflorescence terminal or axillary, never forming a paniculiform, lax, non-leafy, multi-capitulate structure, capitula sometimes solitary; bracts leaf-like, sometimes reduced, usually conspicuous; involucral bracteoles linear or expanded, inconspicuous or conspicuous, sometimes surpassing the capitula; calyx tube straight or recurving.. *Hyptis*

13. Calyx lobes clavate, widening slightly near apex; stigma ± capitate; plants typical of savanna formations .... *Cyanocephalus*

13'. Calyx lobes subulate, never clavate; stigmas bilobed; plants of sandy areas in semi-arid regions .... *Martianthus*

14. Stylopodium present; flowers in axillary lax cymes, sometimes forming a terminal thyrsoid structure; trees or shrubs, rarely subshrubs .... *Hyptidendron*

14'. Stylopodium absent, rarely very short and scarcely overtopping ovary; flowers disposed variously; shrubs, subshrubs or herbs, rarely treelets 15

15. Calyx with ± scarious, deltoid flanges in sinus between calyx lobes; corolla tubular; flowers sessile or subsessile, in few-flowered sessile cymes, with slender bracteoles, in the axils of reduced, inconspicuous bracts, forming slender, elongate, spiciform inflorescences ....*Leptohyptis*

15'. Calyx lobes without flanges in sinus; corolla tubular or infundibuliform; flowers arranged in fascicles in the axils of leaf-like bracts, or in sub-umbellate or congested, pedunculate cymes, or in globose verticillasters or cincinnate or few-flowered cymes, if inflorescence spiciform, usually not slender.. 16

16. Flowers in fascicles, rarely solitary or flowers few on long pedicels, in the axils of often leaf-like bracts, or in shortly pedunculate sub-umbels, often forming elongate, raceme-like inflorescences, or rarely panicles... *Condea*

16'. Flowers not in fascicles or pedunculate sub-umbels.. 17

17. Flowers in a dense, head-like cyme, on a short peduncle from the axils of leaf-like bracts; leaves reduced; corolla blue or violet-blue; shrubs of sandy, semi-arid areas in NE Brazil .... *Eplingiella*

17'. Flowers not as above; leaves developed or reduced; corolla bluish, violet, lilac, witish; herbs, subshrubs or shrubs, widely distributed in tropical America....................................... 18

18. Flowers in dense subglobose or globose verticillasters, formed from congested cincinni, in the axils of reduced bracts, and forming an elongate, often interrupted or congested terminal spike, with leaves often developed toward base of flowering stem; bracteoles setaceous, rigid and almost spine-tipped; calyx strongly deflexed in mid-tube .... *Gymneia*

18'. Flowers in cincinnate or shortly dichotomous cymes, but never forming subglobose verticillasters; bracteoles various, but not as above; calyx tube straight 19

19. Inflorescence usually an elongate spiciform or racemose thyrse; flowers in pedunculate or sessile cymes, not forming cincinni; bracteoles ovate to lanceolate, often forming a small involucre around cymules, rarely reduced; calyx lobes subequal or with posterior lobe broader .... *Cantinoa*

19'. Inflorescence an elongate, spiciform thyrse or often a diffuse leafy panicle of pedunculate, often cincinnate cymes or shortly pedunculate, few-flowered cymes in axils of foliose bracts, or compact, long-pedunculate, shortly cincinnate cymes forming a globose head; bracteoles inconspicuous, never forming an involucre; calyx lobes subequal... *Mesosphaerum*

Asterohyptis Epling

Notes: *Asterohyptis* is distinguished by the other genera of Hyptidinae by lacking the explosive pollination mechanism, with the thickened hinge at base of anterior corolla lip.

Some taxonomic work has been recently conducted (Gonzáles-Gallegos et al. 2014a), which recognized solely two species for the genus, rather than three (Epling 1933) or four (Turner 2011). Despite this, there is still some uncertainty of the number of species recognized (Harley and Pastore 2012; WCSP 2020) and further studies in taxonomy and populations genetics are desired to clarify this.

Cantinoa Harley & J.F.B.Pastore

Notes: *Cantinoa* possesses 26 species, including two natural hybrids, *Cantinoa* × *obvallata* and *Cantinoa* × *sylvularum* (Harley 1999). It has a neotropical distribution, with most of species in Brazil, and two species, *Cantinoa americana* (Aubl.) Harley & J.F.B.Pastore and *Cantinoa mutabilis* (Rich.) Harley & J.F.B.Pastore introduced in the Paleotropics. The genus can be recognized by the combination of thyrsoid inflorescence composed of sessile to shortly pedunculate ovoid cymes with 12–26 subsessile flowers and bracteoles in the same number as flowers surrounding or partially involving the cymes; calyx straight with five subequal, or slightly different lobes, these rarely absent or reduced; corolla with a developed spreading limb; gynoecium without a stylopodium; and smooth nutlets. Although a novelty has been recently described (Harley 2014), there are some problems in species circumscription and recognition within the genus, and a taxonomic revision is needed.

Condea Adans.

Notes: The genus has 28 species distributed from Argentina to Western United States with most of its diversity in Central America. The genus can be recognized by the combination of spiciform, raceme-like or diffusely paniculate thyrse of pedunculate or sessile, 1- to many-flowered cymes which can be ± subumbellate in form, and those with sessile cymes have flowers in fascicles or verticils, from the axils of subtending bracts; flowers usually pedicellate to long-pedicellate; and gynoecium without a stylopodium. Two sections are currently recognized, *Condea* sect. *Condea* Adans and *C.* sect. *Laniflorae* (Epling) Harley & J.F.B.Pastore. Harley (2019) published a new species *Condea petrensis* Harley and made a new combination *Condea macvaughii* (J.G.González & Art.Castro) Harley & J.F.B.Pastore, based on the recently described *Hyptis macvaughii* J.G.González & Art.Castro (Gonzales et al. 2014), and assigned it to *Condea* sect. *Laniflorae*. The last taxonomic work encompassing all the species treated in the genus was made by Epling (1949) when it was still treated in *Hyptis*. In view of that, new taxonomic treatments encompassing the whole genus are much desired. For a list of species placement in sections check Harley and Pastore (2012).

Condea sect. ***Condea*** Adans.

Notes: This sections contains 17 species, centered in the Caribbean and South America. It is characterized by the simple trichomes and flowers solitary or in fascicles.

Condea sect. ***Laniflorae*** (Epling) Harley & J.F.B.Pastore

Notes: This section is recognized by the dendroid trichomes and flowers arranged in pedunculate or sessile subumbellate cymes which are arranged in a broader spiciform or paniculiform inflorescence. It encompasses 10 species distributed from south United States to Western South America.

Cyanocephalus (Pohl ex Benth.) Harley & J.F.B.Pastore

Notes: *Cyanocephalus* is recognized by the combination of globose capitula, calyx lobes clavate, widening slightly near apex and stigma ± capitate. The genus, currently with 24 species, is being subjected to a taxonomic revision (Buchoski et al. in prep) in order to better circumscribe the closely morphologically related species that compose it. A recent novelty, *Cyanocephalus veadeiroensis* Antar & Harley, has been published for the genus (Antar et al. 2019).

Epingiella Harley & J.F.B.Pastore

Notes: *Eplingiella* can be recognized by the combination of the shortly pendunculate subumbellate fascicle inflorescences with foliaceous bracts and gynoecium without a stylopodium. The genus was created to accommodate two species placed in *Hyptis* sect. *Umbellaria* by Epling (1949) but unplaced since 1988, when *Hyptidendron* was created (Harley 1988). One more species has been recently published (Harley 2014b) together with a key to identify the three species of the genus. Additionally, there is a lot of recent studies studying it chemical composition and biological activity (e.g. Beserra-Filho et al. 2019) and a study reporting the presence of displaying resupinate dimorphism in the flowers in the genus (Harley et al. 2017).

Eriope Humb. & Bonpl. ex Benth.

Notes: *Eriope* possesses 31 species and several infraspecific taxa, mostly distributed in Brazilian Cerrado with few species expanding to neighboring countries and other forestry adjacent domains. The genus can be recognized by the combination of raceme-like inflorescences composed by 1-flowered cymes with inconspicuous paired bracteoles at the base of flowers, fruiting calyx zygomorphic, with lobes unequal and gynoecium with a stylopodium. The genus was last revised in 1976 (Harley 1976), however, several additions have been published (e.g Harley 1992; Harley and Walsingham 2014; Schliewe et al. 2017) and a new taxonomic revision is desirable.

Eriopidion Harley

Notes: *Eriopidion* is a monotypic genus with *E. strictum* (Benth.) Harley presenting a disjunctive distribution in the Caatinga domain in Northeastern Brazil and semi-arid vegetation of lower Orinoco River, in Venezuela. The genus was separated from *Eriope*, where it was first described (Bentham 1848), solely based on morphology (Harley 1976) as it differs by possessing persistent bracts, a narrowly campanulate calyx with a broad hygroscopic posterior lobe, which folds when dry to close mouth of calyx, a gynoecium without a stylopodium and nutlets ±triquetrous. In all phylogenies of the subtribe (Pastore et al. 2011, in press), the genus represented a different linage, sister to *Eriope*, thus deserving recognition as a separated genus. Future studies in phylogeography are required to better understand the biogeographic disjunctive pattern of *Eriopidion strictum*.

Gymneia (Benth.) Harley & J.F.B.Pastore

Notes: *Gymneia* possesses seven species distributed mostly in the Brazilian Cerrado with one species expanding to Northeastern Brazil and Bolivia. The genus can be recognized by an erect, elongate spike-like, non-leafy thyrse, simple or slightly branched, of distant or congested, sessile verticillasters formed from a cyme of paired cincinni, with extremely reduced cyme branches so that the flowers and their subtending bracteoles become strongly congested, forming a subglobose or hemispherical verticillaster at each node of the main inflorescence axis; fruiting calyx tube strongly deflexed below the oblique mouth, with rather rigid sometimes acicular calyx lobes; stigma ± capitate and gynoecium without stylopodium. Two new species have been described (Harley 2013) and evolutionary and revisional studies are being undertaken (Soares et al. in prep.).

Hypenia (Mart. ex Benth.) Harley

Notes: *Hypenia* is a Neotropical genus with 26 species with most of its distribution in the Brazilian Cerrado expanding to Bolivia and Paraguay with also one species, *Hypenia* *salzmannii* (Benth.) Harley, widespread in Brazil's northeastern and one species, *Hypenia violacea* Mart.Gord. & S.Valencia, endemic to Mexico. The genus can be recognized by the combination of flowers with often inconspicuous paired bracteoles at base of calyx, flowering stems waxy with often inflated internodes; calyx in fruit actinomorphic, or almost so, with subequal lobes; corolla lilac or pale blue, cream, yellow or red, and corolla tube not abruptly contracted at base. *Hypenia violacea* needs a morphological reevaluation and to be included in a phylogeny, as it differs from the morphology of other species in the genus. Additionally, the monophyly of the genus, due to the uncertain position of *Hypenia simplex*, is not confirmed and further phylogenetic studies with a wider sampling are needed.

Hyptidendron Harley

Notes: *Hyptidendron* possesses 21 species (Antar et al. in press) and can be recognized by the inflorescences arranged in complex bracteolate cymes and flowers with styles jointed below, the lower part forming a persistent stylopodium that protrudes above the ovary. The genus is here, and for the first time, recognized as monophyletic. When the genus was created two sections, *Hyptidendron* sect. *Hyptidendron* (based on *Hyptis* sect. *Buddleioides*) and *Hyptidendron* sect. *Umbellaria* (based on *Hyptis* sect. *Umbellaria*), were recognized. Harley and Pastore (2012) based on the first phylogeny of the subtribe in which the sections of *Hyptidendron* did not form monophyletic groups, decided not to recognize the sections until further studies. Pastore et al. (in press) recovered *Hyptidendron* as paraphyletic with the species that compose the genus divided in three clades, two of them representing the previous recognized section and one clade with *Hyptis eximia* Epling, previously placed in *Hyptis* sect. *Latiflorae* by Epling (1949), and other species previously placed in *Hyptidendron* sect. *Umbellaria*. In the present study we recognize the same three clades but *Hyptidendron* as monophyletic. In order to update its infrageneric classification we recognize *Hyptidendron* sect. *Hyptidendron* and *Hyptidendron* sect. *Umbellaria* and create a new section to accommodate the species placed in this third clade. A revision of the genus is being prepared (Antar et al. in prep) with further discussion on the sections and species recognition.

Hyptidendron sect. ***Hyptidendron*** Harley Type: *Hyptidendron asperrimum* (Spreng.) Harley

Notes: This section encompasses seven species distributed from Ecuador, Colombia and Venezuela to Northern São Paulo state in Brazil. It is characterized by being trees or shrubs with mostly a well-defined terminal thyrsoid inflorescence, bracts mostly reduced, branched hairs present (rare in *H. pulcherrimum* Antar & Harley) and nutlets 4 per flower, flattened, and winged.

Hyptidendron sect. ***Umbellaria*** (Benth.) Harley. Type: *Hyptidendron rhabdocalyx* (Benth.) Harley

Notes: This section is composed of eleven species endemic to Brazil. It is characterized by shrubs or subshrubs with inflorescence composed of somewhat isolated axillary cymes, sometimes forming a well-defined more complex thyrsoid structure, bracts similar to leaves or reduced, branched hairs mostly absent, calyx tube at anthesis mostly with a ring of hairs in the throat, which can be conspicuous or inconspicuous and formed by just few hairs and nutlets 1−2 per flower, not flattened, not winged and with a conspicuous abscission scar.

Hyptidendron sect. ***Latiflorae*** (Epling) Antar & Harley **stat. nov.** Type: *Hyptis eximia* Epling [= *Hyptidendron eximium* (Epling) Harley & J.F.B.Pastore].

= *Hyptis* sect. *Latiflorae* Epling

Shrubs or subshrubs up to 5 m tall, aromatic, rarely not aromatic; stems woody or lightly woody, massive or fistulose, erect. Cauline leaves spreading along the branches, not imbricate, longer or smaller than internodes, lamina chartaceous or membranous, petiole present, rarely absent. Inflorescence composed of axillary pedunculate cymes, forming a lax, branched, terminal thyrsoid structure, cymes dichasial or unilateral, subtended by leaf-like bracts, reduced, mostly smaller than cymes, mature cymes (1−)5−33 flowered, not obscured by bracts. Flowers pedicellate or rarely sessile, subtended by linear bracteoles; calyx 5–lobed, ± actinomorphic, tube cylindrical or infundibuliform, internally without a ring of hairs in the throat, lobes subequal, deltoid, straight or rarely slightly curved, calyx in fruit bigger; corolla 5-lobed, tube cylindrical or rarely somewhat infundibuliform, straight. Nutlets 1 per flower, ellipsoid, suborbicular, globose, or oblong, not flattened, not winged, shiny or not shiny, glabrous and rugulose or rarely pubescent to glabrescent with hairs in the apex, abscission scars mostly conspicuous, sometimes absent and them an appendage at the base present, mucilaginous or slightly mucilaginous when wetted.

Species included: *Hyptidendron glutinosum* (Benth.) Harley, *H. amethystoides* (Benth. in DC.) Harley, *H. rondonicum* (Harley) Harley and *H. eximium* (Epling.) Harley & J.F.B.Pastore.

Hyptis Jacq.

Notes: After taxonomic rearrangements (Harley and Pastore 2012; Pastore et al. in press) based on the results of the previous phylogeny for the subtribe, *Hyptis* remained as much smaller genus with ca. 145 species. The center of distribution of *Hyptis* is the Neotropics, mostly Brazil, where many species occur in humid or upland savanna. A few species extend to the Old World tropics, mostly as weeds. The genus can be recognized by the combination of hemispherical or +- globose capitulate inflorescences, bracts foliaceous, calyx tube straight, calyx lobes sometimes with foliaceous appendage at the apex and stylopodium absent or present. Our phylogeny supports previous results found and enables the recognition of eight sections previously recognized (Pastore et al. in press): *Hyptis* sect. *Hyptis*, *H.* sect. *Apodotes*, *H.* sect. *Axillares*, *H.* sect. *Cyrta*, *H.* sect. *Eriosphaeria*, *H.* sect. *Marrubiastrae, H.* sect. *Peltodon*, *H.* sect. *Xylodontes*; as well as the new, and here proposed, *H*. sect. *Latibracteatae*. *Hyptis* sect. *Myriocephala* is combined in a new genus, *Myriohyptis* and *Hyptis* sect. *Rhytidea* is transferred to *Mesosphaerum*. Further taxonomic and molecular studies dealing exclusively with *Hyptis* are much desired, in order to further discuss the infrageneric classification of the genus, incorporating the novelties published (e.g. Harley and Antar 2019) and classify the *incertae sedis* taxa. Here we provide a list of sections currently recognized in *Hyptis*, without detailing further infra-sectional classification.

Hyptis sect. ***Apodotes*** Benth. Type: *Hyptis sericea* Benth.

Notes: Currently comprises eight species endemic to South America, mostly in Brazil. The group is characterized by a deep sinus between the two anterior lobes of the calyx, and the gynoecium with a persistent stylopodium, overtopping the ovary.

Hyptis sect. ***Axillares*** (Benth.) Harley & J.F.B. Pastore. Type: *Hyptis hirsuta* Kunth.

Notes: This section is composed of six species endemic to South America. It is characterized by sessile or shortly pedunculate capitula born on leaf-like bracts, calyx teeth subulate and calyx tube inflated.

Hyptis sect. ***Cyrta*** Benth. Type: *Hyptis recurvata* Poit.

Notes: Composed of ca. 12 species, characterized by a terminal elongate inflorescence composed of pedunculate capitula, with involucral bracteoles linear to setaceous. Capitulum many-flowered, less congested than in most *Hyptis* species, as the cymose structure can often be clearly seen; flowers with a strongly accrescent calyx; calyx tube declinate just below the mouth; corolla narrowly funnel-shaped; stigma bilobed and gynoecium without a stylopodium. The group is distributed from Southern Mexico to Argentina, with some of its representatives occurring as weeds.

Hyptis sect. ***Eriosphaeria*** Benth. Type: *Hyptis velutina* Pohl ex Benth.

Notes: The group comprises ca. 45 species endemic to South America and mostly distributed in Goiás and Minas Gerais states, in Brazil. It is characterized by the combination of pedunculate hemispherical capitula, mostly with a dense indumentum; involucre of narrowly lanceolate bracts; calyx 5-lobed with the tube straight; indumentum often with yellowish or orange sessile glands; gynoecium with a persistent stylopodium. The section has multiple subsections (Epling 1949; Pastore et al. in prep.; Harley in prep) that are not discussed here, but needs further study, with some species currently unplaced (Harley and Antar 2019).

Hyptis sect. ***Hilaria*** Epling. Type species: *Hyptis lobata* A.St.-Hil. ex Bentham

Notes: Represented solely by *Hyptis lobata* which is known only for the type specimen collected in the XIX century. Several field expeditions were conducted to the type locality, but no further material was found. With the type examination of the material, we decided to maintain it amongst *Hyptis*, although further material is needed to establish its correct position.

Hyptis sect. ***Hyptis*** Jacq. Type: *Hyptis capitata* Jacq.

Notes: This group, which includes the type species, was formerly treated by both Bentham (1833, 1848) and Epling (1936, 1949) as a subsection, but is here given sectional status. Neither the original name of the type section "*Cephalohyptis*", nor of the type subsection "*Genuinae*" are valid following the Art. 22, International Code of Botanical Nomenclature (2016). The section is composed of ca. 15 species distributed in Tropical America with some species, as *Hyptis capitata*, weedy and introduced into the Old World tropics. The group can be recognized by the combination of involucral of bracteoles lanceolate to ligulate and mostly deflexed, calyx tube with a ring of hairs in the throat; calyx lobes mostly subulate; gynoecium without a stylopodium and nutlets smooth.

Hyptis sect. ***Latibracteatae*** (Benth.) Harley, Antar & J.F.B.Pastore **stat. nov**. ≡ *Hyptis* sect. *Cephalohyptis* subsect. *Latibracteatae* Benth. Lab. Gen. et Sp. 101. 1833. Type: *Hyptis lantanifolia* Poit.

Herbs, sometimes stoloniferous, up to 1 m tall, much-branched or poorly branched, ± scentless; stems mostly herbaceous, massive, weakly to strongly quadrangular. Cauline leaves spreading along the branches, not imbricate, lamina ovate or elliptic, slightly discolor, membranous, petiole present, sometimes reduced. Inflorescence composed of solitaire capitula, long pedunculate, hemispherical; bracts leaflike; involucral bracteoles widely spreading, reflexed, conspicuous, surpassing the capitula diameter. Flowers subsessile, straight at anthesis; calyx 5–lobed, actinomorphic, calyx tube cylindrical to narrowly infundibuliform, calyx lobes subulate, subequal; corolla 5-lobed, white, tube ± cylindrical; style without stylopodium, stigma slightly branched. Nutlets ca. 1 – 1.5 x 0.7 – 1 mm, ±ovoid, not flattened, castaneous, smooth, apparently not mucilaginous when wet.

Notes: Species of *Hyptis* sect. *Latibracteatae* share several morphological features as the stems weakly quadrangular, creeping along ground or supported by surrounding vegetation, and often rooting at nodes, often long peduncles, capitulum with widely spreading, rather conspicuous involucral bracts and calyx tube with a ring of hairs in the throat.

Species included: *Hyptis ammotropha* C.Wright ex Griseb., *H. bahiensis* Harley, *H. lantanifolia, H. minutiflora* Griseb., *H. paupercula* Epling.

Hyptis* sect. *Marrubiastrae (Benth.) Harley & J.F.B.Pastore. Type: *Hyptis marrubiastra* Pohl ex Benth.

Notes: Composed of 26 species distributed from Southern United States to Argentina, with some species behaving as weeds. The group can be recognized by the combination of herbs mostly with thin membranous leaves; globose pedunculate capitulum with lanceolate or ovate bracteoles, mostly deflexed and inconspicuous when mature; calyx tube without a ring of hairs in the throat; calyx lobes subulate or broadly deltate; and gynoecium without a stylopodium.

Hyptis sect. ***Peltodon*** (Pohl) Harley & J.F.B. Pastore ≡ *Peltodon* Pohl. Type: *Peltodon radicans* Pohl [= *Hyptis radicans* (Pohl) Harley & J.F.B.Pastore]

Notes: Previously (Bentham 1833, Epling 1936; Harley et al. 2004) treated this as the genus *Peltodon.* The section is composed of five species distributed in southern and eastern Brazil, Paraguay and Argentina. It can be recognized by the calyx lobes with foliaceous appendages at the apex and capitula subglobose with an involucre of broad bracteoles.

Hyptis sect. ***Plagiotis*** Benth. Type: *Hyptis uliginosa* A. St.-Hil. ex Benth.

Notes: Composed of three species distributed in Cuba, Guianas and Southern Brazil to Northern Argentina. It is recognized by the combination of small hemispheric capitula; calyx lobes deltate; calyx tube curved near the apex; corolla slightly exerted and gynoecium with a stylopodium.

Hyptis sect. ***Xylodontes*** (Benth.) Epling. Type: *Hyptis rubiginosa* Benth.

Notes: Comprises about 22 species distributed from Mexico to Brazil. It can be characterized by leaves usually petiolate, coriaceous, with capitula disposed in the axils of reduced leaf-like bracts, sometimes merged and forming a more complex raceme-like or spiciform inflorescence; gynoecium with a stylopodium and nutlet apex usually hairy.

Leptohyptis Harley & J.F.B.Pastore

Notes: *Leptohyptis* species were earlier recognized as a distinct natural group, placed together in *Hyptis* sect. *Leptostachys* by Epling (1949). The genus is composed of six species endemic to Brazil, mostly distributed in Northeast of the country, recognized by the sessile cymes forming lax spiciform inflorescences, the presence of a deltate or ovate, membranous flange-like appendages in the sinus between calyx lobes and the corolla with a long tube and short lobes. The group was studied when it was still a part of *Hyptis* (Harley 1985), and although no recent taxonomic study has been published with the genus as currently recognized, intensive photochemistry investigation has been undergoing (e.g. Souza et al. 2020).

Marsypianthes Mart. ex Benth.

Notes: The genus was first recognized by Bentham (1833), distinguished by the combination of pedunculate or sessile cymes 1-3 to many flowered subtended by elliptic-lanceolate to linear bracteoles; calyx actinomorphic, infundibuliform, with lobes ±deltate often reflexed in fruit; corolla with anterior lobe much shorter than the other lobes; gynoecium with a stylopodium fused to the ovary lobes; and nutlets cymbiform. It contains six species, including the recently described *M. tubulosa* A.Soares, J.F.B.Pastore & Harley (Soares et al. in press), distributed mostly in South America with one species spreading to Mexico and Caribbean. A recent taxonomic revision has been published for five species that occur in Brazil (Hashimoto and Ferreira 2020).

Martianthus Harley & J.F.B.Pastore

Notes: Endemic to South America, this genus currently possess four species recognized by the combination of inflorescence of a globose pedunculate capitula; bracteoles linear, forming an inconspicuous involucre; calyx lobes non-clavate, fruiting calyx tube usually curved downward, from the middle; corolla lobes with apex darker than the rest of the corolla; stigma distinct lobed and gynoecium without stylopodium. Three species are endemic to Brazil and restricted to the Caatinga domain and one species in a dry area in coastal Peru. As previously discussed, the genus contains some heterogeneity and needs reevaluation in view of molecular and morphological studies.

Medusantha Harley & J.F.B.Pastore

Notes: The genus *Medusantha* is based on *Hyptis* sect. *Trichosphaeria* Bentham (1833); the name *Trichosphaeria* at a generic level would be a later homonym of *Trichosphaeria* Fuckel, a fungus. The genus consists until now of eight species, with *M. simulans* Epling and *M. carvalhoi* Harley, from NE Brazil, having both been added in the 20th century. The genus is almost exclusively Brazilian with one species, *M. eriophylla* (Pohl ex Benth.) Harley & J.F.B.Pastore, recently recorded from Eastern Bolivia (Wood et al. 2011). *Hyptis* sect. *Trichosphaeria* was originally divided into two subsections by Epling (1936), *H.* sect *Plumosae* Epling and *H.* sect. *Crinitae* Epling, however the discovery of *M. carvalhoi*, somewhat intermediate between these two subsections, led the senior author to conclude that this division was unjustified (Harley 1986a). *Medusantha* is easily recognized by the combination of spherical capitula, with a few very slender to filamentous bracteoles, which form an indistinct involucre at the base of the capitulum; outer bracteoles often occur on the peduncle, at its apex, just below the capitulum; calyx tube straight, narrow; calyx lobes filamentous and elongate after flowering and corolla tube slender. The key to the subsections and species of this group, in Epling (1949) is largely based on leaf characters. With increased collecting of material since his account was published, some of the characters he used have been shown to be unreliable. In particular, leaf size seems very variable, and the taxonomic status of plants with very small leaves needs investigation. Measurement of floral characters, especially of the calyx, are often difficult due to the rapid changes in dimension of both calyx tube and lobes as the flowers and fruits mature. A more detailed study of the group, which should involve breeding experiments to assess species limits and the possible occurrence of hybrids, would help to elucidate the taxonomy.

Mesosphaerum Browne

= *Hyptis* sect. *Rhytidea* Epling, **synon. nov.** Type: *Hyptis rhytidea* Benth. [= *Mesosphaerum rhytideum* (Benth.) Kuntze].

Notes: This genus was resurrected and redefined in Harley and Pastore (2012), with 25 species, mainly in Central and South America. *Hyptis rhytidea* Benth., a species from Mexico, was originally unplaced by Harley and Pastore (2012), due to lack of adequate material. First described from Mexico by Bentham (1839) in Plantae Hartwegianae, it was later included (Bentham 1848) in *Hyptis* sect. *Polydesmia* Benth. subsect. *Rigidae* Benth. Epling (1933) transferred the species to its own *Hyptis* section *Rhytidea* Epling, and later (Epling 1941) added a further species, *Hyptis pseudolantana* Epling

In the second phylogeny of the subtribe (Pastore et al. in press), molecular data indicated *Hyptis rhytidea* as a member of the genus *Mesosphaerum* Browne. However, due to the uncertainty and similarities between *Mesosphaerum* and *Condea*, they preferred to wait for further data to propose the combination. Although we have not sampled *Hyptis rhytidae*, *H. pseudolantana* or *H. cualensis*, our results better resolve the relationships between the two genera, enabling the taxonomic decisions to be published, placing *Hyptis* sect. *Rhytidea* in synonymy of *Mesosphaerum*. Furthermore, we provide new combinations under *Mesosphaerum* for these two species, and also for the recently described *Hyptis cualensis*

González et al. (2014), also from Mexico. The relationships of these species were discussed by these authors, who assigned them to *Hyptis* sect. *Rhytidea*, suggesting, however, that the new species would belong to genus *Mesosphaerum*, if the Harley and Pastore (2012) delimitation were followed.

Mesosphaerum rhytideum (Benth.) Kuntze ≡ *Hyptis rhytidea* Benth. Type: MEXICO. Aguascalientes, without location, “ad aguas calientes”, 13 July − 22 Sept. 1839, *Hartweg* 170 (holotype K!, isotypes BM!, E!, GH!, NY!, P!, W!).

Mesosphaerum pseudolantanum (Epling) Harley, Antar & J.F.B.Pastore **comb. nov.** ≡ *Hyptis pseudolantana* Epling. Type: MEXICO. Guerrero. Coyuca de Catalán: Aguazarca–Filo, District Mina, Guerrero, 9 November 1937, *G.B. Hinton et al.* 11266 (holotype UC, isotypes F!, K!, MO!, US-00121889!, US-01014362!).

Mesosphaerum cualense (J.G. González & Art. Castro) Harley, Antar & J.F.B.Pastore **comb. nov.** ≡ *Hyptis cualensis* J.G.González & Art. Castro. Type:— MEXICO. Jalisco. Puerto Vallarta: Ojo de Agua, 20º 30’ 43.5” N, 105º 12’ 20.5” W, 1227 m, 1 May 2013, *A. Flores-Argüelles & A.R. Romero-Guzmán* 662 (holotype IBUG, isotypes IEB, MEXU).

Myriohyptis Antar, Harley & J.F.B.Pastore, **nom. & stat. nov.** ≡ *Hyptis* sect. *Myriocephala* Benth. in DC. Prodr. 12: 88. 1848. Type: *Hyptis odorata* Benth. [= *Myriohyptis odorata* (Benth.) Harley & J.F.B. Pastore].

(Fig. 3).

Shrub or treelet, 1–5 m tall, much-branched, ± scentless; stems woody, massive. Cauline leaves spreading along the branches, not imbricate, lamina broadly lanceolate,

Fig. 3. *Myriohyptis odorata* Antar, Harley & J.F.B.Pastore. **A.** Habit and inflorescence; **B.** Inflorescense. Photos by M.R. Pace.

discolorous, slightly coriaceous, petiolate present. Inflorescence composed of multiple 4-6 mm, shortly pedunculate, ± globose, flowering capitula, forming a diffusely branched terminal paniculiform structure; bracts linear, reduced, inconspicuous; involucral bracteoles reduced, not surpassing the capitula. Flowers subsessile, reflexed at anthesis; calyx 5–lobed, ± zygomorphic, calyx tube with oblique throat and curved and more or less sigmoid in fruit, calyx lobes shortly deltate, unequal with the posterior lobe longer; corolla 5-lobed, lilac or violet, rarely white, tube cylindrical, ca. 2 mm long; style without stylopodium, stigma slightly branched. Nutlets 1 – 1.2 x 0.2 – 0.25 mm, ±fusiform, not flattened, castaneous, smooth, apparently not mucilaginous when wet.

Hyptis odorata has an isolated position, not within the *Hyptis* clade, in the latest molecular phylogenetic cladogram, being sister to *Cantinoa*. Therefore, the taxonomic alternatives, on this phylogenetic context, would be 1) wide the genus *Cantinoa* to include *Hyptis odorata* or 2) create a new genus. Morphologically, it hardly can be placed within *Cantinoa*, once the genus is well defined by its ovoid cymes not forming capitula and calyx with straight tube. Whereas *H. odorata* possesses very small capitula disposed in a lax, multi-capitulate, non-leafy terminal panicle, and with a recurving calyx tube. In fact, morphologically *H. odorata* has been historically treated in an isolated position. Originally described and included under *Hyptis* sect. *Plagiotis* (Bentham 1833), the species was later transferred to the monotypic *Hyptis* sect. *Myriocephala* (Bentham 1848). This isolated position (in the context of *Hyptis* s.lat.) was maintained by Epling (1933, 1949). The uniqueness of *Hyptis odorata* was confirmed in this phylogenetic study. By elevating it to generic status, *Hyptis* becomes monophyletic. Therefore, this species is here treated in its own monotypic genus, *Myriohyptis*. The name *Myriocephala* would perhaps be available, but it is very similar to *Myriocephalus* Benth. (Asteraceae). Therefore, to avoid confusion we propose a new name for this monotypic genus: *Myriohyptis*. Endemic to Ecuador, Peru and Bolivia, occurring in montane forests.

Myriohyptis odorata (Benth.) Antar, Harley & J.F.B.Pastore, **comb. nov.** ≡ *Hyptis odorata* Benth. Labiat. Gen. Spec. 81. 1833. Type: PERU. Huánuco, *Ruiz & Pavon* s.n. (Lectotype: K[K000488471], selected here, isolectotypes: BM!, G!, HAL!, K!, MA!, P!).

Bentham (1833) when describing *Hyptis odorata* cites just one material and one herbarium, what is interpreted as the holotype. The material *Ruiz & Pavon* s.n. was indicated to be present at Lambert herbarium. This herbarium was sold and divided and its material is currently divided in at least 18 institutions in Europe and the United States (Miller 1970). The material at Kew, is annotated by Bentham, ex Herb. Hook., and could be interpreted as the original material from Lambert herbarium, as stated by Epling (1936), however, it is impossible to be certain of it. Here we designated it as a lectotype.

Oocephalus Harley & J.F.B.Pastore

Notes: *Oocephalus* was treated by Epling (1949) in *Hyptis* sect. *Polydesmia* subsect. *Glomeratae* and subsect. *Oocephalus*. The genus can be recognized by the combination of inflorescence a thyrse composed of sessile or pedunculate ovoid cymes, with an involucre of usually broad, ovate or lanceolate bracteoles and corolla tube elongate with reduced lobes, never blotched. The group has been stable since its creation, although some species adjustments are needed (Soares et al. in prep). Many recent novelties have been described by the genus (Harley 2015; Soares et al. 2019; Harley et al. 2019; Soares et al. 2020) in the course of the production of a monograph for the genus (Soares et al. in prep.) which now includes 21 accepted species.

Physominthe Harley and J.F.B. Pastore

Notes: Harley and Pastore (2012) published this genus to encompass a single species, *P. vitifolia* (Pohl ex Benth.) Harley & J.F.B. Pastore, which Bentham (1833), had originally published under the name *Hyptis vitifolia* Pohl ex Benth., and assigned to *Hyptis* sect. *Hypenia* Mart. ex Bentham, due to its general habit and stem morphology. The long, virgate, waxy and fistulose flowering stems are similar to most species of *Hypenia*. Harley (1988) raised *Hyptis* sect. *Hypenia* to generic rank. However, *H. vitifolia* differs from other species of *Hypenia* in having small, shortly pedicellate flowers arranged in pedunculate, <5-flowered cymes, while most *Hypenia* species possess uniflorous cymes, with usually minute paired bracteoles at the base of the calyx. The molecular analysis of Pastore et al. (2011) did not associate *H. vitifolia* with *Hypenia*, and its position suggested it were best treated as a distinct genus, *Physominthe*. At this period, the analysis suggested it might perhaps be more closely allied to *Hyptidendron* Harley. The current analysis now places *Physominthe* as sister to the genera *Eriope*, *Eriopidion* and *Hypenia*. This brings together the three genera, which possess what has been termed “the Greasy Pole syndrome” (Harley 1991), with flowering stems having long waxy, fistulose internodes below the inflorescence, and long setose hairs on the lower part of the stems. At first treated as a monotypic genus, composed of *Physominthe vitifolia*, a second species, *Physominthe longicaulis* Harley (2015), from Northern Bahia, Brazil, has been described.

Rhaphiodon Schauer

Notes: *Rhaphiodon* is in all three phylogenetic studies (Pastore et al. 2011; in press) is recognized as a distinct monotypic lineage. The genus can be easily recognized by it spinose involucral bracteoles and the calyx with lobes composed of up to ca 11 spines. The genus is endemic to Brazil occurring in the Caatinga and Cerrado domains, sometimes in disturbed ground.

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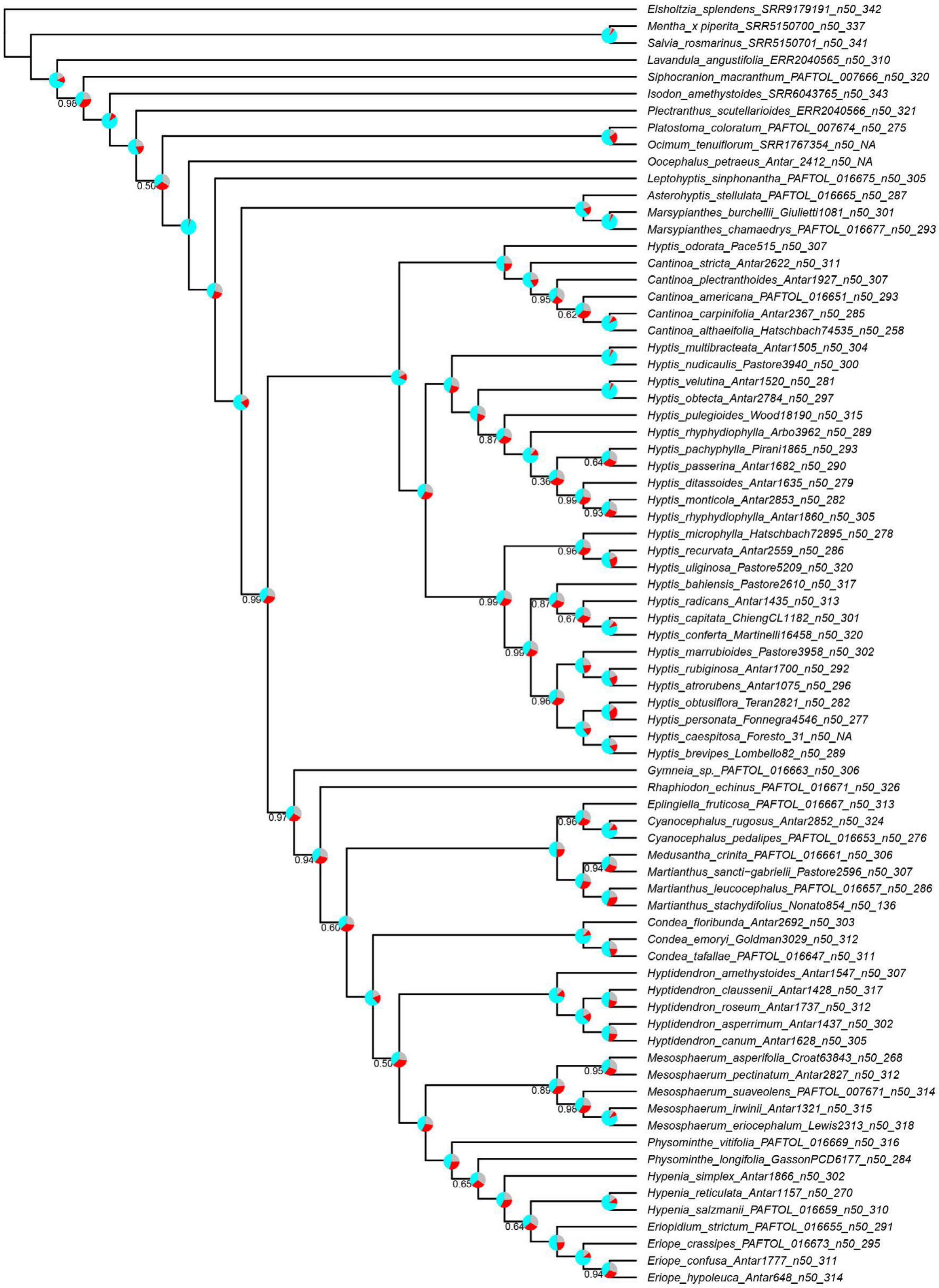
APPENDICES

Appendix 1. List of taxa sampled.

Tribe	Subtribe	Species	Acession	Source	Voucher	Genes at 50%
Ocimeae	Hyptidinae	*Asterohyptis stellulata*	PAFTOL_016665	Herbarium	Guzman 2613	287
Ocimeae	Hyptidinae	*Cantinoa althaeifolia*	Hatschbach74535	Herbarium	Hatschbach74535	258
Ocimeae	Hyptidinae	*Cantinoa americana*	PAFTOL_016651	Herbarium	Wood 24459	293
Ocimeae	Hyptidinae	*Cantinoa carpinifolia*	Antar2367	Silica dried	Antar2367	285
Ocimeae	Hyptidinae	*Cantinoa plectranthoides*	Antar1927	Silica dried	Antar1927	307
Ocimeae	Hyptidinae	*Cantinoa stricta*	Antar2622	Silica dried	Antar2622	311
Ocimeae	Hyptidinae	*Condea emoryi*	Goldman3029	Herbarium	Goldman3029	312
Ocimeae	Hyptidinae	*Condea floribunda*	Antar2692	Silica dried	Antar2692	303
Ocimeae	Hyptidinae	*Condea tafallae*	PAFTOL_016647	Herbarium	Lliuly 1488	311
Ocimeae	Hyptidinae	*Cyanocephalus pedalipes*	PAFTOL_016653	Herbarium	Harley 27911	276
Ocimeae	Hyptidinae	*Cyanocephalus rugosus*	Antar2852	Silica dried	Antar 2852	324
Elsholtzieae	-	*Elsholtzia* sp.	SRR9179191	Transcriptome	SRR9179191	342
Ocimeae	Hyptidinae	*Eplingiella fruticosa*	PAFTOL_016667	Herbarium	Silva-Luz 65	313
Ocimeae	Hyptidinae	*Eriope confusa*	Antar1777	Silica dried	Antar1777	311
Ocimeae	Hyptidinae	*Eriope crassipes*	PAFTOL_016673	Silica dried	Antar 1181	295
Ocimeae	Hyptidinae	*Eriope hypoleuca*	Antar648	Silica dried	Antar648	314
Ocimeae	Hyptidinae	*Eriopidium strictum*	PAFTOL_016655	Herbarium	Harley 56567	291
Ocimeae	Hyptidinae	*Gymneia* sp.	PAFTOL_016663	Silica dried	Antar 1821	306
Ocimeae	Hyptidinae	*Hypenia reticulata*	Antar1157	Silica dried	Antar1157	270
Ocimeae	Hyptidinae	*Hypenia salzmanii*	PAFTOL_016659	Silica dried	Antar 1284	310
Ocimeae	Hyptidinae	*Hypenia simplex*	Antar1866	Silica dried	Antar1866	302
Ocimeae	Hyptidinae	*Hyptidendron amethystoides*	Antar1547	Silica dried	Antar1547	307
Ocimeae	Hyptidinae	*Hyptidendron asperrimum*	Antar1437	Silica dried	Antar1437	302
Ocimeae	Hyptidinae	*Hyptidendron canum*	Antar1628	Silica dried	Antar1628	305

Ocimeae	Hyptidinae	*Hyptidendron claussenii*	Antar1428	Silica dried	Antar1428	317
Ocimeae	Hyptidinae	*Hyptidendron eximium*	Wood16517	Herbarium	Wood16817	305
Ocimeae	Hyptidinae	*Hyptidendron roseum*	Antar1737	Silica dried	Antar1737	312
Ocimeae	Hyptidinae	*Hyptis* aff. *rhyphydiophylla*	Antar1860	Silica dried	Antar1860	305
Ocimeae	Hyptidinae	*Hyptis atrorubens*	Antar1075	Silica dried	Antar1075	296
Ocimeae	Hyptidinae	*Hyptis bahiensis*	Pastore2610	Herbarium	Pastore2610	317
Ocimeae	Hyptidinae	*Hyptis brevipes*	Lombello82	Herbarium	Lombello82	289
Ocimeae	Hyptidinae	*Hyptis capitata*	ChiengCL1182	Herbarium	ChiengCL1182	301
Ocimeae	Hyptidinae	*Hyptis conferta*	Martinelli16458	Herbarium	Martinelli16458	320
Ocimeae	Hyptidinae	*Hyptis ditassoides*	Antar1635	Silica dried	Antar1635	279
Ocimeae	Hyptidinae	*Hyptis marrubioides*	Pastore3958	Silica dried	Pastore3958	302
Ocimeae	Hyptidinae	*Hyptis microphylla*	Hatschbach72895	Herbarium	Hatschbach72895	278
Ocimeae	Hyptidinae	*Hyptis monticola*	Antar2853	Silica dried	Antar2853	282
Ocimeae	Hyptidinae	*Hyptis multibracteata*	Antar1505	Silica dried	Antar1505	304
Ocimeae	Hyptidinae	*Hyptis nudicaulis*	Pastore3940	Silica dried	Pastore3940	300
Ocimeae	Hyptidinae	*Hyptis obtecta*	Antar2784	Silica dried	Antar2784	297
Ocimeae	Hyptidinae	*Hyptis obtusiflora*	Teran2821	Herbarium	Teran2821	282
Ocimeae	Hyptidinae	*Hyptis odorata*	Pace515	Herbarium	Pace515	307
Ocimeae	Hyptidinae	*Hyptis pachyphylla*	Pirani1865	Herbarium	Pirani1865	293
Ocimeae	Hyptidinae	*Hyptis passerina*	Antar1682	Silica dried	Antar1682	290
Ocimeae	Hyptidinae	*Hyptis personata*	Fonnegra4546	Herbarium	Fonnegra4546	277
Ocimeae	Hyptidinae	*Hyptis pulegioides*	Wood18190	Herbarium	Wood18190	315
Ocimeae	Hyptidinae	*Hyptis radicans*	Antar1435	Silica dried	Antar1435	313
Ocimeae	Hyptidinae	*Hyptis recurvata*	Antar2559	Silica dried	Antar2559	286
Ocimeae	Hyptidinae	*Hyptis rhyphydiophylla*	Arbo3962	Herbarium	Arbo3962	289
Ocimeae	Hyptidinae	*Hyptis rubiginosa*	Antar1700	Silica dried	Antar1700	292
Ocimeae	Hyptidinae	*Hyptis uliginosa*	Pastore5209	Silica dried	Pastore5209	320
Ocimeae	Hyptidinae	*Hyptis velutina*	Antar1520	Silica dried	Antar1520	281

Ocimeae	Hanceolinae	*Isodon* sp.	SRR6043765	Transcriptome	SRR6043765	343
Ocimeae	Lavandulinae	*Lavandula* sp.	ERR2040565	Transcriptome	ERR2040565	310
Ocimeae	Hyptidinae	*Leptohyptis sinphonantha*	PAFTOL_016675	Silica dried	Antar, G.M. 1334	305
Ocimeae	Hyptidinae	*Marsypianthes burchellii*	Giulietti1081	Herbarium	Giulietti1081	301
Ocimeae	Hyptidinae	*Marsypianthes chamaedrys*	PAFTOL_016677	Silica dried	Antar, G.M. 1311	293
Ocimeae	Hyptidinae	*Martianthus leucocephalus*	PAFTOL_016657	Herbarium	Paula-Souza 10240	286
Ocimeae	Hyptidinae	*Martianthus sancti. gabrielii*	Pastore2596	Herbarium	Pastore2596	307
Ocimeae	Hyptidinae	*Martianthus stachydifolius*	Nonato854	Herbarium	Nonato854	136
Ocimeae	Hyptidinae	*Medusantha crinita*	PAFTOL_016661	Silica dried	Antar, G.M. 1908	306
Mentheae	Menthinae	*Mentha*x *piperita*	SRR5150700	Transcriptome	SRR5150700	337
Ocimeae	Hyptidinae	*Mesosphaerum asperifolia*	Croat63843	Herbarium	Croat63843	268
Ocimeae	Hyptidinae	*Mesosphaerum eriocephalum*	Lewis2313	Herbarium	Lewis2313	318
Ocimeae	Hyptidinae	*Mesosphaerum irwinii*	Antar1321	Silica dried	Antar1321	315
Ocimeae	Hyptidinae	*Mesosphaerum pectinatum*	Antar2827	Silica dried	Antar2827	312
Ocimeae	Hyptidinae	*Mesosphaerum suaveolens*	PAFTOL_007671	Herbarium	PAFTOL_007671	314
Ocimeae	Hyptidinae	*Physominthe longifolia*	GassonPCD6177	Herbarium	GassonPCD6177	284
Ocimeae	Hyptidinae	*Physominthe vitifolia*	PAFTOL_016669	Silica dried	Antar, G.M. 1386	316
Ocimeae	Ociminae	*Platostoma coloratum*	PAFTOL_007674	Herbarium	PAFTOL_007674	275
Ocimeae	Plectranthinae	*Plectranthus scutellarioides*	ERR2040566	Transcriptome	ERR2040566	321
Ocimeae	Hyptidinae	*Rhaphiodon echinus*	PAFTOL_016671	Silica dried	Antar, G.M. 1274	326
Mentheae	Salviinae	*Salvia rosmarinus*	SRR5150701	Transcriptome	SRR5150701	341
Ocimeae	Siphocranioninae	*Siphocranion macranthum*	PAFTOL_007666	Herbarium	PAFTOL_007666	320



Appendix. 2. Phylogenetic relationships in Hyptidinae inferred from the coalescent-based analyses of 353 genes recovered using target enrichment with Angiosperms353 probe kit, using the Exon dataset. Values next to branches are local posterior probabilities (LPP).

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ABSTRACT

Leaf venation has not been widely used in taxonomic integrative works, although some potential in delimiting taxa has been reported. *Hyptidendron,* a neotropical genus with 20 species, seemed to present some variation in leaf venation patterns, which we sought to further investigate. A number of different herbaria were consulted, and herborized leaves were diaphanized for 20 species of *Hyptidendron* and a set of unidentified material. The taxa were classified according to their venation patterns. *Hyptidendron* possess pinnate semicraspedodromous venation with reticulate irregular tertiary, quaternary and quinternary veins. Freely Ending Veinlets show some variation between species but without clear taxonomic importance. Otherwise, perimarginal veins were greatly informative, being present only in the unidentified material. Together with differences from other species of the genus in leaf shape, margins shape, calyx indumentum and petiole size, we hypothesize the unidentified material as a new species: *Hyptidendron cerradoense,* described here. We provide a full description, illustration, a distribution map, a preliminary conservation assessment and comments on both the taxonomy and ecology of the new species. Our studies support the importance of leaf venation for taxonomic studies, even if in smaller genus.

Keywords: Cerrado, Clearing technique, *Hyptidendron,* Lamiaceae, Leaf venation, Neotropical Flora, Taxonomy

Introduction

Leaf venation has not been widely used as a source of taxonomic information, although different studies report the usage of it for recognizing taxa in different ranks (Buot 2020; Marinho *et al*. 2016; Sun *et al*. 2018). For Hyptidinae, a mostly neotropical subtribe of Lamiaceae with ca. 400 species (Harley & Pastore 2012), some works showed that differences in leaf venation can be informative within the group (Rudall 1980; Silva-Luz *et al*. 2017), suggesting that integrative taxonomy should use this character in new systematic studies.

Hyptidendron Harley, one of the 19 genera of Hyptidinae, is endemic to South America, occurring in Bolivia, Colombia, Ecuador, Guyana, Peru, Venezuela, and especially in Brazil, where all the 20 known species occur (Harley 1988; Harley & Antar 2017; Antar *et al*. 2019; Antar *et al*. 2020). The last taxonomic revision of the genus, when it was still part of *Hyptis* Jacq., was made in by Epling (1949), which did not encompass any mention of the leaf venation as a relevant taxonomic character.

During the preparation of a taxonomic revision of *Hyptidendron*, a promising leaf venation variation was detected among species studied under the stereomicroscope, leading to further investigation, which is reported here. Together with these results, we provide the description of a new species for the genus, *Hyptidendron cerradoense* Antar & Harley*,* recognized by the unique leaf venation pattern in the genus.

Materials and methods

The morphological description and diagnosis were drawn up after examining and analysing specimens of *Hyptidendron* from the following herbaria: ALCB, BHCB, BHZB, BM, BRBA, CEN, CESJ, CGMS, COR, CTBS, DIAM, ESA, ESAL, G, HDJF, HEPH, HRB, HRCB, HUEFS, HUFSJ, HXBH, IBGE, K, MBM, MBML, NX, NY, P, PAMG, R, RB, SP, SPF, SPSC,

SPSF, UB, UEC, UFG, UFMT, UFOP, UPCB, US, VIES (acronyms according to Thiers, continuously updated). A ×10 to ×60 magnification stereomicroscope was used to analyse morphological features of the specimens. Terminology follows Harris & Harris (2001) for general morphology and Hickey (1973) for leaf shape, as well as Antar *et al.* (in press) for specific terms.

IUCN criteria (2012, 2016) alongside with the GeoCAT tool (Bachman *et al.* 2011) were used to infer a preliminary conservation status. GeoCAT was applied with the IUCN default values for Extent of Occurrence (EOO) and Area of Occupancy (AOO) analysis. The distribution map was produced in QGIS version 3.0.1 (QGIS Development Team 2018). In cases where herbarium specimens lacked geo-reference data, the geographic coordinates were approximated using the locality description of the specimen label.

A list of the sampled material for leaf venation analyses is described in table 1. At least two leaves per specimen was used for each species, but whenever possible more specimens were used. The leaves taken were mature, not representing bracts and from ± the middle of the stem. For the description and classification of venation patterns, the leaves were cleared, adapting the method proposed by Strittmater (1973). The herborized material was rehydrated with distilled water and boiled for twenty minutes with 5% sodium hydroxide. The leaves were then included in 20% sodium hypochlorite until clarification. Complete clarification was obtained by subjecting the material to 5% chloral hydrate. The cleared leaves were dehydrated and then stained with 1% safranin in 100% ethanol and butyl acetate (1:1). The leaves were stretched onto glass plates and mounted with Canada balsam. We followed Ellis *et al.* (2009) for venation pattern terminology. The following vein characters were analysed: 1) Primary Vein Framework; 2) Major Secondary Vein Framework; 3) Perimarginal veins; 4) Intercoastal Tertiary Vein Fabric; 5) Quaternary Vein Fabric; 6) Quinternary Vein Fabric; and 7) Freely Ending Veinlets (FEVs). For the FEVs, where more than one type was detected, we categorize it according to the most common type.

TABLE 1. List of the species, vouchers and variable venation characters in *Hyptidendron*.

Species	Voucher	Perimarginal vein	Fev's
Hyptidendron albidum Harley & Antar	Tozzi 2001-474	Absent	Absent
Hyptidendron amethystoides (Benth.) Harley	Antar 1547	Absent	One branched
Hyptidendron amethystoides (Benth.) Harley	Antar 1839	Absent	Unbranched
Hyptidendron arboreum (Benth.) Harley	Flores 2807	Absent	Absent
Hyptidendron arbusculum (Epling) Harley	Antar 1539	Absent	Unbrached
Hyptidendron asperrimum (Spreng.) Harley	Antar 2377	Absent	Unbrached
Hyptidendron canum (Pohl ex Benth.) Harley	Antunes 283	Absent	Absent
Hyptidendron canum (Pohl ex Benth.) Harley	Antar 1628	Absent	Absent
Hyptidendron canum (Pohl ex Benth.) Harley	Bortolato 343	Absent	Absent
Hyptidendron caudatum (Epling & Jativa) Harley	Aparecida Silva 2058	Absent	Absent
Hyptidendron cerradoense Antar & Harley	Pereira da Silva 5199	Intramarginal	Absent
Hyptidendron cerradoense Antar & Harley	Pereira da Silva 16436	Marginal	Absent
Hyptidendron cerradoense Antar & Harley	Aparecida da Silva 3804	Intramarginal	Absent
Hyptidendron cerradoense Antar & Harley	Walter 4191	Intramarginal	Absent
Hyptidendron claussenii (Benth.) Harley	Antar 1429	Absent	Absent
Hyptidendron conspersum (Benth.) Harley	Antar 1612	Absent	Absent
Hyptidendron dictiocalyx (Benth.) Harley	Smith 18	Absent	Absent
Hyptidendron dictiocalyx (Benth.) Harley	Aparecida da Silva 8389	Absent	Absent
Hyptidendron eximium (Epling) Harley	Souza 17310	Absent	Unbranched
Hyptidendron glutinosum (Benth.) Harley	Hatschbach 31909	Absent	Absent
Hyptidendron glutinosum (Benth.) Harley	Souza 16406	Absent	One branched
Hyptidendron leucophyllum (Pohl ex Benth.) Harley	Antar 1923	Absent	Absent
Hyptidendron pulcherrimum Antar & Harley	Gonela 800	Absent	Absent
Hyptidendron pulcherrimum Antar & Harley	Lopes 436	Absent	Absent
Hyptidendron rhabdocalyx (Benth.) Harley	Souza 879	Absent	Absent
Hyptidendron rondonicum (Harley) Harley	Amaral 51	Absent	Absent
Hyptidendron roseum Antar, Harley & J.F.B.Pastore	Antar 1746	Absent	Unbranched
Hyptidendron unilaterale (Epling) Harley	Antar 1875	Absent	Absent
Hyptidendron valthieri (Briq.) Harley	Antar 1634	Absent	Absent
Hyptidendron vauthieri (Briq.) Harley	Edmundo Pereira 1601	Absent	Absent
Hyptidendron vepretorum (Benth.) Harley	Pirani CFCR 12844	Absent	Unbrached
Hyptidendron vepretorum (Benth.) Harley	Antar 2437	Absent	Unbrached
Hyptidendron vepretorum (Benth.) Harley	Harley 25143	Absent	Absent
Hyptidendron vepretorum (Benth.) Harley	Sevilha 1421	Absent	Unbranched
Hyptidendron vepretorum (Benth.) Harley	Sevilha 4821	Absent	Unbranched

Results

Leaf venation

Hyptidendron possesses primary pinnate venation (Fig. 1). Primary veins can be straight or rarely curved as in *H. claussenii*. Primary veins are usually prominent in the abaxial surface, and slightly impressed or slightly prominent on the adaxial surface. Secondary veins are semicraspedodromous (Fig. 1). Tertiary, Quaternary and Quinternary veins are reticulate irregular (Fig. 2). Veins are usually prominent and conspicuous in the abaxial surface and usually plane and inconspicuous in the adaxial surface. FEVs are variable between species. However, no unique species patterns could be found, nor do the most morphologically related species share similar FEVs patterns (Fig. 2). Perimarginal veins were only found in the unidentified material (represented by vouchers: Aparecida-da-Silva 3804; Pereira-Silva 5199, 16436; Walter 4191), which displayed intramarginal veins (Fig. 3), or rarely marginal ones (Fig. 3).

Taxonomic treatment

Hyptidendron cerradoense Antar & Harley, ***sp. nov.*** (Fig. 4). Type: BRAZIL: Goiás: Cavalcante, Vila Veneno - rio São Félix km 4, Área de Influência da futura Hidrelétrica de Cana Brava, influência indireta, 13°32'10"S 48°3'25"W, 27 June 2001, *Pereira-Silva & Carvalho-Silva 5199* (Holotype: CEN [00043108])

Hyptidendron cerradoense is morphologically related to *Hyptidendron arbusculum* by sharing similar leaf measurements, number of teeth in margins and number of flowers per cymes. These two species can be differentiated, as *Hyptidendron cerradoense* possesses perimarginal veins (vs. absent), blades elliptic, narrow elliptic or narrow ovate (vs. widely ovate, ovate, elliptic, widely elliptic, rarely very widely ovate), petioles 0.7−1.6 cm long (vs. petioles 1.5−2.8(−3.5) mm long), leaf margins entire to 4 teeth on each side of leaf (vs. 2−7 teeth on each side of leaf) and calyx externally pubescent to densely pubescent with glandular stipitate

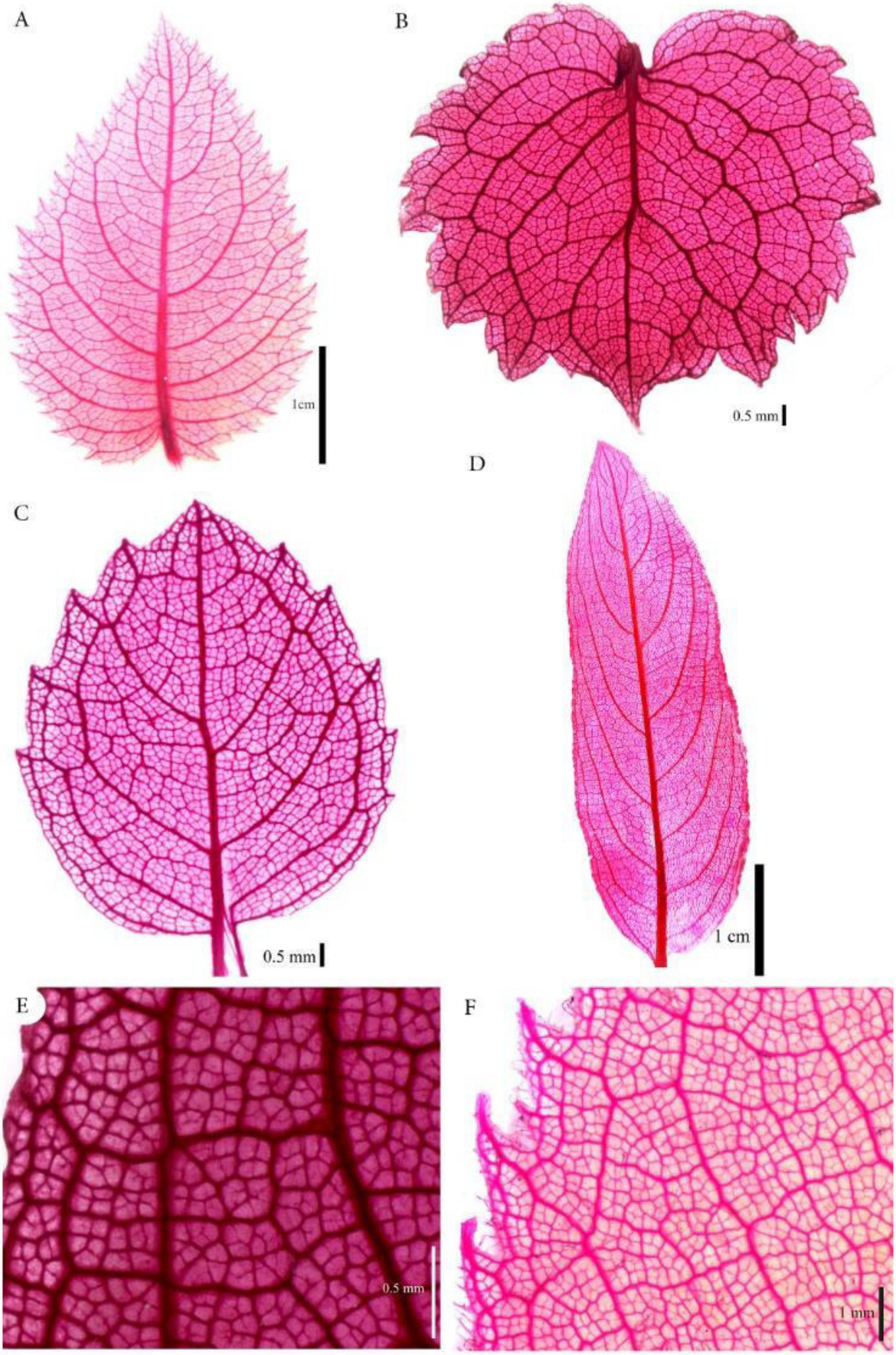
A
1cm
B
0.5 mm
D
C
0.5 mm
1 cm
E
0.5 mm
F
1 mm

FIGURE 1. *Hyptidendron* primary and secondary veins **A.** *Hyptidendron glutinosum* (Benth.) Harley, highlighting the primary pinnate venation and semicraspedodromous secondary vein. **B.** *Hyptidendron rondonicum* (Harley) Harley, highlighting the primary pinnate venation and semicraspedodromous secondary vein. **C.** *Hyptidendron dictiocalyx* (Benth.) Harley, highlighting the primary pinnate venation and secondary semicraspedodromous vein. **D.** *Hyptidendron leucophyllum* (Pohl ex Benth.) Harley, highlighting the primary pinnate venation and secondary semicraspedodromous vein. **E**. *Hyptidendron leucophyllum* (Pohl ex Benth.) Harley highlighting the secondary veins ending at a crenate margin. **F**. *Hyptidendron unilaterale* (Epling) Harley, highlighting the secondary veins ending in a serrate margin.

hairs of varying lengths and scattered long uniseriate hairs, which can be dense and hispid (vs. pubescent with glandular stipitate hairs).

Subshrubs or shrubs 30−50 cm tall, slightly aromatic or aromatic, xylopodium present; stems woody, branched, 2−4 mm diam., younger stems quadrangular, canaliculate, pubescent with long uniseriate eglandular hairs, which can be curved and soft or erect and sharp and then the surface hispid, also rarely small sessile glands and gland-tipped hairs, older stems ± squared and slightly canaliculate or not canaliculate, less hairy, with longitudinal grooves, internodes 0.3−1.5(−2.7) cm long. Cauline leaves mostly congested near the apex or somewhat spreading along the branches, densely imbricate near the apex, sometimes expanding to almost all the leaves, longer than internodes, less commonly smaller or with similar size, mostly diminishing in size towards stem apex, lamina 0.8−1.5 × 0.3−0.7 cm, chartaceous to coriaceous, concolorous or slightly discolorous, with abaxial surface paler, elliptic, narrow elliptic or narrow ovate, base rounded or cuneate, sometimes unequal, apex acute, sometimes slightly apiculate, apiculus ca. 0.5 mm long, adaxial surface glabrous or glabrescent with few gland-tipped hairs and small sessile glands, venation mostly inconspicuous, midrib or plane, secondary veins prominulous,

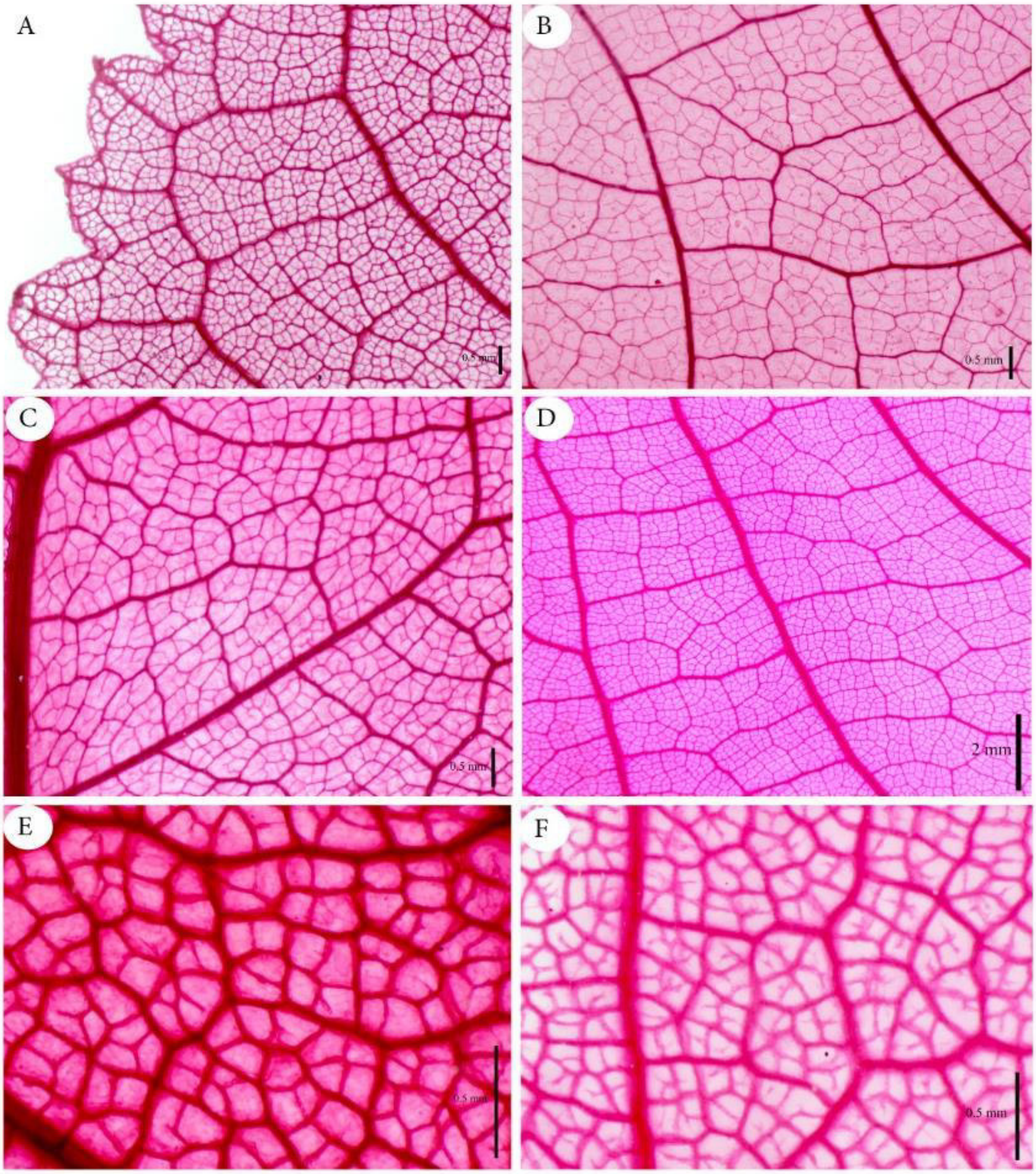

FIGURE 2. *Hyptidendron* tertiary, quaternary and quintenary veins and FEVs. **A.** *Hyptidendron glutinosum* (Benth.) Harley, highlighting tertiary, quaternary and quintenary venation. **B.** *Hyptidendron eximium* (Epling) Harley & J.F.B.Pastore highlighting tertiary, quaternary and quintenary venation. **C.** *Hyptidendron amethystoides* (Benth.) Harley, highlighting tertiary, quaternary and quintenary venation **D.** *Hyptidendron asperrimum* (Spreng.) Harley, highlighting tertiary, quaternary and quintenary venation. **E.** *Hyptidendron vauthieri* (Briq.) Harley,

highlighting FEVs absent. **F.** *Hyptidendron roseum* Antar, Harley & J.F.B.Pastore, highlighting unbranched FEVs.

perimarginal vein present, intramarginal or marginal, abaxial surface glabrous or glabrescent with few gland-tipped hairs and tiny sessile glands, the midvein occasionally with sparse long uniseriate eglandular hairs, venation reticulate, primary and secondary veins prominent, tertiary veins not so conspicuous, margins ciliate, mostly hispid with long uniseriate eglandular hairs, sometimes with gland-tipped hairs, serrulate, entire to 1/2 of leaf margin, rarely completely entire, not revolute, (0−)1−4 teeth on each side of leaf, with tooth apex swollen, acute or obtuse; petiole 0.7−1.6 cm long, canaliculate, expanded in the base, sparsely pubescent or glabrescent with gland-tipped hairs, sessile glands and rare uniseriate curved eglandular hairs. Inflorescence not forming a well-define terminal thyrsoid structure, but with dichasial axillary cymes, concentrated near the apex, subtended by bracts similar to leaves with same shape, with similar size or smaller, 0.35−1.0 × 0.1−0.35 cm, longer or smaller than cymes, mature cymes 0.7−1.7 cm long, 1−3(−4) flowered, not obscured by bracts, rarely slightly obscured by bracts, peduncles 0.4−3.5(−7.5) mm long, pubescent to densely pubescent with small gland-tipped hairs. Flowers with pedicels 1−3 mm long, pubescent to densely pubescent with gland-tipped hairs, rarely few long uniseriate eglandular hairs close to the calyx attachment, and subtended by linear bracteoles, 0.8−2.7 × 0.1 mm, pubescent to densely pubescent with gland-tipped hairs and rarely few long uniseriate eglandular hairs, mostly in the apex; calyx at anthesis (3.8−)5.5−6.4 mm long, green, tube (2.4−)3.0−4.0 mm long, ± infundibuliform, straight, ribbed, externally pubescent to densely pubescent with different height gland-tipped hairs and scattered long uniseriate hairs, which can be dense and hispid, mostly in the base and ribs, tube internally glabrescent with few hairs and with a faint ring of long uniseriate hairs in the throat, calyx lobes subequal, 1.5−3.4 mm long, with the base deltate and apex long acuminate, straight, externally with indumentum as on tube but with a concentration of long uniseriate eglandular hairs, internally pubescent with small gland-tipped hairs and margin with long uniseriate eglandular hairs, calyx in fruit 8.4−9.5 mm long, indumentum less dense, tube 5.0−6.0 mm long, ± cylindrical, ribbed, calyx lobes 2.7−4.0 mm long, subequal, straight; corolla lilac, (5.5−)8.1−8.3 mm long, tube (3.1−)4.9−5.1 mm long, ± cylindrical, becoming slightly enlarged near throat, 0.6−0.9 mm wide, externally with base glabrous becoming sparsely villous with curved uniseriate hairs and small sessile glands, internally with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally glabrous, anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous except by few long, uniseriate hairs near the anther; gynoecium with style jointed, with a well-developed stylopodium protruding above ovary, and apically with two slender stigmatic lobes. Nutlets 1 per flower, 3.0−3.6 × 1.9−2.1 mm, ellipsoid or obovoid, not flattened, not winged, castaneous, not shiny, glabrous, rugulose, with deep abscission scars, slightly mucilaginous when wetted.

Phenology: *Hyptidendron cerradoense* was found with flowering specimens in May and June and with fruiting specimens in September and November.

Distribution and Habitat: *Hyptidendron cerradoense* is endemic to Cavalcante and Niquelândia municipalities, known from seven collections (Fig. 5). It can be found from 350 to 1000 m elevation in *campo sujo, cerrado sensu stricto, cerrado rupestre* and *campo cerrado* habitats, all of these included in the Cerrado domain.

Preliminary Conservation Status: The AOO is 28 km² and the EOO is 3,408 km². *Hyptidendron cerradoense* is known for just seven collections in five localities. It is known to occur in the protected area Reserva Natural da Serra do Tombador. The conservation status of this species is assessed as Endangered according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology: The specific epithet refers to the Cerrado domain in which the species is endemic. The Cerrado is the richest savanna biome with ca. 12451 angiosperm species recognized, of which 5138 are endemic (Flora do Brasil 2020, under construction). Despite this high number of richness and endemism, the domain has been continuously suffering from area lost, with more than 50% of its original area already replaced (Beuchle *et al.* 2015), putting it as one of the hotspots of conservation (Mittermeier *et al*. 2011).

Specimens examined: **Selected specimens examined**: BRAZIL. Goiás: Cavalcante, UHE Cana Brava. Arraial São Félix. Margem direita do Rio Tocantins. Margem direita do Rio São Félix, 13°31'10"S 48°3'4"W, 9 Sep 2000, *Bucci 1382* (UFG); Cavalcante, E Cavalcante-Minaçu, km 75, entrada à direita da rodovia com destino ao rio São Félix, Serra do Tombador, 06 Nov 2012, *G. Pereira-Silva et al. 16436* (CEN); Cavalcante, Reserva Natural da Serra do Tombador, área atrás da sede, área queimada out/17 após 12 anos, 13º39'05"S, 47º49'51"W, 26 Jun 2018, *C.A.S. Rodrigues 26* (CEN); Niquelândia, 14°45'36,01"S 48°3'36,01"W, 17 Sep 2018, *Boldrim et al. 4038* (CEN); Niquelândia, 4 km do povoado de Muquém em direção a Niquelândia, 14°31'41"S 48°9'8"W, 8 May 1998, *Aparecida da Silva et al. 3804* (IBGE, K, US); Niquelândia, área de influência do AHE Serra da Mesa, estrada de terra Niquelândia – Muquém, cerca de 3 km antes de Muquém, 14°32'17"S 48°9'21"W, 3 Jun 1998, *Walter et al. 4191* (CEN).

Affinities and morphological notes: *Hyptidendron cerradoense* is unique in the genus by the presence of a perimarginal vein. The new species is also similar to *H. vepretorum* differing from it by the perimarginal vein present (vs absent), lamina indumentum glabrous or glabrescent with few gland-tipped hairs and small sessile glands (vs abaxial surface pubescent, densely pubescent or rarely villous with gland-tipped hairs and long eglandular uniseriate hairs), leaf margin entire or with 1−4 teeth on each side of leaf (vs (1−)3−14 teeth on each side of leaf) and cymes not obscured by bracts, rarely slightly obscured by bracts (vs. mostly obscured by bracts, at least partially).

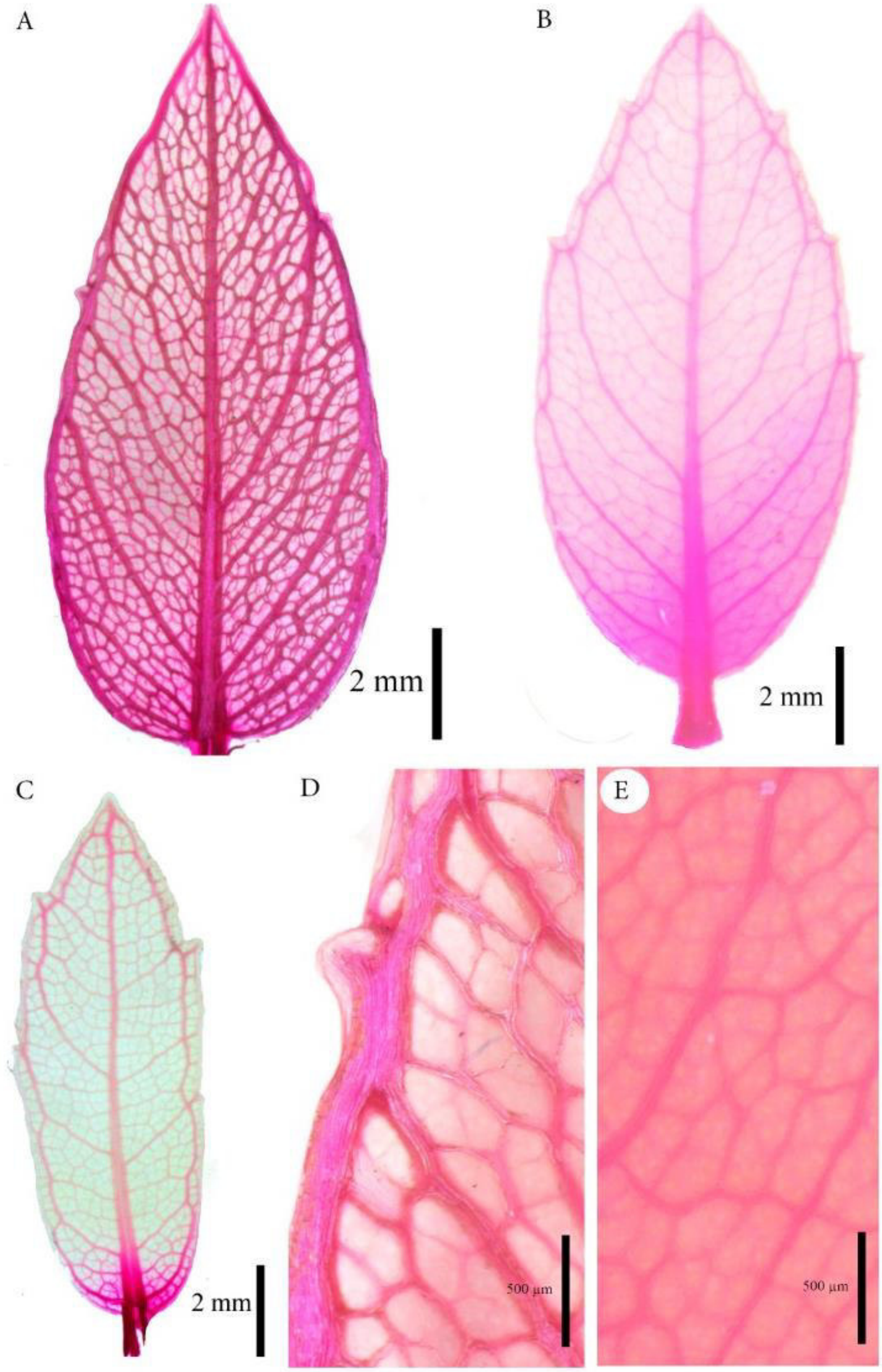

FIGURE 3. *Hyptidendron cerradoense* Antar & Harley venation. **A.** Marginal veins. **B.** Intramarginal venation. **C. I**ntramarginal veins. **D.** Marginal veins, highlighting the high caliber of the perimarginal veins. **E.** Tertiary, quaternary and quintenary veins.

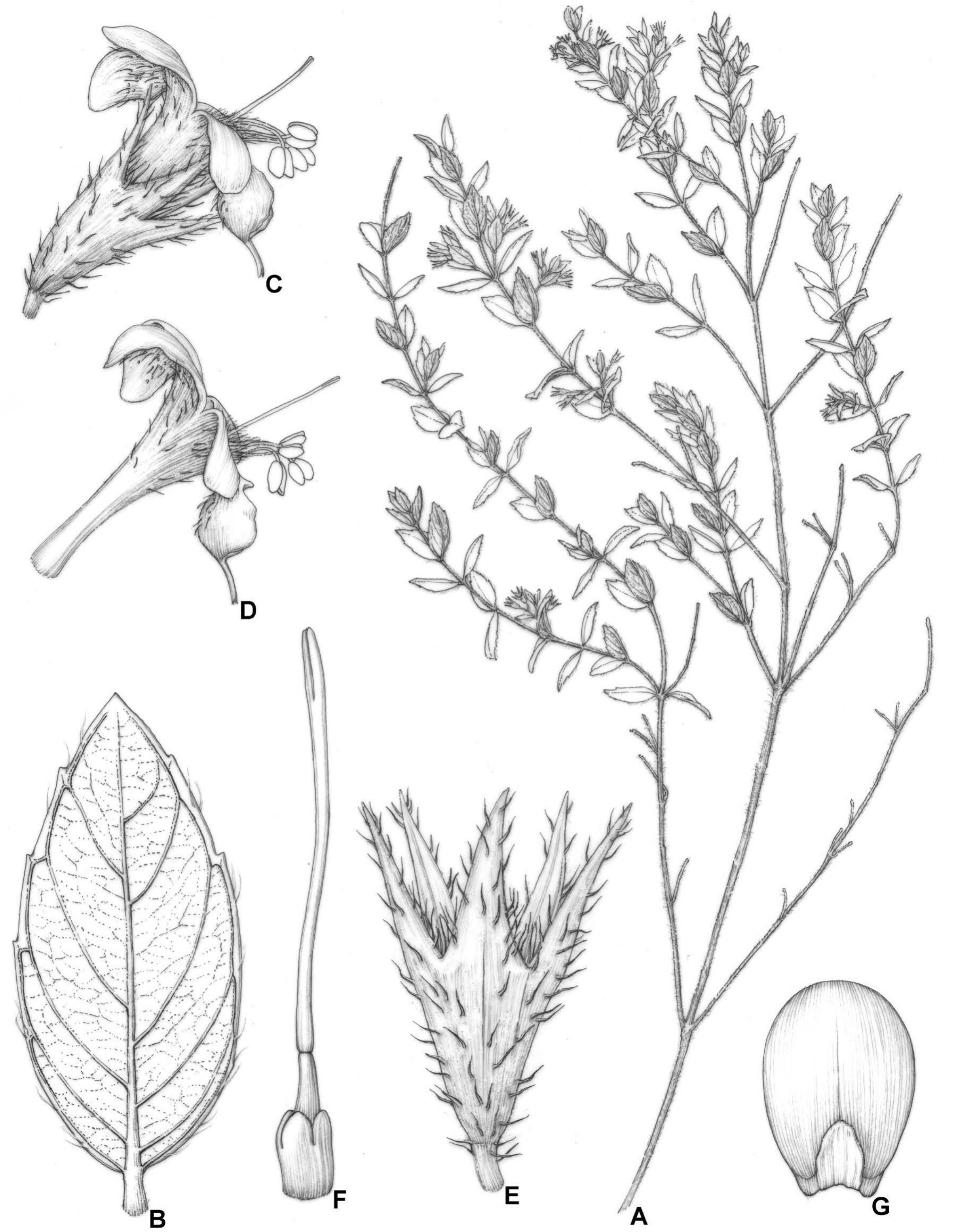

FIGURE 4. *Hyptidendron cerradoense* Antar & Harley **A.** Branch bearing leaves and inflorescences. **B.** Leaves, adaxial surface with indumentum detail. **C.** Leaves, abaxial surface with indumentum detail. **D.** Immature cyme. **E.** Part of an inflorescence showing calyx and bracteole. **F.** Flower, side view. **G.** Corolla, side view. **H.** Gynoecium and style, showing stylopodium. **I.** Ovary. **J.** Mature calyx. **K.** Nutlet. **A–K.** Illustration by Klei Sousa based on Pereira-Silva 5199 (CEN).

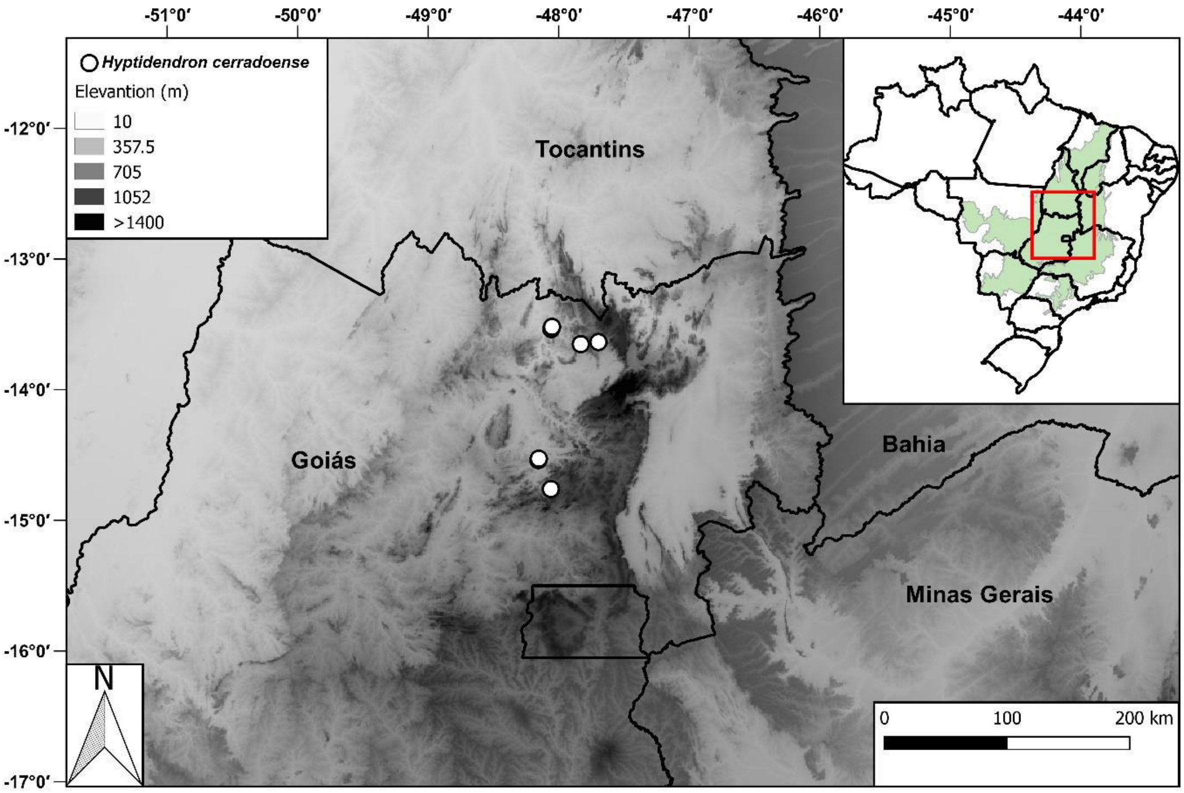

FIGURE 5. Distribution of *Hyptidendron cerradoense* Antar & Harley (white circles). In the small map, the green shape shows the extension of the Cerrado domain.

At first we thought of recognizing two separate taxa from Niquelândia and Cavalcante municipalities, respectively, as these two populations share interesting differences in peduncle size, with populations from Cavalcante with reduced peduncles up to 1.7 mm long and populations from Niquelândia with peduncles from 3−7.5 mm long. However, after careful morphological analyses, although populations from Cavalcante and Niquelândia are ca. 200 km distant, we considered them as part of the same species. Although the peduncle size is somewhat relevant for *Hyptidendron* taxonomy, this feature isolated and mostly seen in just a few specimens, could not be used solely to recognize two different taxa. Furthermore, specimens from Serra do Tombador (Pereira-Silva 16436; Rodrigues 26) also have some other unique features as conspicuously imbricate leaves, reduced pedicels and leaves mostly entire with perimarginal marginal venation. However, as it shares most of its morphological features with the other populations from Cavalcante and Niquelândia, we prefer to maintain it within *H. cerradoense* concept. Further collections and observation *in vivo* may be useful to better understand this variation.

Discussion

Hyptidendron possesses semicraspedodromous secondary venation which is the most common type in Hyptidinae (Rudall 1980). Other taxa within the subtribe can present craspedodromous type as some species in *Cyanocephalus* Harley & J.F.B.Pastore and *Hyptis* (Silva-Luz *et al*. 2012); brochidodromous type as in *Hyptis* sect. *Pachyphyllae* (Epling) Harley (Rudall 1980) and some other species of *Hyptis* (Silva-Luz *et al*. 2012); and eucamptodromous as in some species of *Hyptis* (Silva-Luz *et al*. 2012). Although taxonomic and evolutionary significance of these variation within the subtribe remains obscure, future studies, supported by phylogenies, are much desired and can sustain venation as an important feature for the subtribe's taxonomy.

Although *Hyptidendron* is a relatively small genus, currently with 21 species recognized, it is noteworthy that variation in leaf venation, a genetic determined character (Roth-Nebelsick et al. 2001), is significant for its taxonomy. Our studies support the recognition of a new species that was already apparent due to other morphological and geographical differences from the known species of the genus. In view of this, the integration from classic morphological studies and anatomical studies with leaf venation, in the context of integrative taxonomy, allowed us to circumscribe and describe the new species.

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Taxonomic revision of *Hyptidendron* Harley (Hyptidinae, Lamiaceae)

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Taxonomic revision of *Hyptidendron* Harley (Hyptidinae, Lamiaceae)

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Abstract

A recent molecular phylogenetic analysis recognized *Hyptidendron* as monophyletic with three clades within it. Here we propose the first taxonomic revision of the genus in its current circumscription alongside a revision of its literature and taxonomic history. In total, 22 species restricted to South America with most of the diversity in Brazil are recognized. A new species is described, *Hyptidendron dorothyanum* Antar & Harley and 10 lectotypifications are proposed. This taxonomic revision includes detailed descriptions, a dichotomous key, distribution maps, preliminary conservation status assessment, photographic plates, phenological diagrams, illustrations and comments on the ecology, recognition and distribution of all species. Our results support the importance of detailed taxonomic studies to better understand biodiversity and to propose effective conservation strategies and well-grounded biodiversity modeling or big data studies.

Key words: *Hyptis*, Ocimeae, Neotropics, Nepetoideae, systematics, taxonomy

Introduction

Lamiaceae, a diverse family with worldwide distribution with over 7000 species (Li *et al*. 2016), is an important component of Neotropical biomes. This is in great part due to the particular species-richness of subtribe Hyptidinae (subfamily Nepetoideae, tribe Ocimeae), which comprises about 400 species and ranges from south United States to Argentina with most of the diversity in Brazil (Harley & Pastore 2012).

Hyptidinae when first treated by Bentham (1833, 1848) was divided in four genera: *Eriope* Humb. & Bonpl. ex Benth., *Marsypianthes* Mart. ex Benth., *Peltodon* Pohl and *Hyptis* Jacq., the later, highly diverse in morphology comprising approximately 300 species separated in 20 sections. Schauer (1844) segregated the monotypic genus *Rhaphiodon* Schauer, former treated as a species of *Hyptis* by Bentham (1833). In the course of studies conducted by Carl Epling and Raymond M. Harley during the XX century, another 4 genera were proposed based on morphology: *Asterohyptis* Epling, *Eriopidion* Harley, *Hypenia* (Mart. ex Benth.) Harley and *Hyptidendron* Harley, but still, *Hyptis* remained highly morphological diverse with 24 sections (Harley & Pastore 2012).

Finally, a phylogenetic study based on molecular data (Pastore *et al*. 2011) recognized Hyptidinae as monophyletic and seven of the current nine genera accepted at the time monophyletic, but *Hyptis* as polyphyletic. Based on this result, a new circumscription of *Hyptis* was proposed with the recognition of 19 genera within the subtribe (Harley & Pastore 2012).

Hyptidendron Harley*,* a neotropical genus of currently 21 species (Antar *et al*. in prep), is characterized by having inflorescences arranged in complex bracteolate pedunculate cymes and pedicellate flowers with styles jointed above its base forming a stylopodium which is persistent and protruding above the top of the ovary (Harley 1988; Harley & Antar 2017;

Antar *et al*. 2019a; Antar *et al*. *in press*). Harley (1988) formulated *Hyptidendron* by segregating species from two former sections of *Hyptis*: *Hyptis* sect. *Buddleioides* and *Hyptis* sect. *Umbellaria*. These sections had been recognized by Epling (1949) in his revision of *Hyptis*, which was the last taxonomic work that encompasses the species now treated in *Hyptidendron*.

Hyptidendron* Taxonomic history:—**The first known species, now part, of *Hyptidendron*, was published as *Cordia asperrima* Spreng. in the family Boraginaceae by Sprengel (1824). Later, Bentham (1833) made the first taxonomic treatment of the subtribe Hyptidinae, considering the species now recognized in *Hyptidendron* in four sections of *Hyptis* (the names in bold are now part of *Hyptidendron*), named *Hyptis* sect. *Buddleioides,* composed of ***Hyptis membranacea Benth. and *H. tafallae* Benth.; *Hyptis* sect. *Umbellaria* composed of ***Hyptis rhabdocalyx*** Mart. ex Benth. and *H. tomentosa* Poit.; *Hyptis* sect. *Siagonarrhen* composed of ***Hyptis leucophylla*** Pohl ex Benth., ***H. laurifolia*** A.St-Hil. ex Benth., ***H. scabra*** Benth., ***H. cana*** Pohl. ex Benth., ***H. sordida*** Pohl. ex Benth., ***H. altissima*** A.St-Hil. ex Benth., *H. latifolia* Mart. ex Benth. and *H. salviifolia* Pohl. ex Benth.; and *Hyptis* sect. *Minthidium*, composed of ***Hyptis vepretorum*** Mart. ex Benth., *H. pulegioides* Pohl ex Benth., *H. albida* Kunth, *H. pubescens* Benth., *H. mociniana* Benth., *H. spinulosa* Benth., *Hyptis stellulata* Benth., *H. scoparia* Poit., *H. verticillata* Jacq., *H. fasciculata* Benth., *H. fastigiata* Benth., *H. eriocalyx* A.St-Hil. ex Benth., *H. vesiculosa* Benth., and *H. calida* Mart. ex Benth. Bentham (1833) states in this classical work that due to the great richness and variety of habits it would be better to divide *Hyptis* in a number of different genera, still he was unable to get sufficient characters to differentiate the groups and preferred to maintain separated sections of a larger genus.

Later, Bentham (1848) in De Candolle's Prodomus, rearranged *Hyptis* sections and added some new species. The members that now compose *Hyptidendron* were placed in three sections: *Hyptis* sect. *Turbinaria*, an arrangement of *Hyptis* sect. *Minthidium* and *Hyptis* sect. *Umbellaria* composed by ***Hyptis amethystoides*** Benth*.,* ***H. glutinosa*** Benth*.,* ***H. rhabdocalyx, H. dictiocalyx*** Benth. (including ***H. dictiocalyx*** var. ***elatior*** Benth.), ***H. vepretorum, H. claussenii*** Benth*., H. tomentosa* and *H. laniflora* Benth.; *Hyptis* sect. *Buddleioides*, including ***Hyptis membranacea, H. arborea****, H. tafallae*; and *Hyptis*. sect *Siagonaarrhen* subsect. *Cymosae* with ***Hyptis leucophylla***, ***H. laurifolia***, *H. scabra*, ***H. cana, H. sordida, H. conspersa*** Benth. and ***H. altissima***.

Those two Bentham's studies (1833, 1848) already expose the morphological proximity between the species that compose *Hyptidendron*, and the species that are now treated in the genus *Condea*. The species *Hyptis tafallae, H. tomentosa, H. albida, H. scoparia, H. verticillata, H. fasciculata, H. fastigiata, H. eriocalyx* and *H. laniflora*, now treated in *Condea*, were all placed in sections with species that are current placed in *Hyptidendron*. Also, four species of what is *Asterohyptis*: *Hyptis pubescens* and *H. mociniana*, *H. spinulosa* Benth. and *H. stellulata* Benth.; one species that is still treated in *Hyptis*: *H. pulegioides*; two species that are now treated in *Eriope*: *Hyptis salviifolia* and *H. latifolia*; one species that is now treated in *Lepechinia* Willd.: *Hyptis vesiculosa* Benth. and one in *Leptohyptis*, *Hyptis calida* Mart. ex Benth. were also present. Even so, it is remarkable how Bentham (1833, 1848) grouped what is now *Hyptidendron* based on so few specimens available at that time (Harley 1976).

After Bentham's accounts, a treatment for Lamiaceae of Brazil was made by Schmidt (1858) in the Flora Brasiliensis. He introduced a new classification of *Hyptis* based on inflorescence morphology, encompassing the species now treated in *Hyptidendron* in *Hyptis* sect. *Paniculatae* ser. *Confertiflorae* and *Hyptis* sect. *Cymoso-Axillares* with also many species now included in other genera. He also mentioned the unpublished name *Siagonarrhen subincanus* as a synonym for *Hyptis leucophylla*, based in the Martius' label annotation in M. However, *Siagonarrhen* was never validly published (*nomen nudum*), as well the species *S. subincanus*. Those new sections of *Hyptis* proposed by Schmidt (1858) were ignored by later workers (Harley & Pastore 2012). Kuntze (1891) recognized *Mesosphaerum* Browne (1756) as an earlier name than *Hyptis* Jacq. (1887), and combined all names, published by Bentham (1833, 1848) under *Hyptis*, in this genus. However, in order to maintain taxonomic stability, *Hyptis* was conserved against *Mesosphaerum* and *Condea* Adans. (1763) by the International Botanical Congress of 1905 following a proposal by Briquet (1906) (see Turland *et al*. 2018).

A new revision of the family Labiatae was provided by Briquet (1897), in Engler and Prantl's Pflanzenfamilien. In this, the species, now recognized as *Hyptidendron*, were placed in three *Hyptis* sections: *Hyptis* sect. *Siagonarrhen* subsect. *Cymosae*, *H.* sect. *Buddleioides* and *H.* sect. *Umbellaria* subsect. *Leiocalycinae*. Briquet (1898) also described some new taxa that are now treated in *Hyptidendron*: *Hyptis arborea* subsp. *bracteosa* Briq. (*Mesosphaerum arboreum* subsp. *bracteosum*) in *Hyptis* sect. *Buddleioides*, *Hyptis vauthieri* Briq. in sect. *Umbellaria* and in *Hyptis* sect. *Siagonarrhen Hyptis macrotricha* Briq. (which is now treated in *Eriope*), *Hyptis leucochlora* Briq., and *Hyptis plagiostoma* Briq.

Glaziou (1911) published *Hyptis schwackei* Glaz. a *nomen nudum*, in a work that was later incorporated in suppressed works in the International Code of Nomenclature for algae, fungi, and plants (Turland *et al*. 2018) following the proposal by Mansano and Pederneiras (2016).

Following those treatments, the next systematic study of Hyptidinae was by Carl Epling, who did the most important studies in the subtribe up to the mid-20th century. In his Synopsis of South American Labiatae (Epling 1935, 1936a, 1936b, 1937) he treated the species that are now part of *Hyptidendron* in *Hyptis* sect. *Umbellaria* and *Hyptis* sect.

Buddleioides subsect. *Cymosae*. The first one included also *Hyptis fruticosa* Salzm. ex Benth., now treated as *Eplingiella fruticosa* (Salzm. ex Benth.) Harley & J.F.B. Pastore, plus *Hyptis arbuscula* Epling based on *Hyptis dictiocalyx* var. *elatior* that Bentham described in 1848. He also described *Hyptis eximia* Epling in the monotypic *Hyptis* sect. *Latiflorae*. In this work Epling (1936b) also proposed some synonymizations. He synonymized *Hyptis arborea* subsp. *bracteosa* in *H. arborea*; combined *Cordia asperrima* in *Hyptis* and synonymized *Hyptis membranacea* under *Hyptis asperrima* (Spreng) Epling; and synonymized *Hyptis altissima*, *Hyptis scabra*, *Hyptis sordida*, *Hyptis leucochlora* and *Hyptis plagiostroma* under *Hyptis cana*.

In 1949 Epling published a revision of *Hyptis*, being the most up to date taxonomic treatment of the species that now are part of *Hyptidendron*. In this work he treated the species that now compose *Hyptidendron* in *Hyptis* sect. *Umbellaria* composed of 12 species including *Hyptis fruticosa* and *Hyptis cuniloides* Epling that are not part of *Hyptidendron* and also *Hyptis cymosa* Epling a *nomen nudum* and *Hyptis* sect. *Buddleioides* composed of six species.

Later, Epling also added two species to *Hyptis* sect. *Umbellaria*, *Hyptis unilaterale* Epling (1951) and *Hyptis caudata* Epling & Jativa (1968).

After Epling's studies, R.M. Harley started to work systematically with the subtribe from 1968 until the present. He added a novelty that now is part of *Hyptidendron*, *Hyptis rondonica* Harley in 1986.

Harley (1988), by the combination of two former sections of *Hyptis* Jacq.: *Hyptis* sect. *Umbellaria* Benth. and *Hyptis* sect. *Buddleioides* Benth., published the new genus *Hyptidendron*. The name derives from *Hyptis*, the genus in which *Hyptidendron* species was previously recognized, and *-dendron* (meaning woody), in this way Harley created a genus to accommodate some of the taller and woodier species of *Hypti*s. When proposed (Harley

1988), separated the genus in two sections: *Hyptidendron* sect. *Hyptidendron* and *Hyptidendron* sect. *Umbellaria*. He also removed from *Hyptis* sect. *Umbellaria*: *Hyptis fruticosa* and *Hyptis cuniloides* that remained unplaced in *Hyptis* until they were finally located in a new genus *Eplingiella* Harley & J.F.B.Pastore (Harley & Pastore 2012), following the phylogenetic hypothesis proposed by Pastore *et al.* (2011). He also synonymized *Hyptis laurifolia* in *Hyptidendron leucophyllum* (Pohl ex Benth.) Harley.

Harley and Pastore (2012) also recognized *Hyptidendron eximium* (Epling) Harley & J.F.B.Pastore based on *Hyptis eximia*. Based on the results of their earlier phylogenetic study of the subtribe, they also no longer recognized the infrageneric classification of *Hyptidendron* made by Harley (1988).

Hyptidendron had few species treated in floras, as the Flora of the Venezuelan Guyana (Harley 1999) including *Hyptidendron arboreum* (Benth.) Harley; Flora da Serra do Cipó (Silva-Luz *et al.* 2012), *H. asperrimum* (Spreng.) Harley*, H. vauthieri* (Briq.) Harley and *H. canum* (Pohl ex Benth.) Harley; Flora da Serra Negra (Mota *et al.* 2017), Flora do Parque Nacional do Caparaó (Romão *et al.* 2010) and Flora do Parque Estadual do Ibitipoca (Mota *et al.* 2020) treated *H. asperrimum*; Flora Grão-Mogol (Vásquez & Harley 2004) *H. vepretorum* and *H.* aff. *unilaterale* (Epling) Harley*;* and Flora treated *H. asperrimum.*

During our studies for this revision, several new species were published, including the description of *Hyptidendron albidum* Harley & Antar, *Hyptidendron roseum* Antar, Harley & J.F.B.Pastore, *Hyptidendron pulcherrimum* Antar & Harley and *Hyptidendron cerradoense* Antar & Harley. After a new phylogenetic work, coupled with the same project, *Hyptidendron* was recognized as monophyletic and three sections were recognized (Antar *et al.* in prep), which are treated in this revision.

Phylogeny and infrageneric classification:—The first time *Hyptidendron* was treated in a phylogenetic context was in a paper by El Gazzar & Rabei (2008), who used a numerical approach based on morphological characters. They sampled six taxa in *Hyptidendron*: *H. asperrimum, H. arboreum, H. conspersum* (Benth.) Harley*, H. dictiocalyx* (Benth.) Harley and the synonyms *Hyptis scabra* (synonym of *Hyptidendron canum*) and *H. membranacea* (synonym of *Hyptidendron asperrimum*). Their results mostly showed the formation of two groups separating *H. dictiocalyx* from the rest.

Pastore *et al*. (2011) made the first phylogenetic analyses based on molecular data that encompassed *Hyptidendron* species. They presented two phylogenies, one sampling four species of *Hyptidendron* for six markers and the other presenting nine species using just ITS marker. Neither phylogeny recovered *Hyptidendron* as monophyletic as the first one recovered *Hyptis vitifolia* Pohl ex Benth. (later transferred to *Physominthe* Harley & J.F.B.Pastore) in a polytomy with *Hyptidendron* species, and the later recovered *Hyptidendron* species in two clades. *Hyptis eximia* was recovered within *Hyptidendron* species and was later transferred to the genus. Harley & Pastore (2012) when proposing the new combinations to accommodate the phylogenetic results, presented a diagram displaying the phylogenetic relationships between the genera recognized, in which they show *Hyptidendron* as sister to *Physominthe.*

Pastore *et al*. (in press) proposes a new phylogeny for the subtribe, based on the same six markers plus the waxy region and with a much broader sampling. Twelve terminals of *Hyptidendron* were included and the genus was recovered as paraphyletic with two separated clades, one of them composed by what is currently recognized as *Hyptidendron* sect. *Latiflorae* and the other with *Hyptidendron* sect. *Hyptidendron* and *Hyptidendron* sect. *Umbellaria*.

Antar *et al*. (in prep.) proposed a new phylogeny for the subtribe based on nuclear genomic data in which they recovered *Hyptidendron* as monophyletic with a high support. The genus was divided in three well supported clades, which are recognized as sections in this paper.

Materials and Methods

Species concept:—Here we adopted the phylogenetic species concept, in which we used a unique combination of character states to recognize the proposed species (Wheeler & Platnick 2000). Data from the molecular phylogeny by Antar *et al*. (in prep.) associated with data from macro and micromorphology, distribution and ecology were used to achieve robust taxonomic circumscriptions.

Fieldwork:—Eleven field expeditions from 2016 to 2019 were carried out for this taxonomic treatment; many other field expeditions have been made by the second author in the course of his studies in Hyptidinae that goes back to 1968. However, *Hyptidendron albidum, H. cerradoense, H. dorothyanum* Antar & Harley*, H. pulcherrimum* and *H. rondonicum* (Harley) Harley were species not seen in nature by any of the authors. Geographical coordinates, habit and habitat types, population data and levels of conservation of the environments were recorded. Expeditions encompassed most of the distribution and habitats of *Hyptidendron*, including: vegetation types of the Cerrado domain, such as *campo rupestre* (natural herbaceous or shrubby vegetation, on quartzitic, sandy or stony soils, mostly occurring above 900 meters elevation), open and closed savanahs and riparian forests; and vegetation types of the Atlantic Forest domain, including semideciduous forest or montane forest (Fiaschi & Pirani 2009). The concepts of phytogeographic domains and Brazilian vegetation types follow those proposed by Coutinho (2006), itself based on the system of Walter (1985) and used by Flora of Brazil 2020 (Flora of Brasil 2020, under construction).

Herbaria:—The morphological description was based on the specimens seen in the following herbaria: ALCB, BHCB, BHZB, BM, BRBA, CEN, CESJ, CGMS, COR, CTBS, DIAM, E, ESA, ESAL, FLOR, G, HDJF, HEPH, HRB, HRCB, HUEFS, HUFSJ, HXBH, IBGE, ICN, K, M, MBM, MBML, NX, NY, P, PAMG, R, RB, SP, SPF, SPFR, SPSC, SPSF, UB, UEC, UFG, UFMT, UFOP, UPCB, US, VIES, W, WU (acronyms according to the Index Herbarium – Thiers, continuously updated). The specimens used in the descriptions are partially listed in the "Selected specimens examined" section of each taxon, which is complemented by a virtually complete list of exsiccatae (appendix 1).

Taxonomic analysis and distribution: During the course of the revision, a matrix has been built for all the species analyses, using a database constructed by the second author in the course of this studies within Hyptidinae. This database had the following columns: herbaria, collector, number, day, month and year of the collection. with the previous identification of the specimen, the date of determination and in case of new determination by the authors the date of determination. These data were analysed in R utilizing MonographaR package (Reginato 2016). For distribution purposes, coordinates were gathered from the labels and in case of absence of those, specimens were georeferenced using the locality description. In case of impossibility of georeferencing the specimens, the centroid coordinate for the municipality was used.

For morphological analyses a 10−60 × magnification stereomicroscope was used to analyse morphological features of the specimens. Terminology follows Harris & Harris (2001) for general morphology, including indumentum classification and Hickey (1973) for leaf shape, as well as Epling (1949), Rudall (1980a) and Harley & Pastore (2012) for specific terms. Only mature leaves were considered for measurements. At least three flowers, taken from three different specimens, were rehydrated and opened to make the flower and nutlet descriptions, unless the taxon did not have three flowering specimens available. Measurement of calyces in flower and fruit are based on rehydrated flowers. Calyx at anthesis was measured by opened corollas (triggered or untriggered) and calyx in fruit with calyx with mature nutlets inside.

Conservation Assessment: IUCN criteria (IUCN 2012) alongside with ConR package in R (Dauby *et al*. 2017) were used to infer preliminary conservation status assessment. ConR function was applied with the IUCN default values for Extent of occurrence (EOO) and Area of occupancy (AOO) analysis. The distribution maps were produced in QGIS version 2.16.0 (QGIS Development Team 2018). In case of herbarium specimens being not geo-referenced, the geographic coordinates were approximated using the locality description of the specimen label.

Typification and nomenclatural notes: Most *Hyptidendron* species were first described in *Hyptis* by Bentham (1833, 1848), who sometimes cites just one specimen, which we interpret as holotype designation. He used the term "v.s. sp", where he has seen a specimen in the herbarium indicated, and "h.s.sp." where he had a specimen in his own herbarium (now in K). When Bentham used more than one gathering in the original description, the species were mostly later "inadvertently" lectotypified by Epling (1936b), following Prado *et al*. (2015).

Results

I. Morphological and micromorphological characterization of *Hyptidendron*

Habit:—*Hyptidendron* is a genus primarily composed of trees and shrubs, with a few species, such as *H. glutinosum* being subshrubs (Fig. 1). It is remarkable that the genus encompasses trees as *H. arboreum* or *H. asperrimum* reaching up to 20 m, being that way probably the tallest trees of Nepetoideae, a subfamily mainly characterized by herbs or shrubs. It is also remarkable that the habit and height of the species can be enormously influenced by the environment and human activity of wood collecting. In both *Hyptidendron arboreum* and *H. canum*, individuals can be found that are shrubs little more than 1 m tall, although both species are typically trees. Fire seems to play an important role to determine the habit in the Cerrado domain species, which is well documented in the literature for other Cerrado species (e.g. Gottsberger & Gottsberger 2006). Some species, such as *Hyptidendron dictiocalyx* or *H. vepretorum* (Benth.) Harley, can have an underground reserve system, probably related to the ability to sprout after fire, also a common feature described for Cerrado domain species. The branches are usually erect, as for *Hyptidendron leucophyllum* (Pohl ex Benth.) Harley but can also sometimes be horizontal as observed in *H. roseum* or *H. pulcherrimum*. *Hyptidendron* species are mostly evergreen perennials. Apparently, some species as *Hyptidendron amethystoides* (Benth.) Harley, *H. eximium*, *H. glutinosum* (Benth.) Harley, which have mostly slender stems, can have a short life circle of just few years. *Hyptidendron amethystoides* populations were found almost leafless after fruiting, suggesting senescence after flowering. Other species, although without dense woody stems, can be expected to live for some years.

Stem:—The stem is usually square and canaliculate, at least in younger parts. In older parts, it can become terete and not canaliculate, but then it usually has conspicuous longitudinal grooves. The stem in *Hyptidendron* is solid, with the exception of *H. eximium*, which is clearly fistulose. Most of the species are conspicuously branched, although some species, such as *H. glutinosum, H. eximium* or *H. rondonicum* can have few branches, mostly near the inflorescence. Internode length can vary within the genus and within specimens. However,

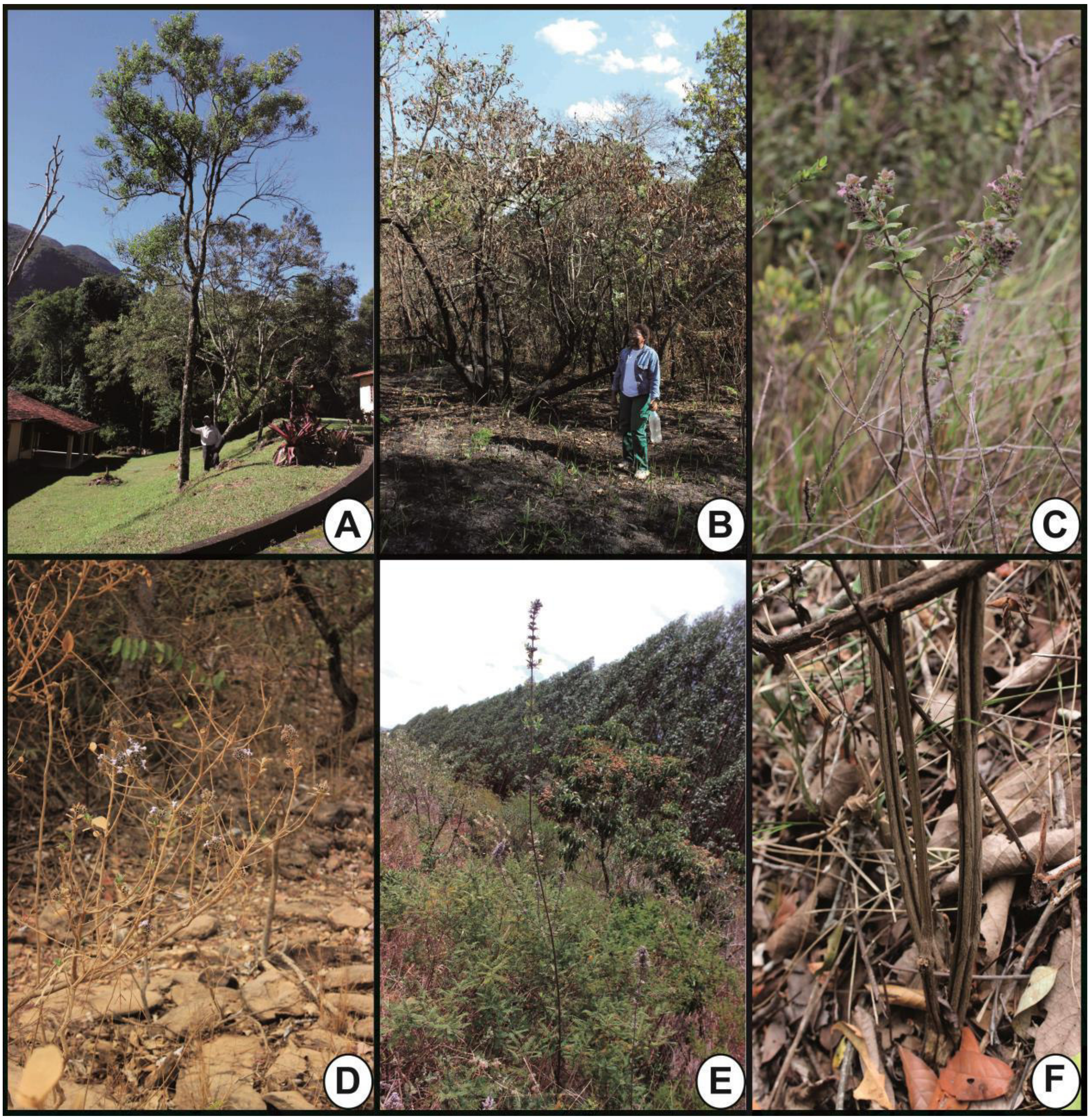

FIGURE 1. Habit in *Hyptidendron* Harley. **A.** *Hyptidendron asperrimum* (Spreng.) Harley, Parque Nacional do Caparaó. **B.** *Hyptidendron canum* (Pohl ex Benth.) Harley, Jardim Botânico de Brasília. **C.** *Hyptidendron vauthieri* (Briq.) Harley, Parque Nacional da Serra do Cipó. **D.** *Hyptidendron canum* (Pohl ex Benth.) Harley, Diamantina municipallity. **E.** *Hyptidendron leucophyllum* (Pohl ex Benth.) Harley, Diamantina municipalitty. **F.** *Hyptidendron amethystoides* (Benth.) Harley, Lençois municipalitty. A-F. by G.M. Antar.

some species, such as *H. leucophyllum*, clearly possess longer internodes than other species with much more congested nodes.

Leaves:—Leaves are simple, opposite, decussate and often aromatic. Most species are at least slightly aromatic, some species, such as *Hyptidendron claussenii* (Benth.) Harley and *H. vauthieri*, are conspicuously so. Other species, such as *H. asperrimum* appear to be odorless. It is remarkable that in some species, as *Hyptidendron vauthieri*, leaf oxidation is very fast with leaves becoming dark few hours after collecting. Rarely, older stems can possess 3-verticillate leaves, as recorded for *Hyptidendron claussenii* or *H. caudatum* (Epling & Jativa) Harley. Leaves may be congested in the apex of the branches or spreading, showing a range of variation on different specimens, probably due to envirommental factors. In some species, very few leaves are present during flowering and fruiting periods when mostly only bracts are present. The leaves can vary significantly throughout the genus, with species ranging from one cm long, as in *Hyptidendron dictiocalyx*, to more than 20 cm long in *H. asperrimum* or *H. canum*. The leaves are mostly chartaceous to coriaceous but can rarely be membranous as in *H. eximium*. The leaf shape can also vary but it, in most cases, the variation is between ovate to elliptic. The leaf margin is crenulate-serrulate or serrate, mostly irregularly, with a variable number of teeth on each side of the lamina, varying from one in *Hyptidendron cerradoense* to 96 in *H. asperrimum*. Rarely, it may be entire. It has been suggested that the teeth may sometimes possess hydathodes (Rudall 1980a). The venation is semicraspedodromous, usually prominent in the abaxial surface, with the venation reticulate and plane, slightly impressed or slightly prominent and usually inconspicuous on the adaxial surface. The petiole may vary from being virtually absent in *Hyptidendron claussenii*, *H. rondonicum* and *H. roseum*, to having long petioles up to 5 cm in *H. amethystoides* or *H. asperrimum*. The petioles are usually canaliculate and hairy.

Indumentum:—The indumentum of leaves is primarily tomentose, pubescent or rarely glabrescent, with some species of *Hyptidendron* sect. *Hyptidendron* with rigid hairs on the adaxial surface, making it scabrous. In *Hyptidendron* is also possible to find dendroid hairs (*Hyptidendron* sect. *Hyptidendron*, *H. albidum* and *H. rondonicum*) which also occur in a few species of *Eriope*, *Cantinoa* Harley & J.F.B.Pastore, *Condea* and *Cyanocephalus* Harley & J.F.B.Pastore. Apart from the presence of dendroid hairs, *Hyptidendron* species also usually possess simple, mostly uniseriate hairs, sometimes gland-tipped hairs, and usually possess glands, which may be stipitate or sessile, and which rarely are sunken in the lamina. The type of indumentum is important for separating the species although the amount of indumentum is variable, possible influenced by environmental conditions.

Inflorescence structure:—The basic structure of the inflorescence in *Hyptidendron* is a dichasial or, less commonly, a monochasial (unilateral) cyme. The cyme can have the first branch as a dichasium and then behave as a cincinnus as in *H. amethystoides*. Those cymes can be one-flowered as in *H. vepretorum*, few-flowered as in *H. claussenii* to multi-flowered as in *H. leucophyllum*. The cymes are arranged in the axils of bracts and when seen in a broader context form complex thyrsoid structures. The thyrsoid inflorescence can be terminal and well defined with bracts reduced as in most species of *Hyptidendron* sect. *Hyptidendron* and *Hyptidendron* sect. *Latiflorae* or undefined and the cymes somewhat isolated with bracts almost equal to leaves as in most of the species of *Hyptidendron* sect. *Umbellaria*. Sometimes, herbarium specimens consist only of an inflorescence, and lack a stem with cauline leaves.

Epling (1949) used the unilateral cymes as a diagnostic character, exclusive to *Hyptidendron unilaterale*. However, in other species of the genus the branches from the lowest nodes of the cyme may be dichasial, while distally these become unilateral, with the branching taking a scorpioid appearance. This feature can be present in other species of the genus as *H. roseum, H. albidum, H. canum H. pulcherrimum*, *H. dictiocalyx, H. pulcherrimum* and *H. amethystoides.* Although the presence of unilateral cymes has some taxonomic value, it is not an exclusive feature of *H. unilaterale*.

Bracts:—The bracts are typically leaf-like and located in the axil of cymes. They range from being clearly different from vegetative leaves (much smaller, different shape, different apex, denser indumentum) as in *H. conspersum* or *H. canum*, or can be almost indistinguishable from vegetative leaves as in some specimens of *H. vauthieri* or *H. cerradoense*.

Bracteoles:—The bracteoles are reduced, mostly linear, but can rarely be narrow elliptic varying from 0.5−6.6 × 0.1−4.9 mm. They emerge in different positions in the inflorescence, sometimes in pairs, but never at the base of the calyx as in *Eriope*, *Hypenia*, *Eriopidion* and *Physominthe*.

Flowers:—The flowers are remarkably uniform in Hyptidinae, characterized by being dichlamydeous, pentamerous, zygomorphic, hermaphrodite, hypogenous and with an explosive pollination mechanism (Harley 1971). However, some variation may be encountered in characters such as tube and lobe shape of the calyx or corolla and in the presence of a stylopodium above the ovary.

Calyx:—This is typically accrescent, 5-lobed. The lobes are subequal or unequal. The calyx can be zygomorphic or more or less actinomorphic. The lobes are deltate, triangular or rarely subulate and they can be straight or curved as in *H. vauthieri*. The calyx internally is pubescent but can rarely possess a conspicuous ring of hairs in the throat as in *H. caudatum* and *H. roseum* or just few hairs forming a faint ring as in *H. dictiocalyx, H. vauthieri, H. vepretorum and H. rhabdocalyx* (Benth.) Harley.

Corolla:—The corolla is pentamerous, zygomorphic, two-lipped, formed by a posterior lip composed of two lobes and an anterior lip composed of three lobes the median one (anterior lobe) being elongated, concave and usually with an apiculus (not present in *H. claussenii* and *H. leucophyllum*). The tube is cylindrical or infundibuliform. The corolla color is purple, lilac, bluish or rarely pinkish or whitish.

Androecium:—The stamens are four, didynamous, the posterior pair are longer and attached to the throat or slightly to the middle of the tube, and are villous with long entangled uniseriate hairs. The anterior pair is shorter and attached to the base of the median lobe of the anterior lip of the corolla, and is usually glabrous or glabrescent, except for entangled hairs near the anther, which can be dense or sparse.

Gynoecium:—The ovary is superior with a gynobasic style. The style is jointed below, the lower part forming a persistent stylopodium that protrudes above the ovary. This feature is also found in *Eriope*, *Marsypianthes, Hypenia* and various sections of *Hyptis*. The style is bilobed with subequal lobes.

Nutlets:—There are one, two or four mature nutlets per fruiting calyx. *Hyptidendron* nutlets are slightly to strongly mucilaginous when wetted. This characteristic is variable in different genera and species of Hyptidinae (Ryding 1992), however its taxonomic value hasn't still been well documented and further studies may show that it could have a strong generic and specific taxonomic importance. Nutlets in *Hyptidendron* can be ovoid, ellipsoid, obovoid, oblong or globose. In *Hyptidendron* sect. *Hyptidendron* the nutlets are flattened and winged, which is uncommon in the subtribe but shared with some species of *Eriope* and *Condea* that possess an arborescent habit as *Eriope latifolia* (Benth.) Harley or *Condea jacobi* (Fern.Alonso) Harley & J.F.B.Pastore. Species of *Hyptidendron* sect. *Latiflorae* and *H*. sect. *Umbellaria* have non-flattened, unwinged nutlets. In *Hyptidendron* the nutlets usually possess deeply abscission scars. However, species of *Hyptidendron* sect. *Latiflorae* have inconspicuous abscission scars, or even lack these, as in *H. eximium*, which possess a white appendage in the base, referred as a caruncle by Epling (1936b), which is unique in the subtribe. Future anatomical studies may elucidate the ontogeny and function of this structure. The nutlets are usually glabrous and rugulose, but may have some hairs, as in *Hyptidendron rondonicum* which has a tuft of hairs at the apex of the nutlet.

Phenology:—*Hyptidendron* species mostly have flowers and fruits at the same period. Some species as *H. arboreum* can be found reproductive all year round, although as a widely distributed species, flower and fruiting periods may be related to specific locality. Other species, representing the most common pattern in the genus mostly produce flowers and fruits during the dry season especially during July to September. Phenological diagrams of all species are presented in Figures 2 and 3.

Natural History: Floral biology, Pollination and Seed Dispersal:—There are no specific studies about seedling establishment or populations studies in *Hyptidendron*. In the course of fieldwork, we have observed that in the areas where *Hyptidendron* populations occur, they mostly form populations with a great number of individuals. There is not a specific study about pollination in the genus *Hyptidendron*, but, as the flower morphology is somewhat homogeneous within the subtribe, it is possible to infer that bees are the effective pollinators of *Hyptidendron* species which place the pollen in the bee's abdomen as described by Harley (1971). In the course of fieldwork some other flower visitors have been observed in *Hyptidendron*. These include hummingbirds visiting *H. canum*, and a species of butterfly, family Hesperiidae (Pedro Ivo Machado, pers. comm.), visiting *H. claussenii* (Fig. 4). Those visitors are probably nectar spoilers as due to their long proboscides or beak size, obviously not adapted to touch the anthers or style, and so, their visits are unlikely to effectively pollinate flowers. Nevertheless, small hummingbirds could be efective pollinators of *Hyptidendron* species with larger corolla tubes, which needs further investigation.

The seed dispersal is probably done by wind or air currents during the dry season. During the rainy season, as nutlets are mostly mucilaginous, the seed stabilization in the soil

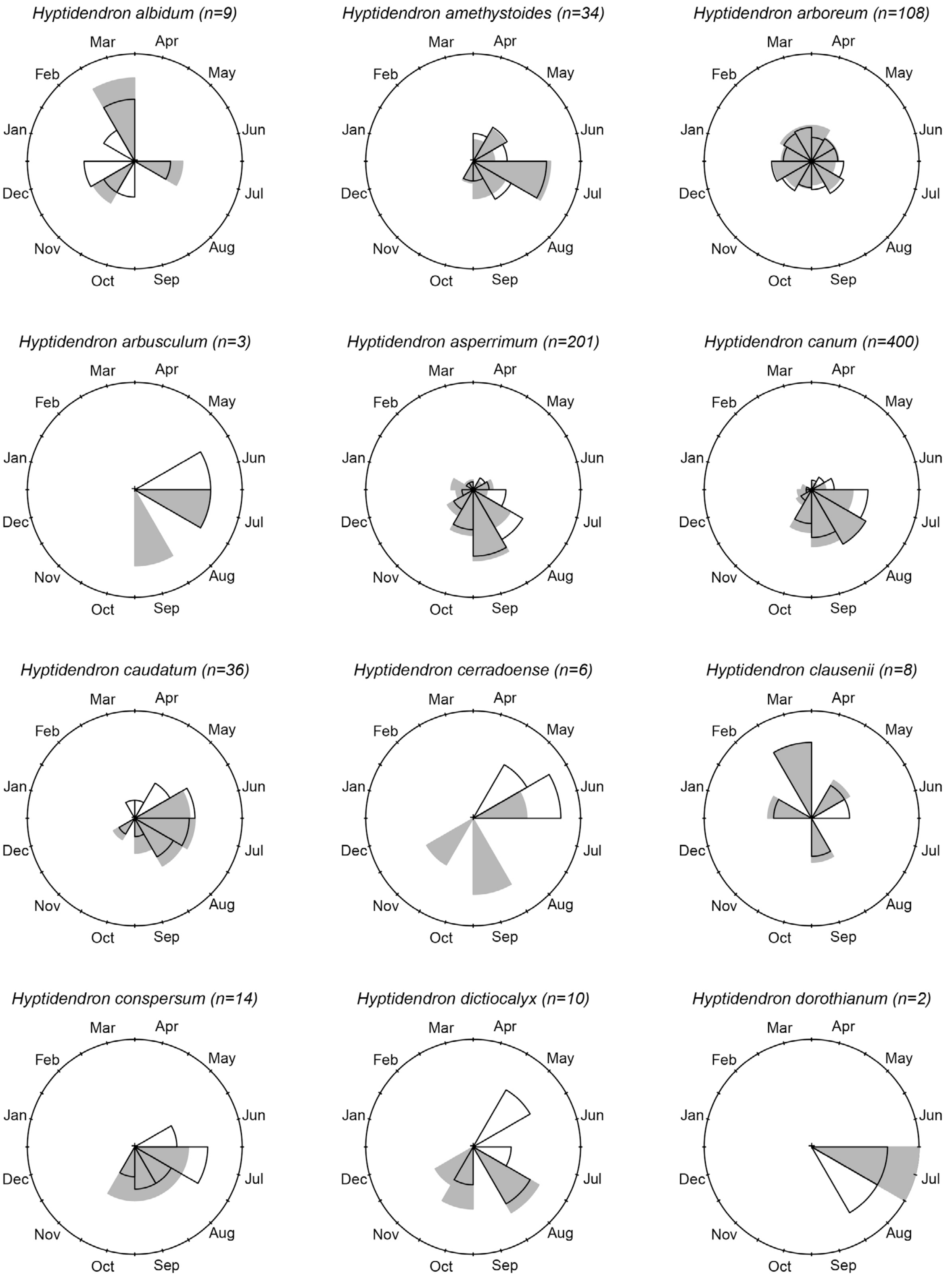

FIGURE 2. Phenology in species of *Hyptidendron* Harley. White slices denote flowering specimens and gray slices fruiting specimens. The size of the slice represents the relative amount of specimens from the total which was blooming or fruiting in that month. "n" represents the number of specimens used to generate the graphics for each species.

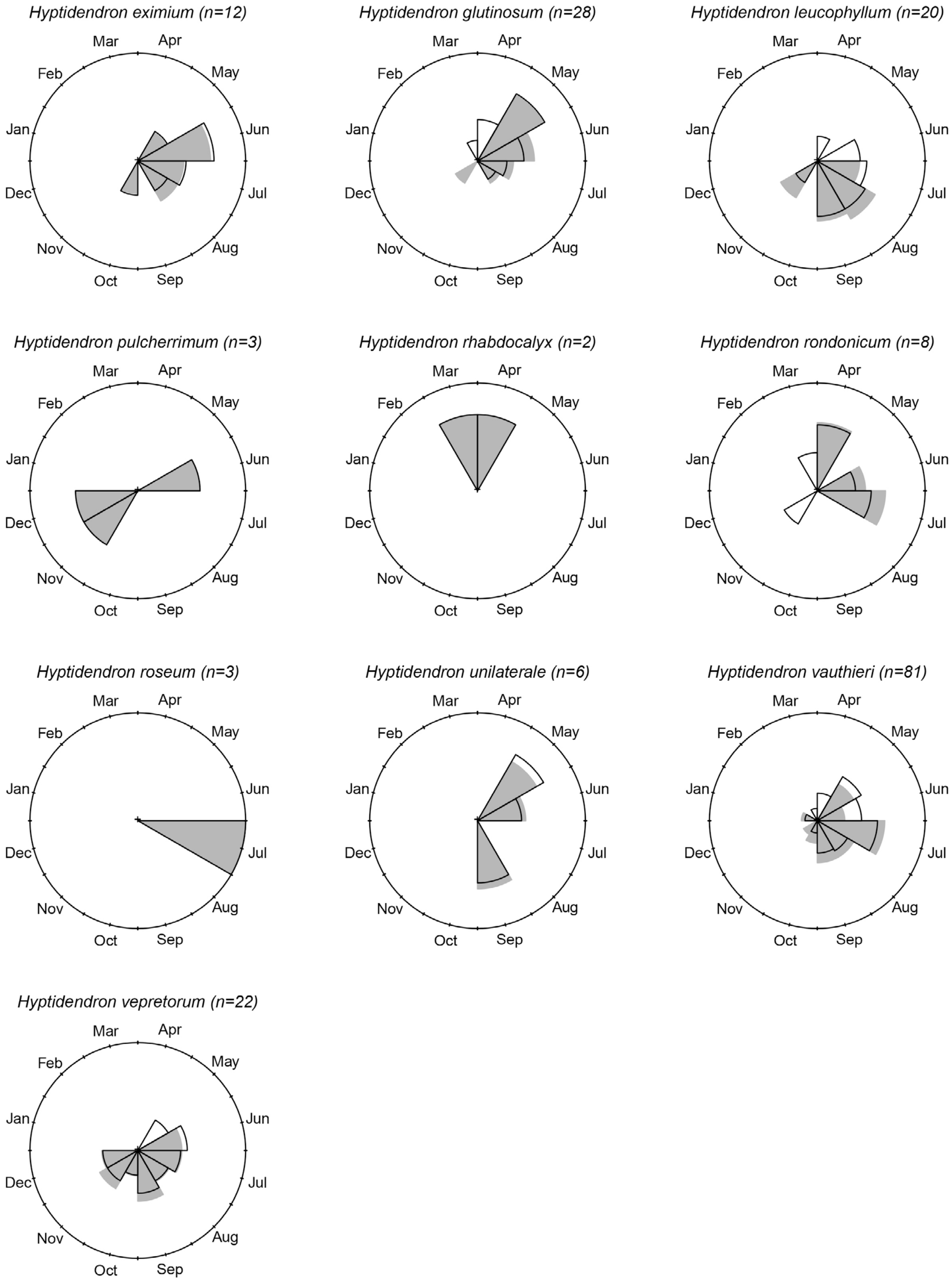

FIGURE 3. Phenology in species of *Hyptidendron* Harley. White slices denote flowering specimens and gray slices fruiting specimens. The size of the slice represents the relative amount of specimens from the total which was blooming or fruiting in that month. "n" represents the number of specimens used to generate the graphics for each species**.**

and future germination is probably related to rainfall events. We have commonly found nutlets predated in mature calyces, showing that they are a source of food for probably some Dipteran larvae, as described for *Hyptis* sect. *Eriosphaeria* subsect. *Pachyphyllae* (Harley 1986). We hypothesize that the winged nutlets in the arborescent species of *Hyptidendron* sect. *Hyptidendron* are probably related to wind dispersion as due to the higher plant size they could disperse their seeds that way.

FIGURE 4. Floral visitors in *Hyptidendron* Harley. **A.** *Apis melifera* visiting *Hyptidendron asperrimum*, Ressaquinha Municipality, Cerrado Domain. **B.** Butterfly of the Hesperiidae family visiting *Hyptidendron claussenii*, RPPN Santuário do Caraça, Cerrado domain. **A-B**. by G.M. Antar.

Natural Hybridization:—Natural hybridization has been reported in Hyptidinae, in *Hyptis* (Harley 1986, 1999) and *Eriope* (Harley 1992) with the description of few hybrids. In *Hyptidendron* no natural hybridization has been documented. During the course of our studies, some specimens were considered as putative natural hybrids, mostly coming from Diamantina municipality, an area that contains five species of *Hyptidendron*. Further studies involving other approaches such as karyological analysis are needed to confirm if those specimens are hybrids or not.

Distribution, Habitats and Endemism:—*Hyptidendron* is restricted to South America being distributed in Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru and Venezuela. Its southernmost distribution is from northern São Paulo State in Brazil and its northernmost distribution is the province of Antioquia in Colombia. Most of its diversity is concentrated in Brazil, mostly in Goiás and Minas Gerais states with 6 and 11 species, respectively (Table 1). In figure 5, it is possible to detect this prevalence of the genus in Brazil, and mostly in the middle of it, with just one species, *Hyptidendron arboreum*, expanding to the north of the country.

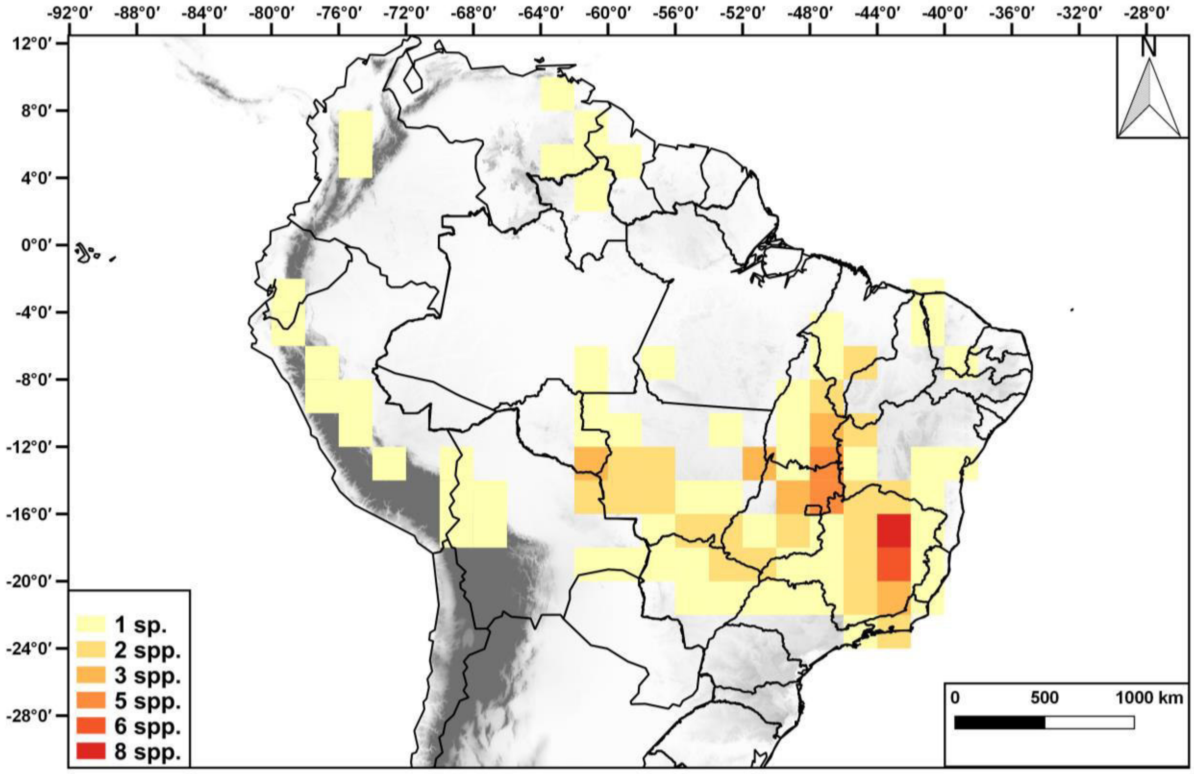

FIGURE 5. Distribution map of *Hyptidendron* Harley, depicting the species density along the distribution of the genus.

Its species occurs mostly in the Cerrado domain, but also in the Caatinga domain with *Hyptidendron amethystoides*, Atlantic Rainforest domain with *H. asperrimum*, and Amazonia domain with *H. arboreum*. The habitats (Fig. 6) are open savannah (Cerrado *sensu stricto,*

TABLE 1. Geographic distribution (with number of domains and provinces of occurrence), habitat and ecological preference of species of *Hyptidendron* BOL: Bolivia, BRA: Brazil, COL: Colombia, GUY GuyanaPAR: Paraguay, PER: Peru, VEN: Venezuela.

Species	**Distribution area**	**Habit**
H. albidum	BRA : MG	*campo rupestre* and savanna
H. amethystoides	BRA : BA, CE, MA. PE, PI, TO	dry forests and savanna
H. arboreum	BOL, BRA, ECU, GUY, PER, VEN	gallery and cloud forests
H. arbusculum	BRA : GO, TO	rocky savanna and savanna
H. asperrimum	BRA : BA, ES, MG, RJ, SP	semideciduos forests
H. canum	BOL : Santa Cruz, BRA : DF, GO, MG, MS, MT, SP	savanna and dry forests
H. caudatum	BRA : DF, GO	rocky savanna and savanna
H. cerradoense	BRA : GO	savanna and rocky savanna
H. claussenii	BRA : MG	*campo rupestre* and savanna
H. conspersum	BRA : BA, MA, PI, TO	savanna in sandy soils
H. dictiocalyx	BRA : BA, GO, MG	savanna and rocky savanna
H. dorothyanum	BRA : AM, PA	savanna with sandy soils
H. eximium	BOL : La Paz, Santa Cruz, BRA : MT	dry forests
H. glutinosum	BOL : Santa Cruz, BRA : MS, MT, RO	savanna or rocky savanna
H. leucophyllum	BRA : MG	savanna and *campo rupestre*
H. pulcherrimum	BRA : MG	*campo rupestre*
H. rhabdocalyx	BRA : MG	*campo rupestre*
H. rondonicum	BRA : MT, RO	savanna
H. roseum	BRA : GO	*campo rupestre*
H. unilaterale	BRA : MG	*campo rupestre*
H. vauthieri	BRA : MG	*campo rupestre*
H. vepretorum	BRA : MG	*campo rupestre* and rocky savanna

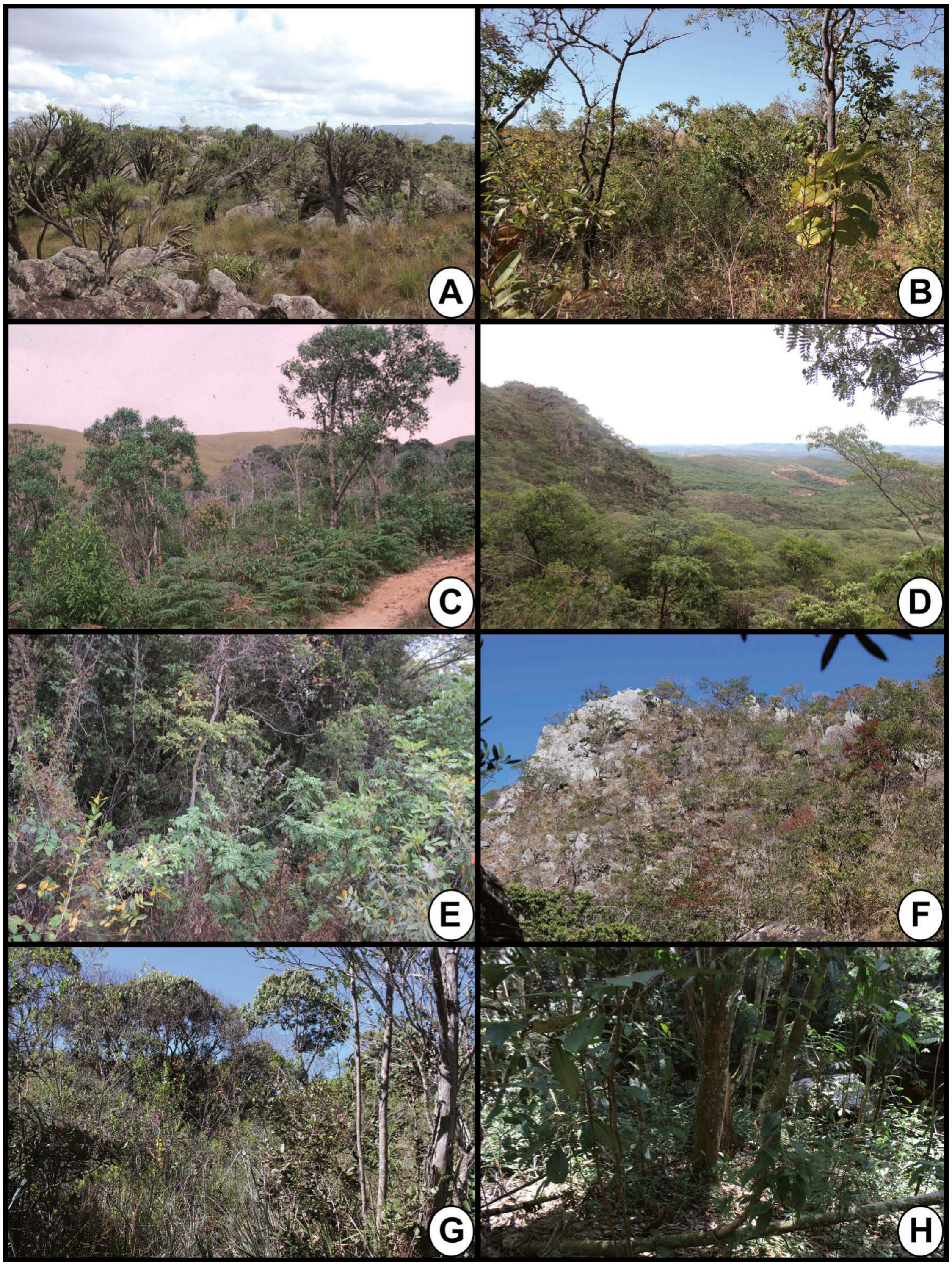

FIGURE 6. Vegetation types were *Hyptidendron* occurs. **A.** Campo rupestre, Parque Nacional da Serra do Cipó, Cerrado Domain. **B.** Cerrado sensu stricto, Barra do Garça municipallity, Cerrado Domain. **C.** Disturbed ground, Bolivia, Amazonian Domain. **D.** Semidecidual Forest, Santana do Pirapama municipalitty, Cerrado domain. **E.** Capão forest border, Diamantina municipallity, Cerrado Domain **F.** Campo rupestre, Cavalcante municipallity, Cerrado Domain. **G.** Transition between campo rupestre and cerrado, RPPN Santuário do Caraça, Cerrado domain **H.** Semidecidual Forest, Felício dos Santos municipalitty, Cerrado domain **I.** A-B, D-H by G.M. Antar, C by R.M. Harley.

campo sujo, cerrado rupestre), *campo rupestre*, chacos, riparian forest, montane forest and semideciduous forest. *Hyptidendron* can also be found in disturbed ground, mostly members of *Hyptidendron* sect. *Hyptidendron* as *H. canum, H. arboreum, H. asperrimum, H. conspersum* and *H. leucophyllum*. Those species are easily seen bordering roads within their occurrences, sometimes dominating the vegetation within those sites. Some other species seems to be much more selective with a restricted distribution, needing a well conserved environment as *H. albidum, H. claussenii*, *H. pulcherrimum* and *H. roseum. H. arboreum* is the most widespread species occurring in Bolivia, Brazil (Roraima), Colombia, Ecuador, Guiana, Peru and Venezuela followed by *H. canum* that occurs in Brazil (Bahia, Distrito Federal, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais and São Paulo states) and Bolivia. The species with the most restricted distribution are *Hyptidendron albidum* endemic to three municipalities in Northern Minas Gerais, *Hyptidendron claussenii* endemic to Serra do Caraça, *Hyptidendron roseum*, endemic to two localities of Chapada dos Veadeiros, *Hyptidendron unilaterale* endemic to few localities in Diamantina region and *Hyptidendron pulcherrimum*, endemic to Pico do Padre Ângelo.

Pollen morphology:—The pollen of *Hyptidendron* is hexacolpate, with granular membrane in colpi, oblate, circular or elliptical in polar view, as in all Hyptidinae (Rudall 1980b). Species of *Hyptidendron* falls in categories A and B according to Rudall (1980b), without any noticeable taxonomic significance. Evidence from recent phylogenetic studies may help in the future to elucidate the patterns of variation of pollen morphology in the subtribe, and help to recognize genera.

Chromosome numbers:—The only known chromosome count for *Hyptidendron* is that made by Harley & Heywood (1992) for *Hyptidendron canum* with 2n=64. Preliminary counting suggests that chromosome number is rather variable in the subtribe and although studies with this approach are currently rare, they could have taxonomic and evolutionary importance for the subtribe and for the genus itself.

II. Economic importance, Chemistry and local uses

Hyptidendron species although very ornamental have not so far been brought into cultivation. Species such as *H. asperrimum* and *H. arboreum* due to their rapid growth and the beauty of their flowers could be used in urban afforestation and for natural environment restoration, in South American countries, where they are also adapted to climatic conditions (Lorenzi 2016). These two arborescent species can have their timber used for construction, mostly frames and house roofs or charcoal. *H. canum* wood can be used for charcoal as well. *H. canum* and *H. amethystoides* are the only species documented to be used in traditional medicine (Fiuza *et al.* 2009; Ribeiro *et al.* 2019). Tea infusion is prepared with leaves and roots and it is used for its antimalarial, anti-inflammatory, anti-ulcerative and anti-hepatotoxic effects. Other species of the genus can be used locally as medicinal, yet this is not documented in the literature.

We have detected four studies conducted with the chemical compounds of *Hyptidendron*, all of them with *H. canum*. These studies focus on the chemical components found in *H. canum*, listing the essential oils (Batista *et al*. 2003; Fiuza *et al*. 2010), acids and steroids (Lemes & Ferri 2011) and biological activity (Fiuza *et al*. 2009; Lemes & Ferri 2011).

III. New records, new species and species conservation

In the course of this revision, several locally new records were found, such as *Hyptidendron asperrimum* for São Paulo state and *H. dictiocalyx* for Minas Gerais and Bahia states. Also, five new species have been found: *H. albidum*, *H. roseum*, *H. pulcherrimum*, *H.*

dorothyanum and *H. cerradoense*, all of those with a restricted distribution. South America botanically very undersampled (e.g. Oliveira *et al*. 2017; Antar & Sano 2019; Daly & Martinez-Habibe 2019) and future collections in new areas may yet uncover new species of *Hyptidendron*. Its species have been continuously losing ground, as natural areas are continually being replaced by human activities, mostly for agriculture. This loss of large areas of natural habitats, mostly for crops cultivation, has resulted in the reduction of areas of occurrence. However, the capacity of some species to spread into such disturbed areas, such as roadsides and neglected cultivation, has mitigated the changes in their conservation status. A number of species, which are spreading into such areas, are thus considered as of Least Concern, due to their apparent capacity to survive in disturbed areas. However, in some cases their occurrence may be due their relictual nature, rather than recolonization. Their survival may prove to be of short duration, as seedling establishment capability in such disturbed areas is not yet known. This is the case of most of the species of *Hyptidendron* sect. *Hyptidendron* and for *H. amethystoides, H. caudatum, H. vauthieri and H. vepretorum*. Some other species of *H.* sect. *Umbellaria* and *Hyptidendron* sect. *Latiflorae* have a more restricted distribution and fewer records, being restricted to better conserved areas. However, few of these species with more restricted distribution are comprehensively conserved by protected areas as *Hyptidendron claussenii* in Santuário do Caraça and *Hyptidendron roseum* in Parque Nacional da Chapada dos Veadeiros. The most threatened species are *Hyptidendron albidum*, endemic to three municipalities with *Eucalyptus* crops nearby, and *Hyptidendron pulcherrimum,* which despite being abundant in its area of occurrence, has a very restricted distribution.

IV. Morphologically and Phylogenetic Related genera, with key to genera

The differentiation of genera within Hyptidinae is based mostly in inflorescence structure. The genus which appears to be morphologically most closely related to *Hyptidendron*, is *Condea*. Especially, if one compares the species of *Hyptidendron* placed in *Hyptidendron* sect. *Hyptidendron*, with some of the arborescent species of *Condea* sect. *Laniflorae*, a primarily Central American group, with two species in Western South America. This is also suggested by the description of some species of *Condea* in the section as some species of *Hyptidendron* when both were part of *Hyptis* by Bentham (1833, 1848) and also by some mis-identification, mostly of *Hyptidendron arboreum* and *Condea tafallae* (e.g. *Vargas 1994* or *Tapayachi 4440* both in CUZ herbarium). Fernandéz-Alonso (2010) when describing *Hyptis jacobi* Fernandéz-Alonso discusses the position and argues about the limits of the two genera that do not seem to be well resolved. However, for Epling (1936b, 1949) and Harley (1988) the difference between both taxa was clear, as altought *Hyptidendron* shares with *Condea* the habit, indumentum, inflorescence structure and nutlet morphology, *Hyptidendron* differs from *Condea* by having a stylopodium and mucilaginous nutlets (vs. gynoecium without stylopodium and nutlets not mucilaginous) (Ryding 1992; Harley & Pastore 2012). Additionally, most species of *Hyptidendron* sect. *Latiflorae* can superficially resemble *Mesosphaerum* morphologically, mostly by the pedunculate cymes with short pedicellate flowers, linear bracteoles and campanulate calyx. However, *Hyptidendron* has dichasial or monochasial cymes, and a stylopodium, while *Mesosphaerum* has a cincinnate inflorescence and lack a stylopodium.

Some species of *Hyptidendron* sect. *Hyptidendron* can also be superficially similar to species of *Eriope* as *Eriope latifolia* and *Eriope hypoleuca* (Benth.) Harley as they share dendroid hairs, the presence of stylopodium (although morphologically different), nutlets flattened and winged (uncommon in *Eriope*), and a similar habitat. However, they can be easily differentiated as *Eriope* has paired bracteoles at the base of the calyx, deciduous bracts, and an inflorescence that is racemoid and composed of one-flowered cymes. It also often has flowering stems are waxy, and frequently with inflated internodes (vs. paired bracteoles not present at the base of the calyx, bracts persistent, multiflowered cymes in a thyrsoid inflorescence or cymes somewhat isolated and flowering stems not waxy or with inflated internodes).

Phylogenetically *Hyptidendron* is in a clade composed of the genera *Hypenia, Eriope, Eriopidion*, *Physominthe*, *Condea* and *Mesosphaerum* (Antar *et al.* in prep.). The first four genera possess cymes usually 1-flowered (rarely up to 3−6-flowered), flowers with often inconspicuous paired bracteoles at base of calyx and flowering stems waxy with often inflated internodes. The last two genera usually have flowers in fascicles or shortly pedunculate sub-umbels, or in lax, often spiciform cincinni or congested to form a globose head, with bracteoles not forming an involucre (Harley & Pastore 2012).

Key to distinguish *Hyptidendron* from related genera (based on Harley & Pastore 2012).

1. Cymes usually many-flowered, rarely 1-few-flowered, usually cincinnate, flowers sometimes congested or modified into axillary fascicles. Paired bracteoles not present at calyx base. Flowering stems never waxy or inflated **2**

1'. Cymes 1-flowered (rarely 3-flowered), arranged in racemoid inflorescences, never cincinnate. Flowers with often inconspicuous paired bracteoles at base of calyx. Flowering stems frequently waxy with inflated internodes. ….. **4**

2. Stylopodium present. Inflorescence a terminal thyrsoid or formed by axillary cymes. Cymes pedunculate, dichasial or unilateral (cincinnate), with flowers pedicellate, never forming a head. Nutlets mucilaginous or slightly mucilaginous, sometimes winged. .... ***Hyptidendron***

2'. Stylopodium absent. **3**

3. Inflorescence mostly cincinnate to spiciform. Cymes pedunculate or almost sessile, dichasial, with flowers with pedicels mostly reduced, sometimes forming a kind of globose head. Nutlets mucilaginous, not winged. ....………………............................... ***Mesosphaerum***

3'. Inflorescence mostly fasciculate, but also racemoid or panuliculiform. Cymes pedunculate or sessile, dichasial, with flowers usually pedicellate, never forming a head, but sometimes forming sub-umbellate. Nutlets not mucilaginous, sometimes winged. .... ***Condea***

4. Cymes up to 3−6-flowered. Peduncle conspicuous. Inflorescence thyrsoid. Flowers shortly pedicelate. Calyx lacking inconspicuous paired bracteoles at base ....***Physominthe***

4'. Cymes mostly uniflorous, rarely 3-flowered (then pedicels long, slender). Peduncle conspicuous or reduced. Inflorescense raceme-like or thyrsoid. Calyx with inconspicuous paired bracteoles at base...**5**

5. Calyx in fruit zygomorphic, lobes unequal, posterior lip rounded or with posterior lobes partly connate. Corolla at anthesis tube abruptly contracted near base, usually lilac, pink or violet, sometimes yellowish in bud...**6**

5'. Calyx in fruit actinomorphic to subactinomorphic, subequal lobes. Corolla at anthesis tube not abruptly contracted at base, lilac or pale blue, cream, yellow or red.......................***Hypenia***

6. Calyx throat closed by upper lobes when dry, lobes with a row of rigid hairs within. Corolla tube shortly and narrowly cylindrical. Stylopodium absent. Nutlets elongate, ± triquetrous...***Eriopidion***

6'. Calyx throat open, though sometimes closed by dense white hairs. Corolla tube often broadly campanulate or funnel-shaped. Stylopodium present; Nutlets broad, slightly flattened or rarely winged...***Eriope***

V. Systematic treatment

Hyptidendron Harley (1988: 90) ≡ *Hyptis* sect. *Buddleioides* Bentham (1833: 132). Type:—*Hyptis membranacea* Benth., lectotype designated by Epling 1936b [= *Hyptidendron asperrimum* (Spreng.) Harley].

= *Hyptis* sect. *Siagonarrhen* Mart. ex Bentham (1833: 133) ≡ *Hyptis* sect. *Siagonarrhen* subsect. *Cymosae* Bentham (1848: 133). Type:—*Hyptis scabra* Benth., lectotype designated by Epling 1936b [= *Hyptidendron canum* (Benth.) Harley].

= *Hyptis* sect. *Latiflorae* Epling (1936b: 224). Type:—*Hyptis eximia* Epling.

= *Siagonarrhen* Mart. ex J.A.Schmidt, in Mart. Fl. Bras. 8(1): 146 (1858). *nomen nudum*.

Shrubs, subshrubs, treelets or trees up to 20 m tall, usually aromatic, woody subterranean reserve structure sometimes present; stems woody, rarely herbaceous, solid or rarely fistulose, erect, less commonly virgate or horizontal, quadrangular and canaliculate or slightly canaliculate, at least in younger parts, indumentum composed of simple or dendroid eglandular hairs, gland-tipped hairs and stipitate or sessile glands. Cauline leaves simple, opposite, decussate, spreading along the branches or congested near the tips, imbricate or not imbricate, mostly longer than internodes, frequently diminishing in size towards stem apex, lamina chartaceous, coriaceous or rarely membranous, mostly discolorous, extremely variable in form from narrowly elliptical or lanceolate to broadly ovate or orbicular, base rounded, cuneate, cordate, or truncate, sometimes irregularly so, apex acute, atenuate or obtuse, often terminating in an acumen, adaxial surface hairy, rarely glabrous or glabrescent, venation usually inconspicuous, abaxial surface hairy, rarely glabrescent, venation prominent, conspicuous, reticulate, margin crenulate, serrulate, serrate or rarely entire, usually entire near the base, ciliate or not ciliate, sometimes revolute, petiole present or less commonly absent, mostly canaliculate, frequently hairy. Inflorescence composed of axillary pedunculate (rarely sessile) cymes, forming a lax, branched, terminal thyrsoid structure or somewhat isolated, cymes dichasial or less commonly unilateral, subtended by leaf-like bracts, sometimes reduced, longer or smaller than cymes, mature cymes 1−38 flowered, sometimes obscured by bracts; bracts sometimes tinged in similar colors to the flowers. Flowers pentamerous, zygomorphic, dichlamideous, heterochlamideous, hypogenous, pedicellate or rarely sessile, subtended by linear to narrow elliptic bracteoles; calyx 5–lobed, gamosepalous, actinomorphic to rarely zygomorphic, accrescent, vinaceous, purple or green, tube cylindrical or infundibuliform, costate, straight or rarely curved, internally sometimes with a ring of hairs in the throat, lobes subequal or unequal, deltate, subulate or rarely linear, straight or curved to deflexed, calyx accrescent in fruit, larger, indumentum less dense; corolla 5-lobed, gamopetalous, bilabiate, purple, lilac, bluish, pink or white, tube cylindrical or rarely somewhat infundibuliform, straight or curved, lobes spreading, different, anterior lobe large, boat-shaped, mostly with a long, almost caudate apex; stamens 4, epipetalous, didynamous, paired, exserted, posterior pair of stamens longer, attached to the middle of the tube, with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair shorter, attached to the base of the anterior lobe, glabrescent with hairs near the anther, anthers 2–thecous, dorsifixed, opening by longitudinal slits, connective not enlarged; gynoecium bicarpellate, 4-lobed, ovary with nectariferous disc, style gynobasic, exserted, jointed and a well-developed stylopodium protruding above ovary, stigmatic lobes slender, bilobed, lobes subequal. Nutlets 1(−2) or 4 per flower, ellipsoid, ovoid, oblong or obovoid, flattened or not flattened, winged or not winged, castaneous, brown, black or dark brown, shiny or not shiny, glabrous and rugulose or rarely pubescent to glabrescent with hairs in the apex, abscission scars usually conspicuous, appendage in the base absent or rarely present, mucilaginous or slightly mucilaginous when wetted.

Etymology:—The name is formed by the prefix that derives from *Hyptis*, genus in which *Hyptidendron* species were previously recognized within and the Latin suffix dendron which means woody, tree. *Hyptis* derives from the Greek "Hyptios" meaning reflexed, probably in a reference to the anterior lobe of corolla after being triggered. The name when first proposed was created to accommodate the taller and woody species of *Hypti*s.

Key to sections of *Hyptidendron*

1. Nutlets 4 per flower, flattened, winged. Leaves usually larger, (1.8−)4−21 cm long. Branched hairs present (rare in *H. pulcherrimum*). Trees or shrubs. Inflorescence a well-defined terminal thyrsoid, rarely not, bracts mostly reduced.. 1. *Hyptidendron* sect. *Hyptidendron*

1'. Nutlets 1−2 per flower, not flattened, not winged. Leaves usually smaller 0.7−5(−12) cm long. Branched hairs absent (present in *H. rondonicum* and *H. albidum*). Shrubs or subshrubs. Inflorescence composed of somewhat isolated axillary cymes, sometimes forming a well-defined more complex thyrsoid structure, bracts similar to leaves or reduced...2

2. Calyx tube at anthesis without a ring of hairs, specimens poorly branched, mostly just near the inflorescence, slightly woody, leaves membranous to chartaceous, nutlets with abscission scar inconspicuous, sometimes absent, xylopodium absent...2. *Hyptidendron* sect. *Latiflorae*

2'. Calyx tube at anthesis mostly with a ring of hairs in the throat, which can be conspicuous or inconspicuous and formed by just few hairs, specimens much branched, woody, leaves chartaceous to coriaceous, nutlets with a conspicuous abscission scar, xylopodium sometimes present. ....3. *Hyptidendron* sect. *Umbellaria*

Key to species of *Hyptidendron* sect. *Hyptidendron*

1. Branched hairs absent, rarely present. Inflorescence composed of axillary cymes not forming a well-defined thyrsoid structure...1.7. *H. pulcherrimum*

1'. Branched hairs present. Inflorescence composed of axillary cymes forming a well-defined thyrsoid structure..2

2. Calyx lobes subequal or slightly unequal (easier to see in fruiting calyx – Fig. 8B). Shrubs to trees up to 20 m tall..3

2'. Calyx lobes conspicuously unequal (easier to see in the fruiting calyx – Fig. 13B). Shrubs to trees up to 8 m tall..4

3. Teeth of calyx up to 1.1 mm long. Plants from southeastern and norteastern Brazil ………………………...1.2. *H. asperrimum*

3'. Teeth of calyx longer than 1.5 mm long. Plants from Northern Brazil, Venezuela Colombia, Bolivia, Guyana, Peru and Ecuador………………........................1.1. *H. arboreum*

4. Calyx at anthesis 4.2−4.7 mm long, peduncle 1-3.5 mm long. Cymes 7−10 flowered, up to 1.5 cm long...1.5. *H. dorothyanum*

4'. Calyx at anthesis 5−12 mm long, peduncle (1.2)3−21 mm long. Cymes 7−37 flowered, more than 1.5 cm long..5

5. Anterior lobe of the corolla without an apiculus. Shrub with elongated internodes (2.4−)3.2−12.5(−20) cm long, usually longer then leaves.........................1.6. *H. leucophyllum*

5'. Anterior lobe of the corolla with an apiculus. Shrubs or trees with internodes 1.4−9.1 cm long, mostly shorter then leaves. 7

6. Fruiting calyx tube 4.7−6.6 mm long. Calyx tube at anthesis 3.5−5 mm long, Mature cymes 0.9−2.5 cm long. Petiole 0.4−0.7 cm long. Plants from Maranhão, Tocantins, Piauí and northwest Bahia in Brazil...1.4. *H. conspersum*

6'. Fruiting calyx tube 7.5−12 mm long. Calyx tube at anthesis (3−)5−8.5 mm, mature cymes 1.7−5 cm long. Petiole (0.4−)0.7−2.9 cm long. Plants from Bolivia and Goiás, Minas Gerais, Mato Grosso, Mato Grosso do Sul, São Paulo and South Bahia in Brazil...1.3. *H. canum*

Key to *Hyptidendron* sect. *Latiflorae*

1. Branched hairs present, petiole absent or up to 1.2 mm long. Peduncle absent or up to 1 mm long...2.4. *H. rondonicum*

1'. Branched hairs absent, petiole present, more than 2 mm long. Peduncle always present, more than 3 mm long...2

2. Stems fistulose. Flowers with calyx tube at anthesis 2.8–3.2 mm long. Nutlet 3.5–4.8 mm long, white appendaged at base...2.2. *H. eximium*

2'. Stems solid. Flowers with calyx tube at anthesis 1–2.9 mm long. Nutlet 2–3.5 mm long, not appendaged...3

3. Calyx tube at anthesis (1.6−)1.8−2.9 mm long. Pedicels (0.3−)0.5−2.6(−3.6) mm long. Cymes dichasial or unilateral. Plants from Bolivia and Mato Grosso, Mato Grosso do Sul and Rondônia states in Brazil...2.3. *H. glutinosum*

3'. Calyx tube at anthesis 1−1.8 mm long. Pedicels 1.5−8 mm long. Cymes always a dichasial. Plants from Bahia, Ceará, Maranhão, Pernambuco and Piauí states in Brazil..2.1. *H. amethystoides*

Key to Hyptidendron* sect. *Umbellaria

1. Branched hairs present..3.1. *H. albidum*

1'. Branched hairs absent...2

2. Ring of hairs in the calyx at anthesis conspicuous, densely white villous.............................3

2'. Ring of hairs in the calyx throat inconspicuous, formed by few hairs, rarely absent...........4

3. Leaves sessile or petioles up to 3 mm long, cymes mostly unilateral..3.8. *H. roseum*

3'. Leaves petiolate, petioles (6−)8−19(−23) mm long, cymes mostly dichasial...3.3. *H. caudatum*

4. Calyx lobes at anthesis 3.7−5 mm long, calyx in fruit 12−15 mm long, leaves sessile, rarely subsessile, peduncles 2−3 mm long...3.5. *H. claussenii*

4'. Calyx lobes at anthesis smaller than 3.4 mm long, calyx in fruit up to 11 mm long, leaves petiolate, rarely subsessile, peduncles 0.5−8 mm long. 5

5. Mature cymes unilateral, rarely dichotomous, 7−19 flowered, peduncles 6−13 mm long...3.9. *H. unilaterale*

5'. Mature cymes dichotomous, 1−12 flowered, peduncles 0.5−8 mm long.............................6

6. Mature cymes 3−12 flowered..7

6'. Mature cymes 1−3(−4) flowered..9

7. Leaf margin with (1−)2−5(−6) teeth on each side of leaf, cymes 3−5 flowered...3.6. *H. dictiocalyx*

7'. Leaf margins with 8−36 teeth on each side of leaf, cymes 3−12 flowered...8

8. Pedicels 0.5−3.3 mm long. Calyx tube at anthesis 2.3−2.8 mm long, leaf margin crenate, rarely serrulate...3.10. *H. vauthieri*

8'. Pedicels (1.5−)2.1−5 mm. Calyx tube at anthesis 2.5−3.9 mm long, leaf margin mostly serrulate...3.7. *H. rhabdocalyx*

9. Intramarginal vein present, leaf margin (1−)2−4 teeth on each side of leaf, rarely entire..3.4. *H. cerradoense*

9'. Intramarginal vein absent, leaf margin (1−)2−14 teeth on each side of leaf, never entire...10

10. Leaf abaxial surface without bullae, glabrescent to pubescent, calyx lobes straight, calyx tube without a ring of hairs in the throat, leaf base rounded, rarely slightly cordate or truncate..3.2. *H. arbusculum*

10'. Leaf abaxial surface with bullae, pubescent to villous, calyx lobes straight or curved, calyx tube with a faint ring of hairs in the throat, leaf base cuneate to rounded, rarely truncate...3.11. *H. vepretorum*

1. ***Hyptidendron* sect. *Hyptidendron*** Harley (1988: 93)

Type:—*Hyptidendron asperrimum* (Spreng.) Harley

Shrubs, treelets or trees up to 20 m tall, aromatic, usually aromatic, woody subterranean structure absent; stems woody, solid, erect, quadrangular and canaliculate, at least in younger parts, indumentum composed of dendroid eglandular hairs, gland-tipped hairs and sessile glands. Cauline leaves spreading along the branches, rarely congested near the tips, imbricate or not imbricate, mostly longer than internodes, frequently diminishing in size towards stem apex, lamina chartaceous or coriaceous, discolorous, ovate, elliptic, wide ovate, wide elliptic, narrow ovate, narrow elliptic, suborbicular, orbicular, or lanceolate, base rounded, cuneate, cordate, or truncate, sometimes uneven, apex acute or obtuse, mostly terminating in an acumen, adaxial surface hairy, rarely glabrescent, venation mostly inconspicuous, abaxial surface hairy, venation prominent, conspicuous, reticulate, margin crenulate, serrulate, serrate, mostly entire near the base, petiole present, mostly canaliculate, hairy. Inflorescence composed of axillary pedunculate cymes, forming a lax, branched, terminal thyrsoid structure, cymes dichasial, subtended by leaf-like bracts, sometimes reduced, longer or smaller than cymes, mature cymes 7−38 flowered, sometimes obscured by bracts; bracts sometimes tinged in similar colors as flowers. Flowers pedicellate or rarely sessile, subtended by linear to narrow elliptic bracteoles; calyx zygomorphic or actinomorphic, vinaceous, purple or green, tube cylindrical or infundibuliform, straight or rarely curved, internally without a ring of hairs in the throat, lobes subequal or different, deltate, straight or slightly curved, calyx in fruit larger, indumentum less dense; corolla purple, lilac or bluish, tube cylindrical or rarely somewhat infundibuliform, straight or curved, lobes spreading, unequal, anterior lobe large, boat-shaped, mostly with a long, almost caudate apex; stamens 4, epipetalous, didynamous, paired, exserted, posterior pair of stamens longer, attached to the middle of the tube, with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair shorter, attached to the base of the anterior lobe, glabrescent with hairs near the anther, anthers 2–thecous, dorsifixed, opening by longitudinal slits, connective not enlarged; gynoecium bicarpelate, 4-lobed, ovary with nectariferous disc, style gynobasic, exserted, jointed and a well-developed stylopodium protruding above ovary, stigmatic lobes slender, bilobed, lobes subequal. Nutlets 4 per flower, ellipsoid, ovoid, oblong or obovoid, flattened, winged, castaneous, brown or dark brown not shiny, glabrous and rugulose or rarely pubescent to glabrescent with hairs in the apex, abscission scars mostly conspicuous, mucilaginous or slightly mucilaginous when wetted. Seven species distributed from Ecuador, Colombia and Venezuela to Northern São Paulo state in Brazil, with most of them in Minas Gerais state, Brazil.

1.1. *Hyptidendron arboreum* (Benth.) Harley (1988: 93) ≡ *Hyptis arborea* Bentham (1848: 132) ≡ *Mesosphaerum arboreum* (Benth.) Kuntze (1891: 526). Type:—GUYANA [BRAZIL]. Woods of Mt. Roraima, *R.M. Schomburgk 1034* (Lectotype, designated by Epling [1936b: 221]: K-000488097; Isolectotype: G-00437843)

= *Mesosphaerum arboreum* var. *bracteosum* Rusby (1896:107) ≡ *Hyptis arborea* subsp. *bracteosa* (Rusby) Briquet (1898:199). Type:—BOLIVIA. [La Paz]: Mapiri, July-August 1892, *M. Bang 1519* (First step lectotype designated by Epling [1936b:221], Second step lectotype designated here: NY-00429304; isolectotypes: BM, E-00025429, G, G, K, M, NY, PH-00017328, US-01014078, US-00121857, W, WU).

(Figs. 7, 8 A-C).

Trees, treelets or erect shrubs 1−20 m tall, slightly aromatic or not aromatic; stems woody, erect, branched, 3−6(−8) mm diam., younger stems canaliculate, tomentose, rarely pubescent, with brown dendroid hairs and usually sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes (1.1−)2.2−6.5(−7.6) cm long. Cauline leaves spreading along the branches, not imbricate, longer than internodes, mostly diminishing in size towards stem apex, lamina (5−)7.4−18.4 × 2.8−5.5(−7.3) cm, chartaceous to coriaceous, discolorous, with abaxial surface paler, elliptic, narrow elliptic, lanceolate or rarely broadly elliptic, base cuneate, less commonly attenuate or rounded, sometimes unequal, apex acute to long attenuate to acuminate, sometimes apiculate, apiculus ca. 1 mm long, adaxial surface glabrous, to sparsely pubescent or rarely tomentose with dendroid hairs and rarely small gland-tipped hairs, except on main vein, which is tomentose with dendroid brown hairs, also often scabrid with broad-based, rigid, sharp, eglandular hairs scattered on the lamina, venation mostly inconspicuous, midrib prominulous, or plane, close to base of lamina, but soon becoming impressed, secondary veins impressed, abaxial surface densely tomentose with white dendroid hairs and sessile glands, slightly less dense in the primary and secondary veins, venation reticulate, prominent, margin not ciliate, crenulate, rarely sinuate, entire in the base to 1/10 of leaf margin, sometimes revolute, mostly near base of lamina, 37−89 teeth on each side of leaf, with tooth apex swollen, obtuse; petiole 1.1−3.5 cm long, canaliculate to slightly canaliculate, tomentose or rarely pubescent with dendroid hairs and small sessile glands. Inflorescence thyrsoid, terminal, up to 30 cm long, with dichasial axillary cymes, subtended by bracts often conspicuously white and tinged purplish-pink, similar to leaves with same shape, sometimes obovate with obtuse apex, slightly smaller, 1.2−4.5(−7) × 0.7−2.2 cm, mostly longer than cymes, mature cymes 2.1−5.9 cm long, 12−38 flowered, not obscured by bracts, peduncles (5−)10−32(−40) mm long, with indumentum as on petioles. Flowers with pedicels 1−8.5 mm long, tomentose with brown dendroid, eglandular hairs and sessile glands and subtended by linear to elliptic bracteoles, (1.5−)3−10.5(−15) × 0.1−6 mm, with indumentum as on pedicels; calyx at anthesis 5.8−7.1 mm long, vinaceous to green, tube 4.3−5.6 mm long, ± cylindrical broadening near the throat to infundibuliform, straight, ribbed, externally densely tomentose with dendroid hairs and small sessile glands, tube internally glabrous at base, becoming pubescent with minute hairs above, and without a ring of hairs in throat, calyx lobes subequal, 1.5−2.5 mm long, deltate, apex acute to long acuminate, straight or rarely curved, externally with indumentum as on tube, internally tomentose at the margin with dendroid hairs up to middle of lobes, calyx in fruit 8.1−10.1 mm long, indumentum less dense, tube 6.5−8.1 mm long, cylindrical to rarely broadly cylindrical, ribbed, calyx lobes 1.7−2.5 mm long, subequal, straight or rarely slightly curved; corolla lilac to bluish, (8.5−)12−16 mm long, tube (6−)8.5−10 mm long, cylindrical, straight from base to middle of the tube, becoming slightly curved and enlarged near throat, 1.3−3 mm wide, externally with base glabrous becoming densely tomentose towards apex with simple or rarely dendroid uniseriate hairs and sessile glands, internally with a ring of villous hairs at base of corolla and with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens and sessile glands in throat and below it, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally glabrous, anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous to middle and with small shortly stipitate glandular hairs, sessile glands or few long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 4 per flower, 3.6−4.6 × 1.5−1.9 mm, ellipsoid to ovoid or obovoid, flattened, winged, with an obtuse, flattened apex, 0.4−1.2 mm long, black to dark brown, not shiny, pubescent to glabrescent with few minute hairs in the apex, with abscission scars, slightly mucilaginous when wetted.

FIGURE 7. Field pictures of *Hyptidendron arboreum* (Benth.) Harley. **A.** Cymes. **B.** Inflorescence. **C.** Reproductive branches. **D.** Reproductive branches. **A-D** photos by P.L. Viana.

FIGURE 8. Line drawing of *Hyptidendron arboreum* (Benth.) Harley. **A.** Branch bearing leaves and inflorescenses. **B.** Flower, side view. **C.** Nutlet. Line drawing of *Hyptidendron asperrimum* (Spreng.) Harley **D.** Branch bearing leaves and inflorescenses. **E.** Flower, side view. **F.** Nutlet. Illustration of Klei Sousa.

Vernarcular name:—Aguanoso, Borrajo, Dormilón, Gallinazo, Gallinazo-Blanco.

Phenology:—*Hyptidendron arboreum* was found flowering and fruting all year round, mostly in February, March, August and December.

Distribution and Habitat:—*Hyptidendron arboreum* is distributed in northern Brazil, Roraima state, Venezuela Gran Sabana region, Colombia Antioquia department, Bolivia Santa Cruz and La Paz departments, Guyana Potaro-Siparuni region, Peru Amazonas, Cuzco, Huánuco, Pasco, Puno and Ucayali departments and Ecuador Zamora-Chinchipe province (Fig. 9). It is the species of the genus with the northern distribution, inhabiting the Amazonian domain from 550 to 2400 m elevation. The species presents no sympatric distribution with other species of *Hyptidendron* despite *Hyptidendron eximium*, which also occurs in La Paz department, Bolivia. It can be a shrub up to 3 m to a tree of 15−20 m tall (*Brant 1517; Cardona 2586*). It is together with *H. asperrimum* the only *Hyptidendron* species that can be taller trees. It is common in disturbed forest occurring in dense populations in borders and alongside trails or road borders. It can also be found in gallery forests and cloud forests. It is described to be fire resistant (Wood 16629 K).

Preliminary Conservation Status:—The AOO is 276 km^2 and the EOO is 3,752,394 km^2. *Hyptidendron arboreum* is known for more than 60 localities and it is a fairly resilient species, occuring also in disturbed ground. The conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:—The specific epithet indicates that this can be a tree. *Hyptidendron arboreum* can be up to 20 m tall, which is unusual for the subtribe Hyptidinae and even to Lamiaceae, which has most of their members as short herbs or shrubs.

Affinities and morphological notes:—*Hyptidendron arboreum* can be differentiated from all other species of the genera by a combination of the following characters: shrub to tree up to

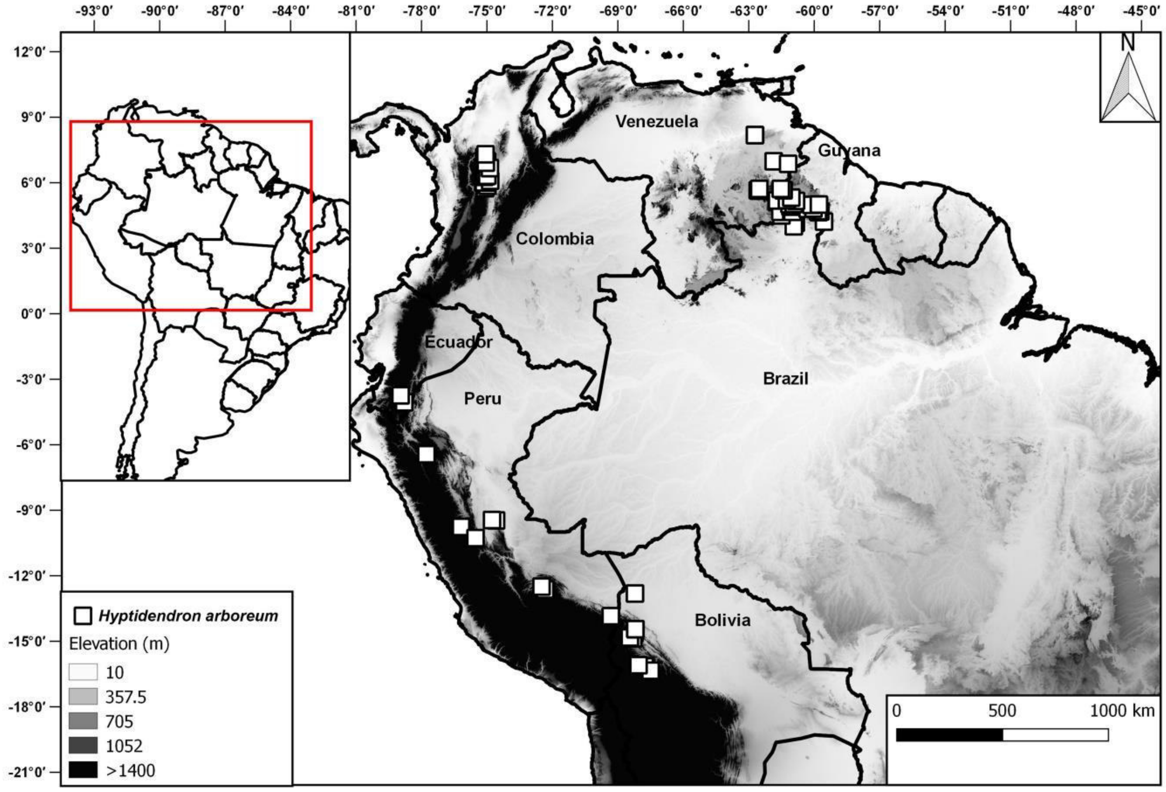

FIGURE 9. Distribution of *Hyptidendron arboreum* (Benth.) Harley.

20 m tall, nutlets 4 per flower, flattened, winged, branched hairs present, inflorescence a conspicuous terminal thyrsoid and calyx lobes subequal or slightly different, 1.5−2.5 mm long at anthesis. The most morphologically related species is *Hyptidendron asperrimum*, the only other species og the genus that can reach up to 20 m tall, differing by the calyx lobes at anthesis (0.7−1.1 mm long in *H. asperrimum* vs. 1.5−2.5 mm long) and at fruit (0.9−1.3 mm long in *H. asperrimum* vs. 1.7−2.5 mm long); corolla tube length (6.8−8.5 in *H. asperrimum* vs. (6−)8.5−10 mm) and nutlets size (2.5−4 × 1.9−2.8 in *H. asperrimum* vs. 3.6−4.6 × 1.5−1.9). It is also morphologically related to *Hyptidendron canum*, differing by the calyx lobes (conspicuously different in *H. canum* vs. subequal to slightly different), leaf shape (mostly ovate in *H. canum* vs. mostly elliptic) and fruiting calyx tube length (7.5−)9−12 mm in *H. canum* vs. 6.5−8.1 mm long).

Altought from different genera, *Hyptidendron arboreum* can also be confused with *Condea tafallae* a sympatric species, by sharing similar habit, leaf and even superficially inflorescence morphology, however these species can be differentiated by the peduncle size (0.5−4 cm in *H. arboreum* vs. 5−10 cm), calyx lobes at anthesis size (1.5−2.5 mm long in *H. arboreum* vs. up to 1 mm long), absence of dendroid hairs (present in *H. arboreum*) and by the stylopodium (absent in *C. tafallae*).

Specimens from Peru and Bolivia tends to have the indumentum of branches composed of longer hairs (up to 0.5 mm) and leaves with denser indumentum than the specimens from Brazil, Guiana, Ecuador, Colombia and Venezuela, which possess smaller hairs and leaves less hairy.

Typification and nomenclatural notes:—Epling (1936b) when lectotypifying *Mesosphaerum arboreum var. bracteosum* wrote that the type was in NY herbarium, without specifying which of the two specimens in NY was chosen. Here we choose as second step lectotypification the specimen that is more complete.

Epling (1936b) states that there is an isotype of *Hyptidendron arboreum* at BM herbarium, but no material has been found in this collection.

Selected specimens examined:—BOLÍVIA. **Franz Tamayo**: Apolo, Near Apolo, 24 July 1902, *Williams 1469* (BM, K, MO, NY, US). **La Paz**: Abel Iturralde, Comunidad Mamacona, sobre camino de Apolo a San José de Uchupiamonas, a 1 km subiendo el rio Mamacona, 14°27'4"S 68°11'38"W, 31 August 2002, *Maldonado et al. 2398* (K, LPB, MO); Chulumani, Sud Yungas, Huancané, ca. 12 km hacia San Isidoro., 16°22'S 67°32'W, 5 August 2000, *Beck 24896* (K, LPB); Coroico, Provincia Nor Yungas, Suapi 16 km. Hacia Santa Rosa., 25 September 1987, *Beck 13630* (K, M, NY); Huancané, Prov. Sud Yungas, 4 km hacia San Isidoro., 16°22'"S 67°32'"W, 5 August 2000, *Beck 24912* (US); La Paz, Songo [Zongo], November 1890, *Bang 836* (BM, E, F, G, K, M, NY, US, W); Mapiri, Provincia de Fraz Tamayo, 100,7 km hacia Apolo, al lado del camino, cerca de Apolo, a 200 m a pie hacia el E, ladera de 30%., 17 August 1993, *Rea et al. 251* (LPB, M, NY). **Santa Cruz**: August 1885, *Pearce 1865* (BM). BRAZIL. **Roraima**: Pacaraima, BR 174, próximo a sede do município., 8 August 2014, *Flores et al. 2791* (MIRR, RB); Pacaraima, Estrada do Suapí., 8 August 2014, *Flores 2807* (MIRR, RB); COLOMBIA: **Antioquia**: Buena Vista, 23 December 1980, *Kalbreyer 1288* (K); Amalfi, 18 km E of Amalfi town center on winding roads to Monos and Portachuelo., 6°55'"N 75°3'"W, 23 May 1989, *Daly & Escobar 6055* (K, NY, US); Anorí, , Cañon del rio Porce, cerca a desembocadura del Rio Rachón, Hacienda Primavera., 15 January 1988, *Fonnegra & Roldán 2247* (K); Cocorná, camino entre "La Piñuela" y "La Vega". Margen Izquierda del Río Santo Domingo, 9 January 1997, *Fonnegra et al. 6300* (F); Guatapé, Cordillera central. Finca Montepinar c. 10 km. NE of Guatape, 6°16'"N 75°7'"W, 10 February 1986, *Stein 3417* (MO, NY); San Carlos, Corregimento Alto de Samaná Norte, Camino de la Vereda Miraflores hacia el Corregimento., 16 June 1989, *Fonnegra et al. 3102* (F, HUA, NY); San Francisco, Carretera al Corregimento de Anti, 10 January 1997, *Fonnegra et al. 6317* (F); San Rafael, 3.1 km E of San Rafael along Guataré-San Rafael road; ca. 0.5 km N of road., 6°18'"N 75°2'"W, 26 October 1987, *Brant & Roldán 1517* (K, MO, NY); San Roque, trail west of river between Q. La Tirana and Providencia, via Popales area. Vic. Planta Providencia, 28 km SW of Zaragoza, valley of Río Anorí in areas surrouding the confluence of Quebrada La Tirana and Rio Anorí, aprox. 3 km upriver from Planta Providencia, 7°18'N 75°4'W, 24 February 1977, *Alverson et al. 109* (NY); Santo Domingo, Mountains near the Termales de Santo Domingo., 30 July 1965, *Barkley & Rivera 35405* (NY); Sonsón, region de Rioverde, a la orilla izquierda del Rio Verde de los Montes; camino hacia Santa Rosa, 4 February 1947, *Gutierrez 35655* (G); Yolombó, Zwischen Yolombo & Cauiau, September 1884, *Lehmann 7924* (BM, K, US). ECUADOR. **Zamora-Chinchipe**: Yacuambi, Centro Shuar Kurints, Cordillera Kunku Naint (Cordillera de la Ciudad). Reserva Tukupi Nunke, 3°44'30"S 78°57'30"W, 8 September 2006, *Wisum & Kajekai 795* (K, MO); Zamora, Región de la Cordillera del Cóndor. Parrouquia San Carlos de las Minas. Nambija. Sendero al Cerro Colorado., 4°3'50"S 78°47'26"W, 28 January 2005, *Quizhpe et al. 799* (K, MO). GUYANA: **Cuyuni-Mazaruni**: Mt. Roraima, Ipelemanta, Arapoo R., 1884, *Jenman 38* (US); Northern Pakaraima Mts. Ciong Valley. 9 km N of Kato Village, 4°42'"N 59°50'"W, 31 May 1995, *Mutchnick 1418* (NY, US); Pavawacutoi Savannah, Ireng District, May 1926, *Altson 532* (K, P, RB); Upper Takutu- Upper Essequibo: Southern Pakaraima mountains, Tipuru R, 1-2 km upstream from Tipuru village, 4°13'"N 59°33'"W, 1 March 1992, *Hoffman et al. 1130* (K, US). PERU. **Amazonas**: Chachapoyas, Leimebamba-Chilchos trail. Chilchos, 3 July 1977, *Boeke 2101* (NY). Cusco: Calca, Dist. Lacco Yabero, 12°29'55"S 72°29'54"W, 18 June 2004, *Valenzuela et al. 3941* (K, MO); Calca, Distrito Quebrada, Yanatile, Punta Lacco, Bosque Intervenido, 12°38'S 72°20'W, 17 August 2003, *Suclli 1084* (F, K). **Huánuco**: 29 July 1969, *Wolfe 12441* (F). Pasco: Oxapampa, Dist. Huancabamba. Parque Nacional Yanachaga-Chemillén, sector Tunqui, zona de amortiguamiento, 10°16'36"S 75°31'25"W, 3 November 2007*, Monteagudo et al. 15884* (K, MO); Oxapampa, Distrito Huancabamba. Zona de Amortiguamiento del Parque Nacional Yanachaga-Chemillén, sector Tunqui, camino a barro blanco., 10°17'13"S 75°31'23"W, 13 September 2007, *Castillo et al. 976* (K, MO). Puno: San Juan del Oro, Circa pagum S. Juan de Oro, atque per viam usque ad Seito-Cocha, et ad oram lacus Titicaca prope Huancane, 24 October 1976, *Bernardi et al. 16853* (F, G, K, US); Sandia, 5 August 1965, *Vargas-Calderón 16369* (US). Ucayali: Iparia, Prov: Coronel Portillo. Falda al Cerro Ariapo, pertenece a las cuencas de los Rios Iparia y Ariapo, afluentes del Rio Ucayali. Reserva Comunal el Sira, 9°28'12"S 74°34'52"W, 15 September 2010, *Graham 6009* (K, MOL). VENEZUELA. **Bolívar**: Gran Sabana, 48 kms al N de Kama-Meru, carretera El Dorado-Sta. Elena, 5°40'"N 61°25'"W, 4 April 1985*, Holst et al. 2231* (NY); La Gran Sabana, Chirimata, carretera al monte Roraima., 5 April 1988, *Sastre et al. 8481* (F, P); Mount Auyan-Tepui, December 1937, *Tate 1140* (NY, US); Prai-Tepui, 28 December 1975, *Ferrari 1475*

(MBM, MY); Rio Cuquenan, December 1909, *Ule 8749* (K); Uaipan-Tepuí, plateau SE foot of the peaks of Uaipan, near the east edge of plateau., 2 May 1967, *Koyama & Agostini 7431* (NY); Caroní, Guayana. Cumbre del cerro Murú. Gran sabana, 15 October 1946, *Cardona 1834* (NY, US); Guayana, Alto Caroní, 25 April 1946, *Lasser 1422* (NY); Guayana, Orillas del Ambetere, valle Urimán, Alto Caroní, January 1949, *Cardona 2586* (NY, US); Ikabarú, 17 km E of El Pauji by road and 64 km W of Santa Elena by road, 4 km N of Highway Rio Las Ahallas, 4°30'"N 61°30'"W, 18 November 1985, *Liesner 19280* (K, MO); Kavanayén, Between Kavanayén and base of Sororopan-tepui, 12 December 1953, *Wurdack 33776* (NY, US); Piar, Pie de la Roca to Guayaraca, talus slope ascent to first level of the southern base of Auyan-tepui, 5°43'"N 62°31'"W, 25 November 1982, *Davidse & Huber 22656* (K, MO); Roscio, a aprox. 3 km al NW de San Ignacio de Yuruaní (Sector Centro-oriental de la Gran Sabana), 5°1'N 61°8'W, 20 June 1983, *Huber & Alacron 7515* (NY); Santa Elena de Uairén, La Gran Sabana, Carretera Luepa-Santa Elena de Uairen, 28 km adelante del salto Kama meru, 6 April 1988, *Sastre et al. 8504* (NY, P); Sifontes, bosques húmedos intervenidos por actividades mineras del sector "La Hoyada" (Paraty tepuy), 7 km al N-W del Caserío "El Pilón", 58 km al W de Santa Elena de Uiarén, 4°40'"N 61°33'"W, 21 October 1986, *Aymard 4580* (NY, PORT).

1.2. *Hyptidendron asperrimum* (Spreng.) Harley (1988: 93) ≡ *Cordia asperrima* Sprengel (1824: 649) ≡ *Hyptis asperrima* (Spreng.) Epling (1936b: 222) ≡ *Hyptis membranacea* Bentham (1833: 132) ≡ *Mesosphaerum membranaceum* (Benth.) Kuntze (1891: 526). Type:—BRAZIL. In Brasilia meridionali, *F. Sellow 1494*, (Lectotype, designated by Epling [1936b: 222] B† (photo at F), replacement lectotype designated here: K-000488098; possible isolectotypes: BR-591455, E-00025384, G-00437847, G-DC-00679765, K-001220691, P-00737517, MPU-015356, US-00121919, W-0051820, W-0061892).

(Figs. 8 D-E, 10).

Trees, treelets or erect shrubs 1.5−20 m tall, slightly aromatic; stems woody, branched, 4−5(−7) mm diam., younger stems quadrangular, canaliculate, broader at nodes, densely tomentose, with brown dendroid hairs and sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 1.6−5.5(−7.7) cm long. Cauline leaves spreading along the branches, not imbricate, longer than internodes, mostly diminishing in size towards stem apex, lamina (4.9−)7.2−16.3 × 2.2−5.4(−7.4) cm, chartaceous, discolorous, with abaxial surface paler, elliptic to narrow elliptic, rarely lanceolate or narrow ovate, base rounded to cuneate, sometimes unequal, apex acute, rarely slightly acuminate or obtuse, sometimes apiculate, apiculus ca. 0.5−1 mm long, adaxial surface scabrid with broad-based, rigid, sharp, eglandular hairs scattered on the lamina, except on main vein, which is tomentose with dendroid brown hairs and long uniseriate simple hairs, mostly in the base to the middle of it, venation mostly inconspicuous, midrib prominulous, or plane, close to base of lamina, but soon becoming impressed, secondary veins impressed, abaxial surface villous or pilose with scattered or densely disposed curved dendroid uniseriate hairs or simple uniseriate hairs, denser in the veins (tomentose) and small sessile glands, surface slightly rugulose to bullate, venation reticulate, prominent, margin not ciliate or with few small hairs, crenulate to serrulate, sometimes inconspicuous, entire in the base to 1/5 of leaf margin, sometimes slightly revolute, mostly near base of lamina, 68−96 teeth on each side of leaf, with tooth apex swollen, obtuse to acute; petiole 1.4−4.4 cm long, canaliculate, tomentose with dendroid hairs and small sessile glands. Inflorescence thyrsoid, terminal, up to 25 cm long, with dichasial axillary cymes, subtended by bracts often conspicuously tinged purple, similar to leaves with same shape, sometimes obovate with obtuse to emarginate apex, slightly smaller, (0.5−)1−5.1 × (0.2−)0.6−2.2 cm, mostly smaller than cymes, sometimes with similar size or slightly longer, mature cymes 1.8−5.2 cm long, 11−20 flowered, not obscured by bracts, peduncles 7−31 mm long, with indumentum as on petioles. Flowers with pedicels 0.7−6(−10) mm long, tomentose with brown dendroid, eglandular hairs and sessile glands and subtended by linear or rarely narrow elliptic bracteoles, 1.5−4 × 0.1−0.5 mm, with indumentum as on pedicels; calyx at anthesis 3.8−5.3 mm long, purple, vinaceous or cinereous, tube 3.7−4.5 mm long, ± cylindrical broadening near the throat to infundibuliform, straight, ribbed, externally densely tomentose with dendroid hairs and small sessile glands, tube internally glabrous at base, becoming pubescent with minute hairs above, and without a ring of hairs in throat, calyx lobes subequal, 0.7−1.1 mm long, deltate, apex acute, rarely shortly acuminate, straight, externally with indumentum as on tube, internally tomentose at the margin with dendroid hairs up to middle of lobes, calyx in fruit 6.7−7.9 mm long, indumentum less dense, tube 5.9−7 mm long, cylindrical to rarely broadly cylindrical, ribbed, calyx lobes 0.9−1.3 mm long, subequal, straight; corolla lilac, purple or bluish, with a white stain in the posterior lobe, 8.1−11.5 mm long, tube 6.8−8.5 mm long, ± cylindrical, straight from base to middle of the tube, becoming slightly curved and enlarged near throat, 1.1−2 mm wide, externally with base glabrous becoming densely tomentose towards apex with dendroid or simple uniseriate hairs, gland-tipped hairs and sessile glands, internally with a ring of villous hairs at base of corolla and with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens and few sessile glands in throat and below it, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally glabrous or glabrescent with few sessile glands, anterior lobe large, boat-shaped with short apiculate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrescent with few long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 4 per flower, 2.5−4 × 1.9−2.8 mm, wide ellipsoid to squared, flattened, winged, castaneous to dark brown, not shiny, glabrous to glabrescent with few sessile glands in the apex, with abscission scars, slightly mucilaginous when wetted.

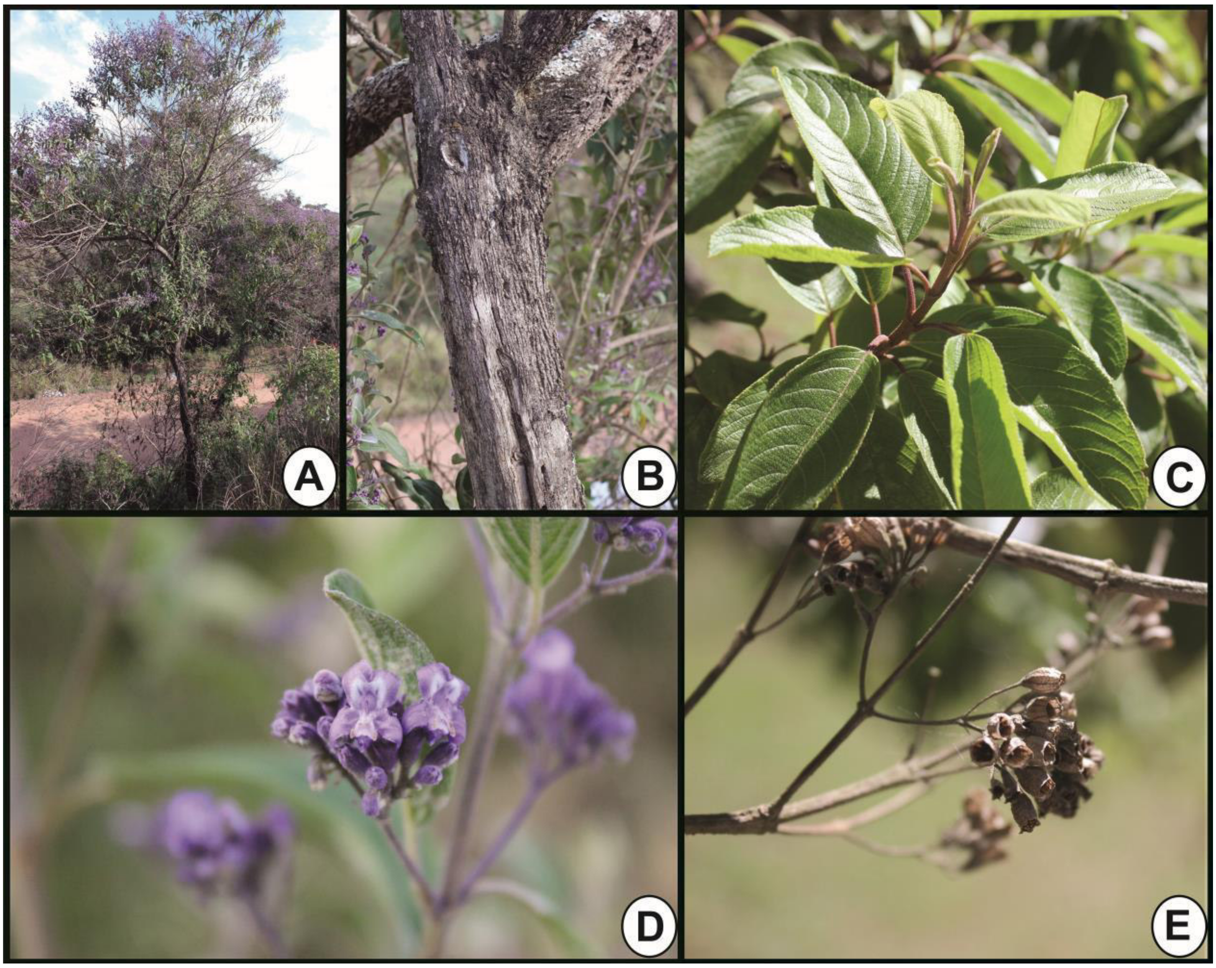

FIGURE 10. Field pictures of *Hyptidendron asperrimum*. **A.** Habit. **B.** Trunk. **C.** Branch with leaves. **D.** Cyme with untrigged flowers. **E.** Cyme, with old calyx. **A-E** photos by G.M. Antar.

Vernacular names:—Alfavaca, Pau-de-São-José, Carrapateiro, Carrapateira, Catinga-de-bode, Cará, Cidreira, Lixinha, Lixeirinha, Maria-Chora, Maria-Mole, Salva-do-campo, São-José, Roxinho.

Phenology:—*Hyptidendron asperrimum* was found flowering and fruiting in all months, except April; however, most of specimens were found fertile during the dry season, ranging to July to October. During July and August most specimens are found just with flowers.

Distribution and Habitat:—*Hyptidendron asperrimum* is endemic to Brazil occurring in the states of São Paulo, Rio de Janeiro, Espirito Santos, Minas Gerais and Bahia (Fig. 11). It

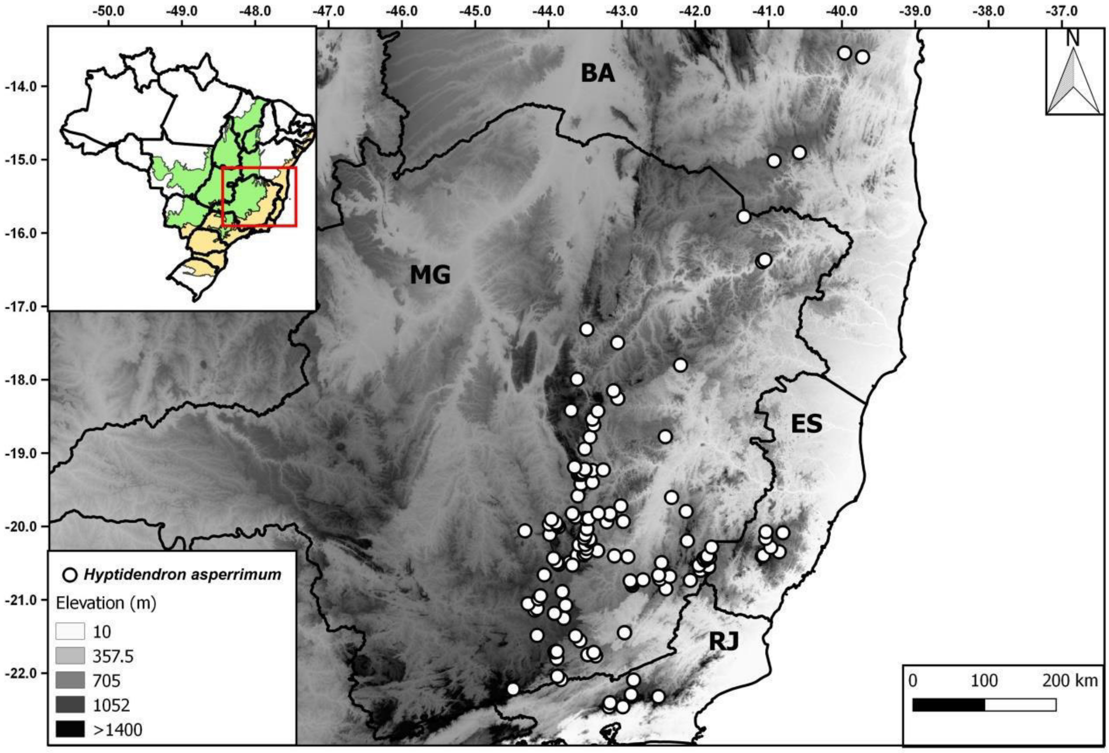

FIGURE 11. Distribution of *Hyptidendron asperrimum* (Spreng.) Harley. The green shape in the small map shows the extension of the Cerrado Domain, and the yellow shape show the extension of the Atlantic Rainforest Domain. (BA, Bahia; ES, Espírito Santo; MG, Minas Gerais; RJ, Rio de Janeiro).

inhabits the Cerrado and Atlantic Forest domains in altitudes from 500 to 2000 m elevation in riparian forest, semideciduos forests. *Hyptidendron asperrimum* can be a pioneer species, growing in disturbed vegetation as border of roadside and *Eucalyptus* L'Hér. crops. It is sympatric with *Hyptidendron canum* and *Hyptidendron vauthieri*, although does not share the same habitat preferences.

Preliminary Conservation Status:—The AOO is 516 km² and the EOO is 256933 km². *Hyptidendron asperrimum* is known from more than 100 localities. It is fairly resilient species, occuring in a wide variety of habitats, including also disturbed ground. It is also present in some protected areas, such as the Parque Nacional do Caparaó, Parque Nacional da Serra do Cipó and the Jardim Botânico da Universidade Federal de Juiz de Fora. The conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:—The epithet refers to the asperous or scabrid adaxial leaf-surface, due to the presence of rigid, antrorse hairs.

Affinities and morphological notes:—*Hyptidendron asperrimum* can be distinguished from all other species in the genus, by the combination of the following characters: calyx lobes in anthesis subequal, <1.1 mm long, calyx in fruit with lobes <1.3 mm long, presence of dendroid hairs, inflorescence a terminal thyrse and 4 winged, flattened nutlets per flower. The species together with *Hyptidendron arboreum* are the only ones in the genus to be tall trees reaching up to 20 meters in high.

The most closely related species to *Hyptidendron asperrimum* are *H. canum* and *H. arboreum*, which are difficult to distinguish when in the vegetative condition, as they share similar intervals in leaf, petiole, and stem measurements. When reproductive, they can be easily differentiated, as *H. asperrimum* possesses smaller calyx lobes up to 1.1 mm in anthesis and 1.3 mm in fruit.

Hyptidendron asperrimum can also be differentiate from *H. arboreum* by their dissimilar distribution patterns. While the first is distributed from South east and North east Brazil, the second occurs in Northern Brazil, Venezuela, Colombia, Ecuador, Peru and Bolivia. Another tree species, which might be confused with these, is *H. canum*. However, this has very different ecological requirements, being a plant of savanna vegetation (cerrado), while the other two occur in forest vegetation.

Typification and nomenclatural notes: When *Cordia asperrima* was described (Sprengel 1824), no material was cited and just a brief description and the location Brazil were added. Bentham (1833) described *Hyptis membranacea* with three syntypes. In his synopsis, Epling (1936b) made the new combination of *Hyptis asperrima* and chose a lectotype for this name and the same lectotype for *Hyptis membranacea*. He chose as a lectotype the Sellow material housed in Berlin herbarium numbered 1494, however, the material was destroyed during second world war. The specimen in K has here been chosen as the replacement lectotype. Apart from the material at B, which has been destroyed, other Sellow material of this taxon is unnumbered, and it is therefore impossible to know as sure whether Sellow collected *H. asperrimum* more than once. However, in Bentham's original protologue, he cites only one Sellow collection, and claims that he has a specimen of this in his herbarium (h. s. sp. e Mus. Reg. Berol.). We can therefore confidently take this as a duplicate of the original collection, as was also accepted by Epling, who annotated the sheet.

Selected specimens examined:—BRAZIL**. Bahia**: De Vitória da Conquista para Itabuna. Serra. 26 June 1965, *Belém 1234* (UB, NY). Barra da Choça: Estrada que liga Barra do Choça à Fazenda Roda d'Água (Rio Catolé), 3-6 km a E de Barra do Choça. 22 November 1978, *Mori et al. 11318* (CEPEC, HRB, K, NY, RB). Jaguaquara: Km 30 da rodovia Jaguaquara/Apuarema. 3 October 1972, *Pinheiro 1954* (K). Vitória da Conquista: Km 5 a 10 da rod. Rio/Bahia ao Norte, 15 February 1972, *Santos 2248* (CEPEC, K, NY). Wenceslau Guimarães: Estação Ecológica de Wenceslau Guimarães, Trilha atrás do alojamento, passando a captação, 13°36'0"S 39°43'6"W. 16 October 2012, *Milliken et al. 5103* (CEN, HUEFS, HURB, RB). **Espírito Santo**: Afonso Cláudio. 20°9'36"S 41°2'24"W. 30 January 2016, *Julkoski 157* (SPF, VIES). Domingos Martins: Estrada Alto Parajú. 20°20'41.2"S 40°51'18"W, 8 October 2010, *Folli 6717* (CVRD, RB). Espera Feliz: Dores do Rio Preto. Pedra Menina, entorno do Parque Nacional do Caparaó, do lado de córrego, 25 August 2005, *Leoni 6278* (GFJP, RB). Iúna: Distrito de Pequiá, Rod. BR-262, 21 July 1982, *Hatschbach*

45155 (BM, ESA, K, MBM, NY, UPCB). Santa Maria de Jetibá: Córrego do Ouro 1/Barra do rio Posmousser, propriedade privada que pertence a família Berger, 23 July 2006, *Santos s.n.* (MBML, SPF). Venda Nova: Alto Caxixe. 20°24'16.3"S 41°5'9.2"W, 11 November 2007, *Simonelli et al. 1292* (MBML, SPF). **Minas Gerais**: Alto Caparaó: Parque Nacional do Caparaó, Estrada entre a sede administrativa e a Tronqueira. 20°24'55"S 41°50'58"W, 30 March 2017, *Antar & Santos 1437* (SPF). Araponga: 1 km W of Araponga. 18 November 1958, *Irwin 2115* (F, NY, R, US). Barão de Cocais: Apiário do Pio, 25 October 1991, *Veríssimo 432* (PAMG). Barbacena: BR-3, km 270. 12 September 1964, *Pereira & Pabst 9154* (F, K, M, NY, RB, UPCB). Barbacena: In vicinia urbis Barbacena prov. Minarum Minas Gerais, Brazil, *Pohl 23* (M, W). Barroso: Mata do Baú, 14 September 2002, *Assis & Magalhães 547* (ESA, ESAL, CESJ, MBM, RB, SPF). Belo Horizonte: Parque do Betânia: [Parque Municipal Jacques Cousteau], Atual Parque Jacques Cousteau. 19 September 1997, *Caldeira s.n.* (BHZB). Belo Vale: Br 040, km 14. 20°26'"S 43°56'"W, 15 August 1998, *Forzza et al. 977* (NY, SPF). Bocaina de Minas. 25 September 2001, *Carvalho, D.A. s.n.* (ESAL, SPF). Caeté: Serra da Piedade, ca. 40 km E of Belo Horizonte, near BR-31. 16 January 1971, *Irwin et al. 30529* (K, NY). Carandaí: Pedra do Sino Hotel Fazenda, BR 040, km 6, mata do Bugiu, 1 October 2005, *Mota & Stehmann 383* (BHCB). Carangola: Área de Proteção Ambiental do Morro da Torre, 20°44'"S 42°4'"W, July 1994, *Leoni 2621* (GFJP, RB). Caratinga: Pedra Itaúna, 15 August 2010, *Cupertino & Silva 69* (GFJP, RB). Carbonita: 18 September 1996, *Brandão 25002* (PAMG). Catas Altas: Reserva Particular do Patrimônio Natural Santuário do Caraça, Serra do Caraça, Seminário do Caraça, mata no caminho para o campo de fora, 27 July 1989, *Cordeiro & Romaniuc Neto 597* (CESJ, SP). Conceição do Mato Dentro, Conceição do Mato Dentro-Diamantina, 5 May 1994, *Brandão 24467* (PAMG). Congonhas: 21 September 2010, *Rabelo s.n.* (PAMG). Congonhas: Proximidades da Mina Casa de Pedra, CSN- Companhia Siderúrgica Nacional, 7 August 2007, *Melo 4039* (ESAL, SPF). Conselheiro Lafaiete: Casa de Pedra – Congonhas, 21 September 1936, *Mello-Barreto*

8142 (F, R). Descoberto, Reserva Biológica da Represa do Grama, 14 October 2001, *Forzza et al. 1888* (CESJ, ESA, SPF). Diamantina: Estrada Real, indo para Diamantina, 2 August 2006, *Salles et al. 4253* (HEPH). Divisa Alegre: próximo ao posto fiscal, 15°45'93"S 41°20'3"W, 2 September 2008, *Oliveira et al. 1584* (HUEFS). Entre Rios de Minas: BR-382, 20°39'30,3"S 44°3'32,3"W, 29 August 2010, *Sobral 13335* (HUFSJ, RB). Espera Feliz: Ida para o Parque Nacional do Caparaó, 22 October 2009, *Pereira & Leoni 53* (GFJP, RB). Ewbank da Câmara: Rio Paraibuna, próximo à cidade de Dores do Paraibuna (Final do Lago), 15 September 1994, *Santos et al. 343* (CEN, HUEFS). Fervedouro: Zona da Mata, 2 August 1992, *Brandão 19556* (PAMG). Gouveia: Rod. BR-259, tronco para Datas, 16 September 1985, *Hatschbach & Zelma 49748* (K, MBM, HUEFS). Igarapé: Rodovia Fernão Dias, 4 September 1971, *Hatschbach 26975* (K, MBM, NY, UPCB, US). Itabirito: Serra de Itabira do campo, 24 March 1904, *Damazio 1355* (G). Itambé do Mato Dentro: Distrito de Santana do Rio Preto (Cabeça de Boi), APA do Parque Nacional da Serra do Cipó, terras de José Agostinho, 19°23'53,9"S 43°24'9,2"W, 24 August 2007, *Santos & Martins 146* (SPF). Jaboticatubas: Serra do Cipó, Km 126, 28 July 1977, *Semir, 6514* (F, MBM, UEC, RB, SP). Jequitinhonha: Serra da Areaia, ca. 47 km ao sul de Pedra Azul, na estrada para Jequitinhonha, 16°22'S 41°3'W, 20 October 1988, *Harley et al. 25264* (E, K, MBM, NY, RB, SPF, UB). Juiz de Fora: Jardim Botânico da Universidade Federal de Juiz de Fora. Mata do Krambeck, na trilha, 31 August 2011, *Silva et al. 52* (CESJ). Lagoa Dourada: 20°56'40"S 44°6'34"W, *Sobral 15011* (BHCB, HUFSJ, RB). Lima Duarte: São José dos Lopes, 12 September 1940, *Magalhães 522* (BHCB, CESJ, MBM). Malacacheta: 17°48'"S 42°12"W, 9 November 1981, *Silva 115* (HRB, RB). Manhuaçu: Estrada entre Manhuaçu e Vitória, km 213, 7 September 1977, *Shepherd et al. 5816* (F, K, MBM, UEC). Mariana: Mina Samarco. Norte de Alegria 1 e 6, 20°9'17"S 43°30'53"W, 16 October 2009, *Rezende & Mendes 3871* (BHCB, BHZB, CTBS). Miradouro: Rodovia BR-116, próximo a Miradouro, 10 October 1992, *Hatschbach, 57936* (MBM, SPSF, UPCB, W). Morro do Pilar: Km 186, 25 August

1933, *Mello-Barreto 3125* (BHCB, F, R). Nova Era: 20 August 1992, *Costa & Atalla s.n.* (BHCB, K). Nova Lima: RPPN Mata Samuel de Paula, 20°0'4"S 43°51'48,7"W, 23 August 2005, *Salino et al. 10566* (BHCB). Ouro Branco: Serra de Ouro Branco, cerca de 10 km da cidade, 11 October 1992, *Souza & Sakuragui 2040* (ESA, K, SPF). Ouro Preto: 20°23'"S 43°31'"W, 23 July 1980, *Ururahy 14* (HRB, RB). Piedade do Rio Grande: July 1999, *Carvalho 66* (ESAL). Ponte Nova: *Badini s.n.* (OUPR). Ressaquinha: Vicinal da BR-040, Rodovia Juscelino Kubitscheck, localidade chamada de Pedrinhas, 21°4'21"S 43°45'59"W, 22 August 2018, *Antar & Antar 2377* (SPF). Rio Piracicaba: Vale, Mina de Água Limpa, PDE Morro Agudo, 19 August 2008, *Morais et al. 7* (OUPR, SPF). Rio Preto: 7 September 1988, *Krieger et al. CESJ 22551* (CESJ). Rio Vermelho, Estrada Fazenda Portão/Serra Azul, 4 September 1988, *Menandro 132* (K). Ritápolis: Floresta Nacional de Ritápolis, próximo ao Tamboril (Eflex), 27 October 1994, *Barbosa 2188* (RB). Santa Bárbara: Estrada Rio Acima, Fazenda Gandarela, 4 November 1966, *Duarte 986* (K, M). Santana do Riacho: Km 114 ao longo da rodovia Belo Horizonte-Conceição do Mato Dentro, 15 August 1979, *Giulietti et al. CFSC 5630* (SP, SPF). Santo Antônio do Amparo: 5 June 2005, *Castro 144* (ESA). Santo Antônio do Itambé: caminho ao pico do Itambé, 9 September 1972, *Hatschbach 27503* (K, MBM, US). Santo Antônio do Rio Abaixo: Área de influência da PCH Quinquim, 25 September 2005, *Viana et al. 1876* (CESJ). Santos Dumont: Dores do Paraibuna, Fazenda Criminoso, 7 September 2007, *Mello-Silva et al. 2934* (CEN, RB, SPF). São Domingos do Prata: BR 262, entre acesso São Domingos do Prata e acesso a Ponte Nova, lado direito, 27 August 1988, *Tabacow & Chamas s.n.* (MBML, SPF). São Gonçalo do Rio Abaixo: 1 December 1986, *Pedralli et al. s.n.* (HXBH). São Miguel do Anta: Road to São Miguel, near km 15, 14 September 1930, *Mexia 5050* (BM, F, G, K, NY, P, US, W). Sardoá: Fazenda Sérgio, 4 September 2008, *Kamino & Maielo-Silva 1135* (BHCB, SPF). Sericita: Fazenda Boa Vista, 3 December 1997, *Salino 3829* (BHCB, HUEFS). Serro: Vila do Príncipe, July 1840, *Gardner 5107* (BM, E, G, G-DC, K, NY, P, SP, US, W). Tiradentes: Serra de São José, October 1989, *Alves 990* (RB). Vargem Alegre: Estrada da Vargem Alegre, 26 August 1928, *Kuhlmann 49* (F, RB). Venda Nova: Fragmento da propriedade do Sr. Waldemar, 22°17'20"S 42°52'24"W, 22 October 2004, *Paula C671* (RB, SPF). Viçosa: Estação de Pesquisa, Treinamento e Educação Ambiental Mata do Paraíso, 1 September 2012, *Simão 284* (PAMG). **Rio de Janeiro**: Nova Friburgo, 11 August 1881, *Glaziou 13055* (P). Petrópolis: Estrada Itaipava-Teresópolis. 28 August 1988, *Tabacow & Chamas 47* (MBML, SP, SPF). Teresópolis: entre Friburgo e Teresópolis, 23 August 1959, *Pabst 4885* (K, MBM, UPCB).

1.3. *Hyptidendron canum* (Pohl ex Benth.) Harley (1988: 93) ≡ *Hyptis cana* Pohl ex Bentham (1833: 135) ≡ *Mesosphaerum canum* (Benth.) Kuntze (1981: 526). Type:—BRAZIL. Minas Gerais: Rio Abaite, July 1820, *J.B.E. Pohl 3287*, (Lectotype, designated here: W-0051808; isolectotypes: K-000488089, UC-2055643, W-0051809, W-0051810).

=*Hyptis altissima* Saint-Hilaire ex Bentham (1833: 135) ≡ *Mesosphaerum altissimum* (A.St.-Hil. ex Benth.) Kuntze (1891: 526) TYPE:—BRAZIL. Goiás: [Pirenópolis] in campis prope pagum Meiaponte et alibi in parte meridionali provinciae Goyaz, *A.F.P. Saint-Hilaire 846* (lectotype, designated here: P-00737511; isolectotypes: P-00737512, P-00737513, US-00121854, F-998929; probable isolectotype: P-00737514).

=*Hyptis plagiostoma* Briquet (1989: 197) ≡ *Mesosphaerum plagiostomum* Briquet (1898: 197). TYPE:—BRAZIL. Minas Gerais, *P. Claussen s.n.* (holotype: G-00437848).

=*Hyptis scabra* Bentham (1833: 134) ≡ *Mesosphaerum scabrum* (Benth.) Kuntze (1891: 526). TYPE:—BRAZIL. Brasilia meridionali, *F. Sellow 1495* (first-step lectotype, designated by Epling [1936b: 222], second step lectotype, designated here: K-000488093; isolectotype: B† (photo at F-17791); possible isolectotypes: G-DC-00679691, HAL-098174, K-001220662, US-00121893, W-0051812).

= *Hyptis sordida* Pohl ex Bentham (1833: 135). TYPE:—BRAZIL. Minas Gerais: ad Barbacena, Oliveira et Villa Rica provinciae, *J.B.E. Pohl 504* (Lectotype, designated here: W-0051813, isolectotypes: F-869292 [fragment], K-000488090, K-000488091, W-0051811).

(Figs. 12, 13 A-C).

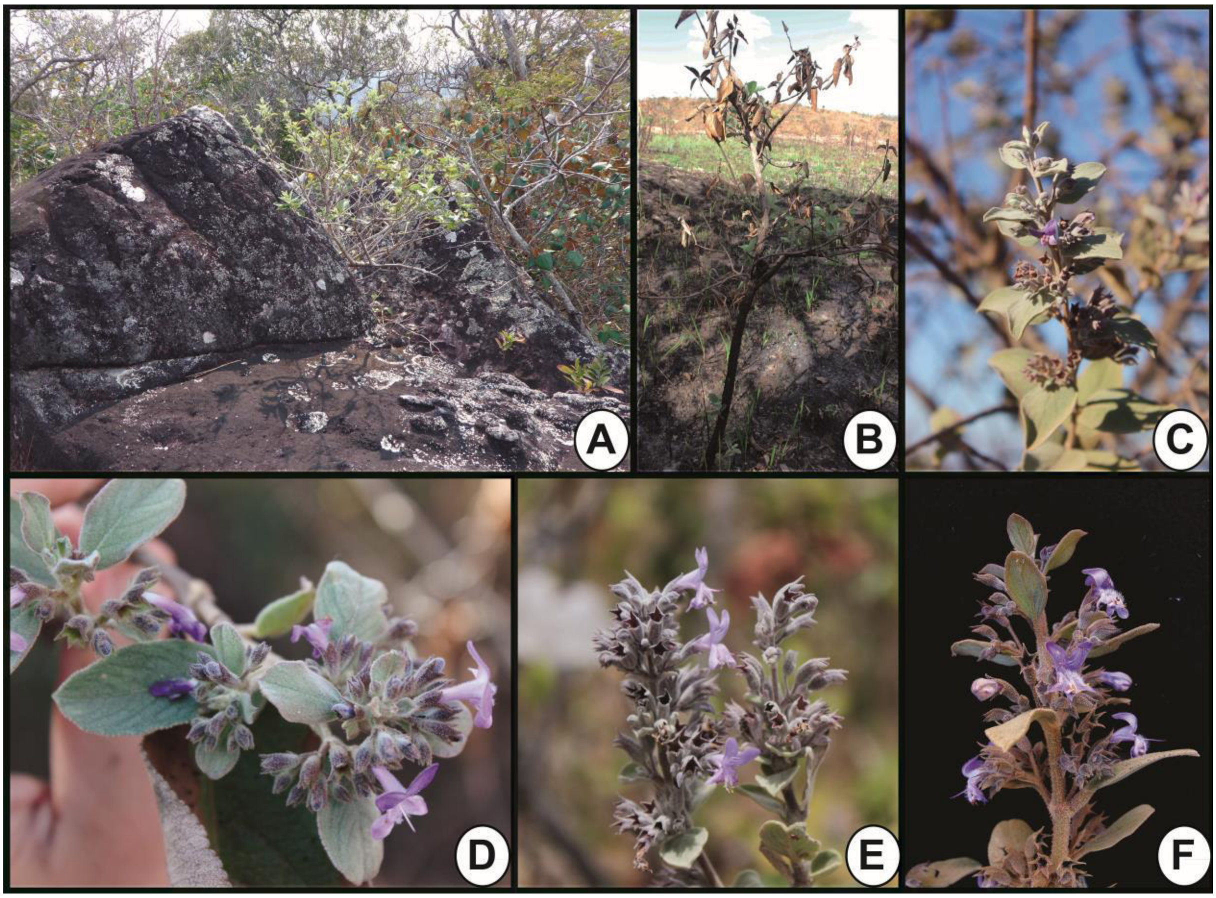

FIGURE 12. Field pictures of *Hyptidendron canum*, **A.** Habit. **B.** Habit, individual recently burned. **C.** Inflorescence. **D.** Branch with inflorescence. **E.** Inflorescence. **F**. Inflorescence. **A.** photo by J. Wood, **B-E** photos by G.M. Antar, **F.** Photo by M.F. Simon.

Trees, treelets or erect shrubs 0.5−8 m tall, often aromatic; stems woody, branched, 3−7(−10) mm diam., younger stems quadrangular, canaliculate, tomentose, canescent or rarely pubescent with white eglandular dendroid hairs, simple gland-tipped hairs of different sizes and small sessile glands, the proportion between these different types of hairs varying in different specimens, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 1.4−6.6(−9.1) cm long. Cauline leaves spreading along the branches or rarely somewhat congested, not imbricate or rarely imbricate, longer than internodes, less commonly equal or smaller, mostly diminishing in size towards stem apex, lamina (2.5−)4.4−15.5 × (2−)2.5−6.9(−8.1) cm, chartaceous to coriaceous, discolorous, with abaxial surface paler or cream, broadly to narrowly ovate, or lanceolate to elliptic, rarely suborbiculate or orbiculate, base rounded or cordate, less commonly truncate or cuneate, apex obtuse or acute, less commonly retuse, mostly apiculate, apiculus ca. 1 mm long, adaxial surface pubescent, tomentose or rarely glabrescent with white or brown dendroid eglandular hairs, simple uniseriate hairs and small sessile glands, denser on the main vein mostly close to the base, venation mostly inconspicuous, midrib prominulous, or plane, close to base of lamina, but soon becoming impressed, secondary veins plane or impressed, abaxial surface densely tomentose, canescent or rarely glabrescent with white dendroid hairs and sessile glands, slightly less dense on the primary and secondary veins, venation reticulate, prominent, margin ciliate, crenulate, serrulate, sometimes entire at the base to 1/5 of leaf margin, mostly slightly revolute, 27−76 teeth on each side of leaf, with tooth apex swollen, obtuse or acute; petiole (0.3−)0.7−2.9 cm long, canaliculate to slightly canaliculate, tomentose with white dendroid hairs and small sessile glands. Inflorescence thyrsoid, terminal, up to 28 cm long, with dichasial axillary or rarely unilateral cymes, subtended by bracts similar to leaves with same shape, mostly with emarginate apex, the same size or smaller then leaves, (0.9−)1.4−4(−6.6) × 0.6−6.2 cm, smaller than cymes, less commonly with similar size or longer, mature cymes 1.7−5 cm long, (7−)10−18(−37) flowered, usually not obscured by bracts, peduncles (1.2−)3−12(−21) mm long, with indumentum as on petioles. Flowers with pedicels 1−12(−15) mm long, tomentose or pubescent with densely white dendroid hairs, small sessile glands and different heights gland-tipped hairs and subtended by linear to narrow elliptic bracteoles, (0.8−)1.5−5 × 0.1−0.8 mm, with indumentum as on pedicels; calyx at anthesis 5.3−12 mm long, green, white, cream or greyish, tube (3.8−)5−8.5 mm long, ± cylindrical broadening near the throat to infundibuliform, straight or curved, ribbed, externally densely tomentose, lanate or canescent with dendroid white hairs, sessile glands and gland-tipped hairs, denser near the base, or pubescent and of different lengths, simple or dendroid gland-tipped hairs, denser at the base, tube internally glabrous at base, becoming pubescent with minute hairs above, and without a ring of hairs in throat, calyx lobes conspicuously unequal, (1.2−)1.6−4.1 mm long, deltate, apex acute to long acuminate, straight or curved, externally with indumentum as on tube, internally tomentose at the margin with dendroid hairs up to middle of lobes, calyx in fruit (9.3−)10−16 mm long, indumentum less dense, tube (7.5−)9−12 mm long, ± cylindrical to broadly cylindrical, ribbed, calyx lobes (1.9−)2−4.2(−4.7) mm long, different, straight or curved; corolla lilac to purple, 11.5−20 mm long, tube (6−)8.5−10 mm long, ± cylindrical, straight from base to middle of the tube, becoming slightly curved and enlarged near throat, 1.2−3 mm wide, externally with base glabrous becoming densely tomentose towards apex with simple or dendroid uniseriate hairs and rarer sessile glands, internally with a ring of villous hairs at base of corolla and with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens and sessile glands in throat and below it, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally ciliate, anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous or glabrescent to middle and with long uniseriate hairs mostly near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 4 per flower, (2.2−)2.7−4.5 × 1.4−3 mm, ellipsoid, ovoid or oblongoid, flattened, winged, black to castaneous, not shiny, pubescent to glabrescent with few minute hairs and rugulose, with abscission scars, slightly mucilaginous when wetted.

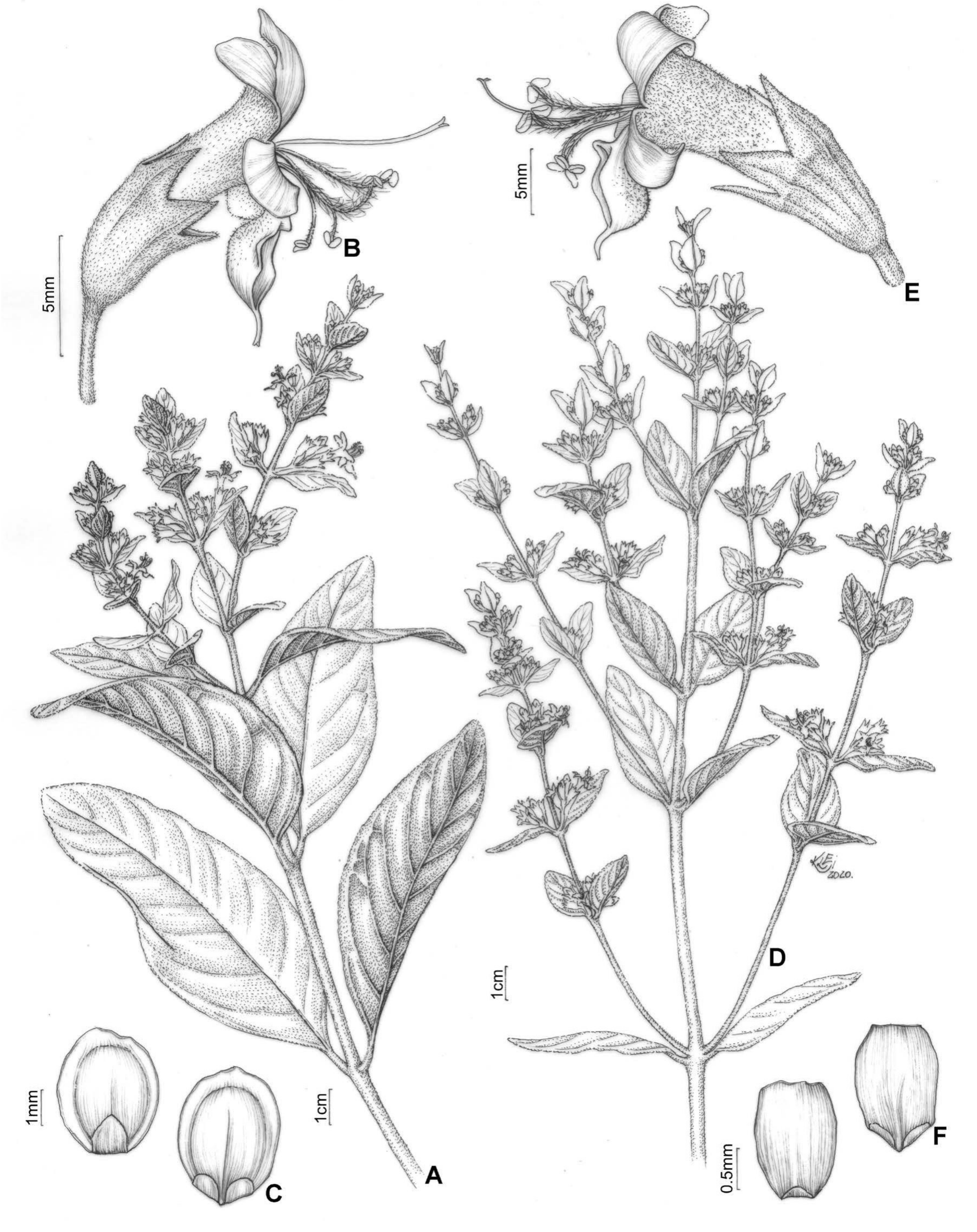

FIGURE 13. Line drawing of *Hyptidendron canum* (Pohl ex Benth.) Harley. **A.** Branch bearing leaves and inflorescenses. **B.** Flower, side view. **C.** Nutlet. Line drawing of *Hyptidendron conspersum* (Benth.) Harley **D.** Branch bearing leaves and inflorescenses. **E.** Flower, side view. **F.** Nutlet. Illustration of Klei Sousa.

Vernacular name:—Lixa, Macieira-Branca, Cinzeiro.

Phenology:—*Hyptidendron canum* was found in a fertile condition, during all months of the year, except *for* April. However, most of the collections are restricted to the dry season, mostly July to September.

Distribution and Habitat:—*Hyptidendron canum* occurs in Brazil (Distrito Federal, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, São Paulo) and Bolivia, in Santa Cruz department (Fig. 14). It inhabitates the Cerrado domain in savanna habitats (Cerrado *sensu stricto*, Campo sujo, campo cerrado), dry forest borders, and disturbed ground from 250 to 1400 meters elevation. This is the most common species of *Hyptidendron* with ca. 40% of the collections for the entire genus. Although it can be uncommon in conserved Cerrado areas, it is a very resilient species that demands very low soil nutrient quality, for that reason being very common in disturbed areas as roadside, trail edge and even borders of mining, where it can form large populations. It occurs sympatrically with *Hyptidendron asperrimum*, *Hyptidendron leucophyllum*, *Hyptidendron albidum, Hyptidendron vepretorum* and *Hyptidendron vauthieri*. It has been sucessfully cultivated (Occhioni 3699, P) outside its distribution area.

Preliminary Conservation Status:—*Hyptidendron canum* possesses the highest Area of Occurrence of the genus. The AOO is 1024 km² and the EOO is 2709480 km². It is known for more than 200 localities and is a fairly resilient species, occurring in a wide variety of habitats, including also disturbed ground. It is also present in some protected areas such as the Parque Nacional da Serra do Cipó, the Jardim Botânico de Brasília and the Parque Estadual da Serra dos Pirineus. The conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:—The epithet refers to the leaves, calyx and younger branches, which are silvery-grey due to the dense indumentum.

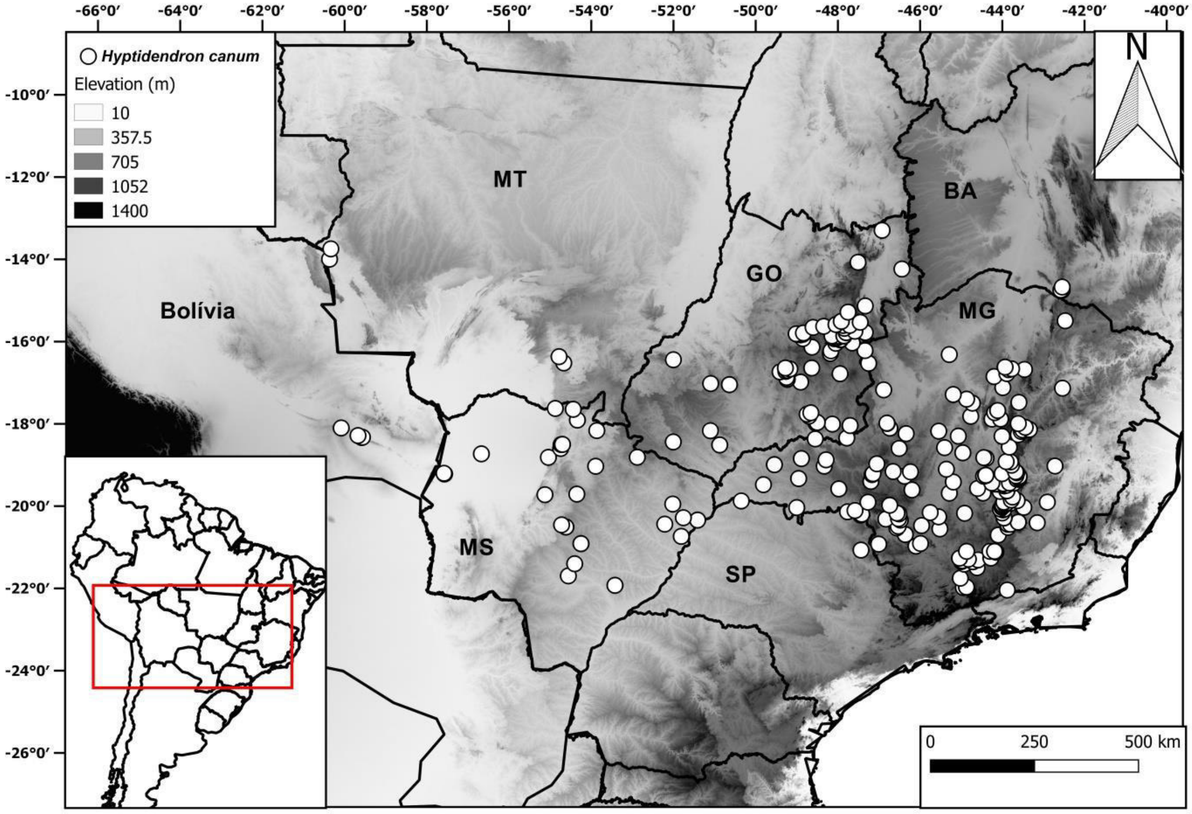

FIGURE 14. Distribution of *Hyptidendron canum* (Pohl ex Benth.) Harley. (BA, Bahia; GO, Goiás; MT, Mato Grosso; MS, Mato Grosso do Sul; MG, Minas Gerais; SP, São Paulo).

Affinities and morphological notes:—*Hyptidendron canum* can be distinguished from all other species in the genus by the combination of the following characters: shrub or tree up to 8 m tall, nutlets 4 per flower, flattened, winged, branched hairs present, mostly white, inflorescence a terminal thyrsoid, calyx lobes conspicuously unequal, at anthesis (1.2−)1.6−4.1 mm long, anterior lobe of corolla with a long apiculus and fruiting calyx tube 7.5−12 mm long. *Hyptidendron canum* is morphologically more closely related to *H. arboreum, H. conspersum* and *H. leucophyllum*. The distinguishing characters of those species are listed in Table 2.

Hyptidendron canum is widely distributed, ranging from the north of São Paulo state to southern Bahia and to the states of Mato Grosso do Sul and Mato Grosso, and eastern

TABLE 2. Diagnostic morphological characters of Hyptidendron arboreum (Benth.) Harley, Hyptidendron canum (Pohl ex Benth.) Harley, Hyptidendron conspersum (Benth.) Harley and Hyptidendron leucophyllum (Pohl ex Benth.) Harley.

Character	*H. arboreum*	*H. canum*	*H. conspersum*	*H. leucophyllum*
Habit	Tree to shrub	Tree to shrub	Treelet to shrub	Shrub
Internodes lenght (cm)	(1.1−)2.2−6.5(−7.6)	1.4−6.6(−9.1)	(1.5−)2.2−7.2(−8)	(2.4−)3.2−12.5(−20)
Leaf size (cm)	(5−)7.4−18.4 × 2.8−5.5(−7.3)	(2.5−)4.4−15.5 × (2−)2.5−6.9(−8.1)	3.4−9.3 × 1.5−4.1	(1.8−)4−7.1 × 0.9−2.1(−2.8)
Petiole lenght (cm)	1.1−3.5	(0.3−)0.7−2.9	0.4−0.7	(0.25−)0.5−1.4(−2.3)
Mature Cyme lenght (cm)	2.1−5.9 cm	1.7−5	0.9−2.5	1.5−3.4
Flowers per cyme	12−38	(7−)10−18(−37)	9−20	(13−)17−31
Calyx lobes	subequal or slightly unequal	conspicuously unequal	conspicuously unequal	conspicuously unequal
Calyx at anthesis lobes lenght (mm)	1.5−2.5	(1.2−)1.6−4.1	2.1−3	1.2−2
Calyx tube at anthesis (mm)	4.3−5.6	(3.8−)5−8.5	3.5−5	3−5
Fruiting calyx tube lenght (mm)	6.5−8.1	(7.5−)9−12	4.7−6.6	4.8−7.8
Corolla apiculus	present	present	present	absent
Phytogeographical Domain	Amazonia	Cerrado	Cerrado	Cerrado

Bolivia. It has some remarkable morphological variability within its range. The most morphological variable attributes are indumentum density, mostly in calyx (responsible for different colours in specimens), peduncle length, calyx length, bracts size, inflorescence internodes length (more congested or lax) and leaf morphology. This variation can explain the number of synonyms published for this species, the largest within the genus, what was even more likely to occur when Bentham (1833) described those species as he had few materials on which to base his descriptions. With the increasing amount of material of *Hyptidendron canum* available, it is possible to assume that the range of variablity is best recognized as part of a single highly variable taxon. However, it is possible to related some of this morphological variation to five different geographically circumscribed populations listed as: 1) Populations related to the type specimen, mostly from Minas Gerais state; 2) Distrito Federal populations that have a more glandular indumentum in the calyx and pedicel 3) Bolivia populations that possess longer bracts somewhat obscuring the leaves and drying black – (rather than smaller and drying grey or castaneous) and branches becoming vegetative after flowering; 4) Populations from Morro do Urucum, Mato Grosso do Sul state, which grow on ironstone soils, and possess orbicular leaves, smaller peduncles, smaller calyx and longer bracts obscuring the leaves; and 5) Population from Comodoro municipality, Mato Grosso state, represented by a single specimen (Antunes 283, UB herbarium) possesses broader leaves, with glabrescent indumentum and larger bracts obscuring the leaves. After considering publishing some of these as new species, mostly for the Comodoro and Bolivian populations (Harley had considered treating the latter as a new species with the provisory name of *Hyptis orbignaei* Harley *sp. nov*., based on the specimen *D'Orbigny 265* in P herbarium), we decided that there is not enough morphological and molecular (Antar *et al*. in prep) evidence to justify their separation. Thus, *Hyptidendron canum* can be considered as a widely distributed and variable species. Further studies in phylogeography of different populations of *H. canum* could be helpful to elucidate the limits of this taxon.

The vernacular name for this species: Cinzeiro, according to *Duarte 3825*, is due to the poor quality of the wood as fuel for burning.

Typification and nomenclatural notes:—Harley (1988) when combining *Hyptis cana* in *Hyptidendron canum* missed the Pohl type number pointing that Pohl's 504 would be the type, when this is the type of *Hyptis sordida*.

As there are three sheets of Pohl collection of *H. cana* we propose a lectotypification.

For *Hyptis scabra*, Epling (1936b) chose a lectotype, Sellow 1495, but didn't indicate in which herbarium it was found. He wrote "typum verum non reperire potui" meaning that he could not find the true type. He indicates isotypes at B and K. The material from B, with Sellow's number would be the best option but it was destroyed in WW2. The K material although possess no Sellow number, it is very morphologically similar to the material of B (saw by F negative) and possess Epling's label with Isotype written. There are two different materials in the sheet but just the one of the left, with the barcode K000488093 is the second step lectotype chosen here.

For *Hyptis altissima*, Bentham (1833) just cited one material from P herbarium, still there are three sheets in P herbarium necessitating a lectotype, designated here.

For *Hyptis plagiostoma*, although the type is based on an unnumbered collection of Claussen, only one specimen annotated by Briquet, could be found at G (where the Herbarium Delessert is housed) and which must represent the holotype. There are unnumbered Claussen collections, that are very similar to *H. plagiostoma* in Kew (K-000488088) and Paris (P02979905), but it is impossible to say with certainty that they are isotype material.

For *Hyptis sordida* Bentham (1833) indicates that the type material is at the W herbarium. However, there are two sheets there and therefore a lectotypification is necessary. Although there is material at Kew, Bentham cites in the protologue only that he has seen the material in W herbarium, and Epling (1936b) followed this, when synonymizing the species under *Hyptis cana* (Epling 1936b). It is interesting that Bentham (1833) commented that both *Hyptis sordida* and *Hyptis cana*, were in his opinion very similar to *Hyptis scabra*, but Pohl assured him that they were distinct. As he did not have, at the time of writing his account, the specimens of these two species from Pohl in front of him, he decided to include them.

Selected specimens examined:—BOLÍVIA. **Santa Cruz**: Chiquitos, *D'Orbigny 365* (K, P, W); Chiquitos, Meseta de Motacú, 18°17'7,4"S 59°40'28,2"W, 17 October 2008, *Wood et al. 25155* (K, UB, USZ); San Jose, Chiquitos, El Portoncillo, deep, shaded valley immediately NW of railway cutting at EL Porton, 18°6'"S 60°5'"W, 19 October 2003, *Wood et al. 19753* (K); Santiago de Chiquitos, Chiquitos, a 3 km del pueblo camino hacia la Serrania de Sunsas, desviando por el sendero a la serrania, en la subida a la serrania cerca al pueblo de Santiago, 18°19'33"S 59°33'57"W, 4 December 2003, *Wood et al. 20168* (K). **Santa Cruz**: Santiago de Chiquitos, Prov. Chiquitos, 3 a 5 km al NE del pueblo, tramo entre el pueblo y la Serranía de Santiago de Chiquitos, 18°20'"S 59°35'"W, 22 October 1994, *Vargas & Foster 3503* (NY, QCNE). BRAZIL. **Bahia**: Licínio de Almeida, Serra Geral, Pedra Preta, 14°45'10"S 42°32'48"W, 5 August 2014, *Guedes et al. 22060* (ALCB). **Distrito Federal**: Brasília, Brasília, 18 August 1964, *Irwin & Soderstrom 5283* (K, MO, NY, RB, UB, UC, US); Brasília, fazenda Água Limpa, mata de Galeria do córrego Capetinga, 10 October 1997, *Sevilha 1719* (IBGE); Brasília, Estação Ecológica Jardim Botânico de Brasília, área adjacente ao córrego Cabeça de Veado, área próxima à escola francesa, 15°51'34"S 47°51'17"W, 21 July 2017, *Antar et al. 1729* (HEPH, SPF); Planaltina, 22 km W of Planaltina, Cerrado Reserve of CPAC (Centro de Pesquisas Agropecuário Cerrados), 20 July 1984, *Mori & Mattos-Silva 16897* (CEN, K, MO, NY); Recanto das Emas, núcleo rural Monjolo, 15°55'46"S 48°4'59"W, 11 August 2009, *Ramos et al. 1843* (HEPH, UFG); Samambaia, próximo ao córrego Gatume, chácara 64 do Sr. Jaime Alves Siqueira, 15°51'43"S 48°8'32"W, 13 June 2003, *Nobrega et al. 1901* (HEPH). **Goiás**: Alexânia, Estrada de terra que liga a BR-060 à Corumbá de Goiás, próximo à ponte que divide Alexânia de Abadiânia. Área de influência indireta do AHE Corumbá IV, margem esquerda do Rio Corumbá, próximo à ponte sobre o rio Corumbá, na estrada de terra, 16°8'10"S 48°37'44"W, 4 August 2003, *Rezende et al. 871* (CEN); Aparecida do Rio Doce, PCH Irara., 18°10'"S 51°6'"W, 11 August 2007, *Guilherme et al. 787* (HJ, UFG); Aporé, Rodovia Aporé-Serranópolis, ca. 65 km de Aporé (57 até a entrada da fazenda), 19°57'"S 52°1'"W, 2 August 1995, *Silva et al. 2327* (MBM); Bela Vista de Goiás, 16°59'5.9"S 48°54'19.2"W, 7 September 2006, *Paula 55* (UFG); Caldas Novas, margem esquerda do Rio Corumbá, cerca de 1 km a montante da barragem da UHE Corumbá., 17°59'"S 48°32'"W, 30 July 1993, *Dias et al. 687* (CEN, SPF); Catalão, Copebrás, em um transecto de 1000 m, 18°9'47"S 53°51'51"W, 27 August 2005, *Rizzo et al. 13393* (UFG); Cocalzinho de Goiás, fazenda Colônia de propriedade do Sr. Edson Aparecido Braz, próximo à pedreira Rio Verde. Riacho afluente do Rio Verde, 15°37'46"S 48°20'37"W, 27 August 2015, *Aparecida da Silva et al. 8284* (IBGE, UFG); Corumbaiba, margem esquerda do Rio Corumbá. Próximo à foz do Corrego Gameleira, 17°58'S 48°30'W, 27 September 1995, *Cavalcanti et al. 1725* (CEN, HUEFS, K, NY); Cristalina, Cerrado do lado esquerdo da área de empréstimo. Área de influência do AHE Queimado; influência indireta, 16°13'5"S 47°20'19"W, 14 August 2002, *Santos et al. 1413* (CEN); Goiandira, fazenda do Chapéu, 18°0'22"S 48°8'1"W, 27 August 2005, *Rizzo et al. 13369* (UFG); Goiânia, 16°43'26.1"S 49°15'54.8"W, 14 September 2006, *Paula 54* (UFG); Hidrolândia, 16°55'9,5"S 49°13'49,3"W, 14 September 2006, *Paula 53* (UFG); Luiziânia, 16°46'53"S 47°56'46"W, 26 September 2007, *Cezare et al. 120* (HDJF, RB, UB); Monte Alegre de Goiás, Serra de Monte Alegre et João Lobo, 13 August 1894, *Glaziou 21916* (G, K, P); Montividiu, Serra dos Caiapós, a 40 km de Amorinópolis para Rio Verde, 20 July 1971, *Rizzo & Barbosa 6542* (UFG); Morrinhos, estrada Morrinhos p/ Caldas Novas, ocorre o córrego Samambaia, 27 June 1970, *Rizzo & Barbosa 5376* (UFG); Paraúna, serra das Galés, 11 July 1995, *Ferreira et al. 3298* (UFG); Pirenópolis, cerca de 10 km de Pirenópolis em direção a Corumbá de Goiás, 15°55'42"S 48°51'3"W, 14 July 2000, *Souza et al. 23868*

(ESA, HUEFS, K, SPF); Posse, BR-020, Alvorada-Formosa; km 158, 17 August 1990, *Cavalcanti et al. 794* (CEN, HUEFS, K, SP, SPF); Quirinópolis, 18°30'48"S 50°52'29"W, 18 July 2017, *Morais 5005* (SPF, UEGQ); Rio Quente, Pousada de Rio Quente, 18 August 1972, *Mello 3686* (HUEFS, R); Senador Canedo, morro de Santo Antônio, 16°40'"S 49°10'"W, 22 July 2007, *Delprete & Silva 10230* (K, NY, RB, UB, UFG); Serranópolis, Reserva Particular do Patrimônio Natural (RPPN) Pousada das Araras, Entrada para a trilha da Gruta das Araras, próx. Ao prédio da FUNATURA, 16°26'29"S 52°0'4"W, 21 August 1998, *Mendonça et al. 3677* (IBGE, K); Serranópolis, Reserva Particular do Patrimônio Natural Pousada das Araras, Cerca de 39 km da cidade. Fazenda Pedreiras, sítio Arqueológico Manoel Braga, 18°26'25"S 52°0'13"W, 18 August 1998, *Aparecida da Silva et al. 3879* (IBGE, K, SP); Silvânia, Flona de Silvânia, 16°38'33.3"S 48°38'7"W, 6 September 2006, *Paula 51* (UFG); Três Ranchos, 6 January 1999, *Fonseca 972083-9* (ESAL). **Mato Grosso**: Comodoro, 13°44'46"S 60°20'7"W, 26 April 2012, *Antunes 310A* (HERBAM, UB, RB, SP); Coxim, Army Reserve, 18°30'"S 54°42'"W, 20 September 1996, *Bridgewater & Filho S-353* (E); Rio Verde de Mato Grosso, Serra da Pindaíba, 30 August 1973, *Hatschbach 32506* (K, MBM); Rondonópolis, 16°22'S 54°47'W, 16 August 1978, *Lima 79* (HRB, RB); Pedro Gomes, Serra do Roncador, 29 August 1973, *Hatschbach 32492* (K, MBM). **Mato Grosso do Sul**: Bandeirantes, rodovia BR0-163, km 572, 86 km N de Campo Grande, 19°42'32"S 54°21'2"W, 13 August 2007, *Pott & Pott 14476* (CGMS); Camapuã, margem da rodovia entre Figueirão e Camapuã, pouco depois do Povoado Pontinha do Cocho, 19°1'54"S 53°53'33"W, 28 June 2015, *Faria et al. 4711* (HUEFS, RB, UB); Campo Grande, 6 August 1973, *Occhioni 5810* (P, RFA); Chapadão do Sul, fazenda Ribeirão, entrada no retiro Baguaçu, km 130 de rodovia MS-306., 18°48'41"S 52°52'48"W, 30 May 2001, *Pott et al. 8989* (CGMS, HMS); Corguinho, fazenda Colina Dourada, 19°43'22.25"S 55°7'34.36"W, 2 October 2013, *Sinani et al. 64* (CGMS); Corumbá, margem do Rio, 20 August 1992, *Ferreira et al. 2562* (UFG); Coxim, 10 km south of Coxim, 12 September 1979, *Christenson et al. 1151* (CEN, HUEFS, MBM, SPF, US); Nova Alvorada do Sul, 21°24'8"S 54°24'9"W, 10 May 2016, *Maruyama & Oliveira 418* (SPSF); Nova Andradina, estrada Campo Grande - Presidente Prudente, ca 90 km do Rio Paraná, 24 July 1977, *Gibbs et al. 5483* (NY, UEC, UFG); Nova Andradina, Rod. BR-267, 6 km S de Casa Verde, 8 August 1997, *Hatschbach et al. 66545* (ESA, G, K, MBM); Pedro Gomes, MS-215, estrada do Recreio, Serra da Arara, 19 August 2011, *Snack et al. 571* (HUEFS); Rio Brilhante, 12 July 1969, *Hatschbach 21778* (MBM, UPCB); Selvíria, fazenda de Ensino e Pesquisa da UNESP Campus de Ilha Solteira, 18 July 1991, *Tiritan 0-38* (SPSF); Sonora, Local Case (Companhia Agrícola Sonora Estância), beira do Correntes, 17°37'33.6"S 54°52'30"W, 17 August 2002, *Pott et al. 10123* (CGMS, HMS); Três Lagoas, km 90 da estrada para Alto Sucuriú, 4 September 1985, *Barros 1171* (SP, SPF). **Minas Gerais**: Abaeté, na margem da estrada para Pompéu, 31 August 1998, *Macedo 2954* (PAMG); Alpinópolis, próximo à barragem de Furnas, 18 September 1977, *Leitão Filho & Martins 5962* (UEC); Araguari, divisa MG/GO próximo a ponte de divisa (estrada Araguari/Caldas Novas), 18°22'S 48°33'W, 24 August 2010, *Pastore & Souza 3135* (HUEFS); Arcos, 6 May 1990, *Vinha 1053* (SPF, VIES); Baependi, toca dos Urubus, 10 August 2005, *Ferreira 862* (CESJ, HUEFS); Belo Horizonte, Parque do Betânia [Parque Municipal Jacques Cousteau], Bairro Betânia, 19 September 1997, *Caldeira et al. 1970* (BHZB); Bom Despacho, 23 July 2001, *Macedo 4295* (PAMG); Brasilândia de Minas, Fazenda Brejão, 3 July 2001, *Matoso 45* (BHCB); Brumadinho, Casa Branca, 100 m do início da subida abrupta para a Serra do Rola Moça, 20°4'7"S 44°2'51"W, 18 August 2009, *Miranda 46* (BHCB); Buenópolis, Curimataí, Rio Preto, 19 August 2002, *Hatschbach et al. 73629* (ALCB, CGMS, HRCB, K, MBM, RB); Buenópolis, Serra do Cabral, a 6-7 km da cidade, 17°53'S 44°15'W, 12 October 1988, *Harley et al. 24840* (CTES, E, K, MO, NY, RB, SP, SPF); Buritizeiro, Rodovia BR-385, subida para a Chapada dos Gerais, 18 September 2005, *Hatschbach & Barbosa 79301* (K, MBM, SPF); Caeté, Estrada Caeté – Sabará, km 29, 13 October 1995, *Kawasaki et al. 882* (K, SP); Campina Verde, Triângulo Mineiro. Zona rural, 20 July 1999, *Silva 981003* (ESAL); Campos

Altos, 17 October 2003, *Rezende s.n.* (BHZB); Carmo do Rio Claro, fazenda Córrego Bonito, 5 September 1961, *Andrade & Emmerich 1020* (R); Carrancas, fazenda Grão-Mogol, 15 August 1998, *Simões & Jannini 203* (UEC); Caxambu, 13 July 1954, *Duarte 3829* (RB); Chapada do Norte, 17°8'''S 42°32'''W, 11 November 1981, *Pinto 390-81* (HRB, RB); Congonhas, Congonhas do campo, 30 June 1884, *Glaziou 15339* (P); Coração de Jesus, entre Coração de Jesus e Montes Claros, 16°51'2"S 44°12'1"W, 24 August 2011, *Proença & Harris 3866* (K, OXF, UB); Couto de Magalhães, caminho para a Fazenda Abóbora, 16 July 1984, *Harley et al. CFCR 4540* (K, NY, SP, SPF); Curvelo, fazenda do Moura, 18°50'6,23"S 44°23'37,49"W, 25 October 2014, *Machado et al. s.n.* (HDJF); Delfinópolis, Fazenda do Ézio, 4 km ao Norte de Delfinópolis, 20°18'55"S 46°49'56"W, 20 August 2013, *Simon et al. 1925* (CEN, SPF); Diamantina, Conselheiro Mata-Rodeador, June 1934, *Brade 13402* (RB, UC); Divinópolis, Bairro Belverde, 3 July 1989, *Oliveira 56* (ESAL); Entre Rios de Minas, 6 September 1970, *Krieger 9117* (CESJ, HUEFS, MBM); Felixlândia, mais ou menos km 500 da Belo Horizote - Brasília, 27 July 1977, *Pereira 695* (K, MBM); Formiga, Estrada para Formiga, 10 km depois do entroncamento Formiga-Bastos-Divinópolis, 27 July 1966, *Mello et al. 2263* (R); Francisco Sá, October 1992, *Gavilanes 5453* (PAMG); Frutal, Rumo a Itumbiara, km 76, 6 September 1976, *Gibbs et al. 2658* (NY, UEC); Gouveia, córrego do Tigre. Acessado pela BR-259., 18°33'57,2"S 43°49'40,1"W, 23 August 2018, *Antar & Antar 2417* (SPF); Grão Mogol, Planta MG 15-Fazenda Tamanduá, 9 October 2005, *Tameirão-Neto 4021* (BHCB); Iguatama, Fazenda Boa Vista, 29 July 1990, *Macedo 1026* (PAMG); Ingaí, Reserva Biológica Unilavras, 23 May 2003, *Silva 323* (ESAL); Itabira, Serra de Itabira, 11 September 1887, *Schwacke 5903* (G, R); Itabirito, RPPN Cata Branca., 20°24'15"S 43°8'59"W, 21 August 2015, *Paiva et al. 681* (BHCB); Ituiutaba, 23 July 1950, *Macedo 2493* (BM, G, MO, US); Itumirim, Serra da Bocaína. Ingai-Itumirim., 18 September 1987, *Carvalho et al. s.n.* (ESAL, SPF, UEC); Iturama, nas proximidades da Barragem de Água-Vermelha., 4 July 1978, *Leitão Filho et al. 8130* (MBM, UEC, US); Itutinga, October 1993, *Gavilanes 5847* (PAMG); Jaboticatubas, Estrada da Usina, 18 October 1973, *Joly et al. 4544* (E, NY, SP, UEC); Jequitibá, 31 July 1962, *Lanna-Sobrinho 244* (K, RB, SP); Joaquim Felício, Serra do Cabral, ca. 5,9 km da cidade, 17°43'40,8"S 44°11'6"W, 13 October 2007, *Paula-Souza et al. 9451* (CTES, SI, SPF); Lagamar, lado esquerdo da Reserva Vegetal da Companhia Mineira de Metais (CMM), 14 September 2003, *Alves & Alves 599* (CESJ, HUFU); Lagoa Santa, 1902, *Warming 905* (K, P); Lassance, 17°49'"S 44°46'"W, 14 August 1982, *Brazão 266* (HRB, HUEFS); Lavras, Serra da Bocaína. Poço Bonito, 4 September 1987, *Carvalho et al. s.n.* (ESAL, SPF, UEC); Martinho Campos, mata do Rio Picão, 5 July 1995, *Carvalho et al. s.n.* (ESAL, SPF); Matozinhos, 19°30'28.2"S 43°57'19.5"W, 12 October 2007, *Ceccantini et al. 3181* (SPF); Matozinhos, Cerradão IBAMA, 19°30'27,9"S 43°57'18,3"W, 24 October 2006, *Melo-Jr. et al. 579* (SPF); Moeda, Serra da Moeda, entrada da Moeda, cerca de 33 km S de Belo Horizonte a partir do entroncamento do anel rodoviário com a BR-040, morros a esquerda da pista em direção a Moeda, cerca de 3 km após o entroncamento com a BR-040, 20°17'16"S 43°57'5.4"W, 29 August 2008, *Leite et al. 18* (BHCB, CEN); Monjolos, entre Conselheiro Mata e Rodeador, 18°18'6"S 44°0'21"W, 22 September 2017, *Antar & Chaves 1865*b (SPF); Monte Alegre de Minas, Triângulo Mineiro region. 61 km west of Uberlândia on highway BR-71, 17 September 1967, *Goodland 3902* (UB); Montes Claros, Arredores da cidade, 16°46'42"S 43°53'15"W, 8 September 2017, *Antar et al. 1770* (SPF); Morada Nova de Minas, Fazenda Cachorro, 15 August 1975, *Ferreira 5189* (PAMG); Nazareno, Parcela Feita para os estudos do EIA do Mineroduto Bom Sucesso-Itaguaí, 21°18'32"S 44°35'24"W, 1 October 2011, *Saddi & Martins 689* (CEPEC, HUEFS, RB, SPF); Olhos-d'Água, *Sellow s.n.* (UC, US); Ouro Preto, distrito de Miguel Burnier, Mina da Gerdau, 20°26'24"S 43°48'7"W, 2 July 2014, *Rezende et al. 4636* (BHZB, CTBS, SPF); Pará de Minas, 19°41'"S 44°28'"W, 27 July 1981, *Silva 48* (HRB, HUEFS, RB); Paracatu, 4 July 2001, *Meyer et al. s.n.* (HXBH); Paraopeba, [Floresta Nacional de Paraopeba], Estação Florestal, 15 September 1975, *Heringer & Eiten 14987* (K, UB, US); Patos de Minas, 10

October 1984, *Brandão 8279* (PAMG); Patrocínio, Fazendas DATERRA, Boa vista., 19 August 1999, *Farah & Freitas 1077* (CESJ, ESA); Pedro Leopoldo, fazenda Jaguara, Fidalgo, 8 August 1991, *Meyer et al. s.n.* (HXBH); Pequi, Distrito de Pindaíba. Fazenda Alvorada, 19°34'13.7"S 44°36'0.26"W, 19 September 2014, *Fernandes 422* (BHZB, CTBS, SPF); Perdizes, Estação de Pesquisa e Desenvolvimento Ambiental Galheiro, Céu cavalo, 22 August 2003, *Mendes et al. 1029* (UB); Pirapora, Entre Pirapora e Montes Claros, 18 September 1963, *Santos & Castellanos 24212* (K, NY); Piumhi, a 5 km da cidade de Piumhi., 9 September 1982, *Leitão Filho et al. 14162* (ICN, SPF, UEC); Prata, Morrinhos, Triângulo mineiro, 3 August 1949, *Labouriau 724* (K, RB); Presidente Olegário, Vereda Grande., 21 August 1991, *Pedralli & Bernardes s.n.* (K); Prudente de Morais, Fazenda Santa Rita, 5 October 1979, *Cunha 95* (OUPR, PAMG); Rio Acima, Região do Rio do Peixe; Região da Mina de Tamanduá, 20°4'46"S 43°57'37"W, 14 April 2010, *Mendes s.n.* (BHCB); Rio Pardo de Minas, Areião. Alto da Chapada. Local de extrativismo de *Caryocar brasiliense* e *Hancornia speciosa* - Indivíduo 170 da fitossociologia, 15°29'39"S 42°28'9"W, 3 November 2006, *Sevilha et al. 4614* (CEN); Rio Parnaíba, Fazenda Cascudo, propriedade do Sr. Manoel Niquita, ca. De 10 km da cidade, 19°10'"S 46°14'"W, 27 July 1992, *Aparecida da Silva et al. 1149* (IBGE, K); Rio Preto, *Saint-Hilaire 560* (P); Sabará, Parcela P32 referente aos estudos para o EIA da LT 500 Kv Itabirito-Vespasiano, 19°55'51"S 43°47'57"W, 18 August 2014, *Saddi et al. 994* (HUEFS, RB); Sacramento, estrada Sacramento-Araxá, 3 August 1984, *Vieira & Castro 303* (CTBS, HUFU); Santa Bárbara, Gandarela, 18 July 1972, *Mello et al. 3476* (NY, R); Santana de Pirapama, 13 July 1970, *Urbano CESJ 8806* (CESJ, HUEFS); Santana do Riacho, Serra do Cipó, vale do Rio Cipó, arredores da Cachoeira Grande, 29 July 1991, *Giulietti et al. CFCS 12678* (K, SPF); São Domingos do Prata, Beetween Pisarão and São Domingos, 19 September 1827, *Burchell 5897* (K); São Gonçalo do Abaeté, 27 July 1963, *Mattos-Filho & Rizzini 427* (P, RB); São Gonçalo do Rio Preto, Parque Estadual do Rio Preto, Próximo ao Poço de Areia, 3 October 2003, *Viana et al. 1245* (BHCB); São João Del

Rei, 28 August 1974, *Badini s.n.* (OUPR); São João Del Rei, Inter Barbacena e São João del Rey, June 1824, *Riedel 167* (NY, US); São Romão, bacia Rio Preto. (PCH Unaí Baixo), 16°18'53"S 45°17'20"W, 4 August 2011, *Pio et al. 99* (IBGE); São Roque de Minas, estrada entre São Roque e Cachoeira Casca D'Anta, 10 km W de Vargem Bonita, 20°20'21"S 46°28'48"W, 22 August 2013, *Simon et al. 1969* (CEN, SPF); São Sebastião do Paraíso, Serra do Chapadão, 4 August 1989, *Tozzi & Tozzi 23090* (UEC); São Thomé das Letras, Estrada para o Pico dos Gaviões, área de treinamento do Exército (Pedir autorização do Exército para chegar ao Pico), ramal a direita., 21°45'11"S 45°1'13"W, 27 August 2007, *Silva-Castro et al. 1297* (HUEFS); Serra do Salitre, Catiara, 18 August 1950, *Duarte 2791* (RB, UC); Sete Lagoas, 18 September 1965, *Duarte & Pereira 8899* (F, G, K, RB, SP, US); Tapira, Serra da Canastra, ca. 12 km, estrada para João Batista, 19°58'46"S 46°44'18"W, 18 August 2014, *Melo et al. 12883* (HUEFS); Tiradentes, October 1999, *Alves s.n.* (R); Tiradentes, Serra de São José, *Argôlo 262* (R); Três Marias, Morro do Baú, 16 September 1975, *Ferreira 5440* (PAMG); Uberaba, 22 August 1848, *Regnell 206* (F, K, M, P, SP, UC, US); Uberlândia, Babilônia, 27 September 1987, *Deguchi & Tsugaru 1596* (NY); Unaí, BR 251, ponte sobre o rio arrependido, Divisa Goiás-Minas Gerais, 15°8'"S 47°20'"W, 29 September 1982, *Scheiner 60* (CEN, UB); Várzea da Palma, Estrada Várzea de Palma a Joaquim Felício, 5 December 2004, *Hatschbach et al. 78856* (K, MBM). **São Paulo**: Altinópolis, região da Gruta do Itambé, 30 July 1982, *Sarti & Filho 14425* (UEC); Aramina, estrada Aramina-Buritizal, 20°8'17"S 47°45'53,3"W, 26 July 1994, *Barreto et al. 2707* (ESA, K, SPF); Iguarapava, fazenda Malvina, 20°6'27,6"S 47°34'56,7"W, 27 August 2002, *Viani et al. 277* (ESA); Pedregulho, Parque Estadual das Furnas do Bom Jesus, Próxima ao encontro dos córregos Pedregulho e Bom Jesus, 20°11'50"S 47°25'10"W, 21 June 2003, *Sasaki et al. 581* (SPF).

1.4. *Hyptidendron conspersum* (Benth.) Harley (1988: 93) ≡ *Hyptis conspersa* Bentham, in DC. (1848: 134) ≡ *Mesosphaerum conspersum* (Benth.) Kuntze (1891: 526). Type:—BRAZIL. Bahia. [Formosa do Rio Preto], Banks of the Rio Preto, September 1839, *G. Gardner 2936* (Lectotype designated by Epling [1936b: 222]: K-000488087, isolectotypes: B† (photo at F-17727), BM-000992899, E-00025409, F-869205 [fragment], F-976976 [fragment], F-1541278, G-00437851, G-00437852, G-00437853, GH-00001240, NY-00000629, NY-00000630, P-00737507, P-00737506, P-00737505, P, UC-2055654, US-00121874, W-0062433, W-0003152).

(Figs. 13 D-F, 15).

Treelets or erect shrubs 1−3 m tall, slightly aromatic or not aromatic; stems woody, branched, 3−6 mm diam., younger stems quadrangular, canaliculate, tomentose with brown, small dendroid hairs densely disposed, scattered larger dendroid hairs and few sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes (1.5−)2.2−7.2(−8) cm long. Cauline leaves spreading along the younger branches, not imbricate, longer than internodes, rarely smaller or equal, mostly diminishing in size towards stem apex, lamina 3.4−9.3 × 1.5−4.1 cm, chartaceous to coriaceous, conspicuously discolorous, with abaxial surface paler, elliptic to narrow ovate, base cuneate or slightly cordate, less commonly truncate, apex acute, rarely obtuse, sometimes apiculate, apiculus ca. 0.5−1 mm long, adaxial surface scabrid with scattered small dendroid hairs and small sessile glands, rarely glabrescent, midvein, mostly near base, densely covered with dendroid hairs, venation mostly inconspicuous, midrib slightly impressed or plane, abaxial surface densely tomentose with cream dendroid hairs, venation reticulate, prominent, margin not ciliate or with scattered small hairs and sessile glands, crenulate to serrulate, entire in the base to 1/4 of leaf margin, rarely revolute, mostly near base of lamina, 20−42 teeth on each side of leaf, with tooth apex swollen, obtuse or acute; petiole 4−7 mm long, canaliculate, densely tomentose with dendroid hairs. Inflorescence thyrsoid, terminal, up to 15−30 cm long, with dichasial axillary cymes, subtended by bracts often similar to leaves but smaller, with similar shape, sometimes elliptic with obtuse to emarginate apex and cuneate base, indumentum denser, 1−3 × 0.7−1.9 cm, mostly longer than cymes, sometimes smaller or of similar size, mature cymes 0.9−2.5 cm long, 9−20 flowered, not obscured by bracts, peduncles 1.5−7 mm long, with indumentum as on petioles. Flowers with pedicels 0.4−2.5(−4) mm long, tomentose with long cream dendroid, eglandular or gland-tipped hairs and subtended by linear to elliptic bracteoles, 1−2.8 × 0.1 mm, tomentose with dendroid cream or brown gland-tipped or eglandular hairs and tiny sessile glands; calyx at anthesis 6−8 mm long, green, tube 3.5−5 mm long, ± infundibuliform, mostly curved, ribbed, externally densely tomentose with dendroid hairs and small sessile glands, denser in the base, tube internally glabrous to glabrescent with tiny hairs, without a ring of hairs in throat, calyx lobes unequal to subequal, 2.1−3 mm long, deltate, apex acute to acuminate, straight or rarely curved, externally with indumentum as on tube, internally puberulous, margin ciliate with dendroid hairs, calyx in fruit 8.7−11 mm long, indumentum less dense, tube 4.7−6.6 mm long, cylindrical to infundibuliform or rarely broadly cylindrical, curved, ribbed, calyx lobes 3−3.7(−4.3) mm long, conspicuously unequal, straight; corolla lilac, 9.8−13 mm long, tube 7−8.5 mm long, cylindrical, straight from base to middle of the tube, becoming slightly curved and enlarged near throat, 1.3−2 mm wide, externally with base glabrous becoming densely tomentose towards apex with dendroid hairs, internally with minute sessile glands in the throat, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally with minute sessile glands, anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely villous with long simple curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous or glabrescent with few uniseriate hairs mostly near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 4 per flower, 1.9−2.8 × 1.3−1.8 mm, oblongoid, flattened, winged, castaneous, not shiny, glabrous or glabrescent with few sessile glands, rugulose, with abscission scars, mucilaginous when wetted.

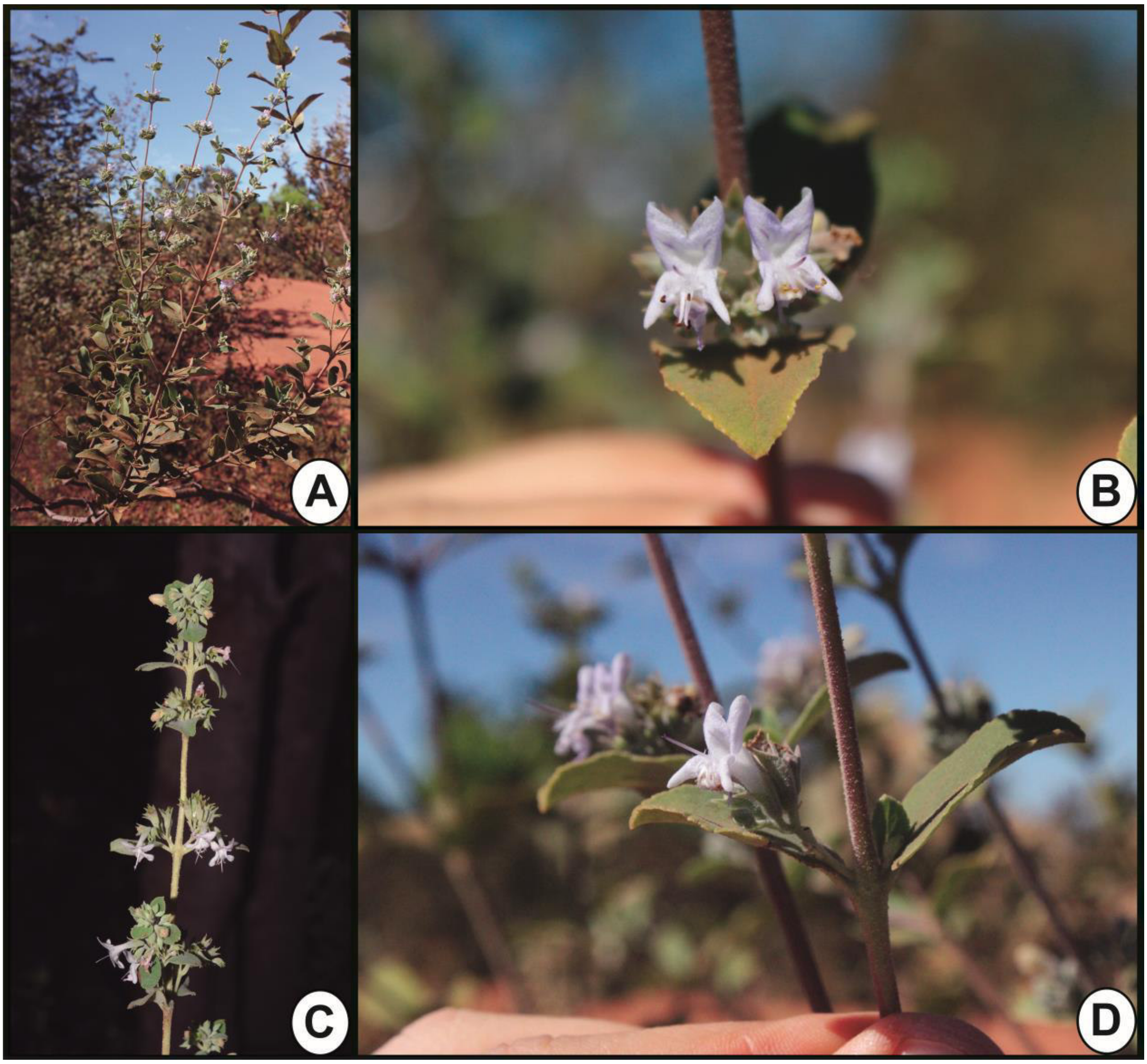

FIGURE 15. Field pictures of *Hyptidendron conspersum* (Benth.) Harley. **A.** Branches and inflorescence. **B.** Flower front view, **C.** Inflorescence, **D.** Cymes**. A-D.** Photos by G.M. Antar.

Phenology:—*Hyptidendron conspersum* was found fertile from June to October, mostly in July.

Distribution and Habitat:—*Hyptidendron conspersum* is endemic to Brazil occurring in Tocantins, Maranhão, Piauí and Bahia (Fig. 16), in a region known as MATOPIBA (see below). It occurs in the Cerrado domain in savanna habitats (cerrado *sensu stricto*, *campo cerrado*, *cerrado rupestre* and *campo sujo*) in sandy soils at altitudes from 300 to 600 meters elevation. The second known collection of *Hyptidendron conspersum* was made 146 years after the type collection, and all of the other collections of this species are from the end of the XX century and beginning of XXI. This highlights that the area of occurrence of *H. conspersum* is still poorly sampled with mostly recent collections but still far from being well documented (Antar & Sano 2019).

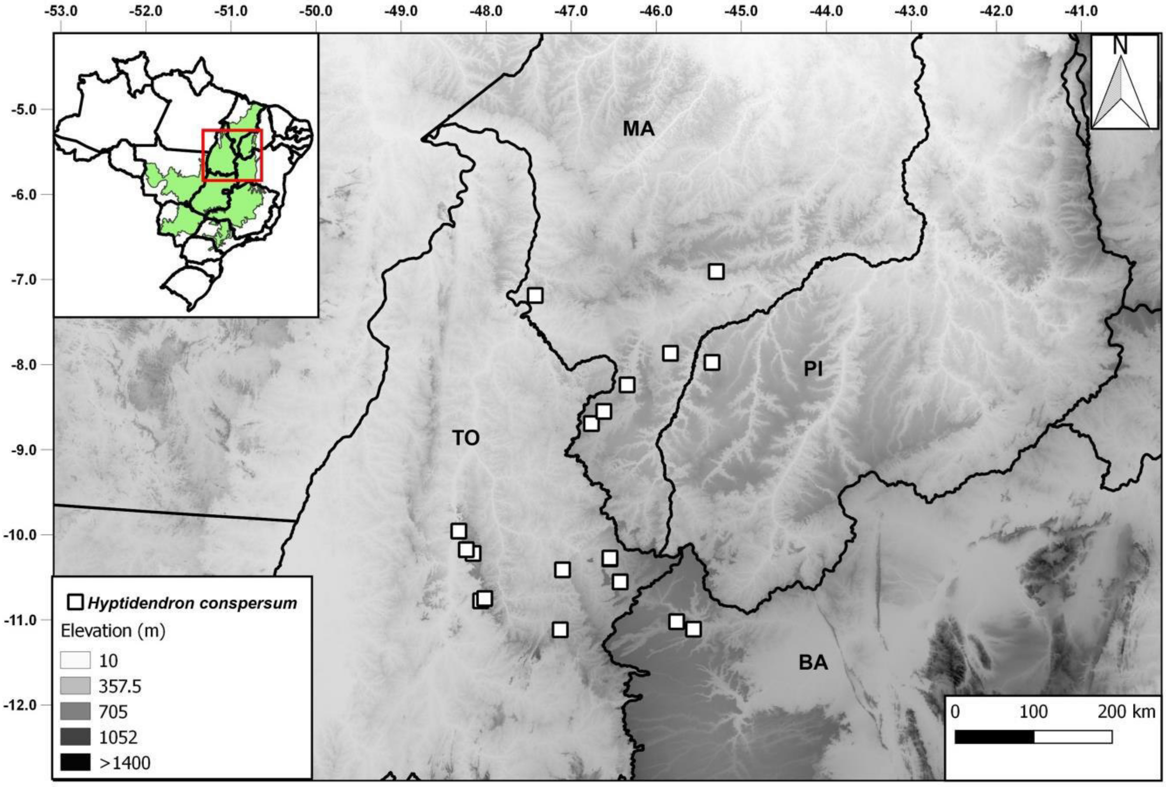

FIGURE 16. Distribution of *Hyptidendron conspersum* (Benth.) Harley. The green shape in the small map shows the extension of the Cerrado Domain. (BA, Bahia; MA, Maranhão; PI, Piauí; TO, Tocantins).

Conservation Status:— The AOO is 72 km² and the EOO is 122277 km². *Hyptidendron conspersum* is known from more than 15 localities and can occur in disturbed ground such as roadsides. It is also present in some protected areas as Parque Estadual do Lajeado and Estação Ecológica Uruçuí-Una. Despite this scenario, the species is mostly distributed within the region named MATOPIBA, in the confluence of Bahia, Maranhão, Piaúi, and Tocantins states. This area, inserted in the Cerrado domain, is considered to be the next frontier area of expanding agricultural expansion and resultant increasing deforestation and disturbance and consequent loss of biodiversity in the near future (Antar & Sano 2019). The conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:—The specific epithet is a reference to the scattered indumentum of dendroid hairs and small sessile glands in the adaxial surface of the leaf.

Affinities and morphological notes:—*Hyptidendron conspersum* can be differentiated from all other species of the genera, by a combination of the following characters: shrub to 3 m tall, nutlets 4 per flower, flattened, winged, branched hairs present, inflorescence a well-defined terminal thyrsoid, calyx lobes conspicuously unequal (at least in fruit), at anthesis 2.1−3 mm long, anterior lobe of corolla with a long apiculus and fruiting calyx tube 4.7−6.6 mm long. The most closely related species is the widespread *Hyptidendron canum*, which shares similar leaf and inflorescence morphology. *Hyptidendron conspersum* differs from *Hyptidendron canum* in its smaller petioles (4−7 mm vs. (4−)7−29 mm), bract mostly longer then cymes (vs. bracts mostly smaller then cymes), pedicels mostly smaller (0,4−2,5(−4) mm vs. 1−12(−14) mm), smaller calyx tube at anthesis (3.5−5 mm vs. (3.8−)5−8.5 mm), smaller tube of calyx in fruit (4.7−6.6 mm vs. (7.5−)9−12 mm), smaller corolla tube (7−8.5 mm long vs. (7.6−)8.3−11 mm long) and smaller nutlets (1.9−2.8 × 1.3−1.8 vs. 2.7−4.5 × 1.4−3 mm).

Specimens of *Hyptidendron conspersum* usually have short inflorescences, no more than 6 cm, but exceptionally, as in *Paula-Souza 9222* (SPF), the inflorescences can be up to 30 cm long.

Typification and nomenclatural notes:—Bentham (1848) does not specify any specimen, just cites Gardner 2936 gathering. Epling (1936b) missed the collection number when designating the lectotype for *Hyptidendron conspersum*, which he later corrected in 1949. He also states that there are two collections of the type material at Kew, however only one could be found.

Selected specimens examined:—BRAZIL. **Bahia**: Formosa do Rio Preto, 48 km da cidade, a 12 km da cancela dentro da Fazenda Estrondo, 11°6'33"S 45°33'45"W, 5 April 2000, *Harley et al.53867* (ALCB, HUEFS, R). **Maranhão**: Balsas, Pé de Galinha. 49 km E of Balsas, 7°52'"S 45°50'"W, 14 July 1993, *Ratter et al. R-6841* (E, HUEFS, UB); Carolina,20 km da cidade na estrada para Estreito. Portal da Chapada, 7°11'13"S 47°25'23"W, 29 January 2012, *Harley et al. 56587* (HUEFS); Sambaíba, Margem da estrada BR 230, 11 km da divisa do município em direção a São Raimundo das Mangabeiras, 6°54'23"S 45°17'40"W, 27 January 2012, Harley *et al.* 56523 (HUEFS, K, SPF). **Piauí**: Ribeiro Gonçalves, Estação Ecológica Uruçuí-Una, 23 July 1985, *Fernandes s.n.* (EAC, K). **Tocantins**: Almas, Fazenda Minnehaha, arredores do córrego do Cachorro, ca. 70 km a nordeste da Cidade das Almas, 11°6'55"S 47°7'46"W, 10 August 2004, *Walter et al. 5270* (IBGE, K, SPF); Mateiros, Estrada Mateiros-Ponte Alta do Tocantins, aproximadamente 3 km da cidade de Mateiros, 10°33'9,7"S 46°25'29"W, 17 September 2014, *Antar et al.* 459 (SPF); Monte do Carmo, Estrada para Ponte Alta do Tocantins, beira de estrada, 18 July 2000, *Souza et al. 24197* (ESA, HUEFS, K, RB, SPF); Palmas, [Parque Estadual do Lajeado], Serra do Lajeado - Unidade de Conservação, 10°10'28"S 48°14'1"W, 27 August 1999, *Lolis. et al. 156* (HUTO, IBGE, UFG).

1.5. *Hyptidendron dorothyanum* Antar & Harley, *sp.nov.*

The new species shares with Hyptidendron leucophyllum and H. canum a similar inflorescence, similar indumentum, and similar leaf morphology, differing from the first by the anterior lobe of the corolla with a with a long apiculus (vs. without an apiculus in H. leucophyllum), internodes 1.3−2 cm long (vs. (2.4−)3.2−12.5(−20) cm long), calyx 4.2−4.7mm long (vs. 5−7 mm long) and nutlets 2.7−3 mm long (vs. 1.7−2.8 mm long). It differs from the second by the calyx at anthesis 4.2−4.7 mm long (vs. 5.3−12 mm long), peduncle 1-3.5 mm long (vs. (1.2−)3−12(−21) mm long) and mature cymes 7−10 flowered up to 1.5 cm long (vs. (7−)10−18(−37) flowered, 1.7−5 cm long). Hyptidendron dorothyanum is also similar to H. conspersum and H. arboreum. Differing by the first by the smaller calyx (4.2−4.7 in H. dorothyanum vs. 6−8 mm long) and calyx lobes at anthesis (1−1.3 mm long in H. dorothyanum vs. 2.1−3 mm long) and by the latter by the smaller petioles (0.6−0.8 cm long in H. dorothyanum vs. 1.4−4.4 cm long in H. asperrimum) and smaller peduncles (1−3.5 mm long in H. dorothyanum vs. 3−12(−20) mm long).

Type:—BRAZIL. Amazonas. Apuí. Rodovia Transamazônica – Propriedade Sr. Leonir, 7º10'37"S, 60º0424"W, Alt: 122 m, 22 Aug 2009, *P.A.C.L. Assunção & F.A. Carvalho 1180* (Holotype: INPA, Isotype: SPF).

(Figs. 17, 18).

Treelet to 3 m tall; stems woody, branched, ca. 4 mm diam., younger stems quadrangular, slightly canaliculate, with longitudinal grooves, tomentose to canescent, rarely pubescent, with white dendroid hairs and sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 1.3−2 cm long. Cauline leaves spreading along the branches, not imbricate, longer than internodes, diminishing in size towards stem apex, lamina 8.4−10.3 × 2.5−3.2 cm, chartaceous, discolorous, with abaxial surface paler, narrow elliptic, base cuneate, apex acute, sometimes apiculate, apiculus ca. 0.5−1 mm long, adaxial surface scabrid with sparsely dendroid hairs and rare gland-tipped hairs or sessile glands, except on main vein which is denser with dendroid hairs up to the middle of the leaf, venation mostly inconspicuous, midrib prominulous or plane close to base of lamina, but soon becoming impressed, secondary veins impressed, abaxial surface densely tomentose with dendroid hairs and sessile glands, venation reticulate, prominent, margin not ciliate or with few small hairs, crenulate to serrulate, entire in the base to 1/9 of leaf margin, sometimes revolute, mostly near base of lamina, 31−35 teeth on each side of leaf, with tooth apex swollen, obtuse to acute; petiole 6−8 mm long, slightly canaliculate, tomentose with dendroid hairs and small sessile glands. Inflorescence thyrsoid, terminal, up to 25 cm long, with dichasial axillary cymes, subtended by bracts similar to leaves but much reduced, 0.7−2.4 × 0.4−0.8 cm, mostly longer than cymes, mature cymes 1.1−1.4 cm long, 7−10 flowered, not obscured by bracts, peduncles 1−3.5 mm long, with indumentum as on petioles. Flowers with pedicels 0.5−2.2 mm long, tomentose with dendroid, eglandular hairs and sessile glands and subtended by linear bracteoles, 0.9−1.3 × 0.1 mm, with indumentum as on pedicels; calyx at anthesis 4.2−4.7 mm long, green, tube 2.9−3.5 mm long, ± cylindrical broadening near the throat to infundibuliform, slightly curved, ribbed, externally densely tomentose to canescent with dendroid hairs and small sessile glands, tube internally glabrous at base, becoming pubescent with minute hairs above, and without a ring of hairs in throat, calyx lobes unequal, 1−1.3 mm long, deltate, apex acute, curved, externally with indumentum as on tube, internally tomentose at the margin with dendroid hairs and pubescent in middle of lobes with minute hairs, calyx in fruit 8.3−8.5 mm long, indumentum less dense, tube 5.2−6.5 mm long, cylindrical to rarely broadly cylindrical, ribbed, calyx lobes 1.1−1.7 mm long, unequal, mostly curved; corolla lilac, 6.6−6.8 mm long, tube 5.1−5.4 mm long, ± cylindrical, straight in middle of the tube, becoming slightly curved and enlarged near throat, ca. 1 mm wide, externally with base glabrous becoming densely tomentose towards apex with simple or rarely dendroid uniseriate hairs and sessile glands, internally with a ring of villous hairs at base of corolla and with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens and sessile glands in throat and below it, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally glabrous, anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous to middle and with small shortly stipitate glandular hairs, sessile glands or few long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 4 per flower, 2.7–3 × 1.6–1.7 mm, ellipsoid, flattened, winged, castaneous, not shiny, glabrous except by tiny sessile glands, with abscission scars, mucilaginous when wetted.

FIGURE 17. Field pictures of *Hyptidendron dorothyanum* Antar & Harley. **A.** Inflorescense with flowers at anthesis and fruiting calyx **B.** Inflorescense with flowers at anthesis. **A-B.** Photos by Fernanda Antunes Carvalho.

Phenology:—*Hyptidendron dorothyanum* was found in a fertile condition in July and August, during the dry season.

Distribution and Habitat:—*Hyptidendron dorothyanum* is endemic to Brazil occurring in Amazonas and Pará states (Fig. 19). It occurs in the Amazon domain in savanna habitats (*campinarana*) with sandy soils, named Amazon savannas (Carvalho & Mustin 2017; Devecchi *et al*. 2020) in 120 to 150 meters elevation. The species is currently known from just two collections distant approximately 280 km in a straight line for each other. The lack of recent collections in the Amazon region is well documented (e.g. Daly & Martinez-Habibe 2019), with the detailed distribution of many species very poorly known, and we believe that this is also the case for this species. New expeditions to such a promising botanical area are needed and should uncover other populations of *Hyptidendron dorothyanum*.

Preliminary conservation Status:—Data Deficient. It is impossible to be precise on the AOO and EOO, as this species is known for just two collections. One of the collections is located inside an indigenous area, and altought it is theoretically well conserved, indigenous areas have been suffering recently illegal deforestation (Villén-Perez *et al*. 2020). Further collections of this species should enable a more accurate preliminary conservation acessment.

Etymology:—The specific epithet honors Sister Dorothy Mae Stang who worked as a missionary at Amazon rainforest, fighting for the right of the poorest people for the land and for education and for environmental questions. Sister Dorothy was brutally murdered at the age of 73 by farmers in 2005, and reflects the, still common, occurrence of violent deaths in the Amazon region, as a result of land property disputes and illegal deforestation.

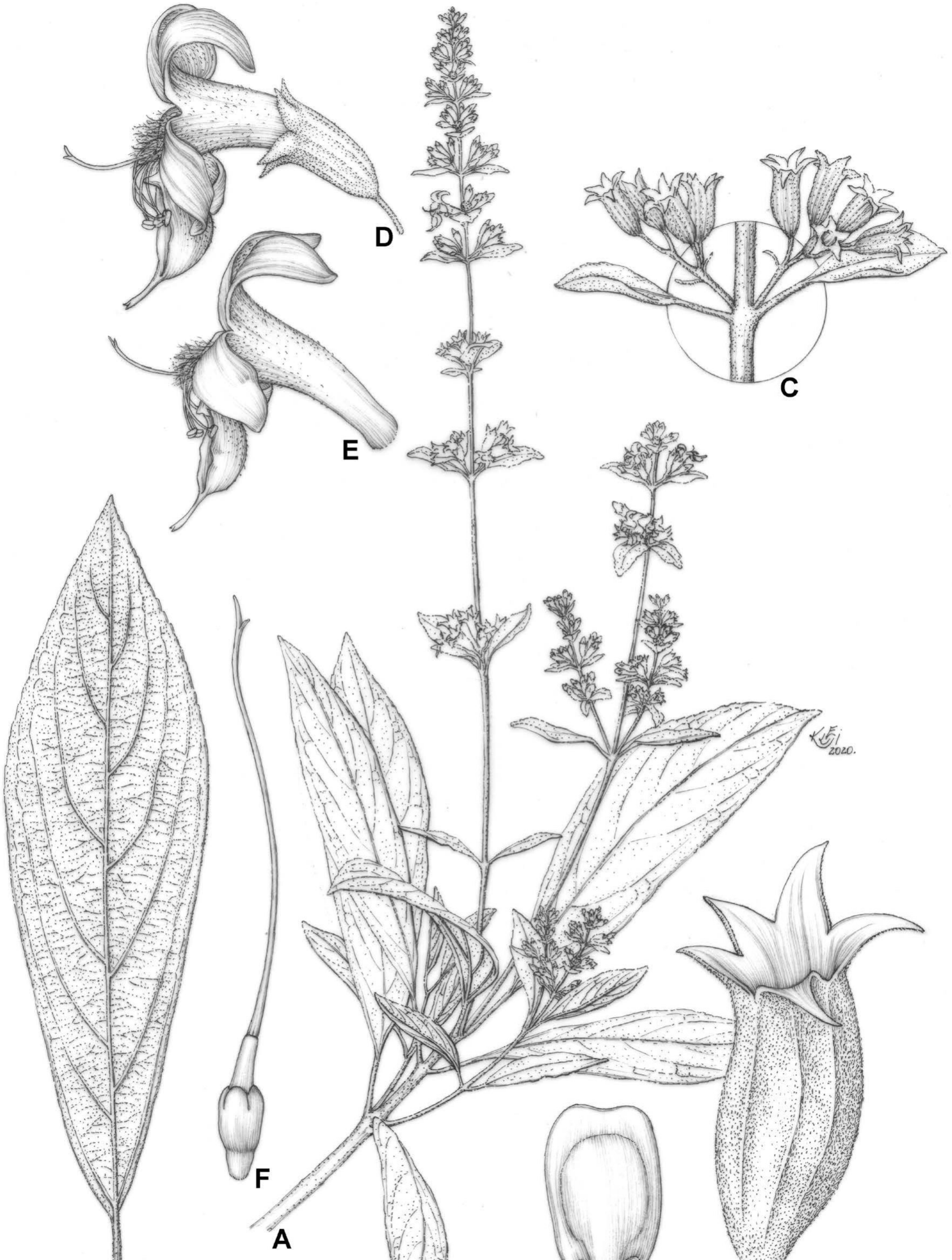

FIGURE 18. Line drawing of *Hyptidendron dorothyanum.* **A.** Branch bearing leaves and inflorescenses. **B.** Leaf, abaxial surface. **C.** Cymes and bracts. **D.** Flower, side view. **E.** Corolla, side view. **F.** Gynoecium and style, showing stylopodium. **G.** Fruiting calyx. **H.** Nutlet. Illustration of Klei Sousa based on P.A.C.L. Assunção & F.A. Carvalho 1180 (SPF).

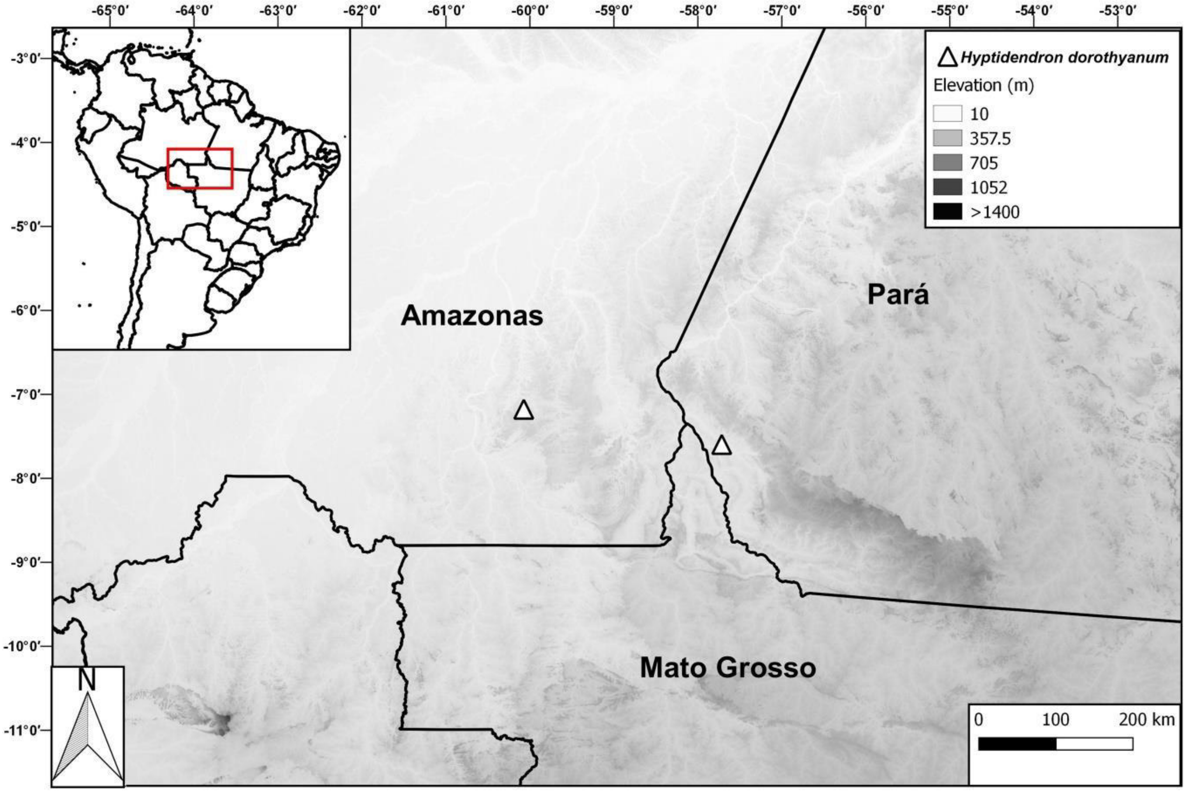

FIGURE 19. Distribution of *Hyptidendron dorothyanum* Antar & Harley.

Affinities and morphological notes:—*Hyptidendron dorothyanum* can be differentiated from all other species of the genera, by a combination of the following characters: nutlets 4 per flower, flattened, winged, branched hairs present, mostly white, inflorescence a terminal thyrsoid, calyx lobes conspicuously unequal, at anthesis 1-1.3 mm long, calyx at anthesis 4.2−4.7 mm long, anterior lobe of corolla with a long apiculus, peduncle 1-3.5 mm long and cymes 7−10 flowered, up to 1.5 cm long.

Specimens examined (Paratype):—BRAZIL. Pará: Alto Tapajós, Missão Cururu, 12 July 1959, *W.A. Egler 824* (CEN, IAN, MG).

1.6. *Hyptidendron leucophyllum* (Pohl ex Benth.) Harley (1988: 98) ≡ *Hyptis leucophylla* Pohl ex Bentham (1833: 134) ≡ *Mesosphaerum leucophyllum* (Pohl ex Benth.) Kuntze, (1891: 526). Type:—BRAZIL. Minas Gerais, inter Rio Jequitinhonha usque ad Barreros, August 1820, *J.B.E. Pohl 3157* (first step lectotype, designated by Epling [1936b: 223], Second step lectotype, designated here: W-0052009, isolectotypes: F-869268 [fragment], K-000488086, GH-00001253, UC-2055656, W-0052008).

=*Siagonarrhen subincanus* Mart. ex J.A.Schmidt, (1858: 146) *nomen nudum*

= *Hyptis laurifolia* A.St-Hil. ex Bentham (1833: 134) ≡ *Mesosphaerum laurifolium* (A.St.-Hil. ex Benth.) Kuntze (1891: 526). Type:—BRAZIL. Minas Gerais: in arenosis prope Penha inter Minas Novas, *A. Saint-Hilaire 1170* (lectotype, designated here: P-00721112; isolectotypes: F-977085 [phototype and fragment], K-000488114 [phototype and fragment], P-00721113).
(Figs. 20, 21 A-C).

Erect shrub 0.6−4 m tall, aromatic; stems woody, branched or rarely not branched, 3−8 mm diam., younger stems quadrangular, canaliculate, canescent, with white dendroid hairs and small sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes (2.4−)3.2−12.5(−20) cm long. Cauline leaves spreading along the branches, not imbricate, smaller than internodes, rarely equal or longer, diminishing in size towards stem apex, lamina (1.8−)4−7.1 × 0.9−2.1(−2.8) cm, chartaceous to coriaceous, discolorous, with abaxial surface white to grey, elliptic, narrow elliptic, narrow ovate or lanceolate, base rounded or cuneate, apex acute, sometimes apiculate, apiculus ca. 0.5−1 mm long, adaxial surface pubescent, rarely glabrescent, with tiny dendroid hairs and scattered sessile glands, denser in the main vein, venation mostly inconspicuous, midrib prominulous, or plane, close to base of lamina, but soon becoming impressed, secondary veins impressed, abaxial surface densely canescent with white dendroid hairs and sessile glands, slightly less dense in the primary and secondary veins, venation reticulate, prominent, margin not ciliate, crenulate, entire in the base to 1/8 of leaf margin, sometimes revolute, mostly near base of lamina, 38−57 teeth on each side of leaf, with tooth apex swollen, obtuse; petiole (0.25−)0.5−1.4(−2.3) cm long, slightly canaliculate, tomentose to canescent with white dendroid hairs and small sessile glands. Inflorescence thyrsoid, terminal, up to 42 cm long, with dichasial axillary cymes, subtended by bracts similar to leaves but smaller, with similar shape, sometimes obovate with obtuse apex, 0.8−2.5 × 0.45−1.1 cm, smaller, longer or with similar size than cymes, mature cymes 1.5−3.4 cm long, (13−)17−31 flowered, not obscured by bracts, peduncles 1.8−5 mm long, with indumentum as on petioles. Flowers with pedicels 0.3−1.2(−4) mm long, tomentose to canescent with white dendroid, eglandular hairs and subtended by linear to elliptic bracteoles, 1.6−2.5(−5.5) × 0.1 mm, with indumentum as on pedicels; calyx at anthesis 5−7 mm long, greyish, tube 3−5 mm long, ± cylindrical broadening near the throat, straight or slightly curved, ribbed, externally lanate to canescent with white dendroid hairs and small sessile glands, mostly in the base to the middle of the tube, tube internally glabrescent with simple hairs, denser at the throat but without a ring of hairs, calyx lobes unequal, 1.2−2 mm long, deltate, apex acute to slightly acuminate, straight or rarely curved, externally with indumentum as on tube, internally tomentose at the margin with dendroid hairs and scattered simple hairs in the middle of lobes, calyx in fruit 7−9(−10.5) mm long, indumentum less dense, tube 4.8−7.8 mm long, cylindrical to rarely broadly cylindrical, curved, ribbed, calyx lobes 1.7−2.4 mm long, unequal, curved; corolla lilac, 8.5−11 mm long, tube 5.9−7.4 mm long, cylindrical, straight from base to middle of the tube, becoming slightly curved and enlarged near throat, 1−1.6 mm wide, externally with base glabrous becoming densely tomentose towards apex with dendroid uniseriate hairs and sessile glands, internally with a ring of villous hairs at base of corolla and with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens and sessile glands in throat, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally with sessile glands, anterior lobe large, boat-shaped with a reduced apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair glabrescent with long, uniseriate hairs mostly near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 4 per flower, 1.7−2.8 × 1.3−1.8 mm, ellipsoid to obovoid or quadrangular, flattened, winged, castaneous, not shiny, glabrous, rugulose, rarely with few small sessile glands, with abscission scars, mucilaginous when wetted.

Phenology:—*Hyptidendron leucophyllum* was found in a fertile mostly during the dry season from June to September. It was also rarely found fertile in April and November.

Distribution and Habitat:—*Hyptidendron leucophyllum* is endemic to Minas Gerais state in Brazil occurring in 11 municipalities (Fig. 22). It inhabitants the Cerrado domain in the transition between savanna and *campo rupestre* habitats in elevations between 650 to 1880 meters. It can be also found in disturbed ground as roadside areas.

Preliminarly Conservation Status:— The AOO is 60 km² and the EOO is 19,670 km². *Hyptidendron leucophyllum* is known for more than 10 localities and it’s a fairly resilient species, occurring also in disturbed ground as roadsides. It hasn’t been documented as occurring inside any protected areas, but it could probably be found in Parque Estadual de Grão-Mogol. The conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:—The specific epithet is a reference to the whitish leaves of this species due to a densely indumentum of white dendroid hairs.

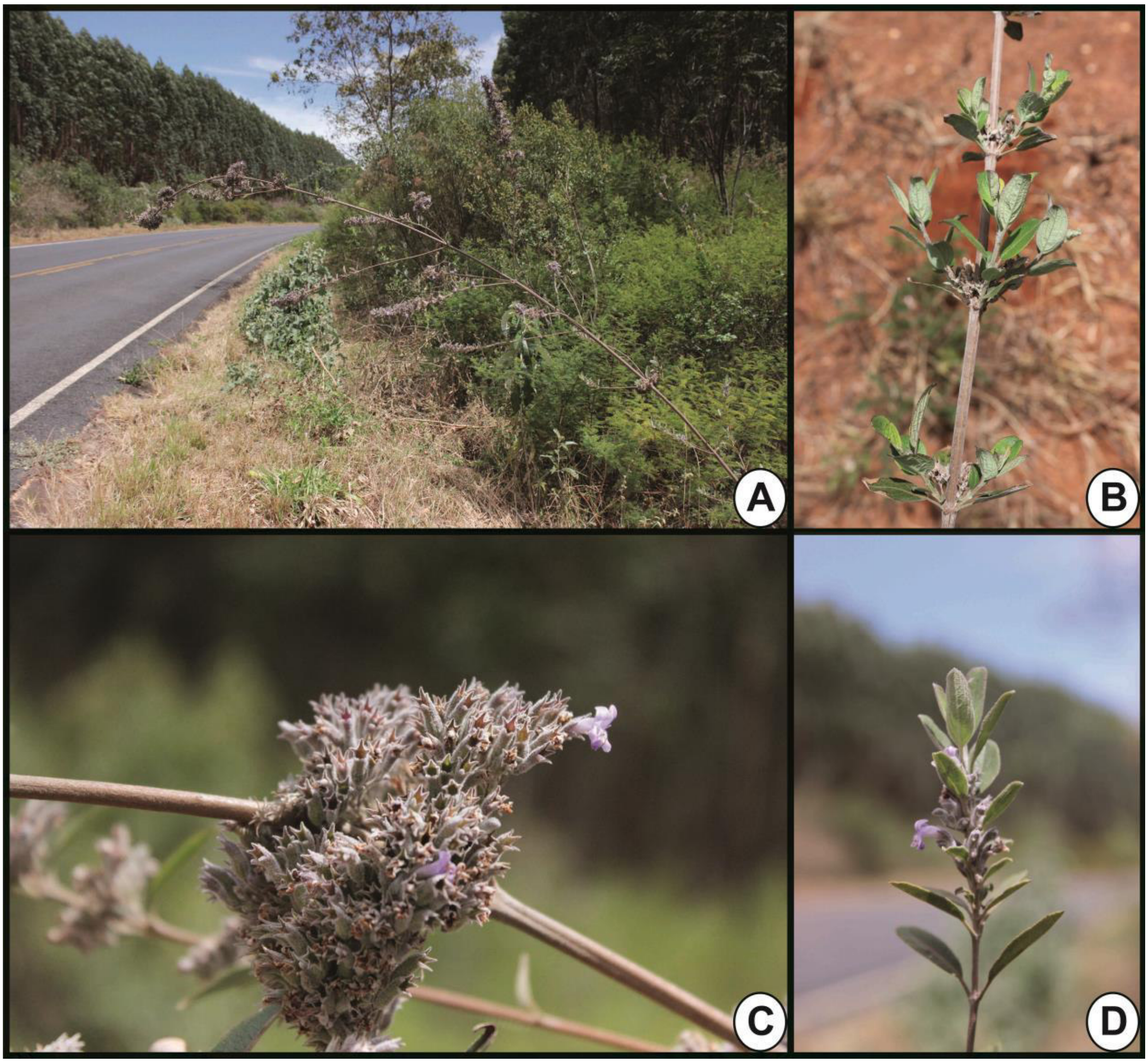

FIGURE 20. Field pictures of *Hyptidendron leucophyllum* (Pohl ex Benth.) Harley. **A.** Habit. **B.** Branch with leaves. **C.** Inflorescence. **D.** Branch bearing leaves and inflorescenses. **A-D.** Photos by G.M. Antar.

Affinities and morphological notes:—*Hyptidendron leucophyllum* is morphologically most related to *Hyptidendron conspersum* with some misidentification between species (see comment in *Hyptidendron conspersum* notes). It is also similar to *Hyptidendron canum*, which also can be misidentified, a sympatric species (see comments in *Hyptidendron canum* notes). *Hyptidendron leucophyllum* can be differentiated from all other species of the genera

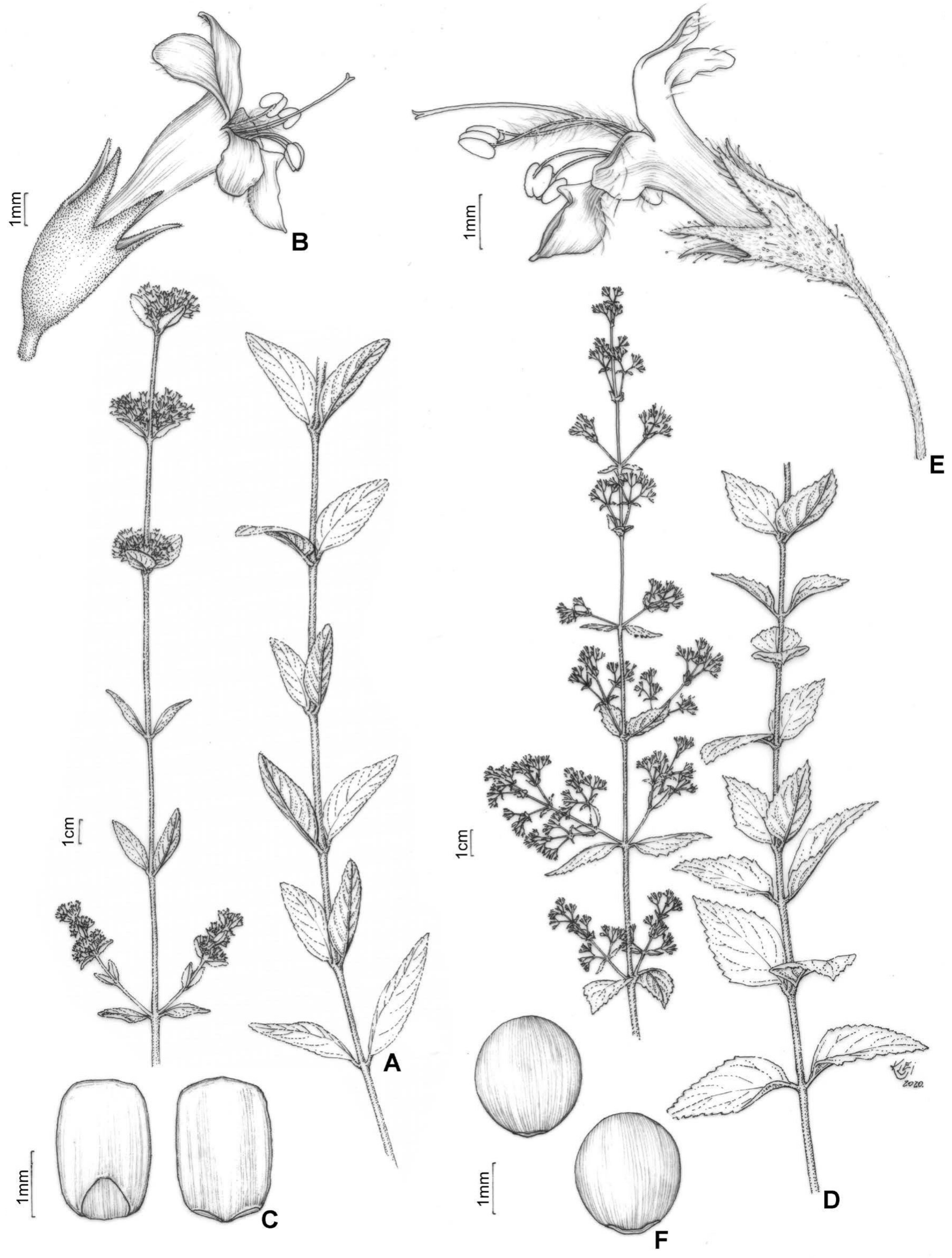

FIGURE 21. Line drawing of *Hyptidendron leucophyllum* (Pohl ex Benth.) Harley. A. Branch bearing leaves and inflorescenses. **B.** Flower, side view. **C.** Nutlet. Line drawing of *Hyptidendron amethystoides* (Benth.) Harley. **D.** Branch bearing leaves and inflorescenses. **E.** Flower, side view. **F.** Nutlet. Line drawing of Illustration of Klei Sousa.

by a combination of the following characters: erect shrub to 4 m tall, nutlets 4 per flower, flattened, winged, branched hairs present, mostly white, inflorescence a lax terminal thyrsoid, calyx lobes conspicuously unequal, at anthesis 1.2−2 mm long, anterior lobe of corolla without a long apiculus and fruiting calyx tube 4.8−7.8 mm long.

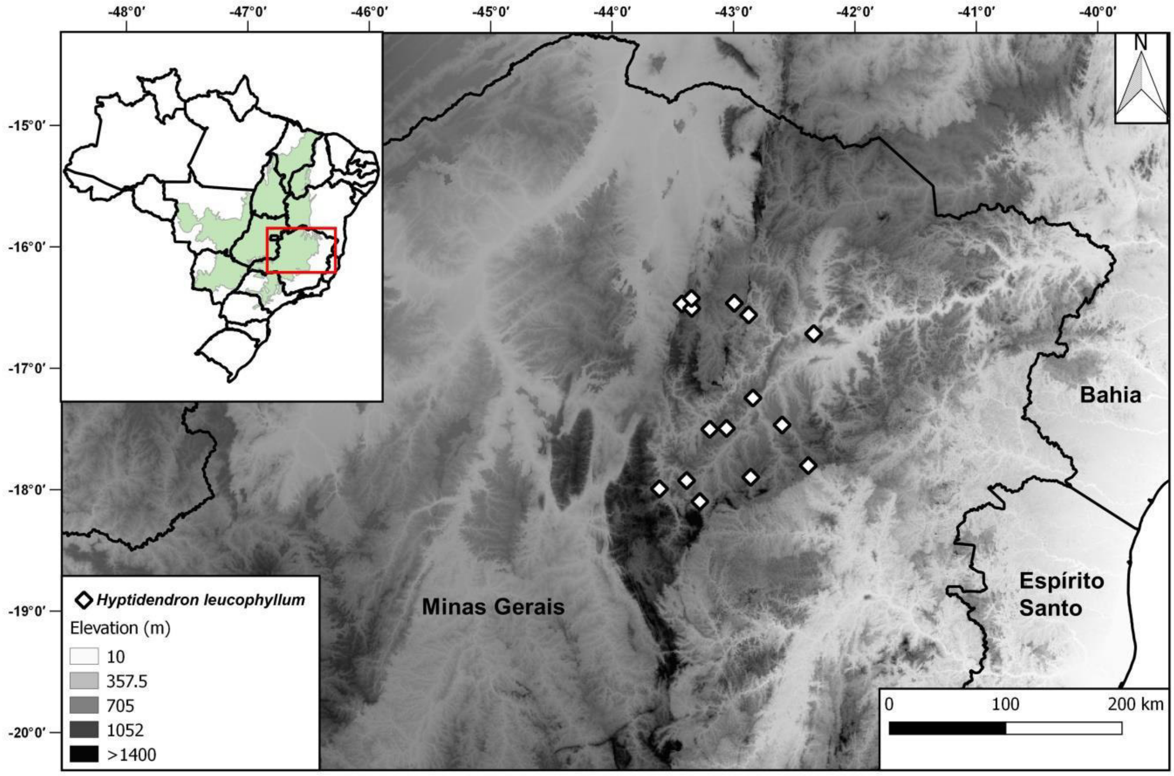

FIGURE 22. Distribution of *Hyptidendron leucophyllum* (Pohl ex Benth.) Harley. The green shape in the small map shows the extension of the Cerrado Domain.

Typification and nomenclatural notes:—Epling (1936b) when lectotypifing *Hyptis leucophylla* wrote that the type was in W herbarium. Still, he didn't point out that there are two specimens at W. Here we choose as second step lecotypification the one that has the most complete material with Epling's handwriting.

Bentham (1833) when describing *Hyptis laurifolia* indicates that the type was in P herbarium. Still, he didn't point out that there are two specimens at P. Here we choose as lectotype the one that has the most complete material with Epling's handwriting.

Selected specimens examined:—BRAZIL. **Minas Gerais**: In campis at Tepico [Tejuco] in Serro Frio, June, *Martius s.n.* (M); In summo monte Itambe, *Martius s.n.* (M); Capelinha, 17°28'''S 42°36'''W, 11 November 1981, *Silva 116* (HRB, RB); Carbonita, 8 September 1996, *Brandão 25996* (PAMG, SPF); Diamantina, estrada para Mendanha (MG2) ca. de 10 km, estrada para Felício dos Santos km 12, 14 July 1984, *Harley et al. CFCR 4444* (K, SP, SPF); Felício dos Santos, rodovia que liga Diamantina a Felício dos Santos, 18°5'51"S 43°16'40"W, 25 September 2017, *Antar & Chaves 1923* (SPF); Francisco Sá, 16°25'26.9"S 43°20'49.5"W, 3 August 2007, *Pereira et al. 15* (CESJ); Grão Mogol, estrada para Virgem da Lapa, ca. 2 km de Grão Mogol (próximo à antena de televisão), 16°33'39"S 42°52'32"W, 13 July 2001, *Souza et al. 25869* (ESA, HUEFS, K, RB, SPF); Itamarandiba, 19 September 1996, *Brandão 26162* (PAMG); São Gonçalo do Rio Preto, estrada para Turmalina próximo ao ponto de gasolina BR, 17°48'3"S 42°23'6"W, 29 August 2007, *Silva-Castro et al. 1365* (HUEFS, SPF); Turmalina, Beira da BR-367, 17°30'7.4"S 43°11'45.5"W, 15 September 2010, *Flores et al. 839* (ESA, SPF); Virgem da Lapa, estrada para Igicatu ou Buriti entre 7−10 km de Virgem da Lapa, 18 July 1985, *Martinelli et al. 11168* (RB, SPF).

1.7. *Hyptidendron pulcherrimum* Antar & Harley (in press). Type:—BRAZIL. Minas Gerais: Conselheiro Pena, Pico do Padre Ângelo, subida ao pico, elev. 1260, 16 Dec 2016, *J.C. Lopes et al. 453* (Holotype: SPF[SPF227258]; isotypes: HUEFS, K, RB).

(Fig. 23).

Shrubs or treelets 1.5–2 m tall, erect or somewhat decumbent, supported by nearby rocks or other plants, aromatic; stems woody, branched, 3–5 mm diam., younger stems quadrangular, canaliculate, pubescent with rigid, broad-based, curved eglandular simple or rarely branched hairs, small stipitate glandular hairs and sessile glands, older stems ± terete, not canaliculate, less hairy, with longitudinal grooves, internodes (0.7–)1.2–5.2 cm long. Cauline leaves spreading along the branches, not imbricate, longer than internodes, mostly diminishing in size towards stem apex, lamina 2–5.8 × 1.4–4.2 cm, chartaceous to coriaceous, discolorous, with abaxial surface paler, elliptic, ovate or wide elliptic, base cuneate or rounded, sometimes unequal, apex obtuse or rounded, sometimes apiculate, apiculus ca. 0.5 mm long, adaxial surface ± bullate, shiny, glabrous to glabrescent, except on main vein, which is tomentose with simple curved eglandular hairs, denser near the base, venation mostly inconspicuous, midrib and secondary veins plane or slightly impressed, abaxial surface glabrous or glabrescent with rare sessile glands and rarely some indumentum on the main nerve, composed of curved hairs and sessile glands, venation reticulate, prominent, conspicuous, margin ± ciliate, with small curved hairs up to the middle of the lamina, crenulate, rarely serulate, entire in the base to 1/4 of leaf margin, sometimes slightly revolute, mostly near base of lamina, 20–36 teeth on each side of leaf, with tooth apex swollen, obtuse to acute; petiole 0.5–1.3 cm long, canaliculate, pubescent with rigid, curved, eglandular hairs, sessile glands and rare gland-tipped hairs, the indumentum is denser in the intervenous lacunae. Inflorescence composed of axillary cymes, not forming a well-defined terminal thyrsoid structure, cymes dichasial, or rarely monochasial subtended by bracts similar to leaves with same shape, sometimes orbicular or oblate with obtuse, rounded, truncate or retuse apex, slightly smaller, 1.1–2.6(–3.9) × 1–2.1 cm, mostly smaller cymes, mature cymes 2.2–4.1 cm long, 7–19 flowered, not or only partially obscured by the leaves, peduncles (2.5–)4–10 mm long, with indumentum as on petioles. Flowers with pedicels 3.5–11.7 mm long, pubescent with rigid, broad-based, curved eglandular hairs, stipitate glandular hairs and sessile glands and subtended by linear bracteoles, 1−1.4 × 0.1 mm, with indumentum as on pedicels; calyx at anthesis (3.5−)4.2−6.1 mm long, vinaceous or green, tube (2.9−)3.1−4.7 mm long, cylindrical broadening near the throat to infundibuliform, straight, ribbed, externally pubescent with small uniseriate hairs gland-tipped hairs and sessile glands, denser in the base and veins, tube internally glabrous at base, becoming pubescent with minute sessile glands at the apex, without a ring of hairs in throat, calyx lobes subequal, 0.8−1.6 mm long, deltate or subulate, apex acuminate, straight or rarely curved, externally with similar indumentum as on tube but the hairs longer in the margins of the lobes, internally pubescent with sessile glands and eglandular hairs in the margins and within the lobes, calyx in fruit 7.2−8 mm long, indumentum less dense, tube 6−6.9 mm long, ± cylindrical, ribbed, calyx lobes 0.9−1.4 mm long, subequal, straight; corolla lilac to purple, 11−13 mm long, tube 7.5−10.5 mm long, cylindrical, straight from base to middle of the tube, becoming slightly curved and enlarged near throat, 2−2.6 mm wide, externally tomentose with simple uniseriate non-glandular hairs and small sessile glands, less dense near the corolla base, internally with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens, lobes spreading, externally with the same indumentum as tube, lobes internally glabrous, anterior lobe large, boat-shaped with a reduced apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with similar indumentum but less dense; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 4 per flower, 2.2−3 × 1.6−2 mm, ellipsoid or oblongoid, flattened, winged, castaneous, inconspicuously shiny, glabrous, rugulose, with abscission scars, slightly mucilaginous when wetted.

Phenology:—*Hyptidendron pulcherrimum* was found fertile in June, November and December.

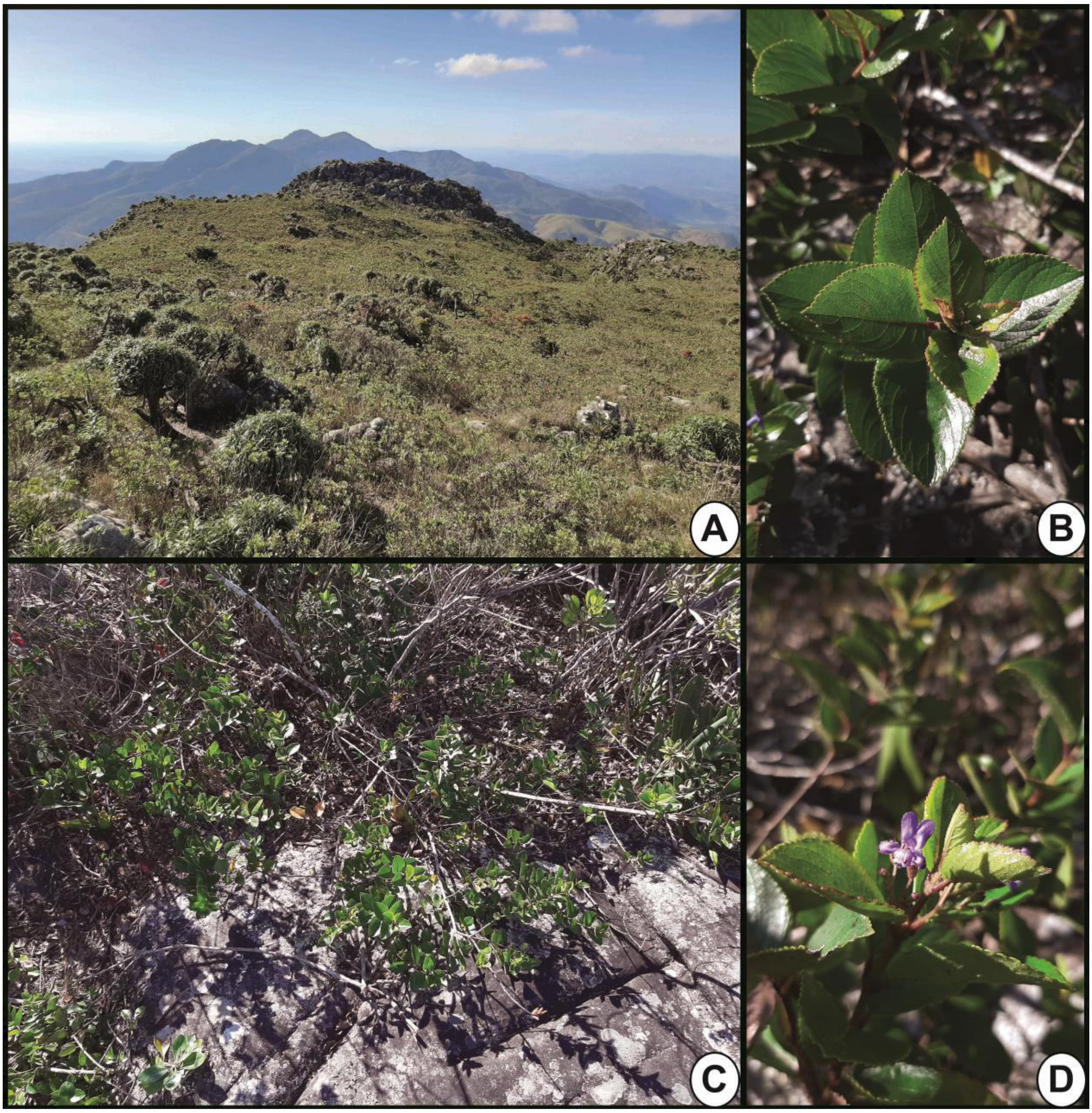

FIGURE 23. Field pictures of *Hyptidendron pulcherrimum* Antar & Harley. **A.** Habitat. **B.** Leaves. **C.** Habit. **D.** Branch bearing leaves and inflorescenses. **A-D.** Photos by P.M. Gonella.

Distribution and Habitat:—*Hyptidendron pulcherrimum* is a microendemic of the Pico do Padrê Ângelo in the Serra do Padre Ângelo in Conselheiro Pena municipality, eastern Minas Gerais state, Brazil, approximately 100 km from the border with Espirito Santo state (Fig. 24). It occurs in the Atlantic Rainforest domain in *campo rupestre* habitats in 1000 to 1500 meters elevation.

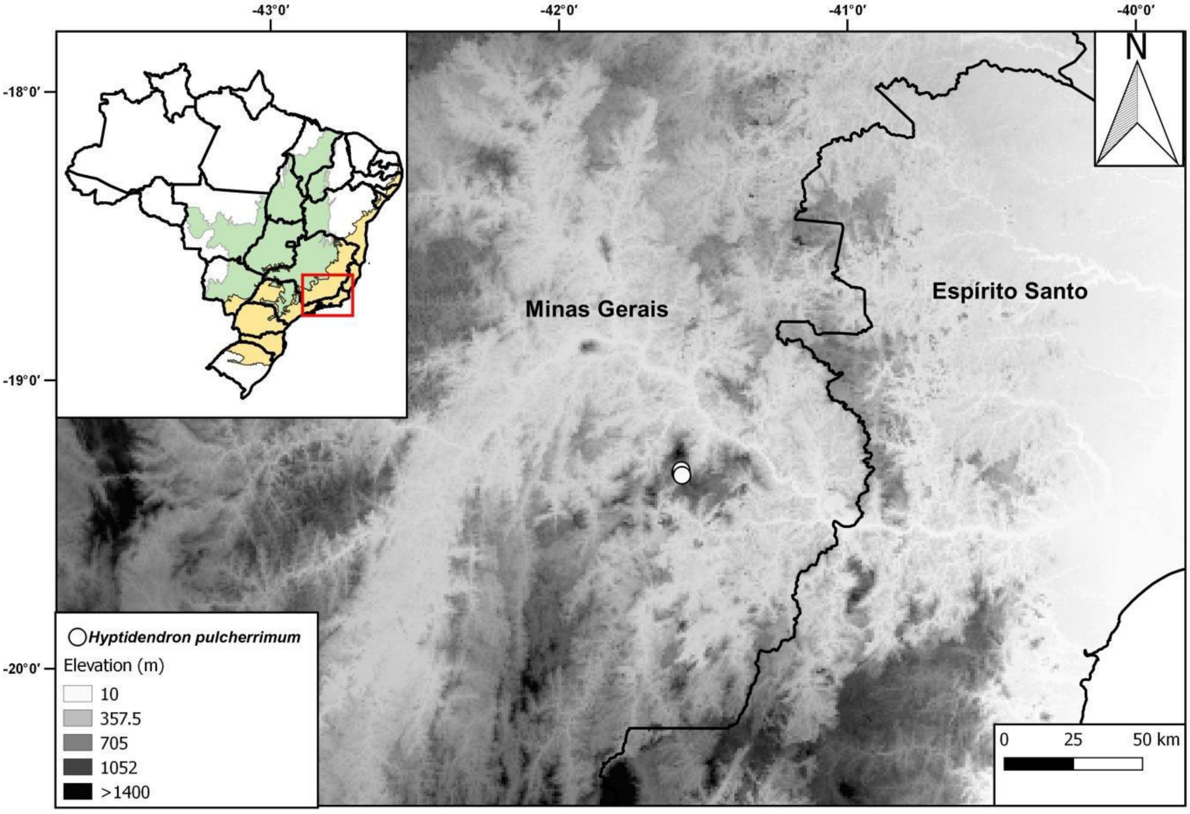

FIGURE 24. Distribution of *Hyptidendron pulcherrimum* Antar & Harley. The green shape in the small map shows the extension of the Cerrado Domain, and the yellow shape show the extension of the Atlantic Rainforest Domain.

Conservation Status:—The AOO and EOO are just 8 km². Together with *Hyptidendron roseum, Hyptidendron pulcherrimum* is within the genus the species with the most restricted distribution. Despite that the species is fairly common in Pico do Padre Angelo (Antar *et al*. in prep), its conservation relies on the protection of a single unprotected locality which has been subjected to invasion by alien grass species, uncontrolled anthropic fires and climatic change. The conservation status of this species is assessed as Critically Endangered according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:—The specific epithet is a reference to the beauty of the plant.

Affinities and morphological notes:—*Hyptidendron pulcherrimum* when described was compared to *Hyptidendron vauthieri* and other species of *Hyptidendron* sect. *Umbellatae*, sharing with them a similar habit, habitat, leaf structure, absence of dendroid hairs, and similar inflorescence structure. In the phylogeny of *Hyptidendron* (Antar *et al*. in press) it was placed as sister of *Hyptidendron asperrimum*, in *H*. sect. *Hyptidendron*. With this result, a revaluation of the morphology was made. *Hyptidendron pulcherrimum* shares with other species of this group the usually longer corollas (> 7mm, cylindrical), the flattened, winged nutlets, 4 per flower (wrongly described as 1 per flower in the protologue). and it can occasionally have dendroid hairs on its branches. It can be easily recognized as is the only species that presents. The most closely related species is *Hyptidendron asperrimum*, sharing similar calyx measurements, but can be distinguished by the indumentum composed mostly of simple curved hairs (vs. white dendroid hairs) and the smaller leaves (2−5.8 in *H. pulcherrimum* vs. (4.9−)7.2−16.3), smaller petioles (0.5−1.3 cm long in *H. pulcherrimum* vs. 1.4−4.4 cm long) and the number of teeth in the leaves (20−36 teeth in *H. pulcherrimum* vs. 68−96 teeth).

Specimens examined:—BRAZIL. **Minas Gerais**: Conselheiro Pena, Pico do Padre Ângelo, subindo pela crista sul da montanha, 19º19’46.14”S, 41º34’26.43”W, alt. 1,025 m, 27 November 2013, *Gonella & Rivadavia 642* (SPF); *ibid*., Pico do Padre Ângelo, no topo do pico, 19º19’14.2”S, 41º34’43.7”W, alt. 1,530 m, 11 June 2017, *Gonella et al. 800* (SPF); *ibid*, Serra do Padre Ângelo, Pico do Padre Ângelo, subindo pela trilha que leva ao topo, 19°18'36.7”S, 41°34'32.8”W, alt. 1,165 m, 04 December 2018, *Gonella et al. 966* (MBML); *ibid*, Serra do Padre Ângelo, Pico do Padre Ângelo, platô do topo do pico, 19 19’13.6”S, 41 34’44.2”W, alt. 1,500 m, 08 June 2020, *Gonella et al. 1232* (SPF).

2. *Hyptidendron* sect. *Latiflorae* (Epling) Antar & Harley (in prep.) ≡ *Hyptis* sect. *Latiflorae* Epling (1936b: 223).

Type:—*Hyptidendron eximium* (Epling.) Harley & J.F.B.Pastore.

Shrubs or subshrubs up to 5 m tall, mostly 1.5 m tall, aromatic, slightly aromatic or rarely not aromatic, woody subterranean structure absent; stems woody or lightly woody, solid or fistulose, erect, quadrangular and canaliculate or slightly canaliculate, at least in younger parts, indumentum composed of simple eglandular hairs, gland-tipped hairs and sessile glands. Cauline leaves spreading along the branches, not imbricate, longer or smaller than internodes, frequently diminishing in size towards stem apex, lamina chartaceous or membranous, discolorous, ovate, elliptic, wide ovate, wide elliptic, narrow ovate, narrow elliptic, oblate or lanceolate, base cordate, rounded or rarely truncate, sometimes uneven, apex acute or obtuse, mostly terminating in an acumen, adaxial surface hairy, rarely glabrescent, venation mostly inconspicuous, abaxial surface hairy, venation prominent, conspicuous, reticulate, margin irregularly crenulate, serrulate or serrate, sometimes entire near the base, petiole present, rarely absent, mostly canaliculate, hairy. Inflorescence composed of axillary pedunculate cymes, forming a lax, branched, terminal thyrsoid structure, cymes dichasial or unilateral, subtended by leaf-like bracts, reduced, mostly smaller than cymes, mature cymes (1−)5−33 flowered, not obscured by bracts. Flowers pedicelate or rarely sessile, subtended by linear bracteoles; calyx ± actinomorphic, vinaceous, green or cream due to the indumentum, tube cylindrical or infundibuliform, straight, internally without a ring of hairs in the throat, lobes subequal, deltate, straight or rarely slightly curved, calyx in fruit longer, indumentum less dense; corolla purple, lilac, violet or whitish, tube cylindrical or rarely somewhat infundibuliform, straight, lobes spreading, different, anterior lobe large, boat-shaped, mostly with a long, almost caudate apex; stamens 4, epipetalous, didynamous, paired, exserted, posterior pair of stamens longer, attached to the middle of the tube, with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair shorter, attached to the base of the anterior lobe, glabrescent with hairs near the anther, anthers 2–thecous, dorsifixed, opening by longitudinal slits, connective not enlarged; gynoecium bicarpelate, 4-lobed, ovary with nectariferous disc, style gynobasic, exserted, jointed and a well-developed stylopodium protruding above ovary, stigmatic lobes slender, bilobed, lobes subequal. Nutlets 1 per flower, ellipsoid, suborbiculoid, globose, or oblongoid, not flattened, not winged, castaneous, brown or dark brown, shiny or not shiny, glabrous and rugulose or rarely pubescent to glabrescent with hairs in the apex, abscission scars mostly conspicuous, sometimes absent and them an appendage at the base present, mucilaginous or slightly mucilaginous when wetted. Four species distributed mostly in Mato Grosso and Rondonia states and Bolivia, with one more widespread species occurring in Northeastern Brazil.

2.1. ***Hyptidendron amethystoides*** (Benth.) Harley (1988: 94) ≡ *Hyptis amethystoides* Bentham (1848:130) ≡ *Mesosphaerum amethystoides* (Benth.) Kuntze (1891:525). Type:—BRAZIL. Ceará: Serra do Araripe, October 1838, *G. Gardner 1804* (first-step lectotype, designated by Epling [1936b: 218]; Second step lectotype, designated here: K-000488073; isolectotypes: B†, BM-000992895, G-00437841, G-00437842, GH-00001233, F [phototype of Berlin herbarium], K-000488074, NY-00000615, NY-00000616, P-00737524, P-00737523, W-0003138, W-0061905).

= *Hyptis cymosa* Epling (1949:189) *nomen nudum* (Figs. 21 D-F, 25).

Subshrubs to shrubs 0.6−1.5(−3) m tall, aromatic or slightly aromatic; stems lightly woody or woody, branched mostly near the inflorescence, 2−4 mm diam., younger stems quadrangular, slightly canaliculate or canaliculate, villous, pilose or rarely pubescent, denser in the nodes, with long uniseriate curved entangled gland-tipped hairs, small stipitate glandular hairs and small sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 1.4−8.8 cm long. Cauline leaves spreading along the branches, not imbricate, mostly smaller than internodes, rarely longer, diminishing in size towards stem apex, lamina 1.4−6.1(−9.5) × 1.1−5.5(−6.6) cm, chartaceous to membranous, discolorous, with abaxial surface paler, ovate, wide ovate, narrow ovate, lanceolate or elliptic, base rounded, cordate, less commonly truncate, sometimes unequal, apex acute to long attenuate or ovate, mostly apiculate, apiculus ca. 0.5 mm long, adaxial surface villous, pilose to sparsely pilose with different heights mostly curved, uniseriate gland-tipped hairs and small sessile glands, denser in the midvein, mostly near the base and in other veins and margins, venation mostly inconspicuous, midrib prominulous, or plane, close to base of lamina, but soon becoming impressed, secondary veins impressed, abaxial surface with the same indumentum as adaxial but denser, mostly in the veins, venation reticulate, prominent, margin ciliate, coarsely crenulate, serrulate or serrate, starting at the base or entire in the first few millimeters, sometimes slightly revolute, mostly near base of lamina, 9−56 teeth on each side of leaf, with tooth apex swollen, obtuse, acute or acuminate; petiole (0.25−)0.4−4.1 cm long, canaliculate to slightly canaliculate, villous or pilose with different heights erect long uniseriate gland-tipped hairs and small sessile glands. Inflorescence thyrsoid, terminal, up to 40 cm long, with dichasial axillary cymes, subtended by bracts similar to leaves but mostly wide ovate, very wide ovate or orbiculate, smaller, with smaller petioles 0.3−1.1(−2.1) × 0.2−0.9(−1.2) cm, mostly smaller than cymes, mature cymes 1.5−4.5 cm long, 5−19 flowered, not obscured by bracts, peduncles 5−27 mm long, with pubescent or pilose indumentum with different heights gland-tipped hairs and sessile glands, sometimes diminishing towards the upper part. Flowers with pedicels 1.5−8.5 mm long, indumentum as on peduncles. subtended by linear bracteoles, 0.4−1.5 × 0.1 mm, with indumentum as on pedicels; calyx at anthesis

1.8−3.6 mm long, green, tube 1−1.8 mm long, ± cylindrical broadening near the throat to infundibuliform, straight, ribbed, externally pilose to pubescent with different heights gland-tipped hairs and sessile glands, mostly in the veins, tube internally glabrescent with minute hairs, mostly in the throat, without a ring of hairs in throat, calyx lobes subequal, 0.7−1.8 mm long, deltate, apex acute, straight or rarely slightly curved, externally with indumentum as on tube, internally glabrescent, the margin ciliate, calyx in fruit 4.8−6.4 mm long, indumentum less dense, tube 3.4−4.4 mm long, infundibuliform to campanulate or ± cylindrical, ribbed, calyx lobes 1.5−2.3 mm long, subequal, straight or rarely slightly curved; corolla lilac, purple or whitish with vinaceous striae, 4−6.1 mm long, tube 1.7−3.2 mm long, ± cylindrical becoming enlarged near throat, 0.5−0.8 mm wide, externally with base glabrous becoming unregularly villous, internally glabrescent, rarely glabrous, with small scattered hairs or sessile glands mostly in the lobes and villous hairs grouped at the insertion of posterior pair of stamens, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally glabrous or glabrescent, anterior lobe large, boat-shaped with an apiculate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous to middle and with long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 2.2−3.2 × 2−2.5 mm, ellipsoid, wide ellipsoid, suborbiculoid, globose, not flattened, not winged, castaneous, dark brown or black, shiny, glabrous to glabrescent with few minute hairs in the apex, mostly rugulose, with inconspicuous abscission scars, slightly mucilaginous when wetted.

Vernacular name:—Alecrim, Tipi.

Phenology:—*Hyptidendron amethystoides* was found flowering and fruting from April to October, but mostly in July.

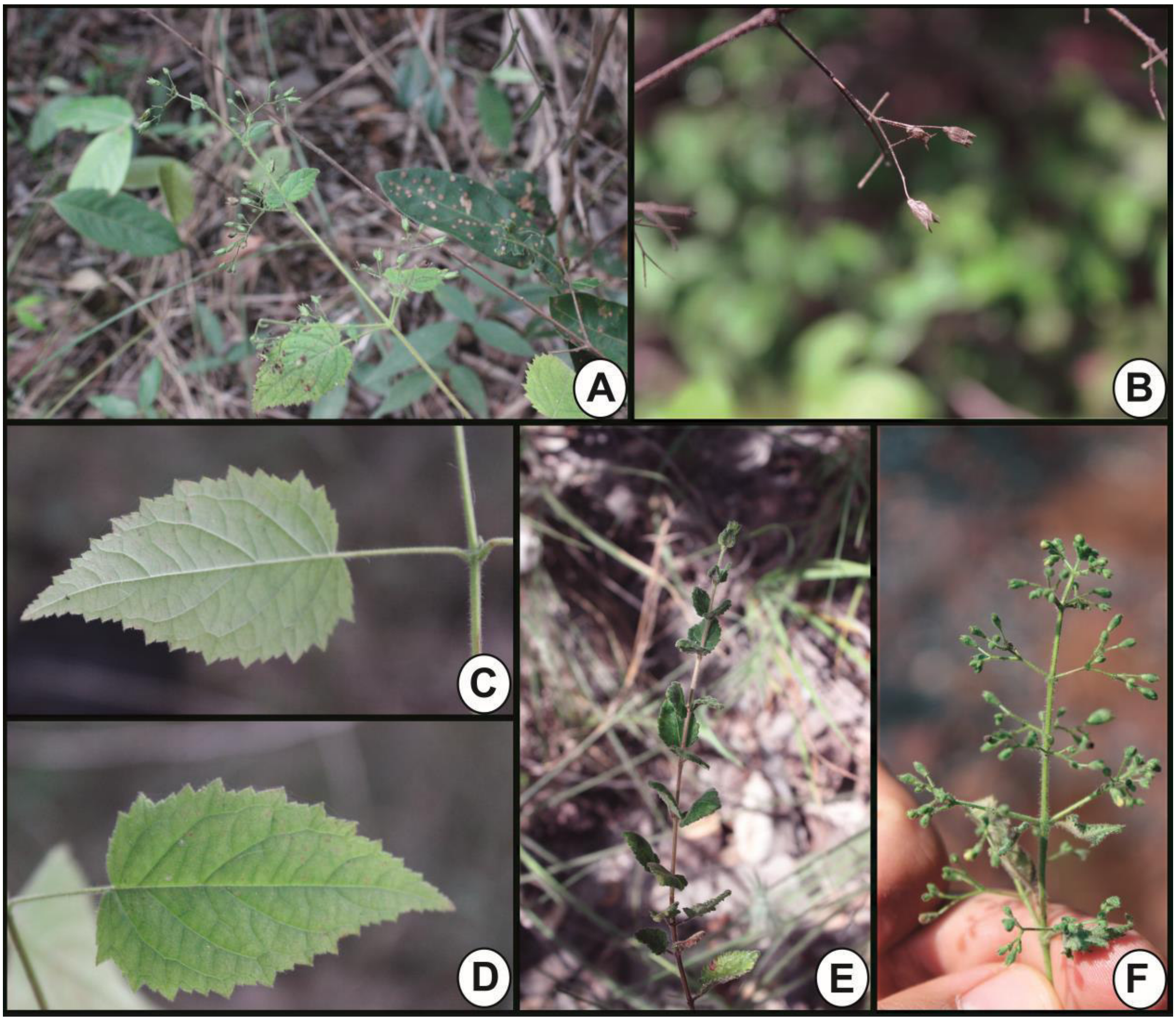

FIGURE 25. Field picture of *Hyptidendron amethystoides* (Benth.) Harley. **A.** Branch bearing leaves and inflorescenses. **B.** Calyx in fruit. **C.** Leaf, abaxial surface. **D.** Leaf, adaxial surface. **E.** Branch bearing leaves. **F.** Inflorescense. **A-F.** Photos by G.M. Antar.

Distribution and Habitat:—*Hyptidendron amethystoides* is endemic to Brazil, occurring in Bahia, Ceará, Maranhão, Pernambuco, Piauí and Tocantins states (Fig. 26). It occurs in the Caatinga and Cerrado domains in the border of riparian forest, dry forests, rocky outcrops and savanna habitats, from 300 to 1000 meters elevation. It seems that *H. amethystoides* can have an ecological behaviour of becoming caducous or semi-caducous and, after proper conditions, sprouting and flowering at the same period. Therefore, most of the specimens have just young leaves and flowers. Specimens (e.g. *Thomas 12251* NY) and fieldwork suggests that mature leaves are longer.

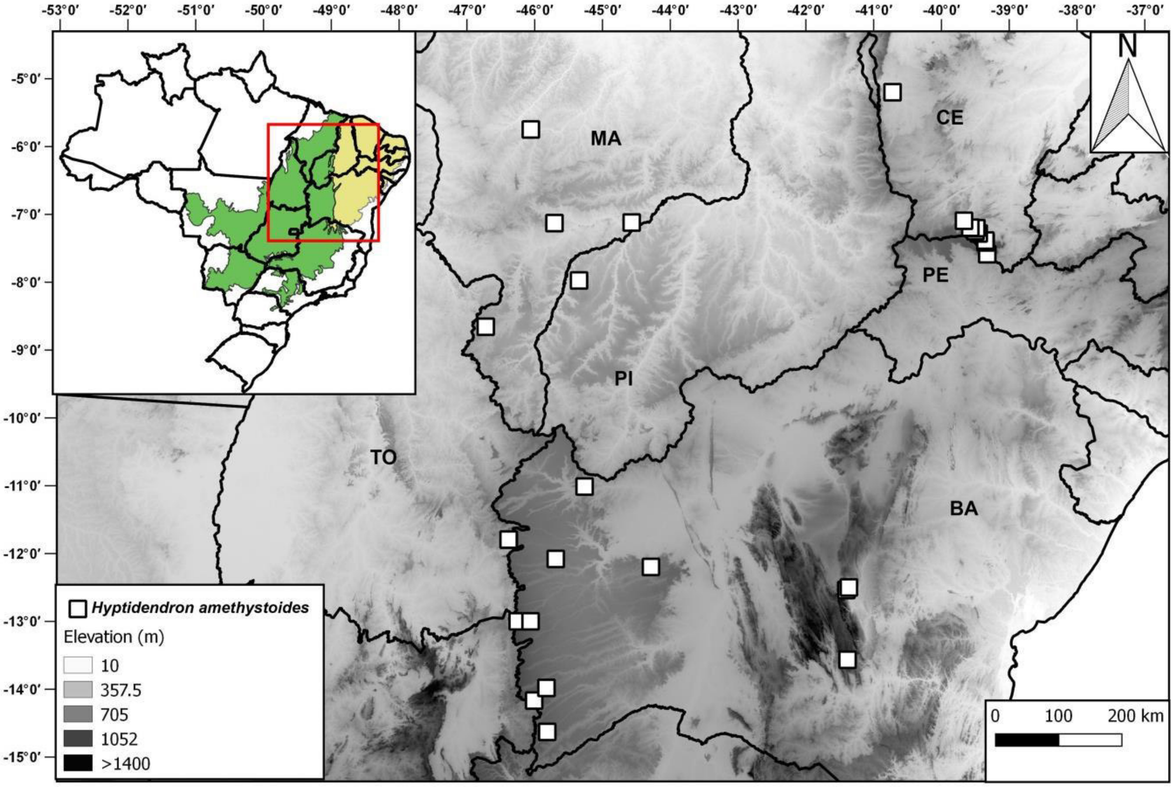

FIGURE 26. Distribution *Hyptidendron amethystoides* (Benth.) Harley. The green shape in the small map shows the extension of the Cerrado Domain, and the yellow shape show the extension of the Caatinga Domain. (BA, Bahia; CE, Ceará; MA, Maranhão; PE, Pernambuco; PI, Piauí; TO, Tocantins).

Conservation Status:— The AOO is 108 km² and the EOO is 65,6326 km². *Hyptidendron amethystoides* is known for more than 20 localities and it occurs in some different habitats within the Cerrado and Caatinga domains. It is also present in some protected areas as Estação Ecológica Uruçuí-Una and Floresta Nacional do Araripe. The conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:— The prefix Amethyst relates to the purple colour and the suffix oides from the Greek means "resembling a". That way, Bentham (1848) probably named this plant amethystoides as it has amethyst (purple) flowers.

Affinities and morphological notes:—*Hyptidendron amethystoides* can be differentiated from all other species of the genera, by a combination of the following characters: nutlets 1 per flower, not winged, not flattened, calyx tube at anthesis 1-1.8 mm long, without a ring of hairs, pedicels 1.5−8 mm long, leaves mostly ovate to lanceolate with base rounded, cymes always a dichasial.

The most closely related species is *Hyptidendron glutinosum*, which does not occur sympatrically. It differs by the latter by the calyx tube at anthesis smaller (1-1.8 mm long in *H. amethystoides* vs. (1.6−)1.8−2.9); pedicels relatively longer, never smaller than 1.5 mm long (1.5−8 mm long in *H. amethystoides* vs (0.3−)0.5−2.6 mm); leaves mostly ovate to lanceolate, with base rounded (vs. leaves mostly wide ovate with base deeply cordate); cymes always a dichasial (cymes dichasial or unilateral). It is also similar to *H. eximium* which occurs sympatrically but can be differed by the solid stems (fistulose in *H. eximium*), calyx tube at anthesis 1−1.8 (vs. 2.8−3.2 in *H. eximium*) and nutlets without an expanded appendage in the base (present in *H. eximium*).

Hyptidendron amethystoides occurs in two different domains, the Caatinga and the Cerrado, and is a rather variable species, with significant variations in its indumentum (mostly branches, petioles, peduncles), leaf shape, leaf morphology and leaf and petiole measurements within its range. Still, those differences are inconstant in specimens and are not sufficient to justify any splitting of *H. amethystoides*. During the data gathering for this revision, we thought at some point to describe a new species that are on the outermost of this variation from Lençois municipality, Bahia state (e.g. *Oliveira 651*, HUEFS herbarium). Still, after careful examination of numerous specimens we've decided to consider it just as one highly variable species. This somewhat different morphotype from Lençois can also occurs in the type locality of *Hyptidendron amethystoides* and we cannot detect any biogeographical or ecological pattern that distinguishes both morphotypes. Also, specimens from same localities can have considerable differences and it is possible to see that even in the same collection (*Nunes s.n.* K-001226015) that has different branches in the same specimen. Epling's (1949) attempt to describe *Hyptis cymosa* a *nomen nudum* and synonym of *H. amethystoides* also states that variation in *H. amethystoides*. Further phyllogeography studies focused on populations of both species may help to shed light in this morphological variation.

Typification and nomenclatural notes:— Epling (1936b) when lectotypifing *Hyptis amethystoides*, wrote that the type was in herb. Kew. Still, he didn't point out that there are two specimens at K even if he examined and identified both. Here we choose as second step lecotypification the one that Epling (1936b) choose as a type with a label and the one which bears the stamp of herbarium Benthamianum. Epling (1936b) states that there is a lectotype at US herbarium but no material has been founded.

Selected specimens examined:— BRAZIL. **Bahia**: Barreiras, Rodovia BR-020; 30-40 km O de Roda Velha, 20 June 1986, *Hatschbach & Silva 50531* (K, MBM, SPF); Cocos, Fazenda Trijunção. Estrada da fazenda para a Sede de Guará, 14°37'49"S 45°48'51"W, 16 May 2001, *Fonseca et al. 2758* (IBGE, K, SP); Correntina, ca. 38 km L de Posse (Goiás), 14°10'4"S 46°0'25"W, 18 May 2001, *França et al. 3691* (ALCB, HRB, HUEFS, K); Cristópolis, Lagoa do Oscar, 13 July 1979, *Hatschbach 42327* (MBM, NY); Formosa do Rio Preto, Estrada para a Estação Ecológica do Rio Preto, 11°0'46"S 45°15'46.3"W, 3 April 2011, *Wanderley et al. 210* (BRBA); Lençóis, Mata das Toalhas, Acessada pela rodovia BA 850, estrada que liga a cidade de Lençóis a BR-242. Próximo à entrada para o terreiro, 12°30'1"S 41°21'48"W, 14 September 2017, *Antar & Anjos 1822* (SPF). **Ceará**: Barbalha, Margens da CE-060, km 12, 7°23'9"S 39°20'59"W, 20 July 2014, *Pinto & Silveira 55* (ALCB); Crateús, Sítio Serra das

Almas., 8 May 2003, *Costa 239* (EAC, UFRN); Crato, Área de Proteção Ambiental da Chapada do Araripe, Parque Nacional da Chapada do Araripe, 22 July 1979, *Fernandes et al. s.n.* (EAC, K); Crato, Serra do Araripe, 12 km southwest of Crato on road to Exú, Pernambuco, 7°14'55.6"S 39°29'53.8"W, 30 July 1997, *Thomas et al. 11685* (HUEFS, MBML, NY, RB, SPF); Missão Velha, Barbalha-Jardim, 7°23'42"S 39°20'57"W, 19 August 2011, *Melo et al. 10384* (HUEFS); Nova Olinda, Sítio Sozinho, 6 May 2006, *Souza & Valadão s.n.* (EAC). **Maranhão**: Balsas, Agrovila nova Di Carli, lote pivo central, 8°39'22"S 46°43'16"W, 5 July 1998, *Oliveira et al. 1287* (HEPH, HUEFS); Benedito Leite, BR-230, próximo a São Domingos de Jabotão, 26 April 1979, *Nunes & Martins s.n.* (EAC, K); Grajaú, 13 km BR-226, Grajaú/Barra do Corda., 5°44'52"S 46°3'21"W, 20 July 1984, *Fonseca 428* (HRB, RB); São Raimundo das Mangabeiras, Entrada a direita ca. de 32 km da BR 230 em direção a Balsas, 7 km no ramal, 7°7'42"S 45°42'28"W, 28 January 2012, *Harley et al. 56555* (HUEFS, K, NY). **Pernambuco**: Serrita, Chapada do Araripe, Entre Jardim e Cachoeira, 7°35'15.8"S 39°19'21.4"W, 21 May 1996, *Araújo & Martins 1197* (HUEFS, UEC, UFC). **Piauí**: Ribeiro Gonçalves, Estação Ecológica Uruçuí-Una, 24 July 1985, *Fernandes s.n.* (EAC, K). **Tocantins**: Jardim Novo, Estrada para Barreiras, ca. 7 km antes da divisa Tocantins/Bahia, 11°47'42"S 46°23'4"W, 21 July 2000, *Souza et al. 24437* (ESA, HUEFS, K, SPF).

2.2. *Hyptidendron eximium* (Epling) Harley & J.F.B.Pastore (2012: 25) ≡ *Hyptis eximia* Epling (1936b: 223). Type:—BRAZIL. Mato Grosso: Barão de Melgaço, entre Barão de Melgaço e Pimenta Bueno, linha telegráfica, June 1918, *J.G. Kuhlmann 2279* (holotype UC-1943451; isotype R-000053369).

(Fig. 27 A-C).

FIGURE 27. Line drawing of *Hyptidendron eximium* (Epling) Harley & J.F.B. Pastore. **A.** Branch bearing leaves and inflorescenses. **B.** Flower, side view. **C.** Nutlet. Line drawing of *Hyptidendron glutinosum* (Benth.) Harley. **D.** Branch bearing leaves and inflorescenses. **E.** Flower, side view. **F.** Nutlet. Illustration of Klei Sousa.

Erect to sprawling herb to slender shrub 1.5−2(−5) m tall, aromatic; stems lightly woody, not branched or just near the inflorescense, 2−3(−5) mm diam., younger stems quadrangular, canaliculate, with longitudinal grooves, sparsely villous with long curved uniseriate eglandular hairs, sessile glands, and rarer gland-tipped hairs, denser in the nodes, older stems similar but less hairy, internodes 2.6−10.7 cm long. Cauline leaves spreading along the branches, not imbricate, longer than internodes, rarely smaller, diminishing in size towards stem apex, lamina (4.2−)5.9−12 × (2−)2.5−5 cm, membranous to chartaceous, slightly discolorous, with abaxial surface paler, narrow ovate to lanceolate or elliptic to narrow elliptic, base rounded to cordiform, sometimes unequal, apex acute to acuminate, sometimes apiculate, apiculus ca. 0.5 mm long, adaxial surface glabrescent to pilose with scattered long uniseriate eglandular hairs, except on main vein, which is tomentose with smaller hairs somewhat spreading to the secondary veins, denser in the base of those ones, also often white sessile glands sunk in the lamina, venation mostly inconspicuous, midrib prominulous, or plane, close to base of lamina, but soon becoming impressed, secondary veins impressed, tertiary veins inconspicuous, abaxial surface with sunken sessile glands commonly distributed in the lamina, except by the veins which have scattered uniseriate curved eglandular hairs, sometimes also in the lamina, venation reticulate, prominent, margin ciliate with simple uniseriate eglandular hairs, irregularly serrulate, entire in the base to 1/6 of leaf margin, 16−35 teeth on each side of leaf, with tooth apex slightly swollen, obtuse to acute; petiole (0.4−)0.6−1.3(−3.6) cm long, canaliculate, villous with long uniseriate curved eglandular hairs and sessile glands. Inflorescence thyrsoid, terminal, up to 35 cm long, with dichasial axillary cymes, subtended by bracts similar to leaves but reduced and diminishing in size towards the apex, the upper ones reduced, with same shape, 0.6−5 × 0.3−2 cm, mostly smaller then cymes, petiole reduced, mature cymes 1.5−5.1 cm long, 7−21 flowered, not obscured by bracts, peduncles 9−38(−43) mm long, villous with long uniseriate curved eglandular hairs, sessile glands and rarely with small gland-tipped hairs. Flowers with pedicels 0.5−2.7 mm long, indumentum as on peduncles and subtended by linear, subulate or rarely outer ones obovate, 0.8−2 × 0.1−6 mm, with indumentum as on peduncles; calyx at anthesis 4−4.4 mm long, green with dark veins, tube 2.8−3.2 mm long, ± cylindrical broadening near the throat to infundibuliform, straight, ribbed, externally villous with long uniseriate eglandular hairs mostly near the base and also shorter gland-tipped hairs and sessile glands, tube internally glabrescent with minute gland-tipped hairs scarcely dispersed and sessile glands, without a ring of hairs in throat, calyx lobes subequal, 1.3−1.9 mm long, deltate, apex acute, straight, externally with indumentum as on tube, internally villous in the margins with long uniseriate eglandular hairs hairs, calyx in fruit 7.3−11 mm long, indumentum less dense, tube 5.8−7.7 mm long, campanulate, ribbed, calyx lobes 1.9−2.9 mm long, subequal, straight or rarely curved; corolla pale violet to purple, 7−7.6 mm long, tube 4−4.3 mm long, campanulate, 0.9−1.2 mm wide, externally with base glabrous becoming glabrescent towards apex with long simple uniseriate hairs, gland-tipped hairs and sessile glands, internally with a ring of villous hairs at the middle of the tube and with tiny hairs and sessile glands in throat and below it, lobes spreading, externally with the same indumentum as tube but denser in the middle of anterior lobe, lobes internally glabrous, anterior lobe large, boat-shaped with short acuminate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous to middle and with few long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 3.5−4.8 × 2.4−3.3 mm, ellipsoid, not flattened, not winged, with an appendage in the abscission region, black to dark brown, not shiny, glabrescent with few minute hairs, without abscission scars, slightly mucilaginous when wetted.

Phenology:—*Hyptidendron eximium* was found in a fertile condition from May to August and rarely in October. Most of fertile specimens collected are from June.

Distribution and Habitat:—*Hyptidendron eximium* occurs in Mato Grosso state in Brazil and in La Paz and Santa Cruz departments in Bolivia (Fig. 28). It inhabits the transition between the Cerrado and Amazonia domains in border of forests and disturbed habitats in 250 to 450 meters elevation.

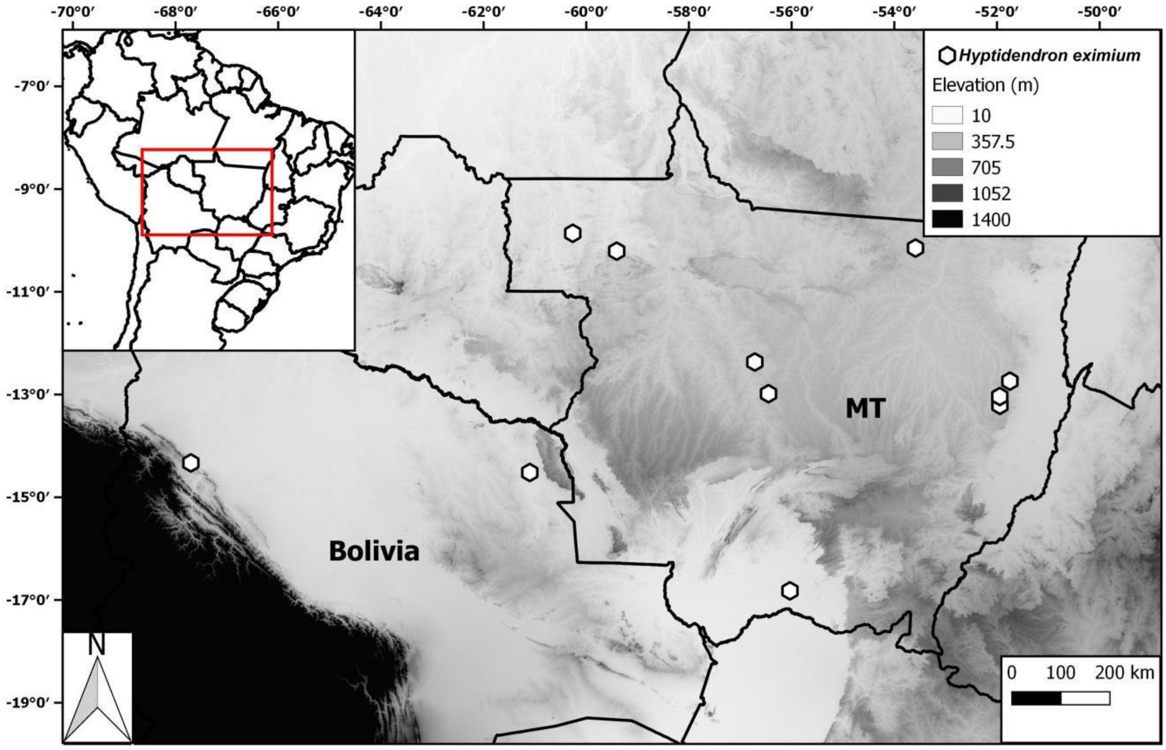

FIGURE 28. Distribution of *Hyptidendron eximium* (Epling) Harley & J.F.B.Pastore. . (MT, Mato Grosso).

Conservation Status:—The AOO is 44 km² and the EOO is 818,986 km². *Hyptidendron eximium* is known for more than 10 localities in two different countries and it also can be found in disturbed ground, near roadside. It is not known to occur inside any protected area. The last known collection of *Hyptidendron eximium* was made more than 20 years ago. We have made a field expedition in July 2018 looking to collected it in Mato Grosso states, still we were unable to find it. Currently the conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012), however, the area in which the species is distributed has suffered huge habitat substitution and, if the species remains not collected for longer, we would recommend to treat it as threatened.

Etymology:—The specific epithet has a meaning of excellent or distinguished. Epling (1936b) when describing *Hyptis eximia* placed it in *Hyptis* sect. *Latiflorae* alone. It also states that the basal appendage of the nutlets (caruncle) had an exceptional ornamentation.

Affinities and morphological notes:—*Hyptidendron eximium* differs from all other species of *Hyptidendron* as it possesses a fistulose stem, when all other species possess a solid stem. Apart from that, it can be recognized by slightly woody shrubs, nutlets 1 per flower, not flattened, not winged, and with an appendage in the base, which is a unique within Hyptidinae. The morphologically closest related species are *Hyptidendron amethystoides* and *Hyptidendron glutinosum*, differing from both by the longer calyx tube at anthesis 2.8−3.2 mm long (vs. (1.6−)1.8−2.9 in *H. glutinosum* and (1-1.8 in *H. amethystoides*), the fistulose stem (vs. solid) and the appendage in the base of the nutlets (vs. nutlets without appendage).

Selected specimens examined:—BOLIVIA. **La Paz**: Abel Iturralde, along road between Tumupasa and Rurrenabaque, on Hacienda Chiquitos, 15.5 km NW of Rio Bene at San Buenaventura, 13.6 km NW of San Isidro, 14°19'51"S 67°42'6"W, 11 August 2000, *Croat et al. 94486* (MO). **Santa Cruz**: Velasco, c. 1-2 km from Campamiento Los Fierros along road to pampa El Encanto, Parque Noel Kempff Mercado, 29 July 2000, *Wood et al. 16517* (K). BRAZIL. **Mato Grosso**: Aripuanã, BR-174, Projeto Juína, estrada para o aeroporto, 1 June 1979, *Silva & Rosario 4736* (F, MG); Lucas do Rio Verde, estrada entre Tapurah e São José do Rio Claro, cerca de 55 km W (em linha reta) de Lucas do Rio Verde, 12°59'"S 56°27'"W, 13 June 1997, *Souza et al. 17928* (ESA, UFMT); Peixoto de Azevedo, Estrada do Cemitério, Sede Fazenda São José, 7 August 1980, *Werner 3-80-PA* (F); Ribeirão Cascalheira, 17 km North along roadside from base camp, near roadside, 23 October 1968, *Harley et al. 10803* (K, MO, NY, P, RB); Tapurah, estrada entre a fazenda Contagro e o assentamento do INCRA (antiga fazenda Agrolasa), 12°22'"S 56°43'"W, 7 June 1997, *Souza et al. 17310* (ESA, UFMT); Xavantina, 40 km N of the Base Camp of the expedition, 14 June 1968, *Santos et al. 1804* (E, K, MO, NY, P, RB, UB).

2.3. *Hyptidendron glutinosum* (Benth.) Harley (1988: 93) ≡ *Hyptis glutinosa* Bentham in DC. (1848: 130) ≡ *Mesosphaerum glutinosum* (Benth.) Kuntze (1891: 526). Type:— BRAZIL. Mato Grosso, in Serra de Chapada, June 1827, *L. Riedel 1080* (Lectotype, designated by Epling [1936b: 218]: K-000488072; Isotypes: UC-2055655, LE?).

(Figs. 27 D-F, 29).

Subshrub or shrub 0.4−1.5 m tall, aromatic; stems lightly woody, fewly branched, 2−5 mm diam., younger stems somewhat quadrangular, not canaliculate or slightly canaliculate, villous with different heights uniseriate gland-tipped hairs and usually sessile glands, older stems terete, not canaliculate, less hairy, with few longitudinal grooves, internodes (1.2−)1.6−4(−4.8) cm long. Cauline leaves spreading along the branches, not imbricate or slightly imbricate near the branch apex, smaller than internodes, rarely equal or longer, mostly diminishing in size towards stem apex, lamina 1.8−4.2(−5) × (1.4−)1.6−3.8(−5.2) cm, chartaceous to membranous, discolorous, or slightly discolorous with abaxial surface paler, very wide ovate to wide ovate, base cordate to deeply cordate, rarely rounded, apex obtuse to acute, sometimes apiculate, apiculus ca. 1−2 mm long, adaxial surface pubescent, pilose or rarely glabrescent with uniseriate gland-tipped or eglandular hairs and sessile glands, mostly near the base, the main nerve and secondary veins, venation mostly inconspicuous, midrib and secondary veins prominulous close to base of lamina, but soon becoming +- plane, venation reticulate, abaxial surface with similar indumentum as the adaxial surface but densely villous in nerves with white hairs - gland-tipped or eglandular hairs, venation reticulate, prominent, margin is ciliate with gland-tipped hairs, irregularly serrulate to crenulate, starting at the base, sometimes slightly revolute, 15−41 teeth on each side of leaf, with tooth apex swollen, apex acuminate; petiole 0.2−0.55(−1) cm long, slightly canaliculate, densely villous with different height but mostly long uniseriate gland-tipped hairs and rare small sessile glands. Inflorescence thyrsoid, terminal, up to 38 cm long, with dichasial axillary cymes, subtended by bracts similar to leaves but reduced and diminishing in size towards the apex, the upper ones reduced, with similar shape, but with obtuse apex, 0.5−1.6 × 0.5−1.8 cm, mostly smaller than cymes, mature cymes 1.5−3.5 cm long, 11−33 flowered, not obscured by bracts, peduncles (3−)4−12(−15) mm long, with indumentum as on petioles. Flowers with pedicels (−0.3)0.5−2.6 mm long, villous with long uniseriate gland-tipped hairs and small sessile glands and subtended by linear bracteoles, 0.6−2.1 × 0.1 mm, with indumentum as on pedicels; calyx at anthesis 3.5−4.5 mm long, green with the lobes vinaceous, tube 2−2.9 mm long, ± cylindrical , straight, ribbed, externally villous with uniseriate gland-tipped hairs and sessile glands, denser near the base, tube internally glabrescent to pubescent with small hairs, without a ring of hairs in throat, calyx lobes subequal, 1.2−1.6 mm long, deltate, apex acute, straight, externally with indumentum as on tube, internally pubescent with gland-tipped hairs, the lobes margin ciliate with long uniseriate gland-tipped hairs, calyx in fruit 6.1−8.3 mm long, indumentum less dense, tube 4.1−5.2(-5.9) mm long, ± cylindrical soon broadening, ribbed, calyx lobes 1.8−3.1 mm long, subequal, straight; corolla lilac, pale lavender or whitish, 5.1−7.4 mm long, tube 3.2−4.6 mm long, cylindrical at the base but soon becoming enlarged, straight, ca. 1 mm wide, externally glabrous to glabrescent with few sessile glands and small hairs, internally with a ring of villous hairs at base of corolla and with curved

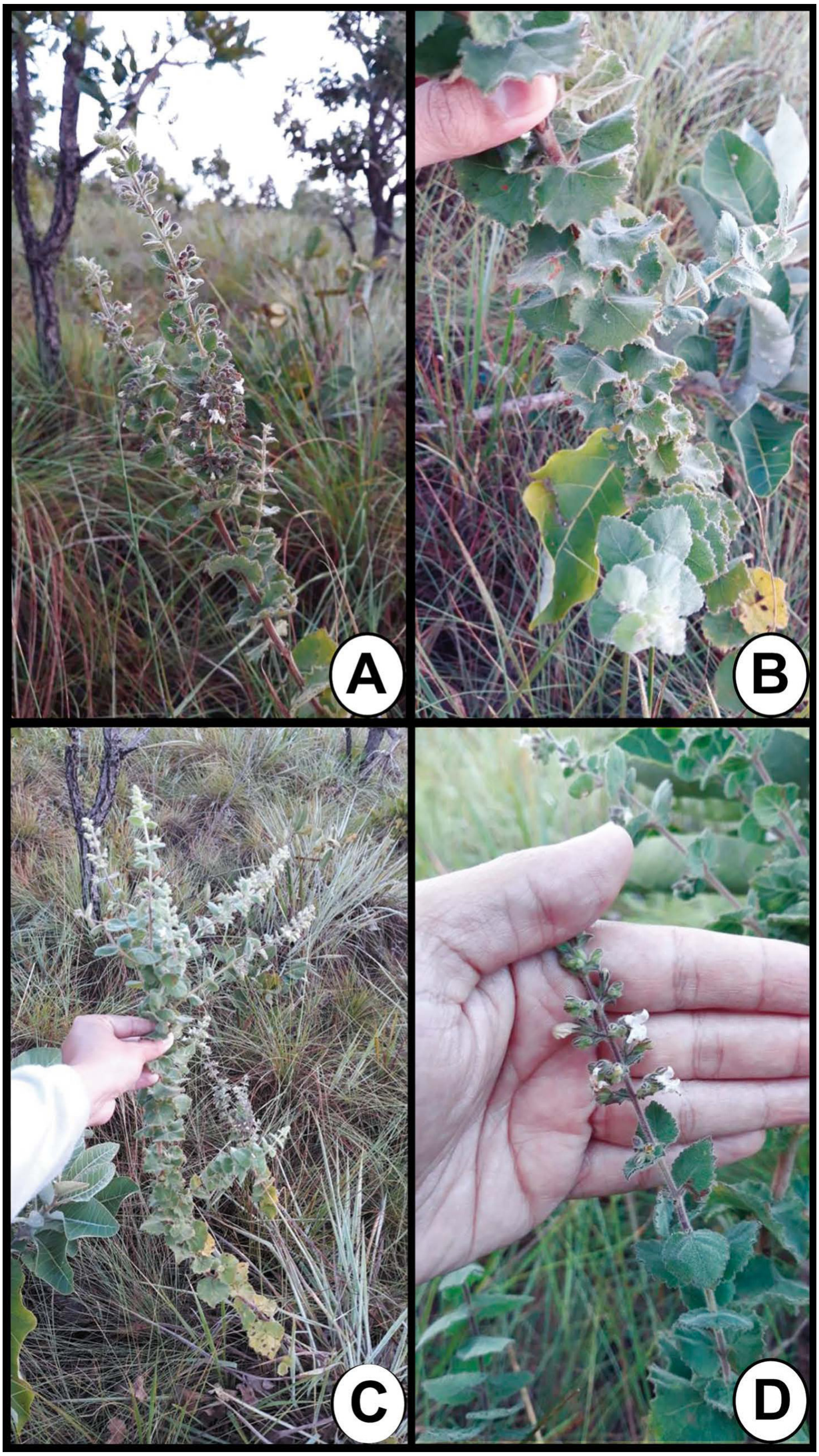

FIGURE 29. Field pictures of *Hyptidendron glutinosum* (Benth.) Harley. **A.** Branch bearing leaves and infloresenses. **B.** Branch bearing leaves. **C.** Habit. **D.** Branch bearing leaves and inflorescenses. **A-D.** Photos by Breno Vitorino.

entangled non-glandular hairs, close to insertion of posterior pair of stamens and sessile glands in throat and below it, lobes spreading, externally pubescent with glandular uniseriate stipitate hairs mostly in the margin and a concentration of sessile glands in upper part of the lobes, lobes internally glabrous, anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous to middle and villous near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 2−2.9(−3.5) × 1.7−2.5 mm, ellipsoid to oblongoid, or globose, not flattened, not winged, brown to dark brown, shiny, glabrous, rugulose, with inconspicuous abscission scars, mucilaginous when wetted.

Phenology:—*Hyptidendron glutinosum* was found in a fertile condition from March to August with one specimen with fruits collected in November. In March and April only flowering specimens were collected and from June to August most of the specimens had fruits.

Distribution and Habitat:—*Hyptidendron glutinosum* occurs in Brazil in Mato Grosso, Rondônia and Mato Grosso do Sul states and in Bolivia in Santa Cruz department (Fig. 30). It inhabits the Cerrado domain in grasslands and open savanna environments as *campo limpo, campo cerrado* and *cerrado sensu stricto*. It occurs in sandy soils or related to rocky outcrops in 300 to 800 m above sea level.

Conservation Status:—*Hyptidendron glutinosum* has as AOO of 104 km² and an EOO of 557,608 km². It is known from more than 20 localities within the Cerrado domain, in which have been recently losing a considerable area (Strassburg *et al.* 2017), mostly Mato Grosso and Rondonia states, where most of the collections of *H. glutinosum* are located. It occurs in the protected area Parque Nacional Noel Kempff Mercado in Bolivia. The conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

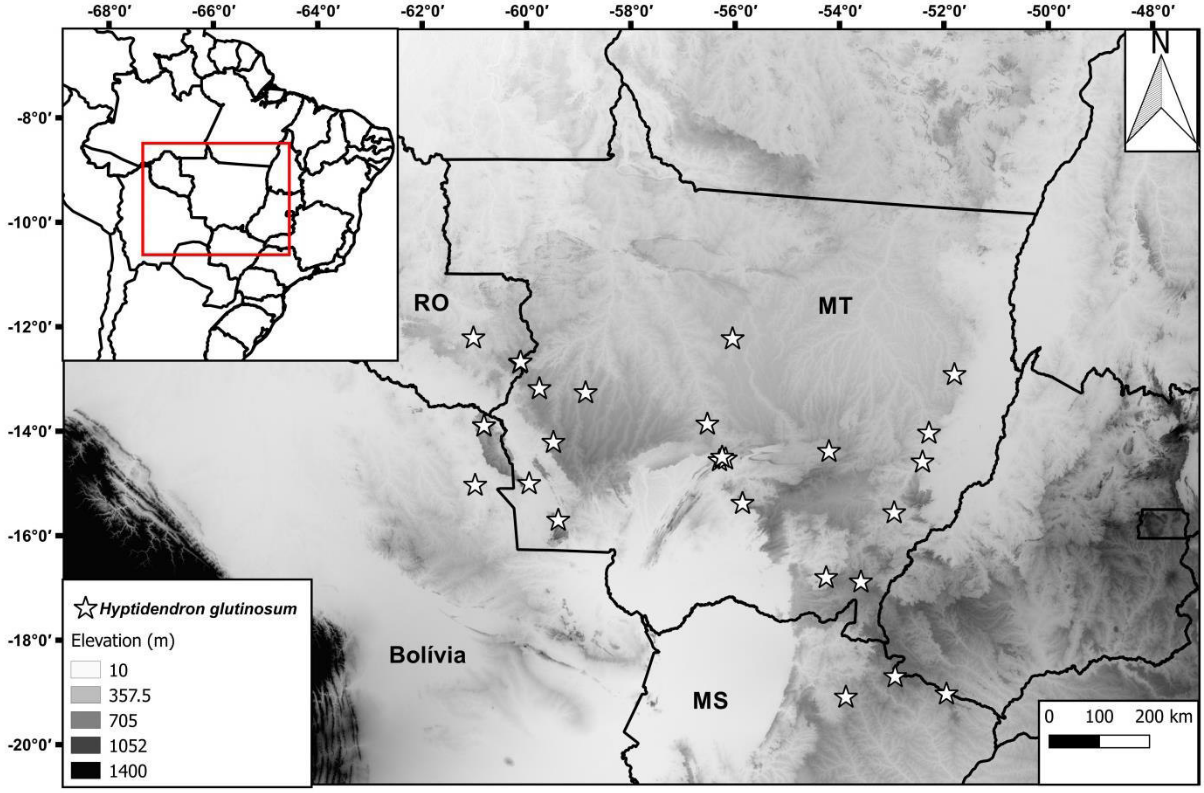

FIGURE 30. Distribution of *Hyptidendron glutinosum* (Benth.) Harley. (MT, Mato Grosso; MS, Mato Grosso do Sul; RO, Rondônia).

Etymology:—The specific epithet is a reference to the viscous leaves and branches of this species.

Affinities and morphological notes:—*Hyptidendron glutinosum* can be differentiated from all other species of the genera, by a combination of the following characters: subshrubs or shrubs with lightly woody branches, nutlets 1 per flower, not winged, not flattened, with inconspicuously abscission scars, calyx tube at anthesis (1.6−)1.8−2.9 mm long, without a ring of hairs, pedicels (0.3−)0.5−2.6 mm long, leaves mostly wide ovate with base rounded, cymes always a dichasial. The most closely morphologically related species is *H. amethystoides* differing by the longer calyx tube at anthesis ((1.6−)1.8−2.9 mm long in *H. glutinosum* vs. 1−1.8 mm long), pedicels relatively shorter (0.3−)0.5−2.6(−3.6) mm long in *H. glutinosum* vs. 1.5−8.5 mm long), leaf shape (mostly very wide ovate or wide ovate and base deeply cordate in *H. glutinosum* vs. mostly ovate to lanceolate, with base rounded) and cyme structure (dichasial or unilateral in *H. glutinosum* vs. always dichasial). It is also related to *H. eximium* deferring by the solid stems in *H. glutinosum* (vs. fistulose), smaller leaves (1.8−4.2(−5) cm long in *H. glutinosum* vs. (4.2−)5.9−12 cm long) and the smaller calyx tube at fruit (4.1−5.2 in *H. glutinosum* mm long vs. 5.8−7.7 mm long).

Hyptidendron glutinosum has a somewhat small morphological variation in its distribution from Brazilian Mato Grosso and Rondonia states and Bolivia. Still two specimens (*Hatschbach 31909* and *Pott et al. 9026*) from Mato Grosso do Sul state presents some morphological variation with straighter leaves (elliptic, narrow ovate, ovate or wide elliptic vs. very wide ovate to wide ovate, rarely wide elliptic), leaf base rounded to cordate (vs. cordate to deeply cordate, rarely rounded) cymes with fewer flowers (1−6 vs. 11−33), fruiting calyx tube long (5.9 vs. 4.1−5.2 mm) and larger nutlets (ca. 3.5 vs 2−2.9(−3.3) mm long). As most of this differences have somewhat intersection with *Hyptidendron glutinosum* morphology and just two collections are known from Mato Grosso do Sul state, although we have considered describing a new species, we are treating here all of this variation in the *Hyptidendron glutinosum* concept. Further collections are needed to clarify this situation.

Typification and nomenclatural notes:—There is also another collection labelled Riedel 1080 corresponding to the type of *Gomphrena decipiens* Seub. Ridel deposited his specimens at LE herbarium, still, we are not sure if a specimen is present in their collection.

Specimens examined:—BOLIVIA. **Santa Cruz**: San Ignacio de Velasco, Parque Nacional Noel Kempff Mercado, Meseta de Caparuch, 1,5 km S de la pista Noel Kempff M., 13°53'55"S 60°48'46"W, 12 May 1994, *Mostacedo et al. 1769* (MO); San Ignacio de Velasco, Parque Nacional Noel Kempff Mercado, Serranía S y NE de la pista Noel Kempff M, 13°54'22"S 60°48'52"W, 16 May 1994, *Mostacedo et al. 1850* (K, MO); Velasco, Parque Nacional Noel Kempff Mercado, at the top of path climbing escarpment to meseta from Los Fierros, 19 April 2002, *Wood 18209* (K). BRAZIL. **Mato Grosso**: Água Boa, ca. 87 km N of Xavantina, 2 June 1966, *Irwin et al. 16481* (F, MO, NY, RB, UB, US); Alto Garças, W of Alto Garças, N of road just before sharp desent, 9 July 1966, *Goodland 520* (NY, RB); Cassilândia, estrada Cassilândia/Alto Araguaia (33 km), 19°2'S 51°57'W, 27 May 1978, *Guimarães 241* (HRB, RB); Comodoro, a 35 km de Comodoro, lado esquerdo, rumo a Vilhena-RO, 13°73'S 59°29'W, 7 June 1990, *Skorupa et al. 856* (CEN); Comodoro, Chapada dos Parecis, 18 April 1977, *Oliveira 110* (HRB); Cuiabá, Serra da Chapada dos Guimarães, ca. 40 km NE of Cuiabá, 1 January 1978, *Harley 20418* (K); Diamantino, 14,5 km da estrada Diamantino-Nobres, cerca de 500 m antes do Córrego Piraputanga, fazenda Piraputanga, 14°34'S 56°18'W, 17 May 1997, *Souza et al. 16157* (ESA, UFMT); General Carneiro, BR-070, km 101, entre General Carneiro e Colônia Mureré, 15°33'49"S 52°57'9"W, 18 April 2005, *Queiroz et al. 10431* (HUEFS); Nobres, cerca de 30 km NE (em linha reta) de Nobres, BR-242, ca. 2 km do entrocamento com a BR 364/163, Serra da Caixa Furada, 14°32'"S 56°11'"W, 19 May 1997, *Souza et al. 16406* (ESA, UFMT); Nova Xavantina, Serra do Roncador, Rio Turvo, ca 210 km N of Xavantina, 28 May 1966, *Irwin et al. 16164* (F, G, K, MO, NY, RB, SP, UB, UC, US); Paranatinga, 1 May 1899, *Pilger 540* (UC); Pedra Preta, Serra da Petrovina, 16 May 1995, *Hatschbach et al. 62842* (ALCB, MBM); Pontes e Lacerda, Serra de Santa Bárbara, 50 km em vicinal a partir do km 28 da MT-473, ao sul de Pontes e Lacerda, 15°42'25"S 59°23'25"W, 24 March 2014, *Simon et al. 2300* (CEN, NY, UFMT); Ribeirão Cascalheira, c. 12 km SW of base camp, 27 November 1968, *Harley et al. 11511* (K); São José do Rio Claro, fazenda Cachoeira de Pau, 13°52'"S 56°32'"W, 14 June 1997, *Souza et al. 18108* (ESA, UFMT, RB); Tapurah, 75 km NE (em linha reta) de Tapurah, estrada para o projeto Ipiranga, 12°14'"S 56°3'"W, 9 June 1997, *Souza et al. 17432* (ESA, UFMT, RB); Vila Bela da Santíssima Trindade, Km 400 da BR-174, 20 July 1986, *Emmerich et al. 5798* (R). **Mato Grosso do Sul**: Camapuã, rodovia Campo Grande-Cuiabá, 14 May 1973, *Hatschbach 31909* (K, MBM, SPF); Chapadão do Sul, fazenda Ribeirão, entrada do Km 130, rodovia MS-306., 18°42'8"S 52°56'2"W, 31 May 2001, *Pott et al. 9026* (CGMS). **Rondônia**: Colorado do Oeste, BR-364, Porto Velho-Cuiabá, estrada para Colorado do Oeste, km 20., 12°13'"S 60°61'"W, 8 June 1984, *Cid et al. 4354* (INPA, K, NY, RB, US); Vilhena, 13°16'"S 58°52'"W, 18 April 1977, *Anonymous 120* (RB).

2.4. ***Hyptidendron rondonicum*** (Harley) Harley, Bot. J. Linn. Soc. 98: 94. 1988. ≡ *Hyptis rondonica* Harley, Kew Bull. 41: 141.1986. Type:—BRAZIL: Rondônia, [Vilhena], Fazenda São Francisco de Assis, Km 645 da estrada Vilhena-Pimenta Bueno, 12º 45' S, 60º 10' W, campo, solo argiloso, *M. G. Vieira et al. 958* (holotype INPA-89280; isotype NY-00000674).

Herb, subshrub to shrub 0.4−1.9 m tall, erect to virgate, not aromatic; lightly woody to woody, not branched or just near the inflorescence, 2−4 mm diam., younger stems quadrangular, slightly canaliculate, lanate to tomentose with dendritic white eglandular hairs and usually sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 0.8−2.7 cm long. Cauline leaves spreading along the branches, not imbricate or just the new leaves imbricate, smaller than internodes or rarely equal or longer, mostly diminishing in size towards stem apex, lamina 0.9−1.5 × 0.9−2 cm, chartaceous, discolorous, with abaxial surface paler, oblate to very wide ovate, base cordate to deeply cordate, apex obtuse to truncate, sometimes apiculate, apiculus ca. 1 mm long, adaxial surface tomentose with dendroid eglandular hairs, obscuring the surface, rarely less dense and small sessile glands, venation mostly inconspicuous due to the dense indumentum, midrib plain or slightly impressed, secondary veins plane or prominulous, abaxial surface lanate with long dendroid eglandular hairs, venation hard to see due to the indumentum, reticulate, prominent, margin not ciliate, irregularly crenate to serrate, starting at base, 37−89 teeth on each side of leaf, with tooth apex swollen, obtuse; petiole absent to 1.2 mm long, lanate with white dendroid eglandular hairs. Inflorescence thyrsoid, terminal, up to 15 cm long, with dichasial axillary cymes, subtended by bracts similar to leaves but reduced and diminishing in size towards the apex, the upper ones reduced, with same shape, (0.3−)0.5−1 × (0.4−)0.6−1.3 cm, longer than cymes, occasionally smaller or with similar size, mature cymes 0.5−1.3 cm long, (3−)4−10 flowered, not obscured by bracts or just the new inflorescences, sessile or peduncles ca. 1 mm long, with indumentum as on petioles. Flowers sessile or with pedicels ca. 1 mm long, indumentum as on peduncles and subtended by linear bracteoles, 0.5−2.3 × 0.1 mm, with indumentum as on pedicels; calyx at anthesis 3.1−4.1 mm long, white, tube 1.9−2.5 mm long, ± infundibuliform, straight, ribbed, externally lanate to tomentose with dendroid hairs and small sessile glands, tube internally glabrous to glabrescent with few small hairs, without a ring of hairs in throat, calyx lobes subequal, 1−1.9 mm long, narrowly deltate, apex long acute to acuminate, straight or rarely curved, externally with indumentum as on tube, internally with indumentum as on tube, calyx in fruit 5−6.5 mm long, indumentum slightly less dense, tube 3.8−4.5 mm long, infundibuliform or ± cylindrical, ribbed, calyx lobes 1.7−2.5 mm long, subequal, curved, closing the nutlet; corolla lilac to whitish, 4.2−5.5 mm long, tube 3−3.8 mm long, cylindrical, becoming enlarged near throat, straight, 0.6−1.2 mm wide, externally with the base glabrous, soon becoming unevenly tomentose with dendritic hairs mostly concentrated in the throat region and rare sessile glands, internally glabrous except by curved entangled non-glandular hairs, close to insertion of posterior pair of stamens, lobes spreading, externally with the same indumentum as tube but denser and with a concentration of sessile glands, lobes internally glabrous, anterior lobe large, boat-shaped without an apex; posterior pair of stamens with sessile glands and filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous to middle and with long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 2.5−3 × 2−3 mm, broadly obovoid to broadly ellipsoid, not winged, castaneous to dark castaneous, shiny, glabrous except by a tuff of straight, white dendroid eglandular hairs at apex, with inconspicuous abscission scars, not mucilaginous when wetted.

Phenology:—*Hyptidendron rondonicum* was found in a fertile condition in March, April, June, July and November. Mostly in April and June.

Distribution and Habitat:—*Hyptidendron rondonicum* is endemic to Brazil occurring in Mato Grosso and Rondônia states (Fig. 31). It inhabits the Cerrado domain, almost in the transition between the Amazonia domain, in savanna (*campo cerrado*) and grasslands habitats in 500 to 600 meters altitude. It has also been reported for disturbed areas.

Conservation Status:— The AOO is 28 km^2 and the EOO is 66,637 km^2. *Hyptidendron rondonicum* is not known to occur in any protected area, and it is also distributed in a region heavily deforested due to agricultural activity. The species is known for just 7 localities. The conservation status of this species is assessed as Vulnerable according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:—The specific epithet is a reference to the state of Rondonia in north Brazil where the type specimen (and at the time of the description the only collection) was found.

Affinities and morphological notes:— *Hyptidendron rondonicum* differs from all other *Hyptidendron* by possessing nutlets 1 per flower, with a tuff of hairs in the apex, not flattened, not winged, without a conspicuous abscission scar, leaves sessile to subsesslie, oblate to very wide ovate, with base cordate, branched hairs present, cymes sessile or peduncle up to 1 mm long and flowers sessile or subsessile with pedicels ca. 1 mm long.

Hyptidendron rondonicum has morphological features very unique in the genera, being probably the most unique species in the genus and easily recognizable. If a comparison is needed, the most morphological closely related species is *Hyptidendron glutinosum* which can be promptly distinguished by the branched hairs (simple hairs in *H. glutinosum*), pedicel absent (present), petiole absent (present) and indumentum of white hairs (not white).

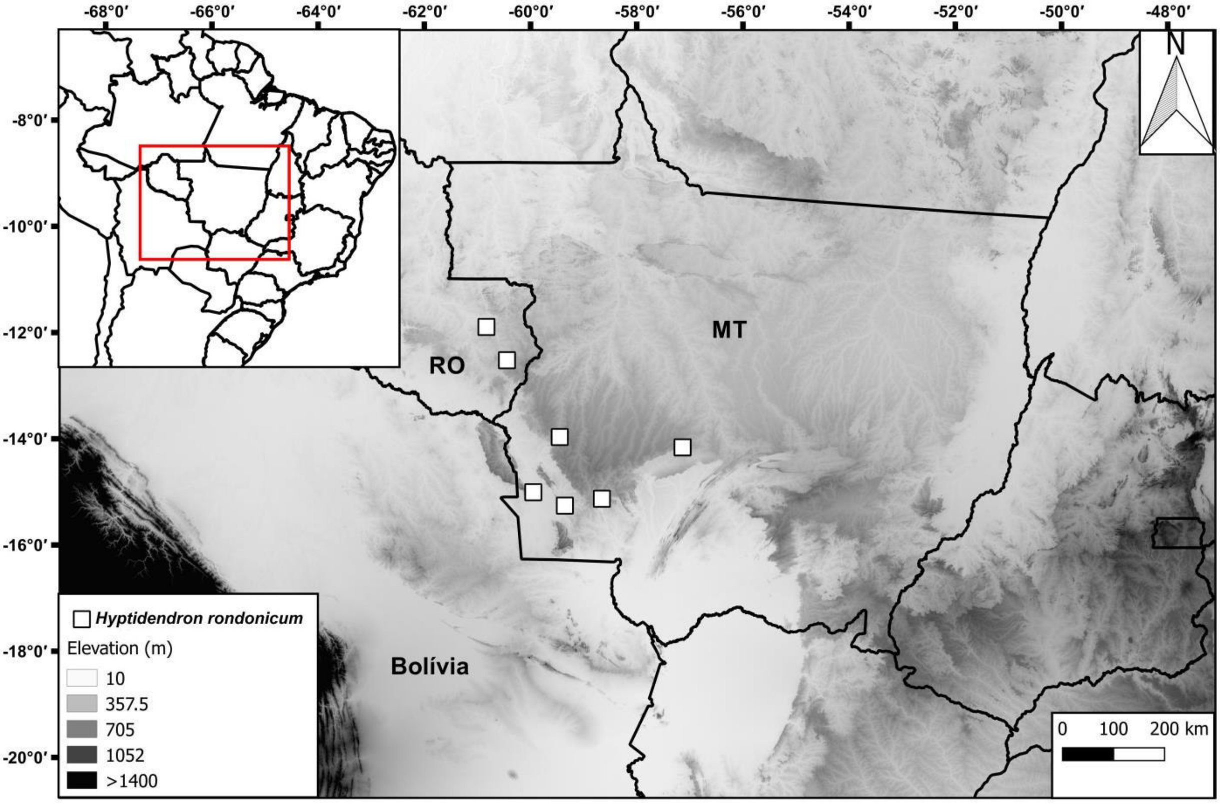

FIGURE 31. Distribution *Hyptidendron rondonicum* (Harley) Harley. (MT, Mato Grosso; RO, Rondônia).

Selected specimens examined:—BRAZIL. **Mato Grosso**: Comodoro, Posto Vale do Guaporé, 13°58'S 59°27'W, 16 April 1978, *Amaral 51* (HRB); Diamantino, Chapada dos

Parecis, ca. 50 km W dos Parecis na estrada para Campo Novo dos Parecis (MT-160)., 14°9'43"S 57°8'11"W, 21 April 2005, *Queiroz et al. 10563* (HUEFS); Indiavaí, 15°7'45.28"S 58°39'22.38"W, 14 June 2018, *Francisco & Carnier 1* (SPF); Nova Marilândia, 50 km W do entroncamento com a MT-170, 14°9'42"S 57°8'11"W, 21 April 2005, *Souza et al. 1289* (HUEFS); Pontes e Lacerda, Chapada dos Parecis, 18 July 1989, *Souza et al. 1391* (R); Vila Bela da Santíssima Trindade, BR 174, área de Pantanal, 13 July 1985, *Souza et al. 1324* (R). **Rondônia**: Pimenta Bueno, rodovia BR 364, sentido Vilhena para Pimenta Bueno, 20 March 2013, *Koch et al. 559* (SP); Vilhena, 40 km N of Vilhena on BR-364, 7 November 1979, *Nelson 387* (NY).

3. ***Hyptidendron*** sect. ***Umbellaria*** (Benth.) Harley (1988: 93) ≡ Hyptis sect. Umbellaria Bentham (1833: 133)

Type:—*Hyptidendron rhabdocalyx* (Benth.) Harley

Shrubs, subshrubs, rarely treelets, 0.3−2(−3.5) m tall, aromatic, woody subterranean structure sometimes present; stems woody, solid, erect, quadrangular and canaliculate or slightly canaliculate, at least in younger parts, indumentum composed of simple or rarely dendroid eglandular hairs, different size gland-tipped hairs and sessile glands. Cauline leaves spreading along the branches or congested near the tips, imbricate or not imbricate, mostly longer than internodes, frequently diminishing in size towards stem apex, lamina chartaceous or coriaceous, discolorous or rarely concolorous, ovate, elliptic, wide ovate, wide elliptic, narrow ovate, narrow elliptic, very wide ovate, suborbiculate, orbiculate, or lanceolate, base rounded, cuneate, cordate, or truncate, sometimes uneven, apex acute, acuminate or obtuse, sometimes terminating in an acumen, adaxial surface hairy, rarely glabrescent or glabrous, venation mostly inconspicuous, abaxial surface hairy, rarely glabrescent or glabrous, venation prominent, conspicuous, reticulate, margin crenulate, serrulate, serrate, sometimes with few teeth, rarely entire, mostly entire near the base to the middle of the lamina, petiole present, rarely absent, mostly reduced, canaliculate, hairy, rarely glabrescent. Inflorescence composed of axillary pedunculate cymes, ± isolated, rarely forming a well-defined branched, terminal thyrsoid structure, cymes dichasial or unilateral, subtended by bracts almost equal to leaves or sometimes reduced, longer or smaller than cymes, mature cymes 1−20 flowered, sometimes obscured by bracts. Flowers pedicelate or rarely sessile, subtended by linear to narrow elliptic bracteoles; calyx actinomorphic or slightly zygomorphic, green, vinaceous, purple or cream, tube infundibuliform or cylindrical, straight, internally mostly with a ring of hairs in the throat, which can be conspicuous or inconspicuous formed by just few hairs, lobes subequal or rarely unequal, deltate, rarely linear, straight, curved or rarely reflexed, calyx in fruit longer, indumentum less dense; corolla purple, lilac, pink, pale pink or rose, tube cylindrical or rarely somewhat infundibuliform, straight, lobes spreading, different, anterior lobe large, boat-shaped, mostly with a long, almost caudate apex; stamens 4, epipetalous, didynamous, paired, exserted, posterior pair of stamens longer, attached to the middle of the tube, with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair shorter, attached to the base of the anterior lobe, glabrescent with hairs near the anther, anthers 2–thecous, dorsifixed, opening by longitudinal slits, connective not enlarged; gynoecium bicarpelate, 4-lobed, ovary with nectariferous disc, style gynobasic, exserted, jointed and a well-developed stylopodium protruding above ovary, stigmatic lobes slender, bilobed, lobes subequal. Nutlets 1–2 per flower, obovoid, ellipsoid, oblongoid, not flattened, not winged, castaneous, brown, black or dark brown mostly shiny, glabrous and rugulose or rarely glabrescent with hairs in the apex, deep abscission scars conspicuous, mucilaginous or slightly mucilaginous when wetted. Eleven species endemic to Brazil, distributed mostly in the *campos rupestres* of Espinhaço range in Minas Gerais state and also in Chapada dos Veadeiros in Goiás state.

3.1. *Hyptidendron albidum* Harley & Antar (2017: 98). Type:—BRAZIL. Minas Gerais: Itacambira, estrada Juramento - Itacambira, cerca de 20 km de Juramento, cerrado pedregoso, 17 December 2003, *V.C. Souza et al. 29588* (holotype: SPF-224000; isotypes: ESA-87220, HUEFS-123513, K, RB-1396963).

Erect shrubs or subshrubs 1−1.5 m tall, probably aromatic; stems woody, branched, 3−5(−6) mm diam., younger stems quadrangular, canaliculate, lanate with white, dendroid hairs and usually sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 0.6−1.7 cm long. Cauline leaves spreading along the branches or concentrated near the apex, mostly imbricate, longer than internodes, diminishing in size towards stem apex, lamina 1.8−3.4 × (1.4−)1.9−3.1 cm, chartaceous to coriaceous, concolorous, wide ovate, ovate to very wide ovate, suborbiculate or orbiculate, base cordate, less commonly rounded or truncate, apex obtuse to acute, mostly apiculate, apiculus ca. 0.5−1 mm long, adaxial surface densely tomentose with white, dendroid hairs and sessile glands, rarely pubescent/tomentose with the venation denser, venation mostly inconspicuous, midrib and secondary veins prominulous, abaxial surface similar to adaxial but denser, rarely pubescent and just denser in the veins, venation sometimes inconspicuous due to the indumentum, reticulate, prominent, margin ciliate, irregularly serrate, entire just near the base, (8−)13−27 teeth on each side of leaf, with tooth apex swollen, acute or obtuse; petiole 0.1−0.8 cm long, slightly canaliculate, lanate or tomentose with white dendroid hairs and small sessile glands. Inflorescence not forming a well-define terminal thyrsoid structure, but with unilateral or less commonly dichasial axillary cymes, concentrated near the apex, subtended by bracts similar to leaves with same shape, with similar size or slightly smaller, 0.8−3.1 × 0.8−2.6 cm, mostly smaller than cymes, mature cymes 1.6−3 cm long, 10−20 flowered, mostly obscured by bracts, peduncles 5,5−11 mm long, with indumentum as on petioles. Flowers with pedicels

0.5–3 mm long, with indumentum as on peduncles and subtended by linear or rarely narrow elliptic bracteoles, 0.8–3.8 × 0.1–1.7 mm, with indumentum as on pedicels; calyx at anthesis 4.5–5.5 mm long, whitish, tube 2.9–3.8 mm long, ± infundibuliform, straight, ribbed, externally densely lanate with white dendroid eglandular hairs and scattered gland-tipped hairs, tube internally glabrous at base, becoming pubescent with minute hairs above forming a faint ring of hairs in throat, calyx lobes subequal, 1.3–2.3 mm long, deltate, apex acute, straight, externally with indumentum as on tube, internally tomentose to lanate with dendroid hairs and gland-tipped hairs, the margins with dendroid white hairs, calyx in fruit 7.5–9 mm long, indumentum less dense, tube 5.8–6.7 mm long, ± cylindrical, ribbed, calyx lobes 1.7–2.4 mm long, subequal, straight; corolla lilac to purple, 6–7.1 mm long, tube 3.5–4.5 mm long, cylindrical, becoming enlarged near throat, straight, 0.7–1.2 mm wide, externally with base glabrous becoming white-tomentose with simple uniseriate hairs unevenly distributed and sessile glands, internally with curved entangled non-glandular hairs close to insertion of posterior pair of stamens, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally glabrous, anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous except by uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 3–3.8 × 1.5–1.9 mm, ellipsoid to oblongoid, not flattened, not winged, dark castaneous, shiny, glabrous, rugulose, with deep abscission scars, slightly mucilaginous when wetted.

Phenology:—*Hyptidendron albidum* was found fertile from September to March (except on January) and in July. Most of the fertile specimens were collected in March.

Distribution and Habitat:—*Hyptidendron albidum* is endemic of Northern Minas Gerais state, Brazil (Fig. 32). It occurs in three municipalities in c*ampo rupestre*, cerrado rupestre or savanna habitats, all of these included in the Cerrado domain, up to 1000 m elevation.

Preliminary Conservation Status:—The AOO is 20 km² and the EOO is 833 km². *Hyptidendron albidum* is known for just 5 localities in a very restricted distribution. It is not known to occur in any protected area. Within the area where *Hyptidendron albidum* occurs much agricultural activity, involving habitat destruction, has been noted. Also, some populations are very close to the highway. The conservation status of this species is assessed as Endangered according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

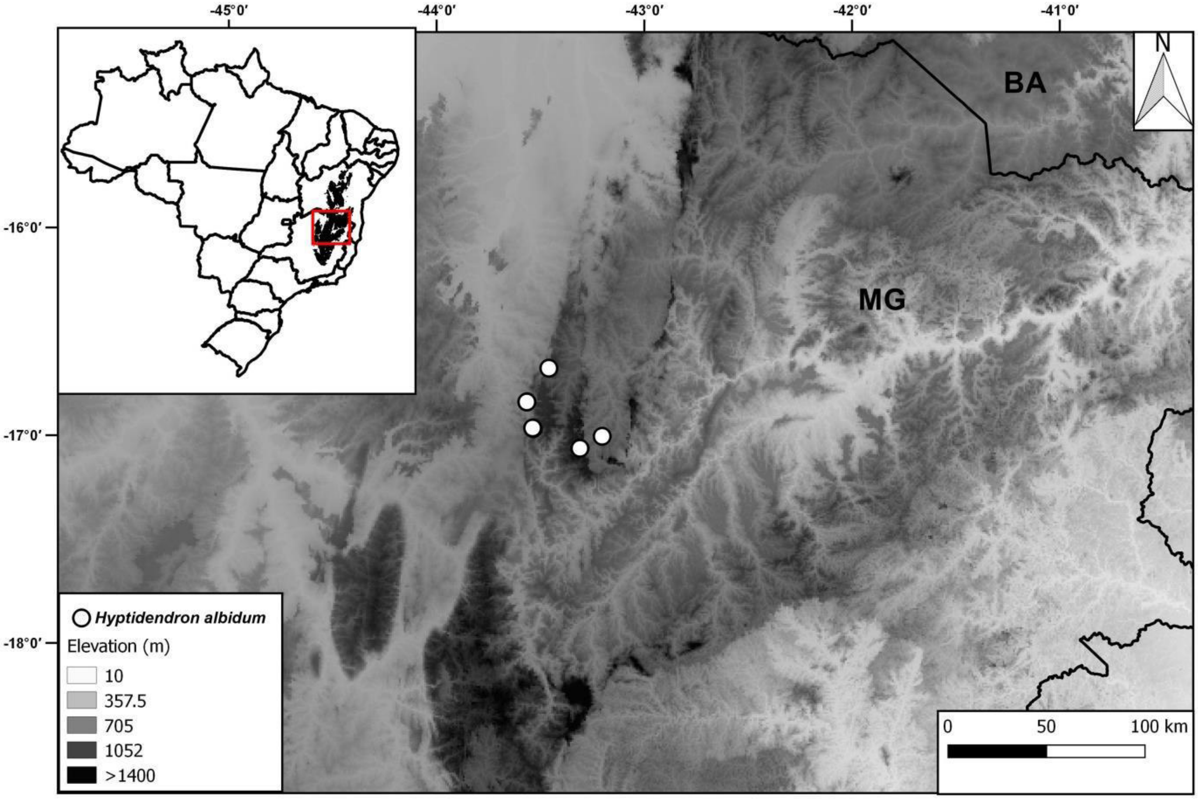

FIGURE 32. Distribution *Hyptidendron albidum* Harley & Antar. The black shape in the small map shows the extension of the Espinhaço Range. (BA, Bahia ; MG, Minas Gerais).

Etymology:—The specific epithet refers to the white indumentum of all vegetative parts.

Affinities and morphological notes:—*Hyptidendron albidum* can be differentiated from all other species of the genera, by a combination of the following characters: indumentum of dendroid white hairs, cymes somewhat isolated not forming a conspicuous thyrsoid structure, mostly unilateral, nutlets 1 per flower, not winged, not flattened with deep abscission scar.

The closest related species are *Hyptidendron unilaterale* and *Hyptidendron caudatum* which can be differentiate by the branched white hairs (vs. long uniseriate hairs) and the cymes obscured by bracts (cymes not obscured).

Of all the material analysed for *Hyptidendron albidum*, one specimen, Tameirão-Neto 4020 (BHCB herbarium), a paratypus, stand out as it has leaves pubescent to tomentose, which is not conspicuously white as all of the other known specimens of *H. albidum*. Its leaves have just a white venation or in older leaves not white at all. Curiously, is the only known collection outside Juramento-Itacambira municipalities, still it shares the same type of indumentum, leaf and cyme morphology.

Specimens examined:— BRAZIL. **Minas Gerais**: Grão Mogol, Planta MG 15-Fazenda Tamanduá, 9 October 2005, *Tameirão-Neto 4020* (BHCB, HUEFS); Itacambira, 11 March 1987, *Tenório s.n.* (HXBH); Itacambira, 17°0'20.5"S 43°12'9.5"W, 13 November 2001, *Tozzi & Alencar 2001-474* (UEC); Itacambira, Estrada Itacambira-Juramento ca. 9 km de Itamcabira, 16°58'7"S 43°32'4,6"W, 23 February 2002, *Souza et al. 28223* (ESA, HUEFS, SPF); Itacambira, Serra de Itacambira, 13 March 1991, *Brandão 18482* (PAMG); Itacambira, Serra do Juramento, 1986, *Saturnino 1466* (PAMG); Juramento, Juramento/Itacambira, 20 July 1987, *Brandão 12603* (PAMG); Juramento, Rodovia Montes Claros a Itacambira, Serra do Catuni, 17 March 1997, *Hatschbach et al. 66389* (MBM); Juramento, Serra do Catuni, 4 December 2004, *Hatschbach & Barbosa 78829* (MBM).

3.2. *Hyptidendron arbusculum* (Epling) Harley (1988: 94) ≡ *Hyptis arbuscula* Epling, (1936b: 219) ≡ *Hyptis dictiocalyx* var. *elatior* Bentham in DC. (1848: 131). Type:—BRAZIL. Goiás [Tocantins], in Serra do Duro [Dianópolis], Sept 1839, *G. Gardner 3394* (Holotype: K-000192534; Isotypes: BM-000992896, BR-681483, G-00437846, UC-1943441).

(Fig. 33, 34 A-C).

Shrubs or treelets?, 0.4−1.2(−4?) m tall, aromatic; stems woody, densely branched, 3−6(−8) mm diam., younger stems quadrangular, canaliculate, pubescent with small gland-tipped hairs, scattered longer gland-tipped hairs, scattered long uniseriate hairs and small sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 0.4−2.1 cm long. Cauline leaves spreading along the branches or congested near the apex, not imbricate or just near the apex, longer than internodes, mostly diminishing in size towards stem apex, lamina 0.9−1.7 × 0.5−1.4 cm, chartaceous, slightly discolorous, with abaxial surface paler, wide ovate, ovate, elliptic, wide elliptic, rarely very wide ovate, base rounded, rarely slightly cordate or truncate, sometimes unequal, apex acute, less commonly obtuse, sometimes apiculate, apiculus ca. 0.5 mm long, adaxial surface pubescent or glabrescent with whitish simple small eglandular and gland-tipped hairs, denser near the base, venation mostly inconspicuous, midrib prominent close to base of lamina, but soon becoming plane, abaxial surface with similar indumentum as adaxial surface but mostly denser, venation reticulate, prominent, margin ciliate, serrulate, entire in the base to 2/3 or 1/2 of leaf margin, not revolute, 2−7 teeth on each side of leaf, with tooth apex slightly swollen, acute; petiole 1.5−2.8(−3.5) mm long, canaliculate to slightly canaliculate, pubescent with eglandular and gland-tipped hairs. Inflorescence not forming a well-define terminal thyrsoid structure, but with dichasial axillary cymes, concentrated near the apex, subtended by bracts similar to leaves with same shape, with similar size or slightly smaller, 0.8−1.1 × 0.5−0.7 cm, mostly longer than cymes or with similar size, mature cymes 1−1.4 cm long, 1−3 flowered, mostly

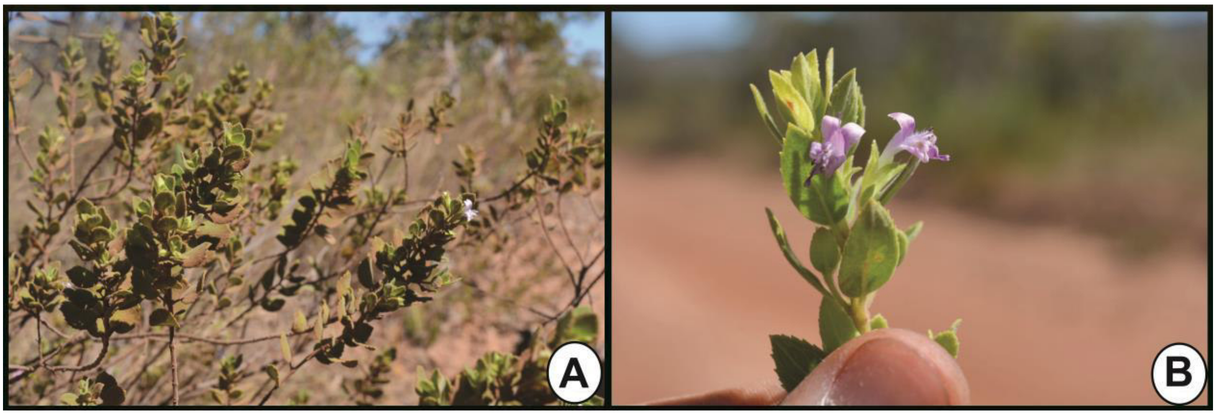

FIGURE 33. Field pictures of *Hyptidendron arbusculum* (Epling) Harley. **A.** Branch bearing leaves and inflorescenses. **B.** Branch bearing leaves. **A-B**. Photos by A. de S. Soares.

obscured by bracts, peduncles (1−)1.6−4.5 mm long, with indumentum as on petioles. Flowers with pedicels 0.5−2 mm long, indumentum as on peduncles and subtended by linear or rarely narrow elliptic bracteoles, 1−3 × 0.1−0.5 mm, puberulent with small gland-tipped hairs and scattered long eglandular hairs mostly in the apex; calyx at anthesis 5.8−7.2 mm long, green, tube 3.6−5 mm long, ± infundibuliform, straight, ribbed, externally pubescent with gland-tipped hairs, tube internally glabrous at base, becoming puberulent with minute hairs above, and without a ring of hairs in throat or just with few hairs, calyx lobes subequal, 2−2.5 mm long, deltate, apex acute to acuminate, straight, externally with indumentum as on tube, internally pubescent with gland-tipped hairs, sessile glands and the margin with eglandular hairs, calyx in fruit 7.3−9(−10) mm long, indumentum less dense, tube 4.9−7 mm long, ± cylindrical to infundibuliform, ribbed, calyx lobes (1.7−)2−2.5(−3.2) mm long, subequal, straight; corolla lilac or purple, ca. 8.5 mm long, tube ca. 7 mm long, cylindrical, straight, ca. 2 mm wide, indumentum unknown externally with base glabrous becoming unevenly pubescent, lobes spreading, anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair glabrescent to middle and with uniseriate

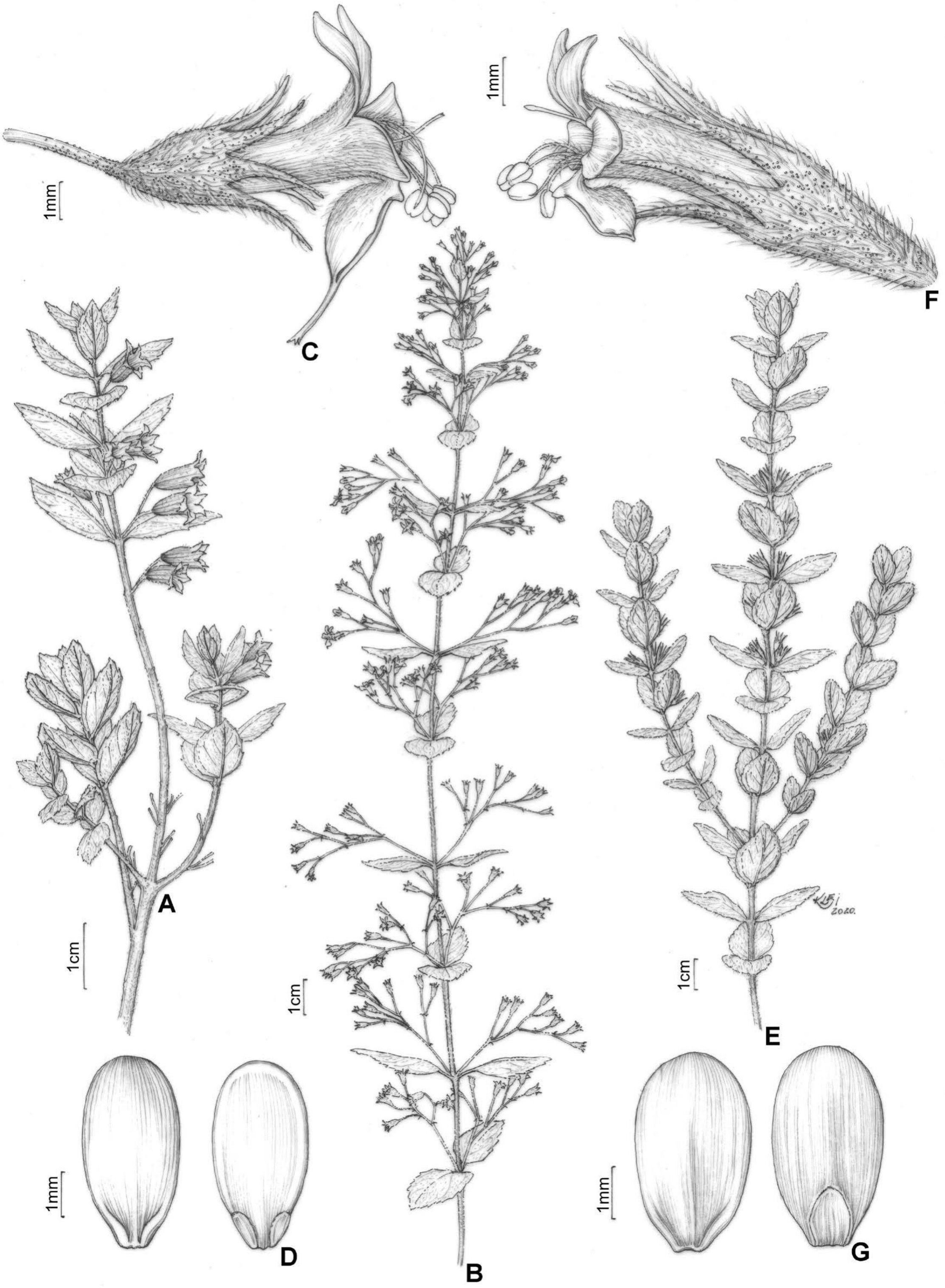

FIGURE 34. Field pictures of *Hyptidendron arbusculum* (Epling) Harley. **A.** Branch bearing leaves and inflorescenses. **B.** Branch bearing leaves. **A-B.** Photos by A. de S. Soares.

hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets (1-)2 per flower, 2.4−3 × 1.7−2 mm, ellipsoid or oblongoid, not flattened, not winged, castaneous, shiny, glabrous, rugulose, with deep abscission scars, slightly mucilaginous when wetted.

Phenology:—*Hyptidendron arbusculum* was found in a fertile condition in June, July and September.

Distribution and Habitat:—*Hyptidendron arbusculum* is endemic to Brazil in Tocantins and Goiás states, occurring in the municipalities of Dianópolis, Cavalcante and Ponte Alta do Bom Jesus (Fig. 35). It inhabitats the Cerrado domain in nutrient poor soils in savanna habitats, *cerrado rupestre* and in the transition between seasonal forests and savanna habitats, in 800 to 1100 meters altitude. It also can occur in disturbed ground.

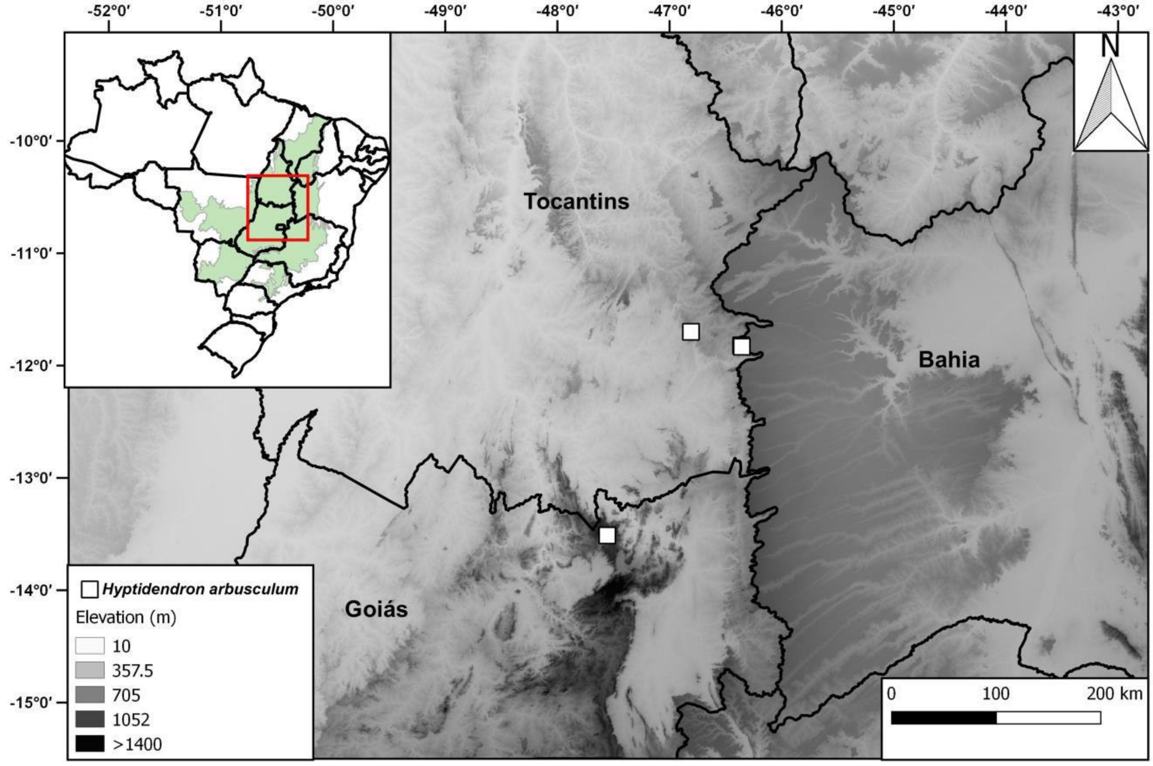

FIGURE 35. Distribution *Hyptidendron arbusculum* (Epling) Harley. The green shape in the small map shows the extension of the Cerrado Domain.

Preliminary Conservation Status:—The AOO is 12 km² and the EOO is 5,579 km². *Hyptidendron arbusculum* is known for just three localities in a very restricted distribution. It is not known to occur in any protected area and some populations can occur very close to the highway. The conservation status of this species is assessed as Endangered according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:— The specific ephitet arbusculum makes reference to the habit of treelet that is described by Gardner by the type collection. Althought this features were used to separate it from *H. dictiocalyx*, we believe that habit is a variable feature, mostly in Cerrado domain species which the fire plays an important role in determining the size of plant individuals (Gottsberger & Gottsberger 2006). Additionally, no other collection was recorded with the same habit, making this characteristic in *H. arbusculum* doubtful.

Affinities and morphological notes:—*Hyptidendron arbusculum* is a poorly known species based on just five collections, of which two are vegetative. Together with *Hyptidendron rhabdocalyx* and *H. dorothyanum* it is the less known species of the genus.

It can be differentiated from all other species of the genera, by a combination of the following characters: 1 nutelets per flower, not winged, not flattened with deep abscission scar, somewhat isolated cymes not forming a well-defined thyrse, cymes 1−3 flowered born on peduncles (1−)1.6−4 mm long, calyx at anthesis 5.8−7.2 mm long, without a ring of hairs in the throat or a ring formed by just few hairs.

It can be differentiate from *Hyptidendron dictiocalyx* the closest related species by the number of flowers (1−3 in *H. arbusculum* vs. 3−5), peduncle size (1−)1.6−4 mm long in *H. arbusculum* vs. (2.6−)3−5.5 mm long) and calyx at anthesis size (5.8−7.2 mm long in *H. arbusculum* vs. 4−4.8 mm long). *H. arbusculum* is also closely related to *Hyptidendron vepretorum* differing by the leaf abaxial surface with inconspicuous bullae, glabrescent to pubescent (vs. leaf abaxial surface with bullae, pubescent to villous in *H. vepretorum*), calyx lobes straight (vs. calyx lobes straight or curved), calyx tube without a ring of hairs in the throat (vs. with a faded ring of hairs in the throat) and leaf base rounded, rarely slightly cordate or truncate (vs. cuneate to rounded, rarely truncate).

Specimens examined:—BRAZIL. Goiás: Cavalcante, GO 241. Estrada de terra que liga Cavalcante à Ecovila Araí. 13°30'46"S 47°33'20"W, 9 June 2019, *Soares 623* (SPF, UFRN). Tocantins: Novo Jardim, Estrada para Placas, cerca de 2 km da divisa com a Bahia (Rodovia TO-280), 11°49'17"S 46°21'44"W, 20 July 2000, *Souza et al. 24260* (ESA, HUEFS); Ponte Alta do Bom Jesus, Divisa entre Bahia e Tocantins., 11°49'58"S 46°21'20"W, 14 January 2007, *Pastore et al. 2404* (HUEFS); Ponte Alta do Bom Jesus, Rodovia TO-040, próximo à divisa com a Bahia., 11°49'28.7"S 46°21'33.7"W, 20 April 2017, *Antar et al. 1539* (SPF).

3.3. *Hyptidendron caudatum* (Epling & Jativa) Harley (1988: 98) ≡ *Hyptis caudata* Epling & Jativa (1968: 296). Type:—BRAZIL. Distrito Federal: Chapada da Contagem, ca. 20 km E. of Brasília, Elev. 700−1000 m, 15 August 1964, *H.S. Irwin & T.R. Soderstrom 5146* (Holotype: UC-2055652; Isotypes: F-1739481, GH-00589350, IAN-129195, K-00488071, NY-00857207, P-00720967, RB-147618, UB?, US-2863441, US-2861994).

(Fig. 34 B-D, 36).

Shrubs 0.4−2 m tall, aromatic; stems woody, branched, 2−6 mm diam., younger stems quadrangular, canaliculate, puberulent with gland-tipped hairs and scattered long uniseriate eglandular hairs, which can be denser and villous in younger stems, also rare sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 1.9−4.4(−7) cm long. Cauline leaves spreading along the branches, not imbricate, smaller than internodes, less commonly equal or longer, mostly diminishing in size towards stem apex, lamina (1.8−)2.2−6.7(−8) × 1.1−1.3−4.1(−5.3) cm, chartaceous, slightly discolorous, with abaxial surface paler, ovate, wide ovate, less commonly narrow ovate, elliptic or wide elliptic, base cordate, rounded or rarely truncate, sometimes unequal, apex acute or obtuse, mostly apiculate, apiculus ca. 0.5−1 mm long, adaxial surface glabrescent to pubescent with small gland-tipped hairs, except on main vein and sometimes secondary veins, which can be pilose with long uniseriate eglandular hairs, also often sessile glands scattered on the lamina, venation mostly inconspicuous, midrib slightly prominent or plane, close to base of lamina, but soon becoming impressed, secondary veins plane or impressed, abaxial surface with similar indumentum, venation reticulate, prominent, margin ciliate, irregularly serrulate to serrate, entire just near the base, not revolute, 13−42 teeth on each side of leaf, with tooth apex swollen, cuspidate; petiole (0.6−)0.8−1.9(−2.5) cm long, slightly canaliculate, pubescent with small gland-tipped hairs, sessile glands and scattered long uniseriate hairs. Inflorescence thyrsoid, lax, terminal, up to 28 cm long, with dichasial or rarely unilateral axillary cymes, subtended by bracts similar to leaves with similar shape but smaller and tending to very wide ovate or orbiculate and with the petiole reduced, usually villous with long uniseriate hairs giving a whitish appearance, 0.6−2 × 0.7−1.9 cm, smaller than cymes, mature cymes (1.8−)2.2−4.5 cm long, 6−15 flowered, not obscured by bracts, peduncles 6−17(−20) mm long, pubescent with small gland-tipped hairs, sessile glands and scattered long uniseriate hairs, which can be denser and pilose. Flowers with pedicels (2.5−)3.5−9.2(−14) mm long, puberulent with small gland-tipped hairs, sessile glands and scattered long uniseriate hairs, subtended by linear or rarely narrowly elliptic bracteoles, 0.6−3 × 0.1−0.6 mm, pilose with long uniseriate eglandular hairs, small gland-tipped hairs and sessile glands; calyx at anthesis 3.6−5.3 mm long, green or vinaceous, tube (2−)2.5−3.2 mm long, ± cylindrical broadening near the throat to infundibuliform, straight, ribbed, externally densely villous with long uniseriate whitish or rarely castaneous hairs and some smaller gland-tipped hairs and sessile glands, tube internally glabrous at base and with a dense ring of white uniseriate eglandular hairs in the throat, calyx lobes subequal, 1.5−3 mm long, deltate, apex acute, reflexed or straight, externally with indumentum as on tube but denser, internally pubescent to glabrescent with small gland-tipped hairs, calyx in fruit 6.6−11 mm long, indumentum less dense, tube 5−8 mm long, ± cylindrical broadening near the throat, ribbed, calyx lobes 1.6−2.7 mm long, subequal, reflexed or straight; corolla pale pink, mauve, pinkish to bluish, 7.5−9.8 mm long, tube 4.5−5.9 mm long, ± cylindrical, straight, 0.9−1.7 mm wide, externally with base glabrous becoming villous to tomentose towards apex with different heights eglandular uniseriate hairs and small sessile glands, internally with a hairs at base of corolla and long uniseriate close to insertion of posterior pair of stamens and sessile glands in throat, lobes spreading, externally with the same indumentum as tube, lobes internally glabrous, anterior lobe large, boat-shaped with long, almost caudate apex ca. 0.5−0.8 mm long; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrescent to middle and with long curved, entangled, uniseriate, eglandular hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1(−2) per flower, 3.1−4.6 × 1.8−2.2 mm, ellipsoid, not flattened, not winged, castaneous to brown, shiny, glabrous, rugulose, with deep abscission scars, slightly mucilaginous when wetted.

Phenology:—*Hyptidendron caudatum* was found in a fertile condition mostly in May to August, but also rarely in September, November, March and April.

Distribution and Habitat:—*Hyptidendron caudatum* is endemic to Brazil in Goiás state and Distrito Federal, occurring in the municipalities of Água Fria de Goiás, Alto Paraíso de Goiás, Brasília, Formosa, Padre Bernardo, Planaltina and São João da Aliança (Fig. 37). It inhabitants the Cerrado domain in nutrient poor soils in savanna habitats, *cerrado rupestre* and in the transition between seasonal forests and savanna habitats, in 800 to 1330 meters altitude. It also can occur in disturbed ground.

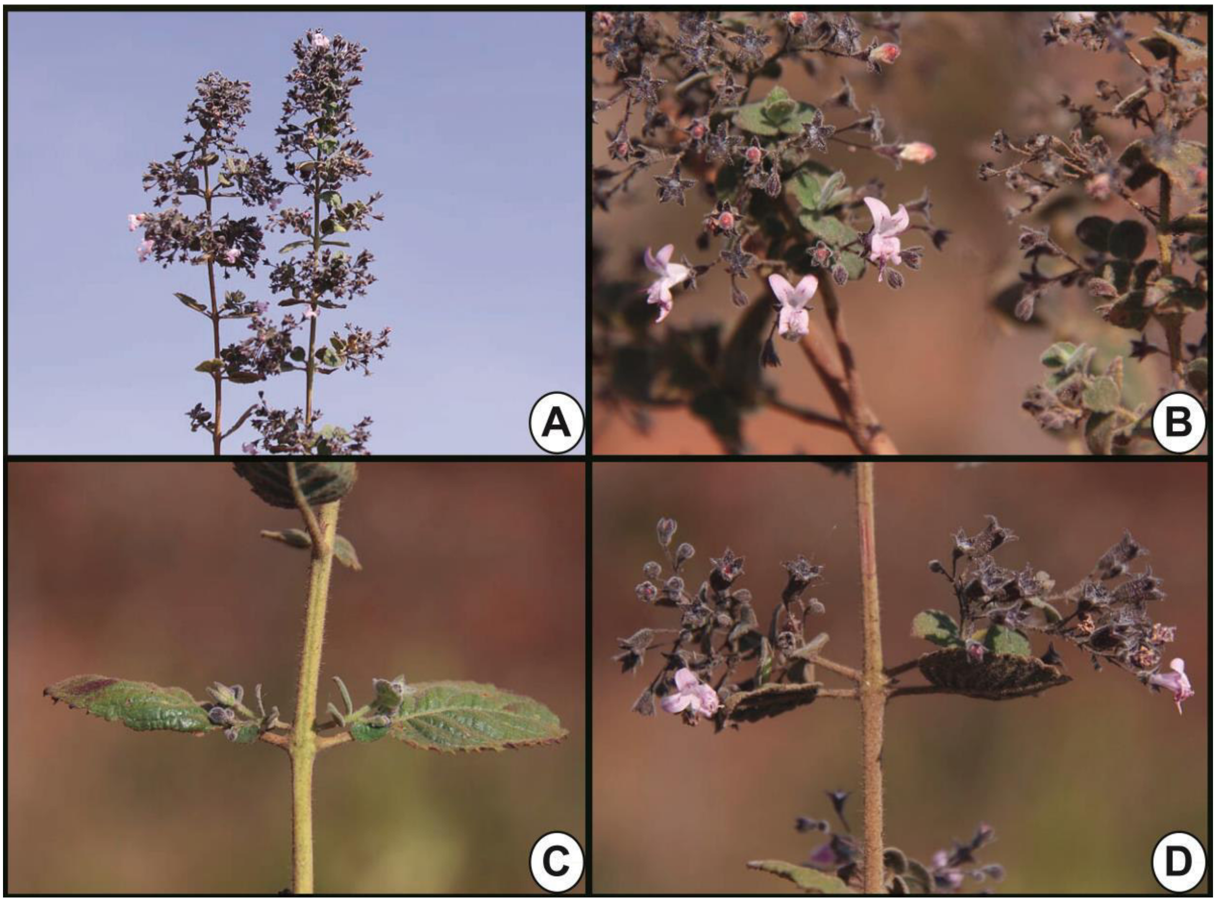

FIGURE 36. Field pictures of *Hyptidendron caudatum* (Epling & Jativa) Harley. **A.** Inflorescense. **B.** Cymes, with flowers at anthesis. **C.** Leaves. **D.** Cymes. **A-D**. Photos by J.F.B. Pastore.

Preliminary Conservation Status:— The AOO is 124 km² and the EOO is 12647 km². *Hyptidendron caudatum* is known for more than 20 localities. It is known to occur in the protected areas Estação Ecológica de Águas Emendadas, Reserva Biológica de Contagem e Parque Urbano e Vivencial do Gama and it probably also occurs in Parque Nacional da Chapada dos Veadeiros. The conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:— The specific epithet *caudatum* makes reference to a cuspidate termination of a structure or tail-like appendage. Probably this epithet makes reference to the calyx lobe apex or the teeth of the leaf, both of which are somewhat cuspidate or the caudate apex of the anterior lobe of the corolla.

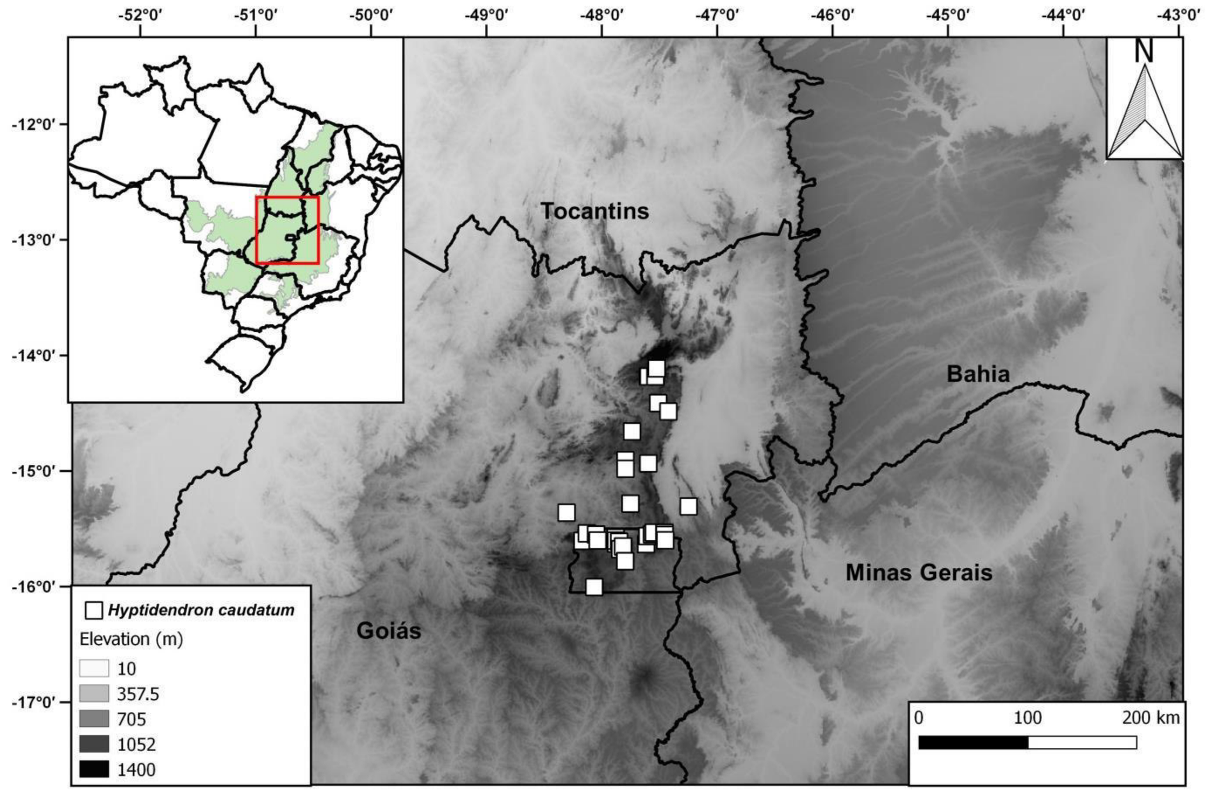

FIGURE 37. Distribution of *Hyptidendron caudatum* (Epling & Jativa) Harley. The green shape in the small map shows the extension of the Cerrado Domain.

Affinities and morphological notes:—*Hyptidendron caudatum* can be differentiated from all other species of the genera, by a combination of the following characters: calyx throat with a conspicuous white ring of hairs, nutlets 1(−2) per flower, not flattened, not winged, with a conspicuous abscission scar, leaves petiolate and a terminal thyrsoid inflorescence with dichasial or rarely unilateral cymes.

The closest related species are *Hyptidendron roseum* which shares the conspicuous white ring of hairs in the calyx throat, being differentiate by the petiole (6−)8−19(−23) mm long in *H. caudatum* vs. absent to 3 mm long) and calyx at anthesis size (3.6−5.3 mm long in

H. caudatum vs. 2.5−3.6 mm long). It is also similar to *Hyptidendron unilaterale* differing by the presence of a white ring of hairs in the calyx throat (faded ring of hairs in *H. unilaterale*) and the dichasial, rarely unilateral cymes (vs. unilateral, rarely dichasial cymes).

Among *Hyptidendron caudatum* distribution range, the leaf indumentum can be variable ranging from glabrescent in the upper surface to densely pubescent. The bracts, younger leaves and calyx at anthesis can have a conspicuous whitish indumentum very discrepant from the indumentum of the rest of the plant, being that way a feature that when present, can help identifying the species.

Selected specimens examined:—BRAZIL. **Distrito Federal**: Brasília, 5-10 km from Fercal to Brasilia, 13 July 1976, *Davis 60247* (E, UB, UEC); Brasília, Limestone hills, Córrego Landim, ca. 25 km N of Brasília., 9 July 1966, *Irwin et al. 18116* (NY, US); Brasília, Estação Ecológica Águas Emendadas, 15°32'"S 47°33'"W, 11 June 1982, *Proença 155* (HEPH); Brazlândia, 15°32'24"S 48°7'48"W, 12 June 2011, *Brandão et al. 349* (HUEFS, IBGE); Fercal, ca. 25 km N of Brasília, near Cia. Cimento Tocantins, Córrego Landim, 11 March 1971, *Irwin. et al. 31685* (K, NY, P, UC); Gama, Parque Urbano e Vivencial do Gama, 3 March 1972, *Ferreira 1586* (HEPH); Planaltina, a 2 km de Brasilinha, 10 km da ponte sobre o rio Maranhã (Diviso do DF com Goiás) e a 80 km do campus da Universidade de Brasília (UNB), 24 August 1988, *Fontellah & Paula 9* (RB, SPF); Sobradinho, 23 July 1964, *Duarte & Mattos 631* (RB). **Goiás**: Água Fria de Goiás, Estação repetidora da Telebrasília de Roncador, 12 June 1993, *Hatschbach et al. 59310* (HUEFS, K, MBM, MO, NY, W); Alto Paraíso de Goiás, a 36,3 km da cidade de Alto Paraíso de Goiás, em direção a São João da Aliança, 18 July 2000, *Fontella et al. 3419* (R); Formosa, Próximo a Formosa, 23 August 1966, *Duarte 9852* (K, RB, SPF); Padre Bernardo, Região de coleta próxima ao município de Padre Bernardo, fazenda particular, 6 May 2004, *Abrahim et al. 4* (UB); Planaltina, Estrada viscinal a W da GO-118. Início da estrada ca. 28,5 km N de São Gabriel de Goiás., 14°58'53"S 47°47'41"W, 14 May 2017, *Bringel et al. 1322* (CEN); São João d'Aliança, Capão da Onça, 28 May 1975, *Hatschbach 36971* (MBM, K, SPF, UC); São João da Aliança, GO 118, após São João da Aliança, sentido Alto Paraíso de Goiás, 14°24'46"S 47°30'41"W, 12 March 2007, *Pastore et al. 1785* (CEN, HUEFS, K).

3.4. *Hyptidendron cerradoense* Antar & Harley (in prep.). Type:—BRAZIL: Goiás. Cavalcante. Vila Veneno - rio São Félix km 4, Área de Influência da futura Hidrelétrica de Cana Brava, influência indireta, 13°32'10"S 48°3'25"W, 27 June 2001, *Pereira-Silva & Carvalho-Silva 5199* (Holotype: CEN-00043108).

Subshrubs or shrubs 0.3−0.5 m tall, slightly aromatic or aromatic, woody subterranean structure present; stems woody, branched, 2−4 mm diam., younger stems quadrangular, canaliculate, pubescent with long uniseriate eglandular hairs, which can be curved and soft or erect and sharp and then the surface hispid, also rare small sessile glands and gland-tipped hairs, older stems ± squared and slightly canaliculate or not canaliculate, less hairy, with longitudinal grooves, internodes 0.3−1.5(−2.7) cm long. Cauline leaves mostly congested near the apex or somewhat spreading along the branches, densely imbricate near the apex, sometimes expanding to almost all the leaves, longer than internodes, less commonly smaller or with similar size, mostly diminishing in size towards stem apex, lamina 0.8−1.5 × 0.3−0.7 cm, chartaceous to coriaceous, concolorous or slightly discolorous, with abaxial surface paler, elliptic, narrow elliptic or narrow ovate, base rounded or cuneate, sometimes unequal, apex acute, sometimes slightly apiculate, apiculus ca. 0.5 mm long, adaxial surface glabrous or glabrescent with few gland-tipped hairs and small sessile glands, venation mostly inconspicuous, midrib or plane, secondary veins prominulous, perimarginal intramarginal or marginal vein present, abaxial surface glabrous or glabrescent with few gland-tipped hairs and tiny sessile glands, the midvein occasionally with sparse long uniseriate eglandular hairs, venation reticulate, primary and secondary veins prominent, tertiary veins not so conspicuous, margins ciliate, mostly hispid with long uniseriate eglandular hairs, sometimes with gland-tipped hairs, serrulate, entire to 1/2 of leaf margin, rarely completely entire, not revolute, (0−)1−4 teeth on each side of leaf, with tooth apex swollen, acute or obtuse; petiole 0.7−1.6 cm long, canaliculate, expanded in the base, sparsely pubescent or glabrescent with gland-tipped hairs, sessile glands and rare uniseriate curved eglandular hairs. Inflorescence not forming a well-define terminal thyrsoid structure, but with dichasial axillary cymes, concentrated near the apex, subtended by bracts similar to leaves with same shape, with similar size or smaller, 0.35−1 × 0.1−0.35 cm, longer or smaller than cymes, mature cymes 0.7−1.7 cm long, 1−3(−4) flowered, not obscured by bracts, rarely slightly obscured by bracts, peduncles 0.4−3.5(−7.5) mm long, pubescent to densely pubescent with small gland-tipped hairs. Flowers with pedicels 1−3 mm long, pubescent to densely pubescent with gland-tipped hairs, rarely few long uniseriate eglandular hairs close to the calyx attachment, and subtended by linear bracteoles, 0.8−2.7 × 0.1 mm, pubescent to densely pubescent with gland-tipped hairs and rarely few long uniseriate eglandular hairs, mostly in the apex; calyx at anthesis (3.8−)5.5−6.4 mm long, green, tube (2.4−)3−4 mm long, ± infundibuliform, straight, ribbed, externally pubescent to densely pubescent with different height gland-tipped hairs and scattered long uniseriate hairs, which can be dense and hispid, mostly in the base and ribs, tube internally glabrescent with few hairs and with a faint ring of long uniseriate hairs in the throat, calyx lobes subequal, 1.5−3.4 mm long, with the base deltate and apex long acuminate, straight, externally with indumentum as on tube but with a concentration of long uniseriate eglandular hairs, internally pubescent with small gland-tipped hairs and margin with long uniseriate eglandular hairs, calyx in fruit 8.4−9.5 mm long, indumentum less dense, tube 5−6 mm long, ± cylindrical, ribbed, calyx lobes 2.7−4 mm long, subequal, straight; corolla lilac, (5.5−)8.1−8.3 mm long, tube (3.1−)4.9−5.1 mm long, ± cylindrical, becoming slightly enlarged near throat, 0.6−0.9 mm wide, externally with base glabrous becoming sparsely villous with curved uniseriate hairs and small sessile glands, internally with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally glabrous, anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous except by few long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 3−3.6 × 1.9−2.1 mm, ellipsoid or obovoid, not flattened, not winged, castaneous, not shiny, glabrous, rugulose, with deep abscission scars, slightly mucilaginous when wetted.

Phenology:— *Hyptidendron cerradoense* was found in with flowering specimens in May and June and with fruiting specimens in September and November.

Distribution and Habitat:—*Hyptidendron cerradoense* is endemic of Cavalcante and Niquelândia municipalities, known from six collections (Fig. 38). It can be found from 350 to 1000 m elevation in *campo sujo, cerrado sensu stricto, cerrado rupestre* and *campo cerrado* habitas, all of these included in the Cerrado domain.

Preliminary Conservation Status:— The AOO is 20 km² and the EOO is 3,389 km². *Hyptidendron cerradoense* is known for just six collections in four localities. It is not known to occur in any protected area. The conservation status of this species is assessed as Endangered according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:—The specific epithet refers to the intramarginal vein present in this species that is alongside other characteristics a diagnostic feature of this species.

Affinities and morphological notes:—*Hyptidendron cerradoense* can be differentiated from all other species of the genera by a combination of the following characters: leaves glabrous

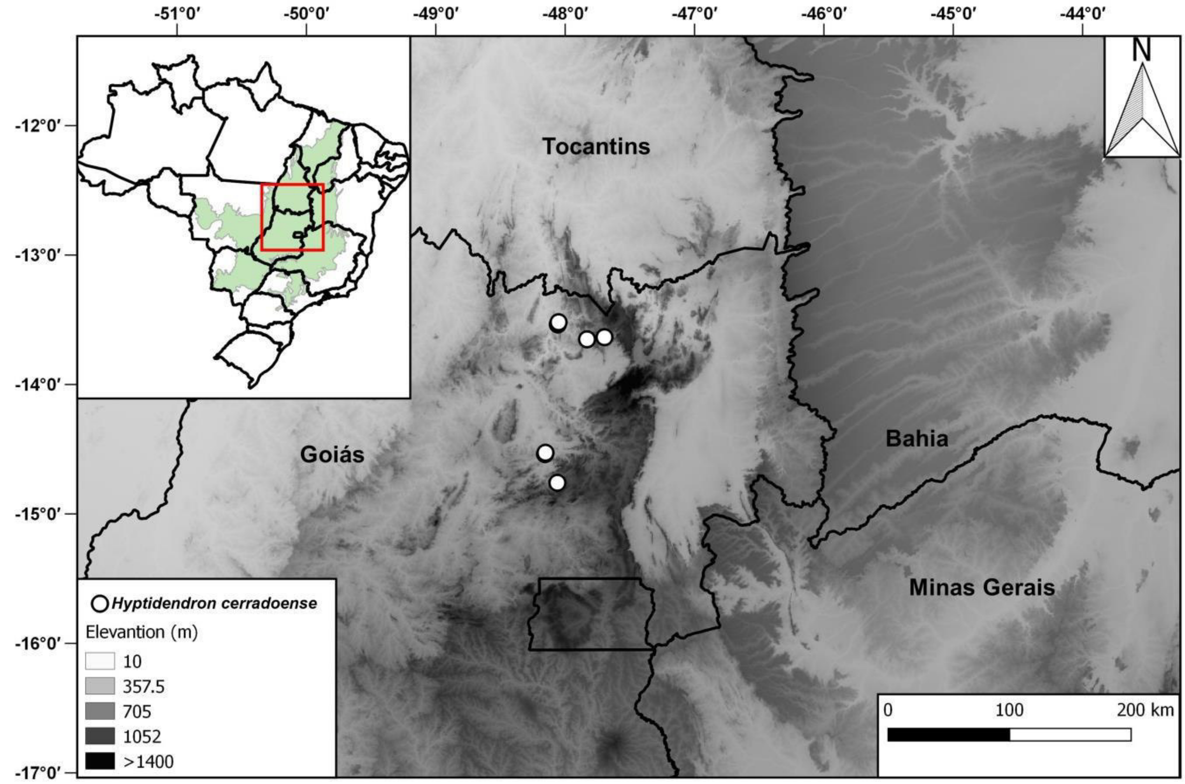

FIGURE 38. Distribution of *Hyptidendron cerradoense* Antar & Harley. The green shape in the small map shows the extension of the Cerrado Domain.

to glabrescent, 0.8−1.5 × 0.3−0.7 cm, with intramarginal venation, margins serrulate with (1−)2−4 teeth, rarely entire, calyx tube at anthesis with an inconspicuous ring of hairs in the throat and nutlets 1 per flower with deep abscission scar.

It is morphologically related to *Hyptidendron arbusculum* by sharing similar leaf measurements, number of teeth in margins and number of flowers per cymes. They can be differentiate as *Hyptidendron cerradoense* possess intramarginal veins (vs. absent) blades elliptic, narrow elliptic or narrow ovate (vs. wide ovate, ovate, elliptic, wide elliptic, rarely very wide ovate), petioles 0.7−1.6 cm long (vs. petiole 1.5−2.8(−3.5) mm long), leaf margins entire to 4 teeth (vs. 2−7 teeth) and calyx externally pubescent to densely pubescent with different height gland-tipped hairs and scattered long uniseriate hairs, which can be dense and hispid (vs. pubescent with gland-tipped hairs). It is also similar to H. *vepretorum* and *H. dictiocalyx* with differences presented in table 3.

When described *Hyptidendron cerradoense* was based just in specimens from Cavalcante municipality, however, after careful morphological analyses specimens from Niquelândia, ca. 200 km distant, first considered to be a different taxon are now considered as part of the same species. However, these two populations share interesting differences in peduncle size, with populations from Cavalcante with reduced peduncles up to 1.7 mm long and populations from Niquelândia with peduncles from 3−7.5 mm long. Although the peduncle size is somewhat relevant for *Hyptidendron* taxonomy, this feature isolated and mostly seen by just few specimens, could not be used solely to recognize two different taxa.

Selected specimens examined:— BRAZIL. **Goiás**: Cavalcante, UHE Cana Brava. Arraial São Félix. Margem direita do Rio Tocantins. Margem direita do Rio São Félix., 13°31'10"S 48°3'4"W, 9 September 2000, *Bucci 1382* (UFG); Cavalcante, E Cavalcante-Minaçu, km 75, entrada à direita da rodovia com destino ao rio São Félix. Serra do Tombador, 06 November 2012, *G. Pereira-Silva et al. 16436* (CEN); Cavalcante, Reserva Natural da Serra do Tombador, área atrás da sede, área queimada out/17 após 12 anos, 13º39'05"S, 47º49'51"W, 26 June 2018, *C.A.S. Rodrigues 26* (CEN); Niquelândia, 14°45'36,01"S 48°3'36,01"W, 17 September 2018, *Boldrim et al. 4038* (CEN); Niquelândia, 4 km do povoado de Muquém em direção a Niquelândia, 14°31'41"S 48°9'8"W, 8 May 1998, *Aparecida da Silva et al. 3804* (IBGE, K, US); Niquelândia, área de influência do AHE Serra da Mesa, estrada de terra Niquelândia – Muquém, cerca de 3 km antes de Muquém, 14°32'17"S 48°9'21"W, 3 June 1998, *Walter et al. 4191* (CEN).

3.5. *Hyptidendron claussenii* (Benth.) Harley (1848: 131) ≡ *Hyptis claussenii* Bentham in DC. (1848:131) ≡ *Mesosphaerum claussenii* (Benth.) Kuntze, (1891: 526). Type:—BRAZIL.

Minas Gerais: Serra da Caraça, April 1839, *P. Claussen s.n.* (Lectotype, designated by Epling [1936b: 220]: K-000488099; Probable Isolectotypes: BM-000992898, BR-680750, BR-591503, BR-680783, F-1541277, F-998483, G-00437850, G-DC-0679824, NY-00000625, P-00737510, P-00737509, TCD-0000533, US-1706085).

(Figs. 34 E-G, 39).

Shrub (0.5–)1–3 m tall, aromatic; stems woody, 3–5 mm in diam., younger stems quadrangular, slightly canaliculate, densely villous with long uniseriate, non-glandular hairs and rare, small, sessile glands, older stems terete, less hairy and with vertical strips, internodes 0.3–1.6 cm long. Cauline leaves imbricate and congested near the apex of the stem, longer than internodes, rarely equal, frequently diminishing in size towards stem apex, lamina 1.2.–2.8 × 0.6–1.9 cm, chartaceous, slightly discolorous, with the abaxial surface paler, ovate, elliptic or wide elliptic, base rounded, rarely slightly cordate or cuneate, apex obtuse, rarely acute, margin crenate or crenulate, with the exception of the base which is entire, usually revolute, 5–12 teeth on each side of leaf, the tooth apex obtuse, swollen, revolute and with uniseriate non-glandular hairs and pale yellow stipitate-glandular hairs, adaxial surface glabrescent or rarely sparsely villous with few long uniseriate eglandular hairs mostly near the base and in the midvein and rare gland-tipped hairs mostly near the apex, the venation scarcely impressed, midrib and primary veins slightly sulcate or plane, abaxial surface with the same indumentum as the adaxial surface but denser and the glandular-stipitate hairs more frequent, venation reticulate, midrib and primary veins prominent; petiole absent, rarely up to 0.5 mm long. Inflorescence not forming a well-define terminal thyrsoid structure, but with dichasial axillary cymes, concentrated near the apex, subtended by foliaceous bracts, similar to the leaves, same size or slightly smaller, 1–1.8 × 0.6–1.7 cm, mostly slightly smaller than cymes, mature cymes 1−1.8 cm long, 2−6 flowered, obscured by bracts, peduncles 2−3 mm long, villous with long uniseriate eglandular hairs. Flowers with pedicels 0.6−2.2 mm long, with the same indumentum as peduncles, and subtended by linear bracteoles, 1.2−3 × 0.1−0.2 mm, with indumentum as on pedicels; calyx at anthesis 7.2−10 mm long, vinaceous or green, tube 3.5−5 mm long, ± cylindrical broadening near the throat to infundibuliform, straight, ribbed, externally densely villous with long uniseriate eglandular hairs, smaller gland-tipped hairs and sessile glands, tube internally glabrous to glabrescent, except by a faint ring of hairs in the throat, calyx lobes subequal, 3.7−5.5 mm long, linear, apex acute, straight, externally with indumentum as on tube, internally pilose with long uniseriate eglandular hairs mostly in the margin, calyx in fruit 12−15 mm long, indumentum less dense, tube 6.5−9.2 mm long, ± cylindrical, ribbed, calyx lobes 4.5−7 mm long, subequal, straight; corolla lilac, 8.5−12.1 mm long, tube 7.5−8.5 mm long, ± cylindrical, enlarging near the throat, straight, 1−2.7 mm wide, externally with base glabrous becoming irregularly pubescent with eglandular hairs and sessile glands, internally with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens, in the base and near the throat, lobes spreading, externally with the same indumentum as tube, lobes internally glabrous or glabrescent, anterior lobe large, boat-shaped without an apiculus; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrescent to middle and with long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 3.5−4.3 × 2−2.4 mm, ellipsoid, oblongoid, not flattened, not winged, castaneous, dark brown or black, shiny, glabrous, rugulose, with deep abscission scars, mucilaginous when wetted.

Phenology:— *Hyptidendron claussenii* was found in a fertile condition in March, May, June, September and January.

Distribution and Habitat:—*Hyptidendron claussenii* is endemic to Serra do Caraça (Fig. 40), known from only three or four localities in two municipalities (Santa Bárbara and Catas

Altas) in Minas Gerais, SE Brazil. It can be found from 1200 to 1500 meters elevation in highland rocky fields (*campo rupestre*), rocky savanna or savanna habitats, all of these included in the Cerrado domain.

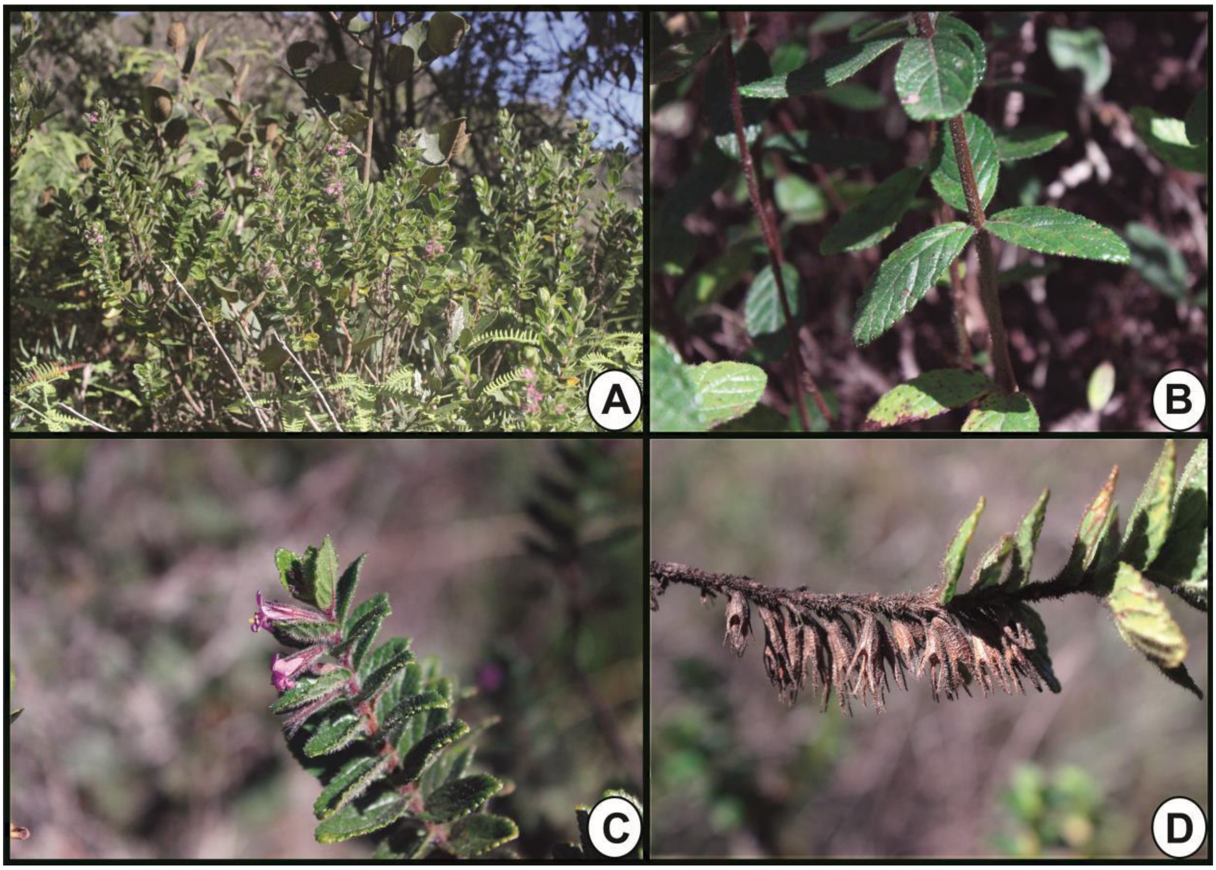

FIGURE 39. Field pictures of *Hyptidendron claussenii* (Benth.) Harley. **A.** Habit. **B.** 3-verticillate leaves. **C.** Branch bearing leaves and inflorescence. **D.** Calyx in fruit. **A-D**. Photos by G.M. Antar.

Preliminary Conservation Status:—The AOO is very reduced of just 16 km² and the EOO is 48 km². Although it is protected by the Reserva Particular do Patrimônio Natural Santuário do Caraça area, it has very reduced populations and its known from just three localities. The conservation status of this species is assessed as Endangered according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

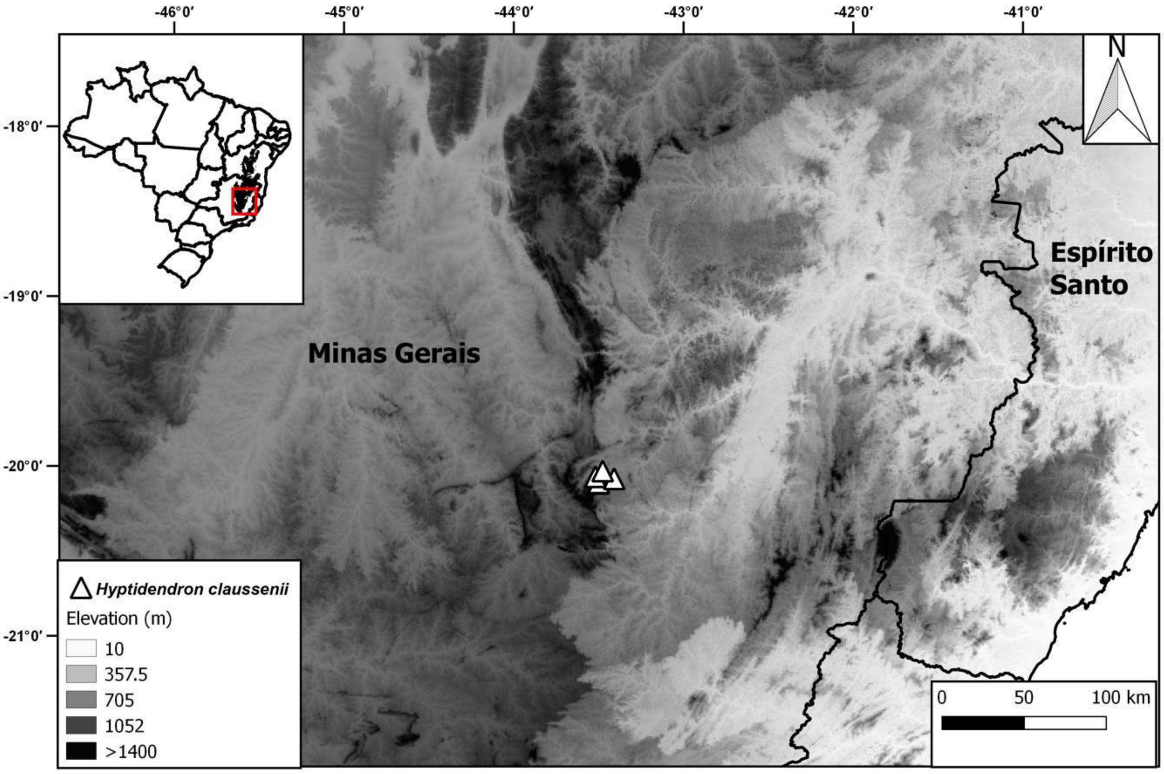

FIGURE 40. Distribution of *Hyptidendron claussenii* (Benth.) Harley. The black shape in the small map shows the extension of the Espinhaço Range.

Etymology:—The specific epithet is named for Peter Clausen, a Danish botanist who firstly collected the species.

Affinities and morphological notes:—*Hyptidendron claussenii* can be differentiated from all other species of the genera by a combination of the following characters: 1 nutlets per flower, not winged, not flattened, with deep abscission scar, peduncles 2−3 mm long, calyx tube at anthesis with a faint ring of hairs in the throat, calyx lobes at anthesis 3.7−5 mm long, calyx at fruit 12−15 mm long and leaves sessile, rarely subsessile. The morphologically closest related species is *Hyptidendron vepretorum*, sharing a similar habitat and cyme morphology, still they can be prompt differentiate by the petiole absent, rarely present and up to 0.5 mm long (vs. petiole 0.8−7(−15) mm long in *H. vepretorum*) and the calyx lobes at anthesis 3.7−5 mm long (vs. 1.5−3.4 mm long in *H. vepretorum*).

Sterile individuals can have leaves 3-verticillate, not congested at the apex of the stems (distributed alongside the whole stem) and larger internodes up to 6.5 cm long and larger leaves 4.5−8 × 2.1−3.9 cm (e.g. *Antar & Santos 1428, 1433*, SPF herbarium).

Typification and nomenclatural notes:—The specimens of *Hyptidendron claussenii* collected by Claussen can be found in some different European and north American herbaria. Sometimes, they are numbered 182, sometimes numbered 1390 and sometimes unnumbered. In BR herbarium it is even presented with a label probably of Claussen with the number 182 but also with a label of the collection of Martius Herbarium Flora Brasiliensis numbered 1196, which is the other syntype chosen by Bentham. Probably they are all part of the same gathering from Claussen, but we could not found evidence that truly confirms it. In that case, we decided to adhere to Epling's decision to lectotype the material with the Kew collections and all the other gatherings are presented as possible isolectotypes.

Selected specimens examined:— BRAZIL. **Minas Gerais**: Catas Altas, Reserva Particular do Patrimônio Natural Santuário do Caraça, Mirante II., 20°6'7"S 43°29'57"W, 2 September 2015, *Gonzaga et al. 597* (RB, SPF); Catas Altas, Reserva Particular do Patrimônio Natural Santuário do Caraça, Trilha para o mirante da Piscina (Mirante do Caraça), 20°5'57,6"S 43°29'58"W, 29 March 2017, *Antar & Santos 1428* (SPF); Santa Bárbara, encosta Norte do Monte Boa Vista, Serra da Conceição (Serra Boa Vista), 6 March 1982, *Hensold et al. CFCR 2901* (K, SPF); Santa Bárbara, Serra do Caraça, caminho para o Miranto, 23 May 1987, *Zappi & Scatena CFCR 10914* (SPF).

3.6. ***Hyptidendron dictiocalyx*** (Benth.) Harley (1848: 131) ≡ *Hyptis dictiocalyx* Bentham in DC., (1848: 131) ≡ *Mesosphaerum dictiocalyx* (Benth.) Kuntze (1891: 526). Type:—

BRAZIL. Goiás, in campis elevates inter San Domingas et Passe [Entre São Domingos e Posse], May 1842, *G. Gardner 4312* (Lectotype, designated by Epling [1936b: 219]: K-000192542; Isolectotypes: BM-000992897; UC-1943441).

(Fig. 41 A-C).

Shrubs or subshrubs 0.5−1.2 m tall, aromatic, woody subterranean structure present; stems woody, much branched, (2−)3−5(−8) mm diam., younger stems quadrangular, slightly canaliculate, pubescent with small gland-tipped hairs, scaterred long uniseriate hairs, rarely denser and villous, and between those two layer gland-tipped hairs, mostly restricted to the younger indumentum and denser near the nodes older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 0.4−2.1 cm long. Cauline leaves spreading along the branches or congested near the apex, not imbricate or slightly imbricate near the apex, longer than internodes, rarely smaller or with similar size, mostly diminishing in size towards stem apex, lamina 0.7−1.9 × 0.4−1.2 cm, chartaceous, discolorous, with abaxial surface paler, ovate, wide ovate, elliptic or wide elliptic, base rounded, rarely truncate or slightly cordate, sometimes unequal, apex acute, rarely obtuse, sometimes apiculate, apiculus ca. 0.5 mm long, adaxial surface pubescent or glabrescent with gland-tipped hairs scattered in the surface, denser near the base, except on main vein, which is pubescent with eglandular hairs, venation mostly inconspicuous, midrib and secondary veins plane or slightly prominent, abaxial surface with similar indumentum but denser, mostly in younger leaves which can be whitish, venation reticulate, prominent, margin ciliate with gland-tipped hairs, serrulate, entire in the base to ½ or 4/5 of leaf margin, not revolute, (1−)2−5(−6) teeth on each side of leaf, with tooth apex swollen, acute or acuminate; petiole 1−4(−6) mm long, canaliculate to slightly canaliculate, densely pubescent or villous with eglandular and gland-tipped hairs. Inflorescence not forming a well-define terminal thyrsoid structure, but with dichasial or rarely unilateral axillary cymes, concentrated near the apex, subtended by bracts similar to leaves with same shape, similar size or slightly smaller, 0.7−1.1 × 0.4−0.8 cm, mostly longer than cymes, mature cymes 0.7−2.1 cm long, 3−5(−6) flowered, partially obscured by bracts, peduncles (2.6−)3−5.5 mm long, pubescent with different height gland-tipped hairs and scattered long eglandular uniseriate. Flowers with pedicels 1−3.5(−4.5) mm long, with indumentum as on peduncles and subtended by linear bracteoles, 0.8−2.3 × 0.1 mm, with indumentum as on pedicels; calyx at anthesis 4−4.8 mm long, green or castaneous, tube 2.2−3.1 mm long, ± infundibuliform, straight, ribbed, externally villous with long white uniseriate hairs, denser in the base, and sessile glands, tube internally glabrescent with a faint ring of uniseriate hairs in the throat, calyx lobes subequal, 1.5−2.2 mm long, deltate, apex acute to acuminate, straight, externally with indumentum as on tube, internally pubescent with scattered hairs and sessile glands, the margin ciliate with uniseriate eglandular hairs, calyx in fruit 6.5−8.5 mm long, indumentum less dense, tube 4.5−6 mm long, ± cylindrical, broadening near the throat, ribbed, calyx lobes 1.9−3.1 mm long, subequal, straight or rarely slightly curved; corolla lilac, 4.5−6.1 mm long, tube 3.5−5.8 mm long, cylindrical, broadening near the throat, straight, 0.9−1.4 mm wide, externally with base glabrous, becoming unevenly villous to the apex with uniseriate eglandular hairs and sessile glands, internally glabrescent except by a ring of hairs in the base of the tube and some tiny gland-tipped hairs in the throat and bellow it, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally pubescent with small gland-tipped hairs, anterior lobe large, boat-shaped with long, almost caudate apex ca. 0.5 mm long; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair glabrescent with few long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 2.7−3.8 × 1.6−2.3 mm, oblongoid, ellipsoid or obovoid, not flattened, not winged, brown, shiny, glabrous or glabrescent, rugulose, with deep abscission scars, slightly mucilaginous when wetted.

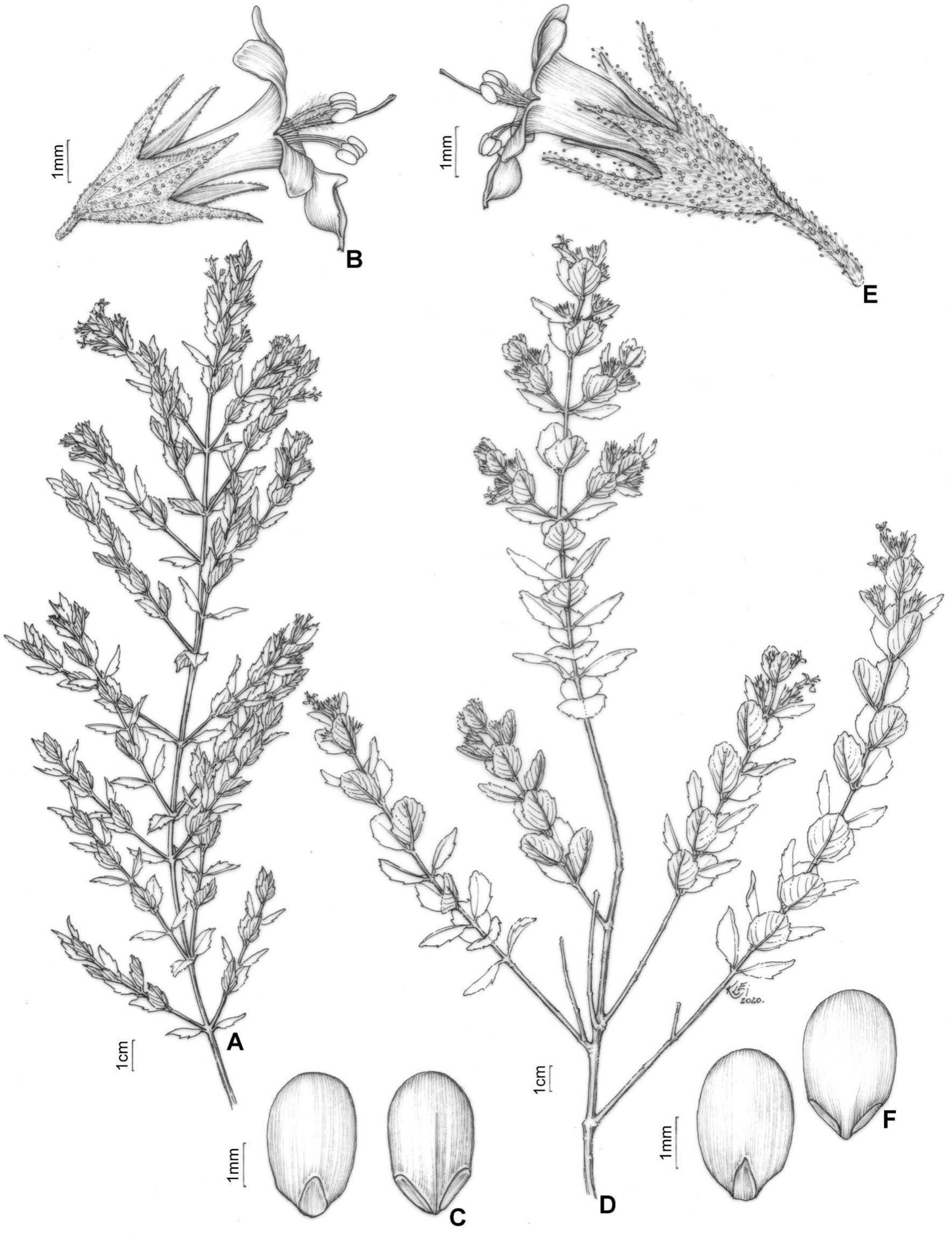

FIGURE 41. Line drawing of *Hyptidendron dictiocalyx* (Benth.) Harley **A.** Branch bearing leaves and inflorescenses. B. Flower, side view. **C.** Nutlet. Line drawing of *Hyptidendron rhabdocalyx* (Benth.) Harley. **D.** Branch bearing leaves and inflorescenses. **E.** Flower, side view. **F.** Nutlet. Illustration of Klei Sousa.

Phenology:—*Hyptidendron dictiocalyx* was found in a fertile condition in May, July, August, October and November.

Distribution and Habitat:—*Hyptidendron dictiocalyx* is endemic to Brazil occurring in Goiás, Minas Gerais and Bahia states (Fig. 42). It inhabitats the Cerrado domain in savanna habitats as *campo sujo*, *campo cerrrado* and *cerrado rupestre*. It growns from 500 to 950 meters elevation.

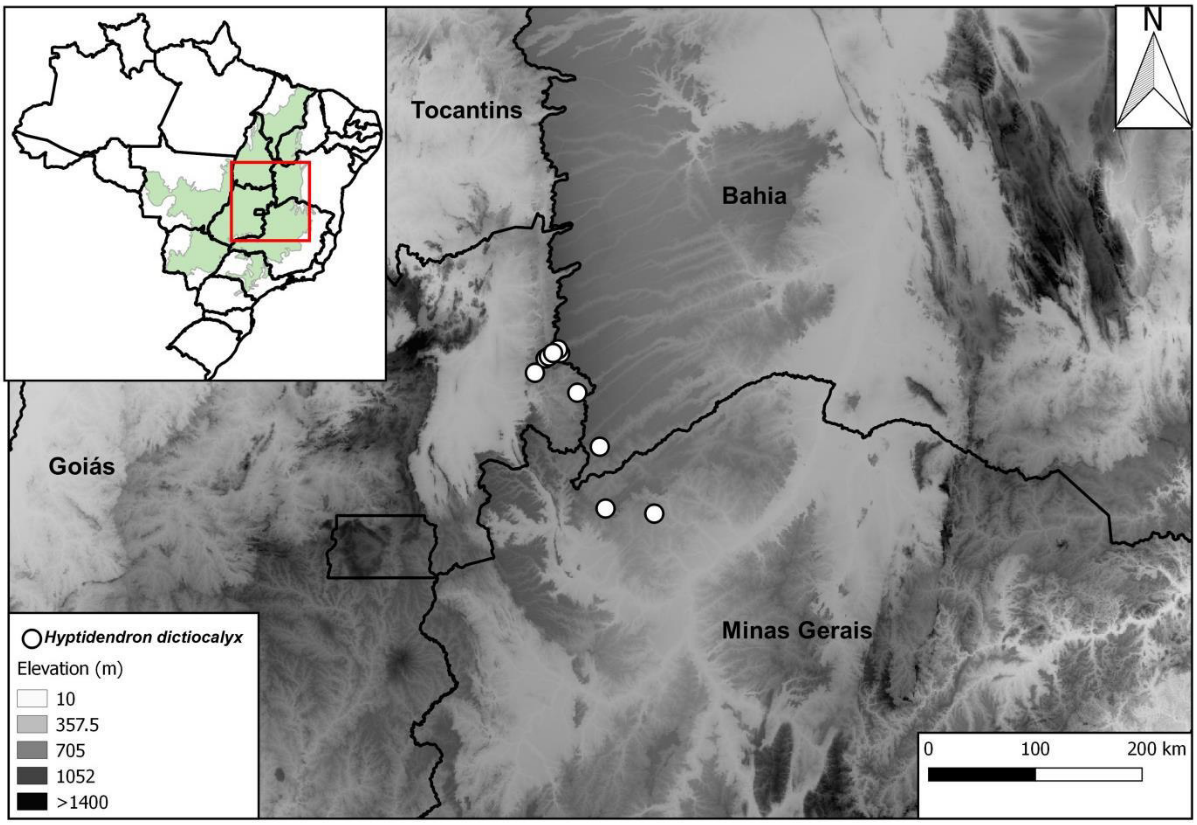

FIGURE 42. Distribution of *Hyptidendron dictiocalyx* (Benth.) Harley. The green shape in the small map shows the extension of the Cerrado Domain.

Preliminary Conservation Status:— The AOO is 40 km² and the EOO is 5,778 km². *Hyptidendron dictiocalyx* is currently known for less than 10 localities, although it occurs in a somewhat undersampled area. It is present in the protected area Parque Estadual da Serra das

Araras. The conservation status of this species is assessed as Vulnerable according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:— The specific epithet is a reference to the netlike (reticulate) venation of the calyx.

Affinities and morphological notes: *Hyptidendron dictiocalyx* can be differentiated from all other species of the genera, by a combination of the following characters: faint ring of hairs in the calyx throat, nutlets 1 per flower, with a conspicuous abscission scar, woody subterranean structure present, leaves with petioles 1−4(−6) mm long and margins with (1−)2−5(−6) teeth on each side of leaf and cymes with peduncles (2.6−)3−5.5 mm long with 3−5(−6 flowers). Together with *H. cerradoense* and *H. vepretorum* it is the only species of *Hyptidendron* confirmed with a woody subterranean structure although other species, mostly of *Hyptidendron* sect. *Umbellaria*, may possess it. *Hyptidendron dictiocaly*x is morphologically closely related to *H. arbusculum*, differing by the cymes with 3−5(−6 flowers) (vs. 1−3 flowered), peduncles (2.6)3−5.5 mm (vs. (1 −)1.6−4 mm), calyx tube at anthesis 2.2−3.1 mm long (vs. 3.6−5 mm long) with a ring of hairs in the throat, formed by few long uniseriate hairs (vs. ring of hairs absent or inconspicuous).

It is also related to *Hyptidendron vauthieri, Hyptidendron vepretorum*, *Hyptidendron intramarginlis* and *Hyptidendron rhabdocalyx* which forms with it a closely related assembly of species. Species comparisons are made in table 3.

Selected specimens examined:—BRAZIL. **Bahia**: Cocos, Fazenda Trijunção, área da Sede Santa Luzia, 14°53'26"S 45°52'0"W, 6 July 2001, *Fonseca et al. 2872* (IBGE, K, SP). **Goiás**: Guarani de Goías, Fazenda Primavera, cerca de 25 km de Posse-GO e 20 km de Rosário-BA, próximo à Serra Geral de Goiás, 14°3'46"S 46°13'3"W, 3 October 2015, *Aparecida da Silva et al. 8389* (HUEFS, IBGE, SPF); Mambaí, outskirts of Mambaí, 21 August 1979, *Smith 18*

(UB); Posse, coletada no morro, próximo ao loteamento, saída da cidade de Posse, 14°6'34.2"S 46°20'47.7"W, 13 October 2012, *Hashimoto 2979* (UFG); Posse, Serra Geral, distando 3 km da cidade de Posse, Br-020, 20 May 1983, *Rizzo & Ferreira 10276* (UFG). **Minas Gerais**: Arinos, RPPN Veredas do Pacari, proprietário: Joaquim A. Alves de Moisés A. de Lima, estrada para Chapada Gaúcha-MG, 15°26'14,8"S 45°48'55,2"W, 27 May 2004, *Fonseca et al. 5518* (CEN, HUEFS, IBGE, SPF); Chapada Gaúcha, Parque Estadual da Serra das Araras, Serra das Araras, Cerrado da capelinha, 15°28'56"S 45°22'60"W, 11 November 2003, *Martins & Gomes 464* (UB).

3.7. ***Hyptidendron rhabdocalyx*** (Mart. ex Benth.) Harley (1988: 98) ≡ *Hyptis rhabdocalyx* Mart. ex Bentham (1833: 133) ≡ *Mesosphaerum rhabdocalyx* (Mart. ex Benth.) Kuntze (1891: 527). Type:—BRAZIL. Rio de Janeiro, in graminosis ad Sebastianopolim in montibus ad Tijuca [doubtful location], August 1842, *C.F.P. von Martius s.n.* (Holotype: M-0111934).

(Fig. 41 D-F).

Shrubs 1.2−1.5 m tall, aromatic; stems woody, branched, 3−6(−8) mm diam., younger stems quadrangular, canaliculate, white villous with long uniseriate eglandular hairs and gland-tipped hairs, mostly in the nodes, and few small sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, leaf scars conspicuous, internodes 0.3−3.4 cm long. Cauline leaves mostly congested near the apex, mostly imbricate, longer than internodes, rarely smaller or with similar size, mostly diminishing in size towards stem apex, lamina 1.2−2.5 × 0.7−2 cm, chartaceous, concolorous or slightly discolorous, with abaxial whitish due to the indumentum, ovate, wide ovate, suborbiculate or wide elliptic, base rounded to slightly cordate, sometimes unequal, obtuse or acute, sometimes apiculate, apiculus ca. 0.5 mm long, adaxial surface densely tomentose/villous with uniseriate eglandular hairs and small gland-tipped hairs, denser near the base of the main vein and in margins, venation mostly inconspicuous, midrib prominulous, or plane, close to base of lamina, but soon becoming impressed, secondary veins impressed, abaxial surface villous with long uniseriate white hairs and scattered gland-tipped hairs, denser and whitish in the veins and margins, venation reticulate, prominent, margin white ciliate, serrulate, entire in the base to 1/5 of leaf margin, not revolute, 12−36 teeth on each side of leaf, with tooth apex swollen, acuminate, acute, or obtuse, whitish due to the indumentum; petiole 0.4−0.9 cm long, canaliculate, densely villous with long white uniseriate curved eglandular hairs and smaller gland-tipped hairs. Inflorescence not forming a well-define terminal thyrsoid structure, but with dichasial axillary cymes, concentrated near the apex, subtended by leaf-like bracts, similar to leaves with same shape, slightly smaller or with similar size, indumentum denser, 1−2 × 0.9−1.7 cm, mostly slightly smaller than cymes, mature cymes 1.4−2.6 cm long, (3−)4−12 flowered, not obscured by bracts or partially obscured by bracts, peduncles 2.8−6 mm long, with indumentum as on petioles. Flowers with pedicels (1.5−)2.1−5 mm long, indumentum as on peduncles, and subtended by linear bracteoles, 1.1−3 × 0.1 mm, with indumentum as on pedicels; calyx at anthesis 4.7−6.8 mm long, green, tube 2.5−3.9 mm long, ± infundibuliform, straight, ribbed, externally densely villous with uniseriate eglandular hairs and small gland-tipped hairs, tube internally glabrous at base, becoming pubescent with small gland-tipped hairs above, and with a faint ring of hairs in throat, calyx lobes subequal, 2.1−2.9 mm long, deltate, apex acuminate, straight or rarely curved, externally with indumentum as on tube, internally with similar indumentum but denser and with longer hairs, calyx in fruit 7.1−9 mm long, indumentum less dense, tube 4.7−5.5 mm long, ± cylindrical, ribbed, calyx lobes 2.8−3.5 mm long, subequal, straight; corolla lilac, ca. 7.2 mm long, tube ca. 5.7 mm long, cylindrical becoming slightly enlarged near throat, straight, ca. 1 mm wide, externally with base glabrous becoming irregularly villous with long uniseriate eglandular hairs, internally with entangled non-glandular hairs, close to insertion of posterior pair of stamens and small gland-tipped hairs and sessile glands in throat and below it, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally with small gland-tipped hairs and sessile glands, anterior lobe large, boat-shaped with an apex ca. 0.5 mm long; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrescent with few long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, ca. 3 × 1.7 mm, obovoid, not flattened, not winged, castaneous, shiny, glabrous, rugulose, with deep abscission scars, slightly mucilaginous when wetted.

Phenology:—*Hyptidendron rhabdocalyx* was found in a fertile condition in March and April.

Distribution and Habitat:—*Hyptidendron rhabdocalyx* is currently endemic to Diamantina and Bocaiúva municipalities (Fig. 43). It occurs in *campo rupestre* habitats, inserted in the in the Cerrado Domain at 750 to 900 meters elevation.

Preliminary Conservation Status:— Data Deficient. It is impossible to accurately precise the AOO and EOO as this species is known for just two collections. None of the collections have been made insided protected areas.

Etymology:—The specific epithet is a reference for the costate calyx presented in this species as rhabdo from Ancient Greek means striate.

Affinities and morphological notes:—*Hyptidendron rhabdocalyx* can be differentiated from all other species of the genera by a combination of the following characters: one nutlets per flower, not flattened, not winged, with deep abscission scar, calyx tube with a faint ring of hairs in the throat, pedicels never smaller than 1.5 mm long, usually 2.1−5 mm long, calyx tube at anthesis 2.5−3.9 mm long, and leaf margin mostly serrulate. It is closely related to *H.*

vauthieri differing by the pedicels never smaller than 1.5 mm long, usually 2.1−5 mm long (vs. pedicels 0.5−3.3 mm long in *H. vauthieri*), calyx tube at anthesis 2.5−3.9 mm long (vs. 2.3−2.8 mm long in *H. vauthieri*) and leaf margin leaf margin mostly serrulate (vs. leaf margins crenulate to crenate, rarely serrulate). It is also related to *H. arbusculum*, *H. dictiocalyx*, *H. unilaterale* and *H. vepretorum* (table 3).

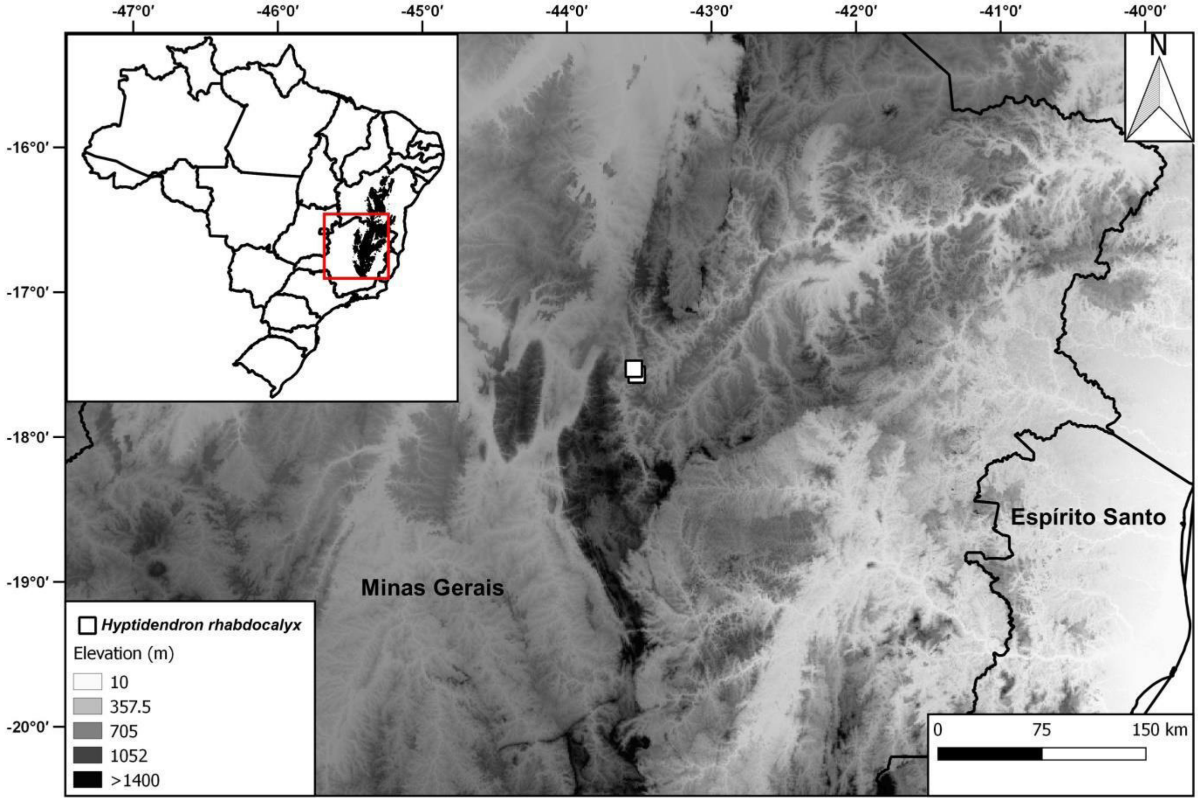

FIGURE 43. Distribution of *Hyptidendron rhabdocalyx* (Benth.) Harley. The black shape in the small map shows the extension of the Espinhaço Range.

Typification and nomenclatural notes:— *Hyptidendron rhabdocalyx* was described based on a single gathering for Rio de Janeiro (Sebastianópolis) municipality, Tijuca region. This locality is inserted in the Atlantic rainforest domain with maximum altitudes of 1045 meters. It has never been found again in Rio de Janeiro notwithstanding that the region is well collected with more than 40000 specimens collected in the municipality. Instead, new collections of *H. rhabdocalyx* have been found in Minas Gerais state, in *campo rupestre* vegetation where *H. rhabdocalyx* closest related species occurs. Although we cannot assure that the locality of the label of Martius collection is incorrect, we understand that the locality is doubtful, even more because Martius used to collect a lot of duplicates (M curators, pers. communication), and *H. rhabdocalyx* is just one gathering. This doubtful locality is also supported by other mislabelled specimens of Martius (Hurbath 2018). We believe that Tijuca in Martius's label can be a reference to Tejuco, an older name for Diamantina municipality.

Specimens examined:—BRAZIL. Minas Gerais: Diamantina, ca. 1,5 km da divisa com a cidade de Olhos d'Água, 17°34'7"S 43°31'3"W, 21 April 2012, *Souza et al. 879* (HUEFS, SPF); Olhos-d'Água, Rodovia Bocaiúva-Diamantina, próximo ao rio Jequitinhonha, 17 March 1997, *Hatschbach et al. 66410* (BHCB, ESA, FLOR, HUEFS, K, MBM).

3.8. *Hyptidendron roseum* Antar, Harley & J.F.B.Pastore (2019a: 65). Type:—BRAZIL. Goiás: Cavalcante Reserva Particular do Patrimônio Natural Renascer, Trilha para a Ponte de Pedra, elev. 1099 m, 27 Jul 2017, *G.M. Antar et al. 1737* (holotype: SPF; isotypes: CEN, CTBS, HUEFS, K, NY, P, RB, UB, US).

(Fig. 44).

Erect shrubs or treelets 1−3.5 m tall, aromatic; stems woody, branched, 3−7(−9) mm diam., younger stems quadrangular, slightly canaliculate, densely pilose with long uniseriate, eglandular hairs and small glandular-stipitate hairs, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 0.6−2.7(−4.2) cm long. Cauline leaves spreading along the branches, not imbricate or just near the tips, longer than internodes, rarely shorter, mostly diminishing in size towards stem apex, lamina 1.6–4.9(–5.8) × 0.8–3.5 cm, chartaceous, discolorous, with abaxial surface paler, lanceolate to ovate, rarely wide ovate or elliptic, base cordate or rounded, apex apiculate, rarely acute, apiculus 1.3–2.5 mm long, adaxial surface pilose with uniseriate eglandular white hairs and gland-tipped hairs, denser on the margins, or glabrescent with just the midrib pilose, venation mostly inconspicuous, midrib and primary veins slightly sulcate or plane, abaxial surface with the same indumentum but denser, venation reticulate, prominent, margin ciliate, sharply serrulate with the exception of the base which is entire, not revolute, 8−14 teeth on each side of leaf, with tooth apex swollen, curved, acute; petiole absent to 3 mm long, slightly canaliculate, pilose with long uniseriate eglandular hairs. Inflorescence not forming a well-define terminal thyrsoid structure, but with unilateral or less commonly dichasial axillary cymes, concentrated near the apex, subtended by bracts, similar to leaves with same shape with similar size or slightly smaller, 1.2−3.4 × 0.7−2.3 cm, smaller than cymes, mature cymes 2.1−3.5 cm long, 9−16 flowered, not obscured by bracts, peduncles 4−11 mm long, densely pilose with long uniseriate eglandular hairs. Flowers with pedicels 1−4.7 mm long, with the same indumentum as peduncles, and subtended by linear to narrow elliptic bracteoles, 1.5−4(−5.2) × 0.1−0.7 mm, with indumentum as on pedicels; calyx at anthesis 2.5−3.6 mm long, vinaceous, tube 1.9−2.4 mm long, ± cylindrical broadening near the throat to infundibuliform, straight, ribbed, externally densely pilose to villous with long uniseriate white eglandular hairs and smaller gland-tipped hairs, tube internally glabrous to glabrescent, except by a dense ring of white hairs in the throat, calyx lobes subequal, 1−1.4 mm long, deltate, apex acute, straight, externally with indumentum as on tube, internally pubescent with scattered small gland-tipped hairs, calyx in fruit 5.5−7.6 mm long, indumentum less dense, tube 4.5−6 mm long, ± cylindrical, ribbed, calyx lobes 1.2−2 mm long, subequal, straight or rarely slightly curved; corolla lilac to pink, 8−12 mm long, tube 8−9.2 mm long, ± cylindrical, enlarging near the throat, straight, 1.2−1.5 mm wide, externally with base glabrescent becoming pilose with white eglandular uniseriate hairs, internally with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens, lobes spreading, externally with the same indumentum as tube, lobes internally glabrous, anterior lobe large, boat-shaped with a short apiculate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrescent to middle and with long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 3.5–4.5 × 1.7–2.4 mm, ellipsoid, not flattened, not winged, castaneous to dark brown, shiny, glabrous, rugulose, apex, with deep abscission scars, mucilaginous when wetted.

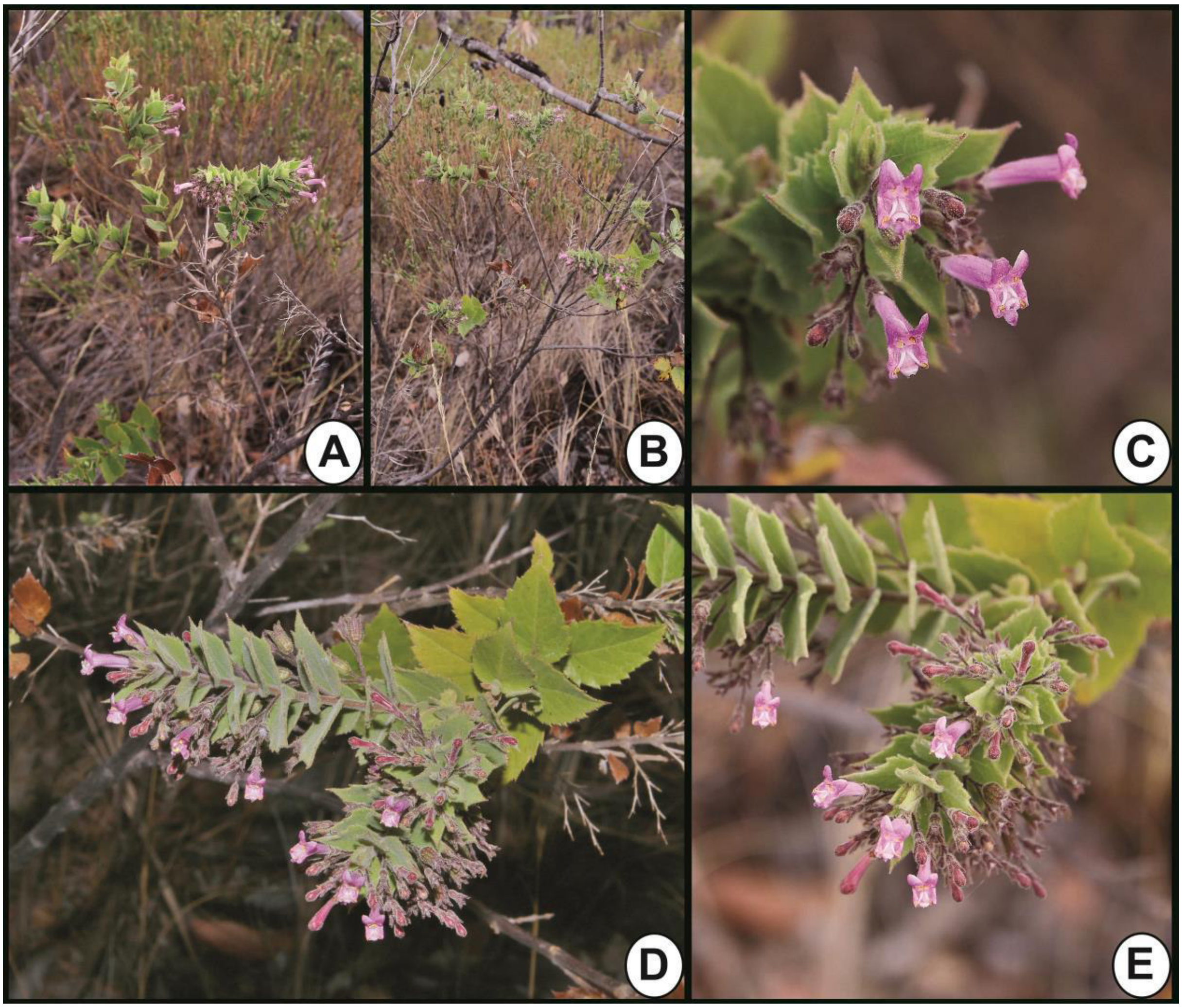

FIGURE 44. Field pictures of *Hyptidendron roseum* Antar, Harley & J.F.B.Pastore. **A.** Habit. **B.** Habit. **C.** Cymes and flowers at anthesis. **D.** Calyx in fruit. **E.** Branch bearing leaves and inflorescence **A-E**. Photos by M. Mercante.

Phenology:—*Hyptidendron roseum* was found in a fertile condition in July. Sterile specimens were found in May and June.

Distribution and Habitat:— Endemic to Brazil, Goiás state, Alto Paraíso de Goiás and Cavalcante municipalities (Fig. 45); from 900 to 1100 meters elevation, in *campo rupestre*, growing among rocks in sandy dry soils. The area is part of the Chapada dos Veadeiros region, known to have high species richness and many Hyptidinae endemic species (Antar *et al*. 2019b).

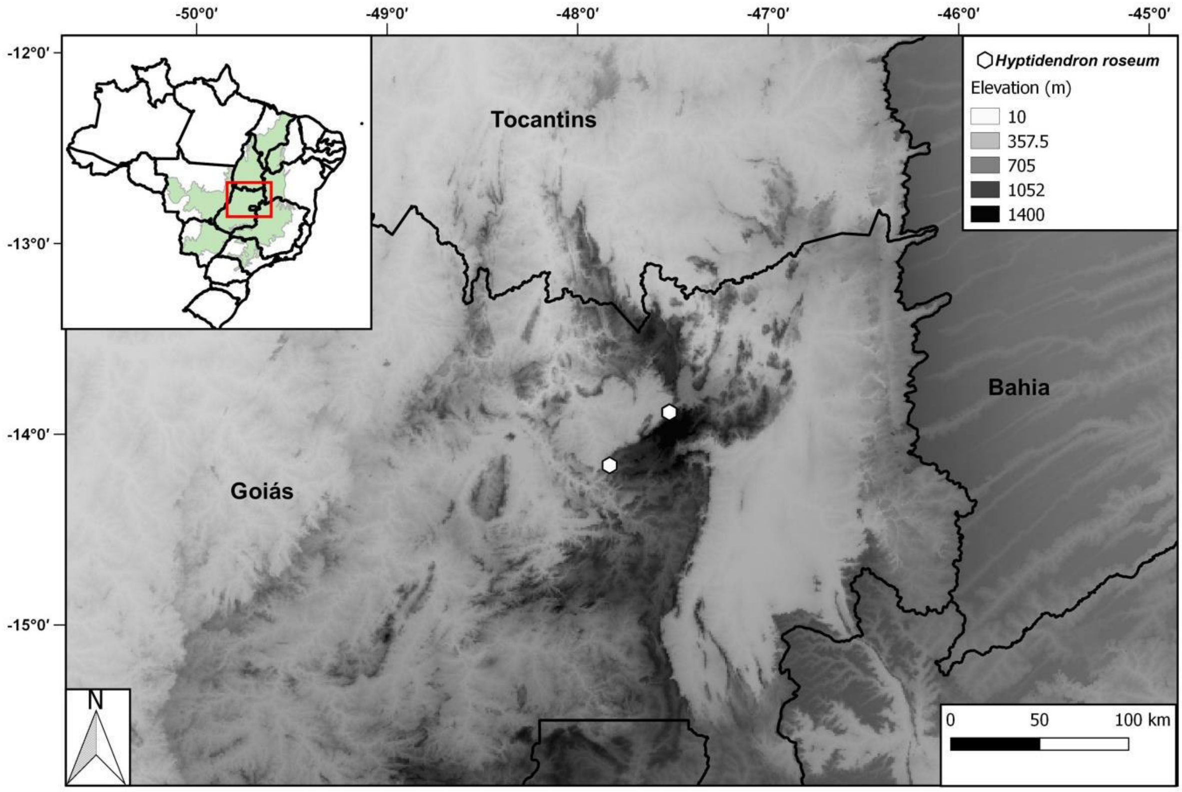

FIGURE 45. Distribution of *Hyptidendron roseum* Antar, Harley & J.F.B.Pastore. The green shape in the small map shows the extension of the Cerrado Domain.

Preliminary Conservation Status:—The AOO and EOO are 8 km². *Hyptidendron roseum* is known for just five collections in two localities. It is protected by the Parque Nacional da Chapala dos Medeiros and Reserva Particular do Patrimonial Natural Renascer. Besides of that it presents a very narrow distribution and is threatened by human induced fires and global warming. The conservation status of this species is assessed as Endangered according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:— The specific epithet refers to the pink corolla. The species in the genus usually have a purple or lilac corolla. Thus, pink corolla is a helpful diagnostic character for this species.

Affinities and morphological notes:— *Hyptidendron roseum* can be distinguished from its congeners by the combination of sessile to subsessile leaves, unilateral cymose structure (rarely dichasial), a ring of hairs in the throat of the calyx tube, and 1 nutlets per flower with deep abscission scar. The closest related species morphologically is *H. caudatum* which shares a dense ring of hairs in the throat of the calyx and a similar habit, however it can be differentiate by the petiole (absent or up to 3 mm long in H. roseum vs. longer than 6 mm) and the calyx size (2.5–3.6 mm long in *H. roseum* vs. 3.6–5.3 mm long). It also resembles *H. unilaterale* and *H. albidum* in having unilateral cymose inflorescences and cordate to rounded leaf bases. *Hyptidendron albidum* differs from *H. roseum* by petiolate leaves, faint ring of hairs around the throat of the calyx, and an indumentum of white dendroid hairs. *Hyptidendron unilaterale* differs from *H. roseum* by petiolate leaves, faint ring of hairs around the throat of the calyx and an indumentum pubescent composed of minute stipitate-glandular hairs and scattered long uniseriate non-glandular hairs.

Specimens examined:— BRAZIL. **Goiás**: Alto Paraíso de Goías, Parque Nacional da Chapada dos Veadeiros, Trilha das Corredeiras, local após afloramento dos cristais e das minas de garimpo abandonadas, 14°9'47"S 47°49'55"W, 9 May 2014, *Silva et al. 338* (CEN, RB); Cavalcante, Reserva Particular do Patrimônio Natural Renascer, 13°53'7"S 47°31'12"W, 2009, *Pastore & Suganuma 1899* (CEN); Cavalcante, Reserva Particular do Patrimônio Natural Renascer, trilha para a Ponte de Pedra, 13°53'7"S 47°31'4"W, 27 July 2017, *Antar et al. 1746* (SPF, HUEFS), *Antar et al. 1760* (SPF).

3.9. *Hyptidendron unilaterale* (Epling) Harley (1988: 93) ≡ *Hyptis unilateralis* Epling (1951: 140) ≡ *Hyptis unilateralis* Epling (1949: 188) *nomen nudum*. Type: BRAZIL: Minas Gerais, Diamantina, Jun 1934, *A.C. Brade 13640* (holotype: UC-2055659; isotypes: B-100247481, HB?, RB-28632).

(Fig. 46).

Erect shrubs 1−2 m tall, aromatic; stems woody, branched, (2−)3−5 mm diam., younger stems quadrangular, canaliculate, pubescent, rarely densely pubescent, with minute stipitate-glandular hairs and hispid and with scattered long uniseriate eglandular hairs, sometimes denser and hispid, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes (1−)1.5−4(−7.5) cm long. Cauline leaves spreading along the branches, not imbricate or just near the apex, smaller than internodes or less commonly equal or longer, diminishing in size towards stem apex, lamina (1.7−)2−4(−5.9) × (1−)1.3−3.3(−4.7) cm, chartaceous, concolorous or slightly discolorous, with abaxial surface paler, ovate, wide ovate, orbiculate or wide elliptic, base rounded to cordate, sometimes unequal, apex acuminate, rarely acute or obtuse, apiculate, apiculus 0.5−2 mm long, adaxial surface pubescent to glabrescent with scattered small gland-tipped hairs and rarer long eglandular uniseriate hairs, except on main vein and sometimes secondary veins, mostly near the base, which are denser to tomentose with different size eglandular uniseriate hairs, venation mostly inconspicuous, midrib prominulous at base but soon becoming plane or slightly impressed, secondary veins slightly impressed or plane, abaxial surface pubescent to densely pubescent with scattered small gland-tipped hairs, long eglandular uniseriate hairs and sessile glands, denser in the veins, tomentose in the midvein base, sometimes rugulose to bullate, venation reticulate, prominent, margin ciliate with uniseriate short or long hairs, irregularly sharply serrulate, entire in the base to 1/10 of the leaf margin, not revolute, 6−25 teeth on each side of leaf, with tooth apex swollen, acuminate, sometimes curved forward; petiole (0.2−)0.6−1.5(−2.5) cm long, canaliculate to slightly canaliculate, pubescent with small gland-tipped hairs and scattered long uniseriate eglandular hairs, which can be dense and hispid. Inflorescence thyrsoid, terminal, up to 25 cm long, with unilateral or less commonly dichasial axillary cymes, subtended by bracts similar to leaves but reduced and diminishing in size towards the apex, the upper ones reduced and subsessile, 0.5−1.9 × 0.35−1.5 cm, with same indumentum as leaves but denser, the upper ones whitish due to the dense villous indumentum, shorter than cymes, mature cymes 1.9−3.5(−4.2) cm long, 7−19 flowered, not obscured by bracts, peduncles 6−13 mm long, pubescent with short gland-tipped hairs, scattered longer gland-tipped hairs, uniseriate eglandular hairs and small sessile glands, rarely hispid with the uniseriate eglandular hairs. Flowers with pedicels 1−5(−8.9) mm long, pubescent with short stipitate glandular hairs densely disposed and scattered longer gland-tipped hairs, rarely with long uniseriate eglandular hairs, and subtended by linear bracteoles, 0.5−2 × 0.1, with indumentum as on pedicels; calyx at anthesis 3.2−4.7 mm long, vinaceous, tube 1.5−2.8 mm long, ± infundibuliform, straight, ribbed, externally densely pubescent with small stipitate glandular hairs, sessile glands, and long uniseriate eglandular hairs, which can be dense and villous mostly in the base, tube internally glabrous to glabrescent with minute hairs near the throat, and without a ring of hairs in throat, calyx lobes subequal, 1.3−2.4 mm long, deltate, apex acuminate, reflexed or straight, externally with indumentum as on tube, sometimes villous in the apex of the calyx lobes, internally pubescent with small eglandular hairs and sessile glands in the middle of the lobes and expanding to the margin with also few long uniseriate hairs in the top margin of the lobes, calyx in fruit 6.9−8.5 mm long, indumentum less dense, tube 4.8−5.5 mm long, ± cylindrical, ribbed, calyx lobes 2−3 mm long, subequal, curved or straight; corolla lilac, 5.5−8 mm long, tube 3.5−5 mm long, cylindrical, straight, 0.8−1 mm wide, externally with base glabrous becoming unevenly pubescent with long uniseriate curved hairs, small gland-tipped hairs and sessile glands, internally glabrous with the exception of a tuff of long curved entangled eglandular hairs close to the insertion of the anterior pair of stamens, lobes spreading, externally with the same indumentum as tube but with a concentration in the upper part of lobes, lobes internally glabrous, anterior lobe large, boat-shaped with long, caudate, fimbriate; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous to middle and with long curved, entangled, uniseriate, eglandular hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 3.6−4.6 × 1.5−2.2 mm, ellipsoid to oblongoid, not flattened, not winged, brown, shiny, glabrous, rugulose, with deep abscission scars, mucilaginous when wetted.

Phenology:—*Hyptidendron unilaterale* was found in a fertile condition in May, June and September.

Distribution and Habitat:— *Hyptidendron unilaterale* is endemic to Diamantina Plateau, Minas Gerais state (Fig. 47). It occurs in the municipalities of Diamantina (in the district of Conselheiro Mata) and in Várzea da Palma municipality. *Hyptidendron unilaterale* occurs only in *campo rupestre* vegetation in sandy, rocky, dry soils. It can be found from 950 to 1150 meters elevation.

Preliminary Conservation Status:— The AOO is 16 km² and the EOO is 3,221 km². *Hyptidendron unilaterale* is known for just eight collections in two localities. It is not known

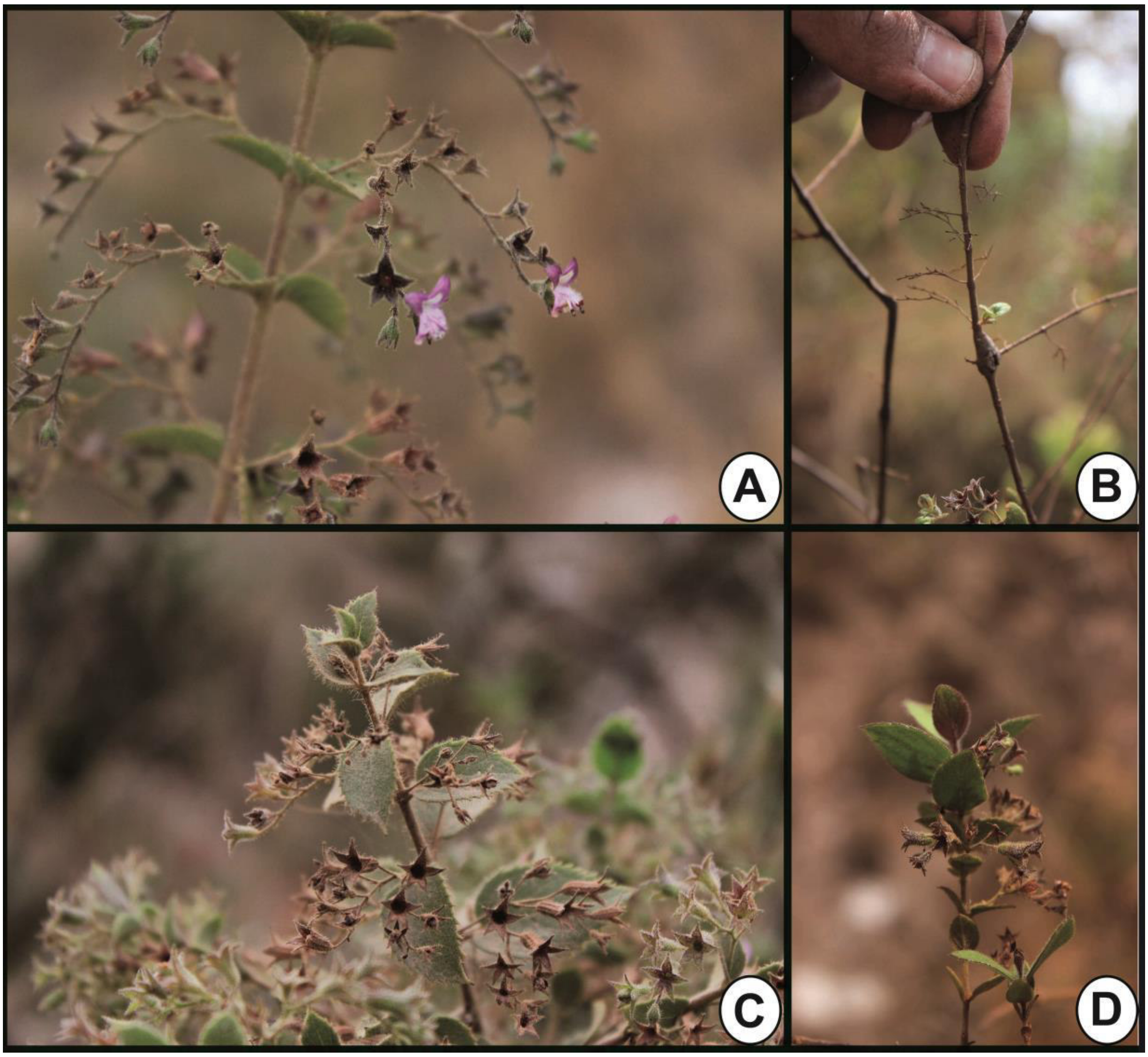

FIGURE 46. Field pictures of *Hyptidendron unilaterale* (Epling) Harley. **A.** Cymes. **B.** Elargment in the stem, probably caused by insect galls. **C.** Branch bearing leaves and inflorescence. **D.** Branch bearing leaves and inflorescence. **A-D**. Photos by G.M. Antar.

for any protected area. The conservation status of this species is assessed as Endangered according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:—The specific epithet refers to the monochasial or unilateral inflorescences that this species display.

Affinities and morphological notes:—*Hyptidendron unilaterale* can be differentiated from all other species of the genera, by a combination of the following characters: 1 nutlets per flower, not flattened, not winged, with deep abscission scar, mature cymes unilateral, rarely dichotomous, forming a somewhat well-defined thyrsoid structure, 7−19 flowered, peduncles 6−13 mm long, calyx at anthesis 3.2−4.7 mm long with a faint ring of hairs in the throat.

The most closely related species to *Hyptidendron unilaterale* are *H. albidum* and *H. roseum*, which can have a similar habit and unilateral inflorescence. *Hyptidendron unilaterale* differs from *Hyptidendron albidum* by an indumentum composed of minute stipitate-glandular hairs and long uniseriate non-glandular hairs (*vs.* indumentum of white dendroid hairs), cymes not obscured by the leaves (*vs.* cymes obscured by the leaves) and the shape and size of the bracts, which are much smaller than leaves, and subsessile to sessile (*vs.* bracts petiolate, similar to leaves but slightly smaller). It differs from *H. roseum* by petioles (0.2−)0.6−1.5(−2.5) cm long (vs. petioles 0–3 mm long), an indumentum composed of minute stipitate-glandular and long uniseriate non-glandular hairs (vs. a dense indumentum of white uniseriate hairs covering much of the plant), and a faint ring of hairs in the throat of the calyx tube (vs. conspicuous ring of hairs present).

Hyptidendron unilaterale is also similar to *Hyptidendron vauthieri*, sharing a similar distribution, and some overlapping measurements. They differ by the mostly unilateral cymes (vs. always dichasial in H. *vauthieri*), the indumentum composed of hispid long hairs (vs. villous long hairs) and the irregularly sharply serrate teeth mostly longer than 1 mm long (vs. crenate or rarely serrate with teeth mostly smaller than 1 mm long).

It is also superficially similar to *H. glutinosum* (Benth.) Harley because of the cordate base to their leaves, but it can be immediately distinguished by the unilateral inflorescence (vs. dichasial in *H. glutinosum*).

It is notable in some specimens *of Hyptidendron unilaterale* (e.g. *Antar & Chagas 1870 SPF, Bacelar 268 PAMG*) the presence of probably insect galls which cause an elargment in the stem (Fig 46 B).

After the type collection *Hyptidendron unilaterale* remained unreported for 56 years, when its rediscovery was reported (Antar *et al*. 2019a).

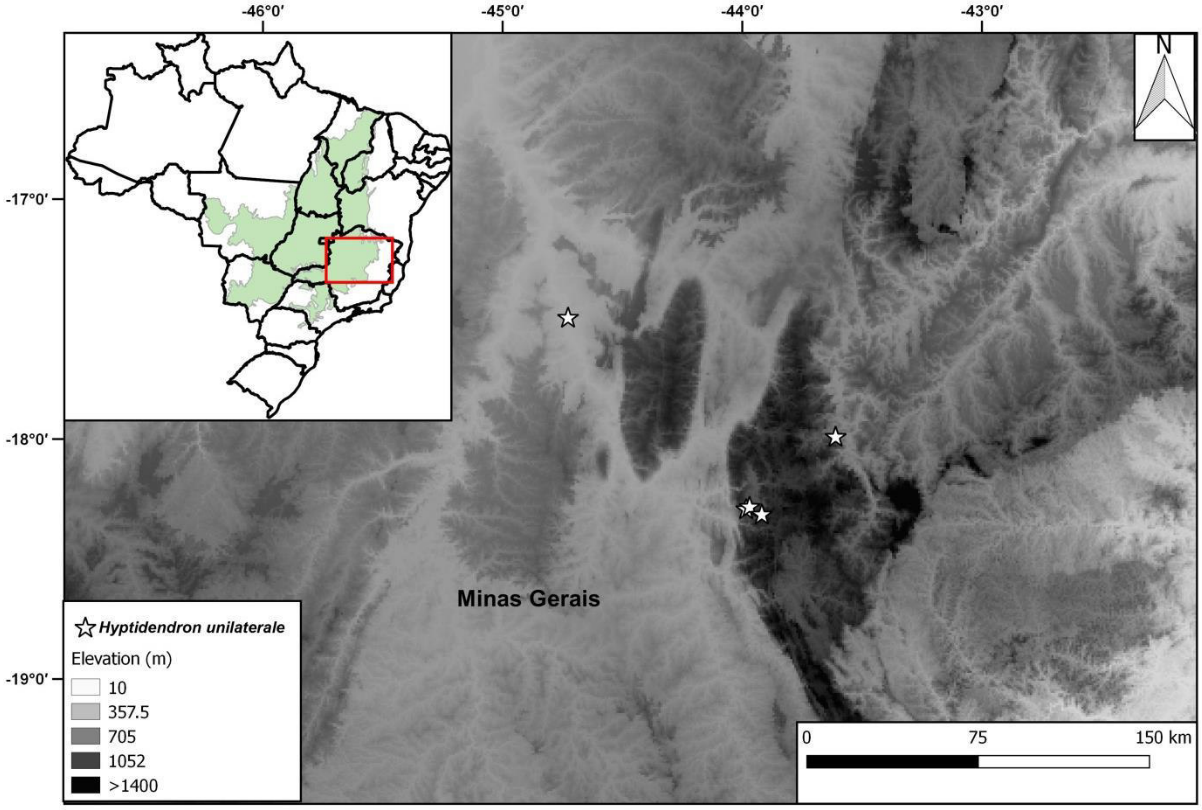

FIGURE 47. Distribution of *Hyptidendron unilaterale* (Epling) Harley. The green shape in the small map shows the extension of the Cerrado Domain.

Selected specimens examined:—BRAZIL. Minas Gerais: Diamantina, 1949, *Brade 13641* (RB); Diamantina, Conselheiro Mata, fazenda Irmãos Cunha, 24 May 1990, *Bacelar 268* (PAMG); Diamantina, Conselheiro Mata., 21 May 1989, *Hatschbach & Nicolack 53048* (K, MBM, MO); Diamantina, estrada Diamantina-Conselheiro Mata, próximo de Conselheiro

Mata, 18°18'59.6"S 43°55'5.3"W, 22 September 2017, *Antar & Chaves 1870* (SPF); Diamantina, estrada Diamantina-Conselheiro Mata, 18°17'4"S 43°58'9"W, 22 September 2017, *Antar & Chaves 1875* (SPF).

3.10. ***Hyptidendron vauthieri*** (Briq.) Harley (1988: 93) ≡ *Hyptis vauthieri* Briquet (1898: 199) ≡ *Mesosphaerum vauthieri* (1898: 199). Type:–BRAZIL. Minas Gerais, Serra do Frio, *A.C. Vauthier 409* (Holotype: G-00441551; Isotypes: P-00737504, K-000488070 [fragment]).

= *Hyptis schwackei* Glaziou (1905: 551) *nomen nudum*.

(Figs. 48, 49 A-C).

Shrubs 0.3−2 m tall, aromatic; stems woody, branched, 3−5 mm diam., younger stems quadrangular, canaliculate, puberulent with tiny gland-tipped hairs, medium gland-tipped hairs and villous with longer uniseriate eglandular hairs, mostly in the apex, sessile glands, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 0.5−4.5 cm long. Cauline leaves spreading along the branches, less commonly congested near the apex, not imbricate, rarely slightly imbricate near the apex, longer than internodes, rarely smaller or with similar size, mostly diminishing in size towards stem apex, lamina 1.2−4.5(−6.4) × 0.8−2.6(−4.4) cm, chartaceous, conspicuously discolorous, with abaxial surface paler, ovate, wide ovate, elliptic, wide elliptic, rarely narrow ovate, narrow elliptic or suborbiculate, base rounded to slightly cordate, sometimes unequal, apex acute, rarely obtuse, sometimes apiculate, apiculus ca. 0.2 mm long, adaxial surface pubescent with small gland-tipped hairs and scattered uniseriate longer hairs, which can be dense and pilose, rarely sessile glands, the veins tomentose with uniseriate hairs, denser in midrib base with small hairs, venation mostly inconspicuous, midrib plane, close to base of lamina, but soon becoming impressed, secondary veins impressed, abaxial surface with indumentum similar to adaxial but denser, especially in veins when it is deeply villous, sometimes whitish lanate, the surface with tiny bullae, venation reticulate, prominent, margin ciliate, crenulate, rarely serrulate, entire just near the base, usually slightly revolute, 8−20 teeth on each side of leaf, with tooth apex swollen, apiculate, acute or obtuse; petiole 0.4−1.8 cm long, canaliculate, densely villous, rarely pubescent, with entangled uniseriate hairs and tiny gland-tipped hairs. Inflorescence not forming a well-define terminal thyrsoid structure, but with dichasial axillary cymes, concentrated near the apex, subtended by bracts, similar to leaves with same shape, sometimes suborbiculate, mostly smaller, indumentum denser, 0.4−2 × 0.3−1.2 cm, mostly slightly longer than cymes, mature cymes 0.9−3.1 cm long, 3−9 flowered, not obscured by bracts or partially obscured by bracts, peduncles (2.2−)3.1−8(−15) mm long, villous/lanate with long uniseriate eglandular hairs, scattered medium size gland-tipped hairs and puberulent with tiny gland-tipped hairs. Flowers with pedicels 0.5−3.3 mm long, with indumentum as on peduncles, and subtended by linear or rarely narrow elliptic bracteoles, 0.7−2.6 × 0.1(−1) mm, pubescent with small brown gland-tipped hairs and scattered long uniseriate eglandular hairs, which can be dense and lanate; calyx at anthesis 4.1−5(−6) mm long, vinaceous to green, tube 2.3−2.8(−3.5) mm long, ± infundibuliform, straight, ribbed, externally lanate/villous with long uniseriate entangled eglandular hairs, scattered gland-tipped hairs and few small sessile glands, denser near the base, tube internally glabrous at base, becoming puberulent with small gland-tipped hairs, and with a faint ring of hairs in throat, calyx lobes subequal, 1.8−2.7(−3.1) mm long, deltate at base, apex long acuminate or subulate, curved, deflexed, rarely straight, externally with indumentum as on tube, internally pubescent with gland-tipped hairs, the margins ciliate with gland-tipped hairs and long uniseriate curved eglandular hairs, calyx in fruit 6.1−9.6(−10.5) mm long, indumentum less dense, tube 4.2−7(−8) mm long, ± cylindrical, expanding near the throat, ribbed, calyx lobes (1.6−)2.3−2.9 mm long, subequal to ± unequal, slightly curved to deflexed, less commonly straight; corolla lilac to bluish, 5.7−7.6

mm long, tube 4.1−5.5 mm long, cylindrical, straight, 0.5−1 mm wide, externally with base glabrous becoming unevenly pilose with long uniseriate hairs and sessile glands, internally with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens and sessile glands in throat and below it, lobes spreading, externally with the same indumentum as tube but with a concentration of sessile glands, lobes internally glabrous, anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair glabrous except by few long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 2.9−3.7 × 1.3−2 mm, obovoid or ellipsoid, not flattened, not winged, castaneous, shiny, glabrous, rugulose, with deep abscission scars, slightly mucilaginous when wetted.

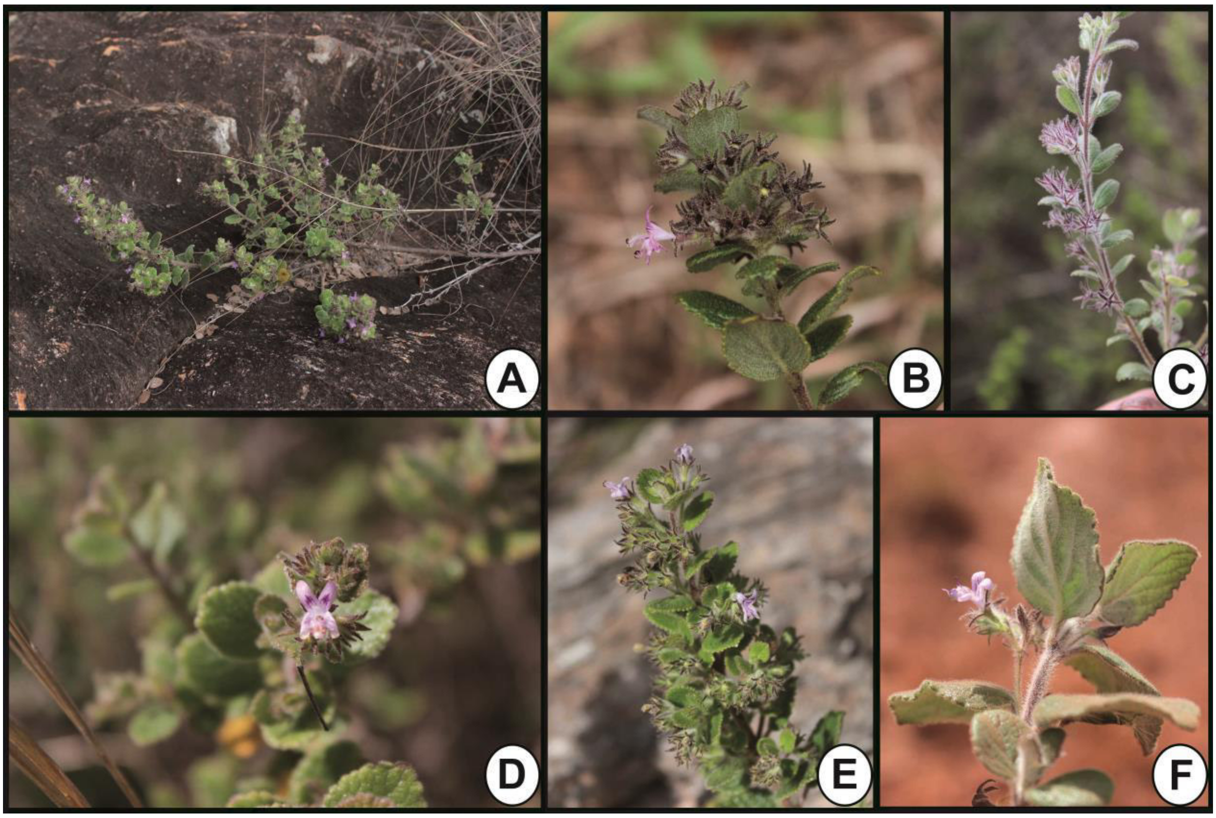

FIGURE 48. Field pictures of *Hyptidendron vauthieri* (Briq.) Harley. **A.** Habit. **B.** Branch bearing leaves and inflorescence. **C.** Branch bearing leaves and inflorescence. **D.** Corolla. **E.**

Branch bearing leaves and inflorescence**.** **F.** Branch bearing leaves and inflorescence. **A-F**. Photos by G.M. Antar.

Phenology:—*Hyptidendron vauthieri* was found in a fertile condition all year round except December and February. However, most of the fertile specimens examined are from May to September coinciding with the dry season.

Distribution and Habitat:—*Hyptidendron vauthieri* is endemic of Minas Gerais state, Brazil (Fig. 50). The type specimen is from Serra do Cipó region but species also reaches Diamantina plateau, where it occurs sympatrically with the morphologically similar *Hyptidendron vepretorum*. In inhabits *campo rupestre* habitats from 1000 to 1380 meters elevation.

Preliminary Conservation Status:—The AOO is 124 km² and the EOO is 17,636 km². *Hyptidendron vauthieri* is known for more than 15 localities and can be found in the protected areas Parque Nacional da Serra do Cipó and Reserva Particular do Patrimônio Natural Brumas do Espinhaço. The conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:— The specific epithet honours the French botanist and entomologist Antonie-Charles Vauthier, who first collected the plant.

Affinities and morphological notes:—*Hyptidendron vauthieri* can be differentiated from all other species of the genera, by a combination of the following characters: 1 nutlets per flower not flattened, not winged, with deep abscission scar, cymes 3−9 flowered somewhat isolated and not forming a well-defined thyrsoid structure with peduncles (2.2−)3.1−8(−15) mm long, calyx tube at anthesis 2.3−2.8(−3.5) mm long with a faint ring of hairs in the throat.

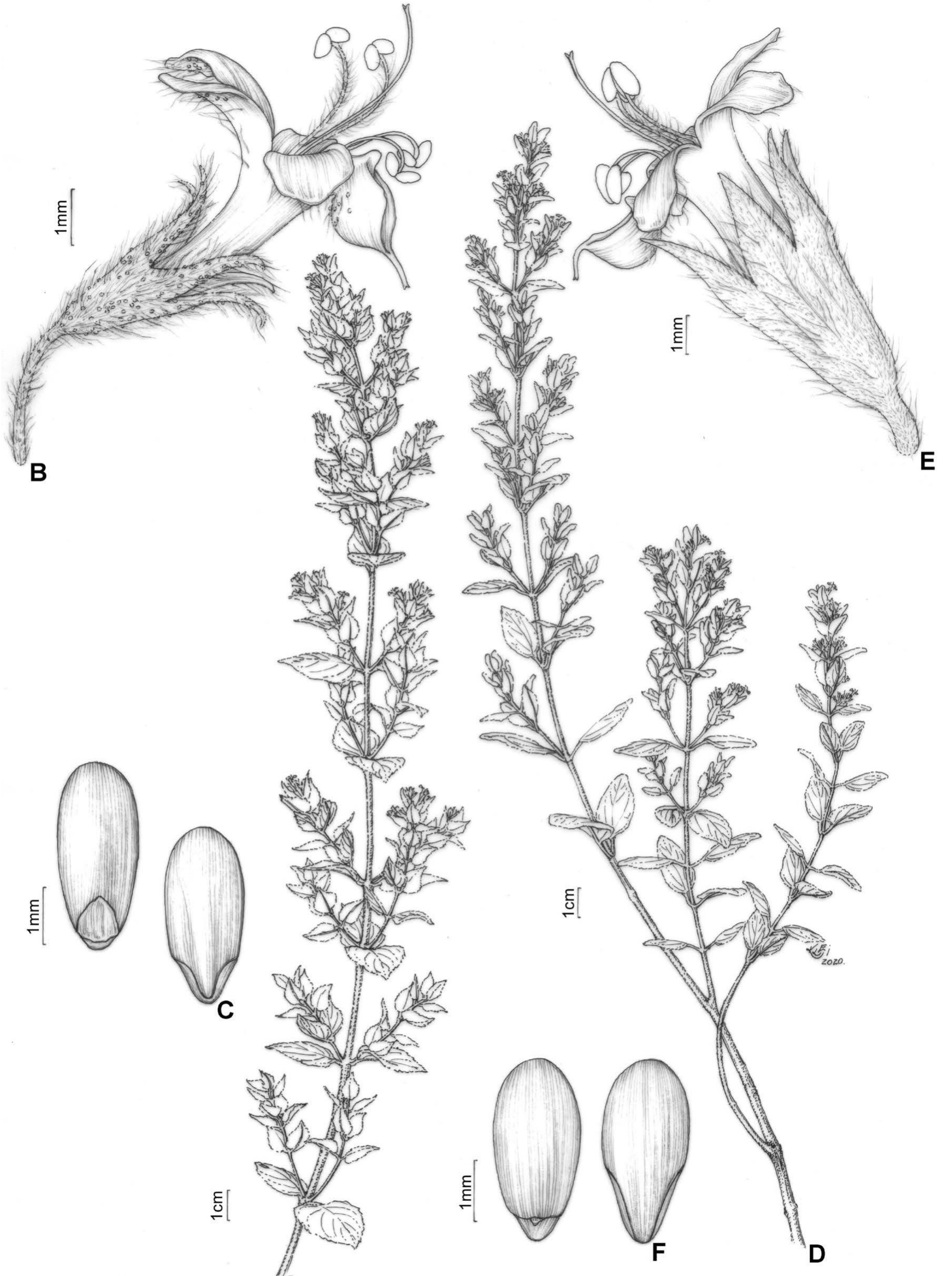

FIGURE 49. Line drawing of *Hyptidendron vauthieri* (Briq.) Harley. **A.** Branch bearing leaves and inflorescenses. **B.** Flower, side view. **C.** Nutlet. Line drawing of *Hyptidendron vepretorum* (Benth.) Harley. **D.** Branch bearing leaves and inflorescenses. **E.** Flower, side view. **F.** Nutlet. Illustration of Klei Sousa.

Its most closely related species is *Hyptidendron vepretorum*, which occurs sympatrically in Diamantina plateau region. Epling (1949) used the indumentum to separate both species, and although the type specimens can be distinguished by that, leaf morphology is variable in both species. This made us considerer synonymizing both species under *H. vepretorum*, the older name, which was discussed by Silva-Luz *et al*. (2012). However, after careful analyses of all of the material available, reproductive features are consistently different between the species and supported our decision to maintain both species. *Hyptidendron vauthieri* differs from *Hyptidendron vepretorum* by 3−9 flowered cymes (vs. 1−3 flowered in H. vepretorum), peduncles (2.2−)3.1−8(−15) mm long (vs. 0.5−2.5(−3.7) mm long), calyx tube at anthesis 2.3−2.8(−3.5) mm long (vs. 2.8−4.6 mm long). *Hyptidendron vauthieri* is also similar to *Hyptidendron arbusculum*, *Hyptidendron rhabdocalyx*, *Hyptidendron dictiocalyx* and *Hyptidendron unilaterale*. Further differences between these species is discussed in table 3.

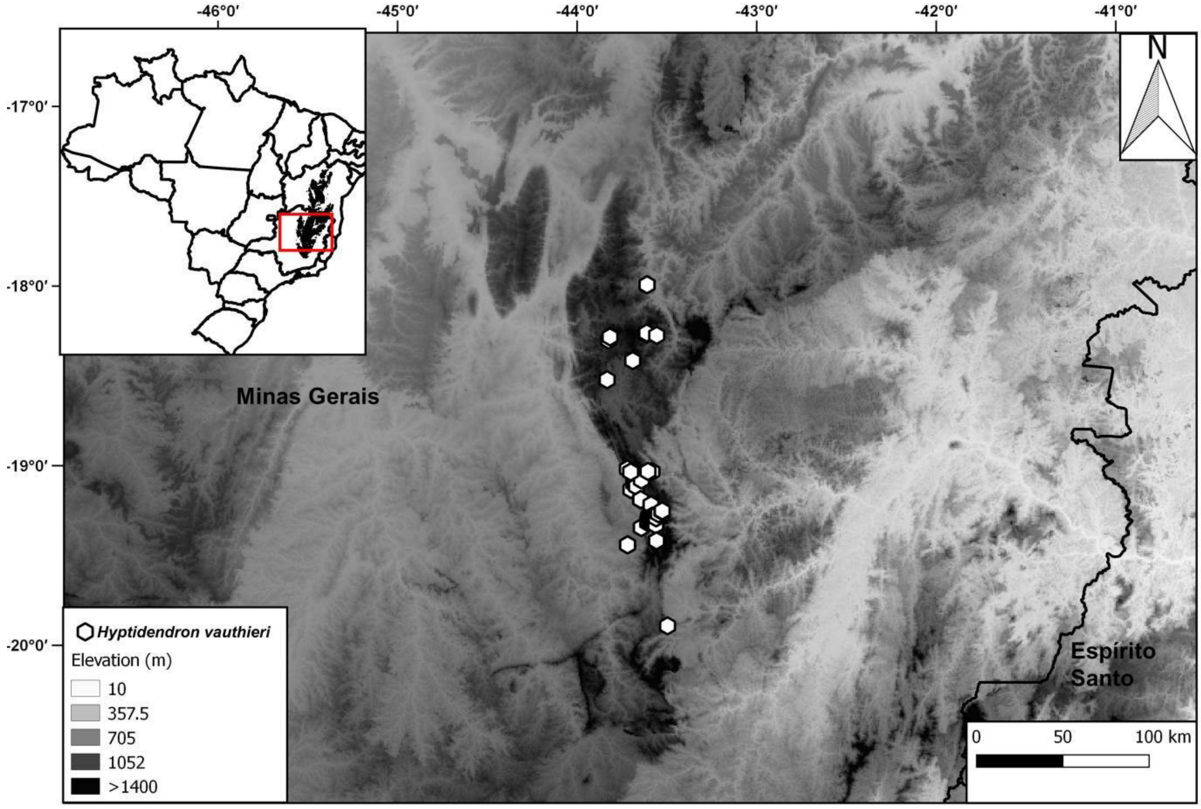

FIGURE 50. Distribution of *Hyptidendron vauthieri* (Briq.) Harley. The black shape in the small map shows the extension of the Espinhaço Range.

Typification and nomenclatural notes:—Glaziou's name *Hyptis schwackei* is considered not validly published as the ''Plantae Brasiliae centralis a Glaziou lectae'' (Glaziou 1911), where those names were published, is listed as suppressed works in the International Code of Nomenclature for algae, fungi, and plants (Turland *et al.* 2018) following the proposal by Mansano and Pederneiras (2016).

Specimens examined:—BRAZIL. **Minas Gerais**: Barão de Cocais, Serra do Garimpo, 30 January 1995, *Brandão 24771* (PAMG); Conceição do Mato Dentro, Serra do Cipó. Estrada para Conceição [Conceição do Mato Dentro], August 1960, *Magalhães 18151* (K, NY, P, UFMT); Diamantina, 18°17'"S 43°49'"W, 18 May 1990, *Arbo et al. 4375* (SPF); Gouvea, Barão de Guaçuí, arredores, 24 July 1998, *Hatschbach et al. 68199* (K, MBM); Jaboticatubas, Serra do Cipó, Chapéu de Sol, 29 April 1952, *Smith et al. 7067* (US); Jaboticatubas, Parque Nacional da Serra do Cipó, Descida da Serra das Bandeirinhas, 28 July 1991, *Giulietti et al. CFSC 12609* (K, NY, SPF); Santana do Riacho, estrada da Usina, 16 August 1979, *Giulietti et al. CFSC 5702* (SP, SPF); Santana do Riacho, Serra do Cipó, rodovia MG 010, Santana do Riacho-Conceição do Mato Dentro, km 112, 19°17'19"S 43°34'19"W, 4 September 2012, *Antar & Antar 126* (SPF); Santana do Riacho, RPPN Brumas do Espinhaço, Ermo do Gerais. Cachoeira do Bicame, 19°1'8"S 43°43'10"W, 15 May 2012, *Andrade et al. 369* (BHZB, CTBS).

3.11. ***Hyptidendron vepretorum*** (Mart. ex Benth.) Harley (1988: 94) ≡ *Hyptis vepretorum* Mart. ex Bentham (1833: 131) ≡ *Mesosphaerum vepretorum* (Mart. ex Benth.) Kuntze (1891:

527) Type:—BRAZIL. Minas Gerais, in campis deserti inter Minas Novas et Rio São Francisco, *C.F.P. von Martius 1498* (lectotype, designated here: M-0111946; isolectotypes: M-0186114, M-0111947).

(Figs. 49 D-F, 51).

Shrubs 0.6−2.5 m tall, aromatic, woody subterranean structure present; stems woody, branched, 2−5 mm diam., younger stems quadrangular, canaliculate, pubescent with tiny gland-tipped hairs, fewer sessile glands, medium size gland-tipped hairs, long uniseriate curved eglandular hairs, which can be dense and villous, older stems terete, not canaliculate, less hairy, with longitudinal grooves, internodes 0.2−4.6 cm long. Cauline leaves spreading along the branches or congested in the apex, not imbricate or imbricate near the apex, longer than internodes, rarely smaller, mostly diminishing in size towards stem apex, lamina 0.7−3.5 × (0.2−)0.5−3 cm, chartaceous to coriaceous, discolorous to slightly discolorous, with abaxial surface paler, elliptic, wide elliptic, narrow elliptic, suborbiculate, ovate, narrow ovate or wide ovate, rarely orbiculate, base cuneate to rounded, less commonly truncate, sometimes unequal, apex acute or obtuse, sometimes apiculate, apiculus ca. 0.5 mm long, adaxial surface pubescent, densely pubescent or rarely villous with gland-tipped hairs and long eglandular uniseriate hairs, denser in the base, main vein, and occasionally secondary veins, which is tomentose, also occasionally ± scabrid with broad-based, rigid, sharp, eglandular hairs scattered on the lamina, venation mostly inconspicuous, midrib prominulous, or plane, close to base of lamina, but soon becoming impressed, secondary veins impressed, abaxial surface pubescent, densely pubescent or rarely villous with gland-tipped hairs and long eglandular uniseriate hairs, denser in the veins, the surface with small bullae between nerves, venation reticulate, prominent, margin ciliate, crenulate or serrulate, entire in the base to 1/3 or 1/2 of leaf margins, sometimes slightly revolute, (1−)3−14 teeth on each side of leaf, with tooth apex swollen, obtuse or acute, hairy; petiole 0.8−7(−15) mm long, canaliculate to slightly canaliculate, pubescent with different sizes gland-tipped hairs, small sessile glands, and long uniseriate eglandular hairs, which can be dense and villous. Inflorescence not forming a well-define terminal thyrsoid structure, but with dichasial axillary cymes, concentrated near the apex, subtended by bracts, similar to leaves with same shape, sometimes suborbiculate, with similar size or slightly smaller, indumentum denser, 0.5−1.6 × 0.2−1.2 cm, mostly smaller than cymes, mature cymes 0.7−1.6 cm long, 1−3 flowered, mostly obscured by bracts, at least partially, peduncles 0.5−2.5(−3.7) mm long, with indumentum as on petioles. Flowers with pedicels 0.5−2.5 mm long, with indumentum as on peduncles, and subtended by linear to rarely narrow elliptic bracteoles, 0.4−2 × 0.1−0.3 mm, with indumentum as on pedicels; calyx at anthesis 4.7−7.8 mm long, green to vinaceous, tube 2.8−4.6 mm long, ± cylindrical broadening near the throat to infundibuliform, straight, ribbed, externally densely pubescent with different height gland-tipped hairs and long uniseriate eglandular hairs, which rarely can be dense and villous, denser near the base, tube internally glabrous at base, becoming pubescent to densely pubescent with small gland-tipped hairs above, and with a faint ring of hairs in throat, formed by long uniseriate hairs, calyx lobes subequal, 1.5−3.4 mm long, deltate, apex acute, acuminate or long acuminate, straight or less commonly curved, externally with indumentum as on tube, internally pubescent with gland-tipped hairs, the margin ciliate with gland-tipped hairs and long uniseriate eglandular hairs, mostly near the apex, calyx in fruit 7.1−10.3 mm long, indumentum less dense, tube (4.5−)6.5−7 mm long, ± cylindrical broadening near the throat, ribbed, calyx lobes 1.3−3.1 mm long, subequal, straight or rarely slightly curved; corolla lilac to purple, 7.1−9 mm long, tube 4.8−7 mm long, ± cylindrical, becoming enlarged after the middle, 0.6−2 mm wide, externally with base glabrous becoming pubescent or rarely villous towards apex with eglandular uniseriate hairs and sessile glands, internally with a ring of villous hairs at base of corolla and with curved entangled non-glandular hairs, close to insertion of posterior pair of stamens and sessile glands in throat and below it, lobes spreading, externally with the same indumentum as tube but with few gland-tipped hairs a concentration of sessile glands, lobes internally with sessile glands, anterior lobe large, boat-shaped with long apiculate apex; posterior pair of stamens with filaments densely villous with long curved, entangled, uniseriate, eglandular hairs, anterior pair with filaments glabrous except by few long, uniseriate hairs near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary and apically with two slender stigmatic lobes. Nutlets 1 per flower, 3−4.1 × 1.5−2 mm, obovoid or ellipsoid, not flattened, not winged, castaneous to dark brown, shiny, glabrous, rugulose, with deep abscission scars, slightly mucilaginous when wetted.

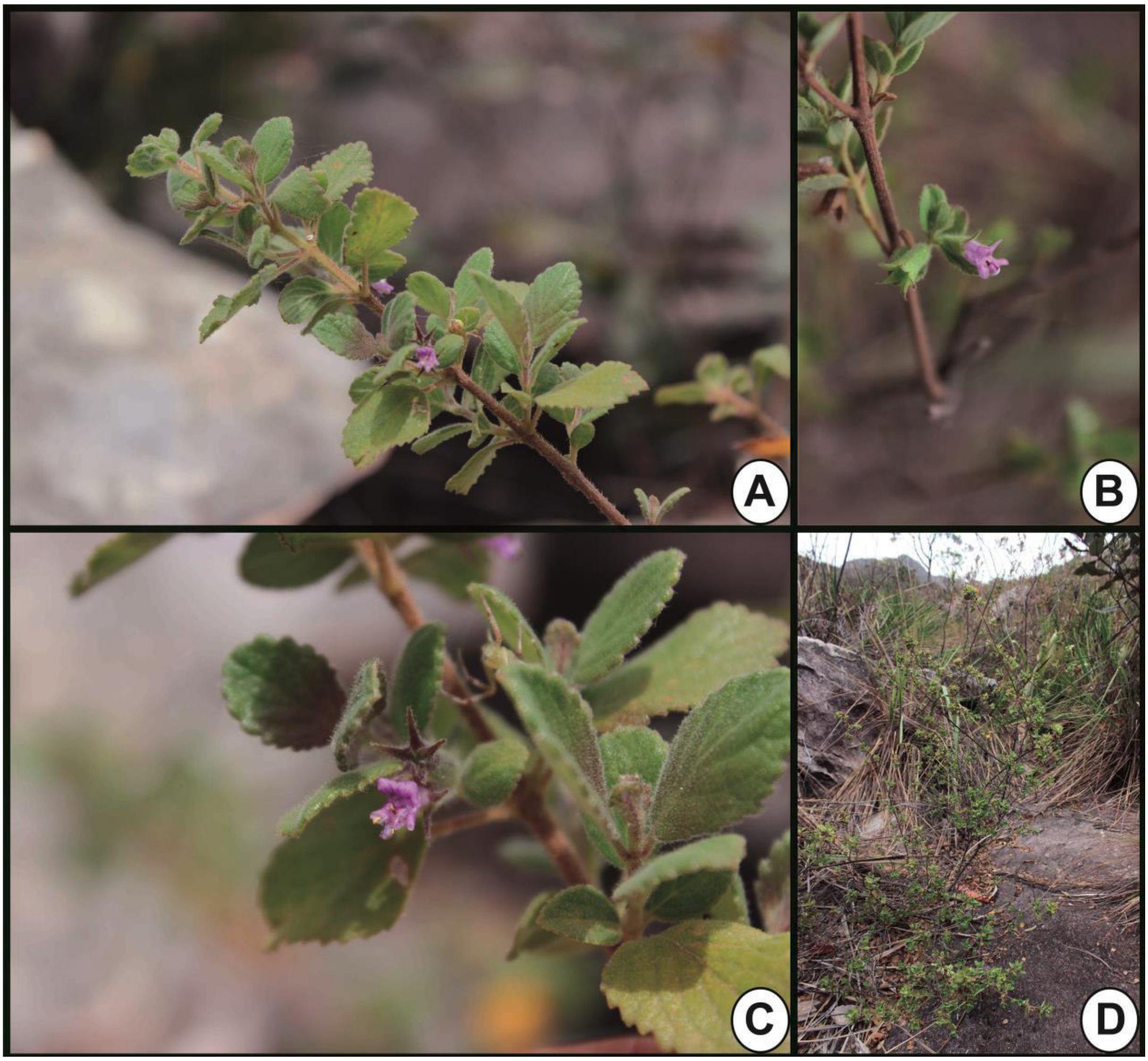

FIGURE 51. Field pictures of *Hyptidendron vepretorum* (Benth.) Harley. **A.** Branch bearing leaves and inflorescence. **B.** Cyme**,** with flower at anthesis. **C.** Branch bearing leaves and inflorescence. **D.** Habit. **A-D**. Photos by G.M. Antar.

Phenology:—*Hyptidendron vepretorum* was found fertile from May to December.

Distribution and Habitat:—*Hyptidendron vepretorum* is endemic to the Diamantina Plateau in the Espinhaço Range, Minas Gerais state, Brazil (Fig. 52). It occurs in *campo rupestre* vegetation and savanna habitats as *campo sujo* and *campo cerrado* from 700 to 1320 meters elevation. It can be very common in its area of occurrence.

Preliminary Conservation Status:— The AOO is 80 km² and the EOO is 16367 km². *Hyptidendron vepretorum* is known for more than 15 localities and can be found in the protected area Parque Estadual de Grão Mogol. The conservation status of this species is assessed as Least Concern according to criteria B1ab(iii)+2ab(iii) (IUCN 2012).

Etymology:— The specific epithet is a reference of the shrubby savanna habitat in which the species occurs.

Affinities and morphological notes:—*Hyptidendron vepretorum* can be differentiated from all other species of the genera, by a combination of the following characters: 1 nutlets per flower, not flattened, not winged, with deep abscission scar, cymes 0.7−1.6 cm long, 1−3 flowered, somewhat isolated and not forming a well-defined thyrsoid structure with peduncles 0.5−2.5(−3.7) mm long, calyx tube at anthesis 2.8−4.6 mm long with a faint ring of hairs in the throat.

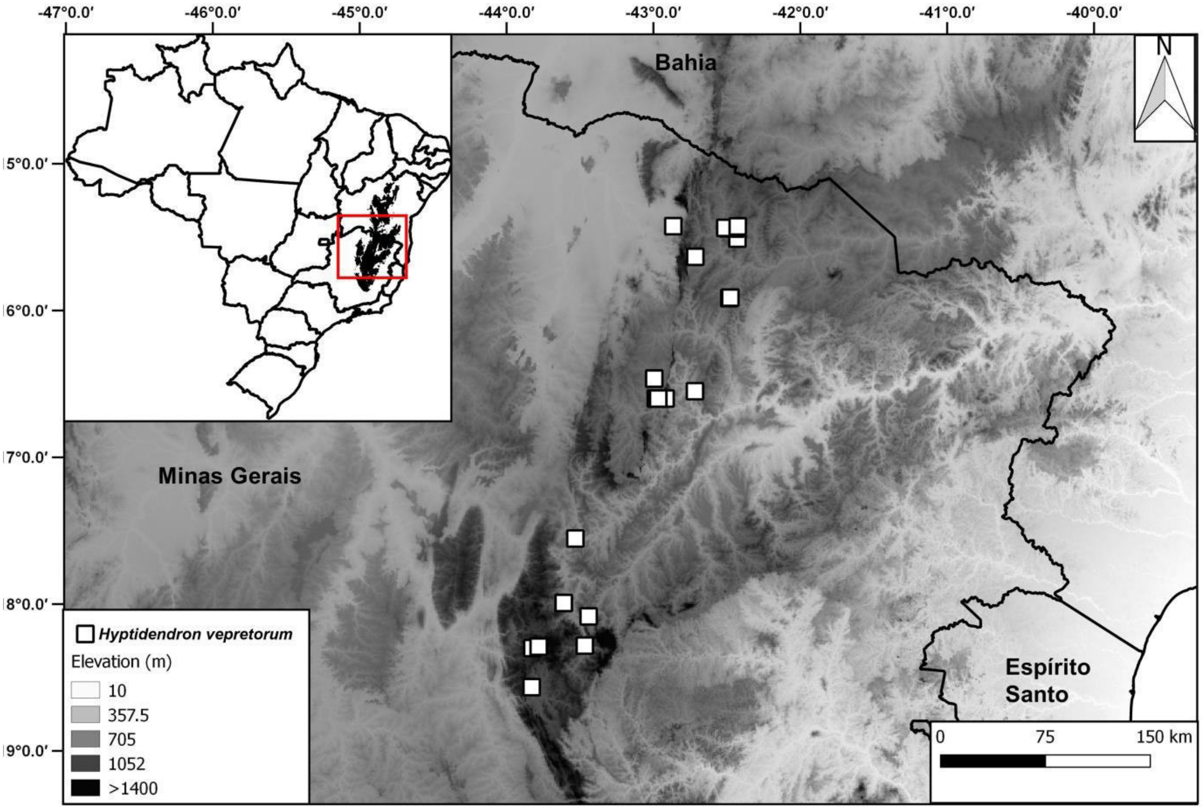

FIGURE 52. Distribution of *Hyptidendron vepretorum* (Benth.) Harley. The black shape in the small map shows the extension of the Espinhaço Range.

The closest related species is *Hyptidendron vauthieri* (see comments under *H. vauthieiri* notes). It is also similar to *H. arbusculum*, *H. rhabdocalyx*, *H. dictiocalyx* and *H. unilaterale*. Further differences between these species is discussed in table 3.

Populations from Felício dos Santos and Couto de Magalhães de Minas municipalities, east of Diamantina municipality, have mostly densely imbricate suborbiculate to orbiculate leaves, which is not common in Diamantina and Grão Mogol municipalities populations (type population). Still, both populations share all other features and are treated here as one species. There are also populations from Rio Pardo de Minas, northern of Dimantina that presents

Typification and nomenclatural notes:—Bentham (1833) when describing *Hyptis vepretorum* states that the type was in M herbarium, what was followed by Epling (1936b).

Still, he didn't point out that there are three specimens at M. Here, we choose as lectotype the one that has the most complete material with Bentham's, Epling's and Harley's handwriting.

Selected specimens examined:—BRAZIL. **Minas Gerais**: Couto de Magalhães, Chapada do Couto, 17 July 1984, *Harley et al. CFCR 4620* (K, SP, SPF); Diamantina, 22 August 2003, *Sano et al. 3057* (SPF); Diamantina, estrada entre Diamantina e Conselheiro Mata, ca. 17 km da Estrada Diamantina-Curvelo, 18°18'2"S 43°49'26"W, 7 July 2001, *Souza et al. 25309* (ESA, HUEFS, K); Diamantina, Parque Nacional das Sempre Vivas, Fazenda do seu Geraldão, acesso por Inhaí, 17°33'14"S 43°31'51"W, 2 May 2000, *Mello et al. 165* (UB); Felício dos Santos, APA Felício, Mata do Isidoro e arredores, 18°17'"S 43°28'"W, 30 August 2008, *Viana et al. 3716* (BHCB, HUEFS); Gouveia, Córrego do Tigre., 5 September 1971, *Hatschbach 27037* (K, MBM, UC, US); Grão Mogol, 20 km ao nordeste da cidade, na estrada para Salinas., 16°33'"S 42°43'"W, 17 October 1988, *Harley et al. 25143* (HUEFS, SPF); Grão Mogol, descida do Morro Papo da Ema para Jambeiro, 15 June 1990, *Pirani et al. CFCR 13107* (K, SPF); Mato Verde, Serra Geral, July 1977, *Magalhães N-976* (PAMG); Rio Pardo

TABLE 3. Diagnostic morphological characters of *Hyptidendron arbusculum* (Epling) Harley, *Hyptidendron dictiocalyx* (Benth.) Harley, *Hyptidendron rhabdocalyx* (Benth.) Harley, *Hyptidendron vauthieri* (Briq.) Harley, *Hyptidendron vepretorum* (Benth.) Harley.

Character	*H. arbusculum*	*H. dictiocalyx*	*H. rhabdocalyx*	*H. vauthieri*	*H. vepretorum*
Leaf abaxial surface	without bullae	present	present	present	present
Leaf margin	serrulate	serrulate	mostly serrulate	crenate, rarely serrulate	crenulate or serrulate
Number of teeth on each side of leaf	2−7	(1−)2−5(−6)	12−36	8−20	(1−)3−14 teeth
Blade base	rounded, rarely cordate or truncate	rounded, rarely truncate or cordate	rounded to cordate	rounded to cordate	cuneate or rounded, rarely truncate
Flowers per cyme	1−3	3−5(−6)	(3−)4−12	3−9	1−3
Peduncle lenght (mm)	(1−)1.6−4.5	(2.6−)3−5.5	2.8−6	(2.2−)3.1−8(−15)	0.5−2.5(−3.7)
Pedicels lenght (mm)	0.5−2	1−3.5(−4.5)	(1.5−)2.1−5	0.5−3.3	0.5−2.5
Calyx lobes	straight	straight	straight	curved	straight or curved
Calyx tube at anthesis lenght (mm)	3.6−5	2.2−3.1	2.5−3.9	2.3−2.8	2.8−4.6

de Minas, Areião II, 15°26'32"S 42°26'29"W, 6 November 2006, *Sevilha et al. 4821* (CEN, SPF).

Doubtful names

=*Hyptis leucochlora* Briq., Annuaire Conserv. et Jard. Bot. Genève 2: 196. 1898

Briquet (1898) described *Hyptis leucochlora* based on an unnumbered specimen of Claussen in G. In the protologue, the species was compared with *Hyptis cana* (*Hyptidendron canum*). Epling (1936b, 1949) places it as a synonym of *Hyptis salviaefolia* (*Eriope salviifolia*) stating that he had seen the type specimen. Harley (1976) in his revision of *Eriope* makes no mention of *H. leucochlora* in the synonym of *Eriope salviaefolia* and later placed it as a synonym of *Hyptidendron canum* (BFG 2015). We tried to locate the type specimen of *Hyptis leucochlora* in G without success. In view of that we preferred to maintain the name as doubtful.

Final remarks

This study presents a taxonomic revision of *Hyptidendron*, a genus that was recently the target of a phylogenetic study (Antar *et al.* in prep). 22 species are recognized in *Hyptidendron*, representing 63 validly published names and 3 *nomina nuda*. The difficulties in finding well-defined characters with low intraspecific variation for defining species are clear throughout this treatment. However, the wide analysis of herbarium collections, bibliographic revision and field observations, with the available data supported by phylogenetic (Antar *et al.* in prep), anatomical studies (Antar *et al.* in prep) and careful morphological analyses provided a satisfactory arrangement of the taxonomy and supports the recognition of this 22 species. Further studies encompassing more material, chemical data, phylogeographical data, morphometry and details in ecology are desirable to test the hypothesis of the current circumscription of each species, and may provide novelties in the recognition of the taxa.

It is important to highlight the use of other sources of evidence for this taxonomic monograph. The phylogenetic results (Antar *et al*. in prep) helped in the circumscription and placement of the species, what was critical for the positioning of *Hyptidendron pulcherrimum* (see comments above) in *H*. sect *Hyptidendron*. Venation anatomy also brought important results for the taxonomy of the genus (Antar *et al*. in prep) and helped in the description of *Hyptidendron cerradoense*. Future studies in the pollen morphology (Carvalho *et al*. in prep) and flower anatomy may be important for *Hyptidendron* taxonomy and help to support the decisions made in the present study.

Epling (1949) is the last taxonomic revision of the species that are now part of *Hyptidendron*. In this work, Epling (1949) recognized 16 taxa (including *Hyptis cymosa* a *nomen nudum*) based on 92 examined specimens, being eight species based on a single gathering. Our revision recognizes 22 species based on 1,111 specimens, none of those based on just one gathering (*Hyptidendron dorothyanum* is based on two collections). These results support the need of updated taxonomic revisions, which in the light of more material and different techniques, can bring considerable differences in species circumscription and delimitation. However, some of the species treated in this revision, as *Hyptidendron roseum* and *H. pulcherrimum*, are known for just few recent collections and are species with restricted distribution. In face of that, it is possible that future exploration, mostly in Brazilian Cerrado, with a lot of poorly collected areas (e.g. Antar & Sano 2019), may unravel other new taxa for the genus.

The Cerrado domain, which encompasses most of the diversity of the genus, is currently facing and unprecedented area loss, with already 50% of its original area suppressed (Beuchle *et al*. 2015), which could lead to a huge biodiversity loss (Strassburg *et al*. 2017). Besides, some areas of the domain still are not satisfactorily known (e.g. Antar *et al*. 2018; Antar & Sano 2019) and demand more collections in order to plan well-based conservation plans for the domain.

As noted above, in the course of our studies a great number of specimens were identified and five new species were described (Harley & Antar 2017; Antar *et al*. 2019a, in press, in prep). These results support the importance of plant taxonomists, mostly in the Neotropics, where the plant diversity is still not entirely known and a great amount of herbaria specimens are usually not identified (Little *et al*. 2020). This taxonomic revision highlights the need for alpha taxonomy and fieldwork to be conducted in the Neotropics. Although funding and credibility for these are scarce, without alpha taxonomy no accurate conservation measurements or evolutionary and biogeographic studies are possible.

Other taxonomic studies of Hyptidinae are imperative and demand urgency, due to anthropogenic impact in most of the subtribe distribution and the expected loss of species.

Acknowledgements

The curators of the herbaria visited, with a special thanks to Roselaine Borges (UFMT) Thiago Flores (ESA), Teonildes Nunes (HUEFS), Marcelo Simon (CEN), Matthew Pace (NY), Juarez Cordeiro (MBM), Mark Strong (US), Mike Hopkins and Mariana Mesquita (INPA), Nicolas Fumeaux (G), Federico Fabriani (K) and Peter Philipson (P). Beatriz Marimon, Daniel Chaves, Gustavo Mariano Rezende, Matheus Fortes Santos, Ronaldo Santos, Heloisa H.P.M. Antar, Heitor Bispo and his sons, Luiz Henrique Fonseca, Matheus

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Appendix 1. Index to Species accepted and numbered collections studied. Arranged by alphabetical order of collector surname (followed the initials when available in the label). Gatherings of each collector are arranged by ascending order of collection number. The parenthesis indicates the species identity (only correct names are used). Types are not cited.

List of species

1. *Hyptidendron* sect. *Hyptidendron*

1.1. *Hyptidendron arboreum*

1.2. *Hyptidendron asperrimum*

1.3. *Hyptidendron canum*

1.4. *Hyptidendron conspersum*

1.5. *Hyptidendron dorothyanum*

1.6. *Hyptidendron leucophyllum*

1.7 *Hyptidendron pulcherrimum*

2. *Hyptidendron* sect. *Latiflorae*

2.1. *Hyptidendron amethystoides*

2.2. *Hyptidendron eximium*

2.3. *Hyptidendron glutinosum*

2.4. *Hyptidendron rondonicum*

3. *Hyptidendron* sect. *Umbellaria*

3.1. *Hyptidendron albidum*

3.2. *Hyptidendron arbusculum*

3.3. *Hyptidendron caudatum*

3.4. *Hyptidendron cerradoense*

3.5. *Hyptidendron claussenii*

3.6. *Hyptidendron dictiocalyx*

3.7. *Hyptidendron rhabdocalyx*

3.8. *Hyptidendron roseum*

3.9. *Hyptidendron unilaterale*

3.10. *Hyptidendron vauthieri*

3.11. *Hyptidendron vepretorum*

Specimens examined

Abrahim, M.A. 4 (3.3). Aglio, F.J.C. 25 (1.2). Almeida, E.F. 172 (1.3). Almeida, S. 501 (1.1). Alonso, A.M. R1172 (1.3). Altson, A.H.G. 532 (1.1). Alverson, W.S. 109 (1.1). Alves, A.S.S. 487 (1.3); 533 (1.3); 565 (1.3); 599 (1.3). Alves, R.J.V. 1356 (1.3); 1390 (1.2); 5935 (1.3); 7225 (1.3); 990 (1.2). Amaral, D.L. 51 (2.4). Amorim, E.H. 675 (1.3). Andrade, A.G. 1020 (1.3). Andrade, I.R. 369 (3.10). Andrade, P.M. 1266 (1.2). Antar, G.M. 126 (3.10); 1428 (3.5); 1429 (3.5); 1432 (3.5); 1433 (3.5); 1437 (1.2); 1539 (3.2); 1547 (2.1); 1612 (1.4); 1630 (3.10); 1634 (3.10); 1650 (3.10); 1684 (3.10); 1705 (1.2); 1729 (1.3); 1746 (3.8); 1760 (3.8); 1770 (1.3); 1822 (2.1); 1839 (2.1); 1865 (1.3); 1870 (3.9); 1875 (3.9); 1923 (1.6); 2377 (1.2); 2417 (1.3); 2727 (1.4); 2774 (1.4); 459 (1.4). Antunes, E.C. 283 (1.3); 310 (1.3). Aoki, C. 25 (1.3). Aparecida-da-Silva, M. 1149 (1.3); 1257 (2.1); 1367 (2.1); 2058 (3.3); 3804 (3.4); 3879 (1.3); 8284 (1.3); 8389 (3.6). Appun, C.F. 1071 (1.1). Araújo, F.S. 1197 (2.1). Arbo, M.M. 4238 (3.10); 4375 (3.10). Árbocz, G.F. 4061 (2.2); 6223 (1.4). Archer, W.A. 5014 (3.10). Argenta, J. 196 (1.3). Argôlo, A. 262 (1.3). Arruda, R. 72 (1.3). Assis, L.C.S. 203 (1.3); 246 (1.2); 547 (1.2). Atui, J.P. 4 (3.10). Aymard, G.C. 2426 (1.1); 4580 (1.1). Azevedo, M.L.M. 868 (1.3). Bacelar, M. 268 (3.9). Badillo, V.M. 6209 (1.1). Bang, M. 836 (1.1). Barbosa, M. 2188 (1.2). Barkley, F.A. 35405 (1.1); 38C541 (1.1). Barreto, K.D. 2707 (1.3). Barros, D. 1019 (1.2). Barros, F. 1171 (1.3). Battaglia, A.E. 6 (1.3). Beck, G. 13630 (1.1); 24896 (1.1); 24912 (1.1); 28332 (1.1). Belém, R.P. 1234 (1.2). Bernardi, A.L. 16853 (1.1); 6743 (1.1).

Bianchetti, L.B. 897 (1.3). Bittencourt-Jr, N.S. 00-75 (1.2). Boeke, J.D. 2101 (1.1). Boff, S. 15 (1.3). Boldrim, M. 4038 (3.4). Borges, S.R. 10 (1.3). Bortolotto, I.M. 332 (1.3); B153 (1.3); B343 (1.3); B371 (1.3). Bosquetti, L.B. 382 (1.3); 919 (1.3). Brade, A.C. 11842 (1.3); 13402 (1.3); 13641 (3.9); 9740 (1.2). Brandão, M. 10740 (1.3); 12603 (3.1); 18482 (3.1); 19556 (1.2); 24467 (1.2); 24771 (3.10); 25002 (1.2); 25996 (1.6); 26162 (1.6); 8279 (1.3). Brandão, M.M.V. 349 (3.3). Brant, A.E. 1517 (1.1). Brazão, J.E.M. 266 (1.3). Bridgewater, S. S350 (1.3); S351 (1.3); S352 (1.3); S353 (1.3). Bringel, J.B.A. 1322 (3.3); 188 (1.3). Bucci, F. 1382 (3.4). Bunting, G.S. 4754 (1.1). Burchell, W.J. 5234 (1.3); 5374 (1.3); 5897 (1.3). Burkhardt, E. 50 (1.3). Calago, K. 172 (3.3). Caldeira, F.M. 1970 (1.3). Calió, M.F. 8 (3.10). Callejas, R. 9003 (1.1). Campos, M.T.V.A. CFSC13371 (1.2); CFSC13402 (1.2). Cardona, F. 1834 (1.1); 2586 (1.1). Carvalho-Silva, M. 243 (1.3). Carvalho, W.A.C. 66 (1.2). Casaretto, G. 2757 (1.2); 2760 (1.3); 2951 (3.5). Castillo, G.A. 976 (1.1). Castro, G.C. 144 (1.2); 145 (1.2). Castro, R.M. 3038 (1.2); 601 (1.2). Cavalcanti, T.B. 1725 (1.3); 654 (3.3); 751 (3.6); 794 (1.3); CFCR8269 (1.3); CFSC9931 (1.3). Ceccantini, G. 2916 (1.3); 3181 (1.3). César, J.F.G. 14 (2.1). Cezare, C.H.G. 120 (1.3). Christenson, G.M. 1151 (1.3). Chukr, N.S. CFSC9829 (3.10). Cid, C.A. 4354 (2.3). Clarke, H.D. 1160 (1.1). Claussen, P. 1059 (1.3); 1060 (1.3); 1061 (1.3); 1566 (1.2); 176 (1.2); 213 (1.2); 214 (1.2); 223 (1.3); 54 (1.2); 566 (1.2). Conceição, C.A. 1597 (1.3). Coons, M.P. 77-1237 (1.2). Coradin, L. 5671 (3.3). Cordeiro, I. 597 (1.2); CFSC6422 (3.10). Cordeiro, J. 5080 (1.6). Costa, R.C. 239 (2.1). Cota, M.R.C. 1 (1.2); 16 (1.2); 17 (1.2); 18 (1.2); 19 (1.2); 20 (1.2); 21 (1.2); 28 (1.2). Croat, T.B. 54257 (1.1); 94486 (2.2). Cunha, L.H.S. 702 (1.3); 95 (1.3). Cupertino, M.A. 69 (1.2). Daly, D.C. 6055 (1.1). Damaso, P.P. 98 (1.3). Damazio, L. 1060 (1.3); 1355 (1.2); 1657 (1.2); 1759 (1.2). Daniel, B. 2198 (1.1). Davidse, G. 22656 (1.1); 22929 (1.1); 4793 (1.1). Davis, P.H. 2271 (1.3); 59704 (1.2); 60191 (1.3); 60247 (3.3); 60249 (1.3). Deguchi, K. B1596 (1.3). Delprete, P.G. 10230 (1.3). Dias, T.A.B. 168 (3.3); 687 (1.3). Domingos, D.Q. 1080 (1.3); 1089 (1.3). Duarte, A.P. 10411 (1.6); 1387 (2.1); 2665 (3.10); 2791 (1.3); 3829 (1.3); 631

(3.3); 8323 (3.3); 8899 (1.3); 9285 (1.6); 9852 (3.3). Duarte, L. 119 (3.3); 986 (1.2). Egler, W.A. 824 (1.5). El Ottra, J.H.L. 8 (3.10). Emmerich, M. 5798 (2.3). Farah, F.T. 1077 (1.3). Faria, G.M. 90 (3.10). Faria, J.E.Q. 1596 (3.3); 2727 (3.3); 2815 (1.3); 4711 (1.3); 5874 (3.10); 5893 (3.10); 6436 (1.3); 6599 (1.3). Farinaccio, M.A. 336 (1.3). Fernandes, F.M. 422 (1.3). Fernandes, M.G.C. 1628 (3.10). Ferrari, G. 1475 (1.1). Ferreira-Júnior, C.A. 602 (3.10). Ferreira, C.D.M. 375 (1.2). Ferreira, F.M. 208 (1.3); 862 (1.3); 876 (1.3). Ferreira, H.D. 2562 (1.3); 3296 (1.3); 3298 (1.3). Ferreira, M.B. 1586 (3.3); 5189 (1.3); 5347 (1.2); 5440 (1.3). Flores, A.S. 2791 (1.1); 2807 (1.1). Flores, T.B. 1307 (1.2); 839 (1.6). Folli, D.A. 6717 (1.2). Fonnegra, R. 2247 (1.1); 2603 (1.1); 3102 (1.1); 6300 (1.1); 6317 (1.1). Fonseca, C.A. 972083 (1.3). Fonseca, M.L. 2758 (2.1); 2872 (3.6); 4851 (1.3); 5518 (3.6); 5572 (2.1). Fonseca, S.G. 875 (1.3). Fonseca, W.N. 428 (2.1). Fontella, J. 3419 (3.3). Fontellah, J.P. 9 (3.3). Forero, E. CFSC8900 (3.10); CFSC8950 (1.3); CFSC9001 (1.3). Forzza, R.C. 1888 (1.2); 4233 (1.2); 977 (1.2); RCF107 (3.10). França, F. 3691 (2.1); 5982 (2.1). Francisco, R.T. 1 (2.4). Freire, G.Q. 153 (1.3). Fuentes, A. 6668 (1.1). Furlan, A. 6443 (1.2). Garces, W.S. 87 (1.3). Gardner, G. 5100 (1.3); 5107 (1.2). Gavilanes, M.L. 1625 (1.3); 2254 (1.3); 2346 (1.3); 3167 (1.3); 3185 (1.3); 4691 (1.3); 5453 (1.3); 5847 (1.3); 659 (1.3). Gentry, A.H. 10507 (1.1). Gibbs, P.E. 2658 (1.3); 5483 (1.3). Giroldo, A.B. 274 (1.3). Giulietti, A.M. CFCR1842 (3.11); CFCS12678 (1.3); CFSC12609 (3.10); CFSC12612 (3.10); CFSC5630 (1.2); CFSC5702 (3.10); CFSC7385 (1.3); CFSC7415 (3.10). Glaziou, A. 13035 (1.2); 13055 (1.2); 13103 (1.3); 14154 (1.3); 15286 (3.5); 15338 (1.3); 15339 (1.3); 15340 (1.2); 15388 (1.3); 19688 (3.10); 21916 (1.3); 3706 (1.2); 8179 (1.2). Goes, O.C. 57 (1.2); 978 (1.2). Gomes-Klein, V.L. 2841 (1.3); 7309 (1.3). Gonella, P.M. 642 (1.7); 800 (1.7). Gonzaga, D.R. 597 (3.5). Goodland, R. 100 (1.3); 3533 (1.3); 3547 (1.3); 3902 (1.3); 520 (2.3). Graham, J.G. 6009 (1.1). Guarim-Neto, G. 1269 (1.3). Guarino, E.S.G. 313 (1.3); 783 (1.3). Guedes, M.L. 22060 (1.3). Guerin, N. 14 (1.3). Guilherme, F.A.G. 787 (1.3). Guimarães, J.G. 241 (2.3). Gutierrez, G. 35655 (1.1). Hahn, W. 5654 (1.1). Harley, R.M. 10803 (2.2); 11511 (2.3);

20418 (2.3); 24840 (1.3); 25143 (3.11); 25264 (1.2); 28179 (1.3); 53867 (1.4); 55165 (1.3); 56523 (1.4); 56555 (2.1); 56587 (1.4); 56691 (1.4); CFCR4444 (1.6); CFCR4540 (1.3); CFCR4620 (3.11); CFCR6455 (1.6). Hashimoto, M.Y. 2979 (3.6). Hatschbach, G. 21764 (1.3); 21778 (1.3); 26975 (1.2); 27037 (3.11); 27248 (1.3); 27388 (3.10); 27503 (1.2); 29846 (3.10); 31909 (2.3); 32492 (1.3); 32506 (1.3); 36971 (3.3); 38733 (1.3); 40048 (1.3); 42327 (2.1); 44665 (3.10); 45155 (1.2); 49748 (1.2); 50531 (2.1); 53048 (3.9); 53088 (3.10); 54207 (1.6); 55913 (3.3); 57936 (1.2); 59310 (3.3); 62842 (2.3); 63250 (1.3); 63451 (1.3); 66389 (3.1); 66410 (3.7); 66545 (1.3); 67956 (1.6); 68199 (3.10); 72255 (3.9); 73446 (1.3); 73629 (1.3); 78829 (3.1); 78856 (1.3); 79301 (1.3). Henkel, T.W. 5585 (1.1); 5762 (1.1); 779 (1.1). Henrique, M.C. CFSC7618 (1.2). Hensold, N. CFCR2901 (3.5). Heringer, E.P. 14987 (1.3); 1799 (1.3); 18648 (1.3); 1922 (1.3); 3491 (1.3); 3975 (1.3); 3998 (1.3); 5246 (1.3); 6557 (1.3); 7202 (1.3); 7214 (1.3). Hoehne, F.C. 6120 (1.3). Hoffman, B. 1130 (1.1). Hokche, O. 829 (1.1). Holst, B.K. 2231 (1.1). Horta, M. 506 (1.2). Huber, O. 11349 (1.1); 11968 (1.1); 7230 (1.1); 7515 (1.1); 9118 (1.1). Irwin, H.S. 16164 (2.3); 16481 (2.3); 18116 (3.3); 2115 (1.2); 28970 (3.5); 30529 (1.2); 31685 (3.3); 5283 (1.3); 6049 (1.3); 6264 (1.3); 8193 (3.3). Jenman, G.S. 38 (1.1). Joly, A.B. 108 (3.10); 1434 (3.10); 2493 (3.10); 2514 (3.10); 2554 (3.10); 2564 (3.10); 2911 (3.10); 3025 (3.10); 3082 (3.10); 4544 (1.3); 58 (3.10). Julkoski, D. 157 (1.2). Junqueira, D.I. 483 (1.3). Kalbreyer, G. 1288 (1.1). Kameyama, C. CFSC10481 (3.10). Kamino, L.H.Y. 1135 (1.2). Kawasaki, M.L. 882 (1.3). Kinoshita, L.S. 10--6 (1.3). Kirkbride-Jr, J.H. 4351 (1.3). Koch, A.K. 559 (2.4). Koczicki, C. 292 (1.2). Kollmann, L. 9906 (1.2). Koyama, T. 7431 (1.1); 7510 (1.1). Krapovickas, A. 40251 (2.3). Krieger, L. 15123 (1.2); 22239 (1.2); 9117 (1.3); 9274 (1.2); 9626 (1.2); CESJ20261 (1.3); CESJ22551 (1.2); CESJ29402 (1.3); CESJ7092 (1.2). Kuhlmann, J.G. 2589 (1.2); 49 (1.2). Labouriau, L. 1017 (1.2); 724 (1.3). Laca 1570 (1.3). Ladeira, J. 527 (1.2). Lanna-Sobrinho, J.P. 244 (1.3). Lasser, T. 1422 (1.1). Lehmann, F.C. 7924 (1.1). Leitão-Filho, H.F. 14162 (1.3); 5962 (1.3); 8130 (1.3). Leite, R.L.R.M. 18 (1.3). Lemes, E. 102 (1.3). Leoni, L.S. 1180 (1.2); 2621 (1.2);

2631 (1.2); 2649 (1.2); 6278 (1.2); 7537 (1.2). Liesner, R. 19280 (1.1); 23742 (1.1). Lima, F.M. 120 (1.3). Lima, H.C. 1306 (1.2). Lima, J.P.S. 79 (1.3). Lima, L.R. 514 (1.2). Lolis, S.F. 156 (1.4). Lombardi, J.A. 4044 (1.2). Luan, S. 46 (1.2). Luchi, A.E. 18 (1.2); 5 (1.2); CFSC9120 (1.2). Lund, P.W. 1839 (1.3). Macedo, A. 2440 (1.3); 2493 (1.3); 404 (1.3). Macedo, J.F. 1026 (1.3); 2954 (1.3); 4295 (1.3). Macedo, M. 1789 (1.3). Macedo, W. 93 (1.3). Magalhães, M. 15583 (1.2); 18151 (3.10); 18383 (1.6); 522 (1.2); 541 (1.2); N976 (3.11). Maguire, B. 33187 (1.1); 33661 (1.1); 40313 (1.1); 40340 (1.1); 45948 (1.1); 46141 (1.1); 49052 (1.2); 56374 (1.3). Maldonado, C. 2398 (1.1); 2494 (1.1); 2564 (1.1). Manhães, M.A. 46 (1.2). Mantovani, W. 110 (1.3); 118 (3.10). Marcondes-Ferreira, W. 344 (1.3); 347 (1.3). Martinelli, G. 11168 (1.6). Martins, F.R. 16208 (1.3). Martins, R.C. 464 (3.6). Martius, C.P.V. HFB1203 (1.2). Maruyama, A. 418 (1.3). Matos, J.S. 2 (1.3). Matos, M.E.R. 3 (1.3). Matoso, S. 45 (1.3). Mattos-Filho, A. 392 (3.3); 427 (1.3). McPherson, G. 13301 (1.1). Mello-Barreto, H.L. 3089 (1.3); 3090 (1.3); 3095 (1.3); 3097 (1.3); 3098 (1.3); 3124 (1.2); 3125 (1.2); 336 (1.3); 514 (1.3); 8142 (1.2). Mello-Silva, R. 1420 (3.11); 2934 (1.2). Mello, F.N.A. 390 (1.3). Mello, L.E. 2238 (3.10); 2263 (1.3); 3476 (1.3); 3686 (1.3). Mello, T.R.B. 165 (3.11). Melo-Pinna, G.F.A. 13 (1.6). Melo Jr., J.C.F. 579 (1.3). Melo, E. 10373 (2.1); 10384 (2.1); 10403 (2.1); 12883 (1.3); 343 (3.3). Melo, P.H.A. 4039 (1.2). Menandro, M.S. 132 (1.2); 241 (1.2). Mendes, S. 1010 (1.3); 1018 (1.3); 1029 (1.3); 1049 (1.3); 217 (1.3); 260 (1.3); 84 (1.3); 931 (1.3); 987 (1.3). Mendonça, R.C. 3656 (1.3); 3677 (1.3). Menezes, N.L. 687 (3.10); 699 (3.10); 700 (1.2); 704 (1.3); CFSC6165 (3.10). Messias, M.C.T.B. 496 (1.2). Mexia, Y. 5050 (1.2). Miers, J. 161 (1.1). Milliken, W. 5103 (1.2). Miranda, G.M. 46 (1.3). Monge, M. 1262 (1.2). Monteagudo, A. 15884 (1.1). Monteiro, H. 3658 (1.3). Moore, H.E. 9626 (1.1). Morais, A.S. 7 (1.2). Morais, I.L. 5005 (1.3). Moreira, O.S.T. 24592 (1.2). Mori, S.A. 11318 (1.2); 16897 (1.3). Mostacedo, B. 1769 (2.3); 1850 (2.3). Mota, N.F.O. 383 (1.2). Moura, T.M. 303 (1.3). Mutchnick, P. 1391 (1.1); 1411 (1.1); 1418 (1.1); 318 (1.1). Nakajima, J.N. 4575 (1.2). Nelson, B.W. 387 (2.4). Neto, S.D. 193 (1.3). Neves, D.M. 1413

(1.2). Nobrega, M.G. 1901 (1.3). Nogueira, R.E. 36 (1.2). Occhioni, P. 1873 (1.3); 3581 (1.3); 3669 (1.3); 5029 (1.3); 5810 (1.3). Oliveira, F.M. 56 (1.3). Oliveira, J. 110 (2.3); 120 (2.3); 133 (2.3). Oliveira, R.C. 1158 (1.4); 1266 (1.4); 1287 (2.1); 752 (2.1). Oliveira, R.P. 1584 (1.2); 651 (2.1). Oliveira, S.S. 97 (1.3). Orbigny, A.C.V.D. 365 (1.3). Pabst, G. 4885 (1.2); 7383 (1.2). Paggoto, T.C.S. 87 (1.3). Paiva, J.A. 681 (1.3). Paiva, V.F. 12 (1.3); 534 (1.3). Parra, L.R. CFSC12986 (1.2). Pastore, J.F.B. 1785 (3.3); 1899 (3.8); 2261 (1.3); 2404 (3.2); 3101 (1.3); 3135 (1.3); 4110 (3.10); 623 (3.3). Paula-Souza, J. 9222 (1.4); 9451 (1.3). Paula, C.H.R. 671 (1.2). Paula, J.R. 51 (1.3); 53 (1.3); 54 (1.3); 55 (1.3). Pearce, R. 1865 (1.1). Pedralli, G. QAPT1511 (1.2). Pena, M.A. 306 (3.10); 457 (3.10); 467 (3.10); 896 (3.10). Pequeno, P.H.A. 74 (1.2). Pereira-Noronha, M.M.R. 703 (1.3). Pereira-Silva, G. 3407 (1.4); 5199 (3.4); 9187 (1.3); 16436 (3.4). Pereira, A.M.S. 15 (1.6). Pereira, B.A.S. 1080 (1.3). Pereira, C. 695 (1.3). Pereira, E. 1601 (3.10); 2632 (3.5); 9154 (1.2); 9901 (1.2). Pereira, M. 791 (3.10). Pereira, O.J. 6423 (1.2). Pereira, R.S. 53 (1.2). Phelps, K.D Ph341 (1.1). Pilger, R. 540 (2.3). Pinheiro, R.S. 1954 (1.2). Pinkus, A.S. 43 (1.1). Pinto, F.C.L. 55 (2.1). Pinto, G.C.P. 390 (1.3); 83 (2.1). Pio, A.D. 99 (1.3). Pirani, J.R. 5083 (3.10); 6006 (3.10); CFCR12241 (3.11); CFCR12844 (3.11); CFCR13107 (3.11); CFSC12341 (3.10); CFSC12426 (1.2). Pires, F.R.S. CFSC10450 (1.3). Pires, J.M. 16513 (2.3); 7844 (1.1); 9411 (3.3). Pohl, J.E. 23 (1.2); 52 (1.3). Pott, A. 10123 (1.3); 14427 (1.3); 14476 (1.3); 1614 (1.3); 8989 (1.3); 9026 (2.3). Prado, J. CFCR10498 (3.10). Prance, G.T. 59054 (1.3). Proença, C. 155 (3.3); 3866 (1.3). Queiroz, L.P. 10431 (2.3); 10563 (2.4). Quizhpe, W. 799 (1.1). Ramalho, R.S. 1547 (1.2); 1823 (1.2); 972 (1.2). Ramos, A.E. 1843 (1.3); 2138 (3.3); 2227 (1.3); 2269 (3.3); 293 (3.3). Rando, J.G. 75 (3.10). Ratter, J.A. 3177 (3.3); 3426 (1.3); 4797 (1.3); R6841 (1.4). Rea, L. 251 (1.1). Regnell, A. 206 (1.3). Reichardt, H.W. 40 (1.3). Renon, P. 412 (1.3). Resende, U.M. 129 (1.3); 1413 (1.3); 2684 (1.3). Rezende, J.M. 871 (1.3). Rezende, S.G. 3871 (1.2); 4636 (1.3); 4637 (1.3). Riedel, L. 167 (1.3); 390 (1.2). Riina, R. 388 (1.1). Rizzo, J.A. 10276 (3.6); 1244 (1.3); 13349 (1.3); 13369 (1.3); 13393 (1.3); 1589

(1.3); 1756 (1.3); 1968 (1.3); 5376 (1.3); 5450 (1.3); 6542 (1.3); 6622 (1.3). Rocha, G.P.E. 288 (1.3). Rodrigues, C. 26 (3.4). Romero, R. 2529 (1.3); 3622 (1.3); 4461 (1.3). Roque, N. 3381 (1.3); 3693 (1.3); 3755 (1.3). Rosa, J.D. 31 (1.2). Rosa, N.A. 2114 (2.2); 3319 (1.1). Rose, L.S. 30 (1.2). Roth, L. CESJ2362 (1.3). Saddi, E.M. 689 (1.3); 994 (1.3). Saint-Hilaire, A. 1312 (1.2); 352 (1.2); 560 (1.3). Salimena, F.R.G. 3024 (1.2). Salino, A. 10566 (1.2); 3829 (1.2). Salles, A.H. 4253 (1.2); 65 (1.3). Sampaio, A.B. 220 (1.3). Sano, P.T. 3057 (3.11). Sano, S.M. 150 (3.11). Santos, A.A. 1413 (1.3). Santos, F.M. 55 (1.3); 651 (1.3). Santos, H.G.P. 343 (1.2). Santos, J. S462 (1.3). Santos, M.F. 146 (1.2). Santos, R.R. 1479 (2.2); 1804 (2.2). Santos, R.S. 24037 (1.3); 24212 (1.3). Santos, T.S. 2248 (1.2). Sarti, S.J. 14425 (1.3). Sasaki, D. 581 (1.3); 628 (1.3). Sastre, C. 8481 (1.1); 8504 (1.1). Saturnino, H.M. 1466 (3.1). Scheiner, P. 60 (1.3). Schliewe, M.A. 35 (3.10); 88 (3.3). Schomburgk, R.H. 546 (1.1); 960 (1.1). Schucht, F. 6174 (1.3). Schwacke, C.A.W. 12826 (1.3); 13442 (1.3); 5903 (1.3); 8075 (3.10). Sellow, F. 1495 (1.3). Semir, J. 2340 (3.10); 2607 (3.10); 2658 (3.10); 2693 (3.10); 2823 (3.10); 4277 (3.10); 4286 (3.10); 6514 (1.2). Sevilha, A.C. 1719 (1.3); 4199 (3.11); 4299 (3.11); 4614 (1.3); 4765 (3.11); 4821 (3.11); 5147 (3.11); 6986 (3.11); 7017 (3.11). Shepherd, G.J. 5751 (1.2); 5816 (1.2). Silva-Castro, M.M. 1297 (1.3); 1365 (1.6). Silva-Luz, C.L. 12 (1.3); 15 (3.10). Silva, A.F. 127 (1.3); 286 (1.3); 323 (1.3); 534 (1.3). Silva, A.R. 564 (1.3). Silva, C.N. 106 (1.2); 52 (1.2). Silva, D.B. 338 (3.8). Silva, F.C.F. 115 (1.2); 116 (1.6); 48 (1.3); 74 (1.2); 80 (1.2). Silva, J.B. 67 (1.3). Silva, J.D. 81 (1.3). Silva, M.G. 4559 (2.3); 4736 (2.2). Silva, M.R.P. 2327 (1.3). Silva, R.R. 997 (1.3). Silva, S.B. 22 (3.3). Silva, T.R.S. CFCR12620 (3.11). Silva, W.A. 981003 (1.3). Simão-Bianchini, R. 432 (1.3). Simão, M.R.V.C. 284 (1.2). Simões, A.O. 203 (1.3). Simon, M.F. 1925 (1.3); 1969 (1.3); 2300 (2.3). Simonelli, M. 1292 (1.2); 1402 (1.2). Sinani, T.R.F. 64 (1.3). Siniscalchi, C.M. 230 (3.10). Skorupa, L.A. 856 (2.3). Smith, L.B. 7067 (3.10). Smith, S. 18 (3.6). Snack, C. 571 (1.3). Soares, A.S. 623 (3.2). Soares, E.A. 1399 (1.4). Sobral, M. 13308 (1.3); 13335 (1.2); 14284 (1.2); 15011 (1.2). Soejarto, D.D. 3635 (1.1). Souza, A. 1324 (2.4); 1391 (2.4). Souza, A.B.

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Chapter 4

A new occurrence database of *Hyptidendron* (Lamiaceae, Hyptidinae) supports the need for taxonomic studies in the Neotropics

To be submitted to Biodiversity Data Journal

A new occurrence database of *Hyptidendron* (Lamiaceae, Hyptidinae) supports the need for taxonomic studies in the Neotropics

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Abstract

Background

Hyptidendron is a monophyletic genus with 22 species endemic to South America. The genus, historically treated as part of *Hyptis*, was last revised in 1949, and recently presented considerable amount of specimens unidentified in the herbaria and evident taxonomic and nomenclatural issues. As part of a taxonomic revision for the genus, a new database for it was constructed based on 1) the revision of the collection of 50 herbaria visited 2) the consultation of virtual catalogues 3) new fieldwork data.

New Information

Here, we present this database with 1,112 records of which ~44% had their identification updated since the project began. Our results support the need for careful conducted taxonomic revision for increasing data quality enabling more assertive conservation propositions and evolutionary studies, and the need for the training of new taxonomists to work with the Neotropical Flora, which is still far from being satisfactorily known.

Key words

Brazil, Cerrado, Herbaria, *Hyptis*, Neotropical Flora, Taxonomy

Introduction

Hyptidendron Harley, a genus of currently 22 species (Antar et al. in prep.), is characterized by having inflorescences arranged in complex bracteolate pedunculate cymes and pedicellate flowers with styles jointed above its base forming a stylopodium which is persistent and protruding above the top of the ovary (Harley 1988; Antar et al. in prep). The genus is endemic to South America with most of its distribution in Central Brazil with some species expanding to Bolivia, and one species, *Hyptidendron arboreum* (Benth.) Harley, widely distributed in the Amazonia domain, occurring in Brazil, Bolivia, Colombia, Ecuador, Guyana, Peru and Venezuela (Antar et al. in prep.).

Harley (1988) formulated *Hyptidendron* by segregating species from two former sections of *Hyptis* Jacq.: *Hyptis* sect. *Buddleioides* and *Hyptis* sect. *Umbellaria*, which had been recognized by Epling (1949) in his revision of *Hyptis*, the last taxonomic work that encompasses the species now treated in *Hyptidendron*. From this date, few papers have been published on the genus until 2016, when a taxonomic revision of the genus started. Since then, some novelties were published (Harley and Antar 2017; Antar et al. 2019a; Antar et al. in press.; Antar et al. in prep) and a database was created to account for all the specimens examined of the genus. This was originally partly based on an early database of Hyptidinae started by Harley (unpublished results) in the 1980s.

Such biodiversity databases are an important source for evolutionary, biogeographical, ecological, modelling and conservational studies (Maldonado et al. 2015). This is especially true for groups of Neotropical organisms which, in many cases, still lack profound knowledge of species delimitation and distribution, sometimes neglected by the few taxonomists currently working on them (Lagomarsino & Frost 2020).

General Description

Objective: In view of the importance of gaining access to high quality taxonomic data (Costello et al. 2013; Marinho and Beech 2020) and the importance of properly verified taxonomic databases (Maldonado et al. 2015), we here provide an updated database of the records of *Hyptidendron*, based on a revision of herbarium material, virtual database consultation and new field work data. Additionally, we discuss the impacts of a taxonomic revision on the identification of the specimens present in the database.

Sampling Methods

Study extent: This study considers all known records of *Hyptidendron* in the world, therefore including records from all countries where the genus occurs.

Sampling description: Three sources were used for the database construction: 1) The visit and collection revision of the following herbaria: ALCB, BHCB, BHZB, BM, BRBA, CEN, CESJ, CGMS, COR, CTBS, DIAM, E, ESA, ESAL, FLOR, G, HDJF, HEPH, HRB, HRCB, HUEFS, HUFSJ, HXBH, IBGE, ICN, K, M, MBM, MBML, NX, NY, P, PAMG, R, RB, SP, SPF, SPFR, SPSC, SPSF, UB, UEC, UFG, UFMT, UFOP, UPCB, US, VIES, W, WU (acronyms according to the Index Herbarium – Thiers, continuously updated); 2) the consultation of online databases with available specimen images: the Virtual Herbarium of Flora and Fungi of Brazil (INCT, 2020, http://splink.cria.org.br/) and Reflora (Reflora – Virtual Herbarium 2020, http://reflora.jbrj.gov.br/); and 3) Eleven field expeditions from 2016 to 2019 were carried out in Brazil in order to expand the sampling of the genus.

The data was compiled according to the collection labels registering the herbarium were each specimen was deposited, collector, additional collectors, collection number (with a prefix or suffix when necessary), date, phenology, previous determination, updated determination, with determiner and date of this updated determination, country, state or province, municipality, gazetteer, locality, coordinates and elevation. When the coordinates were not available on the label, one of three possible alternatives was followed: 1) When the location described was precise, we georeferenced the specimen; 2) When the location is not precise but the municipality is described, we used the municipality's centroid; 3) When no location of municipality was provided, we did not add a coordinate.

The database was used for the taxonomic revision of the genus (Antar *et al.* in prep), in order to provide maps of distribution, lists of specimens examined and phenology of the species.

Geographic coverage

Description: South America.

Coordinates: 56°32′16″S and 15°53′03″N Latitude; 92°00′33″W and 28°50′51″W Longitude.

Taxonomic coverage

Description: We retrieved 1,112 records of 22 species of *Hyptidendron*. Of these records, 44% had their identification update since the revalidation of records had begun, including both determination of undetermined specimens and re-circumscription or determination of specimens at species level. Catalogued species of *Hyptidendron* are summarized in the Table below.

Taxa included:

Rank	Scientific Name
Species	*Hyptidendron albidum* Harley & Antar
Species	*Hyptidendron amethystoides* (Benth.) Harley
Species	*Hyptidendron arboreum* (Benth.) Harley
Species	*Hyptidendron arbusculum* (Epling) Harly
Species	*Hyptidendron asperrimum* (Spreng.) Harley
Species	*Hyptidendron canum* (Pohl ex Benth.) Harley
Species	*Hyptidendron caudatum* (Epling & Jativa) Harley
Species	*Hyptidendron cerradoense* Antar & Harley
Species	*Hyptidendron claussenii* (Benth.) Harley
Species	*Hyptidendron conspersum* (Benth.) Harley
Species	*Hyptidendron dictiocalyx* (Benth.) Harley
Species	*Hyptidendron dorothianum* Antar & Harley
Species	*Hyptidendron glutinosum* (Benth.) Harley
Species	*Hyptidendron eximium* (Epling) Harley & J.F.B.Pastore
Species	*Hyptidendron leucophyllum* (Pohl ex Benth.) Harley
Species	*Hyptidendron pulcherrrimum* Antar & Harley
Species	*Hyptidendron rhabdocalyx* (Benth.) Harley
Species	*Hyptidendron rondonicum* (Harley) Harley
Species	*Hyptidendron roseum* Antar, Harley & J.F.B.Pastore
Species	*Hyptidendron unilaterale* (Epling) Harley
Species	*Hyptidendron vauthieri* (Briq.) Harley
Species	*Hyptidendron vepretorum* (Benth.) Harley
Genus	*Hyptidendron* Harley

Of the 1,112 gatherings, 63 have no coordinates, 454 were georeferenced with centroid, 219 were georeferenced with the location and 375 had original coordinates in the label.

The gatherings are not evenly distributed through all species, with *Hyptidendron canum* (Pohl ex Benth.) Harley, *Hyptidendron asperrimum* (Spreng.) Harley, *Hyptidendron arboreum* and *Hyptidendron vauthieri* (Briq.) Harley, the four most common species, accounting for ~77% of all gatherings. *Hyptidendron canum* the most common species accounts solely for ~38% of all gatherings. The rarer species, with less than 15 gatherings: *Hyptidendron albidum*, *H. arbusculum*, *H. cerradoense*, *H. claussenii* (Benth.), *H. dictiocalyx*, *H. dorothianum*, *H. eximium*, *H. pulcherrimum*, *H. rhabdocalyx*, *H. rondonicum*, *H. roseum* and *H. unilaterale*, together account for only 7% of all gatherings.

Traits Coverage

Our database includes distribution information and therefore high-quality spatial information on species occurrences in major areas of South America (especially Brazil and Bolivia), as well as main phytogeographic domains and vegetation where species prevail.

Endemism and conservation status of *Hyptidendron*

Our database reveals that *Hyptidendron* is restricted to South America, with most records from Brazil and Bolivia. In Brazil, where most of the records occur, 20 species occur in the Cerrado domain, distributed mostly in the Center-Western region. Some species, like *Hyptidendron claussenii, Hyptidendron pulcherrimum* and *Hyptidendron roseum* are restricted to a specific vegetation type of the Cerrado Domain, namely the *campo rupestre*, which is widely known for its highest levels of plant and animal endemism (Colli-Silva et al. 2019). Just one record was detected as a cultivated plant (Occhioni 3669 – SP herbarium), which perhaps suggests the still unexplored ornamental potential of the genus.

Temporal Coverage

Notes: The oldest record of *Hyptidendron* was collected in 1824 by the German botanist Ludwig Riedel, the frequency of records increasing since then, especially during the second half of the XXth century (*Fig. 1*). A second significant increase is also observed between 2016 and 2017, were recent studies carried out by us have increased the number of collections of the genus in unexplored sites.

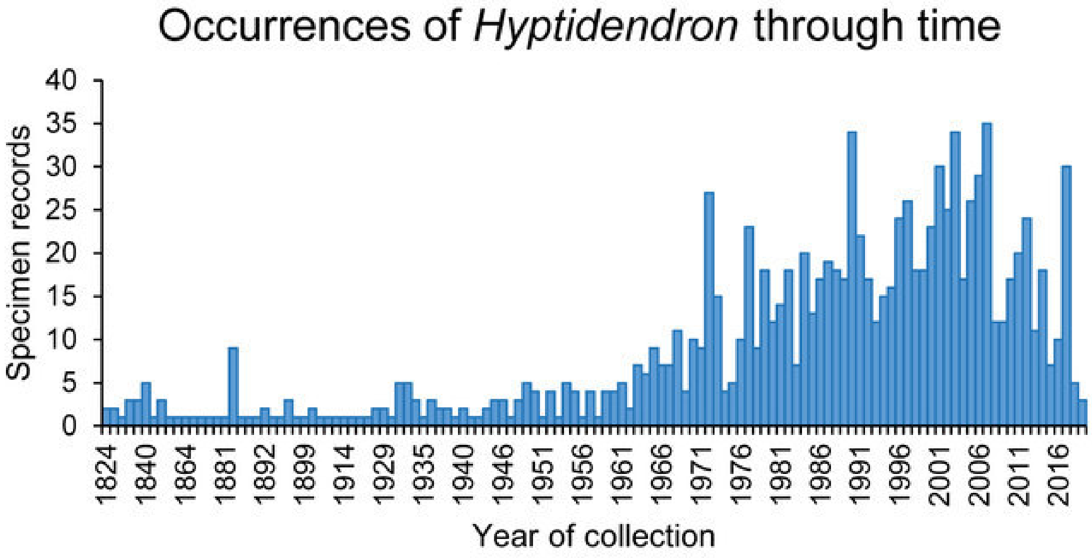

Figure 1. Specimen records of *Hyptidendron* by year of collection.

The presence of most records from the last decade is probably related to an increase of collection in Brazil as all of the genus species occurs in the country and 18 of them are endemic. This pattern is probably related to a growth in the training of botanists, as a result in an expansion in investments in science during the end of the first and the beginning of the second decades of XX before a consistent decline (e.g. Ríos-Saldaña et al. 2018, Zamudio et al. 2018). However, although this might be true for most of Brazil’s territory, there is a tendency in the Amazonia domain of a lack of recent collections (Daly & Martinez-Habibe

2019). This is particularly apparent in *Hyptidendron arboreum*, an endemic of the Amazonian domain, with few collections this century, and just three collections in the decade 2010-2019.

Also, for the rarest species of *Hyptidendron*, the decade with most collections was 2010-2019, reflected by the collection effort made to compile this database. These results support the need for revisionary studies and fieldwork, using the "specialist eye" to better sample and circumscribe the least known species of the genus. In the Neotropics, there are many species known only from the type collection or few collections (e.g. Borges & Antar 2017, Antar et al. 2018) and taxonomic revision with fieldwork associated are a good tool for broader sampling these species resulting in proper conservation status analysis and planning.

Conclusions and Perspectives

Before our studies, the most up to data taxonomic revision of *Hyptidendron* was made by Epling (1949), when 91 gatherings were examined. Our taxonomic revision was based on a database with 1,112 gatherings, an increase in 12 times. With the increase in plant collecting in the Neotropics, up to date taxonomic revision for groups revised in the XX century are much desired, usually resulting in major nomenclatural and taxonomic rearrangements and the recognition of new species (e.g. Antar et al. 2019b; Borges et al. 2017; Devecchi et al. 2018)

Our results also highlight the importance of visiting smaller herbaria and the need for digitalization of their collections (Colombo et al. 2016). For our database, only 27% of the gatherings were already listed in GBIF. We believe that much of this number are due to specimens from smaller herbaria that have not been digitalized and are not available in online catalogues. However, the sampling focus was in Brazil, which presents most of the genus diversity. Smaller herbaria in other South America countries, that could present other *Hyptidendron* specimens were not sampled, and could further improve the database.

Finally, our results of taxonomic identification support the need for taxonomic revision and formation of new taxonomists, as most of *Hyptidendron* IDs were provided during this Ph.D. project, and moreover by the two specialists in the subtribe. Although modern evolutionary approaches are interesting and desired to better understand biodiversity formation and evolution, without good and robust taxonomic data, further assumptions seem risky and less reliable. We believe that basic taxonomy in the Neotropics is still much needed and should be properly funded. Although funding and credibility for these are scarce, without basic taxonomy no accurate conservation measurements or evolutionary and biogeographic studies are possible.

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Occurrences of *Hyptidendron*. v1.1.

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ocurrence dataset

https://figshare.com/s/2e557ba19d7c08153d7c

Chapter 5

Nomenclatural and taxonomical novelties in Hyptidinae (Lamiaceae)

Hyptidendron albidum (Lamiaceae, Hyptidinae), a remarkable new species from northern Minas Gerais state, Brazil

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Hyptidendron albidum (Lamiaceae, Hyptidinae), a remarkable new species from northern Minas Gerais state, Brazil

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Abstract

Hyptidendron albidum a new and endemic species from Northern Minas Gerais state, Brazil, is here described. This new species is unique due to the morphological combination of its dense indumentum of white dendroid trichomes, covering much of the plant and the inflorescence composed of a unilateral cymose structure. The new species is morphologically similar to *H. unilaterale* which displays a similar unilateral cymose structure but differs in its indumentum, inflorescence length and leaf morphology. We provide a description, an illustration, a conservation status assessment, a distribution map, and comments on the recognition of this new species.

Key Words: Campo rupestre, Cerrado, Ocimeae.

Resumo

Hyptidendron albidum uma espécie nova e endêmica do norte do estado de Minas Gerais é aqui descrita. Essa nova espécie é única pela combinação morfológica de denso indumento de tricomas dendríticos alvos, cobrindo a maior parte da planta, e pela inflorescência composta por cimeiras unilaterais. A nova espécie é morfologicamente similar a *H. unilaterale*, a qual possui uma estrutura de cimeira unilateral similar, mas difere no indumento, no tamanho da inflorescência e na morfologia foliar. Nós fornecemos uma descrição, uma ilustração, o status de conservação, um mapa de distribuição, além de comentários sobre o reconhecimento dessa nova espécie.

Palavras-chave: Campo rupestre, Cerrado, Ocimeae.

Introduction

Hyptidendron Harley (1988: 90) is a genus of the subtribe Hyptidinae (tribe Ocimeae, Lamiaceae) currently with 17 species, distributed in South America, mostly in the Cerrado domain (a savanna formation centered in Brazil and extended to Paraguay and Bolivia) (Harley & Pastore 2012). The genus is characterized by having inflorescences arranged in complex bracteolate cymes and flowers with style jointed below, the lower part forming a stylopodium which is persistent and protruding above the top of the ovary (Harley 1988, Harley *et al*. 2004, Harley & Pastore 2012).

Harley (1988) separated *Hyptidendron* from *Hyptis* Jacquin (1787: 101), by segregating species from two former sections: *Hyptis* sect. *Buddleioides* Bentham (1833: 132) and *Hyptis* sect. *Umbellaria* Bentham (1833: 133), both of which had been recognized by Epling in his revision of *Hyptis* (1949). Epling, however had modified and augmented the content of these sections from the treatments originally proposed by Bentham (1833, 1848), including six species within *H.* sect. *Buddleioides* and 12 species within *H.* sect. *Umbellaria*, which he later raised to 13, by the publication of *H. caudata* Epling & Játiva (1968: 296). In 1986, Harley published another species, *H. rondonica* Harley (1986: 141), from the Brazilian state of Rondônia.

Harley (1988) when proposing *Hyptidendron*, recognized two sections: *Hyptidendron* sect. *Hyptidendron* and *Hyptidendron* sect. *Umbellaria* (Bentham) Harley (1988: 93). The former of these, included five, mostly tree species, which had been assigned previously to *Hyptis* sect. *Buddleioides*, and the latter was composed of 11 fruticose species. Two species included by Epling in *Hyptis* sect. *Umbellaria*: *Hyptis fruticosa* Salzm. ex Bentham (1833: 123) and *Hyptis cuniloides* Epling (1947: 517) were removed from *Hyptidendron*, as they lacked a stylopodium, and these remained unassigned to a section within *Hyptis* (Harley 1988), until the genus *Eplingiella* Harley & Pastore (2012: 21), supported by molecular (Pastore *et al*. 2011) and morphological evidence (Harley & Pastore 2012, Harley *et al*. 2017) was created to include them. At the same time a 17th species of *Hyptidendron* was proposed: *H. eximium* (Epling 1936: 223) Harley & Pastore (2012: 25), taken from the monotypic *Hyptis* sect. *Lateriflorae* Epling (1936: 223).

At present, we prefer to recognize no sections within *Hyptidendron* until further more detailed phylogenetic trees are obtained by means of a more inclusive species sampling (Harley & Pastore 2012).

During the preparation of a taxonomic revision of the genus, a new species from northern Minas Gerais state, Brazil, was recognized from material collected from 1997 onwards. This is described and illustrated here as the new species *H. albidum*. Unfortunately the taxon was omitted from the account of Lamiaceae in the Flora of Grão Mogol (Vásquez & Harley 2004) due to the non-availability of the material in SPF herbarium at that time.

Material & Methods

The morphological description was based on the specimens seen in the following herbaria: ESA, HUEFS, K, MBM, RB, SPF, UEC. A 10−60 × magnification stereomicroscope was used to analyze morphological features of the specimens. Terminology follows Harris & Harris (2001) for general morphology and Hickey (1973) for leaf shape, as well as Epling (1949), Rudall (1980) and Harley & Pastore (2012) for specific terms.

IUCN criteria (2001, 2016) alongside with GeoCAT tool (Bachman *et al.* 2011) were used to infer conservation status. GeoCAT was applied with the IUCN default values for Extent of occurrence (EOO) and Area of occupancy (AOO) analysis. The distribution map was produced in QGIS version 2.16.0 (QGIS Development Team 2016). In case of herbarium specimens being not geo-referenced, the geographic coordinates were approximated using the locality description of the specimen label.

Taxonomic treatment

Hyptidendron albidum Harley & Antar *sp. nov.* (Figs. 1−2)

The new species shares with Hyptidendron unilaterale a similar unilateral cymose inflorescence structure, differing from it in the indumentum composed of white dendroid trichomes, the shorter inflorescence obscured by the leaves and the leaf base frequently cordate

Type:—BRAZIL. Minas Gerais: Itacambira, estrada Juramento - Itacambira, cerca de 20 km de Juramento, cerrado pedregoso, 17 December 2003, fl., fr., *Souza et al. 29588* (holotype SPF!, isotypes ESA!, HUEFS!, K!, RB!).

Erect shrub or subshrub, 1−1.5 m tall, all vegetative parts densely covered with white, dendroid trichomes, densely branched; stems woody, at least in upper part, <4−5 mm in diameter, ± rounded in cross-section. Cauline leaves opposite, ascending, longer than internodes, imbricate, diminishing in size towards stem apex, lamina 2.2−3.4 × (1.4−)1.9−3.2 cm, coriaceous, whitish, the older ones brown and less indumented, rounded to broadly ovate, or rarely ovate-oblong, base cordate, rarely truncate or rounded, apex obtuse to acute, usually very shortly apiculate, margin sharply serrate, with (8−)13−26 teeth on each side of leaf, the tooth apex swollen and sub-glabrous (hydathodes not confirmed, but most probably present), adaxial surface with venation scarcely impressed, abaxial surface with venation reticulate, midrib and primary veins slightly prominent, but obscured by indumentum, which is denser on abaxial surface, and with scattered sessile glands; petiole 1−6 mm long. Inflorescence a terminal thyrse of shortly pedunculate cymes subtended by foliaceous bracts, which are conspicuous, similar to the leaves, but smaller, sub-imbricate, and shorter than the cymes, mature cymes 10−20 flowered, mostly unilateral and borne on peduncles 6−10 mm long. Flowers on pedicels 1−3 mm long and subtended by narrowly linear, almost subulate bracteoles 1−2 mm long; calyx at anthesis 5−5.5 mm long, tube 3−3.8 mm long, straight, slightly turbinate, externally densely white-tomentose, the branches of the trichomes sometimes terminating in a pale yellow, spherical gland, tube internally glabrous (especially frequent on the calyx lobes), calyx lobes subequal, 1.8−2.2 mm long, deltate, densely white-tomentose externally and internally more sparsely hairy, calyx in fruit 7.5−8.5 mm long, with tube accrescent in fruit, 5.8−6.7 mm long, ± cylindrical; corolla purplish or lilac, 6−7 mm long, tube 3.5−4 mm long, straight, narrowly cylindrical, 0.7−0.9 mm wide, externally rather densely, but unevenly white-tomentose, glabrous within, lobes spreading, the anterior lobe large, boat-shaped with long, almost caudate apex; anterior stamens with glabrous to glabrescent filaments, posterior pair with filaments hairy, gynoecium with style jointed and well-developed stylopodium protruding above ovary, and apically with two slender stigmatic lobes. Mericarps 3.0−3.5 × 1.5−1.8 mm, oblong-ellipsoid, dark castaneous, rugulose and shining, glabrous, with deep abscission scars, not mucilaginous when wetted.

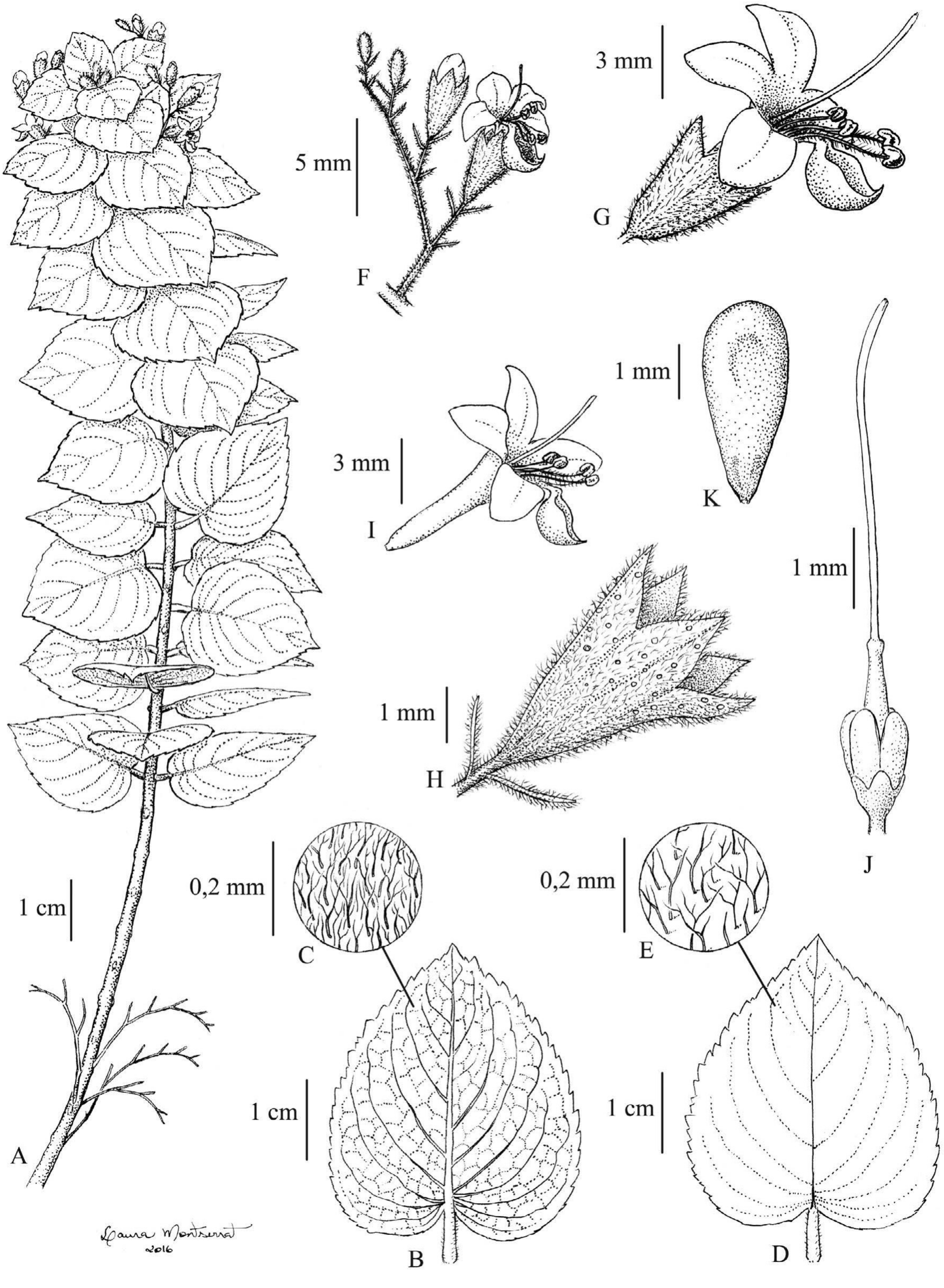

FIGURE 1. *Hyptidendron albidum.* **A.** Branch bearing leaves and inflorescenses. **B–C.** Leaves, adaxial surface with indumentum detail. **D–E.** Leaves, abaxial surface with indumentum detail. **F.** Immature cyme. **G.** Flower, side view. **H.** Calyx with bracteole, side view. **I.** Corolla, side view. **J.** Gynoecium and style, showing stylopodium. **K.** Mericarp. **A–K.** Illustration of Laura Montserrat based on Souza et al. 29588 (SPF).

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LAMIACEAE

(*Hyptis*) Hyptidendron

Det.:

BRASIL. Estado de Minas Gerais. Itacambira. Estrada Juramento - Itacambira, cerca de 20 km de Juramento. Cerrado pedregoso.

Obs.: Subarbusto, ca. 1 m alt.; folhas acinzentadas; corola roxa.

Col.: **Souza, V.C. 29588** Lorenzi, H., Romão, G.O.

Data: 17/XII/2003

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FIGURE 2. *Hyptidendron albidum.* Holotype at SPF.

Distribution, habitat and phenology:—*Hyptidendron albidum* is known from only four localities in three municipalities in Northern Minas Gerais, SE Brazil (Fig. 3). It can be found up to 1000 m elevation in highland rocky fields (*Campo rupestre*), rocky savannah or savannah physiognomies, all of these included in the Cerrado domain. *Hyptidendron albidum* has been found in a fertile condition from September to March.

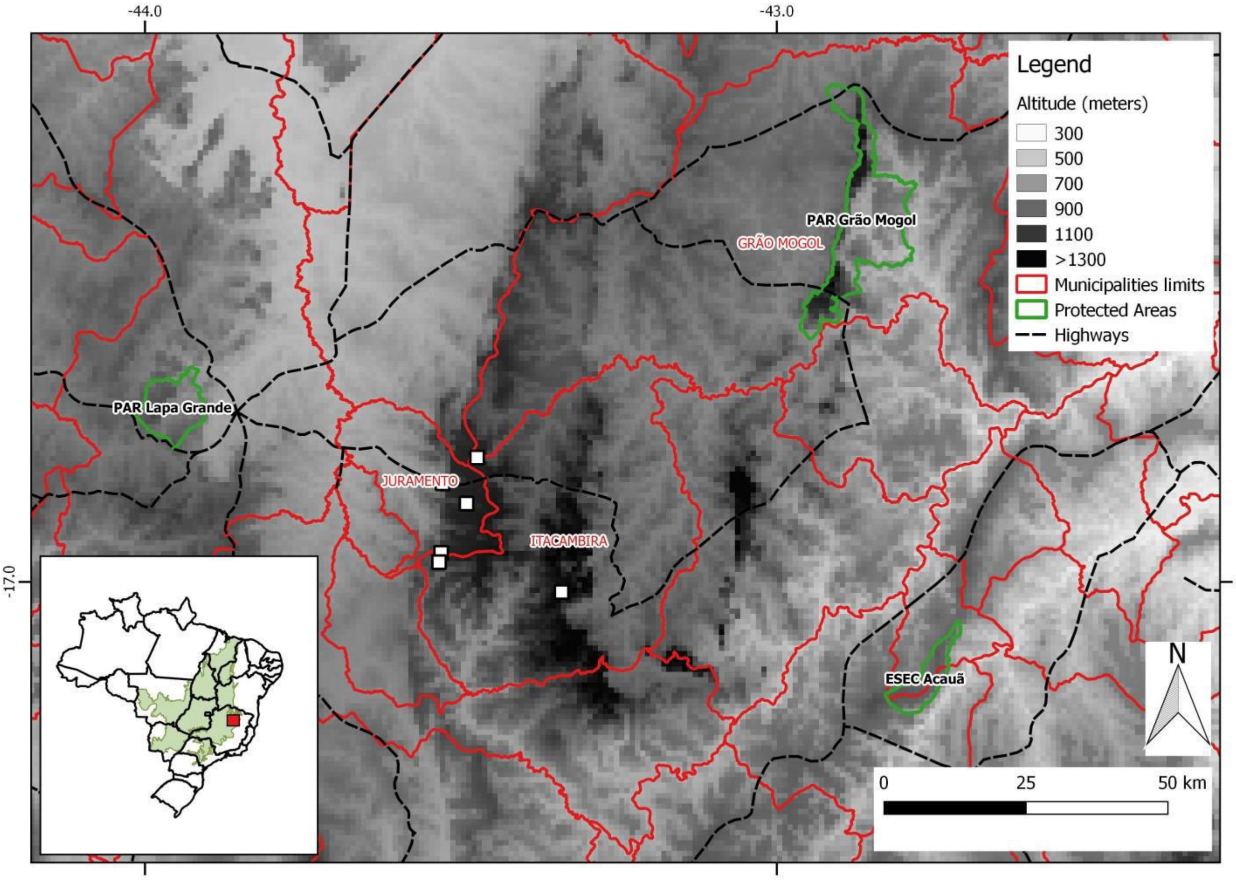

FIGURE 3. Distribution of *Hyptidendron albidum* (white square) in southeast Brazil. The green shape in the small map shows the extension of the Cerrado domain.

Conservation Status:—The area of occupancy is very reduced, being just 24,000 km². It is known only from six collections, none of those located inside protected areas. With the rapid advance of Cerrado deforestation, mostly for pasture or crops, the Cerrado flora, throughout the domain is largely threatened. It is estimated that more than 50% of its original area has already been replaced (Beuchle *et al.* 2015). Within the area where *Hyptidendron albidum* occurs much agricultural activity, involving habitat destruction, has been noted. Also, some populations are very close to the highway. The conservation status of this species is assessed as Endangered according to criteria B1ab(iii)+2ab(iii) (IUCN 2001).

Etymology:—The specific epithet refers to the indumentum of all vegetative parts, which are densely covered with white, dendroid trichomes.

Additional specimens (paratypes):—BRAZIL. Minas Gerais: Grão Mogol, MG-15, Fazenda Tamanduá, 10 September 2005, fl., *Tameirão-Neto 4020* (BHCB!, HUEFS!); Itacambira, 17º00.572''S, 43º20.266''W, 1300 m, 13 November 2001, fl., fr., *Tozzi & Alencar 2001-474* (UEC!); ibid., estrada Itacambira - Juramento, 9 km de Itacambira, 16º58' 58.07''S, 43º32'04.6''W, 1100 m, 23 February 2002, fl., fr., *Souza et al. 28223* (ESA!, HUEFS!, SPF!); Juramento, rodovia Montes Claros a Itacambira, Serra do Catuni, 17 March 1997, fl., fr., *Hatschbach et al. 66389*, (K!, MBM!); ibid., Serra do Catuni, 1000 m, 4 December 2004, fl., fr., *Hatschbach & Barbosa 78829* (K!, MBM!).

Affinities and morphological notes:— *Hyptidendron albidum* can be immediately recognized from all other species of the genus on account of its dense indumentum of white dendroid trichomes covering much of the plant, allied with its inflorescence composed of a unilateral cymose structure.

The species which shows greatest morphological similarity is *Hyptidendron unilaterale* (Epling 1951: 140) Harley (1988: 93), which displays a similar unilateral cymose structure. It can be distinguished from *Hyptidendron albidum* by the following characters: the latter species having an indumentum composed of white dendroid trichomes (*vs.* indumentum of dense, short, glandular trichomes with scattered long articulated trichomes), leaves with cordate, or rarely truncate or rounded base (*vs.* leaves with a rounded base), mature inflorescences obscured by the leaves, hardly surpassing leaf size, up to 3.0 cm long (*vs.* mature inflorescences not obscured by leaves, surpassing leaf size, up to 6 cm long), pedicels 1−3 mm long (*vs.* pedicels 1−5 mm long) and calyx tooth at anthesis 1.8−2.2 mm long (*vs.* calyx tooth at anthesis 1−1.5 mm long).

Hyptidendron albidum is also similar to other species of the former *Hyptidendron* sect. *Umbellaria*, in which it seems to belong. The main morphological differences among *H. albidum* and related species are summarized in Table 1. It is also superficially similar to two species of the former *Hyptidendron* sect. *Hyptidendron*: *Hyptidendron canum* (Pohl ex Bentham 1833: 135) Harley (1988: 90) and *H. leucophyllum* (Pohl ex Bentham 1833: 134) as those species share a similar indumentum of white dendroid trichomes. Still, *H. canum* and *H. leucophyllum* have flowers arranged in terminal cymose panicles and *Hyptidendron albidum* has flowers arranged in unilateral cymes.

In several species previously placed in *Hyptidendron* sect. *Umbellaria* the cyme structure is mixed. Often the branches from the lowest nodes of the cyme may be dichasial, while distally these become unilateral, with the branching taking a scorpioid appearance. The complexity of the cyme structure within this group caused Epling to make some conflicting statements. He suggested in the revision of *Hyptis* (Epling 1949) that *Hyptis unilateralis* Epling (1951: 140) is the only species of *Hyptis* sect. *Umbellaria* with a unilateral cymose inflorescence, using it to separate this species in the key from all other members of the section. However when validating the publication of *Hyptis unilateralis* he compares it to *Hyptis glutinosa* Bentham (1848: 130), on the grounds that both show a similar cymose structure (Epling 1951). We believe that further studies of inflorescence structure are required to clarify the differences and relationships between the species of this group, which presents great taxonomic complexity and species without taxonomic resolution.

Acknowledgements

We thank Laura Montserrat for providing the plant illustration; curators of the visited herbaria; Thiago Bevilacqua Flores for helping in curator process; Renato Ramos for helping with the map**;** two anonymous reviewers and the editor J.G. González-Gallegos for improvements to our manuscript. RMH, Honorary Research Fellow at R.B.G. Kew, also thank the staff of the Kew Herbarium, for their support, while working on the original draft of this paper. GMA thanks CAPES and Idea Wild for financial support.

TABLE 1. Diagnostic morphological characters of *Hyptidendron albidum* and related species

Character	*H. albidum*	*H. unilaterale*	*H. vauthieri*	*H. glutinosum*	*H. claussenii*
Cauline leaf size (cm)	2.2−3.4 × (1.4−)1.9−3.2	2−3.3 × 1.2−2.2	1.5−2.5 (−4) × 1−2.3	2.5−4 × 2.7−5	1.5−3.5 x 1−2.5
Leaf base	cordate, rarely truncate or rounded	rounded	rounded, rarely truncate	cordate	rounded
Petiole	present	present	present	present	absent
Branch and leaf indumentum	dendroid trichomes	short glandular trichomes and long articulated trichomes	short glandular trichomes and long articulated trichomes	short glandular and long articulated glandular trichomes	short glandular trichomes and long articulated trichomes
Inflorescensce type	unilateral cyme	unilateral cyme	dichasial cyme	dichasial cyme	dichasial cyme
Inflorescence conspicuity	obscured by leaves	not obscured by leaves	obscured by leaves	not obscured by leaves	obscured by leaves
Pedicel length (mm)	1−3	1−5	2−3	1−2	1
Calyx lobes length at anthesis (mm)	1.8−2.2	1−1.5	2−4	1.5−2.1	4−5

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Hyptis pastorei, an unusual new species of *Hyptis* sect *Eriosphaeria* (Lamiaceae: Hyptidinae) from the Chapada dos Veadeiros, Goiás, Brazil

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Hyptis pastorei, an unusual new species of *Hyptis* sect *Eriosphaeria* (Lamiaceae: Hyptidinae) from the Chapada dos Veadeiros, Goiás, Brazil

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Summary

A brief account of *Hyptis* sect. *Eriosphaeria* (Lamiaceae, subfamily Nepetoideae, tribe Ocimeae, subtribe Hyptidinae) and its distribution, is followed by a description of the new species and details showing how it differs from other members of the section, a plate showing details of its morphology, and a distribution map. Habitat, phenology and conservation status are also included.

Key Words. campo rupestre, Cerrado Biome, *Hyptis kempffiana*, Labiatae, taxonomy, unusual leaf-form

Introduction

During the last 20 years, the level of activity of botanical fieldwork has increased enormously, especially aided by the ever improving and expanding development of the highways in Brazil, and the number of botanists now studying its rich flora (BFG 2015). The opening up of new areas, which were earlier difficult of access, has resulted in the discovery of very many new species of plant, that require rapid publication, in order to facilitate ongoing projects, especially the Flora do Brasil online (Flora do Brasil 2020, under construction) and molecular phylogenetic studies, which will help to elucidate plant relationships and their evolutionary history. Early publication will also ensure that data on conservation status is made available, and if the new taxon is threatened, steps can be taken to help ensure its survival. This paper is one of a number, now in press or in the planning stage, which will help to reduce the backlog of the, as yet, unpublished neotropical Lamiaceae taxa, of which many potentially interested researchers are still unaware.

Hyptis section *Eriosphaeria* Benth., contains at present over thirty species, which form a monophyletic assemblage (Pastore *et al*. 2011; Harley & Pastore 2012), extending from its centre of diversity in the Brazilian Planalto, into Northeast Brazil and north into Amazonia, with the widespread *Hyptis crenata* Pohl ex Benth. extending westward into eastern Bolivia. Southwards, the group extends beyond Minas Gerais only with the rare *Hyptis alpestris* A. St.-Hil. ex Benth., which has been recorded from São Paulo state.

The section is distinguished by having flowers with a style which is jointed above the level of the ovary, the lower, basal portion, termed the stylopodium being persistent, with the upper part falling with the corolla after pollination. The flowers are usually in a hemispherical, shortly pedunculate capitulum, with an involucre of narrowly lanceolate bracts. The capitulum is typically densely hairy, with long, silky hairs rising between the flowers. The calyx is symmetrically five-lobed (Harley & Pastore 2010). Epling (1949) records eight subsections, two of which contain only a single species.

Studies of *Hyptis* over many years, both in the field and in herbaria, including preparation for an account of the Lamiaceae for the Flora do Brasil, enabled the collector and the authors to recognize that recent collections from the Chapada dos Veadeiros, Goiás State were of a new and unrecognized species of *Hyptis* sect. *Eriosphaeria*. It is described here along with comments on possibly related species, ecological aspects, illustrations and its conservation status.

Materials & Methods

The morphological description was based on the specimens seen in the following herbaria: CEN, HUEFS, K, MBM and SPF (acronyms according to Thiers, continuously updated).

A 10−60 × magnification stereo-microscope was used to analyse morphological features of the specimens. All specimens cited have been seen by one or both of the authors.

GeoCAT tool (Bachman *et al.* 2011) alongside with IUCN Red List criteria (2001, 2016) and field notes were used to infer conservation status. GeoCAT was applied with the IUCN default values for Extent of Occurrence (EOO) and Area of Occupancy (AOO) analysis. The distribution map was produced in QGIS version 2.18.15 (QGIS Development Team 2018). In case of herbarium specimens not being geo-referenced, the geographic coordinates were approximated using the locality description of the specimen label.

Taxonomic Account

Hyptis pastorei *Harley & Antar* **sp. nov.** sect. *Eriosphaeria* Benth. Type:— BRAZIL. Goiás (Fig.1).

Cavalcante: Caminho para Engenho Vão do Moleque, a 17 km da cidade. 21 May 2011, *Pastore & Bringel 3231* (Holotype: HUEFS; Isotypes: CEN, K).

Subshrub with several herbaceous stems arising from a xylopodium, to c. 30 cm tall, branched and procumbent to ascending, green, slender, weakly quadrangular to 1.0 – 1.5 mm diam., with numerous short, rather broad-based, antrorsely adpressed trichomes, usually with sharply acute apex. *Cauline leaves* aromatic, sessile, patent, c. 6.5 – 11 × 2 – 3 mm, shorter than internodes, lamina rigid, ±elongate/linear, with base variable, varying from rounded, through cuneate to attenuate, apex rounded, with margin very deeply crenate or lobed, almost to midrib, and strongly undulate, with conspicuous, pale, thickened border, the undulations affecting the entire lamina, both surfaces pale green, glabrous except for a few short, white, broad-based, adpressed trichomes along midrib and both surfaces rather densely covered with conspicuous orange sessile glands. *Inflorescence* a terminal corymb of 3– 5 pedunculate capitula, subtended by very small leaf-like bracts, peduncles 1.3 – 2.4 mm diam., with short, white, antrorsely curved to adpressed, uniseriate, broad based trichomes and scattered orange sessile glands, capitula hemispherical, 1.1 – 1.8 cm diam., c. 16-flowered, with an involucre of spreading, often bluish-purple-tipped bracteoles, the outer lanceolate, slightly spreading, 4.0 – 5.5 × 1.0 mm, external surface with sparse, broad-based trichomes, adpressed along midrib, and sessile glands, internal surface subglabrous except for sparsely hairy base, and non-glandular, inner surface of bracteoles very slender, 4.0 – 6.0 × 0.2 – 0.6 mm, slightly paleaceous and long-ciliate along basal half, with long, soft, white trichomes. *Flowers* subsessile, with long white hairs, ascending from base and overtopping the calyx, calyx at anthesis c. 8 mm long, tube 3.0 – 4.0 mm long, thinly membranous, pale green, ±cylindrical, widening slightly towards throat, outer surface sparsely hairy and with orange, sessile glands, inner surface glabrous near base and sparsely hairy towards throat; lobes of calyx c. 4.0 mm long, very narrowly triangular, with subulate apex, long-ciliate in basal half; corolla with lobes lilac, tube pale purple, 7 – 7.5 mm long, 1 – 1.5 mm wide, cylindrical, externally glabrous except distally, near throat, with scattered, short trichomes and sessile glands, internally glabrous except for sparse hairs along some of the main veins; stamens glabrous, with filaments pale purple, gynoecium with style glabrous, the stylopodium overtopping the ovary by c. 1 mm, stigma shortly bilobed, tinged pale purple. *Fruit* not seen.

RECOGNITION. This remarkable and attractive plant differs from any other member of *Hyptis* sect. *Eriosphaeria*, and indeed from any other known Lamiaceae, by its very unusual leaves, with a thickened border which is deeply crenate and strongly undulate, affecting the entire lamina. None of the sections at present recognized (Epling 1949) appears to accommodate *H. pastorei*, but it perhaps can be compared to *Hyptis kempffiana* Harley (2012), from Eastern Bolivia, Santa Cruz, Velasco Province, from the Parque Nacional Noel Kempff, which is another member of *Hyptis* sect. *Eriosphaeria*, and shows a very similar habit. This species is also found in campo rupestre and damp grassland. It also has a corymbose inflorescence of few, pedunculate capitula, with an involucre of linear-lanceolate bracteoles. However, *H. kempffiana*, has leaves which are narrowly linear, with a plane, entire margin, quite different from those of *Hyptis pastorei*. This also is a species which cannot readily be placed in a subsection. Although these two species differ greatly from each other in the form of the leaves, their similar habit and inflorescence morphology suggests that they may possibly be related. New phylogenetic studies focused on *Hyptis* and with the inclusion of molecular data of both species may allow the placement of those within the genus.

DISTRIBUTION. This species is at present only known from three localities, in the municipality of Cavalcante, in the Chapada dos Veadeiros (Map 1). This is an area well-known for its rich and endemic flora (Harley 2013; Antar *et al*. 2018).

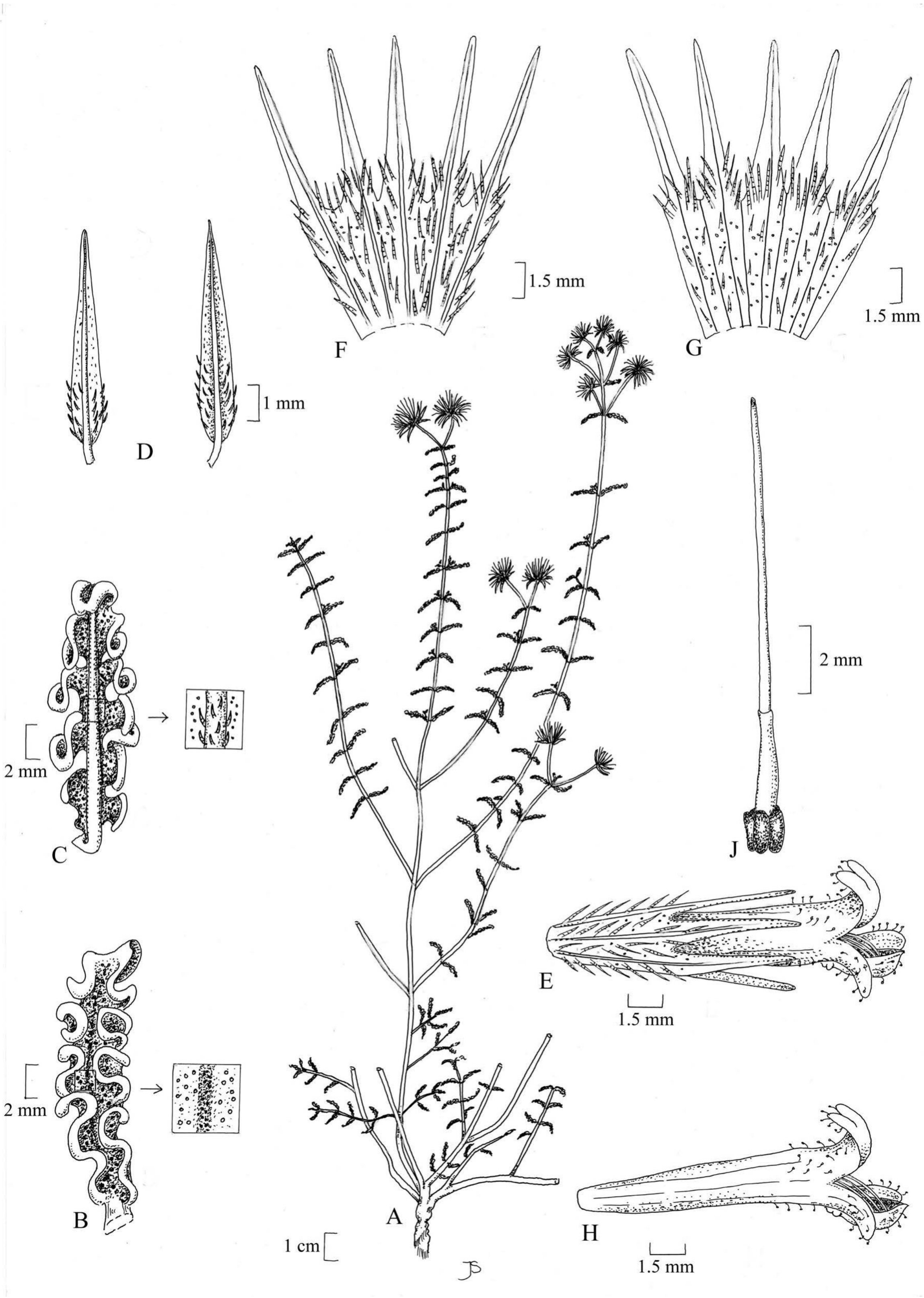
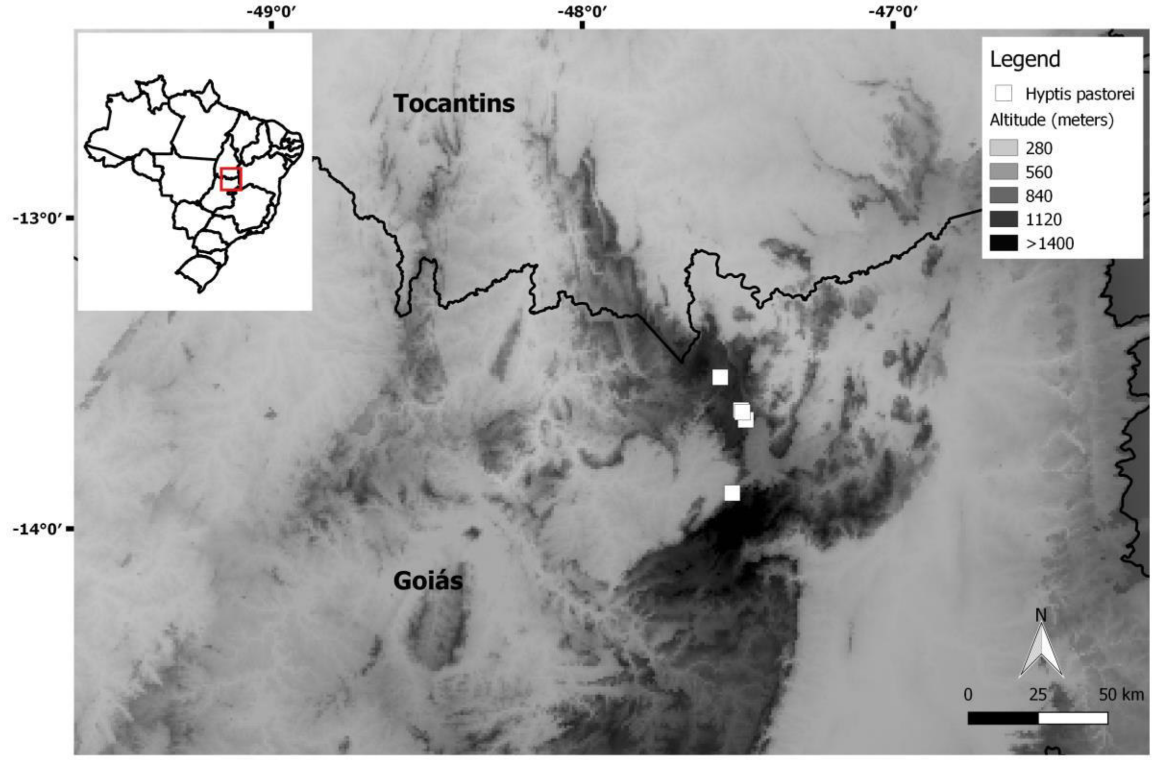


Fig. 1. *Hyptis pastorei.* **A** habit; **B** cauline leaf (enlarged) showing adaxial surface; **C** cauline leaf (enlarged) showing abaxial surface; **D** involucral bracteoles from capitulum; **E** flower side view; **F** calyx at anthesis displayed to show external surface; **G** calyx at anthesis displayed to show internal surface; **H** corolla side view; **J** gynoecium showing stylopodium. A–J. Illustration of Judi Stone based on Pastore & Bringel 3231 (K).



Map. 1. Distribution of *Hyptis pastorei* (white squares), in Northern Goiás State, Brazil.

SPECIMENS EXAMINED. BRAZIL. Goiás. Cavalcante: Ponte de Pedra, 20 April 2003, *Pastore, J.F.B. et al. 551* (CEN); Cavalcante: Estrada para Engenho Vão do Moleque após a subida da Serra, seguindo reto após a bifurcação para comunidade Kalunga (Cachoeira Santa Barbara) em direção da Cachoeira do Prata, 13˚ 37' 07" S 47˚ 29' 22" W, 1199 m elev., 09 April 2007. *Pastore, J.F.B. & Suganama, E. 1913* (HUEFS); Cavalcante: Caminho para o Engenho Vão do Moleque, a 17 km da cidade, 21 May 2011, *Pastore, J.F.B. & Bringel Jr, J.B. de A. 3231* (holotype: HUEFS; isotypes: CEN, K); Cavalcante: Serra do Tombador, 13 April 2013, *Cordeiro, J. et al. 4837* (MBM); Cavalcante: Serra do Tombador, 13˚ 30' 46" S, 47˚ 33' 22" W, 1097 m elev., 19 April 2013, *Cordeiro, J. 4944* (MBM); Cavalcante: Engenho II, sítio Histórico Kalunga, 19 May 2015, *Silvestre, L.F.V. 227* (UB).

HABITAT. Humid grassland and campo rupestre, probably always at elevations above 1000 m.

CONSERVATION STATUS. The Area of Occurrence and Extent of Occurrence of this species are very limited, being just 20 km² and 155 km² respectively. However, it is to some extent protected, occurring within conservation areas: Reserva Particular do Patrimônio Natural Renascer and Reserva Natural Serra do Tombador. The principal threats to this species are the occurrence of uncontrolled fires, although the ever-increasing destruction of the natural vegetation for agriculture: mostly soya bean cultivation and *Eucalyptus* L'Hér. plantations, have been responsible for extensive habitat loss, as has the over-exploitation of campo rupestre for tourism. Nearby areas are currently not fully explored, and may also contain populations of *Hyptis pastorei*. Currently the conservation status of this species is assessed as Endangered according to criteria EN B1ab(iii)+2ab(iii) (IUCN 2001).

PHENOLOGY. The few records indicate that the plants are in flower and fruit between April and May.

ETYMOLOGY. The species is named for Dr. José Floriano Barêa Pastore, whose analysis of the DNA of Hyptidinae (Pastore *et al.* 2011) was the basis for a fundamental revision of generic limits within the subtribe (Harley & Pastore 2012). His field collections of the group have also helped to reveal the amazing degree of speciation which has occurred in Hyptidinae, especially in the campos rupestres of Brazil.

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Novelties in *Hyptidendron* (Hyptidinae – Lamiaceae) from Brazil: A new species and a rediscovery

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Novelties in *Hyptidendron* (Hyptidinae – Lamiaceae) from Brazil: A new species and a rediscovery

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Abstract

A new species, **Hyptidendron roseum**, from the Chapada dos Veadeiros region, Goiás state, is described and illustrated. This new species is unique due to the morphological combination of an inflorescence composed of a unilateral cymose structure, sessile to subsessile leaves, a ring of trichomes in the throat of the calyx tube, and a dense indumentum of white uniseriate trichomes covering much of the plant. The new species is compared with morphologically similar species such as *H. unilaterale* and *H. albidum*. New specimens of another species, *H. unilaterale*, formerly known only from the type, were identified in herbaria and collected in the field. Photos *in vivo* of this species are provided for the first time, accompanying a full description and an illustration. We assess its conservation status and comment on its distribution, ecological aspects, and identification.

Key words: Campo rupestre, Cerrado, Chapada dos Veadeiros, *Hyptis*, Ocimeae, taxonomy.

The Hyptidinae is almost exclusively neotropical, ranging from the southern United States to Argentina, with two species extending their natural ranges to Africa (Harley et al., 2004; Harley & Pastore, 2012). The subtribe is an important component of grasslands and savannah formations, with several genera, including *Hyptidendron* Harley, mostly diversified in the Cerrado biome (Pastore et al., 2011; Harley & Pastore, 2012). *Hyptidendron*, one of the 19 genera currently recognized for Hyptidinae (Harley & Pastore, 2012), was proposed by Harley (1988) by the combination of two former sections of *Hyptis* Jacq.: *Hyptis* sect. *Umbellaria* Benth. and *Hyptis* sect. *Buddleioides* Benth. Originally, Harley (1988) recognized two sections: *Hyptidendron* sect. *Hyptidendron* and *Hyptidendron* sect. *Umbellaria* (Benth.) Harley. However, these are not being currently recognized due their incompatibility with the available phylogenetic data (Harley & Pastore, 2012).

Hyptidendron can be recognized by the inflorescences arranged in complex bracteolate cymes and flowers with styles jointed below, the lower part forming a persistent stylopodium that protrudes above the ovary (Harley, 1988; Harley & Pastore, 2012; Harley & Antar, 2017). The genus is endemic to South America, occurring in Bolivia, Ecuador, Paraguay, Peru, Guyana, Colombia, Venezuela and Brazil. In the latter country, all 18 known species of the genus occurs (Harley et al., 2004; BFG 2015; Harley & Antar, 2017). Some species of *Hyptidendron* are known from just a few collections, and usually from restricted areas (e.g., Harley, 1986; Harley & Antar, 2017).

During the preparation of a taxonomic revision for the genus, we found a new species, here named *Hyptidendron roseum,* from Chapada dos Veadeiros. Also, we found new specimens, both in the field and herbarium, of *H. unilaterale*, a species known previously only from the type collection. Both species are endemic to the *campo rupestre*, a high altitude grassland vegetation that occurs alongside rocks mostly in the Cerrado biome (Alves et al., 2014). This study presents descriptions for both species, with comments on closely related species, ecological aspects, illustrations, and conservation status.

Materials and methods

The morphological descriptions were based on the specimens seen in the following herbaria: ALCB, BHCB, BHZB, BRBA, CEN, CGMS, COR, CTBS, DIAM, ESA, ESAL, HDJF, HEPH, HRB, HRCB, HUEFS, HUFSJ, HXBH, IBGE, MBM, MBML, NX, NY, PAMG, R, RB, SP, SPF, SPSC, SPSF, UB, UEC, UFMT, UFOP, UPCB, US, VIES (acronyms according to Thiers, continuously updated). A 10−60 × magnification stereomicroscope was used to analyze morphological features of the specimens. Terminology follows Harris & Harris (2001) for general morphology and Hickey (1973) for leaf shape, as well as Epling (1949), Rudall (1980), Harley & Pastore (2012) and Harley & Antar (2017) for specific terms.

GeoCAT tool (Bachman et al. 2011) alongside with IUCN criteria (2001, 2016) were used to infer conservation status. GeoCAT was applied with the IUCN default values for Extent of Occurrence (EOO) and Area of Occupancy (AOO) analysis. The distribution map was produced in QGIS version 2.18.15 (QGIS Development Team 2018). In case of herbarium specimens not being geo-referenced, the geographic coordinates were approximated using the locality description on the specimen label.

Results

Hyptidendron roseum Antar, Harley & J. F. B. Pastore, **sp. nov.** Type: Brazil. Goiás: Cavalcante, Reserva Particular do Patrimônio Natural Renascer, Trilha para a Ponte de Pedra, elev. 1099 m, 27 July 2017, *G.M. Antar et al. 1737* (Holotype: SPF, isotypes: CEN, CTBS, HUEFS, K, NY, P, RB, UB, US). (Figs. 1–3)

Diagnosis: The new species shares with *Hyptidendron unilaterale* and *Hyptidendron albidum* a similar unilateral cymose inflorescences but differs by sessile to subsessile leaves, a ring of trichomes around the throat of the calyx tube, and a dense indumentum of white uniseriate trichomes covering much of the plant.

Trees or erect shrubs 1−3.5 m tall, aromatic, branches sometimes horizontal; stems woody, 3−7(−9) mm in diameter, younger stems quadrangular, slightly canaliculate, densely pilose with long uniseriate, non-glandular trichomes and minute, glandular-stipitate trichomes, older stems terete and less hairy. Cauline leaves opposite, decussate, imbricate when near the apex of the stem, longer than internodes, rarely equal or shorter, diminishing in size towards stem apex, lamina 2.2−4.9(−5.8) × 1.3−3.5 cm, chartaceous, light green, discolorous, with the abaxial surface paler, lanceolate to ovate, rarely broadly ovate or elliptic, base cordate to rounded, apex acuminate, rarely acute, acumen 1.3−2.5 mm long, margin sharply serrulate with the exception of the base which is entire, 8−14 teeth on each side of leaf, the tooth apex swollen, turned forward and with uniseriate non-glandular trichomes and pale yellow stipitate-glandular trichomes, adaxial surface pilose with uniseriate non-glandular white trichomes and glandular-stipitate trichomes, denser on the margins, the venation scarcely impressed, midrib and primary veins slightly sulcate or plane, abaxial surface with the same indumentum as the adaxial surface but denser and the glandular-stipitate trichomes more frequent, venation reticulate, midrib and primary veins prominent; sessile or petiole up to 3 mm long, enlarged, slightly canaliculate, densely pilose with long, thin, uniseriate non-glandular trichomes. Inflorescence a terminal cymose panicle with unilateral cymes subtended by foliaceous bracts, which are conspicuous, similar to the leaves, slightly smaller, 1.5−3.4 × 1.1−2.3 cm, sessile to subsessile, and mostly shorter than the cymes, mature cymes 9−16 flowered, not obscured by leaves or only partially obscured by the leaves, borne on peduncles 4−11 mm long, with the same indumentum as the petioles. Flowers on pedicels 1−4.7 mm long, densely pilose with long, thin, uniseriate, non-glandular, white trichomes and subtended by linear to narrowly elliptic bracteoles, 1.5−4(−4.5) mm long, with the same indumentum as the pedicels; calyx at anthesis 2.5−3.6 mm long, cupuliform, tube 2−2.4 mm long, straight, ribbed, externally densely pilose with long uniseriate non-glandular trichomes, and minute brown glandular-stipitate trichomes, tube internally glabrous or glabrescent with a ring of white trichomes in the tube throat, calyx lobes subequal, 1−1.4 mm long, deltate, apex acute, externally with the same indumentum as the tube, internally with minute stipitate-glandular trichomes, calyx in fruit 5.5−7.6 mm long, less hairy, tube accrescent, 4.5−6 mm long, ± cylindrical, ribbed, calyx lobes 1.2−2 mm long, straight or slightly curved; corolla purple, 8−12 mm long, tube 8−9.2 mm long, straight, cylindrical, 1.2−1.5 mm wide, externally pilose with long white non-glandular uniseriate trichomes, internally glabrous with the exception of tufts of long curved entangled non-glandular trichomes close to the insertion of the posterior pair of stamens in the corolla, lobes spreading, externally pilose with long white non-glandular uniseriate trichomes, internally glabrous, the anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely covered with long curved entangled non-glandular trichomes, anterior pair glabrescent with some long curved entangled non-glandular trichomes mostly near the anther; gynoecium with style jointed and a well-developed stylopodium protruding above ovary, ca. 1 mm long, and apically with two slender stigmatic lobes. Nutlets 3.5−4.5 × 1.7−2.4 mm, ellipsoid, castaneous, rugulose and shining, glabrous to glabrescent, with deep abscission scars, mucilaginous when wetted.

Distribution and habitat.—Endemic to Goiás state, Cavalcante municipality (Fig. 1); above 1000 m, in *campo rupestre*, growing among rocks in sandy dry soils. The area is part of the Chapada dos Veadeiros region, known to have high species richness and many endemic species (Harley, 2013).

Additional specimens examined. Brazil, Goiás: Cavalcante, Fazenda Renascer, 05 April 2007, *J. F. B. Pastore & E. Suganuma 1899* (CEN, HUEFS); ibid; Reserva Particular do Patrimônio Natural Renascer, Trilha para a Ponte de Pedra, 27 July 2017, *G. M. Antar et al. 1746* (B, CEN, HUEFS, NY, R, RB, SPF, UC, UFG); ibid, 27 July 2017, *G. M. Antar et al. 1760* (CEN, ESA, K, SPF, UB, US)

Phenology.—Hyptidendron roseum was found in a fertile condition in July.

Conservation status.—The Area of Occupancy is just 4 km² and the Extent of Occurrence is 0.033 km². All the collections were found inside a private protected area named Reserva Particular do Patrimônio Natural Renascer. Even so, *Hyptidendron roseum* is only known from one locality, which is subject to uncontrolled fires. Nearby areas are currently unexplored and may also contain populations of *Hyptidendron roseum*; still, the conservation status of this species is currently assessed as Critically Endangered according to criteria CR B1ab(iii)+2ab(iii) (IUCN 2001).

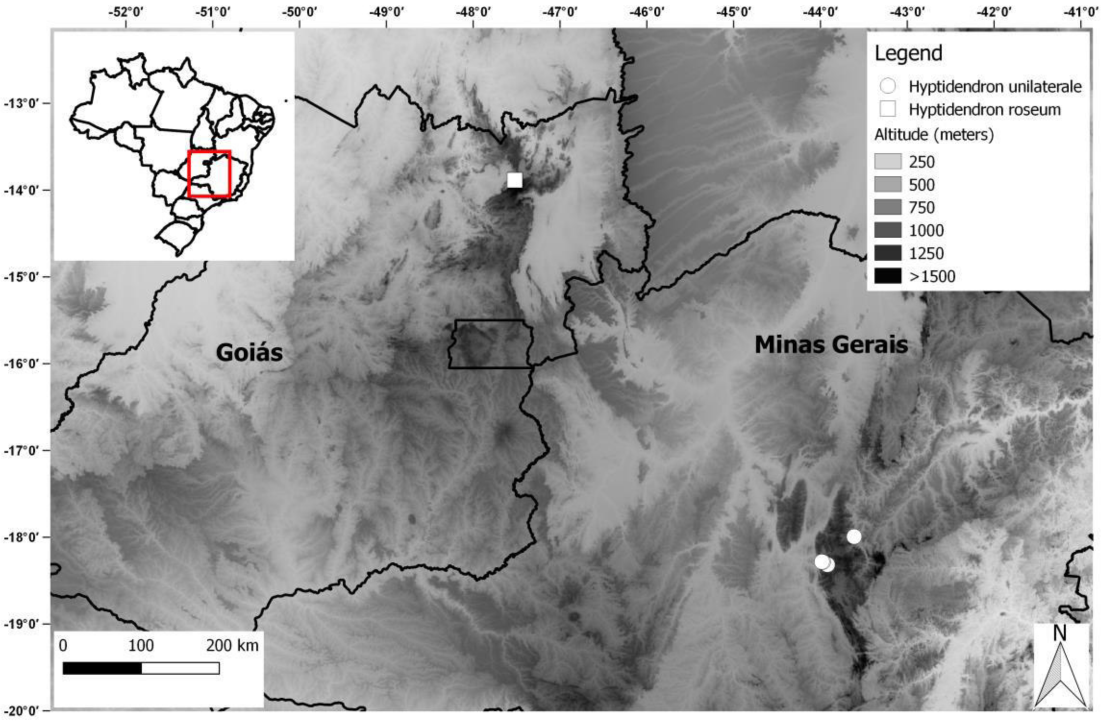

FIG 1. Distribution of *Hyptidendron roseum* (white squares) and *Hyptidendron unilaterale* (white circles).

Etymology.—The specific epithet refers to the pink corollae. Although corolla color in some species of *Hyptidendron* has not yet been documented, usually the species of the genus present a purple or lilac corolla. Thus, pink corollae are probably a diagnostic character for this species.

Notes.—Hyptidendron roseum can be distinguished from its congeners by sessile to subsessile leaves, unilateral cymose structure, and a ring of trichomes in the throat of the calyx tube. It resembles *H. unilaterale* and *H. albidum* Harley & Antar in having unilateral cymose inflorescences and cordate to rounded leaf bases. *Hyptidendron albidum* differs from *H. roseum* by petiolate leaves, absence of a ring of trichomes around the throat of the corollae, and an indumentum of white dendroid trichomes. *Hyptidendron unilaterale* differs from *H. roseum* by petiolate leaves, absence of a ring of trichomes around the throat of the corolla, and an indumentum composed of minute stipitate-glandular trichomes alongside with long, uniseriate non-glandular trichomes.

FIG. 2. *Hyptidendron roseum* **A.** Branch bearing leaves and inflorescences. **B.** Leaves, adaxial surface with indumentum detail. **C.** Leaves, abaxial surface with indumentum detail. **D.** Immature cyme. **E.** Flower, side view. **F.** Calyx with bracteole, side view. **G.** Corolla, side view. **H.** Gynoecium and style, showing stylopodium. **I.** Nutlet. A−I. Illustration of Monique Rached based on *Antar et al. 1737* (SPF).

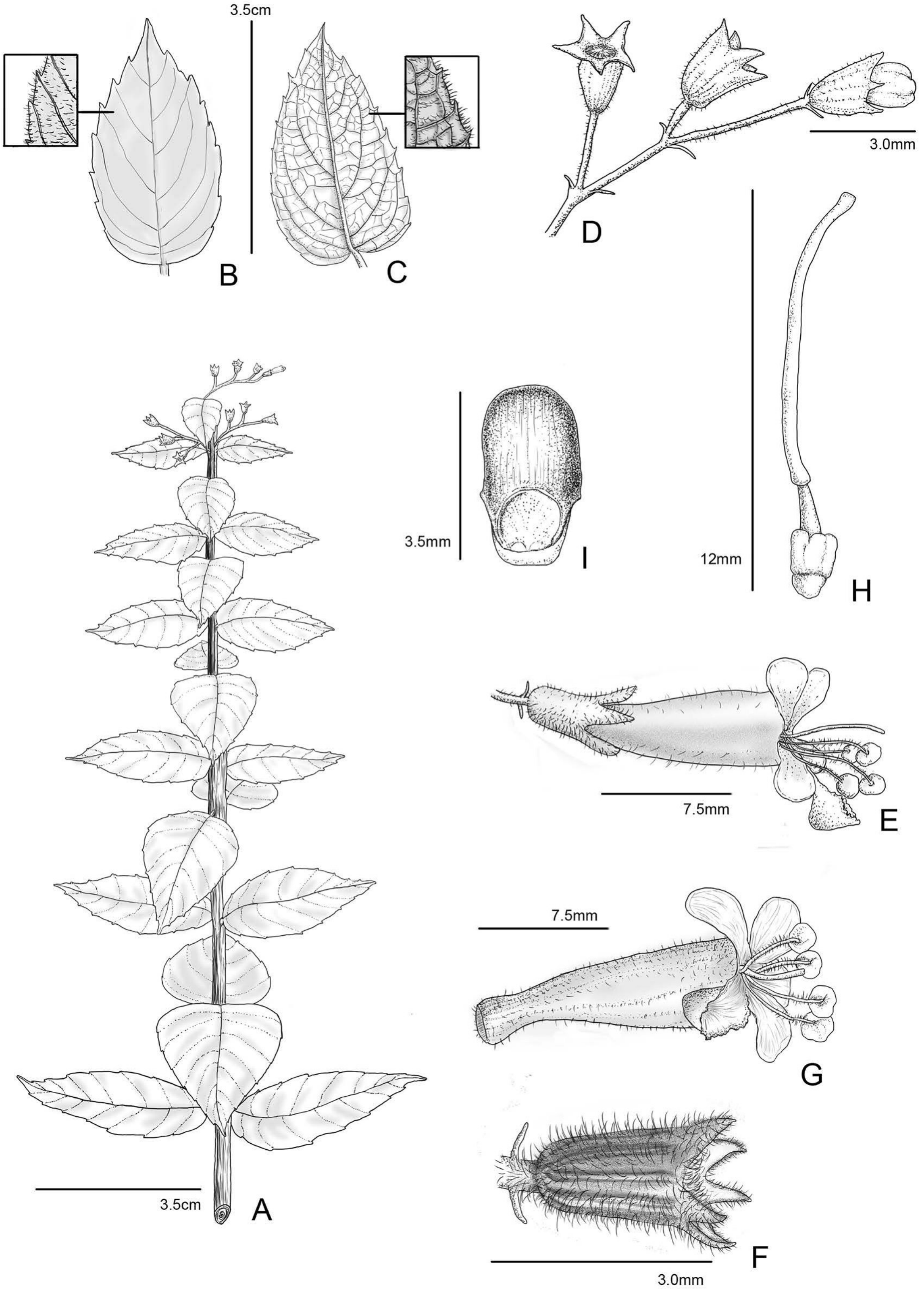

FIG. 3. *Hyptidendron roseum* **A.** Habitat. **B.** Habit. **C.** Branch. **D.** Flower and inflorescence. **E.** Inflorescence.

Hyptidendron unilaterale (Epling) Harley, Bot. J. Linn. Soc. 98: 93. 1988. *Hyptis unilateralis* Epling, Brittonia 7: 140.1951. *Hyptis unilateralis* Epling, Rev. Mus. La Plata, 7: 188. 1949, *Nomen Nudum*. Type: Brazil: Minas Gerais, Diamantina, June. 1934, *Brade* 13640 (Holotype: UC!, isotypes RB!, B [scan seen], HB?). (Figs. 1, 4 and 5).

Erect shrubs 1−2 m tall, aromatic; stems woody, 3−5 mm in diameter, younger stems quadrangular, slightly canaliculate, pubescent with minute stipitate-glandular trichomes and hispid, with long uniseriate non-glandular trichomes, the latter sometimes sparse, older stems terete and less hairy. Cauline leaves opposite, decussate, not imbricate, longer or equal to internodes, rarely shorter, diminishing in size towards stem apex, lamina 2−4.5(−5.9) × (1−)1.3−3.3(−4.7) cm, chartaceous, brown, concolorous or slightly discolorous, ovate, elliptic broadly ovate or rarely orbicular, base rounded or cordate, apex acuminate, acumen 0.6−1.5 mm long, margin sharply serrulate with the exception of the base which is entire, (7−)11−21(−24) teeth on each side of leaf, the tooth apex swollen, turned forward and with uniseriate non-glandular trichomes, adaxial surface with scattered stipitate-glandular and long uniseriate non-glandular trichomes, denser at the margins, the venation scarcely impressed, midrib and primary veins slightly sulcate or plane, densely covered with uniseriate trichomes, abaxial surface with the same indumentum as the adaxial surface but denser, venation reticulate, midrib and primary veins prominent; petioles (0.2−)0.6−1.5(−2.5) cm long, slightly canaliculate, obscured by the pubescent indumentum with minute stipitate-glandular and long, uniseriate non-glandular trichomes. Inflorescences an axillary or terminal cymose panicle with unilateral cymes subtended by foliaceous bracts, which are conspicuous, similar to the leaves, but much smaller, 5−15 × 3.5−10 mm, sessile to subsessile, and shorter than the cymes, mature cymes 7−19 flowered, not obscured by leaves, mostly unilateral and borne on peduncles 6−10 mm long, with similar indumentum as the petioles. Flowers on pedicels (1−)1.5−4(−5) mm long, pubescent with minute stipitate-glandular trichomes, and subtended by narrowly linear bracteoles, 1−2 mm long, with similar indumentum as the pedicels; calyx at anthesis 2.5−4(−4.5) mm long, tube 1.2−2.5 mm long, straight, cylindrical to slightly infundibuliform, ribbed, externally densely covered with small stipitate-glandular trichomes and with sparse, long, uniseriate non-glandular trichomes, tube internally glabrous, calyx lobes subequal, 1.2−2(−2.4) mm long, deltate, apex acute, densely covered with small stipitate-glandular trichomes and long uniseriate non-glandular trichomes located at the apex of the teeth, and internally with small stipitate-glandular trichomes, calyx in fruit (5−)6−7.5(−8.5) mm long, less hairy, tube accrescent, 5−6 mm long, ± cylindrical, ribbed, calyx lobes 1.3−2.5 mm long, straight or reflexed; corolla lilac, 5−6.5 mm long, tube 3.5−5 mm long, straight, cylindrical, ca. 1 mm wide, glabrous with the exception of tufts of long curved entangled non-glandular trichomes close to the insertion of the posterior pair of stamens in the corolla, lobes spreading, pubescent with small stipitate-glandular trichomes, the anterior lobe large, boat-shaped with long, almost caudate apex; posterior pair of stamens with filaments densely covered with long curved entangled non-glandular trichomes, anterior pair glabrescent with some long curved entangled non-glandular trichomes mostly near the anther; gynoecium with style jointed and well-developed stylopodium protruding above ovary, ca. 1 mm long, and apically with two slender stigmatic lobes. Nutlets 3.6−4.5 × 1.5−2.2 mm, oblong-ellipsoid, dark castaneous, rugulose and shining, glabrous, with deep abscission scars, mucilaginous when wetted.

Distribution.—Hyptidendron unilaterale is endemic to Diamantina Plateau, Minas Gerais state. It occurs in the municipality of Diamantina in the district of Conselheiro Mata (Fig. 1).

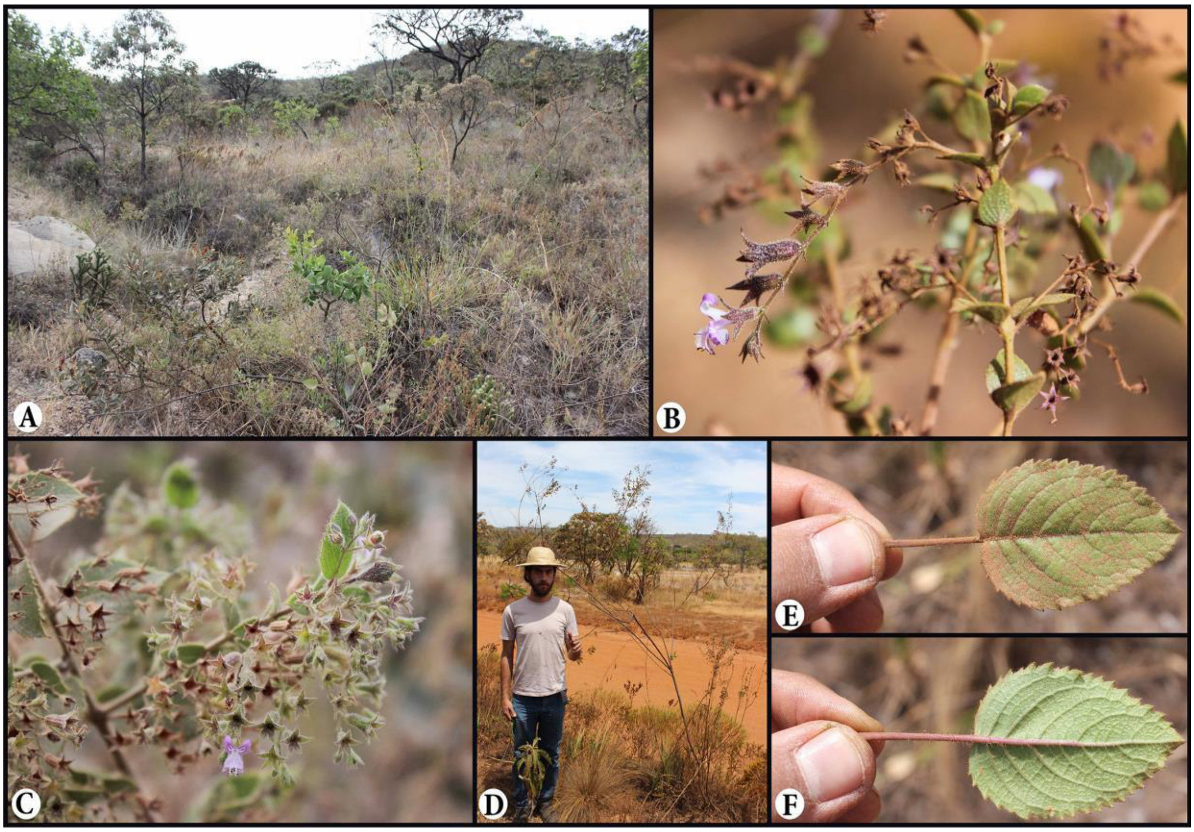

FIG. 4. *Hyptidendron unilaterale* (Epling) Harley **A.** Habitat. **B.** Unilateral inflorescence. **C.** inflorescence. **D.** Habit. **E.** Leaf, adaxial side**. F.** Leaf, abaxial side. All photographs by G.M. Antar.

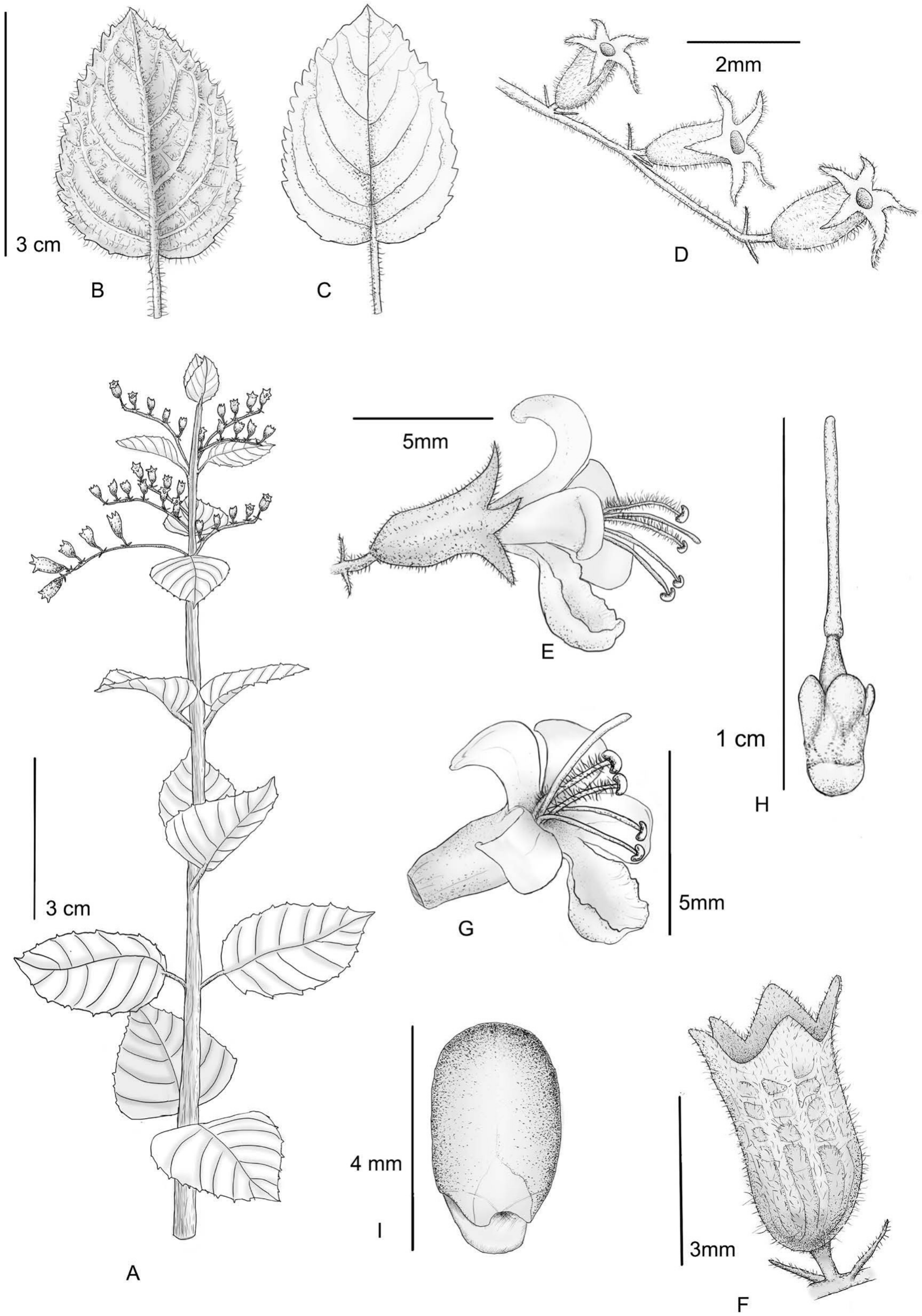

FIG. 5. *Hyptidendron unilaterale* **A.** Branch bearing leaves and inflorescences. **B.** Leaves, abaxial surface. **C.** Leaves, adaxial surface. **D.** Part of the cyme. **E.** Flower, side view. **F.** Fruiting calyx with bracteoles. **G.** Corolla, side view. **H.** Gynoecium and style, showing stylopodium. **I.** Nutlet**. A−I**. Illustration of Monique Rached based on Antar & Chaves 1870 (SPF).

Additional specimens examined. BRAZIL. Minas Gerais: Diamantina: Conselheiro Mata, Fazenda Irmãos Cunha, 24 May 1990, *M. Bacelar*. 268 (PAMG); ibid., Estrada Diamantina-Conselheiro Mata, 18°18'59.6"S, 43°55'05.3"W, 1138 m, 22 Sep 2017, *G.M. Antar & D.A. Chaves* 1870 (SPF); ibid, Estrada Diamantina-Conselheiro Mata, próximo de Conselheiro Mata, 18°17'04"S, 43°58'09"W, 1030 m, 22 Sep 2017, *G.M. Antar & D.A. Chaves* 1875 (SPF).

Habitat.—Hyptidendron unilaterale occurs only in *campo rupestre* vegetation in sandy, rocky, dry soils. It can be found from 1000 to 1100 meters above sea level.

Phenology.*—Hyptidendron unilaterale* was found in fertile condition from May to September.

Conservation status.—The Area of Occupancy is only 16 km², and the Extent of Occurrence is 183.757 km². Collections were not found inside protected areas, and the only known populations are close to the road. If the road becomes asphalted, the only currently known populations could suffer a big reduction in size, leading to possible extinction. The conservation status of this species is assessed as Endangered according to criteria EN B1ab(iii)+2ab(iii) (IUCN 2001).

Notes.—Prior to this report, *Hyptidendron unilaterale* was only known from the type specimen, collected by Brade in 1934 (Harley, 1988). However, it has never been considered in any red list or as rare. It is rediscovered after 56 years.

The species most closed related to *Hyptidendron unilaterale* are *H. albidum* and *H. roseum*, which have the same unilateral inflorescences. *Hyptidendron unilaterale* differs from *Hyptidendron albidum* by an indumentum composed of minute stipitate-glandular trichomes along with long uniseriate non-glandular trichomes (*vs.* indumentum of white dendroid trichomes), cymes not obscured by the leaves (*vs.* cymes obscured by the leaves) and the shape and size of the bracts, which are much smaller than leaves, and subsessile to sessile (*vs.*

bracts petioled, similar to leaves but slightly smaller). It differs from *H. roseum* by petioles (0.2−)0.6−1.5(−2.5) cm long (vs. petioles 0–3 mm long), an indumentum composed of minute stipitate-glandular and long uniseriate non-glandular trichomes (vs. a dense indumentum of white uniseriate trichomes covering much of the plant), and a ring of trichomes in the throat of the calyx tube absent (vs. ring of trichomes present).

Hyptidendron unilaterale also superficially resembles *H. glutinosum* (Benth.) Harley because of the cordate base to their leaves, but it can be immediately distinguished by the unilateral inflorescence (vs. dichasial in *H. glutinosum*).

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Chapter 5.4

Cyanocephalus veadeiroensis (Hyptidinae – Lamiaceae): a striking new species from the Chapada dos Veadeiros, Goiás, Brazil

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Cyanocephalus veadeiroensis (Hyptidinae – Lamiaceae): a striking new species from the Chapada dos Veadeiros, Goiás, Brazil[i]

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Abstract

A new species, *Cyanocephalus veadeiroensis*, from the Chapada dos Veadeiros region, Goiás state, which was first recognized on the Facebook is here described and illustrated. This new species is unique due to the combination of densely imbricate leaves obscuring the stems, the leaves longer then the internodes, the secondary veins almost parallel to the main vein, the margin entire to serrate and the leaf apex acuminate. The new species is compared with morphologically similar species such as *Cyanocephalus adpressus* and *Cyanocephalus lanatus*. We also provide comments on the distribution, ecological aspects and recognition of this taxon.

Key words: Campo rupestre, Cerrado, Chapada dos Veadeiros, *Hyptis*, Nepetoideae,
Ocimeae, Taxonomy.

Introduction

Hyptidinae (Nepetoideae, tribe Ocimeae) has ca. 380 species being an important component of South American biomes, mostly in the Brazilian Cerrado (Pastore *et al*. 2011; Harley and Pastore 2012; BFG 2015). The subtribe itself was first studied by Bentham (1833), but formally recognized by Endlicher (1838). In his detailed account of the group, Bentham (1833, 1848) recognized four genera: *Eriope* Humb. & Bonpl. ex Benth., *Hyptis* Jacq., *Marsypianthes* Mart. ex Benth. and *Peltodon* Pohl. *Hyptis,* the largest in species number, was divided in 20 sections based in the inflorescence structure. Later in the 20th century, Epling (1949) published a revision of *Hyptis*, increasing the number of sections to 27. Novelties in the classification of the subtribe were published by Harley (1976, 1986a and 1988), a broader delimitation of *Eriope* was proposed, *Hyptis* sect. *Hypenia* Mart. ex Benth. was elevated to generic level and two new genera *Hyptidendron* Harley and *Eriopidion* Harley were created. Apart from these remarkable changes, phylogenetic studies of Pastore *et al.* (2011) revealed *Hyptis* as polyphyletic and, supported by morphological evidence, Harley and Pastore (2012) proposed a new classification of the subtribe, elevating a number of sections to the generic level and recognizing 19 genera within the subtribe.

Cyanocephalus (Pohl ex Benth.) Harley & J.F.B.Pastore, is one of the newly proposed genera. It includes 25 species, which occur mainly in the *Cerrado* biome of central Brazilian plateau, extending to eastern Bolivia and Paraguay (Harley and Pastore 2012). These species were formerly placed in *Hyptis* sect. *Cyanocephalus* Benth., which had five subsections: *Longifoliae* Epling, *Cordifoliae* Epling, *Rugosae* Epling, *Rigidae* Benth. and *Argenteae* Epling (Epling 1949; Harley 1985). Harley (1985, 2006), however, considered this sectional classification unsatisfactory, as it was based largely on leaf morphology, characters much affected by developmental and environmental factors.

The recognition of the new species described in this paper occurred originally by chance, in September 2013, when attention was drawn to it by images posted on DetWeb, a Facebook group that shares botanical knowledge. The unusual appearance of this plant was early noted in comments by JFBP, who recognized it as a yet undescribed new species of *Cyanocephalus*. Recognition of new species through social media is not common, although this is the third known case. *Pleurophora pulchra* J.A.Siqueira, Cotarelli, J.F.B.Pastore & T.B.Cavalc. and *Drosera magnifica* Rivadavia & Gonella were also 'discovered' via Detweb (Siqueira-Filho *et al.* 2015, Gonella *et al.* 2015), which can be used as a good tool to accelerate biodiversity documentation. The specimen photographed was analyzed in the CEN herbarium and recollected at its original locality. However, photographs were also shown to RH, who recorded earlier collections of this species. It had originally been collected by Glaziou in the Serra da Baliza (part of Chapada dos Veadeiros) in 1894 and again 1895. Then in 1971, Harley, in company with Howard Irwin of the New York Botanical Garden, collected sterile material in São João da Aliança, further north in the Chapada. At this time, due to lack of adequate material, the species had remained unpublished. Surprisingly, the two Glaziou collections were published with different names (both nomina nuda) as *Hyptis quadrangularis* and *Hyptis acutifolia* (Glaziou 1911). The specimens in Paris had also both been annotated by Epling.

Chapada dos Veadeiros region is known to have high species richness and endemism for Hyptidinae with many novelties in recent years (e.g. Harley 1986b; Harley and Pastore 2010; Harley 2013; Schliewe *et al.* 2017; Antar *et al.* 2019; Soares *et al.* 2019). Here we describe *Cyanocephalus veadeiroensis*, and provide a full description, illustration, putative conservation assessment as well as taxonomic and ecological comments.

Materials and Methods

The morphological descriptions were based on the specimens seen in the following herbaria: CEN, HUEFS, K, SPF and UB (acronyms according to Thiers 2019). A 10−60 × magnification stereomicroscope was used to analyze morphological features of the specimens. Terminology follows Harris and Harris (2001) for general morphology and Hickey (1973) for leaf shape, as well as Epling (1949), Rudall (1980), Harley (2006) and Harley and Pastore (2012) for specific terms. The distribution map was produced in QGIS version 2.18.15 (QGIS Development Team 2018).

Taxonomic Treatment

Cyanocephalus veadeiroensis Antar & Harley **sp. nov.** (Figs. 1-2). Typus: Brazil, Goiás: Alto Paraíso de Goiás, GO–118, km 143,5 [142,5], 22 km ao sul de Alto Paraíso, entrada para a fazenda Paraisinho, October 20, 2013, *M.F. Simon & H.C.J. Moreira – EMATER 2015* (holotype: CEN; isotypes CTBS, HUEFS, K, NY, RB, SPF) (Figs. 1–3).

= *Hyptis quadrangularis* Glaz. (1911) nomen nudum.

= *Hyptis acutifolia* Glaz. (1911) nomen nudum.

Cyanocephalus veadeiroensis can be recognized from all other species of the genus on account of its densely imbricate leaves, obscuring the stems, sessile leaves smaller than 1 cm with leaf base rounded to cuneate, secondary veins almost parallel to the main vein and hispid indumentum. *Cyanocephalus veadeiroensis* is closely related to *Cyanocephalus adpressus* (A.St.-Hil. ex Benth.) Harley & J.F.B.Pastore and *Cyanocephalus lanatus* (Pohl ex Benth.) Harley & J.F.B.Pastore, sharing a similar distribution, habitat, imbricate sessile leaves and a similar inflorescence structure (Table 1). *Cyanocephalus adpressus* differs from *C. veadeiroensis* in having stems which are not totally obscured by leaves, which are usually

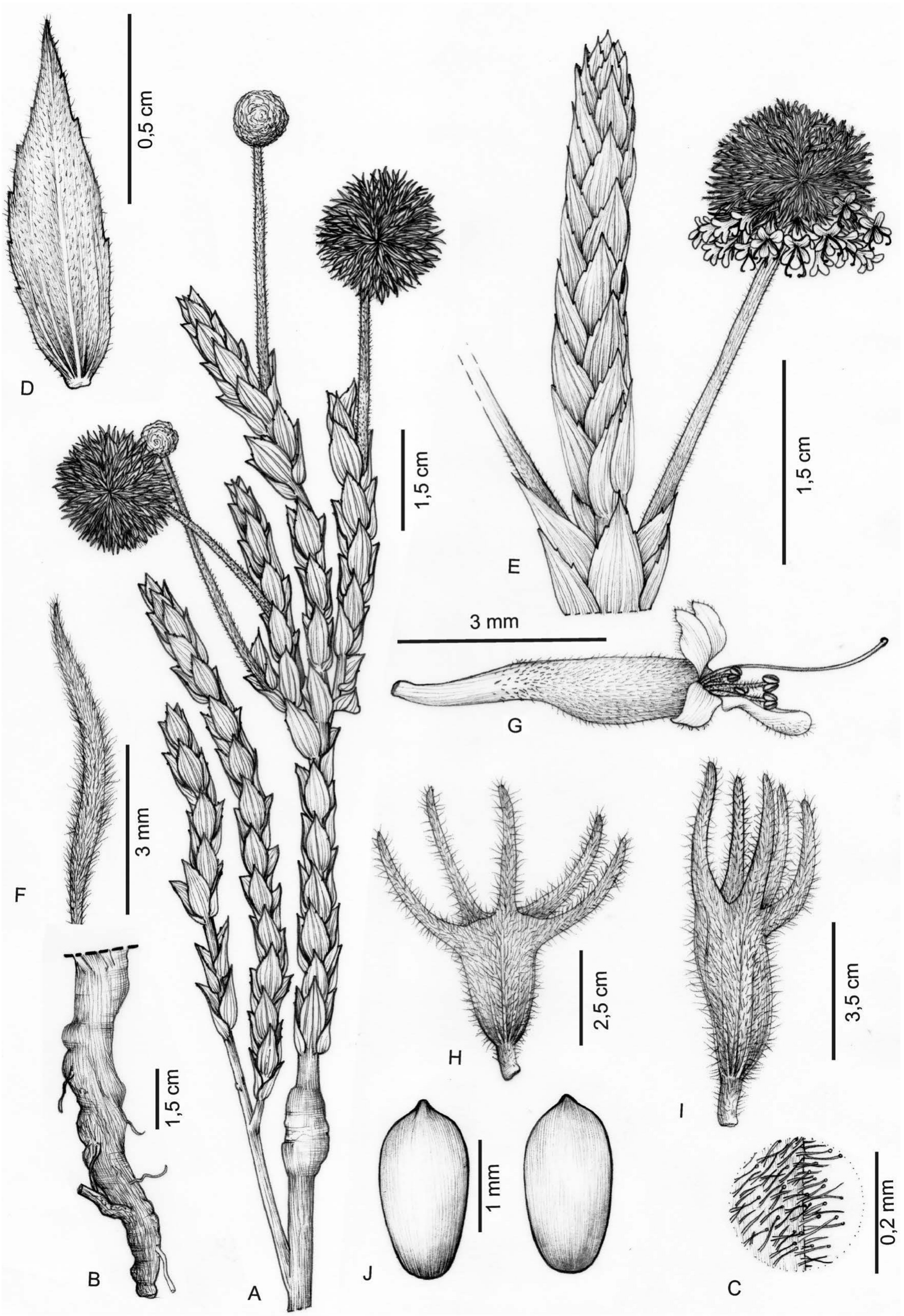

FIG 1. *Cyanocephalus veadeiroensis* (A) Habit. (B) Woody subterranean structure. (C) Stem indumentum. (D) Leaves, abaxial surface. (E) Branch, showing a fertile capitula. (F) Bracteole. (G) Corolla, side view. (H) Calyx in anthesis, side view. (I) Calyx in fruit, side view. (J) Nutlet, front and side view (A–J). Illustration of Carla Teixeira de Lima based on *Simon & Moreira 2015* (CEN).

TABLE 1. Diagnostic morphological characters of *Cyanocephalus veadeiroensis* and related species.

Character	*C. veadeiroensis*	*C. adpressus*	*C. lanatus*
Plant height (cm)	30–50	30–70	(25-) 40–100
Plant indumentum	Hispid	Hispid	Lanate
Leaf arrangement	Densely imbricate	Imbricate	Imbricate
Leaves × Internodes	Longer	Smaller, rarely longer	Longer to smaller
Leaf size (cm)	(0.7-)1.0–1.6 × 0.3–0.6	0.7–1.8× 0.4–1.0	1.2–1.8×1.0–1.3
Leaf margin	Entire to serrate	Serrate	Serrate
Blade shape	Elliptic to lanceolate	Narrowly ovate to elliptic	Ovate to elliptic
Leaf apex	Acuminate to acute	Acute	Acute
Secondary Veins related to the main vein	Almost Parallel	Curved	Curved
Calyx teeth length (mm)	2.8–3.5	2–2.2	3–3.5

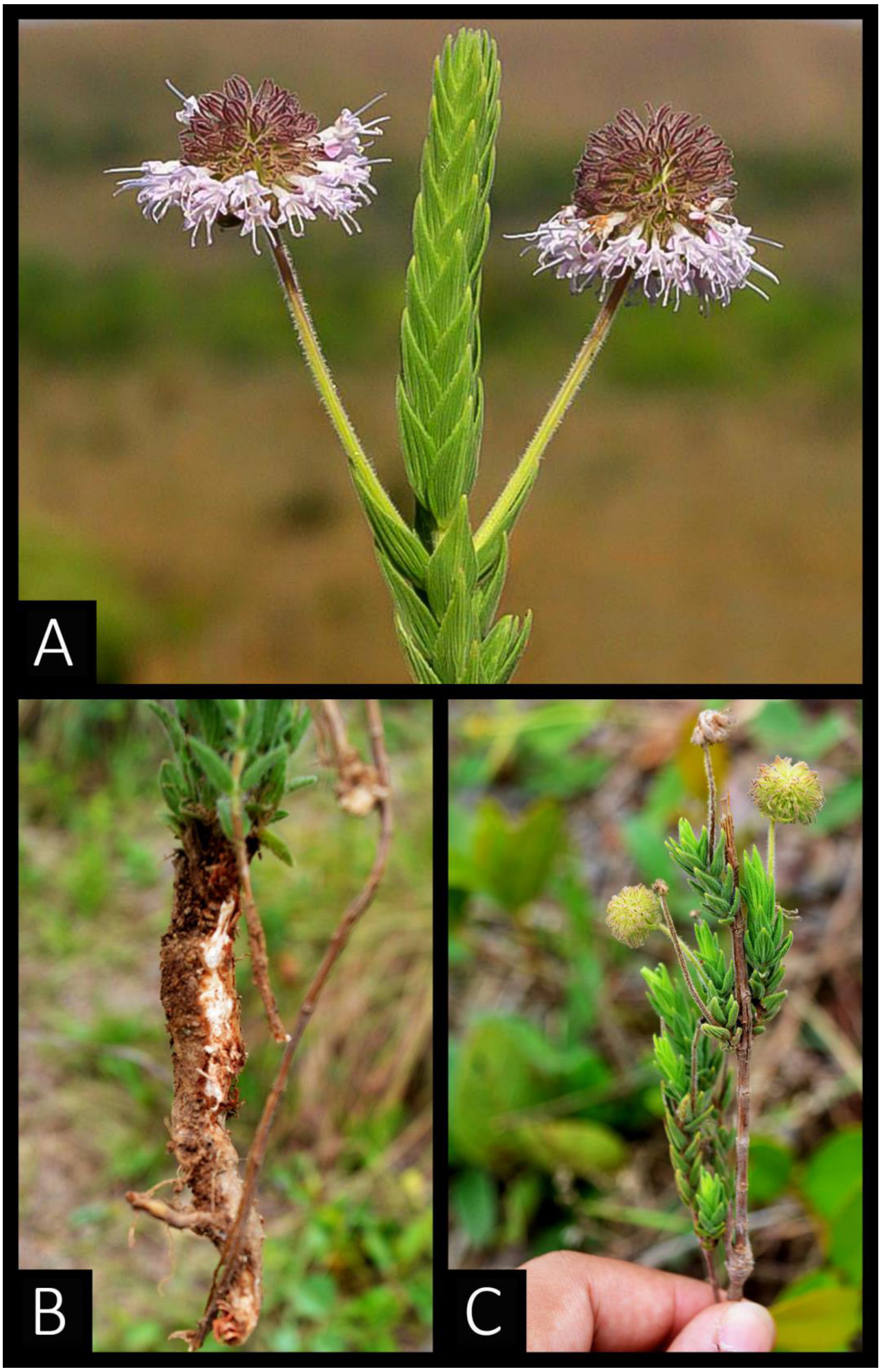

FIG 2. *Cyanocephalus veadeiroensis* (A) Habitat. (B) Habit. (C)Branch. (A). Photo by Henrique Moreira (B-C) Photos by Arthur de Souza Soares.

shorter than the internodes, and with serrate margins, its blade apex are acute, its secondary veins are curved in relation to the main vein and its flowers are smaller (e.g. calyx at anthesis 2–2.2 mm long). *Cyanocephalus lanatus* differs from *C. veadeiroensis* in having lanate indumentum, larger leaves (1.2–1.8×1.0–1.3 cm), its blade apex are acute and its secondary veins are curved related to the main vein.

Subshrubs 30−50cm tall, with 1−few stems arising from a woody subterranean structure, similar to xylopodium; stems erect, ca. 2 mm diam., non-aromatic, simple or sparingly branched, younger stems quadrangular, ribbed, canaliculate, densely covered with uniseriate, non-glandular trichomes of variable length and sessile glands; older stems less hairy, terete and with bark stripping off in longitudinal threads. Cauline leaves opposite, decussate, densely imbricate obscuring the stems, longer than internodes, sessile, present all along the stem but the base of stem or older stems, lamina (0.7–)1.0–1.6× 0.3–0.6 cm, elliptic to lanceolate, chartaceous, concolorous, base rounded to cuneate, apex acuminate, margin entire to serrate with few teeth, adaxial surface with veins weakly impressed, pilose to glabrescent with uniseriate, non-glandular trichomes and sessile glands, adaxial surface with primary and secondary veins prominent, secondary veins almost parallel to the main vein, indumentum densely tomentose of uniseriate, non-glandular trichomes of variable length, often longer on the veins and shorter between veins, and sessile glands. Inflorescence of pedunculate, spherical capitula disposed near stem apex and borne singly from the axils of leaf-like bracts but less imbricate, with indumentum as on leaves. Peduncles 2.2–6.0 cm long, slender, ribbed, slightly curved and elongating in fruit, densely hairy with trichomes uniseriate, of various lengths, and with stipitate and sessile glands; capitula 1.0–1.4 cm diam., enlarging in fruit, many-flowered, with involucral bracteoles 5–6 mm long., linear, reflexed at anthesis, curved and inflexed at mid-point and soon becoming obscured. Flowers sessile to subsessile, pedicels up to ca. 0.5 mm long, covered with sessile glands; calyx at anthesis 4.5–

6.1 mm long, with the tube green, 2–3 mm long, cylindrical, ribbed, +- straight, with oblique mouth, externally covered with uniseriate, glandular-stipitate trichomes and sessile glands mostly at the base, internally glabrescent with the exception of the throat which is covered with glandular stipitate trichomes, calyx-lobes often vinaceous, 2.8–3.5 mm long, subequal, narrowly subulate, weakly incurved, densely covered with glandular-stipitate trichomes, sinus between lobes truncate, calyx in fruit accrescent, tube 5.5–6.4 mm long, deflexed above the middle, thin-walled, crustaceous in upper part some way below the throat, less hairy, lobes 2–3 mm long, slightly curved; corolla lilac or whitish, 5–6.5 mm long, tube (4.5-)5–5.5 mm long, straight, cylindrical, externally pilose with the exception of the base which is glabrescent, internally glabrous, lobes spreading, externally pilose with uniseriate long trichomes in the margins and sessile glands, internally glabrous, the anterior lobe large, boat-shaped with long, almost caudate apex; stamens pilose; style without persistent stylopodium protruding above ovary, glabrous, stigma inconspicually bilobed. Nutlets ca. 2×1 mm, oblong, pale castaneous, smooth, glabrous or glabrescent, with very small abscission scar with small beak, slightly mucilaginous when wet.

Distribution. *Cyanocephalus veadeiroensis* is endemic to Chapada do Veadeiros region in Goiás state, occurring in the municipalities of Alto Paraíso de Goiás and São João da Aliança (Fig. 1).

Habitat. The species can be found from 1,050 to 1,400 meters above sea level, in rocky fields (*campo rupestre*), growing in clayey or sandy rocky dry soils.

Phenology. *Cyanocephalus veadeiroensis* was found in a fertile condition in October and November. Sterile material has been gathered in March and specimens with just older peduncles in December and January. Specimens collected in October and November have

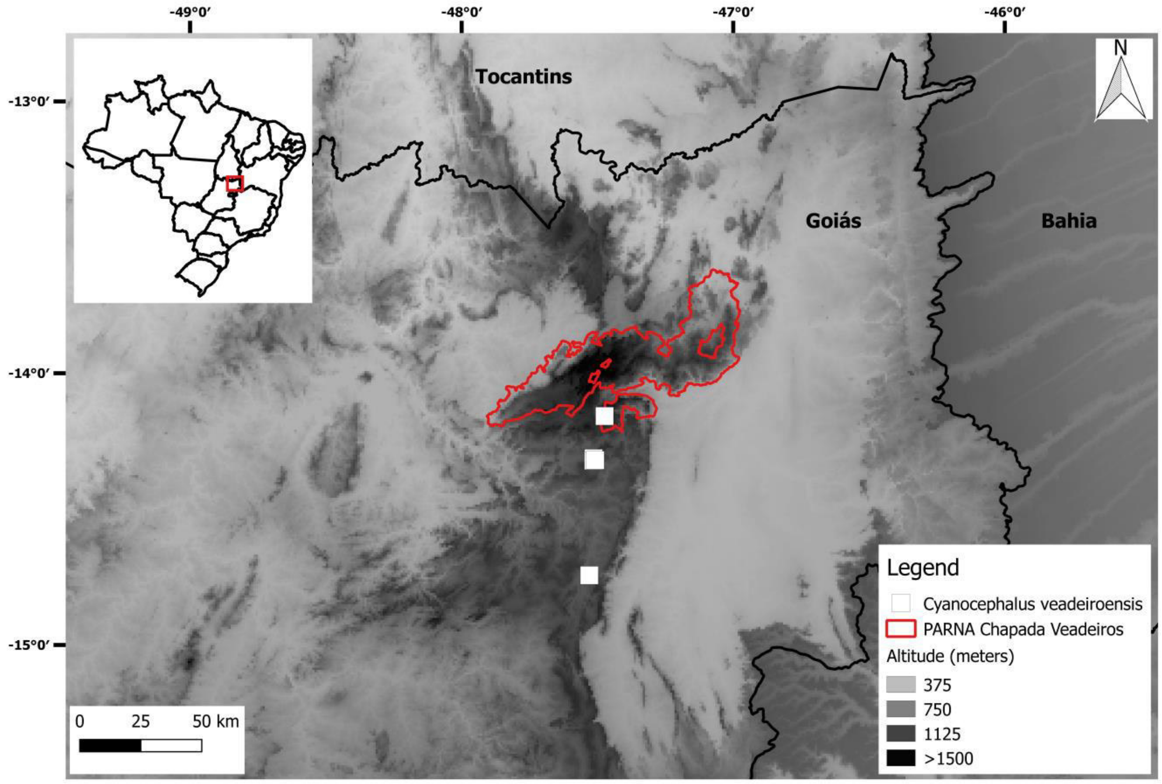

FIG 3. Distribution of *Cyanocephalus veadeiroensis* (white squares). In red the actual limits of the Protected Area Chapada dos Veadeiros National Park.

mostly older inflorescences suggesting that the flowering period may be protracted, possibly commencing in June to September.

Conservation status. *Cyanocephalus veadeiroensis* is known from just five collections. With the expansion of the area of Chapada dos Veadeiros National Park at 2017, the Serra da Baliza, where Glaziou first collected *C. veadeiroensis* is now part of a protected area and, although no recent collections of this species have been made there, the area may contain populations of the new species. Recent collections are restricted to a single area where the known population was found in a cattle-impacted area nearby roadside. The area is subjected to grazing and fire and nearby areas are being rapidly replaced by soybean cultivation. Yet, much of the surrounding countryside is currently unexplored and may also contain populations of *Cyanocephalus veadeiroensis*. Until a more detailed study of the distribution of this species, it should be considered as Data Deficient, still, as it has currently a restricted distribution at an impacted area, it would be fit Critically Endangered (IUCN 2001, 2016).

Etymology. The specific epithet refers to the Chapada dos Veadeiros region in the northeast of the Goiás State in Brazil, the place where the new species is endemic.

Comments. If following the classification of *Hyptis* sect. *Cyanocephalus* as proposed by Epling (1949), based on leaf morphology, *Cyancephalus veadeiroensis* would be placed in subsect. *Cordifoliae*. Yet, leaf morphology is quite variable due to environmental factors and this classification is possibly non-monophyletic (Harley 2006). Therefore, further studies on the morphology and phylogeny of the genus are needed to provide a more natural infrageneric classification.

Glaziou's names *Hyptis quadrangularis* and *Hyptis acutifolius* are considered not validly published as the "Plantae Brasiliae centralis a Glaziou lectae" (Glaziou 1911) where those names were published is listed as suppressed works in the I*nternational Code of Nomenclature for algae, fungi, and plants (Turland et al. 2018) following the proposal by Mansano and Pederneiras (2016).*

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Hyptidendron pulcherrimum **(Hyptidinae – Lamiaceae) a new narrowly endemic species from Minas Gerais, Brazil**

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Hyptidendron pulcherrimum (Hyptidinae - Lamiaceae) une microendémique nouvelle espèce de Minas Gerais, au Brésil

Antar *et al.*: *Hyptidendron pulcherrimum* a new species from Brazil

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ABSTRACT

Hyptidendron Harley, one of the 19 genera recognized for the subtribe Hyptidinae, has some of its species with a narrow *campos rupestres* (a Brazilian vegetational formation) distribution, often restricted to a single mountain range. We report a new species, *Hyptidendron pulcherrimum* Antar & Harley, endemic to a single mountain in the Serra do Padre Ângelo, a disjunct area of *campos rupestres* from where some new angiosperm species have been recently described. The new species is unique due to the morphological combination of flowers arranged in dichasial cymes, indumentum composed of curved, rigid, broad-based hairs, leaves petiolate, glabrescent and bullate, corolla tomentose, with the tube curved, 7.5-10 mm long and one slightly winged nutlet per fruiting calyx. The new species is compared with *Hyptidendron vauthieri* the most similar species morphologically. We also provide a complete description, diagnosis, illustration, distribution map with the new species and closely related species, a photograph plate, and a preliminary conservation status assessment.

KEY WORDS

Campos rupestres, *Hyptis*, Ocimeae, Serra do Padre Ângelo, taxonomy.

INTRODUCTION

The *campos rupestres* (rupestrian grasslands or highland rocky grasslands) are a Brazilian montane open formation composed of herb-shrubby fire-prone vegetation associated mainly with quartzitic rock outcrops and sandy soils at elevations above 900 m (Harley 1995; Alves *et al*. 2014; Morellato & Silveira 2018; Colli-Silva *et al*. 2019). Such vegetation is found in the ancient quartzitic mountainous formations in central and eastern Brazil and is recognized by its high biodiversity with approximately 40% of its angiosperm flora endemic (BFG 2015). The core areas of *campos rupestres* are either fully included within the Cerrado phytogeographical domain, such as in the Chapada dos Veadeiros in Goiás state, or found in the ecotone of the Cerrado, Caatinga and Mata Atlântica domains, such as in the Espinhaço Range, in the states of Bahia and Minas Gerais (Harley 1995; Fiaschi & Pirani 2009; Conceição *et al.* 2016).

Recently, the discovery of new angiosperm species and both new botanical and zoological geographical records highlighted the existence of this vegetation in smaller and undersampled mountain complexes entirely located within the Mata Atlântica domain, c. 200 km east of the Espinhaço Range, in eastern Minas Gerais. These ranges, namely the Serra do Padre Ângelo, the Pico da Aliança and the Sete Salões State Park, present quatzitic and sandstone outcrops with floristic elements typical of the *campos rupestres*, including some disjunct distributions of groups of taxa previously only known to the Espinhaço Range (e.g. Gonella *et al*. 2015; Loeuille & Pirani 2016; Lopes *et al.* 2016; Siniscalchi *et al*. 2016; Mello-Silva 2018; Andrino & Gonella in prep.; Troncoso *et al*. in prep.). Analogously to the core areas of *campos rupestres*, these regions, situated in the Doce River valley, are refuges to many narrowly endemic and threatened species.

Hyptidinae (subfamily Nepetoideae, tribe Ocimeae) is a Neotropical subtribe composed of 19 genera (Pastore *et al*. 2011; Harley & Pastore 2012) with many narrowly endemic species, particularly in the *campos rupestres* (Harley 1988a), where 127 of the approximately 400 species of the subtribe occur (Flora of Brazil 2020 under construction), making it an important component of this kind of vegetation (Harley 1988a). As botanical exploration in *campos rupestres* increases (Morim & Nic Lughadha 2015), many novelties have been revealed for the subtribe, most remarkably in the genera *Oocephalus* Harley & J.F.B.Pastore (Harley 2014a; Harley et al. 2019; Soares *et al.* 2019, 2020), *Gymneia* Harley & J.F.B.Pastore (Harley 2013), *Hyptis* Jacq. (Harley & Pastore 2010; Harley & Antar 2019), *Cyanocephalus* (Harley 1985, Antar *et al*. 2019a), *Leptohyptis* (Harley 1985b), *Eplingiella* Harley & J.F.B.Pastore (Harley 2014b), *Eriope* Kunth ex Benth. (Harley & Walsingham 2014, Schliewe *et al*. 2017) and *Hyptidendron* Harley (Harley & Antar 2017; Antar *et al*. 2019b).

Hyptidendron is endemic to South America, occurring in Bolivia, Colombia, Ecuador, Guyana, Peru, Venezuela and especially in Brazil, where all the 19 known species occur (Harley *et al*. 2004; Harley & Pastore 2012; Harley & Antar 2017; Antar *et al*. 2019). The genus was proposed by Harley (1988) by combining two sections of *Hyptis* Jacq.: *Hyptis* sect. *Umbellaria* and *Hyptis* sect. *Buddlejoides*. Some species of *Hyptidendron*, such as *Hyptidendron albidum* Harley & Antar, *H. clausenii* (Benth.) Harley, *H. roseum* Antar, Harley & J.F.B.Pastore, and *H. unilaterale* (Epling) Harley are endemic to *campos rupestres* vegetation, presenting narrow distributions, restricted to few localities or sometimes to a single mountain range (Harley & Antar 2017; Antar *et al*. 2019).

During the preparation of a taxonomic revision of *Hyptidendron*, another novelty was found for Conselheiro Pena municipality. The new species, here named *Hyptidendron pulcherrimum*, is endemic to the *campos rupestres* vegetation and presents a narrow distribution disjunct from the core areas of *campos rupestres*.

MATERIAL AND METHODS

The morphological description and diagnosis were drawn up after examining specimens of *Hyptidendron* analysed in the following herbaria: ALCB, BHCB, BHZB, BM, BRBA, CEN, CESJ, CGMS, COR, CTBS, DIAM, ESA, ESAL, G, HDJF, HEPH, HRB, HRCB, HUEFS, HUFSJ, HXBH, IBGE, K, MBM, MBML, NX, NY, P, PAMG, R, RB, SP, SPF, SPSC, SPSF, UB, UEC, UFG, UFMT, UFOP, UPCB, US, VIES (acronyms according to Thiers, continuously updated). A 10−60 × magnification stereomicroscope was used to analyze morphological features of the specimens. Terminology follows Harris & Harris (2001) for general morphology and Hickey (1973) for leaf shape, as well as Epling (1949), Rudall (1980), Harley & Pastore (2012), Harley & Antar (2017) and Antar *et al*. (2019b) for specific terms.

IUCN criteria (2012, 2016) alongside with GeoCAT tool (Bachman *et al.* 2011) were used to infer a preliminary conservation status. GeoCAT was applied with the IUCN default values for Extent of Occurrence (EOO) and Area of Occupancy (AOO) analysis. The distribution map was produced in QGIS version 3.0.1 (QGIS Development Team 2018). In cases of herbarium specimens lacking geo-reference data, the geographic coordinates were approximated using the locality description of the specimen label.

TAXONOMIC TREATMENT

Hyptidendron pulcherrimum Antar & Harley, sp. nov. (Figs 1−3)

The new species is unique in the genus by the combination of flowers arranged in dichasial cymes, branch indumentum pubescent composed of rigid, broad-based and curved eglandular hairs, leaves petiolate, glabrescent and bullate, corolla tomentose, curved, long exserted from calyx, with the tube 7.5−10 mm long and one slightly winged nutlet per fruiting calyx. The new species shares with Hyptidendron vauthieri (Briq.) Harley *a similar* *inflorescence, habitat preference and habit, but differs as it has leaves glabrescent and deeply bullate (vs. leaves pubescent to pilose and not deeply bullate), calyx lobes at fruit 0.9−1.4 mm long (vs. calyx lobes at fruit 1.9–3.6 mm long), corolla curved with the tube 7.5−10 mm long (vs. corolla straight with the tube 4.1−5.0 mm long), and nutlets slightly winged (vs. nutlets not winged).*

TYPUS. −**Brazil**, Minas Gerais: Conselheiro Pena, Pico do Padre Ângelo, subida ao pico, 19º18'45.6"S, 41º34'34.7"W, alt. 1.260 m, 16.XII.2016, *Lopes et al.* 453 (holo-, SPF[SPF227258]; iso-, HUEFS, K, RB).

PARATYPES. —**Brazil**.−MINAS GERAIS: Conselheiro Pena, Pico do Padre Ângelo, subindo pela crista sul da montanha, 19º19'46.14"S, 41º34'26.43"W, alt. 1,025 m, 27.XI.2013, *Gonella & Rivadavia 642* (SPF); *ibid*., Pico do Padre Ângelo, no topo do pico, 19º19'14.2"S, 41º34'43.7"W, alt. 1,530 m, 11.VI.2017, *Gonella et al. 800* (SPF with duplicates to be sent to CEN, P, US); *ibid*, Serra do Padre Ângelo, Pico do Padre Ângelo, subindo pela trilha que leva ao topo, 19°18'36.7"S, 41°34'32.8"W, alt. 1,165 m, 04.XII.2018, *Gonella et al. 966* (MBML); *ibid*, Serra do Padre Ângelo, Pico do Padre Ângelo, platô do topo do pico, 19 19'13.6"S, 41 34'44.2"W, alt. 1,500 m, 08.VI.2020, *Gonella et al. 1232* (SPF).

ETYMOLOGY. —The specific epithet refers to the beauty of the new species, which presents remarkable conspicuous flowers and shining leaves, making it a potential species for ornamental use.

DISTRIBUTION, HABITAT AND ECOLOGY. — Endemic to the Pico do Padre Ângelo, in the Serra do Padre Ângelo in Conselheiro Pena municipality, eastern Minas Gerais (Fig. 1). It grows at elevations from 1,000 to 1,530 m, in *campos rupestres* vegetation among quartzitic rock outcrops, in sandy soils covered by a litter layer. The species is especially abundant in the higher areas of the Pico do Padre Ângelo, above 1,400 m, where it is usually associated with the rock outcrops. The Serra do Padre Ângelo region is subjected to a marked seasonality, with rainy summers and dry winters, but water condensation in the form of fog is present year-round at higher elevations.

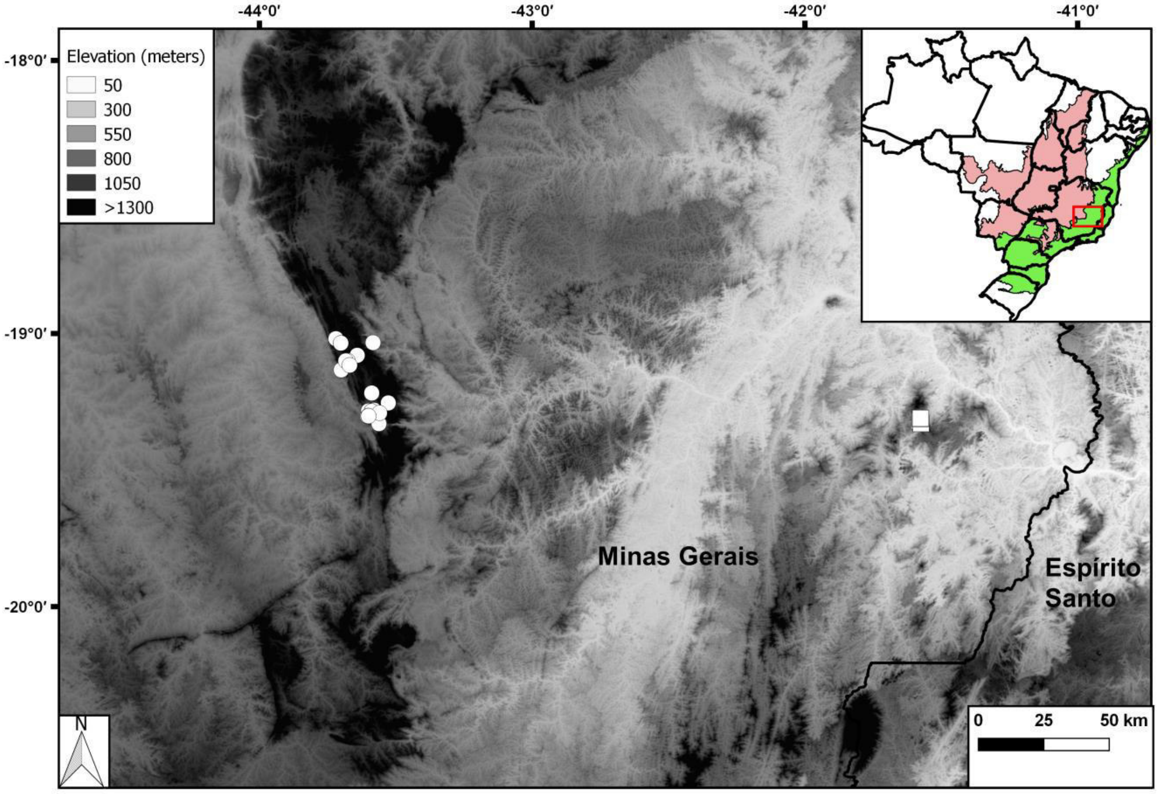

FIG 1. Distribution of *Hyptidendron pulcherrimum* Antar & Harley *sp. nov.* (white squares) and *Hyptidendron vauthieri* (Briq.) Harley (white circles). In the small map, the pink shape shows the extension of the Cerrado domain and the green shape show the extension of the Mata Atlântica domain.

CONSERVATION STATUS. — The estimated Area of Occupancy is low, being just 12 km², and the estimated Extent of Occurrence is 0.449 km², both being likely to decline further. All of the collections were found on a single mountain: the Pico do Padre Ângelo, the second highest peak in the Serra do Padre Ângelo, which is an unprotected area that is subjected to invasion by alien grass species and uncontrolled anthropic fires. Furthermore, these mountaintop areas are highly threatened by climate change, which threatens to reduce significantly the suitable areas for the occurrence of *campos rupestres* vegetation in the next decades, threatening many of its endemic species with extinction (Barbosa & Fernandes 2016). Propelled by the flagship species *Drosera magnifica* Rivadavia & Gonella (Gonella *et al*. 2015), there is an attempt among conservationists to make the locality a Protected Area (Mello-Silva 2018). Nearby areas, most remarkably the Pico do Sossego (1,550 m alt.), also in the Serra do Padre Ângelo, and the Sete Salões State Park, are currently unexplored and may also contain populations of *Hyptidendron pulcherrimum*. Although the species could be regarded as still data deficient concerning its distribution, we consider that, due to the precarious state of conservation of its suitable habitats, it should be assessed as Critically Endangered according to criteria CR B1ab(i,ii,iii)+2ab(i,ii,iii) (IUCN 2001).

DESCRIPTION

Shrub or treelet 1.5−2 m high, erect or somewhat decumbent, supported by nearby rocks or other plants, aromatic, branches sometimes horizontal; stems woody, 3−5 mm in diameter, younger stems quadrangular, canaliculate, pubescent with rigid, broad-based, curved eglandular hairs, small stipitate glandular hairs, and sessile glands, older stems terete and less hairy. Cauline leaves simple, opposite, decussate, not imbricate, petiolate, longer than internodes, rarely equal or shorter, diminishing in size towards stem apex; lamina 2.0−5.8 × 1.4−4.2 cm, chartaceous, discolorous, with the abaxial surface paler, elliptic, ovate or broadly elliptic, base cuneate to rounded, apex obtuse to rotund, rarely cuspidate to mucronate, margin crenulate or rarely serrulate, with the exception of the base which is entire (approximately 1/4 to 1/8 of the leaf), 20−36 teeth on each side of leaf, the tooth apex swollen, acute, glabrous, adaxial surface bullate, shiny, glabrous to glabrescent, with the exception of the main vein

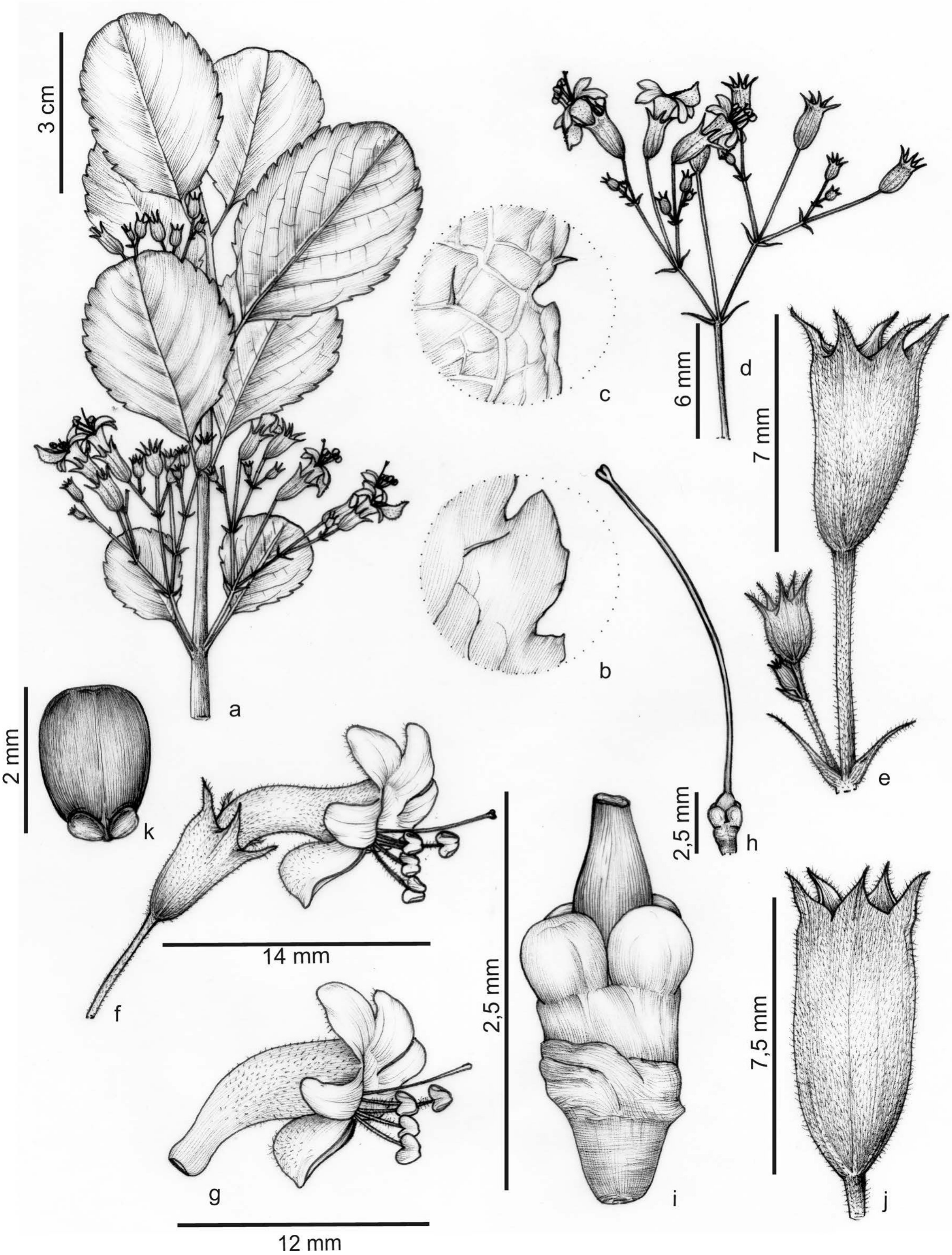

FIG. 2. —*Hyptidendron pulcherrimum* Antar & Harley *sp. nov.* **A.** Branch bearing leaves and inflorescences. **B.** Leaf margin, adaxial surface with indumentum detail. **C.** Leaf margin, abaxial surface with indumentum detail. **D.** Immature cyme. **E.** Part of an inflorescence showing calyx and bracteoles. **F.** Flower, side view. **G.** Corolla, side view. **H.** Gynoecium and style, showing stylopodium. **I.** Ovary. **J.** Mature calyx. **K.** Nutlet. A−K. Illustration by Carla Teixeira de Lima based on *Lopes et al. 453* (SPF).

which is densely covered with non-glandular curved hairs (mostly near the base), which can be on the secondary veins as well but less densely, also some rare curved hairs can be present, margins with some curved hairs mostly near the base, the venation plane or sometimes slightly impressed, midrib and primary veins visible, other veins obscure, abaxial surface glabrous or glabrescent with rare sessile glands and rarely some indumentum on the main nerve, composed of curved hairs and sessile glands or clustered long uniseriate hairs, venation reticulate, conspicuous, midrib and secondary veins prominent; petiole 5−13 mm long, 1−2 mm wide, terete, canaliculate, pubescent with rigid, curved, eglandular hairs, sessile glands and rare glandular stipitate hairs, the indumentum is denser in the intervenous lacunae. Inflorescence a terminal or axillary cymose panicle with dichotomous or less commonly unilateral cymes subtended by foliaceous bracts, which are conspicuous, similar to the leaves, slightly smaller; bracts elliptic, ovate, rotund or orbicular, 1.4−2.6(−3.9) × 1.1−2.1 cm, petiolate, mostly shorter than the cymes; bracteoles 1.0−1.4 mm long, with the same indumentum as the pedicels; mature cymes 7−19 flowered, not or only partially obscured by the leaves, borne on peduncles 4−10 mm long, with the same indumentum as the petioles. Flowers on pedicels 3.5−11.7 mm long, pubescent with rigid, broad-based, curved eglandular hairs, stipitate glandular hairs and sessile glands, subtended by linear bracteoles; calyx at anthesis (3.5−)4.2−6.1 mm long, cylindrical to slightly infundibuliform; tube 3.4–4.7 mm long, straight, ribbed, externally pubescent with small uniseriate hairs mostly on the ribs, and with glandular stipitate hairs and sessile glands, in the margins of the lobes the hairs are longer and uniseriate, with glandular stipitate uniseriate hairs at the apex of the calyx tube, internally glabrous with the exception of sessile glands at the apex; lobes subequal, 1.1−1.6 mm long, narrowly triangular to subulate, externally with the same indumentum as the tube, internally with sessile glands and usually with some small non-glandular hairs, the margins ciliate with small eglandular hairs; fruiting calyx 7.5−8.0 mm long, less hairy, tube accrescent, 6.2−6.9 mm long, ± cylindrical, ribbed, fruiting calyx lobes 0.9−1.4 mm long, subequal, straight; corolla purple to lilac, 11−13 mm long; tube 7.5−10.0 mm long, straight, cylindrical, 2.0−2.6 mm wide, externally tomentose with simple uniseriate non-glandular hairs, less dense near the corolla base, internally glabrous with the exception of tufts of long uniseriate non-glandular hairs close to the insertion of the posterior pair of stamens in the corolla; lobes spreading, externally tomentose with simple non-glandular uniseriate hairs and sessile glands, internally glabrous; anterior lobe large, boat-shaped; stamens with posterior filaments 4.5–5.8 mm long, villous with long uniseriate entangled eglandular hairs anterior filaments 2.5–3.2 mm long, similar indumentum as the posterior pair but less hairy; anthers ca. 1 mm long; gynoecium with style 7–11 mm long, jointed and basally with a well-developed stylopodium protruding above ovary, 0.9–1.4 mm long, and apically with two unequal, short, slender stigmatic lobes. Nutlets 2.2−3.0 × 1.6−2.0 mm, 1 per fruiting calyx, ellipsoid, oblong to widely oblong, castaneous, rugulose and shining, glabrous, slightly winged, with deep abscission scars, not mucilaginous when wetted.

REMARKS

Hyptidendron pulcherrimum is similar to other species of the former *Hyptidendron* sect. *Umbellaria*, to which it seems to belong. The most similar species is *Hyptidendron vauthieri* (Briq.) Harley (see diagnosis), a species that occurs in the *campos rupestres* of the Serra do Cipó, in the southern portion of the Espinhaço Range (Fig. 1). It is also superficially similar to other species endemic to the *campos rupestres* of the Espinhaço Range, such as *Hyptidendron vepretorum* (Benth.) Harley, from which it differs by the longer peduncle size (0.5−2 mm long in *H. vepretorum* vs. 4−10 mm long) and the longer corolla tube (4.8−7.0 mm long in *H. vepretorum* vs. 7.5−10 mm); and *Hyptidendron unilaterale* (Epling) Harley, from which it differs by the longer corolla tube (3.5−5.0 mm long in H. *unilaterale* vs. 7.5−10 mm long) and the cyme structure (unilateral or rarely dichasial in *H. unilaterale* vs. dichasial or rarely unilateral).

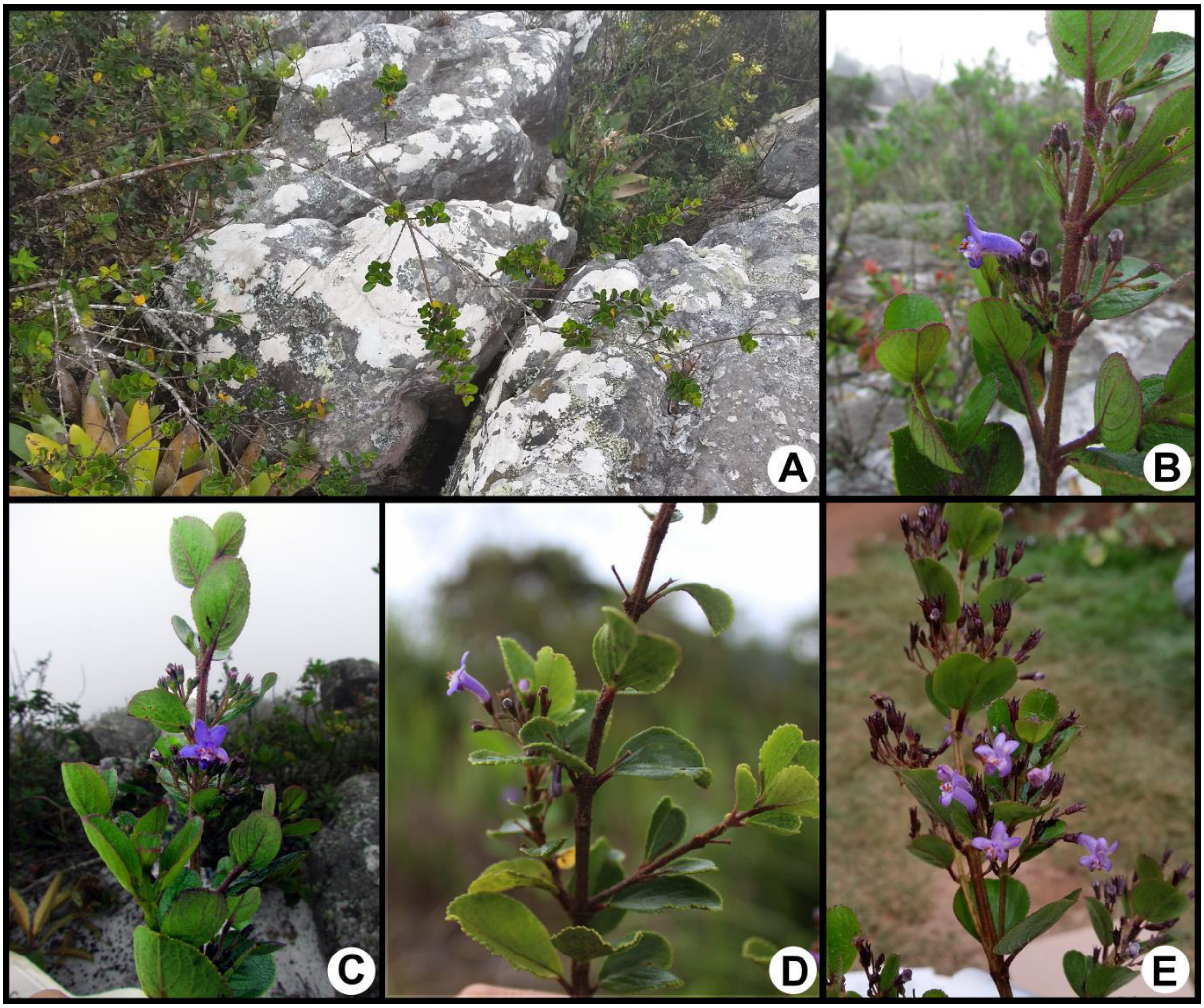

FIG. 3. *Hyptidendron pulcherrimum* Antar & Harley *sp. nov.* **A.** Habit and habitat; **B.** Flowering branch, highlighting a flower, side view; **C.** Branch; **D.** Flower and inflorescence; **E.** Flowering branch. Photo credits: A-C by P.M. Gonella; D, E by J.C. Lopes.

DISCUSSION

As noted above, the most closely related species to *H. pulcherrimum* is *H. vauthieri*, which occurs more than 200 km apart, in the Espinhaço Range (Fig. 1). Such a disjunction raises biogeographical questions, mostly in view of the small, autochoric dispersed seeds of the genus (Harley *et al*. 2004), which would imply a limited dispersion range. Although both species occur in the *campos rupestres* vegetation, the latter is restricted to its core area, within the Cerrado domain, while the former occurs in an area located within the Mata Atlântica domain, surrounded mostly by a matrix of lowland semi-decidual forests, where no closely related species of *H. pulcherrimum* occurs. A combination of edaphic and climatic conditions, not found in these surrounding areas, may explain the isolation of this new species in the Serra do Padre Ângelo. Yet, hypotheses about long-distance dispersal or vicariant events are in debate for the isolation of floristic elements of the *campos rupestres* within these eastern disjunct areas (e.g. Siniscalchi *et al.* 2016). Further phylogenetic and biogeographical studies using these groups with similar distribution patterns may contribute to the understanding of the events that led to this isolation and diversification.

The Serra do Padre Ângelo and other areas of *campos rupestres* in eastern Minas Gerais (e.g. Pico da Aliança and Sete Salões State Park) remain largely unexplored botanically. Further sampling effort in these areas, such as the ongoing floristic survey of Serra do Padre Ângelo, will aid in better understand their biodiversity, as well as foment appropriate conservation measures. The description of *Hyptidendron pulcherrimum* raises the number of endemic species of these easternmost areas of *campos rupestres* in Minas Gerais to 15 (Leme & Kollmann 2013; Leme *et al.* 2014; Leme 2015; Campacci 2014, 2015; Gonella *et al.* 2015; Siniscalchi *et al.* 2016; Loeuille & Pirani 2016; Loeuille *et al.* 2019; Leme *et al*. 2020; Kollmann 2020), highlighting the urgency of inventory studies and the need for conservation of these areas.

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Typification and notes on Hyptidinae (Lamiaceae) described by Pilger from Mato Grosso state, Brazil

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Typification and notes on Hyptidinae (Lamiaceae) described by Pilger from Mato Grosso state, Brazil

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Abstract

The subtribe Hyptidinae (Lamiaceae) is predominantly neotropical with ca. 400 species, most diverse in the Cerrado domain, the Brazilian savanna. Mato Grosso state, located in the core of the Cerrado, owns a remarkable richness in the subtribe with 73 species recognized. Robert Pilger, who accompanied Hermann Meyer on an expedition to the state in 1898, collected about 700 angiosperm specimens which were primarily incorporated in the Berlin herbarium, but later destroyed during WWII. Five species of Hyptidinae were described by Pilger based on these materials from Mato Grosso, and lectotypified by Epling (1936b) in B herbarium. They are: *Hyptis helophila* (synonym of *H. petiolaris*), *H. indivisa* (synonym of *Cantinoa indivisa*), *H. lasiocalyx* (synonym of *Cyanocephalus desertorum*), *H. loeseneriana* and *H. mattogrossensis* (synonym of *Hypenia macrosiphon*). Here, following the ICN art. 9.8, neotypes are designated for these names. Additionally, a second step lectotype is provided for *Hyptis petiolaris*. Furthermore, we provide notes on the habitat and distribution of these taxa.

Keywords. Brazilian flora, Cerrado, *Hyptis*, Neotypification, Taxonomy

Introduction

Hyptidinae is a predominantly neotropical subtribe of Lamiaceae with ca. 400 species, being most diverse in the Cerrado, the Brazilian savanna (Harley & Pastore 2012). The subtribe was first described to encompass the genera *Eriope* Humb. & Bonpl. ex Benth., *Marsypianthes* Mart. ex Benth., *Peltodon* Pohl and *Hyptis* Jacq., the latter highly diverse in morphology, comprising approximately 300 species divided in 20 sections by Bentham (1836, 1848). Further morphological and molecular studies (Epling 1933; Harley 1976; Harley 1988; Pastore et al. 2011; Harley & Pastore 2012) have widely changed the generic delimitation in the subtribe, mainly segregating *Hyptis*, thus making Hyptidinae with current 19 genera recognized.

Since its creation, the most significant contributions to the systematic knowledge of Hyptidinae were made by George Bentham (1836, 1848), John Briquet (1897, 1898), Carl Epling (e.g. 1935, 1936a, 1936b, 1937, 1949) and Raymond Harley (e.g. 1976, 1986, 1988), although some other authors produced isolated works in the subtribe. One of these was the German botanist Richard Pilger, who accompanied Hermann Meyer on an expedition in 1898 to Mato Grosso state, Brazil, a remarkable rich area in Hyptidinae with currently 73 species recognized (Flora do Brasil 2020 under construction). During this expedition, Pilger collected about 700 specimens which were later incorporated in B with duplicates probably sent to LZ (Robert Vogt pers. comm.). After this expedition, Pilger (1901) published the work Beitrag zur Flora von Mattogrosso describing the plants collected in this expedition encompassing five new species of *Hyptis*: *H. helophila* Pilg., *H. indivisa* Pilg., *H. lasiocalyx* Pilg., *H loeseneriana* Pilg. and *H. mattogrosssensis* Pilg., all of them based on only one collection.

Epling (1936b) in his Synopsis of Lamiaceae from South America, inadvertently lectotypified (Prado et al. 2015) all those names by selecting the material in B as the type. He also synonymised three of these names: *Hyptis helophila* as a synonym of *H. petiolaris* Pohl ex Benth., *H. lasiocalyx* as *H. desertorum* Pohl ex Benth. [now treated as *Cyanocephalus desertorum* (Pohl ex Benth.) Harley & J.F.B.Pastore] and *Hyptis mattogrossensis* as *Hyptis macrosiphon* Briq. [now treated as *Hypenia macrosiphon* (Briq.) Harley].

Afterwards, the specimens from Pilger stored both at B and LZ were destroyed during WWII (Prance 1971; Robert Vogt pers. comm.), leaving these names lacking their nomenclatural types. In agreement with the International Code of Nomenclature for algae, fungi, and plants (art. 9.8), neotypes for all these names are here designated. Additionally, a second step lectotypification is proposed for *Hyptis petiolaris*. We also provide notes on the distribution and ecology for species to which these names are assigned.

Material and methods

A field expedition was conducted by the first author to Mato Grosso in July 2018. Other several expeditions to the state were conducted by the second author in the course of his studies with Hyptidinae that started in 1968. This study is based on examination of digital images available in JABOT (http://rb.jbrj.gov.br/v2/consulta.php), REFLORA (http://reflora.jbrj.gov.br/) and SpeciesLink (http://splink.cria.org.br) databases and specimens deposited in the following herbaria: B, BM, CEN, CTBS, HUEFS, IBGE, G, K, M, NY, P, SP, SPF, UB, US and W (Thiers continuously update). Additionally, phototypes deposited at F herbarium were consulted. Our decision follows the rules and recommendations proposed in the International Code of Nomenclature for algae, fungi, and plants (Turland et al. 2018) associated with Prado et al. (2015).

Results

1. ***Cantinoa indivisa*** (Pilg.) Harley & J.F.B. Pastore, Phytotaxa 58: 10 (2012).

≡ *Hyptis indivisa* Pilg., Bot. Jahrb. Syst. 30(2): 190 (1901). Lectotype, designated by Epling [1936b: 253]: Type:—Brazil. Mato Grosso: Cuiabá, 2 April 1899, *Pilger 399* (B†), photo F[0BN017746], MO[MO-2583257]; **Neotype (designated here)**: Brazil, Mato Grosso: Between River Amolar and River Nobres [near source of Rio Paraguai], June 1927, *Dorrien-Smith 240* (K [K001232997]). Figure 1.

Typification: *Hyptis indivisa* was described by Pilger (1901) based on the type specimen collected by himself (*Pilger 399* with no herbarium citation) in the Cerrado vegetation, somewhere near Cuiabá, Mato Grosso state, Brazil. The original material was primarily deposited in B, with probably a duplicate at LZ, however, both herbaria had the Lamiaceae collection destroyed during the WWII in 1943. Nevertheless, before this, Epling (1936b).

Figure 1. Neotype of *Cantinoa indivisa* (Pilg.) Harley & J.F.B. Pastore (*Dorrien-Smith* 240 [K001232997]). ©The Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with the consent of the Royal Botanic Gardens, Kew.

inadvertently lectotypified this name to the collection at B. Epling (1936b) considered *H. indivisa* a possible synonym (with a question mark) of *H. petraea* A.St.-Hil ex Benth. [synonym of *Oocephalus petraeus* (A.St.-Hil ex Benth.) Harley & J.F.B.Pastore]. Later, in the revision of *Hyptis*, Epling (1949) accepted this species as a member of *Hyptis* sect. *Polydesmia* subsect. *Glomeratae* (Epling 1949). From the type specimen of *C. indivisa*, housed in B herbarium, lost during WWII, remained a photograph negative from Macbride collection in F. Here, the specimen *Dorrien Smith 240* (K001232997) is chosen as neotype. The neotype specimen was identified by Epling as *H. indivisa* matching nicely with the original description and type morphology. Furthermore, this specimen and original type belong to the same region in the Mato Grosso state. In fact, this species is only known from two localities apparently near each other, although, the precise localities have not been traced. These localities lie somewhere between Cuiabá and Nobres municipalities.

Notes: *Cantinoa indivisa* occurs on the border of the forest formation in the Cerrado domain, known as *Cerradão*. Further collections of this species are much desired to clarify its distribution, conservation status and morphological circumscription.

2. *Cyanocephalus desertorum* (Pohl ex Benth.) Harley & J.F.B.Pastore, Phytotaxa 58: 12 (2012).

≡ *Hyptis desertorum* Pohl ex Bentham, Labiat. Gen. Spec. 83 (1833). Type:—BRAZIL. Minas Gerais: Rio Parahybuna, *Pohl 542* (holotype W [W0051778])

= *Hyptis lasiocalyx* Pilg. Bot. Jahrb. Syst. 30(2): 190 (1901). Type:—BRAZIL. Mato Grosso: Cuiabá, 22 April 1849, *Pilger 512*. Lectotype, designated by Epling (1936b): B†, photo F[0BN017751]; **Neotype (designated here)**: Brazil, Mato Grosso: R. 10, c. 12 km SW of base camp, 20 September 1968, Harley & Souza *10151* (RB [149681]; isoneotypes K[K001232861], NY[NY00857156], P[P04147865], UB). Figure 2.

Typification: The original collection, once housed in B, was also destroyed during the WWII (see comments above). Therefore, a neotype for *Hyptis lasiocalyx* is chosen here. Although, there are not relevant morphological variation between specimens from the type locality of *C. desertorum* (from the Minas Gerais state) and type of *Hyptis lasiocalyx* from Mato Grosso, a specimen from near to the original site in (Mato Grosso state) was chosen as neotype of *H. lasiocalyx* in order to represent better the original species concept adopted by Pilger (1901). From Mato Grosso state, the gathering *Harley & Souza 10151* (neotype in RB), which has plenty of inflorescences, mature leaves and subterranean organ, best represents the original morphology found in the destroyed type specimen at B.

Notes: *Cyanocephalus desertorum* is a fairly well-known species distributed in Mato Grosso, Distrito Federal, Goiás, Tocantins, Pará, Piauí and Minas Gerais states, in Brazil. It inhabits the Cerrado domain in natural grasslands and savanna physiognomies, eventually at periodically flooded terrain.

3. ***Hypenia macrosiphon*** (Briq.) Harley Bot. J. Linn. Soc. 98: 92 (1988).

≡ *Hyptis macrosiphon* Briq. Bull. Herb. Boiss., 4: 785 (1896). TYPE:—Brazil, Mato Grosso, *Kuntze s.n.* (NY)

= *Hyptis mattogrossensis* Pilg., Bot. Jahrb. Syst. 30(2): 191 (1901). Type:—Brazil. Mato Grosso: Cuiabá, 1899, *Pilger 607* (Lectotype, designated by Epling (1936b): B†, photo F[0BN017755]; **Neotype (designated here)**: Brazil, Mato Grosso, Cuyabá, rocky soil on

Figure 2. Neotype of *Hyptis lasiocalyx* Pilg. (Harley & Souza *10151* [RB 149681]). Reproduced with permission of the Jardim Botânico do Rio de Janeiro.

edge of scrub, May 1927, *Dorrien-Smith* 116 (K [K001228357], isoneotype K [K001228358]). Figure 3.

Typification: Epling (1936b) wrongly wrote the collection number when proposing the lectotypification of *Hyptis mattogrossensis* as Pilger 407; however, this collection corresponds to the original material of *Hyptis loeseneriana* (see below), 607 being the correct number for *Hyptis mattogrossensis*. We choose as a neotype the gathering from Miss. *Dorrien-Smith 116* which presents a well-preserved specimen which also possess a label by Epling identifying it in 1928 as *Hyptis mattogrossensis* and in 1929 as *Hyptis macrosiphon*.

Notes: *Hypenia macrosiphon* occurs in Bolivia in Beni department, Paraguay in Canindeyú and Brazil in Mato Grosso, Rondônia and Goiás states. It inhabits the Cerrado domain in savanna physiognomies.

4. *Hyptis loeseneriana* Pilg., Bot. Jahrb. Syst. 30(2): 191 (1901). Type:—Brazil. Mato Grosso: Cuiabá, 2 April 1899, *Pilger 407* (lectotype designated by Epling [1936b: 303] B†, photo F[0BN017752]; **Neotype (designated here)**: Brazil, Mato Grosso, Cuiabá: ca. 10 km de Cuiabá na estrada para a Chapada dos Guimarães, 15º28'49''S, 56º03'21''W, 208 m, 20 April 2005, *Queiroz L.P. et al. 10482* (HUEFS [HUEFS000158750]; isoneotypes: ASE [ASE0028323], ESAL). Figure 4.

Typification: *Hyptis loeseneriana* is known for just eight collections. Queiroz et al. 10482 is one matching the description of the protologue and the description of Epling (1949) and has a clear resemblance with the Phototype at F[0BN017752]. It is the gathering that presents leaves and inflorescence best preserved. As the lectotype was destroyed from Berlin during WWII, we design the specimen from HUEFS herbarium as the neotype.

Notes: The second known collection of *Hyptis loeseneriana* was made in 1966 (Harley 20411 – K), 68 years after that first collection made by Pilger. Recently, other collections have been

Figure 3. Neotype of *Hyptis mattogrossensis* Pilg. (*Dorrien-Smith 116* [K001228357]). ©The Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with the consent of the Royal Botanic Gardens, Kew.

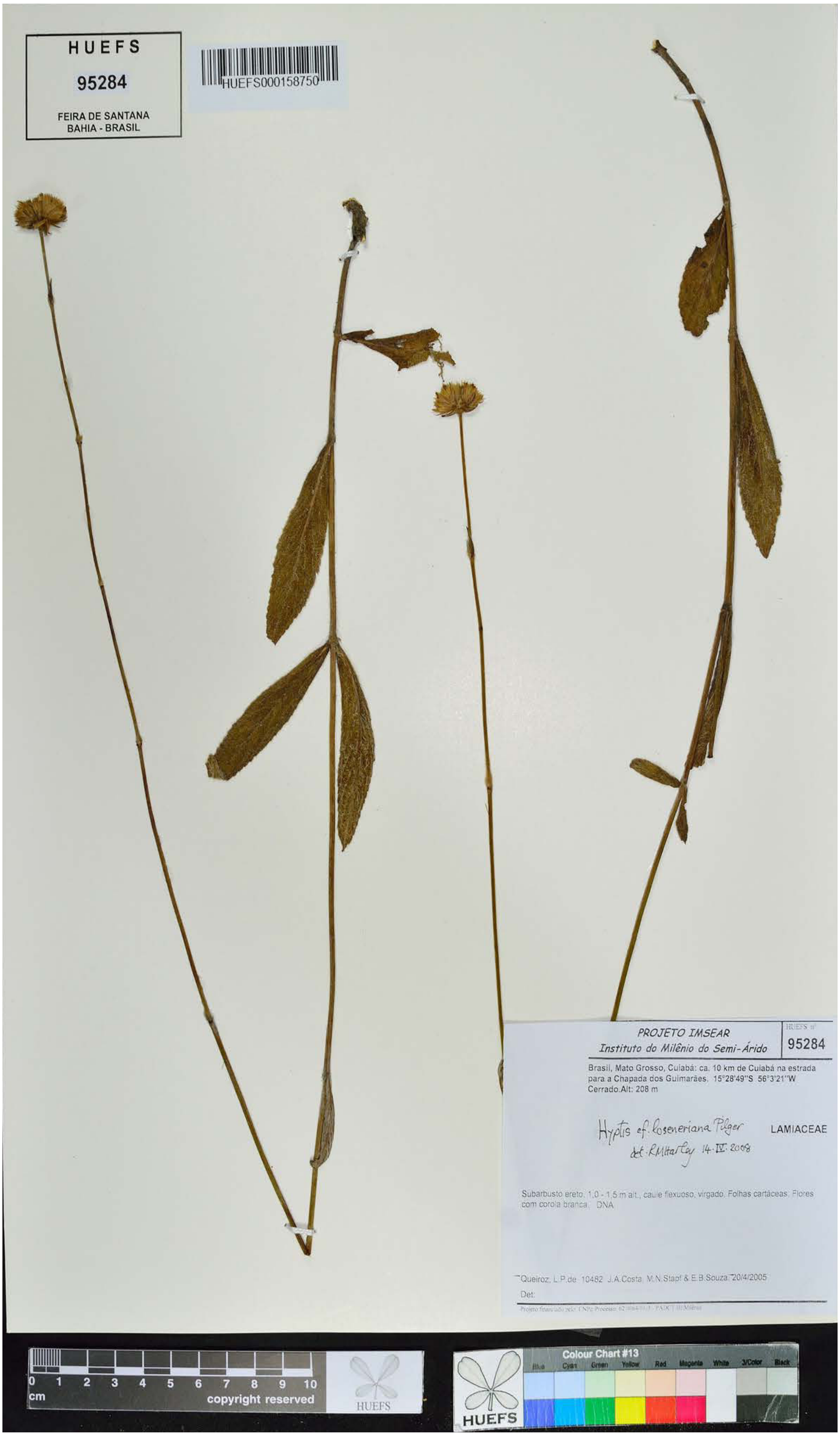

Figure 4. Neotype of *Hyptis helophila* Pilg. (Irwin et al. 16959 NY [NY00857815]). Image courtesy of the C. V. Starr Virtual Herbarium (http://sweetgum.nybg.org/science/vh/).

made and but most of material was indetermined in the herbaria and just latter uncovered. The species is endemic to Mato Grosso state, from the municipalities of Cuiabá, Nova Xavantina, Nobres, and Água Boa. It is located inside the protected areas of Parque Nacional da Chapada dos Guimarães and Reserva Biológica Municipal Mario Viana. It occurs in the Cerrado domain in savanna physiognomies as *cerrado rupestre* and *cerrado sensu stricto*, natural grasslands as *campo limpo* or the transition between savannah and forestry (*Cerradão*) physiognomies.

5. *Hyptis petiolaris* Pohl ex Benth. Labiat. Gen. Spec. 101 (1833). First step lectotype designated by Epling [1936b: 318], **Second step lectotype, designated here**: Brazil, Goiás, "Ad Aldeya Maria, Cap. Goyaz & in via a Rio Crixas ad Maranhão, Cp. Gz. H.79" [May 1819?], *Pohl 1564* or *1654* (W [W0051714], isolectotypes: K [K000488380], W[0051713]). Figure 5.

= *Hyptis helophila* Pilg., Bot. Jahrb. Syst. 30(2): 189 (1901). Lectotype designated by Epling [1936b: 318]: Brazil. Mato Grosso: ad Rosario prope Cuyaba, 9 April 1899, Pilger 427 (B†, photo F[0BN017743]; **Neotype (designated here)**: Brazil, Mato Grosso, drainage of the upper Rio Araguaia, ca. 30 km S. of Xavantina, 400 m, 11, June 1966, *Irwin et al. 16959* (NY [NY00857815]; isoneotypes: F [F1735844], MO [MO1245921], RB [RB 152368], UB, US [US02886019]). Figure 6.

Typification: *Hyptis petiolaris* was described by Bentham based on Pohl specimens at K and W. The specimen at K is noted as "Aldeya Maria, Prov. Goyaz", whereas there are two locality references under note for the 'H. 79' in W: 'Aldeia Maria', a locality in the municipality of Sanclerlândia, near to the district of Aparecida da Fartura (as reference 16°21'1.76"S - 50°29'17.67"W) and a locality in the stretch between the rivers Crixas and Maranhão in the Northern of the Goiás state. Therefore, is not clear whether the specimens in W belong to the same collection. Epling (1936b), inadvertently, designated the lectotype in

Figure 5. Lectotype of *Hyptis petiolares* Pohl ex Benth. (Pohl 1564 or 1654 [W0051714]). Image used with permission and provided by the Naturhistorisches Museum Wien.

THE NEW YORK BOTANICAL GARDEN
Plants of the Planalto do Brasil
Drainage of the upper Rio Araguaia, Estado de Mato Grosso
No. 16959

Hyptis petiolaris Pohl ex Benth.
Det. R. M. Harley

Erect herb ca. 1.25 m. tall. Corolla lavender-pink. Periodically flooded campo, ca. 30 km. S. of Xavantina, Mato Grosso. Elevation 400 m.

H. S. Irwin, R. Souza, J.W.Grear,
R. Reis dos Santos
11 June 1966

Field work conducted with the collaboration of the Universidade de Brasília, Instituto Agronômico do Norte, and the Fundacao Brasil Central. Supported in part by funds from the National Science Foundation.

Figure 6. Neotype of *Hyptis helophila* Pilg. (Irwin et al. 16959 NY [NY00857815]). Image courtesy of the C. V. Starr Virtual Herbarium (http://sweetgum.nybg.org/science/vh/).

W. However, he did not mention that there are two specimens at this herbarium. Therefore, a second step lectotypification is needed. The lectotype chosen here is the one which keeps the original label.

Hyptis helophila was described based on a collection of Pilger between Cuiabá and Rosário municipalities. *Irwin et al. 16959* although not from the same locality is a well-preserved gathering which matches the description of the protologue and the description of Epling (1949) and has a clear resemblance with the type specimen photographed at F. It is also identified by Dr. Raymond Harley. We here choose the specimen from NY as the neotype.

Notes: *Hyptis petiolaris* is endemic to Brazil, distributed in Mato Grosso and Goiás states. It occurs in wet fields in the Cerrado domain. It is known from less than five collections. Further collections and, even more, herbaria consultation may uncover other populations of this species, that has currently its conservation status and distribution poorly known.

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O resultado apresentado nesta tese traz um significativo acréscimo de conhecimento sobre Hyptidinae e *Hyptidendron*. Com a nova filogenia baseada em 353 marcadores nucleares e 67 terminais de Hyptidinae, pela primeira vez, *Hyptidendron* foi reconhecido como monofilético, com alto suporte e formado por três clados. Estes três clados foram são aqui propostos como seções do gênero, sendo um destes, *H.* sect *Latiflorae* uma seção inédita. Ainda, novas combinações no gênero *Mesosphaerum* são propostas, além da descrição do gênero monotípico *Myriohyptis*. Apesar de futuros estudos filogenéticos ainda serem necessários para elucidar a circunscrição de *Hypenia*, que surge como parafilético, esta nova filogenia provê suporte robusto para as relações da subtribo e fortalece a proposta de Harley & Pastore (2012) do reconhecimento de 19 gêneros – agora 20 - na subtribo, segregados de *Hyptis*.

Com estudos taxonômicos na subtribo, foi possível a descrição de sete espécies novas (1 em *Cyanocephalus*, 1 em *Hyptis* e 5 em *Hyptidendron*), muitas destas baseadas em poucas coletas recentes. Este resultado demonstra que, apesar dos diversos estudos realizados, a diversidade deste grupo ainda não se encontra totalmente descrita e novas coletas e estudos taxonômicos amplos são necessários. Ainda, tipificações são propostas para as espécies da subtribo que ocorrem no estado do Mato Grosso descritas por Pilger, além de diversos nomes em *Hyptidendron*. Esses resultados demonstram a necessidade de revisar a nomenclatura dos táxons da subtribo, em vista do Código Internacional de Nomenclatura para Algas, Fungos e Plantas, possibilitando, assim, maior estabilidade taxonômica para o grupo.

O padrão de venação, ainda pouco explorado na subtribo, foi descrito em detalhes pela primeira vez para *Hyptidendron*, mostrando potencial para o reconhecimento de uma nova espécie. Por fim, *Hyptidendron* foi detalhadamente revisado, com descrições, ilustrações, mapas de distribuição, além de comentários de ecologia, fenologia, reconhecimento e conservação. No começo do projeto que resultou nesta tese, 17 espécies eram reconhecidas, muitas dessas com problemas de identificação. Após esse estudo, 22 espécies são reconhecidas com suas circunscrições e nomenclatura atualizadas. O banco de dados utilizado para a revisão, baseado na visita de 50 herbários, consulta a bancos de dados de herbários e expedições em campo, é publicado em um *data paper*, visando a disseminação dos dados coletados.

Além da contribuição ao conhecimento do grupo, essa tese demonstra, em seus diversos capítulos, a necessidade e a importância da formação de taxonomistas. Como discutido no *data paper*, ~44% de todas as 1112 coletas analisadas tiveram sua identificação alterada, mostrando a importância de um projeto com foco em um grupo para o real conhecimento deste. Estes resultados tornam-se ainda mais relevantes tendo em vista a conclusão próxima do projeto Flora do Brasil 2020, bem como os resultados do que é considerado o sexto evento de extinção que está atualmente ocorrendo com a biodiversidade da Terra. Como primeiro passo para a conservação, além de estudos químicos, ecológicos e evolutivos, é necessária uma taxonomia robusta para um grupo, fato que, com esse trabalho, mostrou significativo avanço para o gênero *Hyptidendron* e a subtribo Hyptidinae.