UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
INSTITUTO DE BIOCIÊNCIAS

SISTEMÁTICA E CONSERVAÇÃO DAS ESPÉCIES SUL-AMERICANAS NÃO ANDINAS DE *HYPERICUM* L. (HYPERICACEAE)

CLEUSA VOGEL ELY

Porto Alegre
2019

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Tese apresentada ao Programa de Pós-Graduação em Botânica, da Universidade Federal do Rio Grande do Sul, como um dos requisitos para obtenção do grau de Doutora em Botânica.

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Porto Alegre, 26 de abril de 2019

Agradecimentos

Primeiramente gostaria de agradecer às pessoas que me trouxeram até aqui, minha família, em especial ao meu pai Pedro Egídio Ely e minha mãe Dulce Lorida Vogel Ely pelo incentivo e auxílio em todos os momentos e em todos os aspectos.

Ao Felipe Roberto Daronco pela sólida e sincera parceria. Agradeço imensamente pelo apoio, paciência, incentivo, carinho e compreensão de sempre. Você foi parte fundamental nesse processo. Gratidão!

À minha querida orientadora Ilsi Iob Boldrini pela sensibilidade e carinho com que sempre me tratou. Me orgulho muito de ter sido sua orientada, pois admiro enormemente a sua postura como profissional e como pessoa. Admiro especialmente o fato de estar sempre disposta a ajudar, jamais foge dos problemas e nem te deixa desamparada. Sempre muito objetiva, encara de frente e junto com seus alunos as dificuldades que surgem no dia a dia da pós-graduação. O fato é que a Ilsi é uma orientadora verdadeiramente presente e super acessível, isso fica evidente por sua sala estar sempre de portas abertas, literalmente. Enfim, sou imensamente grata por fazer parte da equipe Boldrini (LevCamp) e também por ser uma das poucas alunas que teve o privilégio de subir desafiadores vulcões com a orientadora (rsrsrs). Obrigada Ilsi pela amizade, confiança e pelo estímulo de sempre.

Ao meu coorientador João Ricardo Vieira Iganci pelo auxílio intelectual e logístico durante o caminhar da tese, por me abrir os olhos para o mundo da biogeografia e também pela amizade e pelas agradáveis conversas.

Ao Sérgio Augusto de Loreto Bordignon pela lindíssima amizade, pela humildade com que compartilha seu vasto conhecimento botânico e também pela prestatividade de sempre. Seu amor e dedicação à botânica me inspiram profundamente. O fato é que não existem palavras que demonstrem de forma autêntica a minha gratidão ao Sérgio, só posso dizer que você é um exemplo de pessoa e de botânico que eu pretendo seguir, te admiro profundamente. Agradeço também por ser o grande responsável por me fazer ingressar nesse maravilhoso porém desafiador mundo dos *Hypericum*.

À maravilhosa equipe LevCamp pela amizade, "janelas abertas", churras, campos, pelas empolgantes discussões acadêmicas e políticas do RU, pelas gordices que proporcionaram uma significativa melhora no rendimento e, em síntese, por todas as boas relações criadas e por todo conhecimento compartilhado e adquirido nesses quatro anos.

À Eudes Maria Stiehl-Alves pela generosa, prestativa e impressíndível ajuda em todo processo de extrações e amplificações realizadas no LABSIM da UFRGS, além é claro, da preciosa ajuda intelectual. Agradeço imensamente pelos ensinamentos, instruções, dicas e pelas agradáveis conversas.

Ao Leonardo Nogueira da Silva, anjo que entrou na minha vida e que me salvou nos momentos de maior dificuldade que enfrentei durante o doutorado. Agradeço pela linda amizade, pela generosa e prestativa ajuda analítica e intelectual, e também pelas maravilhosas comidinhas que me ensinastes a fazer. Léo obrigada por TUDO.

Ao Nicolai M. Nürk pela importante colaboração, proporcionando crescimento intelectual e reflexões relevantes sobre a presente tese, além do compartilhamento de sequências e de valiosas informações não publicadas.

À Bianca Ott Andrade pela importantíssima colaboração no manuscrito de qualificação da presente tese, e também pela amizade e pelas prazerosas conversas.

Aos inúmeros amigos do meio acadêmico pelos bons momentos compartilhados e por todas as dicas que deram certo e que me auxiliaram enormemente nesse doc. Especialmente à Ethiéne Guerra, pessoa que admiro profundamente e com quem muito aprendi nesses quatro anos, e ao Dióber B. Lucas pela parceria assídua e agradável em viagens de campo, revisões de herbários e eventos andinos. Com certeza foram pessoas e momentos que agregaram e alegraram muito esses anos de doutorado.

Ao Prof. Dr. Jefferson Prado pela gentil ajuda na resolução de inúmeras dúvidas nomenclaturais e ao Prof. Dr. Rafael Trevisan pelo auxílio prestativo com o Latim.

Ao Héctor A. Keller pelo generoso envio de amostras argentinas, inclusive pela doação de um parátipo de *Hypericum robsonii* ao herbário ICN da UFRGS. Da mesma forma, à Michelle Mota pelo envio de um espécime de *Hypericum austrobrasiliense* e amostras em sílica oriundas de Santa Catarina, e à Inara da Silva Batista pelo auxílio e envio de fotografias contendo detalhes de espécimes depositados no herbário R.

Aos amigos Andrés González e José Luis A. Zaballa pelo grande e agradável auxílio no campo em terras uruguaias e também pelo maravilhoso ‘asado uruguayo’.

À equipe Hypericaceae (projeto Flora do Brasil 2020) pela parceria e pelo auxílio nos mais diferentes aspectos, especialmente ao Lucas C. Marinho pelas longas e produtivas conversas, pelas gargalhadas e pelo espírito motivador de sempre.

À Profa. Gilsane Lino von Poser e ao Henrique Bridi, que dedicam suas pesquisas ao conhecimento farmacognóstico das espécies nativas de *Hypericum* (Departamento de

Farmácia da UFRGS), pela acessível troca de dados e experiências e também pelas perspectivas de colabolação no âmbito da quimiotaxonomia.

À Profa. Tatiana Chies por tornar nosso trabalho no LABSIM possível e prazeroso, e também pelas suas esclarecedoras e importantíssimas dicas e orientações no âmbito da biologia molecular.

À Profa. Silvia Miotto pelos agradáveis momentos em campo e também fora dele.

À todos que lembraram de coletar *Hypericum* pelo caminho: Dióber B. Lucas, Pedro Joel S. da Silva Filho, Leonardo Nogueira da Silva, Fábio P. Torchelsen, Guilherme Coelho, Jonas Castro, Martin Grings, Gabriel E. Ferreira, Luciana Menezes, Anderson Christ, Cássio Rabuske, Carolina Costa Alff, Fernanda Schmidt, Matias Köhler, Rosângela Rolim, Juliana Schaefer, Felipe Gonzatti, Josimar Külkamp, Eduardo Lozano, Cristiano Buzatto, Michelle Nervo, Silviane C. Pesamosca e Marlon G. Facco. Obrigada de coração!

À curadora Mara Ritter e às funcionárias Camila e Márcia do herbário ICN da UFRGS pela prestatividade e auxílio durante todo o doutorado. Vocês foram essenciais!

Aos funcionários e curadores dos herbários visitados, especialmente àqueles que nos receberam e nos auxiliaram num contexto que vai muito além das coleções, tais como: Eduardo Marchesi do MVFA, Manuel Garcia do MVM, Liliana Delfino do MVJB, Norma Deginani do SI, Ruy Válka Alves do R e José Tadeu Motta do MBM. Agradeço também aos curadores e funcionários dos herbários FCAB, HBEI, HDCF, HRCB e SAMES pelo envio de fotos dos espécimes de *Hyperium* desses herbários.

Ao CNPq pela bolsa concedida e à PROPesq pela ajuda de custo em viagens com o intuito de promover a divulgação acadêmica, especialmente para os trabalhos apresentados nas Jornadas Argentinas de Botânica em Mendoza (Argentina) e no Congresso Latino Americano de Botânica em Quito (Equador).

Ao ‘Neotropical Grassland Conservancy’ pelo recurso fornecido. Sem este auxílio não teria sido possível finalizar as revisões de herbário, os campos e o sequenciamento de todas as amostras previstas no meu projeto de doutorado.

À todos que contribuíram de forma direta ou indireta para que este trabalho fosse possível, obrigada!

Resumo

Hypericaceae é uma família da ordem Malpighiales, composta por seis gêneros e cerca de 620 espécies, das quais mais de 80% pertencem ao gênero *Hypericum*. Com distribuição quase cosmopolita, *Hypericum* possui dois importantes centros de diversidade na América do Sul: os Páramos andinos (seção *Brathys*) e os campos do sudeste da América do Sul (seção *Trigynobrathys*). Estudos filogenéticos recentes têm demonstrado que essas duas maiores seções do gênero, *Brathys* and *Trigynobrathys,* são não monofiléticas. De acordo com a compreensão atual, todas as espécies sul-americanas de *Hypericum,* juntamente com espécies Africanas, Asiáticas e Norte Americanas são acomodadas em um clado que reúne 30% das espécies do gênero e que tem sido informalmente denominado *Brathys* s.l. ou grupo *Brathys.* Na presente tese utilizamos análises Bayesianas e de Máxima Verossimilhança a partir de sequências de DNA nuclear e do cloroplasto (ITS + At1G13040 + *petD* + *trnL*) para inferir as relações evolutivas entre as espécies de *Hypericum* sul-americanas. Nessa etapa consideramos uma estratégia de amostragem robusta para as espécies sul-americanas não andinas, as quais eram previamente subamostradas em reconstruções filogenéticas. Também investimos em um bom conhecimento taxonômico e de campo para auxiliar na resolução de dificuldades taxonômicas e nomenclaturais acerca de espécies de *Hypericum* da região não andina da América do Sul, além de fornecer a primeira avaliação global do risco de extinção para 22 espécies de *Hypericum* e assim prover informações que subsidiem ações de conservação para as espécies e seus ecossistemas. Com o uso dessas abordagens, melhoramos nosso entendimento sobre a taxonomia e a história evolutiva de representantes sul-americanos do gênero *Hypericum.* Ou seja, na tese demonstramos que as espécies sul-americanas não andinas de *Hypericum* formam um grupo monofilético que é fortemente sustentado em nossas análises e que a espécie morfologicamente distinta, *H. piriai*, fica posicionada separada do clado andino e do clado do sudeste sul-americano, representando uma terceira linhagem que colonizou a América do Sul. Nossos estudos também resultaram em nove novos registros para os territórios argentino, brasileiro e uruguaio, na sinonimização de seis nomes, no restabelecimento da prioridade nomenclatual de *Hypericum cordiforme* sobre *H. cordatum*, na indicação de seis lectótipos e 21 casos envolvendo segundo passo de lectotipificação, quatro indicações de neótipos, um epítipo, além da identificação de dois nomes supérfluos e um nome não validamente publicado. Do ponto de vista da conservação, foi possível identificar onze espécies ameaçadas globalmente, sendo seis classificadas na categoria Em Perigo (EN) e cinco como Criticamente em Perigo (CR).

Palavras-chave: América do Sul, conservação, filogenética molecular, *Hypericum*, nomenclatura, novos registros, taxonomia, espécies sul-americanas não andinas.

Abstract

Hypericaceae is a family of the order Malpighiales, composed of six genera and about 620 species, of which more than 80% belong to the genus *Hypericum*. With almost cosmopolitan distribution, *Hypericum* has two important centers of diversity in South America: the Andean Páramos (*Brathys* section) and the southeastern South America grasslands (*Trigynobrathys* section). Recent phylogenetic studies have shown that these two major sections of the genus, *Brathys* and *Trigynobrathys*, are not monophyletic. Indeed, all South American species of *Hypericum* along with African, Asian and North American species are accommodated in a clade that accounts for 30% of the species of the genus and which has been informally termed *Brathys* s.l. or *Brathys* group. In the present thesis, we used Bayesian and Maximum Likelihood analyzes from nuclear and chloroplast DNA sequences (ITS + At1G13040 + *petD* + *trnL*) to infer the evolutionary relationships between the South American *Hypericum* species. In this step, we considered a robust sampling strategy for the non-Andean South American species, which were previously under-sampled in phylogenetic reconstructions. We also invested efforts in a substantial taxonomic and field knowledge to improve the resolution of taxonomic and nomenclatural difficulties regarding *Hypericum* species in the non-Andean South America, as well as to provide the first global extinction risk assessment for 22 *Hypericum* species and to provide information that subsidize conservation actions for species and their ecosystems. Using these approaches, we improved our understanding of the taxonomy and evolutionary history of South American representatives of the *Hypericum* genus. That is, in the thesis we demonstrated that the non-Andean South American species of *Hypericum* form a monophyletic group that is strongly supported in our analyzes and that the morphologically distinct species, *H. piriai*, is separated from the Andean clade and also from the southeast South American clade, representing a third lineage that colonized South America. Our studies also resulted in nine new records for the Argentinean, Brazilian and Uruguayan territories, synonymization of six names, the restoration of the nomenclatural priority of *Hypericum cordiforme* over *H. cordatum*, the indication of six lectotypes and 21 cases involving second-step lectotypes, four indications of neotypes, one epitype, besides the identification of two superfluous names and an name not validly published. From the conservation framework, it was possible to identify eleven endangered species globally; six classified in the category Endangered (EN) and five in the Critically Endangered (CR).

Keywords: South America, conservation, *Hypericum*, molecular phylogenetics, new records, nomenclature, taxonomy, non-Andean South American species.

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CAPÍTULO I. A formatação da Parte I seguiu o modelo exigido para publicação na revista **Perspectives in Plant Ecology, Evolution and Systematics**, na qual o artigo já foi publicado (artigo apresentado no exame de qualificação deste doutorado). Já a formatação da Parte II seguiu o modelo exigido para publicação na revista **Plant Systematics and Evolution**, na qual pretedemos submeter o artigo em breve.

CAPÍTULO II. A formatação da Parte I seguiu o modelo exigido para publicação na revista **Brittonia**, na qual o artigo já foi publicado. Já a formatação da Parte II seguiu o modelo exigido para publicação na revista **Taxon**, na qual o artigo será submetido em breve.

As instruções para os autores podem ser encontradas nos endereços eletrônicos abaixo:
Perspectives in Plant Ecology, Evolution and Systematics (www.elsevier.com/locate/ppees)
Plant Systematics and Evolution (https://www.springer.com/life+sciences/plant+sciences/journal/606)
Brittonia (https://link.springer.com/journal/12228)
Taxon (https://onlinelibrary.wiley.com/journal/19968175)

Introdução Geral

Hypericaceae Juss. é uma família da ordem Malpighiales, composta por seis gêneros e cerca de 620 espécies (Nürk et al. 2015; Robson 2012, 2016; Stevens 2001 em diante), das quais mais de 80% pertencem ao gênero *Hypericum* L. (Nürk et al. 2015; Robson 2012). A família faz parte do clado Clusioide, tendo como grupo-irmão Podostemaceae, e está dividida em três tribos bem suportadas (Fig. 1), sendo elas Vismieae, Cratoxyleae e Hypericeae (Robson 2012; Ruhfel et al. 2011, 2013, 2016). A tribo Hypericeae abrangia cinco gêneros (Stevens 2007), dos quais quatro foram recentemente incorporados em *Hypericum* a fim de torná-lo monofilético (Meseguer et al. 2013, 2015, 2018; Nürk et al. 2013a,b, 2015, 2017; Robson 2012, 2016; Ruhfel et al. 2011, 2013). Os pequenos gêneros *Lianthus* N.Robson, *Santomasia* N.Robson, e *Thornea* Breedlove & E.M.McClint. foram transferidos para dentro de *Hypericum* e passaram a ser considerados seções dentro deste gênero, enquanto que as seis espécies do gênero *Triadenum* Raf. foram incorporadas em *Hypericum* seção *Elodea* Choisy (Robson 2012, 2016).

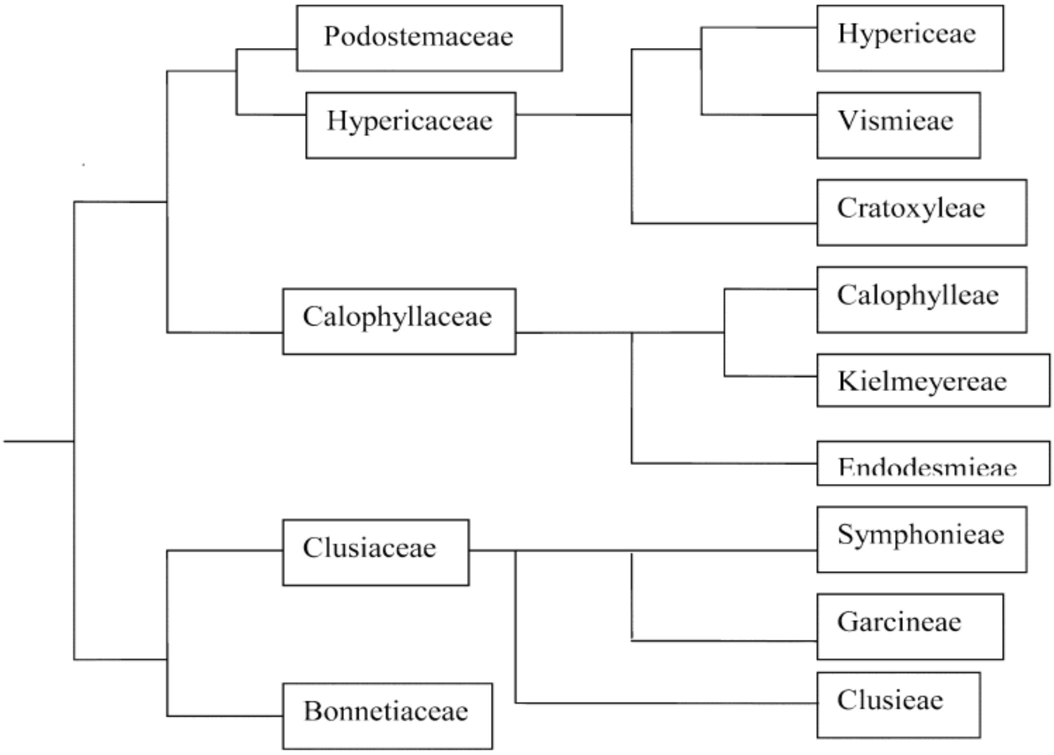

Figura 1. Relações das famílias e tribos do clado Clusioide, de acordo com Ruhfel et al. (2011), obtido em Robson (2012) e corroborado por Ruhfel et al. (2013, 2016).

Além das mudanças na circunscrição de *Hypericum*, as relações filogenéticas dentro do gênero também estão se tornando mais claras, especialmente devido ao advento da biologia molecular (Meseguer et al. 2013, 2015, 2018; Nürk et al. 2013a,b, 2015, 2017). Tais trabalhos vêm demonstrando que as 36 seções de *Hypericum* (Robson 1977, 2012) parecem em grande parte artificiais e necessitam de reavaliação. Dentre os problemas encontrados na classificação infragenérica, podemos destacar o não monofiletismo das duas maiores seções do gênero: *Brathys* (Mutis ex L.f.) Choisy and *Trigynobrathys* (Y.Kimura) N.Robson (Robson 1987, 1990). Essas duas seções acomodam todas as espécies sul-americanas de *Hypericum* e, juntamente com espécies Africanas, Asiáticas e Norte Americanas, formam um clado que reúne 30% das espécies do gênero e que tem sido informalmente denominado *Brathys* s.l. (Nürk & Blattner 2010; Nürk et al. 2013a,b, 2015) ou grupo *Brathys* (Meseguer et al. 2013). Mais recentemente, dados oriundos de métodos morfo-geográficos e de filogenias moleculares levaram a descrição de dois subgêneros em *Hypericum*: *Brathys* (Mutis ex L.f.) N.Robson, que inclui espécies principalmente do Novo Mundo e *Hypericum* que acomoda espécies principalmente do Velho Mundo (Robson 2016). Em suma, todas as espécies de *Hypericum* da América do Sul foram alocadas no subgênero *Brathys* (Robson 2016), e podem ser divididas em dois grupos, aquelas que se distribuem na porção andina da América do Sul e aquelas que ocorrem nos campos do sudeste sul-americano.

As mais de 500 espécies de *Hypericum* possuem diferentes formas de vida, variando de ervas anuais até árvores de grande porte (Robson 1981, 2016), e são adaptadas a ambientes bastante específicos, ocorrendo desde regiões tropicais alpinas como os Páramos Andinos, até várzeas temperadas e ambientes mediterrânicos rochosos e secos (Robson 1981, 2016). As espécies de *Hypericum* podem ser encontradas nos mais diversos ecossistemas do Globo, possuindo uma distribuição quase cosmopolita, mas reúnem em zonas temperadas e regiões tropicais de grandes altitudes sua maior riqueza (Nürk et al. 2013a; Robson 2003). O gênero apresenta seu centro primário de riqueza em regiões temperadas da Eurasia (Meseguer et al. 2013; Nürk et al. 2013a, 2015), o que contrasta com todos os outros grupos do clado Clusioide, que são quase que exclusivamente tropicais (Nürk et al. 2015; Ruhfel et al. 2011, 2016). Na América do Sul, as espécies de *Hypericum* ocorrem em áreas de vegetação campestre (Nürk et al. 2013b, Vogel Ely et al. 2019), e apresentam duas importantes áreas de endemismo: os Páramos

Andinos (centro de diversidade da seção *Brathys*) e os campos do sudeste da América do Sul (centro de diversidade da seção *Trigynobrathys*) (Robson 1987, 1990).

No contexto da biogeografia, análises realizadas por Nürk et al. (2015) indicaram o Hemisfério Norte, mais especificamente o oeste Paleártico, ou ainda uma distribuição mais ampla entre o oeste Paleártico e Neártico, como área de origem de *Hypericum.* Em contrapartida, Meseguer et al. (2013, 2015) indicaram o oeste Paleártico como primeira possível área ancestral de *Hypericum* e a África como segunda possível área ancestral do gênero, embora isso contraste com a presença do fóssil mais antigo no oeste da Sibéria, o qual é datado para o final do Eoceno (Arbuzova 2005, Meseguer & Sanmartín 2012). Apesar da falta de correspondência entre algumas inferências biogeográficas, há concordância de que a família Hypericaceae, assim como a maioria dos gêneros e famílias da ordem Malpighiales, possuem origem tropical, possivelmente na África (Meseguer et al. 2013, 2015; Nürk et al. 2015; Robson 1981; Ruhfel et al. 2011, 2016). Esses estudos foram realizados graças a presença de um número considerável de registros fósseis de diferentes táxons do clado Clusioide (Ruhfel et al. 2011, 2013), além de microfósseis do gênero *Hypericum* (Meseguer & Sanmartín 2012). Tais registros permitiram calibrar diferentes pontos das filogenias e inferir com uma maior precisão o tempo de divergência dessas linhagens. Desta forma, segundo inferências realizadas por Meseguer et al. (2013), a diversificação da família Hypericaceae ocorreu por volta de 53.8 Ma, a divergência entre as tribos Hypericeae e Vismieae foi estimada para o início do Eoceno (49.9 Ma), enquanto que a divergência entre os grupos de *Hypericum* do Novo e do Velho Mundo ocorreu entre o final do Eoceno e o início do Oligoceno (33.7–37 Ma).

Duas hipóteses foram sugeridas para explicar o processo de colonização de *Hypericum* na América do Sul. A primeira hipótese sugeriu que as espécies sul-americanas teriam chegado ao Neotrópico através de um único evento de dispersão (Meseguer et al. 2013, 2015). Por outro lado, a segunda hipótese sugeriu que duas linhagens dispersaram independentemente na América do Sul, uma no sudeste sul-americano, a qual teria diversificado por volta de 4.1 Ma, e a outra andina que teria diversificado por volta de 3.8 Ma, coincidindo com o soerguimento dos Andes (Nürk et al. 2013b, 2017). A baixa amostragem de táxons sul-americanos não andinos parece impedir a inferência de cenários biogeográficos concisos (Meseguer et al. 2015; Nürk et al. 2013b, Nürk et al. 2017), especialmente em relação à distribuição ancestral dos clados sul-americanos (Nürk et al. 2017).

Quanto aos propósitos medicinais de *Hypericum*, é sabido que o reconhecido uso da espécie *Hypericum perforatum* L. para fins medicinais fez com que várias espécies do gênero fossem amplamente contempladas em estudos farmacognósticos (Biavatti 2011). O interesse químico e farmacológico sobre o gênero, aliado ao grande número de espécies quimicamente desconhecidas fez com que diversas espécies de *Hypericum* sul-americanas fossem alvo de pesquisas neste âmbito. Desde então, muitas atividades farmacológicas já foram evidenciadas, dentre as quais podemos mencionar a atividade antidepressiva de *H. caprifoliatum* (Viana et al. 2005), atividade antimicrobiana de *H. myrianthum* Cham. & Schltdl. (Dall'Agnol et al. 2005), atividade antiviral de *H. connatum* (Fritz 2006), propriedades antidepressivas, inseticidas e neuroativas de *H. polyanthemum* Klotzsch ex Reichardt (Viana 2007; Rates et al. 2010), entre outras. Além disso, um perfil fitoquímico entre espécies de *Hypericum* coletadas no sul do Brasil foi identificado (Von Poser et al. 2010), sugerindo que compostos fenólicos como ácido clorogênico poderiam ser usados como caráter taxonômico, uma vez que foram amplamente quantificados nas espécies do sudeste sul-americano.

Do ponto de vista da conservação, há várias espécies sul-americanas não andinas de *Hypericum* em vias de extinção, seja em decorrência da falta de conhecimento sobre essas espécies ou pela falta de estratégias de conservação para as espécies e seus ecossistemas (Keller & Crockett 2015; Vogel Ely & Boldrini 2015). Inclusive, os ecossistemas campestres em que as espécies sul-americanas de *Hypericum* ocorrem vem sofrendo com um conjunto de processos de degradação e raramente são consideradas em políticas de conservação (Andrade et al. 2015; Overbeck et al. 2007, 2015; Veldman et al. 2015).

O interesse farmacognóstico sobre espécies de *Hypericum* é uma das razões que ressaltam a importância de pesquisas visando sanar problemas no conhecimento e na delimitação dos táxons. Nesse sentido, trabalhos sistemáticos como o que apresentamos aqui garantem que pesquisas no âmbito da farmacognosia sejam desenvolvidas com segurança pois asseguram a identificação precisa do material utilizado evitando uma série de problemas, especialmente com relação à obtenção de patentes. O baixo número de espécies sul-americanas de *Hypericum* (ca. 9%) que tiveram seu status de conservação avaliados globalmente, aliado aos inúmeros processos de degradação dos ecossistemas campestres em que as espécies ocorrem, é outro ponto que justifica a necessidade urgente de pesquisas envolvendo aspectos taxonômicos e de conservação desse gênero. Em suma, com o uso de abordagens taxonômicas e de biologia molecular, a presente tese visa preencher lacunas, colaborando para o conhecimento das espécies sul-americanas não andinas de *Hypericum* e de suas relações evolutivas com as demais espécies do gênero.

Referências

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Capítulo I — Sistemática e conservação das espécies sul-americanas não andinas de *Hypericum*

PARTE I — INTEGRATIVE TAXONOMY IMPROVES DELIMITATION IN *HYPERICUM* SUBSPECIES

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Testing delimitation of *Hypericum* subspecies

HIGHLIGHTS

- *Hypericum rigidum* subspecies overlap geographically, ecologically and morphologically.
- No adaptive match of *H. rigidum* phenotypes to the environment was found.
- Random processes may spur phenotypic variation in *H. rigidum*.
- Mayr’ subspecies concept is not met by morphology and allopatry.

ABSTRACT

Integrative approaches have been very useful to identify diagnostic morphological characters in species delimitation and to understand how abiotic factors influence the geographical distribution of taxa and whether these factors may be driving to specific changes in phenotypic variation patterns. Here we use a South American *Hypericum* species to discuss the importance of such collaborations for taxonomy. The current classification recognizes four sympatric subspecies within *Hypericum rigidum*; however, due to the presence of intermediary diagnostic characters, a significant number of specimens cannot be assigned to any of these subspecies. Therefore, since the described subspecies are difficult to differentiate, in this study, we applied ecological and morphometric approaches to evaluate whether the infraspecific classification may be sustained in terms of environmental and morphological variation. Applied statistical analyses make evident the high morphological variation within *H. rigidum* subspecies and the absence of diagnostic characters that sustain the current infraspecific classification. Multivariate analyses also indicate that the morphologic variation of *H. rigidum* subspecies does not represent adaptive matching of phenotypes to the environment and, therefore, cannot be explained by phenotypic plasticity nor by ecotypic variation. We also discuss the non-standardization of the subspecies concept in plants. In conclusion, *H. rigidum* subspecies overlap geographically, ecologically and morphologically and, therefore, we recommend that these phenotypes should not be regarded as subspecies, but as part of one single highly variable species.

KEYWORDS

ecological niche; Hypericaceae; infraspecific delimitation; multivariate analyses; phenotypic variation; South America

1. INTRODUCTION

Taxonomy is built based on categories around which reaching a scientific consensus is an ongoing challenge. The subspecies' concept, for example, defines that populations distributed in non-overlapping geographic units must have diagnostically distinct phenotypes (Mayr, 1942; Patten and Remsen, 2017). Nevertheless, subspecies definition is seldom applied accordingly (Hamilton and Reichard, 1992; Patten, 2015). Such conceptual arbitrariness promotes taxonomic inflation, resulting in unrealistic measures of biodiversity (Isaac et al., 2004) and this may have consequences on biodiversity management and prioritization of regional conservation (Padial et al., 2006).

The taxonomic instability has troubled biologists for a long time. Recently, integrative taxonomy, using different lines of evidence, has helped to solve such problems, becoming a standard practice in taxa delimitation (Morales et al., 2014; Padial et al., 2006; Robbiati et al., 2017; Turchetto et al., 2014). Morphometric analyses, for example, has been very useful to identify diagnostic morphological characters in taxa delimitation (Pierre et al., 2014). However, when combined with ecological approaches they may help to understand how abiotic factors influence the geographical distribution of taxa and whether these factors may be driving to specific changes in phenotypic variation patterns (Robbiati et al., 2017). Such collaborations should be encouraged as they help taxonomy to go beyond naming species, they promote the understanding of the processes that lead to speciation (Schlick-Steiner et al., 2010).

Hypericum L. is the largest genus of Hypericaceae Juss., reaching over 500 species distributed in the most diverse ecosystems of the World (Robson, 2016, 2012, 1977). In South America, many species of *Hypericum* are habitat specialists, ranging from rocky to damp environments (Nürk et al., 2013; Vogel Ely et al., 2018). *Hypericum rigidum* A.St.-Hil., for example, is distributed in open areas of subtropical South America, occurring mainly between 900 and 1,700 m a.s.l., in high altitude wetlands of the Atlantic Forest region. Scrutinize such environmental conditions may help us to understand which factors are driving taxa distribution (Soberón, 2007), especially since species are expected to be nonrandomly distributed regarding ecogeographical variables (Hirzel et al., 2002). Methods that extract spatial environmental data (e.g. abiotic factors such as average temperature, precipitation, terrain and soil aspects) from occurrence records are relevant to measure ecological niche differences (Broennimann et al., 2012) and, consequently, defining ecological limits between taxa.

The species *H. rigidum* itself is identified by its leaves-like bracts, long primary pedicel and characteristic venation in both the field and on herbarium specimen (Fig. 1A–C). Its infraspecific classification, however, is problematic and of limited practical utility: diagnosis and identification key contain overlapping or extremely close morphological characters (Robson, 1990). With wide phenotypic variation, *H. rigidum* was initially described as three distinct species (Keller, 1923; Saint-Hilaire, 1828; Smith, 1958) and later, synonymized, but segregated into four subspecies within *H. rigidum* (Robson, 1990). Names like *H. rigidum* subsp. *rigidum* ('rigidum') and *H. rigidum* subsp. *sellowianum* (R.Keller) N.Robson ('sellowianum') were applied to phenotypes exhibiting morphological extremes (Fig. 1D and G), while *H. rigidum* subsp. *meridionale* (L.B.Sm.) N.Robson ('meridionale') and *H. rigidum* subsp. *bracteatum* N.Robson ('bracteatum') are phenotypes that lie between these extremes (Fig. 1E and F). The current taxonomy recognizes these four non-allopatric subspecies within *H. rigidum* and, according to Robson (1990), these subspecies are morphologically distinguishable from each other based on the morphological characters described in Table 1. However, as already noted by Slusarski et al. (2007), the overlap of the characters used by Robson (1990) as diagnostic was quite evident in his study and, in practice, results in a significant number of specimens that cannot be identified by the current infraspecific classification of *H. rigidum.*

In this study, we investigate the morphological and ecological delimitation between the four *H. rigidum* subspecies in order to solve taxonomic issues related to these subspecific names. Specifically, we test for (1) morphological separation of *H. rigidum* individuals using a comprehensive sample of geo-referenced specimens and field observations, and for (2) differences in their ecological niches. We (3) identify whether potentially obtained entities (distinct phenotypes or ecotypes) agree with the current subspecies concept (sensu Robson, 1990). Finally, we analyze our results in the light of Mayr's concept of subspecies delimitation, that is, whether or not potentially identified entities belong to geographically and/or ecologically isolated populations.

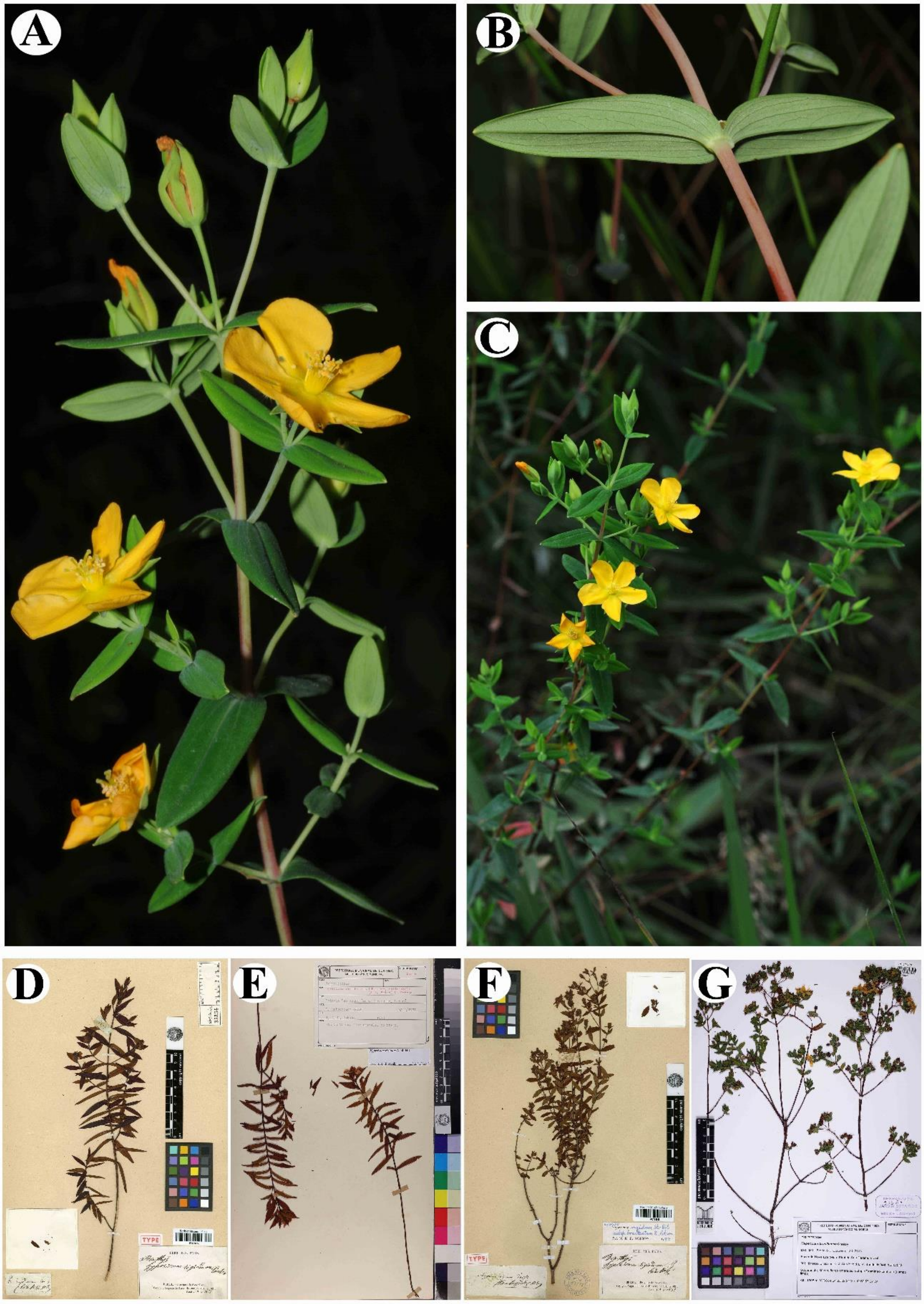

Fig. 1. A–G. *Hypericum rigidum.* A. Leaves-like bracts. B. Leaf venation. C. Habit. D. *H. rigidum* subsp. *rigidum*. E. *Hypericum rigidum* subsp. *meridionale*. F. *Hypericum rigidum* subsp. *bracteatum*. G. *Hypericum rigidum* subsp. *sellowianum*. (Photos: A–C was taken by Sérgio A. L. Bordignon; D–G obtained in the Reflora Virtual Herbarium).

Table 1. Diagnostic characters in the separation of *Hypericum rigidum* subspecies, according to Robson's classification (1990).

Subspecies	**Leaf size***	**Leaf shape***	**Inflorescence***	**Flower size***	**Bracts and bracteoles**	**Pedicel length***	**Capsule length***
‘rigidum’	20−60 × 4−13 mm	narrowly elliptic or narrowly oblong to linear-oblong, apex acute to acuminate, base parallel-sided	1−9-flowered	20−30 mm diam.	foliar	(9)12−32 mm long	8−9 mm long
‘meridionale’	10−30 × 2−8 mm	± narrowly elliptic or oblong to linear-oblong, apex acute to acuminate, base parallel-sided to narrowly cuneate	1−7-flowered	14−24 mm diam.	foliar	8−10 mm long	5−7 mm long
‘bracteatum’	15−20 × 4−6 mm	narrowly elliptic to narrowly oblong-elliptic, apex acute to subacute, base narrowly cuneate to truncate	5−12-flowered	15−18 mm diam.	reduced foliar	3−6 mm long	Capsule not seen
‘sellowianum’	10−20 × 4−6 mm	broadly to narrowly elliptic or broadly to narrowly oblong or lanceolate, apex acute to rounded, base narrowly cuneate to shallowly cordate	1−22-flowered	13−20 mm in diam.	foliar or rarely ultimately reduced	6−16(20) mm long	4.5−8 mm long

* Morphological variables selected for our analyzes.

2. MATERIAL AND METHODS

2.1. Specimens studied

From a total of 129 herbarium specimens of *H. rigidum*, we selected 74 specimens from 44 localities as a representative subset for uni- and multivariate statistical analyses (Appendix S1 in the Supplementary material). Specimens selection followed two primary criteria: the presence of characters considered diagnostic by the current infraspecific classification and precise information about collection locality (i.e. geographic coordinates or municipality). The coordinates of specimens were obtained during field expeditions and from exsiccate labels. Also, specimens collected in the same place, but at different times were in cluded in the dataset. Herbarium material from ICN and high-resolution images from ALCB, FURB, HUEFS, K, MBM, NY, P, RB, US, and W were examined and measured through the Jabot and Reflora databases (JBRJ, 2017; Reflora, 2017; Thiers, 2017).

2.2. Morphological data

Measurements were made on the morphological characters formally used as diagnostics in the separation of the four subspecies of *H. rigidum* (Robson, 1990): leaf length, leaf width, number of flowers per inflorescence, flower diameter, primary pedicel length and capsule length (Table 1). However, after checking for multicollinearity using Pearson correlation among these six morphological variables initially selected, we detected a high collinearity between leaf length and leaf width ($r \geq 0.8$). Thus, we created a new morphological variable: length × width leaf ratio. Except for the box-plots and analysis of variance, all other analyses comprised only five morphological variables: (1) length × width leaf ratio; (2) number of flowers per inflorescence, (3) flower diameter; (4) primary pedicel length; and (5) capsule length. Bracts and bracteoles were not included in the analyses because they can be foliaceous or reduced in the same specimen.

Aiming to cover the entire morphological variation of *H. rigidum*, we measured 26 specimens from 'rigidum' (type included), 12 from 'meridionale' (type excluded because it did not have precise location data), one from 'bracteatum' (subspecies known only by its type), 27 from 'sellowianum' (type excluded because it did not have precise location data), and eight indeterminate or 'indet' (specimens that could not be classified into any of the four subspecies because they presented intermediate diagnostic characters). Specimens identification was performed based on the taxonomic key, illustrations, and descriptions found in Robson (1990). Fertile and sterile specimens were both analyzed to embrace the entire geographic range and the full spectrum of morphological variation of *H. rigidum* subspecies. In order to account for the inter- and intra-populational variation of *H. rigidum*'s morphology, we made five measurements contemplating average and extreme morphological values of each character per specimen, whenever possible. In our dataset each of the five measurements was considered as a different replicate, allowing us to get access to the variation within specimens as well.

Analyses were performed using two different matrix sizes ('morphological-1' dataset and 'morphological-2' dataset) to handle with NMDS analytical limitations owing to missing data. The 'morphological-1' dataset contains 368 measurements obtained from 74 specimens, while the 'morphological-2' dataset has a subset of 200 measurements obtained from 69 specimens. In both matrices we measured vegetative and reproductive morphological characters, covering the entire morphological variation and geographic distribution of *H. rigidum*. Due to absence of flowers or fruits in many specimens the datasets contained varying amounts of missing data (45% missing data in 'morphological-1' dataset, 26% in 'morphological-2' dataset), a common challenge to whom that conduct macroecological and evolutionary studies using life-history trait databases (Penone et al., 2014; Sauquet and Magallón, 2018).

2.3. Ecological data

To evaluate the subspecies' distributional response to environmental gradient and to test whether the ecological niche differs among subspecific taxa, we built a database of environmental variables based on the occurrence records of *H. rigidum* subspecies. For this, we selected seven climatic variables from WorldClim database (available at http://www.worldclim.org/bioclim) for being ecologically meaningful, since they represent extreme climatic conditions: BIO3 (Isothermality), BIO5 (Maximum temperature of warmest month), BIO6 (Minimum temperature of coldest month), BIO13 (Precipitation of wettest month), BIO14 (Precipitation of driest month), BIO15 (Precipitation Seasonality, Coefficient of Variation), and elevation above sea level. However, after detecting high collinearity ($r \geq 0.8$) between BIO15 and two other environmental characteristics (BIO13 and BIO14), we excluded BIO15 from further analysis. Additionally, soil organic carbon stock (SOC, t ha-1) was obtained from a 1 km spatial resolution map for Brazil (Vasques et al., 2018; available at http://geoinfo.cnps.embrapa.br/documents/1060), which has been proposed as a proxy for soil water characteristics (Saxton and Rawls, 2006).

2.4. Analyses

All analyses were performed in the statistical computing environment R, version 3.4.0 (R Core Team, 2017), using packages ade4, cluster, ggplot2, raster, and vegan. The morphological variation of characters used in subspecific taxa delimitation sensu Robson (1990) was represented in the box-plots, and their significant differences tested using Fisher's least significant difference (LSD) at $P < 0.05$ after a nonparametric analysis of variance (Kruskal-Wallis). We opted for a nonparametric analysis of variance because our data did not meet the assumptions of normality and homogeneity of variance.

In order to test the morphological separation of *H. rigidum* subspecies, we applied two multivariate analyses: hierarchical cluster analysis (HCA) using Ward’s method and non-metric multidimensional scaling (NMDS). For both analyses, we used Gower distance as a dissimilarity measure (Gower, 1971). Considering that in HCA the specimens are clustered only due to their morphological differences (i.e. without assignment to taxa), this analysis is appropriate to test whether the individuals cluster according to the infraspecific classification of *H. rigidum* (Robson, 1990). To perform HCA, the Gower distance was used to create a dissimilarity matrix of the ‘morphological-1’ dataset. We used NMDS in order to reduce the multidimensionality of data and thereby facilitates interpretation (James and Mcculloch, 1990). Also, NMDS is considered a robust technique for ecological approaches (Minchin, 1987), and can handle incomplete datasets. For the analysis, we used ‘morphological-2’ dataset, which contains at least three measurements per morphological variable per specimen.

Mantel test, based on Pearson’s product-moment correlation, was performed to seek the statistically significant relationship between morphological and environmental distance matrices (Legendre and Legendre, 2012). For this analysis, two matrices of equivalent size were used, one containing the ‘environmental’ dataset and other containing the ‘morphological-2’ dataset. Mantel test was conducted using 999 random permutations. Additionally, aiming to figure out how similar are the abiotic resource requirements and restrictions among the subspecies we carried out a principal component analysis (PCA). The PCA is an ordination technique that aims to reduce the complexity of the study focus, in our case the environmental variance where each subspecies is found, transforming many correlated variables into two uncorrelated principal components. Because of its capacity to maximize the environmental variance of the species environment, it is considered a robust method for estimating niche overlap (Broennimann et al., 2012). For PCA dataset we considered only a single register of each subspecies per site in order to avoid collinearity problems. PCA was based on log-transformed abiotic variables.

3. RESULTS

3.1. Geographical distribution and environmental data

The distribution of *H. rigidum* covers approximately 450,000 km^2 of the Atlantic Forest grasslands, in the south-southeast Brazil, ranging within nine degree latitude and ten degree longitude (Fig. 2A), with an altitudinal interval ranging from 229 to about 1,700 m a.s.l. The annual cumulative precipitation ranges from 1,050 mm in the driest area in the extreme east up to 2,050 mm in the extreme west of *H. rigidum* distribution (INMET, 1992), with monthly precipitation ranging from 157 mm to 323 mm in the wettest month and from 16 mm to 137 mm in the driest month. The average annual temperature varies from 14 °C in the extreme south to 24 °C in the extreme north of *H. rigidum* distribution (INMET, 1992), with maximum temperature ranging from 23 °C to 32 °C in the hottest month, and the minimum temperature from 4 °C to 12 °C in the coldest month. The soil organic carbon (SOC) content varies from 36.7 to 108.5 t ha^{-1}.

3.2. Morphometrical analyses

In the box-plots, we can see that LSD revealed statistical differences at $P < 0.05$ in leaf length and length × width leaf ratio for ‘rigidum’, ‘meridionale’, and ‘sellowianum’, primary pedicel length for ‘bracteatum’, as well as flower diameter and capsule length of ‘rigidum’ (Fig. 3; see Appendix S2 in the Supplementary material). For instance, when analyzed for the length × width leaf ratio parameter, ‘rigidum’, ‘meridionale’, and ‘sellowianum’ showed statistical differences among each other (represented by the letters a, b, and c respectively), whereas ‘meridionale’ and ‘sellowianum’ did not differ statistically from ‘bracteatum’ (which was represented by the letters bc) for the same parameter (Fig. 3). Nevertheless, all measured characters showed overlap among the suggested subspecies at some point: ‘number of flowers per inflorescence’, for example, show overlap among ‘rigidum’ (b), ‘meridionale’ (b), and ‘bracteatum’ (ab), which also shows overlap with ‘sellowianum’ (a). That is, no evidence is provided in our data to morphologically differentiate the four subspecific taxa. Similarly, in the cluster analysis of the morphological data, the specimens do not group according to the infraspecific classification of *H. rigidum*. Four main clusters are revealed by HCA (Fig. 2C), and specimens assigned to one of the four subspecies very often group in more than one cluster, highlighting the absence of correspondence between morphological clustering and intraspecific classification. Moreover, duplicate specimens of the same collection often do not group together in the HCA dendrogram. For example, *Hatschbach 34,336* comprises four mounted specimens deposited in HUEFS, MBM, RB and W. These duplicate specimens were found in the four groups of our dendrogram. Similarly, *Lozano & Engels 2,228,* which has three duplicates found in ICN, MBM, and RB, were gathered in the third (III) and fourth (IV) groups. NMDS corroborates the HCA analysis showing that all phenotypes are mixed into a single group (Fig. 2D).

3.3. Ecological analyses

The Mantel test that examined the relationship between morphological distance and environmental distance was not significant (rMantel=-0.056, P = 0.971). That is, subspecies distribution is not correlated to the environmental gradients. The first two PCA axis represented 76% of the total variation in the environmental dataset. The first axis describes differences in a local scale in the environment, by differences in the soil organic matter accumulation, while the second axis makes evident differences in a landscape scale like temperature and pluviosity, especially the minimum temperature of coldest month and the precipitation of wettest month. One single group of points, representing subspecies occurrence in the environment, can be visualized. Furthermore, the subspecies group centroids are close to each other in the PCA center, reflecting an overlapping ecological distribution of the *H. rigidum* subspecies (Fig. 2B).

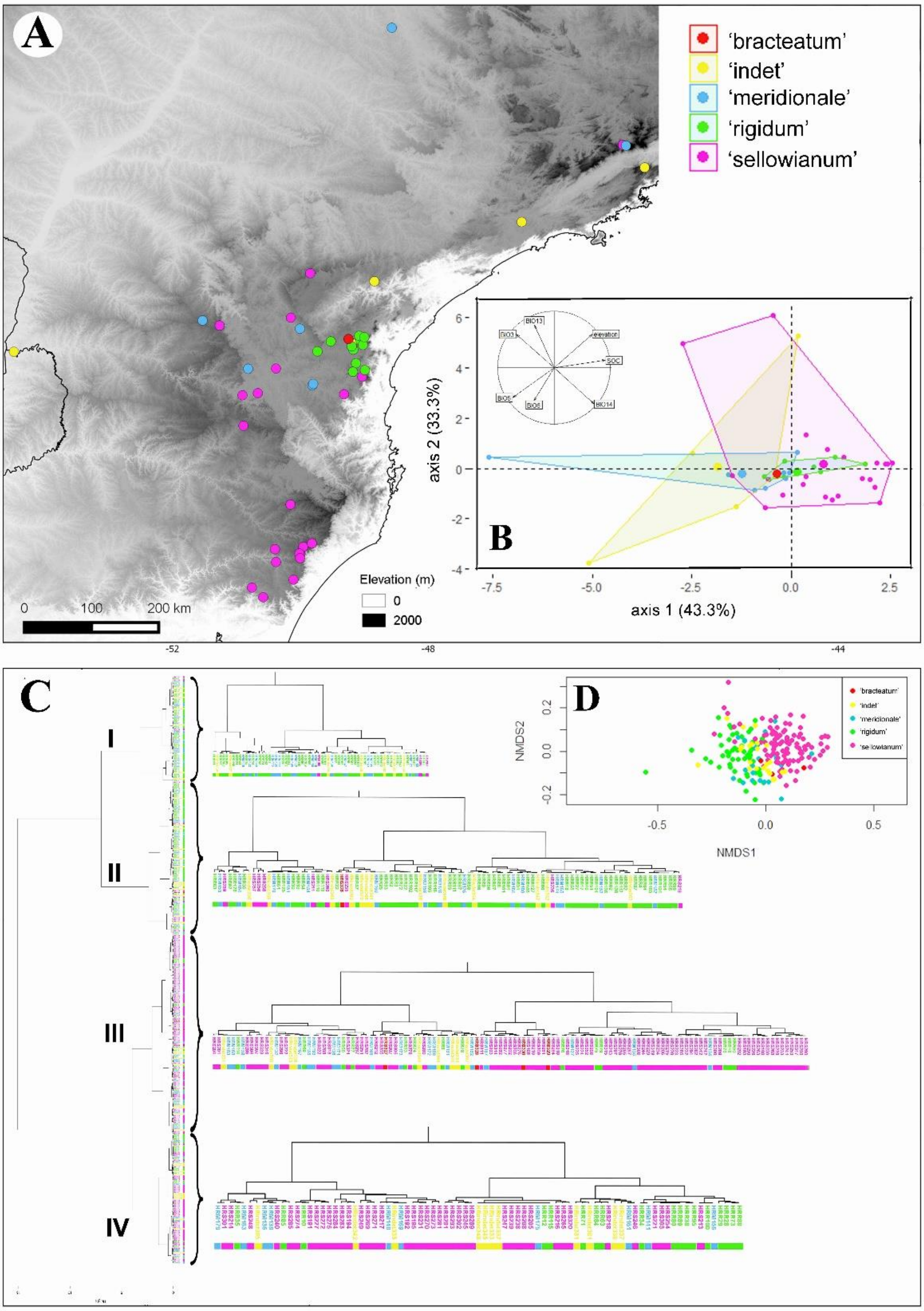

Fig. 2. A–D. Geographic, ecological and morphological evidence supporting synonymization of *Hypericum rigidum* subspecies. A. Geographic distribution of the four subspecies following Robson's classification (1990). B. Principal component analysis (PCA) of six environmental variables and the projection of these variables on the first and second axis of PCA ordination. C. Cluster dendrogram of *H. rigidum* subspecies based on five morphological characters. D. Ordination resulting from nonmetric multidimensional scaling (NMDS). Colors represent subspecies: green, *H. rigidum* subsp. *rigidum* ['rigidum']; blue, *H. rigidum* subsp. *meriodionale* ['meridionale']; red, *H. rigidum* subsp. *bracteatum* ['bracteatum']; pink, *H. rigidum* subsp. *sellowianum* ['sellowianum']; yellow, indeterminate specimens of *H. rigidum* ['indet']. Note that *H. rigidum* subspecies overlap geographically (2A), ecologically (2B), and morphologically (2C–D).

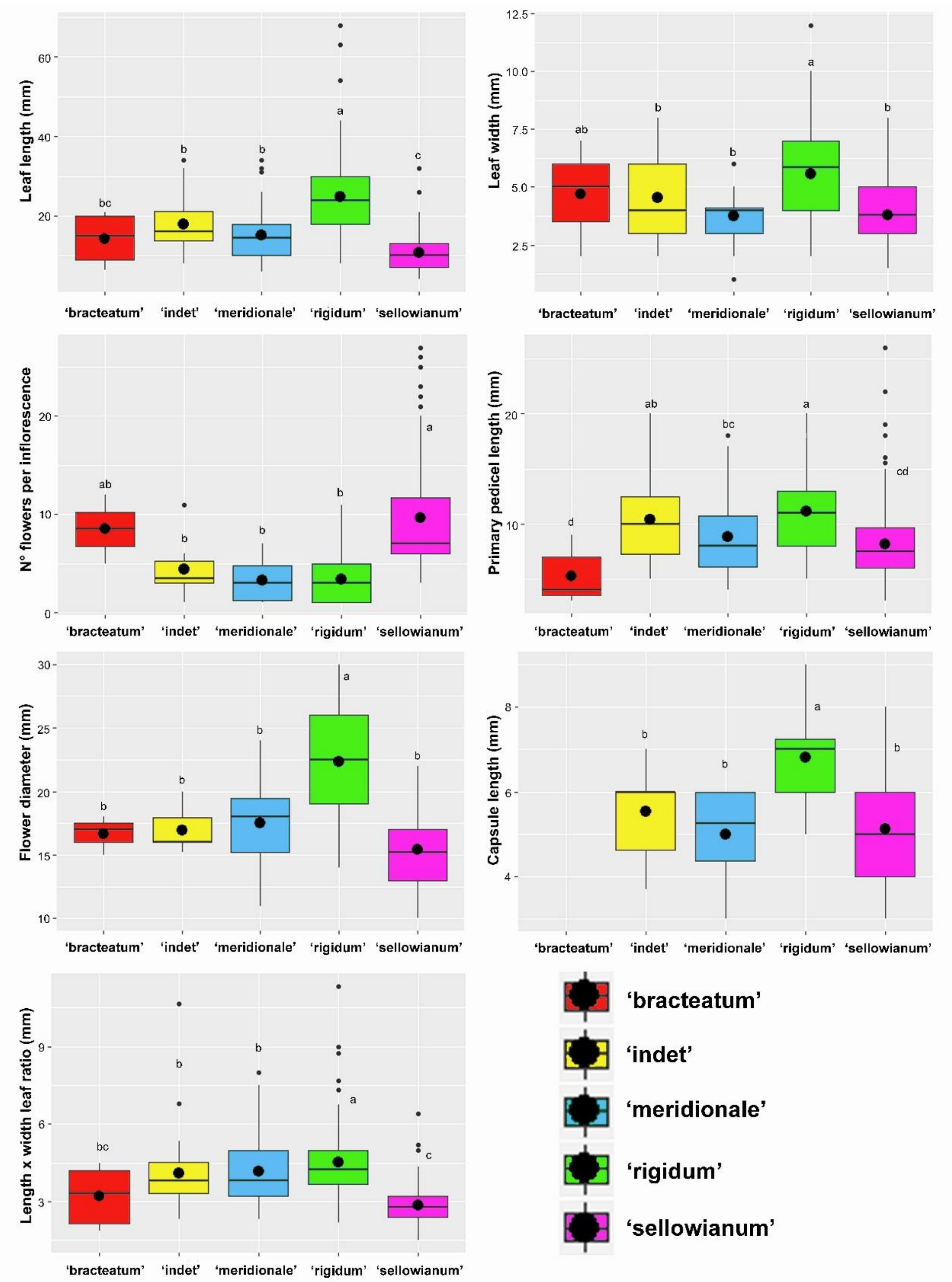

Fig. 3. Box-plots representing the variation of discriminant characters in *Hypericum rigidum* subspecies. It is based in the analysis of variance tested using Fisher's least significant difference (LSD) at P < 0.05. The box represents 75% of the entire variation of the character measured, while the horizontal bars represent the other 25% of variation; the circle within the box and the bar in the middle of the box represent the mean and the median, respectively. Points represent outliers. Different letters show significant differences between the means. *Hypericum rigidum* subsp. *rigidum* ['rigidum'], *Hypericum rigidum* subsp. *meridionale* ['meridionale'], *Hypericum rigidum* subsp. *bracteatum* ['bracteatum'], *Hypericum rigidum* subsp. *sellowianum* ['sellowianum'], indeterminate specimens ['indet']. Note that all measured characters showed overlap among the suggested subspecies.

4. DISCUSSION

Morphometrics can be defined as the mathematical description of biological forms (James and Mcculloch, 1990). When integrated with ecological analyses, they are considered powerful tools in accessing the morphological variation and environmental information needed for species delimitation (Henderson, 2006; Pierre et al., 2014; Robbiati et al., 2017). However, what is usually omitted is that these tools are also quite useful in detecting false diagnostic characters, thereby supporting taxa synonymization. Through analysis of variance, the differences among groups are tested according to the means of all the variables (James and Mcculloch, 1990). For this reason, although our results show the existence of statistical differences among some characters and subspecies, they all overlap at least in their morphological extremes (Fig. 3). Furthermore, the non-observance of a correlation pattern between plant morphologic and environmental matrices in the Mantel test may be explained by the patterns found in the PCA analysis (Fig. 2B), which reveals similar environmental patterns within *H. rigidum* distribution. In short, the distribution of all subspecies overlap geographically and ecologically, that is, phenotypes are sympatric (Fig. 2A–B). For instance, the types of ‘rigidum’ and ‘bracteatum’ are duplicates since they were collected by *Saint-Hilaire 1,631* at the same time and place (Fig. 1D and F). However, even for the subspecies found in sympatry, Robson (1990) argues that it is unlikely that the morphological differences between these two specimens would correspond to a simple intra-population variation. Likewise, *Hatschbach 13,796* (deposited in MBM) has two specimens on the same exsiccate that would clearly correspond to the ‘meridionale’ and ‘sellowianum’ phenotypes. Overall, taxon delimitation requires the identification of diagnostic characters, which are present in all individuals of the circumscribed entity and absent in non-member individuals (Remagnino et al., 2017). Absence of such diagnostic characters between the subspecies of *H. rigidum* sensu Robson (1990), does not support formal recognition of these intraspecific taxa, and hence, we reject the recognition of subspecies in *H. rigidum.*

Many studies using morphometric methods have proved to be useful in solving species complexes (Atria et al., 2017; Bünger et al., 2016; Robbiati et al., 2017) or assisting in the recognition or synonymization of infraspecific taxa (Pometti et al., 2007; Turchetto et al., 2014). Segregation or synonymization of taxa based on morphometric approaches are robust tools in taxonomy but may be meaningless if not applied properly.

A representative sampling also considering outliers to fully cover the phenotypic variation provides crucial data for delimiting taxonomic entities. Thus, after extensive field observations and measurement of morphological characters from herbarium specimens, it is evident that *H. rigidum* populations exhibited high levels of phenotypic variation, especially in leaf size and shape (Figs. 3 and 4). Being the organs most exposed to aboveground conditions, leaves are the most variable of plant organs (Hudson and Jeffree, 2001), and this variation can be a result of phenotypic plasticity or ecotypic variation (Briggs and Walters, 1997). The first would be the change in the expressed phenotype of a genotype as a function of the environment (Gianoli and Valladares, 2012; Scheiner, 1993) and the second suggests that the phenotypic differences among populations would result from genetic variants of a particular species that is adapted to specific environmental conditions (Briggs and Walters, 1997; Geng et al., 2007). The phenotypic variation of plants is frequently correlated with environmental variables in strong environmental gradients (Richards et al., 2005). Consequently, since the environments in which *H. rigidum* subspecies were found are very similar (Fig. 2B), without major differences in environmental conditions, our findings showed that the observed morphologic variation does not represent adaptive matching of phenotypes to the environment. Thus, the phenotypic variation found within *H. rigidum* does not seem related to phenotypic plasticity nor to ecotypic variation. According to Scheiner (1993), random processes (i.e. genetically identical individuals reared in identical environments may exhibit different phenotypes) may also spur phenotypic variation.

Randomness is still poorly understood, despite the numerous unexplained observations of phenotypic variation in isogenic or clonal populations (McAdams and Arkin, 1997). According to these authors, phenotypic variation under these circumstances may be a consequence of the stochastic mechanisms in gene expression. Epigenetic variation, for example, may arise stochastically, being able to control gene expression and affect plant phenotypes and fitness in many ways (Balao et al., 2018; Richards et al., 2017; Seymour and Becker, 2017). Perhaps the synergistic effect of these unknown factors may be playing a significant role in the phenotypic variation found in *H. rigidum*, but further studies in this regard are necessary. Typically, the growth of plants is also affected by soil flooding, showing changes in leaves, roots and stem morphology in response to ecophysiological processes (Lambers et al., 2008). Hence, as our ordination indicates that all subspecies share similar environmental conditions (Fig. 2B), the high intraspecific variation of this species may also be the result of hypoxia or other stressful factors found in the marshy environments in which it occurs. However, future investigations involving ecophysiological aspects, as well as polyploidy, genetics, and epigenetics, may provide a better understanding of which mechanisms may be promoting or contributing to such morphological variation.

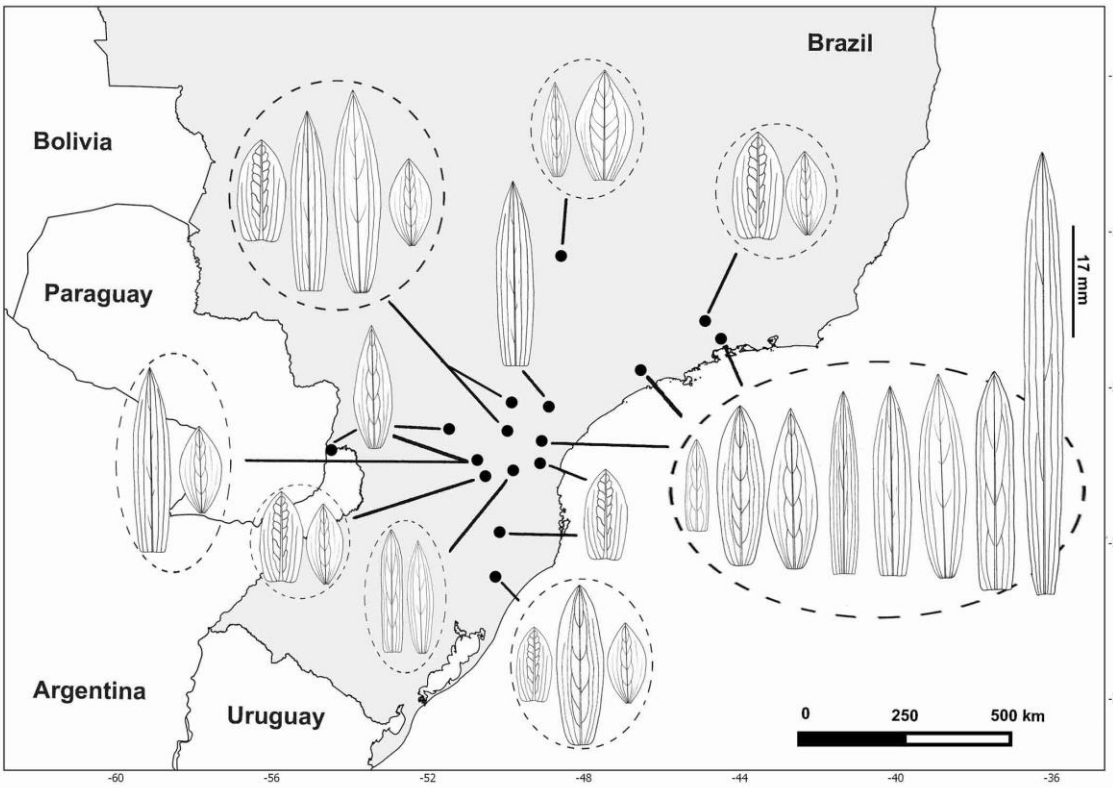

Fig. 4. Geographic distribution of leaf morphology of *Hypericum rigidum*. The range of leaf shapes and size in each collection point. Note that the leaf morphology does not show a geographic structuring, that is, leaves attributed to different subspecies may be found in sympatry.

Conceptual standardization is another important consideration in establishing limits between taxa. Misconceptions may increase communication difficulties, resulting in significant implications for conservation and leading to misleading conclusions within macroecology (Agapow et al., 2004; Isaac et al., 2004). Inconsistency regarding the application of the subspecific concept reported by Hamilton and Reichard (1992) was also confirmed here. Absence of geographic/ecologic distinctness among phenotypes of *H. rigidum* indicates that the application of the concept was inappropriate. Moreover, without robust morphological characters for the separation of the phenotypes, we discard the possibility of segregating these phenotypes into any other infraspecific category.

In summary, no analysis supported the recognition of the four subspecies accepted by the current infraspecific classification (Robson, 1990). Although *H. rigidum* presents a wide morphological variation, the overlapping of diagnostic characters and the high frequency of intermediate specimens to the four phenotypes found in nature, make it clear that these phenotypes should not be considered as distinct taxa. That is, *H. rigidum* subspecies overlap geographically, ecologically and morphologically and, therefore, we recommend that these phenotypes should not be regarded as distinct subspecies, but as one single highly variable species. We also emphasize the importance of integrative taxonomic studies to increase understanding, clarity, and simplicity of taxa classification.

ACKNOWLEDGEMENTS

We acknowledge Nicolai M. Nürk for the careful review and constructive suggestions on this manuscript, as well as Pedro M.A. Ferreira, Cristiano Buzatto and Gustavo Heiden for their helpful comments on a previous version of it. Our thank also goes to Sérgio A.L. Bordignon who kindly provided the photos in Fig. 1A–C and to the curators of all the herbaria that digitized their collections in the “Reflora Virtual Herbarium” and “Jabot”, these data were critical for the preparation of this paper. CVE acknowledges Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for awarding her Ph.D. scholarship (grant 141635/2015-0), IIB for her Research Productivity Fellowship, and JRVI thanks Neotropical Grassland Conservancy for financial support.

APPENDIX A. SUPPLEMENTARY DATA

Supplementary material related to this article can be found, in the online version, at doi: https://doi.org/10.1016/j.ppees.2018.08.005

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Appendix. Supplementary data

S1. Sampling sites and specimens used in this study. Vouchers with several herbarium acronyms had each corresponding specimen measured.

Taxa	Voucher	Sampling sites	Geographical coordinates
‘rigidum’	1. Cordeiro & Oliveira 430 (MBM)	PR, Piraquara	S25°30'28"/W49°01'33"
	2. Hatschbach 638 (MBM, W)	PR, Tijucas do Sul	S25°34'54"/W49°10'29"
	3. Hatschbach 5561 (MBM)	PR, Tijucas do Sul	S25°54'08"/W48°59'38"
	4. Hatschbach 10935 (MBM, US)	PR, Quatro Barras	S25°22'00"/W49°04'59"
	5. Hatschbach 22992 (MBM)	PR, Piraquara	S25°26'25"/W49°03'44"
	6. Hatschbach 34336 (HUEFS, MBM, RB, W)	PR, Tijucas do Sul	S25°47'43"/W49°07'56"
	7. Hatschbach 42774 (MBM, US)	PR, São José dos Pinhais	S25°31'54"/W49°11'59"
	8. Hatschbach 48170 (MBM)	PR, Curitiba	S25°25'00"/W49°15'00"
	9. Kummrow 1214 (MBM, US)	PR, Tijucas do Sul	S25°55'36"/W49°10'50"
	10. Kummrow 2206 (HUEFS, MBM)	PR, Campo Largo	S25°27'15"/W49°31'35"
	11. Kuniyoshi 5515 (MBM)	PR, Quatro Barras	S25°23'17"/W49°00'10"
	12. Ribas & Silva 3 (ICN)	PR, Tijucas do Sul	S25°55'36"/W49°10'50"
	13. Ribas & Silva 83 (MBM)	PR, Tijucas do Sul	S25°55'36"/W49°10'50"
	14. Ribas *et al.* 4517 (ALCB, ICN, RB)	PR, Lapa	S25°36'36"/W49°44'11"
	15. Saint-Hilaire 1631, pro parte (P)*	PR, Curitiba	S25°25'00"/W49°15'00"
‘meridionale’	1. Mattos & Laubouriau s.n. (P04685569, RB63284)	SP, Barretos	S20°33'16"/W48°34'22"

	2. Hatschbach 1213 (MBM, US)	PR, Piraquara	S25°26'25"/W49°03'44"
	3. Hatschbach 12027 (MBM)	PR, Quatro Barras	S25°22'00"/W49°04'59"
	4. Hatschbach 15370 (MBM, US)	PR, Mallet	S25°52'52"/W50°49'13"
	5. Hatschbach 26298 (MBM)	PR, Piraquara	S25°26'25"/W49°03'44"
	6. Hatschbach 46021 (MBM)	PR, Turvo	S25°07'36"/W51°31'50"
	7. Silva Filho *et al.* 2009 (ICN)	PR, Ponta Grossa	S25°15'20"/W50°00'33"
	8. Smith & Klein 10665 (US)	SC, Mafra	S26°08'29"/W49°48'55"
	9. Smith & Klein 12077 (US)	SC, Mafra	S26°07'05"/W49°48'08"
‘sellowianum’	1. Barbosa & Araujo 144 (NY, P)	MG, Passa Quatro	S22°23'02"/W44°57'38"
	2. Boldrini *et al.* s.n. (ICN177612)	RS, São José dos Ausentes	S28°36'33"/W49°49'22"
	3. Bordignon 1651 (ICN)	RS, São José dos Ausentes	S28°50'22"/W50°00'27"
	4. Bordignon *et al.* 3063 (ICN)	RS, Jaquirana	S28°54'00"/W50°22'59"
	5. Bordignon & Cancelli s.n. (ICN177613)	RS, São José dos Ausentes	S28°46'55"/W50°00'04"
	6. Brotto *et al.* 944 (RB)	PR, Piraí do Sul	S24°23'22"/W49°50'57"
	7. Felitto *et al.* 501 (ICN)	PR, Ponta Grossa	S25°04'59"/W50°09'00"
	8. Hatschbach 13796 (MBM, US)	PR, São Mateus do Sul	S25°52'38"/W50°22'59"
	9. Korte 5934 (FURB)	SC, São Bento do Sul	S26°16'48"/W49°19'12"
	10. Lozano & Engels 2228 (ICN, MBM, RB)	PR, Guarapuava	S25°12'20"/W51°15'54"
	11. Paz 116 (ICN)	RS, São Francisco de Paula	S29°27'00"/W50°34'59"
	12. Rambo 35246 (US)	RS, Bom Jesus	S28°42'00"/W50°24'00"

	13. Silva Filho *et al.* 1965 (ICN)	SC, Campo Alegre	S26°00'23"/W49°02'15"
	14. Sonja s.n. (ICN43319)	RS, Cambará do Sul	S29°10'35"/W50°06'34"
	15. Smith & Reitz 8581 (US)	SC, Canoinhas	S26°15'43"/W50°40'02"
	16. Smith & Klein 10719 (K, US)	SC, Porto União	S26°17'40"/W50°54'27"
	17. Smith & Klein 11002 (US)	SC, Caçador	S26°46'17"/W50°53'32"
	18. Vidal s.n. (P04685726)	MG, Passa Quatro	S22°23'44"/W44°54'45"
	19. Vogel Ely & Ferreira 112 (ICN)	RS, São José dos Ausentes	S28°39'47"/W49°57'30"
	20. Vogel Ely 384 (ICN)	SC, Painel	S28°00'13"/W50°09'27"
	21. Vogel Ely 424 (ICN)	RS, São José dos Ausentes	S28°46'03"/W50°01'02"
	22. Vogel Ely 435 (ICN)	RS, São Francisco de Paula	S29°18'02"/W50°45'37"
'bracteatum'	1. Saint-Hilaire 1631, pro parte (P)*	PR, Curitiba	S25°25'00"/W49°15'00"
'indet'	1. Brade 12237 (P)	SP, São Paulo	S23°35'17"/W46°32'36"
	2. Brade 20529 (P)	SP, São José do Barreiro	S22°44'14"/W44°37'15"
	3. Brade 20755 (P)	SP, São José do Barreiro	S22°44'14"/W44°37'15"
	4. Brade 21071 (P)	SP, São José do Barreiro	S22°44'14"/W44°37'15"
	5. Cordeiro 18 (RB)	PR, Curitiba	S25°28'59"/W49°11'46"
	6. Cruz *et al.* 248 (RB)	PR, Fóz do Iguaçu	S25°36'56"/W54°28'51"
	7. Mgf & App 10359 (P)	SP, São José do Barreiro	S22°44'14"/W44°37'15"
	8. Puiggari s.n. (P04685728)	SP, Apiaí	S24°30'54"/W48°50'44"

* Type specimens; Acronyms of the Brazilian states: MG, Minas Gerais; SP, São Paulo; PR, Paraná; SC, Santa Catarina; RS, Rio Grande do Sul

S2. Table Analysis of variance tested using Fisher's least significant difference (LSD) at $p<0.05$ for morphological variables of *Hypericum rigidum* subspecies.

Parameters	**length**	**width**	**length × width leaf ratio**	**number of flowers**	**flower diameter**	**primary pedicel length**	**capsule length**
Mean	17.25	4.5	3.79	6.40	18.27	9.37	5.42
CV	42.11	33.28	30.77	74.22	19.48	37.12	20.00
Mean Square	52.80	2.25	1.36	22.57	12.66	12.11	1.17

PARTE II — PHYLOGENETIC POSITION, TAXONOMIC SYNOPSIS, AND CONSERVATION OF *HYPERICUM* FROM SOUTHEASTERN SOUTH AMERICA

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Running title: South American *Hypericum*

ABSTRACT

Hypericum is an almost cosmopolitan genus that has two diversity centers in South America. With more than 500 species, *Hypericum* is divided into 36 sections based mostly in morpho-geographical methods. However, recent phylogenetic analyses have shown that *Hypericum*'s infrageneric classification appears, in parts, artificial and needs re-evaluation. The subsampling of South American taxa, especially non-Andean, leads to uncertainty in some phylogenetic relationships. Therefore, our aim is to (1) test the monophyly of the South American groups of *Hypericum*, (2) evaluate the phylogenetic relationships amongst *Hypericum* species from southeastern South America region, (3) improve the taxonomic knowledge of these non-Andean species of *Hypericum*, and (4) assess the conservation status of each southeastern South America species of *Hypericum*. To infer the evolutionary relationships between the South American *Hypericum* species, we used Bayesian and Maximum Likelihood analyzes from two nuclear (ITS and At1G13040) and two plastidial (*petD* and *trnL*) DNA regions. In this step, we considered a robust sampling strategy for the non-Andean South American species, which were previously poorly sampled in phylogenetic reconstructions. We also invested our efforts in good taxonomic and field knowledge to provide information that subsidizes conservation actions for species and their grassland ecosystems. We conclude that the two known lineages of South America form monophyletic groups, and a third South American lineage of *Hypericum* was identified for the first time. Our results also showed nine new records for the Argentinean, Brazilian and Uruguayan territories and eleven *Hypericum* species globally assessed as threatened.

KEYWORDS

Conservation, Hypericaceae, IUCN, molecular phylogeny, SESA grasslands, taxonomy.

INTRODUCTION

Hypericum L. (St. John's wort) is the most diverse genus of Hypericaceae Juss. (Clusioids, Malpighiales). The genus has recently risen to more than 500 species (Robson 2016), distributed across most World's temperate regions and in alpine tropical areas of the Southern Hemisphere (Meseguer et al. 2013; Nürk et al. 2013b, a). In South America, *Hypericum* occurs in open grassland vegetations (Nürk et al. 2013b; Vogel Ely et al. 2019), and despite the richness and high level of endemism, these grassland ecosystems are neglected environments when compared to the forests concerning the priority for research and conservation purposes (Overbeck et al. 2007, 2015; Iganci et al. 2011; Andrade et al. 2018).

Recent phylogenetic analyzes (Nürk and Blattner 2010; Ruhfel et al. 2011; Meseguer et al. 2013; Nürk et al. 2013a) led to the expansion of *Hypericum* circumscription (*Lianthus* N.Robson, *Santomasia* N.Robson, *Thornea* Breedlove & E.M.McClint., and *Triadenum* Raf. were incorporated into *Hypericum*) and the description of two subgenera: *Brathys* (Mutis ex L.f.) N.Robson mainly from the New World and *Hypericum* mainly from the Old World (Robson 2016). Furthermore, considering such phylogenetic evidence, the infrageneric classification describing 36 sections within *Hypericum* (Robson 1977, 2012) appears, in parts, artificial and needs re-evaluation. For example, about 100 (20%) *Hypericum* species native to South America are accommodated within the two largest sections of the genus: *Brathys* (Mutis ex L.f.) Choisy and *Trigynobrathys* (Y.Kimura) N.Robson (Robson 1987, 1990). The first section has its diversity center in the Andean Páramo, while the second has in the southeastern South America (SESA) grasslands (Robson 1987, 1990); however, neither of these sections is monophyletic (Nürk and Blattner 2010; Meseguer et al. 2013; Nürk et al. 2013b, a, 2018). *Hypericum* is a large genus, and despite the sampling effort made in previous studies, some groups remain under-represented. The subsampling of South American taxa, especially non-Andean, may be one of the reasons for the obscurity in sections' circumscription. Therefore, although recent molecular studies have provided a better understanding of the phylogenetic relationships between *Hypericum* species, further phylogenetic analyses are still needed to clarify the relationships amongst the South American *Hypericum*.

In the SESA grasslands occur 25 species of *Hypericum*, of which at least seven are distributed within an area lesser than 4,000 km^2. Some of these species are only known by one or two collection points (e.g., *H. bordignonii* Vog.Ely and Boldrini, *H. legrandii* L.B.Sm., *H. microlicioides* L.B.Sm., *H. pleiostylum* C.Rodr.Jim., and *H. robsonii* H.A.Keller & S.Crockett). Thus, although a variety of anthropogenic activities threaten these microendemic species, the Global Red List does not include species of *Hypericum* from SESA grasslands (IUCN 2019). Without identifying threats and providing a first extinction risk assessment for these species, it becomes difficult setting priorities for conservation action.

Here, we conducted a phylogenetic study of the South American species of *Hypericum* aiming to (1) test the monophyly of the South American groups of *Hypericum* (Nürk et al. 2013b, 2018) when a broader non-Andean species sampling is provided, (2) evaluate the phylogenetic relationships amongst *Hypericum* species from SESA region, (3) improve the taxonomic knowledge of these non-Andean species of *Hypericum*, and (4) assess the conservation status of each *Hypericum* species from SESA grasslands. To achieve these goals, we consider an almost complete non-Andean species sampling. We also invested our efforts in good taxonomic and field knowledge to provide information that subsidizes conservation actions for species and their grassland ecosystems.

MATERIALS AND METHODS

Taxon sampling

A total of 122 species of *Hypericum* (439 accessions) were sampled, of which 23 species (140 accessions) are from SESA grasslands, representing 92% of the non-Andean South American species diversity of this genus. Our approach involved the sampling of multiple accessions from distinct geographic areas for as many species as possible. Only two species from SESA grasslands, *H. legrandii* and *H. pleiostylum*, which are only known from the type specimens, were not included in the phylogenetic analyses. Species from Andean South America (49 spp.), Central and North America (46 spp.), Asia (4 spp.), Africa (3 spp.), and Europe (2 spp.) were also included in our analysis (sequences available in Genbank and EMBL databases). Species from the early-diverging lineage of *Hypericum*, *H. elodes* L. and *H. calcicola* (Standl. & Steyerm.) Breedlove, besides *H. perforatum* L. from the late-diverging lineage, were used for rooting, as well as in Nürk et al. (2018). A list of the vouchers used in the molecular study is presented in Appendix 1.

DNA Extraction, Amplification, and Sequencing

Total DNA was extracted from leaves of plants freshly collected in the field and dried in silica gel, using a method modified from Doyle and Doyle (1990). Based on previous studies (Nürk et al. 2013b, a, 2015, 2018), we have selected four molecular markers, two nuclear (At1G13040 and ITS) and two from the chloroplast genome (*petD* and *trnL*). The primer combinations used in this study and detailed PCR conditions of ITS, At1G13040, *petD*, and *trnL* are given in Nürk et al. (2013b, a, 2015, 2018). PCR products were purified and sequenced by Macrogen Co. Ltd. (South Korea). Forward and reverse sequences were assembled with CodonCode Aligner v.8.0.2 and the consensus sequences were edited after a detailed examination of chromatograms and correction of the ambiguous bases.

Alignment and Phylogenetic Analyses

For the alignments, we used MAFFT v.7 (Katoh and Standley 2013) and performed manual adjustment with MEGA7 (Kumar et al. 2016). Indels (insertions-deletions) shared by two or more taxa and unambiguously aligned were coded with SeqState v.1.4.2 (Müller 2006), following to Modified Complex Indel Coding approach (Simmons et al. 2007). Conversely, ambiguous gaps were treated as missing data (non-informative).

Phylogenetic trees were constructed under maximum likelihood (ML) analyses, conducted on the CIPRES Science Gateway (Miller et al. 2010) with RAxML-HPC2 on XSEDE (Stamatakis 2014), using the GTRCAT model. The stability of the tree topology and branch support were assessed with 100 independent ML searches, and 1,000 bootstrap replicates. DNA sequence data were also analyzed using Bayesian Inference (BI) implemented in MrBayes v.3.2.6 (Ronquist et al. 2012). Since datasets were partitioned for each gene, intron or spacer region, for each partition the appropriate substitution model was selected based on the Akaike Information Criterion (AIC) in MrModeltest v.2.3 (Nylander 2004) − (see Table 1 in Results). For BI optimization, two independent Markov Chain Monte Carlo (with one cold and three heated Markov chains), performed simultaneously and starting with a random tree, were run for 10 million generations, sampling trees every 100 generations. After discarding the first 25% trees from each run as burn-in, the remaining trees from the two independent runs were summarized into a 50% majority-rule consensus tree with Bayesian posterior probabilities (PP) generated for the resulting tree. Initially, phylogenetic analyses were conducted on each DNA region separately (single-region analyses) and, subsequently, combining nuclear and plastid markers separately. Incongruences amongst tree topologies generated by different datasets were explored through visual comparison and support values. Since tree topologies generated by different analyses and markers were mostly congruent (supplied in Online Resources 1−7), we concatenated the four loci. Phylogenetic trees resulting from BI (majority-rule tree) and ML (best-scoring tree) analyses were reported on the BI majority-rule topology to summarize the results of both analyses at once. A given node was kept in the final representation of the BI tree only if the PP was ≥ 0.95 and the ML bootstrap values reached at least 50% or when there was no topological conflict between ML and BI trees.

Taxonomy and species conservation

Between April 2012 and December 2018, we made field trips to know the species in their natural habitat, and to scrutinize the ecology and the main threats visibly incident on the populations of different species (c. 200 days spent on fieldwork). All vouchers were included in the ICN herbarium. We performed a comprehensive literature survey and examination of *Hypericum* specimens deposited in the main Brazilian (ALCB, BAH, BHCB, CEN, CEPEC, CESJ, ECT, EFC, ESA, FCAB, FLOR, FURB, HAS, HB, HBEI, HBR, HDCF, HPBR, HPL, HRCB, HUCP, HUCS, HUEFS, HUFSJ, HUI, HURG, IAC, ICN, INPA, MBM, MPUC, PACA, PEL, R, RB, SAMES, SMDB, UB, UEC, UNILASALLE, and UPCB), Argentinean (BA, BAB, CTES, LP, MERL, and SI) and Uruguayan (MVM, MVFA, and MVJB) herbaria. We also reviewed materials through online databases of the herbaria or Brazilian Reflora database: B, BM, BR, C, E, FI, G, GH, GOET, HAL, HBG, HCF, HUEMG, JOI, K, L, LINN, LUSC, M, MICH, MO, MPU, MU, NY, P, PH, S, SPF, U, UNIP, UNOP, UPS, US, W, WAG, WIS, and WU (acronyms after Thiers 2019). All these data were used to prepare morphological descriptions, to build an identification key, and to provide commentaries about ecological specificities and conservations aspects for all *Hypericum* species from SESA grasslands. A map showing the *Hypericum* species richness in SESA region was also provided. Three species outside the southeast South America clade, but that occur naturally in SESA region, were included in the richness map: *H. gentianoides* (L.) Britton, Sterns & Poggenb., *H. mutilum* L., and *H. piriai* Arechav. (indicated by the black arrows in Figure 1). The map was prepared in DIVA-GIS v.7.5 based on the World Geodetic System (WGS-84) datum and using 2-degree latitude longitude cells (c. 220 × 220 km grid cells size). The figures were edited in Adobe Photoshop© CS5.

Due to the imminent extinction risk of many species (Vogel Ely and Boldrini 2015; Vogel Ely et al. 2017), the low number of *Hypericum* species assessed globally (IUCN 2019), and the alarming increase in loss of ecosystems, especially grasslands, many species require urgent conservation plans. Therefore, based on strong taxonomic and field knowledge, we provide the first extinction risk assessment for 22 non-Andean species of *Hypericum*. Such data are essential in adopting appropriate conservation strategies, especially for species of elevated conservation concern. The conservation status of the species was defined using Red List Criteria (IUCN 2012, 2017) and GeoCAT webtool (Bachman et al. 2011).

RESULTS

Phylogenetic Analyses

In this study, seventeen non-Andean *Hypericum* species were sequenced for the first time for

ITS, At1G13040, *petD* and *trnL*. Other six species (seven accessions) from SESA grasslands, and that had already sequences available (Nürk et al. 2013b, 2018), were included in our analyses along with our new sequences of these species. In total, 439 sequences were analyzed, of which 140 were new sequences generated in this study and 299 were sequences previously published in Nürk et al. (2018). ITS was the most variable loci, with more than 50% of its sites variable, and 38% considered potentially informative sites (Table 1). At1G13040, *petD*, and *trnL* have 29.2%, 19.5%, and 18.5% of its sites variable, and 14.8%, 10.6%, and 9.4% considered potentially informative sites, respectively (Table 1). When we combined nuclear + chloroplast DNA datasets, the variable characters reached 29.3%, and the potentially parsimony informative characters reached 18% (Table 1). Additional information, such as accession numbers, lengths of aligned sequences, coded gaps, dataset partitions with its models of evolution, is provided in Table 1.

ML and BI phylogenies were topologically congruent. The tree topology of the combined nuclear + chloroplast DNA dataset was better resolved, and internal nodes had higher branch support than in the separate analyses (Online Resources 1−7). On the other hand, At1G13040 and *trnL* individual trees topologies and the concatenated chloroplast dataset (*petD* + *trnL*) showed little internal resolution (Online Resources 3, 5, and 7). Nevertheless, we generally do not found incongruences amongst trees (individual and concatenate) in our study. Therefore, support values obtained from the two analyses of the nuclear + chloroplast concatenated datasets (ITS + At1G13040 + *petD* + *trnL*) were merged on the BI majority-rule tree topology presented in Fig. 1. Unless otherwise indicated, we focus our discussion from here forward on the results of this combined BI topology.

The large clade, informally named *Brathys* s.l., includes a strongly supported clade called southeast South America (BS = 92%, PP = 1.00) that contains only non-Andean species of *Hypericum*, and is sister to America-Asia-Africa clade (BS = 100%, PP = 1.00). Despite the broader non-Andean species sampling, within the southeast South America clade, the phylogenetic relationships are poorly resolved (Fig. 1, Online Resources 1−7). The position of *H. dichotomum* Lam., *H. drummondii* (Grev. & Hook.) Torr. & A.Gray, *H. gentianoides*, and *H. terrae-firmae* Sprague & L.Riley remain unresolved; that is, they are sometimes allocated inside Andean radiation clade (BS = *, PP = 0.98) and other times as sister to this clade (Online Resources 1–7). Unsurprisingly, our most interesting result was the position of *H. piriai*, not embedded in the southeast South America clade, nor in the Andean radiation clade (Fig. 1, species indicated by the bottom black arrow). With almost full support in ML and BI analyses of all markers, of individual and concatenated datasets, *H. piriai* was embedded in the informal group *Brathys* s.l., as sister to the remaining species of *Brathys* s.l. (Fig. 1, Online Resources 1−7).

Taxonomy and species conservation

Taxonomic outcomes of all *Hypericum* species distributed in SESA grasslands are as follows: (1) a key to identify these *Hypericum* species; (2) updated descriptions, diagnosis, ecological and distribution data, and photographs; (3) a species richness map on SESA region, (4) nine new records for the Argentinean, Brazilian and Uruguayan territories, and (5) eleven *Hypericum* species classified as threatened globally (Online Resource 9). All species inside the southeast South America clade and three species outside this clade, but naturally distributed on SESA grasslands (*H. gentianoides*, *H. mutilum*, and *H. piriai*), were included in the taxonomic treatment and on the species richness map (Table 2).

Table 1 Information on the *Hypericum* datasets analyzed in this study.

	ITS			**At1G13040**	***petD***			***trnL* intron**	**nr + cp combined**
Sequence data	138			76	100			125	439
Aligned length (bp)	747			729	1245			457	3178
Indel characters	4			0	20			4	28
Variable characters (%)	393 (52.6%)			213 (29.2%)	243 (19.5%)			85 (18.5%)	934 (29.3%)
Parsimony informative characters (%)	290 (38.8%)			108 (14.8%)	133 (10.6%)			43 (9.4%)	574 (18%)
Dataset partitions	ITS-1	5.8S	ITS-2	At1G13040	spacer *petB-petD*	*petD* intron	*petD* exons	*trnL* intron	8 partitions
Model of Evolution	SYM+I+G	K80+G	SYM+I+G	HKY+I+G	GTR+I	GTR+G	GTR+I	GTR+I	5 different models

Table 2 Distinctiveness of *Hypericum* phylogenetically segregated but with overlapping distribution in SESA grasslands.

	All species from southeast South America clade	***Hypericum gentianoides* (L.) Britton et al.**	***Hypericum mutilum* L.**	***Hypericum piriai* Arechav.**
Distribution	only in SESA grasslands	beyond South America	beyond South America	only in SESA grasslands
Stem	without pale glands (*)	with pale glands	with pale glands	with pale glands (*)
Petals	roll up in a cartridge form (corolla movement)	does not roll up in a cartridge form	does not roll up in a cartridge form	does not roll up in a cartridge form
Styles	(2−) 3−5 (−8)	3–4	3–4	3
Stamens	numerous, arranged in a continuous ring	few, isolated	few, isolated	numerous, arranged in three fascicles
Stigmas	subcapitate	broadly capitate	broadly capitate	subcapitate
Seeds	yellow to brown	yellow to brown	yelow	black

* Exceptions exist

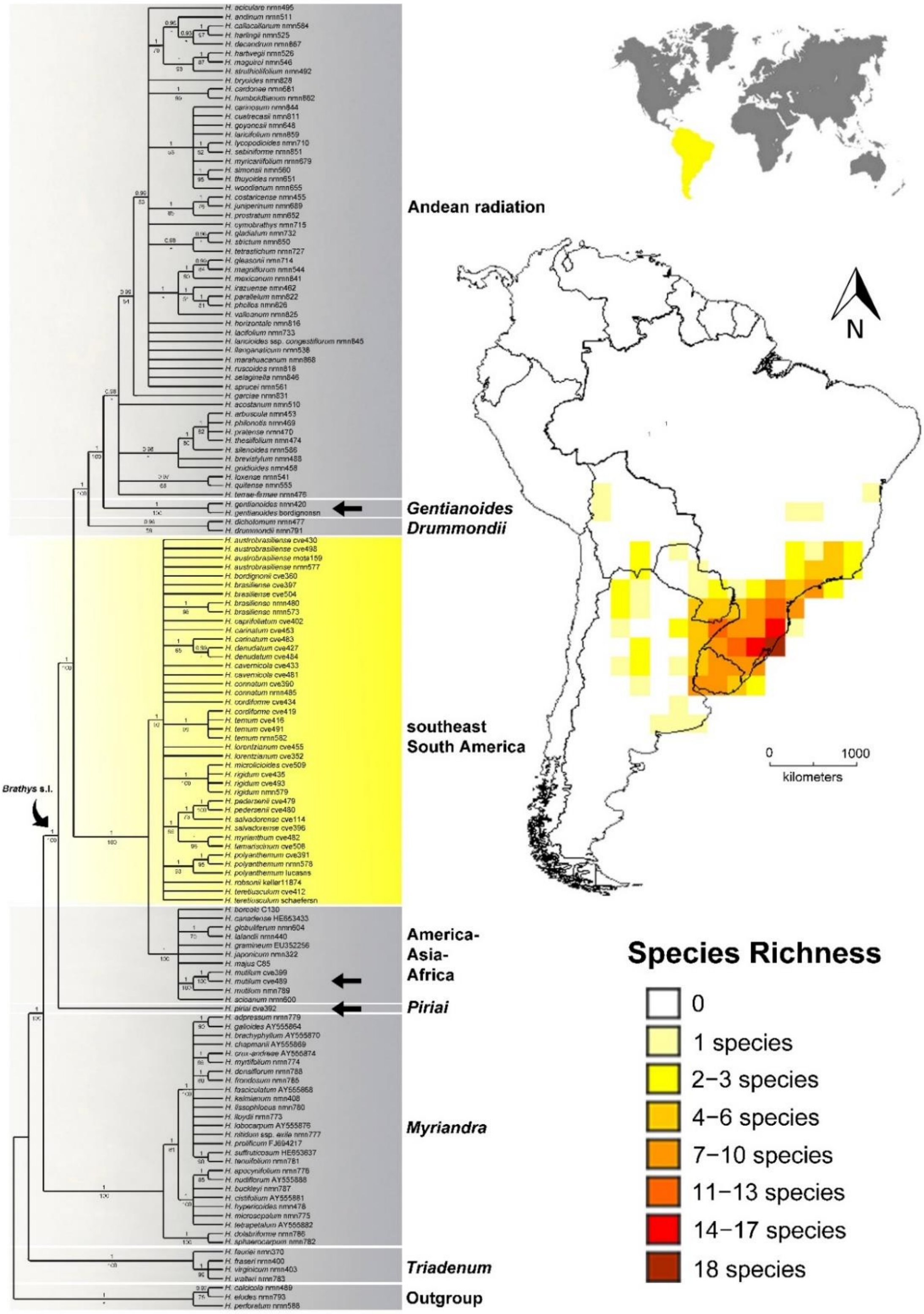

Fig. 1 Phylogenetic position of the non-Andean species of *Hypericum* inferred from nuclear + chloroplast concatenated datasets (ITS + At1G13040 + *petD* + *trnL*). Numbers above the branches are posterior probabilities (PP ≥ 0.95) values, and those below the branches are maximum likelihood (ML ≥ 50%) values. Black arrows indicate species outside southeast South America clade, but included in the species richness map (*H. gentianoides*, *H. mutilum*, and *H. piriai*). The informal group node (*Brathys* s.l.) is indicated on the left side of the tree.

DISCUSSION

Phylogenetic relationships

Previous molecular phylogenies focused on broader questions such as the monophyly of the genus *Hypericum* and its sections, reconstructing biogeographic scenarios, and therefore included just a couple of species from SESA grasslands (Meseguer et al. 2013, 2015, 2018, Nürk et al. 2013a, b, 2015, 2018). Such studies included at most six species from SESA region (e.g., *H. austrobrasiliense* Vog.Ely, Boldrini & Bordignon [called *H. linoides* A.St.-Hil.], *H. brasiliense* Choisy [sometimes called *H. campestre* Cham. & Schltdl.], *H. connatum* Lam., *H. polyanthemum* Klotzsch ex Reichardt, *H. rigidum* A.St.-Hil., and *H. ternum* A.St.-Hil.). Nevertheless, besides the increasing in sampling, our results are mostly in congruence with these previous phylogenetic studies (Meseguer et al. 2013; Nürk et al. 2013a, b).

Since the combined nuclear + chloroplast DNA dataset has a better-resolved tree topology, we used this result to discuss the phylogenetic relationships amongst the South American *Hypericum*. Little internal resolution in At1G13040 and *trnL* individual trees topologies are probably related to the lower sampling and variable characters, respectively (Table 1, Online Resources 5 and 7). This could also help to explain why the concatenated chloroplast dataset (*petD* + *trnL*) showed trees with low internal resolution as well (Online Resource 3). Nevertheless, the phylogenetic relationships recovered in our analyses were largely consistent with previous findings (Meseguer et al. 2013; Nürk et al. 2013b, a, 2018). In other words, we corroborated *Triadenum* as sister-group of *Myriandra* + *Brathys* s.l. (i.e., *Piriai*, America-Asia-Africa, southeast South America, *Drummondii*, *Gentianoides*, and Andean radiation). The Andean radiation clade, which includes species formally included in the *Brathys* and *Trigynobrathys* sections (Robson 1987, 1990), also showed similar phylogenetic relationships to previous reconstructions (Meseguer et al. 2013; Nürk et al. 2013b, a, 2018). That is, we confirmed the non-monophyletic nature of *Brathys* and *Trigynobrahtys* sections, of which both type-species were here sampled (sect. *Brathys*: type species is *Hypericum juniperinum* Kunth; sect. *Trigynobrahtys:* type species is *Hypericum myrianthum* Cham. & Schltdl.).

With a broader non-Andean species sampling, we confirmed the monophyletic nature of the South American clades of *Hypericum* (Nürk et al. 2013b, 2018). Except for *H. piriai*, our study also showed that all *Hypericum* species distributed exclusively in SESA grasslands form a monophyletic group (Fig. 1). As such, the species of the southeast South America clade have displayed molecular, geographic, and morphological structuring (for details see Taxonomic Treatment). However, the low internal resolution of the southeast South America clade did not allow us to explore the phylogenetic relationships amongst these non-Andean species of *Hypericum* deeply. Previously unsampled in any molecular phylogeny and formally allocated in the *Brathys* section (Robson 1987), *H. piriai* occurs in SESA grasslands but has quite distinct morphology from all other South American *Hypericum* species (see Taxonomic Treatment). Thus, besides the molecular evidence, morphological data also supports the separation of *H. piriai* from other South American phylogenetic groups. *H. piriai* is a morphologically distinct species, possessing stem with pale glands, petals that never roll up in a cartridge form, stamens filaments basally united in three fascicles, and black seeds (Table 2, Fig. 14), unlike all other South American *Hypericum* species. In this way, as *H. piriai* is formally allocated in the *Brathys* section (Robson 1987), its position in the phylogenetic tree requires that the informal concept of *Brathys* s.l. (Nürk et al. 2013b) be expanded.

These new findings are likely to promote changes in the reconstruction of the biogeographic scenarios of *Hypericum* in South America (Meseguer et al. 2015; Nürk et al.

2015, 2018). Specifically, the position of *H. piriai* as sister to the remaining *Brathys* s.l., raises new hypotheses, especially regarding the ancestral distribution of the large clade *Brathys* s.l. Although we did not perform any biogeographical analyzes, our phylogenetic results suggest that a third dispersal event into South America probably occurred and that it might have resulted in a precursor lineage of the two formally known South American lineages (Nürk et al. 2013b, 2018). Such hypotheses arose from the consistent phylogenetic placement of *H. piriai,* and contrast with previous studies suggesting one (Meseguer et al. 2015), or two dispersal events into South America (Nürk et al. 2013b, 2018).

Taxonomy and conservation

We reported two new records for the Argentinean flora (*H. polyanthemum* and *H. teretiusculum* A.St.-Hil.), one for the Uruguayan flora (*H. denudatum* A.St.-Hil.), and six new records for some Brazilian states (*H. caprifoliatum* Cham. & Schltdl. – RJ, *H. carinatum* Griseb. – SP and MG, *H. gentianoides* – SC, *H. rigidum* – RJ, *H. teretiusculum* – SP). Species distribution data provide crucial information for extinction risk assessments and are essential for detecting areas of species richness or endemism. Our map built based on distribution data of twenty-five non-Andean species of *Hypericum* revealed a higher species richness in SESA grasslands, which justifies the so-called southeast South America clade (Fig. 1).

Hypericum species allocated on the southeast South America clade show geographic and morphological structuring (for details see Taxonomic Treatment). However, many of these morphological characteristics are also shared with species from other clades inside *Brathys* s.l. Furthermore, in congruence with Meseguer et al. (2013) and Nürk et al. (2013b, a), our phylogenetic results show that the sectional classification of *Brathys* and *Trigynobrathys* (Robson 1987, 1990) does not reflect the natural evolutionary relationships. Nevertheless, any taxonomic changes should be deferred until a robust sampling of related groups (e.g., African and Asian species) is done. Since the type species of *Brathys* and *Trigynobrathys* sections are allocated in the Andean radiation and the southeast South America clades, respectively, perhaps a more detailed morphological analysis, looking for synapomorphies, allied to transfers of some species previously allocated in *Trigynobrathys* to *Brathys* could help to rearrange both sections. Indeed, the feasibility of such sectional reclassification can only be proposed when a more detailed morphologic and molecular data of the large group informally called *Brathys* s.l. are available.

Habitat loss is a recurring threat for biodiversity in South American grasslands (Veldman et al. 2015; Bond 2016). SESA grasslands are continuously being reduced by afforestation (e.g., *Acacia, Eucalyptus,* and *Pinus*), agriculture (e.g., soybean), invasive alien species (e.g., *Eragrostis plana* Nees., *Ulex europaeus* L., and *Urochloa*), beyond numerous other degrading processes (Overbeck et al. 2007; Andrade et al. 2015). The habitat loss caused by human activities, allied to the small extent of protected areas in grasslands ecosystems, less than 0.5% of the South Brazilian grasslands, are the main factors that threaten such landscapes (Overbeck et al. 2007). Additionally, in South America only nine species of *Hypericum* (c. 9%) had their conservation status assessed globally, being seven of them categorized as threatened (IUCN 2019). No species of *Hypericum* from SESA grasslands is included in the IUCN Red List of Threatened Species, even though most of these species occur in habitats strongly disturbed. In the Brazilian Red List, only *H. mutilum* was listed as threatened (Martinelli and Moraes 2013), while most species were not even evaluated. In Rio Grande do Sul, the richest Brazilian State, seven species of *Hypericum* were classified as threatened (Decreto 52.109 2014), and two species discovered later (Vogel Ely and Boldrini 2015; Vogel Ely et al. 2015) are waiting to be included in the next Red List. Identifying endangered species is the first step for planning conservation actions. To get there, updated information on the geographical distribution of the species are fundamental data to categorize threatened species and adopt appropriate conservation strategies. In total, eleven species of *Hypericum* from SESA grasslands were classified as threatened globally, six in the Endangered (EN) and five in the Critically Endangered (CR) categories (for details see Taxonomic Treatment).

CONCLUSION

The results of this study provided evidence of the evolutionary relationships amongst the South American species of *Hypericum*, revealing some well-known and strongly supported groups (i.e., *Triadenum, Myriandra,* America-Asia-Africa, southeast South America, and Andean radiation clades), and inferring a consistent and isolated phylogenetic positioning for *H. piriai.* In summary, we conclude that the South American clades of *Hypericum* (Nürk et al. 2013b, 2018) are monophyletic, and the southeast South America clade encompasses all species distributed exclusively in SESA grasslands, except for *H. piriai.* It also seems that our phylogenetic results provide new insights to reassess South American biogeographic scenarios. The taxonomic treatment cites nine new records for the Argentinean, Brazilian and Uruguayan territories, and provides data that allow the identification of all species of *Hypericum* naturally distributed in the SESA grasslands. In the conservation framework, our data are still poor and need refinement; however, they can be used as a first step for setting conservation priorities, starting with the eleven threatened *Hypericum* species that require urgent conservation plans.

TAXONOMIC TREATMENT

Species of *Hypericum* from southeast South America clade range from annual herbs to shrubs and most are rhizomatous. Phyllotaxy is opposite-decussate or 3–4-whorled, often varying in the same plant. Bracts can be reduced or foliaceous. Flowers are grouped in cymose inflorescences, mainly dichasial and monochasial cymes, rarely solitary flowers or pleiochasial cymes. Calyx and corolla are pentamerous but may vary to tetramery or hexamery in the same plant. Sepals, petals, and stamens persist during and after fruit development. Corolla is stellate, petals can be erect or reflexed but always asymmetrical and with a more or less pronounced apiculus. Stamens are numerous, arranged in a continuous ring, and with a pale gland on anther connectives. Ovary usually has three or five free styles; however, two, four or even eight styles may also occur in these species. Stigmas are subcapitate with stigmatic papillae. Seeds range from yellow to brown, testa is always ribbed-scalariform.

Notes: although the characteristics mentioned above refer only to the species allocated in southeast South America clade, we added *H. gentianoides*, *H. mutilum,* and *H. piriai* to the taxonomic treatment. Despite positioned outside the clade, these three *Hypericum* species have been added in the taxonomic treatment since they are naturally distributed on the SESA region. The differences amongst *Hypericum* species of southeast South America clade with *H. gentianoides, H. mutilum,* and *H. piriai* are listed in Table 2. Some morphological characteristics of the *Hypericum* species from SESA grasslands are presented in Fig. 2.

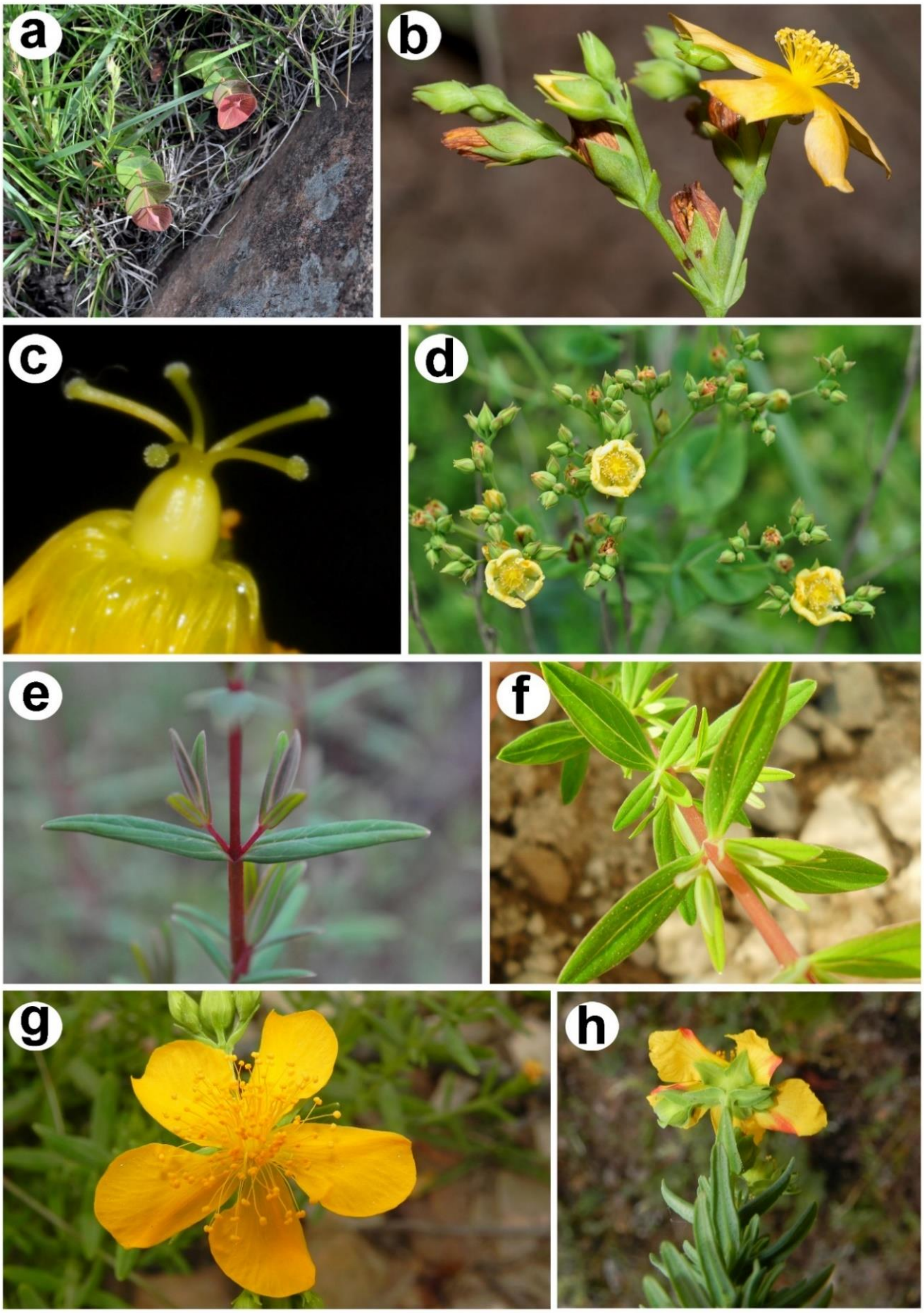

Fig. 2 Morphological characteristics commonly found in the *Hypericum* species from SESA grasslands. **a** Red colour (anthocyanin) usually occurs in the aboveground parts; **b** Cymose inflorescences; **c** Ovary with five free styles, subcapitate stigmas with stigmatic papillae; **d** Corolla movement (petals roll up in cartridge form); **e–f** Leaves sessile opposite-decussate or 3-whorled; **g** Petals asymmetrical with an apiculus and numerous stamens arranged in a continuous ring; **h** Apiculus region with shades of red. Photos: Gabriel E. Ferreira (g, h).

Key for *Hypericum* species from SESA grasslands

1a. Leaf pairs ⅔ to completely connate 2

1b. Leaf pairs free, rarely ⅓ connate 3

2a. Plant unbranched or with few lateral branches. Leaves usually coriaceous, with black or yellow thickened margins ....***H. connatum***

2b. Plant densely branched from base to apex. Leaves usually membranous, without thickened margins ....***H. caprifoliatum***

3a. Bracts and bracteoles foliaceous (leaves-like bracts in shape, texture, and size) 4

3b. Bracts and bracteoles reduced (sometimes leaves-like bracts in shape and texture but never in size) 13

4a. Flowers solitary 5

4b. Flowers in cymes 6

5a. Small herb. Leaves 3–4-whorled, patent. Flowers about 20 mm in diameter .....***H. robsonii***

5b. Subshrub. Leaves paired, adpressed. Flowers about 30 mm in diameter.. ***H. microlicioides***

6a. Styles 5–8. Plants of humid environments 7

6b. Styles 3 (4). Plants of dry environments 8

7a. Small herb. Flowers ≤ 7 mm in diameter .... ***H. pleiostylum***

7b. Shrub or subshrub. Flowers ≥ 15 mm in diameter .... ***H. rigidum***

8a. Leaves acicular. Pleiochasial cymes present. Styles tortuous 9

8b. Leaves never acicular. Pleiochasial cymes absent. Styles straight 10

9a. Terminal cymes up to four flowers. Anther connective prolonged................***H. bordignonii***

9b. Terminal cymes up to twenty flowers. Anther connective never prolonged ..... ***H. legrandii***

10a. Small herb. Flowers ≤ 5 mm in diameter. Capsule fusiform...................... ***H. gentianoides***

10b. Shrubs or subshrubs. Flowers ≥ 8 mm in diameter. Capsule ovoid or globose 11

11a. Sepals ≥ 6 mm in length ....***H. cavernicola***

11b. Sepals ≤ 3 mm in length 12

12a. Leaf base subcordate, rarely parallel-sided, and apex obtuse to rounded-cucullate. Sepals subequal or unequal, two outer broadly rhombic to ovate and three inner oblong to elliptic, often distally recurved .... ***H. salvadorense***

12b. Leaf base attenuate or parallel-sided and apex acute to rounded. Sepals equal, narrowly ovate, never recurved .... ***H. pedersenii***

13a. Stamens in three fascicles. Seeds black .... ***H. piriai***

13b. Stamens in a continuous ring. Seeds yellow to brown 14

14a. Flowers ≤ 5 mm in diameter. 15

14b. Flowers ≥ 7 mm in diameter 17

15a. Small herb. Stem with punctiform glands. Venation acrodromous. Plants of humid environments .... ***H. mutilum***

15b. Subshrub. Stem without glands. Venation hyphodromous. Plants usually of dry environments 16

16a. Ramose plant, internodes usually long and visible. Stem often single, branching laterally from base to apex. Leaves usually patent and not imbricate, base cuneate or parallel-sided. Inflorescence lax. .... ***H. myrianthum***

16b. Leafy plant, internodes usually short and hidden by leaves. Stem often multiple, branching difuselly, more often at base. Leaves usually adpressed and imbricate, base subcordate-amplexicaul or parallel-sided. Inflorescence condensed. .... ***H. tamariscinum***

17a. Venation hyphodromous 18

17b. Other venation types 21

18a. Plants usually multi-stemmed. Midrib prominent in the abaxial surface of chartaceous leaves 19

18b. Plants usually single-stemmed. Midrib not prominent in the abaxial surface of coriaceous leaves 20

19a. Leaf base subcordate-amplexicaul. Sepals strongly unequal, distally recurved .... ***H. polyanthemum***

19b. Leaf base parallel-sided. Sepals equal to subequal, not recurved .... ***H. austrobrasiliense***

20a. Stem with many lateral branches, adpressed and ramifying asymmetrically on the stem apex. Lateral branches with leaves densely imbricated .... ***H. ternum***

20b. Stem without lateral branches, if present, usually not adpressed and ramifying symmetrically along the stem. Lateral branches with leaves not imbricated ...... ***H. cordiforme***

21a. Venation acrodromous. Basal leaves markedly deciduous. Abaxial surface of the leaves often with papillae .... ***H. denudatum***

21b. Other venation types. Basal leaves usually persistent. Abaxial surface of the leaves without papillae 22

22a. Leaves broadly ovate to broadly elliptic, free to ⅓ connate; leaf base truncate, rounded or subcordate .... ***H. teretiusculum***

22b. Leaves narrowly to broadly elliptic, narrowly oblong to oblong, or linear, always free; leaf base cuneate 23

23a. Terminal cyme commonly condensed (corymbiform) and often with more than 50 flowers about 7–10 mm in diameter .... ***H. lorentzianum***

23b. Terminal cyme commonly lax and usually with less than 40 flowers about 15–25 mm in diameter 24

24a. Leaf base decurrent, forming a deep V .... ***H. carinatum***

24b. Leaf base decurrent or not, never forming a deep V .... ***H. brasiliense***

1. *Hypericum austrobrasiliense* Vog.Ely, Boldrini & Bordignon, Phytotaxa 192(4): 290. 2015. HOLOTYPE: Brazil, Rio Grande do Sul: Bom Jesus, 12 Dec 2007, *S. Bordignon & G.L. von Poser 3454* (ICN00000239!; isotypes: K000543822!; MBM409615!; RB01112719!).

Figs. 3a–b

Description: Subshrub, multi-stemmed, usually diffusely branched at base, rarely single-stemmed or branched at apex; eglandular. Leaves opposite-decussate, free, chartaceous, patent, linear to narrowly oblong, apex obtuse, base parallel-sided, margin not thickened; venation hyphodromous, midrib prominent beneath. Inflorescences 3–18 flowers, primary pedicels 1–4 mm long; bracts and bracteoles reduced. Flowers (10–) 15–20 mm in diameter. Sepals 5, equal to subequal, not recurved, narrowly to broadly ovate, linear glands sparse, punctiform glands not seen. Petals 5, golden yellow, usually tinged in red beneath. Stamens in a continuous ring; connective not prolonged. Styles 5, straight. Capsule ovoid to globose. Seeds brown.

Geographical distribution and ecology: Brazil (RS and SC). Acronyms for the Brazilian political divisions are given in Table 3. *H. austrobrasiliense* inhabits dry and stony grasslands of Brazilian Atlantic Forest and usually forms patches along roadsides from 900 to 1,700 m a.s.l.

Conservation status: H. austrobrasiliense was already assessed for the IUCN Red List (Vogel Ely et al. 2015). However, since the species has not yet been included in any official Red List, and two new locations were added to the species distribution in the last years, here we reevaluate its conservation status. Individuals of this species are found in small and isolated subpopulations, located mainly on disturbed areas (e.g., roadsides). Furthermore, only one subpopulation of *H. austrobrasiliense* occurs within a protected area (Parque Nacional de São

Joaquim). Considering that afforestation and agricultural activities are accelerating the fragmentation of suitable habitats of this species, especially in areas adjacent to the species' distribution, we can expect populational declines in the near future. Roads construction, or even its maintenance, can also be considered an imminent threat to those subpopulations that occur roadsides. Thus, under the criterion B, *H. austrobrasiliense* met the subcriteria B1 (EOO 3,635 km^2) and B2 (AOO 40 km^2), qualifying as Endangered − EN B1ab(ii,iii,iv)+2ab(ii,iii) (IUCN 2012).

Notes: Hypericum austrobrasiliense differs from *H. polyanthemum*, species morphologically more similar, by its leaves with parallel-sided base (vs. subcordate-amplexicaul base), equal to subequal sepals without recurved margins (vs. unequal and usually distally recurved), and inflorescences intensely vinaceous (vs. floral buds usually reddish, never vinaceous, and inflorescences green) (Fig. 3). It is important to point out that stamens are not deciduous in *H. austrobrasiliense*. This information was mistakenly added to the protologue (Vogel Ely et al. 2015) because many plants, in different populations, were found without stamens. However, after further field observations and cultivation of this species, we discovered that Coleoptera preys upon the stamens. *H. austrobrasiliense* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: BRAZIL. Rio Grande do Sul: Jaquirana, 13 Nov 2015, *C. Vogel Ely and S. Bordignon 430* (ICN!); Bom Jesus, 15 Dec 2015, *C. Vogel Ely et al. 498* (ICN!). Santa Catarina: Urubici, Parque Nacional de São Joaquim, 23 Jan 2018, *M.C. Mota et al. 159* (ICN!, CTBS).

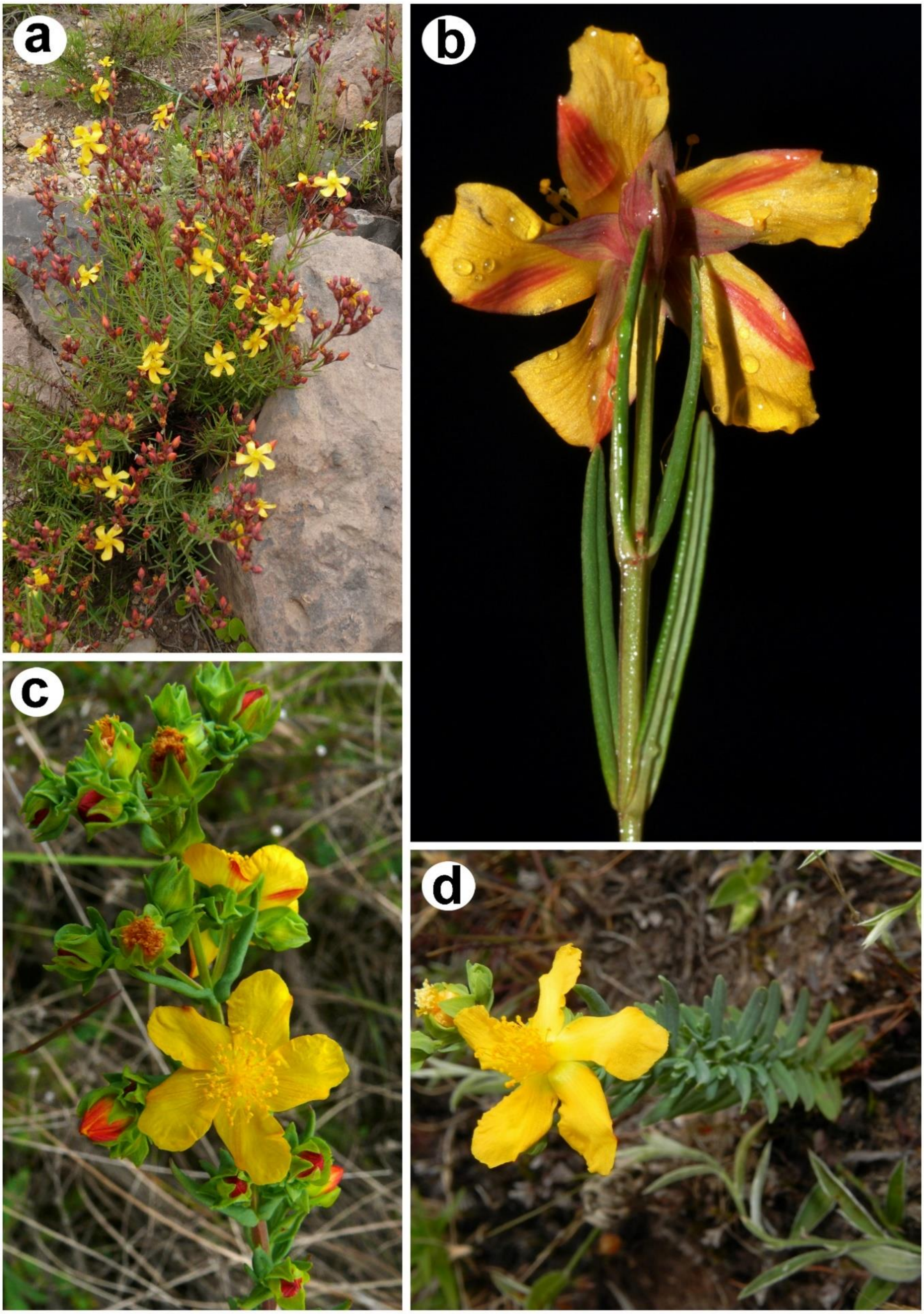

Fig. 3 *Hypericum austrobrasiliense* (**a**–**b**): **a** habitat and habit, showing the intensely vinaceous inflorescences; **b** linear leaves with parallel-sided base. *Hypericum polyanthemum* (**c**–**d**): **c** fertil branch showing the distally recurved sepals and subcordate-amplexicaul base of leaves; **d** habit. Photo: Gabriel E. Ferreira (d).

2. *Hypericum bordignonii* Vog.Ely and Boldrini, Syst. Bot. 40(4): 989. 2015. HOLOTYPE: Brazil, Rio Grande do Sul: Porto Alegre, Morro Santa Teresa, 2 Dec 2013, *C. Vogel Ely and S. Bordignon 360* (ICN00003526!; isotypes: US!, RB01408745!, and NY03090956!).

Figs. 4a–b

Description: Shrub or subshrub, single-stemmed, always naked below and diffusely branched at apex; eglandular. Leaves 3–4-whorled, free, chartaceous to coriaceous, typically imbricated and adpressed, acicular, apex acute, base truncate; margin not thickened; venation hyphodromous, midrib sometimes prominent beneath. Inflorescence 1–4 flowers, primary pedicels 1 (–2) mm long; bracts and bracteoles foliaceous. Flowers 10–13 mm in diameter. Sepals 5 (6), equal to subequal, not recurved, narrow triangular, linear glands dense, distally punctiform. Petals 5 (6), yellow. Stamens arranged in a continuous ring, connective prolonged. Styles 3 (4), tortuous. Capsule ovoid to ellipsoid. Seeds light brown.

Geographical distribution and ecology: Brazil (RS). Acronyms for the Brazilian political divisions are given in Table 3. This species was only found in dry rocky grasslands of Santa Teresa hill, which has 100 m a.s.l.

Conservation status: H. bordignonii was already assessed for the IUCN Red List (Vogel Ely and Boldrini 2015), but the species has not yet been included in any official Red List. The species has a restricted range, occurring in a single hill, where a variety of anthropogenic activities threatens natural grasslands in which it occurs. Due to the high extinction risk, *H. bordignonii* was classed as Critically Endangered − CR B2ab(ii,iii,v);D (IUCN 2012; Vogel Ely and Boldrini 2015).

Notes: Hypericum bordignonii resembles *H. legrandii* and numerous species of Andean *Hypericum* (e.g., *H. andinum* Gleason, *H. juniperinum*, *H. monroi* N.Robson, and *H. sprucei* N.Robson) by its habit and acicular leaves (Fig. 4a). However, *H. bordignonii* differs from all *Hypericum* species by having prolonged connectives (Fig. 4b). *H. bordignonii* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: BRAZIL. Rio Grande do Sul: Porto Alegre, Morro Santa Teresa, 2 Dec 2013, *C. Vogel Ely and S. Bordignon 360* (ICN!).

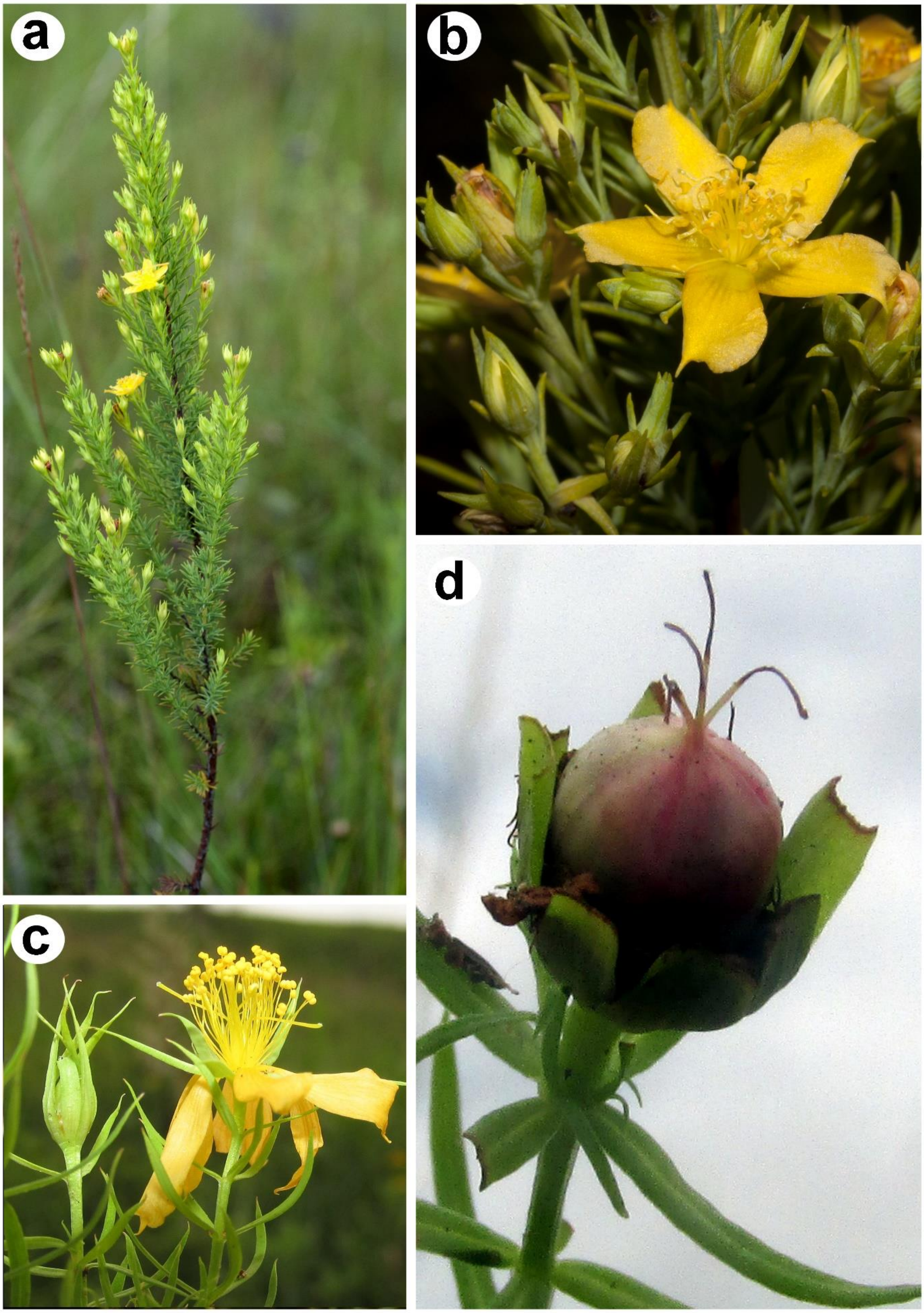

Fig. 4 *Hypericum bordinonii* (**a–b**): **a** habit; **b** flowers with prolonged anther connectives. *Hypericum robsonii* (**c–d**): **c** leaves 3-whorled, foliar bracts and flower; **d** fruit. Photos: Héctor A. Keller (c, d).

3. ***Hypericum brasiliense*** Choisy, Prodr. 1: 547. 1824. NEOTYPE: Brazil, Rio de Janeiro, 1830, *Gaudichaud 1* (G00355062 [photo!]).

Figs. 5a–b

Description: Herb or subshrub, single-stemmed, densely branched from base to apex; eglandular. Leaves opposite-decussate, rarely 3-whorled, free, membranous to chartaceous, patent, narrowly to broadly elliptic, oblong to linear, apex acute, obtuse or rounded, base cuneate, eventually forming a shallow V, margin not thickened; venation without a specific arrangement, midrib prominent beneath. Inflorescence 3–40 (–80) flowers, primary pedicels 2–7 mm long; bracts and bracteoles reduced. Flowers (10–) 15–20 mm in diameter. Sepals 5, equal to subequal, sometimes distally recurved, narrowly triangular or narrowly ovate, linear glands dense, sometimes distally punctiform. Petals (4) 5, yellow, sometimes tinged in red beneath. Stamens arranged in a continuous ring, connective not prolonged. Styles (4) 5 (6), straight. Capsule ovoid, ellipsoid or globose. Seeds yellow to light brown.

Geographical distribution and ecology: Argentina (BA, CH, CO, CR, ER, JJ, MI, SA, SF, and TU), Bolivia (CH, LP, and TA), Brazil (BA, ES, GO, MG, PR, RJ, RS, SC, and SP), Paraguay (AP, CO, CL IT, GU, PA, and CY), and Uruguay (AR, CA, CL, CO, MA, PY, RI, RN, SJ, TA, and TT). Acronyms for the Argentinean, Bolivian, Brazilian, Paraguayan, and Uruguayan political divisions are given in Table 3. The species is habitat generalist, occurring in dry or humid ecosystems from sea level to 2,800 m.

Conservation status: H. brasiliense has a wide distribution in South America, which is evidenced by the high value attributed to its extent of occurrence (EOO > 4 million km^2). Field expeditions and herbaria revision allowed us to trace the EOO polygon of the taxon reliably. However, since the species is habitat generalist and has much more subpopulations than we have gathered so far, any value attributed to the area of occupation (AOO, suitable habitat currently occupied by the taxon) would be unrealistic. Besides, it is unlikely that any global population decline could meet (or be close to meeting) the threshold for Vulnerable. Hence, considering the species' tolerance to anthropized environments and the EOO datum, *H. brasiliense* qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum brasiliense presents a wide morphological variation being more commonly confused with *H. denudatum* and *H. carinatum,* of which can be differentiated by the absence of acrodromous venation (*H. denudatum*) and leaf base, if decurrent, never forming a deep V (*H. carinatum*) (Fig. 5). It is important to emphasize that we have never observed stamens arranged, even obscurely, in 5 or 6 fascicles in this species. This information has been added in several studies with *Hypericum* (Reichardt 1878; Rodríguez Jiménez 1973, 1980; Robson 1990; Bittrich 2003; Ulibarri 2005; Slusarski et al. 2007), and although we have often examined the same specimens, we have never observed such a characteristic (both in the field and herbarium). *H. brasiliense* belongs to the southeast South America clade (Fig. 1).

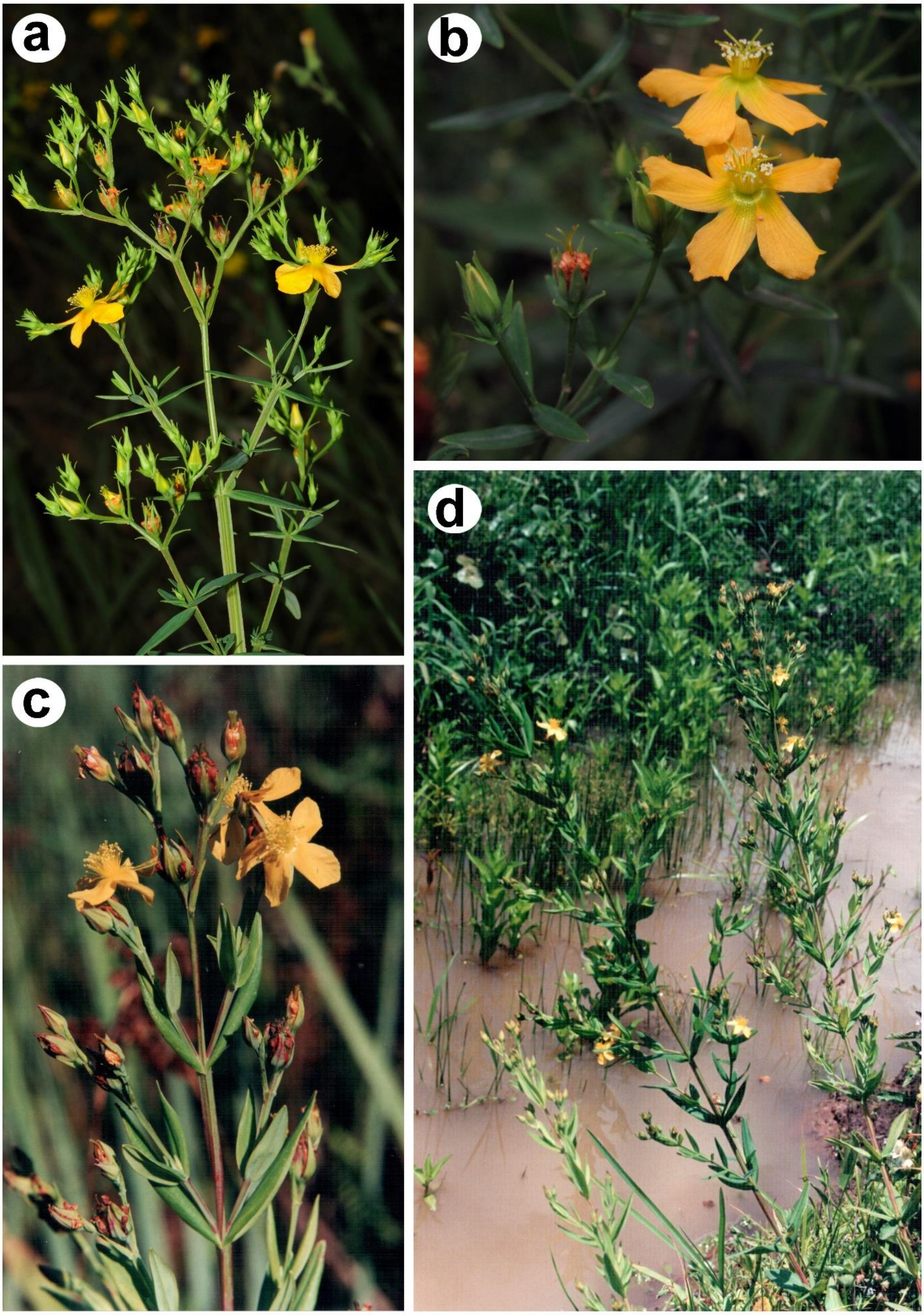

Fig. 5 *Hypericum brasiliense* (**a–b**): **a** fertile branch; **b** flowers. *Hypericum carinatum* (**c–d**): **c** leaf base decurrent and forming a deep V; **d** habit and habitat.

Additional specimens examined: ARGENTINA. Prov. Misiones: Dpto. San Pedro, Yabotí Biosphere Reserve, 26 Jan 2006, *H.A. Keller et al. 3482* (CEN [photo!]). Prov. Corrientes: Dpto. Passo de los libres, ruta 126, 13 Jan 2007, *J. Paula-Souza et al. 7115* (ESA [photo!]). BOLIVIA. Dpto. Chuquisaca: Prov. Hernando Siles, Huacareta, Serranía Los Milagros, 24 Dec 2005, *M. Serrano et al. 6893* (BM [photo!]). Dpto. La Paz: Prov. Nor Yungas, Polo-Polo bei Coroico, Nov 1912, *O. Buchtien 244* (BM [photo!]). Dpto. Tarija: Prov. Aniceto Arce, La Masmora a Bermejo, 21 Nov 2001, *O. Morrone et al. 3895* (SI!). BRAZIL. Bahia: Barra do Choça, 30 Mar 1977, *R.M. Harley 20173* (UEC!, CEPEC [photo!]). Espírito Santo: [Ibitirama] Alegre, Parque Nacional do Caparaó, Pico da Bandeira, 1 Mar 1959, *H.S. Irwin 2751* (R!, NY [photo!]). Goiás: Distrito Federal, Reserva Ecológica do Guará, 13 Jan 2000, *M.A. da Silva and D. Alvarenga 4258* (UEC!, FURB!). Minas Gerais: Liberdade, 29 Dec 2011, *M. Sobral 14590* (HUFSJ!, UEC!). Paraná: Laranjeiras do Sul, 12 Dec 1968, *G. Hatschbach 20597* (MBM!). Rio de Janeiro: [Itatiaia] Serra do Itatiaia, Mar 1984, *E. Ulle* (R 79201!). Rio Grande do Sul: Bagé, 16 Jan 2013, *C. Vogel Ely et al. 285* (ICN!). Santa Catarina: Xanxerê, 28 Oct 2015, *C. Vogel Ely et al. 507* (ICN!). São Paulo: Ibiúna, 23 Mar 2006, *I.C.R. Moraes 2* (IAC!). PARAGUAY. Dpto. Guairá: Iturbe, 6 Sep 1952, *J.E. Montes 12843* (RB!). Dpto. Itapúa: Cangó, 2 Dec 1896, *N. Alboff s.n.* (LP 51164!]). Dpto. Paraguary: Ybytymí, 18 May 1952, *J.E. Montes 12920* (RB!). Dpto. Concepción: Villa Sana, 30 Jan 1909, *Fiebrig 4895* (BM [photo!], K [photo!]). URUGUAY. Dpto. Maldonado: Arroyo Sarandí Grande, 26 Jan 1967, *B. Rosengurtt and O. del Puerto 10795* (MVFA!). Dpto. Paysandú: Estación Experimental de Paysandú, 2 Dec 1976, *Ferrés s.n.* (MVFA 12969!). Dpto. Rivera: Gruta de Piria, Cuchilla Negra, 15 Nov 1996, *M. Bonifacino et al. s.n.* (MVFA 26010!). Dpto. Tacuarembó: Gruta de los Cuervos, 9 Mar 1966, *B. Rosengurtt et al. 10084* (MVFA!).

4. *Hypericum caprifoliatum* Cham. & Schltdl., Linnaea 3: 125. 1828. LECTOTYPE: Brazil, “Brasiliae meridionalis provinciis”, 1823–1828, *Sellow s.n.* (BR0000008677112 [photo!]; isolectotype: HAL0014527 [photo!]).

Figs. 6a–c

Description: Subshrub, single-stemmed, densely branched from base to apex; eglandular. Leaves opposite-decussate, ⅔ to completely connate, rarely free, membranous, sometimes chartaceous, patent, triangular to oblong, apex obtuse or acute, margin not thickened; venation eucamptodromous, midrib prominent beneath. Inflorescence 7–43 flowers, primary pedicels 1–3 mm long; bracts and bracteoles reduced. Flowers 15–30 mm in diameter. Sepals 5, equal to subequal, not recurved, ovate to oblong, linear glands dense, sometime distally punctiform. Petals 5, golden yellow or dark orange. Stamens arranged in a continuous ring; connective not prolonged. Styles (4) 5, straight. Capsule ovoid to globose. Seeds light brown.

Geographical distribution and ecology: Argentina (MI) and Brazil (RS, SC, and RJ). *H. caprifoliatum* was also cited to PR (Slusarski et al. 2007); however, all the vouchers mentioned in the article are actually *H. connatum*. On the other hand, here we report the first record of *H. caprifoliatum* for Rio de Janeiro state (Brazil), increasing its known distribution by more than 800 km to the north. Acronyms for the Argentinean and Brazilian political divisions are given in Table 3. Different from most *Hypericum* species, *H. caprifoliatum* tolerates shading, being often found under diffuse sunlight in shrub vegetation or forest edges. Despite being habitat generalist, the species occurs preferentially in dry environments from sea level to 1,100 m.

Conservation status: H. caprifoliatum is a common species in southern Brazil. Herbaria revision and field knowledge allowed us to trace the EOO polygon of the taxon reliably (EOO > 220 thousand km^2). On the other hand, for *H. caprifoliatum,* our best estimate of AOO is still underestimated. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum from our assessment. The species is possibly declining in parts of its range, but it is still unlikely that any global population decline could meet (or be close to meeting) the threshold for Vulnerable. Therefore, considering the abundance of the species within its distribution range and the EOO datum, *H. caprifoliatum* currently qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum caprifoliatum differs from *H. connatum* and *H. teretiusculum*, species morphologically most similar, for being a diffusely branched subshrub with leaves without thickened margin, eucamptodromous venation, tiny bracts (smaller than 2 mm in length), and petals often dark orange and reflexed (Fig. 6). *H. caprifoliatum* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: ARGENTINA. Prov. Misiones: Dpto. San Javier, Matto Quemado, 26 Sep 1946, *Bertoni 2964* (F [photo!]); Dpto. San Pedro, Moconá, 27 Nov 2006, *M.J. Belgrano et al. 691* (SI!). BRAZIL. Rio de Janeiro: Arraial do Cabo, Ilha do Cabo Frio, Mar 2006, *R.J.V. Alves s.n.* (R 227445!). Rio Grande do Sul: Cambará do Sul, 14 Nov 2012, *C. Vogel Ely and G.E. Ferreira 237* (ICN!); Taquari, 5 Nov 2015, *C. Vogel Ely and S. Bordignon 402* (ICN!). Santa Catarina: Concórdia, Linha Vitória, 21 Jan 2009, *S. Dreveck et al. 508* (FURB!); São Domingos, 12 Dec 2001, *C. Poli and F.A. Silva 38* (FLOR!).

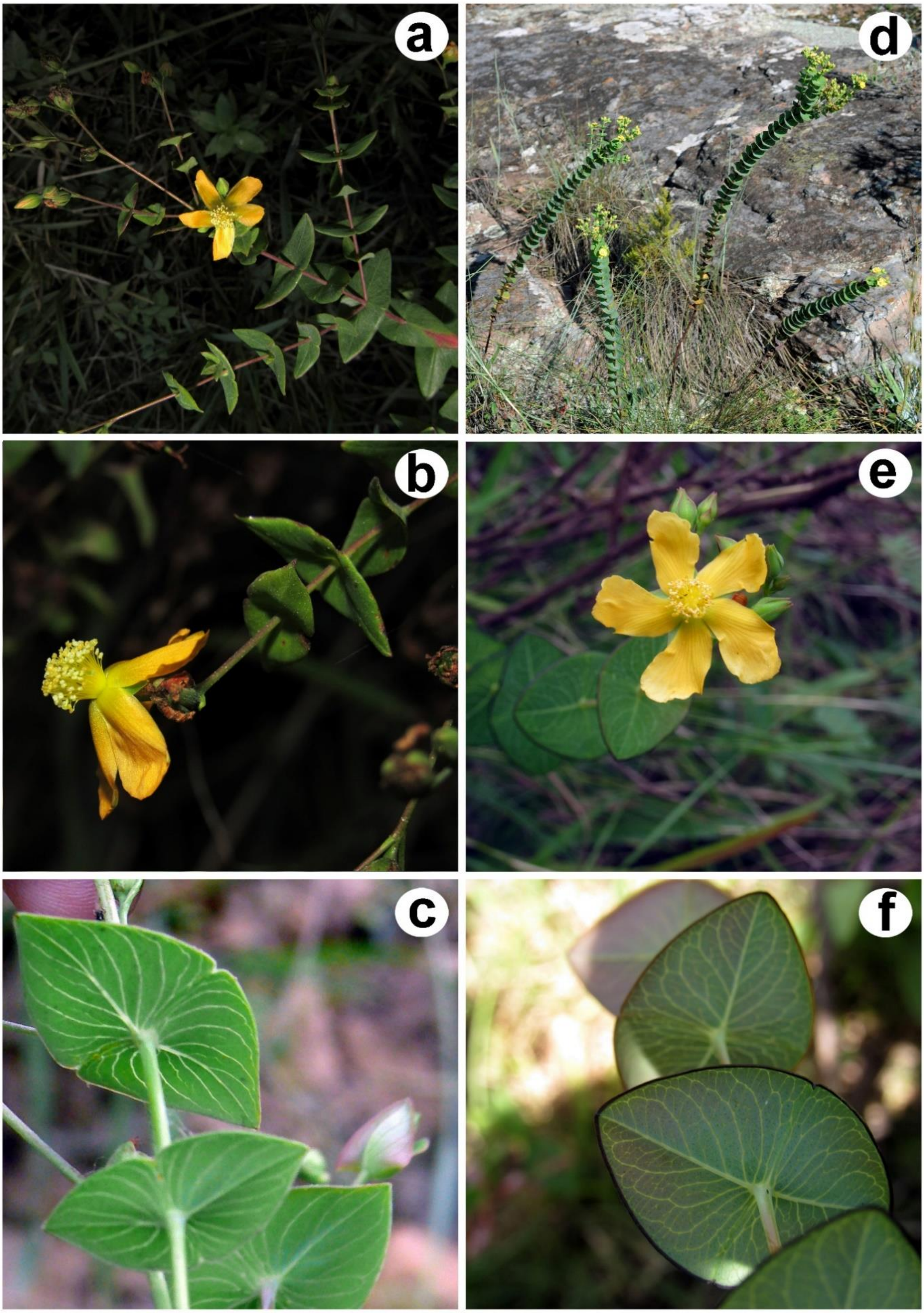

Fig. 6 *Hypericum caprifoliatum* (**a**–**c**): **a** stem branched; **b** flower with golden yellow petals, reflexed; **c** leaves without thickened margins and with eucamptodromous venation. *Hypericum connatum* (**d**–**f**): **d** habit and habitat; **e** flower with yellow petals, not reflexed; **f** leaves with black thickened margins and with brochidodromous venation.

5. *Hypericum carinatum* Griseb., Symb. Fl. Argent. 41. 1879. LECTOTYPE: Argentina, Córdoba: Sierra Achala, 22 Feb 1877, *G. Hieronymus 881* (GOET000923 [web!]).

Figs. 5c–d

Description: Subshrub, single-stemmed, branched from base to apex; eglandular. Leaves opposite-decussate, free, chartaceous, patent, narrowly to broadly elliptic, apex obtuse or acute, rarely rounded, base cuneate, forming a deep V, margin not thickened; venation without a specific arrangement, midrib prominent beneath. Inflorescence 5–25 flowers, primary pedicels 2–12 mm long; bracts and bracteoles reduced. Flowers 15–25 mm in diameter. Sepals 5, equal to subequal, not recurved, narrowly oblong or narrowly triangular, linear glands dense, distally punctiform. Petals 5, yellow, sometimes tinged in red beneath. Stamens arranged in a continuous ring; connective not prolonged. Styles (4) 5, straight. Capsule ovoid to globose. Seeds light brown.

Geographical distribution and ecology: Argentina (BA, CR, ER, JJ, and MI), Brazil (RS, SC, PR, SP and MG), Paraguay (AS, AY, CG, CL, and IT), and Uruguay (CL, CO, DU, FA, MA, PY, RN, RI, RO, SA, SJ, TI, and TA). Acronyms for the Argentinean, Brazilian, Paraguayan, and Uruguayan political divisions are given in Table 3. Here we report the first records of *H. carinatum* for São Paulo and Minas Gerais states (Brazil), increasing its known distribution by more than 700 km to the north. The species is habitat specialist, occurring in floodplains, riverbanks, or near water bodies (wetlands) from sea level to 2,000 m.

Conservation status: H. carinatum was already regionally evaluated for its extinction risk in Rio Grande do Sul state (Decreto 52.109 2014). The assessment was made according to IUCN Red List Criteria and regional adjustments using the LIVE System. However, no global assessment has yet been made for this species. *H. carinatum* is widespread in South America, which is evidenced by the high value attributed to its extent of occurrence (EOO > 2 million km^2). Field expeditions and herbaria revision allowed us to trace the EOO polygon of the taxon reliably. However, despite being habitat specialist (restricted to the threatened wetlands), *H. carinatum* has much more subpopulations than we have gathered so far, and any value attributed to AOO would be unrealistic. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum from our assessment. Thus, considering the EOO datum, *H. carinatum* qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum carinatum presents a wide phenotypic variation, being confused mainly with *H. brasiliense* and *H. denudatum*, of which can be differentiated by its decurrent leaves that form a deep V (Fig. 5c). *H. carinatum* has specificity for humid environments (Fig. 5d), so when its habitat goes through long periods of drought or is artificially drained this phenotype becomes less characteristic and difficult its determination (i.e., when we used 'aff. *carinatum*'). *H. carinatum* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: ARGENTINA. Prov. Buenos Aires: Delta Del Paraná, Caraguatá, 10 Feb 1932, *A. Burkart 4501* (SI!). Prov. Corrientes: Dpto. Concepción, Carambola, 23 Dec 1988, *T.M. Pedersen 15143* (MBM!). Prov. Entre Rios: Dpto. Concórdia, Ayuí, 16 Dec 1991, *N.M. Bacigalupo and E.R. Guaglianone 1528* (MBM!). BRAZIL. Minas Gerais: São João Del Rei, 11 Nov 2010, *M. Sobral et al. 13426* (HUFSJ!). Paraná: Guarapuava, 7 Feb 1969, *G. Hatschbah 21020* (MBM!). Rio Grande do Sul: Cambará do Sul, 21 Nov 2011, *C. Vogel Ely and G.E. Ferreira 175* (ICN!). Santa Catarina: Painel, 15 Dec 2015, *C. Vogel Ely et al. 453* (ICN!). São Paulo: Campinas, Oct 1900, *J.C. Novaes 974* (US [photo!]).

PARAGUAY. Asunción: Sta Isabel, 17 Sep 1893, *C. A. M. Lindman in herb. Regnelli Ser. I, No. 2061* (S [photo!]). Dpto. Cordillera: Altos 'Cordillera de los Altos', 1985-1995, *E. Hassler 3312* (BM [photo!]). Dpto. Caaguazú: Caaguazú, Feb 1905, *E. Hassler 9019* (BM [photo!]). URUGUAY. Dpto. Cerro Largo: arroyo del Lavadero, puntas del Fraile Muerto, 8 May 1985, *O. del Puerto s.n.* (MVFA 17798!). Dpto. Rivera: Tranqueras, 27 Mar 1985, *Marchesi et al. s.n.* (MVFA 17519!).

6. *Hypericum cavernicola* L.B.Sm., Wrightia 2: 90. 1960. HOLOTYPE: Uruguay, Tacuarembó: Gruta de los Cuervos, 17 Dec 1907, *Berro 4862* (US00037001 [photo!]; isotypes: MVFA0000039! & MVFA0000040!, K000221233 [photo!]).

Figs. 7a–b

Description: Subshrub, single-stemmed, usually naked below and diffusely branched at apex, rarely multi-stemmed, branched at base; eglandular. Leaves opposite-decussate, rarely 3-whorled, free, subcoriaceous to coriaceous, patent, narrowly oblong, elliptic or ovate, apex obtuse or acute, base truncate or cordate, margin not thickened; venation usually hyphodromous, sometimes actinodromous, midrib sometimes prominent beneath. Inflorescence 3–9 flowers, primary pedicels up to 1 mm long; bracts and bracteoles foliaceous. Flowers 12–20 mm in diameter. Sepals 5, strongly unequal, usually distally recurved, two outer broadly ovate to broadly elliptic and three inner narrowly oblong to narrowly elliptic, linear glands absent, punctiform glands sparce. Petals 5, yellow. Stamens arranged in a continuous ring; connective not prolonged. Styles 3 (4), straight. Capsule globose. Seeds yellow.

Geographical distribution and ecology: Brazil (RS) and Uruguay (RI, TA, and TT). Acronyms for the Brazilian and Uruguayan political divisions are given in Table 3. *H. cavernicola* inhabits dry and stony grasslands from 150 to 1,050 m a.s.l.

Conservation status: H. cavernicola was regionally evaluated for its extinction risk in Rio Grande do Sul state twice (Decreto 42.099 2003; Decreto 52.109 2014). In the first assessment, the species was included in regional Red List of Rio Grande do Sul state and in the last assessment, which was made according to IUCN Red List Criteria and regional adjustments using the LIVE System, not. However, no global assessment has yet been made for this species. Furthermore, although it has different criteria and objectives, it is worth noting that *H. cavernicola* is also included in the lists of priority species for conservation of Uruguay (Soutullo et al. 2009, 2013). Habitats suitable for *H. cavernicola* have been severely converted mainly into afforestation areas. Currently, one subpopulation was found nearby an agricultural area (e.g., soybean) and several subpopulations occur adjacent to *Pinus* or *Eucalyptus* crops. Afforestation is extremely compromising for heliophytic species as *H. cavernicola* and, probably represent the main threat for this and many other *Hypericum* species. Considering that *H. cavernicola* occurs in severely fragmented habitats and has experienced or will tend to experience populational declines soon, it may be considered a species of elevated conservation concern. Thus, under the criterion B, *H. cavernicola* does not meet the subcriterion B1 (EOO 127,508 km^2) but meet the subcriterion B2 (AOO 68 km^2), qualifying as Endangered − EN B2ab(ii,iii,iv) (IUCN 2012).

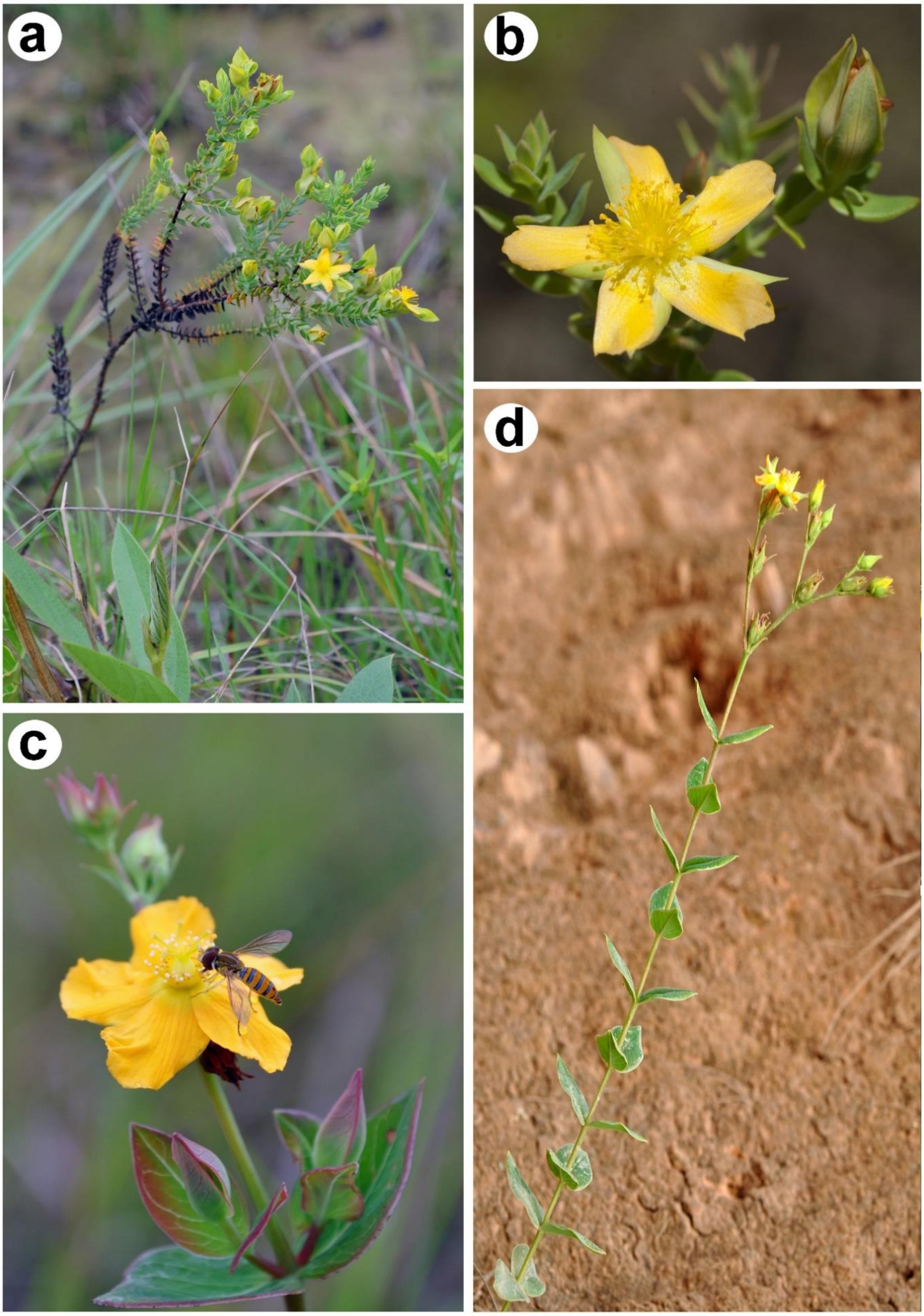

Fig. 7 *Hypericum cavernicola* (**a**–**b**): **a** habit, showing sepals that stand out in the inflorescences; **b** flower and strongly unequal sepals. *Hypericum teretiusculum* (**c**–**d**): **c** fertil branch; **d** habit.

Notes: Hypericum cavernicola is easily recognized by its coriaceous sepals that are strongly unequal and stand out in the inflorescences (Figs. 7a, b). *H. cavernicola* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: BRAZIL. Rio Grande do Sul: Arroio dos Ratos, 23 Jan 2013, *C. Vogel Ely and S. Bordignon 133* (ICN!); Jaquirana, 17 Nov 2012, *C. Vogel Ely and F.E. Ferreira 132* (ICN!); Jari, 14 Jan 2013, *C. Vogel Ely et al. 134* (ICN!); Santana do Livramento, 16 Nov 1975, *M.L. Porto et al. 1835* (ICN!). URUGUAY. Dpto. Rivera, Cerro Chato Dorado, 12 Dec 1997, *E. Marchesi and I. Grela s.n.* (MVFA 27181!). Dpto. Tacuarembó: Gruta de los Cuervos, 9 Mar 1966, *B. Rosengurtt et al. 10089* (MVFA!). Dpto. Treinta y Tres, Quebrada de los cuervos, 11 Nov 1965, *E. Marchesi et al. s.n.* (MVFA 5517!).

7. *Hypericum connatum* Lam., Encycl. 4: 168. 1797. LECTOTYPE: Uruguay, Montevideo: "Cette singulière espèce croît naturellement sur le morne de Montevideo", May 1767, *Commerson s.n.* (P00798959 [photo!]; isoletotypes: P00798960 [photo!], P00798961 [photo!], P00670152 [photo!], MPU022193 [photo!], LINN-HS 1244.21 [photo!], FI005984, only the specimen from the lower left corner [photo!]).

Figs. 6d–f

Description: Subshrub, single-stemmed, unbranched or with few lateral branches; eglandular. Leaves opposite-decussate, rarely 3-whorled, ⅔ to completely connate, rarely free, chartaceous to coriaceous, patent, ovate to semicircular, apex acute or rounded, margin thickened black or yellow; venation brochidodromous, midrib prominent beneath. Inflorescence 5–60 (–90) flowers, primary pedicels 3–5 mm long; bracts and bracteoles reduced. Flowers 25–33 (–40) mm in diameter. Sepals 5, subequal to unequal, not recurved, two outer broadly ovate to broadly elliptic or broadly rhombic and three inner elliptic or ovate, linear glands scarce or absent, punctiform glands sparce. Petals 5, yellow to golden yellow, sometimes tinged in red beneath. Stamens arranged in a continuous ring; connective not prolonged. Styles 5, straight. Capsule ovoid to ellipsoid. Seeds light brown.

Geographical distribution and ecology: Argentina (BA, CH, CO, CR, ER, FO, JJ, MI, SA, SL, and TU), Bolivia (CH and TA), Brazil (RS, SC, PR and SP), Paraguay (AP, CG, GU, and PA), and Uruguay (AR, CL, CO, DU, FA, LA, MA, MO, PY, RI, RN, RO, SA, SJ, SO, TA, and TT). Acronyms for the Argentinean, Bolivian, Brazilian, Paraguayan, and Uruguayan political divisions are given in Table 3. *H. connatum* occurs in dry and stony grasslands or rocky outcrops from sea level to 2,100 m.

Conservation status: H. connatum is widespread in South America, which is evidenced by the high value attributed to its extent of occurrence (EOO > 2 million km^2). Field expeditions and herbaria revision allowed us to trace the EOO polygon of the taxon reliably. However, this species has much more subpopulations than we have gathered so far, and any value attributed to AOO would be unrealistic. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum from our assessment. Thus, considering the EOO datum and the low probability of a significant global population decline of this species, *H. connatum* qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum connatum differs from all other South American species of *Hypericum* by having connate leaves with black or yellow thickened margins (Fig. 6f). It differs from *H. caprifoliatum,* with which is sometimes confused, by having a stem without or with few lateral branches (vs. stem densely branched), brochidodromous venation (vs. eucamptodromous venation), and flowers never reflexed (vs. flowers usually reflexed) (Fig. 6d, e). *H. connatum* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: ARGENTINA. Prov. Buenos Aires: Mar del Plata, 1 Mar 1932, *Hicken s.n.* (SI 26607!). Prov. Córdoba: Dpto. Calamuchita, La Cumbrecita, 18 Nov 1955, *F.A. Roig 1080* (MERL [photo!]). Prov. Missiones: Dpto. Candelaria, Yebebiry, 27 Apr 1945, *J.E. Montes 885* (LP!). Prov. Salta: Dpto. Anta, Parque Nacional El Rey, 19 Jul 1979, *A. Brown et al. 999* (SI!). BOLIVIA. Dpto. Chuquisaca: Prov. Hernando Siles, Huacareta, 24 Dec 2005, *M. Serrano et al. 6893* (BM [photo!], HSB [photo!], MO [photo!]); Prov. Tomina, Padilla, Rosal, 3 Oct 1949, *W.M.A. Brooke 5755* (BM [photo!]). Dpto. Tarija: Prov. Aniceto Arce, Bermejo, 3 Dec 1903, *K. Fiebrig 2361* (SI!, S [photo!]). BRAZIL. Paraná: Jaguariaiva, 3 Nov 1989, *E. Melo and F. França 188* (UPCB!). Rio Grande do Sul: São Francisco de Paula, 22 Nov 2013, *C. Vogel Ely 186* (ICN!). Santa Catarina: São Joaquim, 12 Apr 2008, *M. Verdi and F.E. Carneiro 568* (FURB!). São Paulo: Itararé, 6 May 2005, *L.C. Bernacci and E.F. Souto 3983* (IAC!). PARAGUAY. Dpto. Alto Paraná: Hernandarias, 10 Jan 1974, *A. Schinini 8036* (RB!). Dpto Caaguazú: Yhú, Nov 1905, *E. Hassler 9686* (BM [photo!], G [photo!]). Dpto. Guairá: Cordillera Villarrica, Jan 1905, *E. Hassler 8758* (BM [photo!], G [photo!]). Dpto. Paraguarí: Tebicuarymí, 17 Nov 1978, *M. Bernardi 18762* (BM [photo!]). URUGUAY. Dpto. Colonia: Tarariras, 11 Jul 1983, *E.A. Paz 547* (MVM!). Dpto. Florida: Cerro Colorado, Feb 1944, *Gallinal et al. PE-5033* (MVFA!). Dpto. Maldonado: Piriápolis, Cerro Pan de Azúcar, 6 Feb 1986, *Marcela and Sánchez 77* (BAB!). Dpto. Río Negro, Paso del Puerto Río Negro, 22 Mar 1964, *E. Marchesi 988* (MVFA!). Dpto. Rivera: Minas de Corrales, 3 Dec 2004, *L. Delfino s.n.* (MVJB 24605!). Dpto. Rocha: Sierra de los Rocha, 18 Jan 1965, *R. Brescia and E. Marchesi s.n.* (MVFA 3970!).

8. *Hypericum cordiforme* A.St.-Hil., Fl. Bras. Merid. 1: 330. 1828. LECTOTYPE: Brazil, São Paulo: “in pascuis prope urbem Sancti Pauli”, 1816–1822, *A. de Saint-Hilaire C1-1172* (P01901409 [photo!]; isolectotype: P01901411 [photo!]; probable isolectotype: P01901410 [photo!]).

Figs. 8a–b

Description: Subshrub, single-stemmed, unbranched or branching symmetrically along the stem; eglandular**.** Leaves opposite-decussate, free to ⅓ connate at the base, coriaceous, usually patent, narrowly to broadly ovate, apex acute to obtuse, base subcordate to cordate; margin not thickened; venation usually hyphodromous, sometimes actinodromous, midrib not prominent. Inflorescence 3–25 (–32) flowers, primary pedicels 1–4 mm long; bracts and bracteoles reduced. Flowers 15–20 mm in diameter. Sepals 5, subequal to unequal, not recurved, two outer broadly elliptic or broadly rhombic, rarely elliptic, and three inner narrow elliptic to elliptic, linear glands dense, distally punctiform. Petals 5, light yellow to yellow, sometimes tinged in red beneath. Stamens arranged in a continuous ring; connective not prolonged. Styles 3 (4, 5), straight. Capsule globose. Seeds yellow.

Geographical distribution and ecology: Brazil (RS, SC, PR, SP, MG, and RJ). Acronyms for the Brazilian political divisions are given in Table 3. *H. cordiforme* inhabits dry and stony grasslands of Brazilian Atlantic Forest and Cerrado, occurring mainly from 400 and 1,700 m a.s.l.

Conservation status: H. cordiforme (called by its synonym *H. cordatum* (Vell.) N.Robson) was already included in a regional Red List of Rio Grande do Sul state (Decreto 52.109 2014). The assessment was made according to IUCN Red List Criteria and regional adjustments using the LIVE System. However, no global assessment has yet been made for this species. Some subpopulations of *H. cordiforme* occurs within protected areas (e.g., Parque Nacional de Aparados da Serra). Nevertheless, habitats suitable for *H. cordiforme* are being reduced mainly due to agricultural practices (e.g., soybean) and afforestation (e.g., *Pinus* and *Eucalyptus*). These economic activities are extremely compromising for heliophytic species as *H. cordiforme* and, probably represent the main threat for this and many other *Hypericum* species. Herbaria revision and field knowledge allowed us to trace the EOO polygon of the taxon reliably (EOO > 293 thousand km^2). On the other hand, for *H. cordiforme,* our best estimate of AOO is still underestimated. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum from our assessment. The species is possibly declining in parts of its range, but it is still unlikely that any global population decline could meet (or be close to meeting) the threshold for Vulnerable. Therefore, considering the EOO datum, *H. cordiforme* currently qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum cordiforme is sometimes confused with *H. ternum*, species morphologically most similar, of which can be differentiated by having a stem without or with few lateral branches (vs. stem densely branched), when present, symmetrically arranged (vs. asymmetrically arranged on the stem apex), internodes usually elongated (vs. short internodes), and cordiform leaves that are more often patent and never arranged in three whorls (vs. narrow leaves that are usually imbricated and adpressed, often arranged in three whorls) (Figs. 8). Heterophylly is common in this species. *H. cordiforme* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: BRAZIL. Minas Gerais: [Itamonte] Serra do Picú, 10 Dec 1886, without collector information (R 79213!). Paraná: Jaguariaíva, 17 Jan 1965, *L.B. Smith et al. 14655* (HBR!); Lapa, 30 Jan 1949, *G. Hatschbach 1182* (MBM!).Rio Grande do Sul: Cambará do Sul, 15 Nov 2012, *C. Vogel Ely and G.E. Ferreira 104* (ICN!); Jaquirana, 21 Nov 2012, *S. Bordignon and G.L.von Poser s.n.* (ICN 176271!). Rio de Janeiro: Rio de Janeiro, Nov 1879, *M. Glaziou 10396* (K [photo!]). Santa Catarina: Bom Retiro, 25 Nov 2011, *S.L. Stürmer* (FURB 37228!); Urubici, Águas Brancas, 8 Mar 2005, *G. Hatschbach et al. 78933* (MBM!). São Paulo: Capão Bonito, Dec 1949, *J. Vidal III-307* (R!); Ibiúna, 9 Feb 2006, *R.A. Rombello 72* (IAC!); São Paulo, Vila Ema, Dec 1932, *A.C. Brade 12239* (R!).

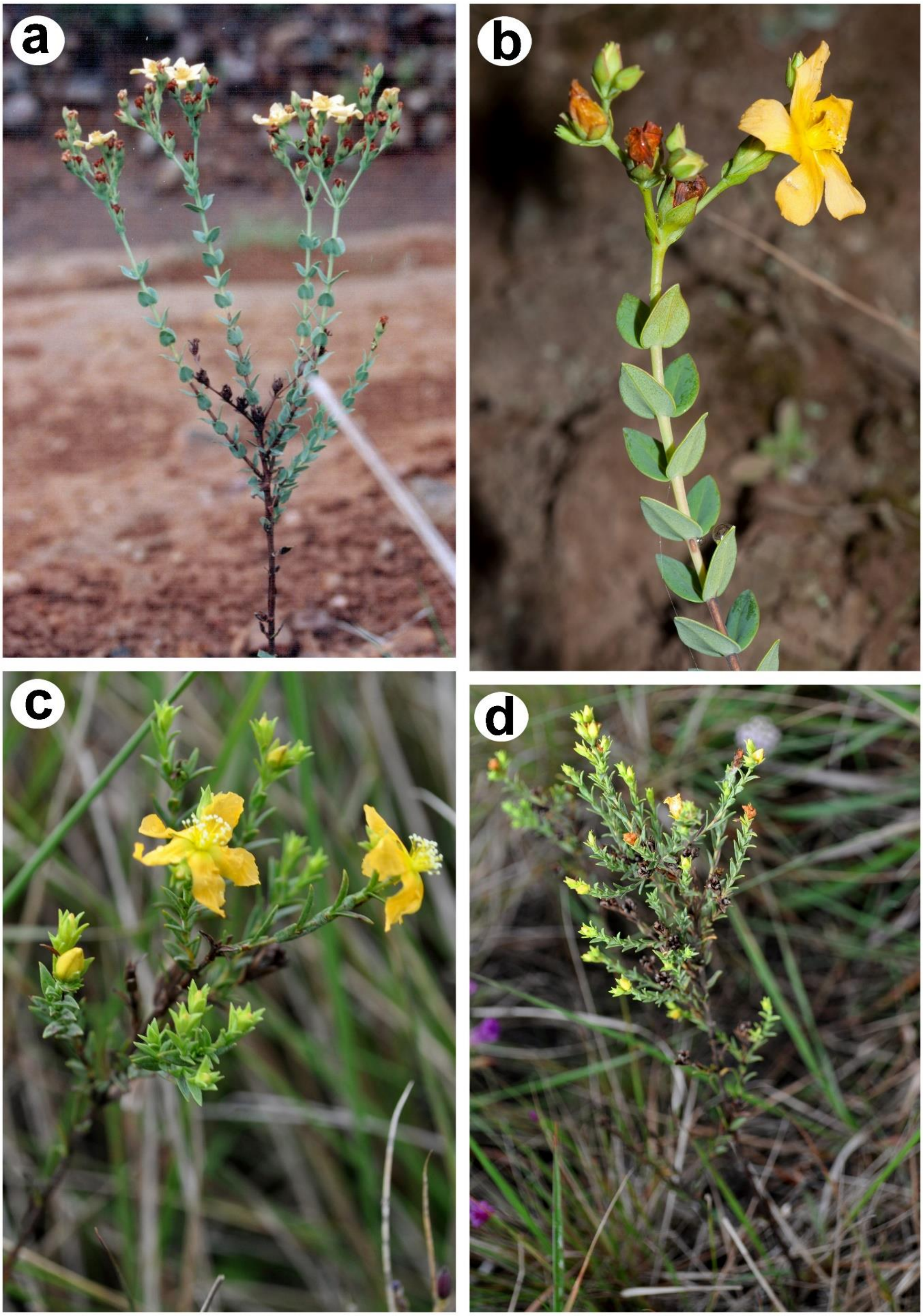

Fig. 8 *Hypericum cordiforme* (**a–b**): **a** habit; **b** leaves cordate, not imbricated. *Hypericum ternum* (**c–d**): **c** leaves narrow, imbricated; **d** stem diffusely branched, ramifying asymmetrically on the stem apex.

9. *Hypericum denudatum* A.St.-Hil., Fl. Bras. Merid. 1: 336. 1828. LECTOTYPE: Brazil, Paraná: near Tibagi, Barra do Iapó, 1820, *A. de Saint-Hilaire C1-1530* (P00798948 [photo!]; isoletotype: P00798949 [photo!]).

Figs. 9a–c

Description: Subshrub, single-stemmed, naked below and diffusely branched at the apex; eglandular. Leaves opposite-decussate, free, chartaceous, patent, narrowly elliptic or narrowly oblong, apex acute to obtuse, base cuneate, eventually forming a shallow V, margin not thickened; venation acrodromous, midrib prominent beneath. Inflorescence 3–34 (–∞) flowers, primary pedicels 2–13 mm long; bracts and bracteoles reduced. Flowers (7–) 15–34 mm in diameter. Sepals 5, equal to subequal, not recurved, narrowly ovate to narrowly triangular, linear glands dense, distally punctiform. Petals 5, yellow to golden yellow, sometimes tinged in red beneath. Stamens arranged in a continuous ring; connective not prolonged. Styles (4) 5, straight. Capsule ovoid to globose. Seeds brown.

Geographical distribution and ecology: Argentina (MI), Brazil (RS, SC, and PR), and Uruguay (CA and RN). Acronyms for the Argentinean, Brazilian, and Uruguayan political divisions are given in Table 3. Here we report the first records of *H. denudatum* for Uruguay, increasing its known distribution by more than 450 km to the south. The species is habitat specialist, occurring in floodplains, bogs, peatlands, or near water bodies (wetlands) from sea level to 1,200 m.

Conservation status: H. denudatum was already regionally evaluated for its extinction risk in Rio Grande do Sul state (Decreto 52.109 2014). The assessment was made according to IUCN Red List Criteria and regional adjustments using the LIVE System. However, no global assessment has yet been made for this species. *H. denudatum* is widespread in South America, which is evidenced by the high value attributed to its extent of occurrence (EOO > 540 thousand km^2). Field expeditions and herbaria revision allowed us to trace the EOO polygon of the taxon reliably. However, despite being habitat specialist (restricted to the threatened wetlands), *H. denudatum* has much more subpopulations than we have gathered so far, and any value attributed to AOO would be unrealistic. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum from our assessment. Thus, considering the EOO datum, *H. denudatum* qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum denudatum presents a wide phenotypic variation, especially in leaves (5–24 mm in length) and flowers (15–34 mm in diameter) size. The species is characterized by the leaves with acrodromous venation and abaxial surface frequently covered with papillae, resulting in its discolor aspect (Fig. 9b). As *H. denudatum* has specificity for humid environments, it is also characterized by a stem that loses the basal leaves as a result of the water level variation. When *H. denudatum*’s habitat does not have permanent storage of water, the papillae of leaves are reduced or even totally lost. *H. denudatum* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: ARGENTINA. Prov. Misiones: Posadas, 2 Oct 1909, *Rodríguez 84* (SI!, BA!). BRAZIL. Paraná: Palmas, 31 Oct 2015, *C. Vogel Ely 484* (ICN!). Rio Grande do Sul: São Francisco de Paula, 21 Oct 1999, *S. Bordignon 1755* (ICN!). Santa Catarina: Painel, 28 Jan 2015, *C. Vogel Ely et al. 406* (ICN!). URUGUAY. Dpto. Canelones: Atlántida, 9 Nov 1915, *C. Osten 6931* (MVM!). Dpto. Rio Negro: Río Negro, frente al Cerro de los Claveles, 2 Apr 1998, *E. Marchesi and M. Vignale s.n.* (MVFA 28166!).

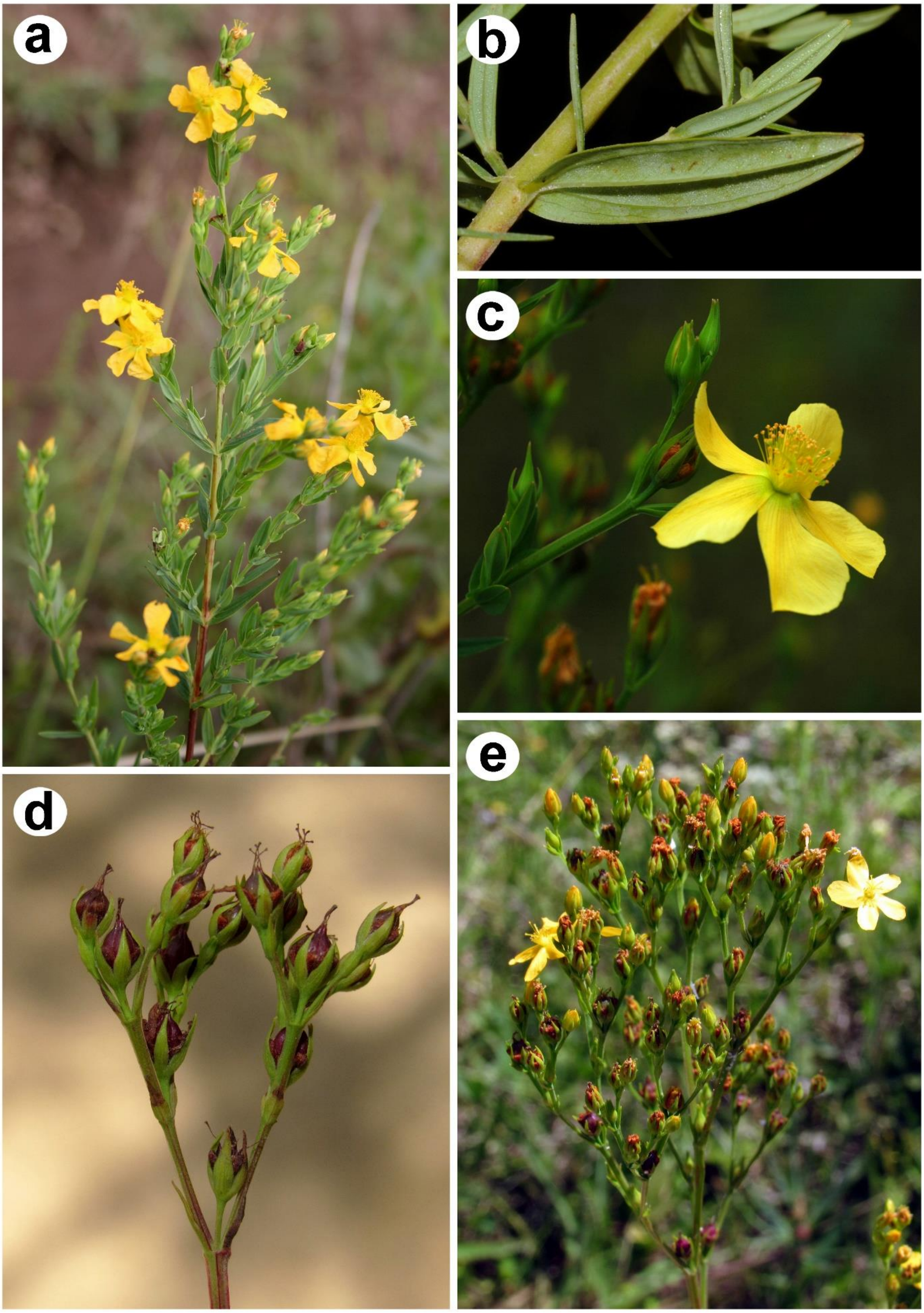

Fig. 9 *Hypericum denudatum* (**a**–**c**): **a** fertil branch; **b** leaf with acrodromous venation; **c** flower. *Hypericum lorentzianum* (**d**–**e**): **d** capsules; **e** fertil branch.

10. *Hypericum gentianoides* (L.) Britton, Sterns & Poggenb., Prelim. Cat. Pl. 9. 1888. LECTOTYPE: U.S.A. *s.loc.*, *s.d.*, *Pehr Kalm s.n.* (LINN No. 391-1 [photo!]).

Figs. 10a–b

Description: Small herb, single-stemmed, usually diffusely branched at the apex; glandular. Leaves opposite-decussate, free, chartaceous to subcoriaceous, adpressed, basal leaves obovate to elliptic (deciduous) and apical leaves reduced to narrowly scales (persistent), apex obtuse to rounded, base truncate or cuneate; margin not thickened; venation hyphodromous, midrib not prominent. Inflorescence 2–7 flowers, primary pedicels 0.5–1 mm long; bracts and bracteoles foliaceous. Flowers 2–5 mm in diameter. Sepals 5, equal to subequal, not recurved, oblong or narrowly ovate, 2 linear glands, distally punctiform. Petals 5, light yellow. Stamens isolated; connective not prolonged. Styles 3 or 4, straight. Capsule fusiform. Seeds yellow to light brown.

Geographical distribution and ecology: Brazil (RS and SC) and Paraguay (CL and PA). Acronyms for the Brazilian and Paraguayan political divisions are given in Table 3. *H. gentianoides* also occurs in the Dominican Republic, Canada, United States, and France (Robson 1990). Here we report the first record of *H. gentianoides* for Santa Catarina state (Brazil). Psammophilous species, commonly found in humid and sandy lowlands.

Conservation status: H. gentianoides was already included in the regional Red List of Rio Grande do Sul state (Decreto 52.109 2014). The assessment was made according to IUCN Red List Criteria and regional adjustments using the LIVE System. However, no global assessment has yet been made for this species. Globally speaking, the species is widespread, and while it is possibly declining in parts of its range, it is unlikely that any global population decline could meet (or be close to meeting) the threshold for Vulnerable. Therefore, *H. gentianoides* is assessed as Least Concern – LC (IUCN 2012).

Notes: Hypericum gentianoides is a small annual herb. The species is characterized by its densely glandular stem, three styles with broadly capitate stigmas, and fusiform capsules (Table 2, Figs. 10a, b). This species seems to be distributed naturally through the SESA grasslands, but it does not belong to the southeast South America clade; indeed, it seems to be allocated in somewhere before the emergence of the ‘Andean radiation’ (Fig. 1).

Additional specimens examined: BRAZIL. Rio Grande do Sul: São Borja, 20 Jan 1938, *B. Rambo 3009* (PACA!); São Lourenço do Sul, 5 Nov 2012, *C. Vogel Ely et al. 121* (ICN!). Santa Catarina: Passo de Torres, 18 Apr 2016, *P.J.S. Silva Filho s.n.* (ICN 197735!). PARAGUAY. Dpto. Cordillera: Altos 'Cordillera de los Altos', 7 Nov 1902, *K. Fiebrig 399* (BM [photo!]). Dpto. Paraguarí: Pirаretá, 12 Dec 1992, *E. Nicora et al. 9916* (SI!).

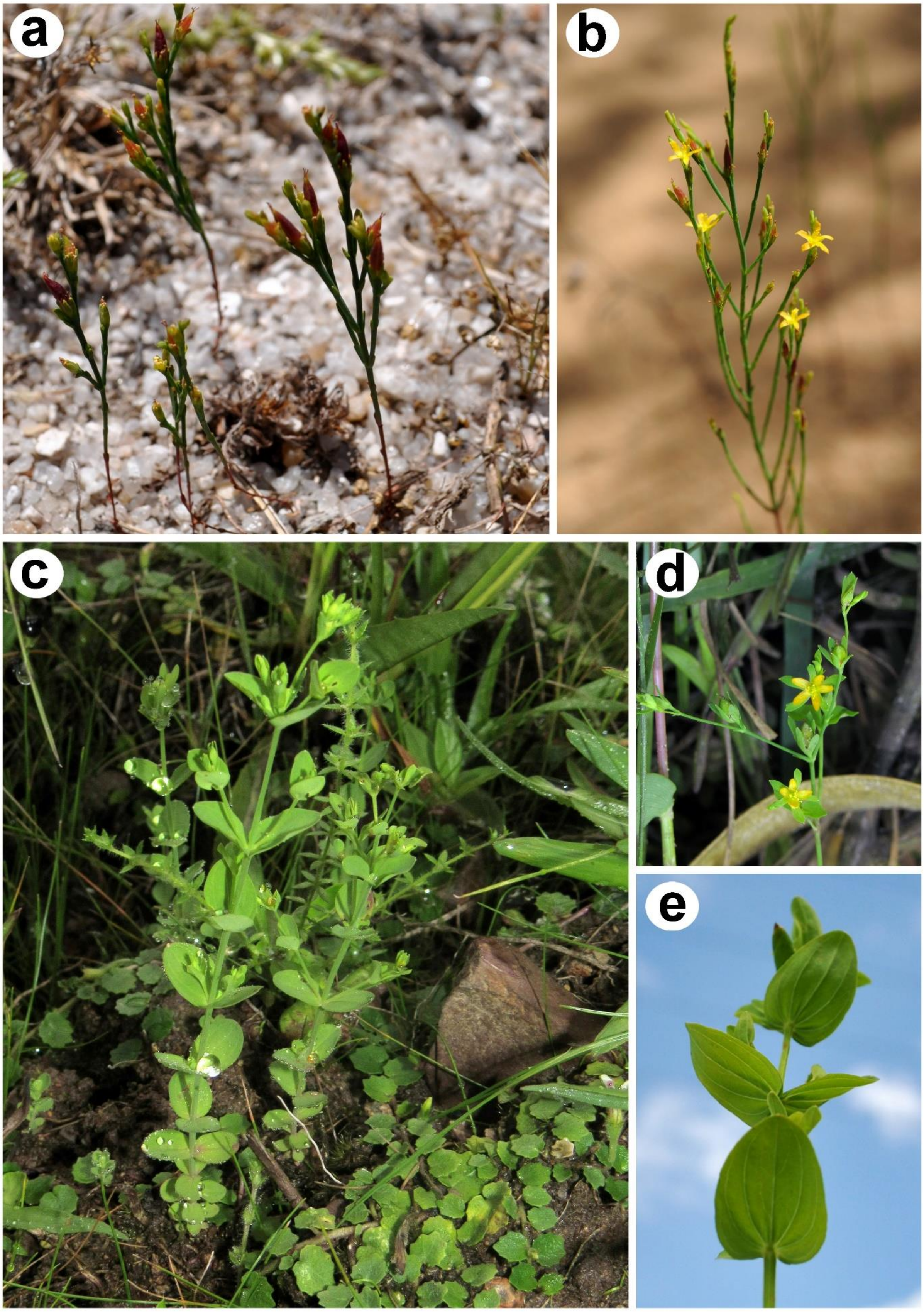

Fig. 10 *Hypericum gentianoides* (**a**–**b**): **a** habit and habitat; **b** fertil brach showing fusiform capsules. *Hypericum mutilum* (**c**–**e**): **c** habit; **d** fertil brach; **e** leaves with acrodromous venation.

11. ***Hypericum legrandii*** L.B.Sm., J. Wash. Acad. Sci. 48: 314. 1958. LECTOTYPE: Uruguay, Rivera, 17 Dec 1901, *Berro 1720* (MVM No. 2767!; isolectotypes: US00074199 [photo!], MVFA!).

Description: Shrub or subshrub, single-stemmed, always naked below and diffusely branched at apex; eglandular. Leaves opposite-decussate or 3–4-whorled, free, chartaceous to coriaceous, imbricated and adpressed, acicular, apex acute, base truncate; margin not thickened; venation hyphodromous, midrib slightly prominent beneath. Inflorescence 14–20 flowers, primary pedicels 2–4 mm long; bracts and bracteoles foliaceous. Flowers c. 10 mm in diameter. Sepals 5, subequal, not recurved, two outer ovate and three inner narrow ovate or narrow oblong, linear glands dense, distally punctiform. Petals 5, yellow. Stamens arranged in a continuous ring, connective not prolonged. Styles 3, tortuous. Capsule not seen. Seeds not seen.

Geographical distribution and ecology: Uruguay (RI). Acronyms for the Uruguayan political divisions are given in Table 3. According to information extracted from the exsiccate labels, this species was only found in stony grasslands of a hillside.

Conservation status: H. legrandii has only been collected twice, apparently in the same place, a long time ago (last seen in 1907). Field expeditions to search for this species on its natural habitat was made but without success. Considering that we do not know the exact collection point of *H. legrandii*, we thought that the species can still be found, but more field effort is needed to identify if it is still extant. One of our concerns is that the species has lost its habitat or is close to that, because the Rivera department, which is where the species was collected, has already lost many natural grasslands through afforestation, as well as other imminent anthropogenic activities. *H. legrandii* is a species of elevated conservation concern, which is why it is included in the list of priority species for conservation of Uruguay (Soutullo et al. 2013). Therefore, due to the restricted range of *H. legrandii* and its latent extinction risk, this species was assessed as Critically Endangered (Possibly Extinct) under criterion B2ab(ii,iii) (IUCN 2012).

Notes: Hypericum legrandii differs from *H. bordignonii*, species morphologically more similar, by having pleiochasium always with more than four flowers (vs. pleiochasium with four flowers), longer primary pedicels (2–4 mm long vs. 1 (–2) mm long), and anther connectives never prolonged (vs. prolonged anther connectives). By its restricted distribution in SESA grasslands, flowers grouped in cymes, stamens arranged in a continuous ring, and stem without glands, *H. legrandii* probably belongs to the southeast South America clade.

Additional specimens examined: URUGUAY. Rivera: *F. Felippone 5070* (K); Chacara Santúrio, 10 Dec 1907, *M.B. Berro 4865* (MVFA!, ICN!);

12. ***Hypericum lorentzianum*** Gilg ex R.Keller, Bot. Jahrb. Syst. 58(3): 199. 1923. NEOTYPE: Brazil, [Rio Grande do Sul or Santa Catarina], 1814–1831, *Sellow s.n.* (S03-1999 [photo!]).

Figs. 9d–e

Description: Subshrub, single-stemmed, densely branched from base to apex; eglandular. Leaves opposite-decussate, rarely 3-whorled, free, chartaceous, patent, narrowly elliptic to elliptic, narrowly oblong to oblong, apex obtuse, rarely acute, base cuneate, margin not thickened; venation without a specific arrangement, midrib prominent beneath. Inflorescence 3–80 (–∞) flowers, primary pedicels 1.5–4 mm long; bracts and bracteoles reduced. Flowers 7–10 (–15) mm in diameter. Sepals 5, equal to subequal, not recurved, oblong or narrowly ovate, linear glands dense, sometimes distally punctiform. Petals 5, light yellow to yellow, sometimes tinged in red beneath. Stamens arranged in a continuous ring; connective not prolonged. Styles 4 or 5, straight. Capsule ovoid to globose. Seeds yellow to light brown.

Geographical distribution and ecology: Argentina (CR, ER, MI, and SA), Brazil (RS and SC), Paraguay (CL and GU), and Uruguay (AR, CL, CO, FA, LA, MA, MO, RI, RO, SA, SJ, TA, and TT). *H. lorentzianum* was also cited to PR (Robson 1990); however, the voucher mentioned in the revision is actually *H. brasiliense*. Acronyms for the Argentinean, Brazilian, Paraguayan, and Uruguayan political divisions are given in Table 3. The species is habitat generalist, occurring in dry or humid ecosystems from sea level to 1,100 m.

Conservation status: H. lorentzianum is a relatively common species in southern Brazil. Herbaria revision and field knowledge allowed us to trace the EOO polygon of the taxon reliably (EOO > 574 thousand km^2). On the other hand, for *H. lorentzianum,* our best estimate of AOO is still underestimated. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum from our assessment. Thus, although we observe many anthropogenic activities threatening different subpopulations of *H. lorentzianum*, considering the EOO datum, *H. lorentzianum* currently qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum lorentzianum is characterized by inflorescences with many relatively small flowers (7–10 mm in diameter), usually corymbiform (Figs. 9d, e), which is why it may be confused with *H. myrianthum* that has much smaller flowers (2–4 mm in diameter). *H. lorentzianum* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: ARGENTINA. Prov. Entre Rios: Dpto. Concordia, Yeruá, 15 Dec 1958, *I. Galli 176* (SI!). Prov. Corrientes: Mercedes, Rincón del Ombú, 9 Feb 1960, *T.M. Pedersen 5384* (LP!). Prov. Misiones: Dpto. Apóstoles, cerca de San José, 10 Oct 1977, *A.L. Cabrera 28484* (SI!). Prov. Salta: Camino del alto Salta-Jujuy, 29 Jan 1947, *C.A. O'Donell 4393* (MVFA!). BRAZIL. Rio Grande do Sul: Viamão, 2 Dec 2016, *C. Vogel Ely and M.B. Neves 455* (ICN!). Santa Catarina: Grão Pará, 10 Mar 2005, *G. Hatschbach et al. 78974* (MBM!). PARAGUAY. Dpto. Cordillera: Altos 'Cordillera de los Altos', 14 Nov 1902. *K. Friebrig 427* (BM [photo!]). Dpto. Guairá Tebicuary: Azucarera, Nov 1941, *T. Rojas 9306* (BM [photo!]). URUGUAY. Dpto. Artigas: area a inundar por Represa Salto Grande, al sur del Arroyo Guaviyú, 19 Dec 1977, *Berreta s.n.* (MVFA 14995!). Dpto. Colonia: Conchillas, 8 Dec 2003, *M. Bonifacino 1012* (MVFA!). Dpto. Maldonado: Punta Ballena, 31 Mar 1973, *Izaguirre s.n.* (MVFA 11999!). Dpto. Rivera: Picanso, Confusa, 18 Feb 2009, *C. Brussa et al. s.n.* (MVJB 27363!). Dpto. Salto: area a inundar por Represa Salto Grande, entre Arroyo Espinillar y Río Arapey, 22 Nov 1977, *O. del Puerto s.n.* (MVFA 14433!). Dpto. Treinta y Tres: Isla Patrulla, 20 Jan 1986, *O. del Puerto s.n.* (MVFA 18095!).

13. *Hypericum microlicioides* L.B.Sm., J. Wash. Acad. Sci. 48(10): 311. 1958. HOLOTYPE: Brazil, Santa Catarina: Campo Alegre, Morro Iquererim, 10 Dec 1956, *L.B. Smith & R. Klein 8535* (US00037003 [photo!]; isotypes: NY00075913 [photo!], P02442084 [photo!], HBR0017818 [photo!], R000197296!).

Figs. 11a–c

Description: Subshrub, single-stemmed, always naked below and diffusely branched at apex; eglandular. Leaves opposite-decussate, free, chartaceous, imbricated and adpressed, narrowly elliptic to elliptic, apex obtuse to acute, base cuneate, margin not thickened; 1–4 pairs of secondary veins emerging from leaf base and ascending laterally to the midrib, secondary veins also emerging from the median region of the midrib and branching into connected arches, midrib prominent beneath. Inflorescence reduced to one flower, pedicels 3–6 mm long; bracts and bracteoles foliaceous. Flowers 30–33 mm in diameter. Sepals 5, equal to subequal, not recurved, narrowly elliptic, linear and punctiform glands absent or few tiny punctiform glands. Petals 5, yellow. Stamens arranged in a continuous ring; connective not prolonged. Styles 5, straight. Capsule ovoid. Seeds brown.

Geographical distribution and ecology: Brazil (SC and PR). Acronyms for the Brazilian political divisions are given in Table 3. *H. microlicioides* inhabits high altitude wetlands of Brazilian Atlantic Forest from 1,300 to 1,500 m. a.s.l.

Conservation status: H. microlicioides has not yet been included in any official Red List. The species has a restricted range, being registered in only two points, one in Serra do Quiriri (without exact location) and another in Serra do Araçatuba (nebular environment at Perdidos hilltop). Field expeditions to search *H. microlicioides* on its natural habitat was made, but only one subpopulation was found; however, more field effort in the vast potentially suitable areas inside both mountain range (Quiriri and Araçatuba) may probably reveal new subpopulations. Thus, due to its restricted range (AOO 8 km^2), and absence of conservation actions, *H. microlicioides* was assessed as Critically Endangered under criterion B2ab(ii,iii,iv) (IUCN 2012).

Notes: Hypericum microlicioides differs from *H. rigidum*, species morphologically more similar, by having adpressed and imbricated leaves (vs. patent and not imbricated leaves), and large solitary flowers with shorter pedicels (solitary flowers of 30–33 mm in diameter with pedicels of 3–6 mm long vs. cymes with flowers of 15–20 (25) mm in diameter and primary pedicels of 4–20 mm long) (Fig. 11). *H. microlicioides* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: BRAZIL. Paraná: Guaratuba, Morro dos Perdidos, 21 Nov 2018, *C. Vogel Ely and F.R. Daronco 525* (ICN!). Santa Catarina: Garuva, Serra do Quiriri, 3 Nov 2008, *A. Jachowicz 19* (MBM!).

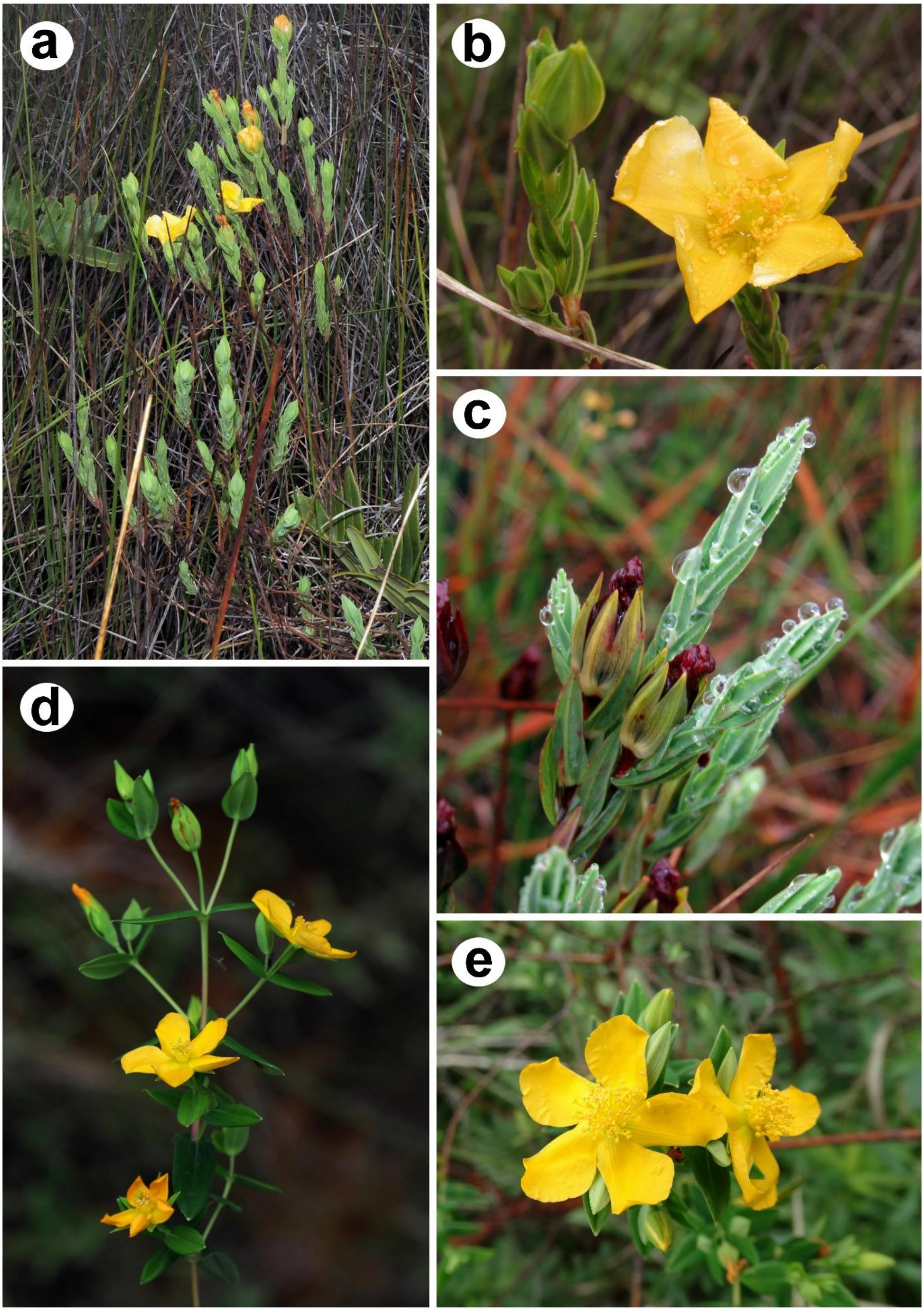

Fig. 11 *Hypericum microlicioides* (**a**–**c**): **a** habit; **b** solitary flower; **c** leaves adpressed and imbricated, short pedicel also visible. *Hypericum rigidum* (**d**–**e**): **d** fertile branch showing patent leaves and the long primary pedicel; **e** flowers grouped in cymes. Photo: Eduardo Lozano (e).

14. *Hypericum mutilum* L., Sp. Pl. 2: 787. 1753. LECTOTYPE: U.S.A. Virginia, *s.d.*, *Clayton 232* (BM000042223 [photo!]; isolectotype: BM000540494 [web!]).

Figs. 10c–e

Description: Small herb, usually single-stemmed, branched from base to apex, sometimes multi-stemmed, diffusely branched at base; glandular. Leaves opposite-decussate, free, membranous to chartaceous, patent, broadly ovate, broadly elliptic or suborbicular, apex obtuse to rounded, base truncate or rounded, rarely subcordate, margin not thickened; venation acrodromous, midrib slightly prominent beneath. Inflorescence 3–8 (–50) flowers, primary pedicels 0.5–1 mm long; bracts and bracteoles reduced. Flowers 2–4 mm in diameter. Sepals 5, subequal to unequal, not recurved, two outer oblong, obovate or ovate and three inner narrowly oblong to oblong, linear glands dense, distally punctiform. Petals (4) 5, yellow. Stamens isolated; connective not prolonged. Styles 3 or 4, straight. Capsule ellipsoid. Seeds yellow.

Geographical distribution and ecology: Argentina (BA, CR, ER, MI), Brazil (RS, SC, PR, SP, MG, and RJ), Paraguay (MI), and Uruguay (RI). Acronyms for the Argentinean, Brazilian, Paraguayan, and Uruguayan political divisions are given in Table 3. *H. mutilum* also occurs in Colombia, Peru, Ecuador, Dominican Republic, Honduras, Mexico, United States, Canada, Portugal, Poland, Italy, France, Soviet Union, the Hawaiian Islands, the Azores and New Zealand (Robson 1990). The species is habitat specialist, occurring always in floodplains, riverbanks, or near water bodies (wetlands).

Conservation status: H. mutilum was already included in the Brazilian national Red List (Martinelli and Moraes 2013). This species was also regionally evaluated for its extinction risk in Rio Grande do Sul state (Decreto 52.109 2014). Both assessments were made according to IUCN Red List Criteria. However, no global assessment exist for this species. *H. mutilum* is also included in the lists of priority species for conservation of Uruguay (Soutullo et al. 2009, 2013). The species is widespread, and while it is possibly declining in parts of its range, it is unlikely that any global population decline could meet (or be close to meeting) the threshold for Vulnerable. Therefore, *H. mutilum* is assessed as Least Concern – LC (IUCN 2012).

Notes: Hypericum mutilum is a small annual herb. The species is characterized by its densely to sparsely glandular stem, leaves with acrodromous venation, three styles with broadly capitate stigmas, and capsules usually ellipsoid (Table 2, Figs. 10c–e). *H. mutilum* seems to be distributed naturally through the SESA grasslands, but it does not belong to the southeast South America clade; indeed, this species is allocated within the sister clade, called ‘America-Asia-Africa’ (Fig. 1).

Additional specimens examined: ARGENTINA. Prov. Buenos Aires: Delta Del Parana, 8 Feb 1937, *A. Burkart 8216* (SI!). Prov. Corrientes: Mburucuyá, 13 Jan 1951, *T.M. Pedersen 944* (LP!). Prov. Entre Rios: Dpto. Concórdia, Yuqueri Grande, 25 Nov 1988, *N.M. Bacigalupo et al. 899* (SI!). Prov. Missiones: Posadas, 25 Nov 1943, *A. Burkart 14021* (SI!). BRAZIL. Minas Gerais: Carandaí, 15 Oct, 2012, *M. Sobral et al. 15088* (HUFSJ!). Paraná: Antonina, 22 Nov 1991, *G. Hatschbach et al. 45101* (MBM!). Rio de Janeiro: Cantagalo, 1916, *Brito 9* (R!, RBR). Rio Grande do Sul: Caxias do Sul, Criúva, *S. Bordignon and A. Knob 1442* (ICN!). Santa Catarina: Urubici, 13 Dec 2015, *C. Vogel Ely et al. 489* (ICN!). São Paulo: São Paulo, Santo Amaro, 27 Jan 1944, *L. Roth 945* (UEC!). PARAGUAY. Dpto. Misiones: Santiago, 19 Oct 1967, *T.M. Pedersen 8657* (SI!). URUGUAY. Dpto. Rivera: Tranqueras, 6 Oct 1954, *B. Rosengurtt et al. s.n.* (MVFA 62!).

15. *Hypericum myrianthum* Cham. & Schltdl., Linnaea 3: 123. 1828. LECTOTYPE: Uruguay, “in campis pratisque provinciarum meridionalium Brasiliae, Montevideo, ad fluvium Rio Negro, alibique frequentem”, 1822 –1823, *Sellow s.n.* (HAL0014759 [photo!]).

Figs. 12a–c

Description: Subshrub, usually single-stemmed, branched from base to apex, eglandular. Leaves opposite-decussate, free, chartaceous, patent, narrowly obovate to obovate, apex rounded, obtuse or acute, base cuneate to parallel-sided, margin not thickened; venation hyphodromous, midrib slightly prominent beneath. Inflorescence c. 25–250 (–∞) flowers, primary pedicels up to 1 mm long; bracts and bracteoles reduced. Flowers 2–5 mm in diameter. Sepals (4) 5, subequal to unequal, not recurved, two outer broadly rhombic, broadly elliptic or obovate and three inner narrowly oblong to oblong, narrowly elliptic or narrowly obovate, 2–4 linear glands, distally punctiform. Petals (4) 5, yellow. Stamens arranged in a continuous ring; connective not prolonged. Styles (2) 3, straight. Capsule elipsoid. Seeds yellow.

Geographical distribution and ecology: Argentina (CR and MI), Brazil (RS), and Uruguay (CL, DU, LA, MA, RI, RN, RO, SA, SO, TA, and TT). Acronyms for the Argentinean, Brazilian, and Uruguayan political divisions are given in Table 3. *H. myrianthum* is habitat generalist, but it occurs preferentially in dry environments from sea level to 950 m.

Conservation status: H. myrianthum was already regionally evaluated for its extinction risk in Rio Grande do Sul state (Decreto 52.109 2014). The assessment was made according to IUCN Red List Criteria and regional adjustments using the LIVE System. However, no global assessment has yet been made for this species. Field expeditions and herbaria revision allowed us to trace the EOO polygon of the taxon reliably (EOO > 330 thousand km^2). However, despite agricultural activities and afforestation (e.g., *Pinus*, *Acacia*, and *Eucalyptus*) seem to be the main threats to this species, *H. myrianthum* has much more subpopulations than we have gathered so far, and any value attributed to AOO would be unrealistic. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum from our assessment. Considering the species’ tolerance to anthropized environments and the EOO datum, *H. myrianthum* qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum myrianthum is about 1 m tall and characterized by the lax inflorescences, usually corymbiform, with numerous tiny flowers. This species differs from *H. tamariscinum*, species morphologically more similar, by having internodes usually longer and visible (vs. shorter internodes often hidden by leaves), leaves with cuneate to parallel-sided base (vs. leaves with subcordate-amplexicaul or parallel-sided base), many lateral inflorescences (vs. none or few lateral inflorescences), and calyx without prominent veins (vs. calyx with prominent veins) (Figs. 12). *H. myrianthum* belongs to the southeast South America clade (Fig. 1).

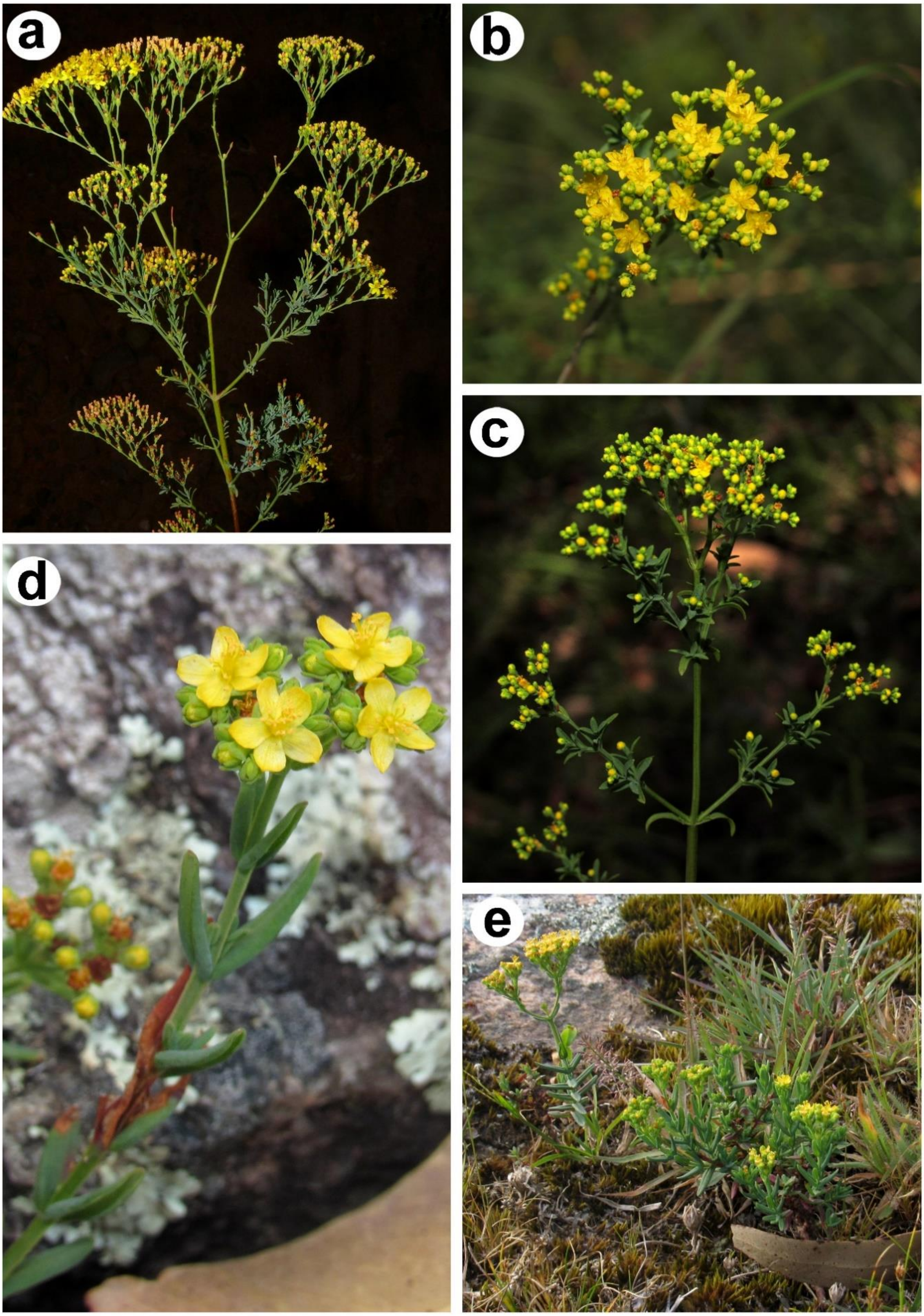

Fig. 12 *Hypericum myrianthum* (**a**–**c**): branch with numerous tiny flowers grouped in a terminal and many lateral lax inflorescences. *Hypericum tamariscinum* (**d**–**e**): **d** branch with numerous tiny flowers grouped in a terminal condensed inflorescence and leaves with subcordate-amplexicaul base; **e** habit and habitat.

Additional specimens examined: ARGENTINA. Prov. Corrientes: Dpto. Santo Tomé, 2 Feb 1976, *A. Krapovickas and C.L. Cristóbal 29134* (MBM!). Prov. Misiones: Dpto. Candelaria, Candelaria, 21 Oct 2001, *A.D. Giácomo s.n.* (SPF 157464 [photo!], CTES). BRAZIL. Rio Grande do Sul: São Gabriel, 25 Nov 2015, *C. Vogel Ely 482* (ICN!). URUGUAY. Dpto. Cerro Largo: ruta 8 km 374, 29 Nov 2001, *G. Seijo et al. 2566* (SI!). Dpto. Durazno: Estancia Las Palmas, Mar 1922, *C. Osten 16859* (MVM!). Dpto. Río Negro: Campo Sunhary, 20 Feb 1908, *M.B. Berro 4220* (MVFA!). Dpto. Rivera: Tranqueras, Nov 1899, *J. Arechavaleta s.n.* (MVM 568!). Dpto. Salto: Daymán, 17 Dec 1905, *M.B. Berro 2260* (MVFA!). Dpto. Soriano: Balza al Norte, 25 Dec 1913, *M.B. Berro 7084* (MVFA!). Dpto. Tacuarembó: Gruta de los Cuervos, 18 Aug 1944, *D. Legrand 3391* (MVM!). Dpto. Treinta y Tres: Quebrada de los Cuervos, Mar 1945, *Rosengurt 4829* (MVFA!).

16. *Hypericum pedersenii* N.Robson, Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 72. 1990. HOLOTYPE: Brazil, Rio Grande do Sul: Arroio dos Ratos, Faxinal, 10 Nov 1977, *Pedersen 11972* (BM001207325 [photo!]; isotypes: MBM163948!, G00355547 [photo!], MO2018350 [photo!], CTES0001808 & CTES0001809 [web!]).

Figs. 13a–b

Description: Shrub to subshrub, single-stemmed, naked below and diffusely branched at apex; eglandular. Leaves opposite-decussate, free, chartaceous to coriaceous, patent or adpressed and imbricated, narrowly elliptic, apex acute to rounded, base attenuate to parallel-sided, margin not thickened; venation hyphodromous, midrib not prominent. Inflorescence 3–11 flowers, primary pedicels 1–2 mm long; bracts and bracteoles reduced. Flowers 10–12 mm in diameter. Sepals 5, equal, not recurved, narrowly ovate, 2 (4) linear glands, distally punctiform. Petals 5, light yellow. Stamens arranged in a continuous ring; connective not prolonged. Styles 3, straight. Capsule ovoid to globose. Seeds brown.

Geographical distribution and ecology: Brazil (RS). Acronyms for the Brazilian political divisions are given in Table 3. Rupicolous species, found in rocky outcrops from 150 to 600 m a.s.l.

Conservation status: H. pedersenii was already included in a regional Red List of Rio Grande do Sul state (Decreto 52.109 2014). However, since new locations were added to the species distribution in the last years, here we reevaluate its conservation status. Individuals of this species are found in isolated subpopulations, almost all located on disturbed areas. Mining activities and afforestation may be considered the main threats to this rupicolous and heliophytic species. That is, the high risk of global populational declines in the near future is mainly due to mining of the rocky outcrops in which *H. pedersenii* occurs, or by the long periods of shading caused by afforestation (e.g., *Pinus* or *Eucalyptus*) that surround subpopulations of this species. Therefore, under the criterion B, *H. pedersenii* met the subcriteria B1 (EOO 2,241 km^2) and B2 (AOO 24 km^2), qualifying as Endangered − EN B1ab(iii,iv)+2ab(iii,iv) (IUCN 2012).

Notes: Hypericum pedersenii differs from *H. salvadorense,* species morphologically more similar, by having narrow equal sepals that are never recurved (vs. broad subequal to unequal sepals, often distally recurved), and leaves with attenuated to parallel-sided base (vs. leaves with subcordate base, rarely parallel-sided) (Fig. 13). *H. pedersenii* belongs to the southeast South America clade (Fig. 1).

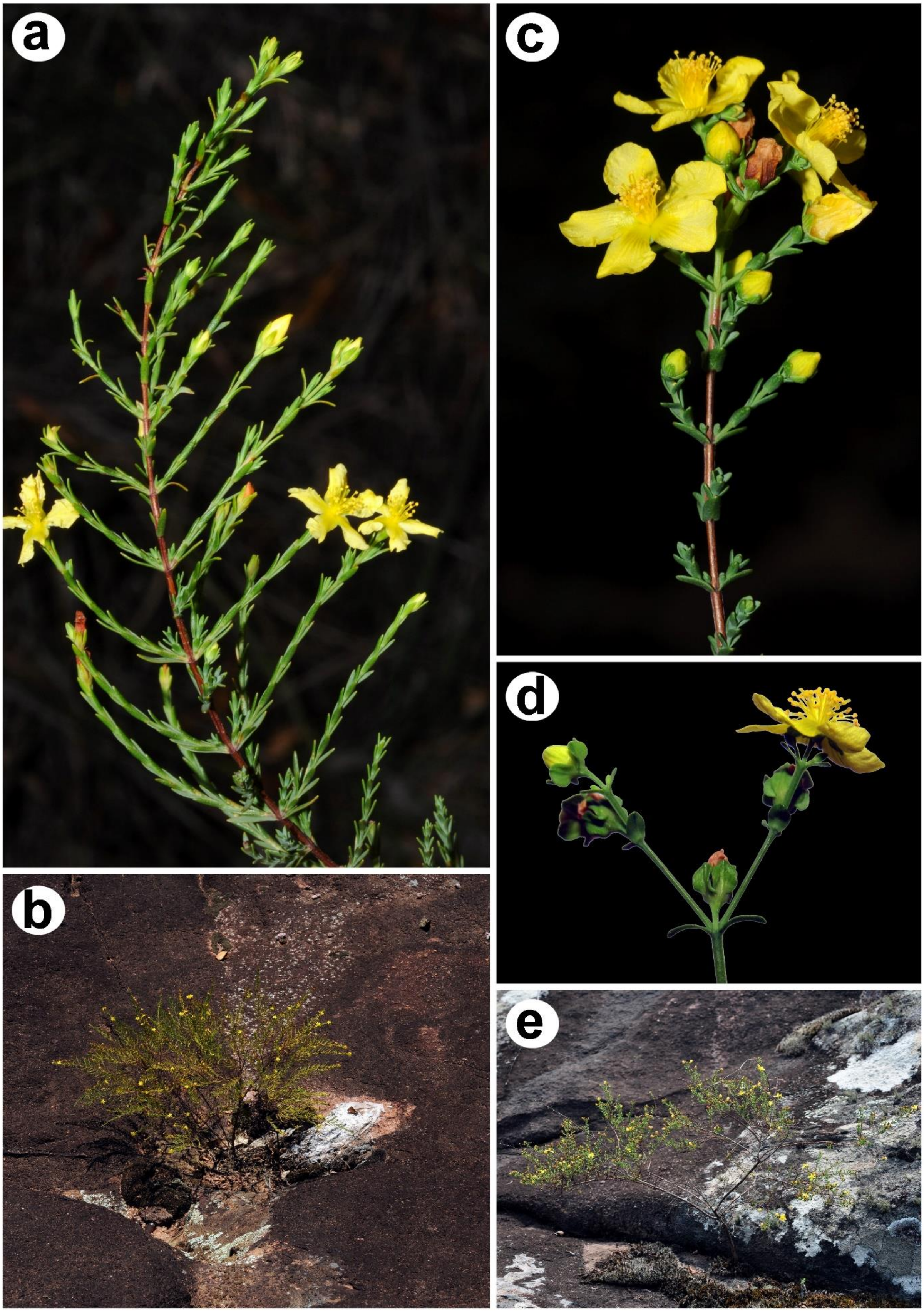

Fig. 13 *Hypericum pedersenii* (**a**–**b**): **a** fertil branch showing the attenuated to parallel-sided leaves base; **b** habit and habitat. *Hypericum salvadorense* (**c**–**e**): **c** fertil branch showing the subcordate leaves base; **d** fertil branch showing the distally recurved sepals; **e** habit and habitat.

Additional specimens examined: BRAZIL. Rio Grande do Sul: Arroio dos Ratos, Cerro Gateado, 15 Jan 2016, *C. Vogel Ely and S. Bordignon 480* (ICN!); Nova Petrópolis, Linha Brasil Fundos, 11 Mar 2012, *M. Grings and L.L. Mosher 1647* (ICN!); São Jerônimo, 16 Jan 2016, *C. Vogel Ely and S. Bordignon 479* (ICN!).

17. *Hypericum piriai* Arechav., Anales Mus. Nac. Montevideo 3: 108. 1898. LECTOTYPE: Uruguay, Maldonado: "colinas de Pan de Azúcar cerca del Castillo de Piriápolis", *s.d.*, *J. Arechavaleta s.n.* (MVM No. 564!; isolectotypes: MVM No. 564!, US00114095 [photo!]).

Figs. 14a–e

Description: Subshrub, single-stemmed or multi-stemmed, usually branched at base; glandular. Leaves opposite-decussate, rarely 3-whorled, free, coriaceous, patent, linear, apex acute, base parallel-sided, margin not thickened; venation hyphodromous, midrib prominent beneath. Inflorescence 1–15 flowers, primary pedicels 2–5 mm long; bracts and bracteoles reduced. Flowers 10–15 mm in diameter. Sepals 5, unequal, not recurved, two outer elliptic and three inner oblong, linear and punctiform glands dense. Petals 5, light yellow. Stamens arranged in three fascicles; connective not prolonged. Styles 3, straight. Capsule ovoid. Seeds black.

Geographical distribution and ecology: Brazil (RS, SC, PR and SP) and Uruguay (CL, LA, MA, and TT). Acronyms for the Brazilian and Uruguayan political divisions are given in Table 3. Different from most non-Andean *Hypericum* species that have aggregate distribution, individuals of *H. piriai* are found sparsely distributed by the landscape. *H. piriai* inhabits dry and stony grasslands from sea level to 1,000 m.

Conservation status: *H. piriai* was already regionally evaluated for its extinction risk in Rio Grande do Sul state (Decreto 52.109 2014). The assessment was made according to IUCN Red List Criteria and regional adjustments using the LIVE System. However, no global assessment has yet been made for this species. Furthermore, although it has different criteria and objectives, it is worth noting that *H. piriai* is also included in the lists of priority species for conservation of Uruguay (Soutullo et al. 2009, 2013). Afforestation (e.g., *Pinus, Acacia*, and *Eucalyptus*), mining and agricultural activities may be considered the main threats to this species. Our field knowledge and herbaria revision allowed us to trace the EOO polygon of the taxon reliably (EOO > 298 thousand km^2). On the other hand, for *H. piriai,* our best estimate of AOO is still underestimated. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum from our assessment. The species is possibly declining in parts of its range, but it is still unlikely that any global population decline could meet (or be close to meeting) the threshold for Vulnerable. Therefore, considering the EOO datum, *H. piriai* currently qualifies as Least Concern – LC (IUCN 2012).

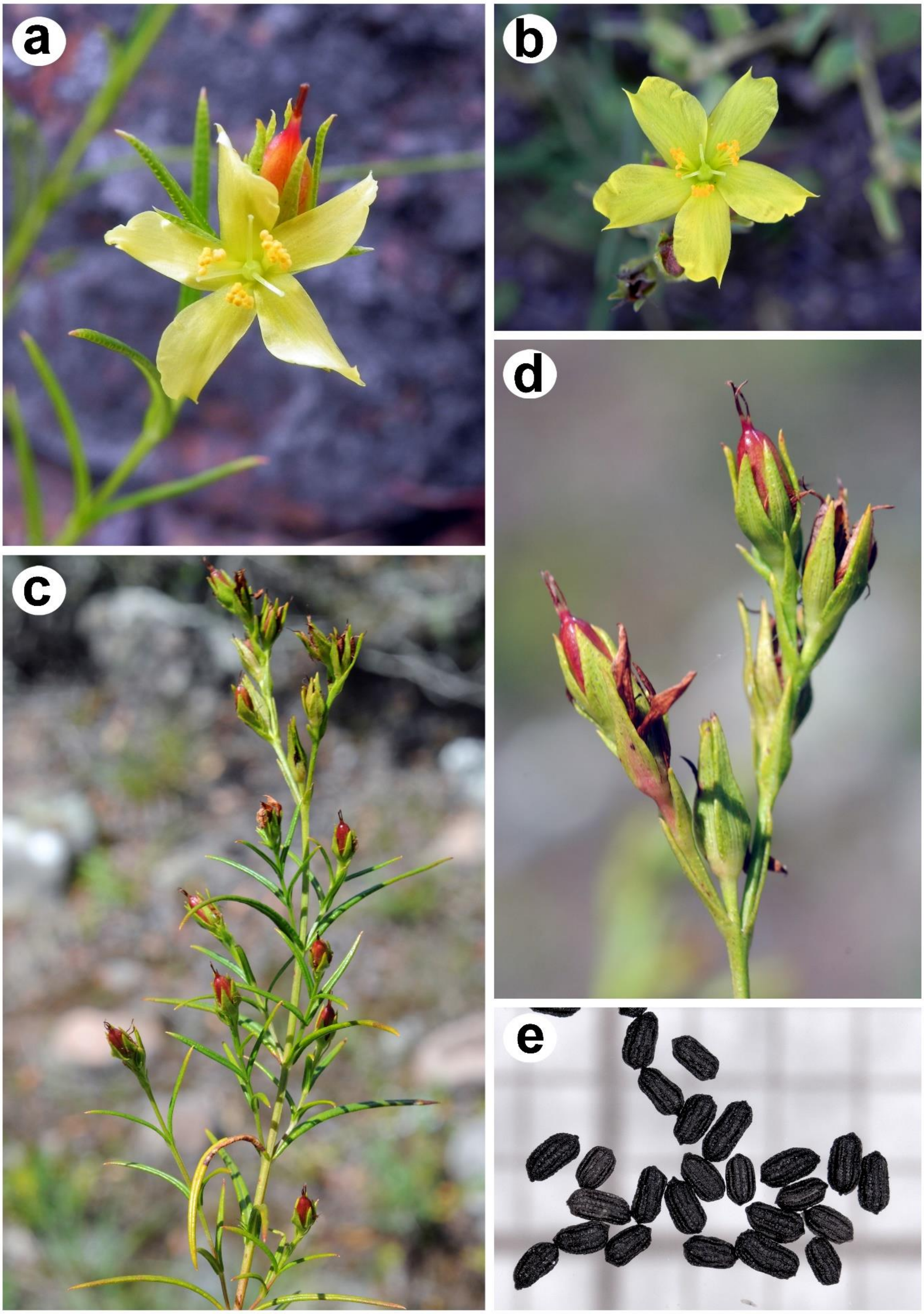

Fig. 14 *Hypericum piriai* (**a–e**): **a** fertil branch; **b** flower showing stamens grouped in three fascicles; **c** leaves linear and coriaceous; **d** capsules and unequal sepals; **e** black seeds. Photos: Gabriel E. Ferreira (a, b).

Notes: unlike all other *Hypericum* species allocated in the southeast South America clade, *H. piriai* is characterized by its densely to sparsely glandular stem (vs. eglandular stem), stamens grouped in three fascicles (vs. stamens arranged in a continuous ring), and black seeds (vs. yellow to brown seeds) (Table 2, Fig. 14). We want to emphasize that flowers obconic to pseudo-tubular were described for *H. piriai* (Robson 1987, 2012), but we have never observed such characteristic. *H. piriai* has stellate corolla, as well as all other *Hypericum* species from SESA grasslands (Fig. 14a, b). The only observed difference between the other non-Andean species and *H. piriai* is related to corolla movement. That is, *H. piriai* closes its flowers with the petals straight, similar to a tube, which might have generated the misinterpretation of the corolla shape, while petals from species of the clade roll up in a cartridge form (Fig. 2d). *H. piriai* is distributed exclusively in SESA grasslands, but it does not belong to the southeast South America clade; indeed, it is allocated as sister to the remaining *Brathys* s.l. group (Fig. 1).

Additional specimens examined: BRAZIL. Paraná: Ponta Grossa, Parque Estadual Vila Velha, 13 Nov 2016, *L.N. da Silva 738* (ICN!). Rio Grande do Sul: Porto Alegre, Morro São Pedro, 13 Oct 2006, *R. Setubal et al. 418* (ICN!). Santa Catarina: Abelardo Luz, 15 Nov 1964, *L.B. Smith and R.M. Klein 13305* (US [photo!]). São Paulo: São Paulo, Santo Amaro, 3 Nov 1943, *L. Roth 822* (CESJ!). URUGUAY. Dpto. Cerro Largo: estancia Perdomo, 10 Nov 1965, *Arrillaga et al. 2391* (MVFA!). Dpto. Lavalleja: salto del Penitente, 24 Nov 1990, *E. Marchesi s.n.* (MVFA 19975!). Dpto. Maldonado: Punta Ballena, 12 Oct 1956, *Arrillaga 420* (MVFA!). Dpto. Treinta y Tres: quebrada de los cuervos, 24 Jan 1967, *B. Rosengurtt and O. del Puerto 10753* (MVFA!).

18. *Hypericum pleiostylum* C.Rodr.Jim., Mem. Soc. Cienc. Nat. La Salle 33(94–95): 118. 1973. HOLOTYPE: Brazil, Minas Gerais: Caldas, Nov 1869, *A.F. Regnell in herb. Regnelli Ser. III, No. 1732* (UPS No. V-930159 [photo!]; isotype: UPS No. V-930160 [photo!]).

Description: Robson (1990), Rodríguez Jiménez (1973).

Geographical distribution and ecology: Brazil (MG and RJ). Acronyms for the Brazilian political divisions are given in Table 3. *H. pleiostylum* has only two collection points (without exact location), both in humid environments (e.g., river bank).

Conservation status: H. pleiostylum is only known by the type specimens, and there is no accurate information about collection localities (last seen in 1876). It is possible that *H. pleiostylum* occurs within a protected area (Parque Nacional do Itatiaia), but the plant search gets a little more complicated because it is a small annual herb. That is, only someone with an eye trained to see small herbs and doing fieldwork in the right season could find this species. Besides, it is known that even inside the National Parks like Itatiaia, illegal activities such as pasture and agriculture threaten local biodiversity (Costa et al. 2015). This species could possibly be extinct, but intensive field effort is needed to identify if it is still extant. Hence, due to the restricted range of *H. pleiostylum* and its latent extinction risk, this species was assessed as Critically Endangered (Possibly Extinct) under criterion B2ab(ii,iii) (IUCN 2012).

Notes: Hypericum pleiostylum resembles *H. mutilum* by its habit and habitat but can be differentiated from it by the styles number. That is, *H. mutilum* has three or four styles, and *H. pleiostylum* have five or more styles. By its restricted distribution in SESA grasslands, flowers grouped in cymes, and stem without glands, *H. pleiostylum* probably belongs to the southeast South America clade.

Additional specimens examined: BRAZIL. Minas Gerais: Caldas, 20 Nov 1873, *H. Mosén 823* (P [photo!]). Rio e Janeiro: Itatiaia, 20 Nov 1876, *A. Glaziou 8284* (R!, P [photo!]).

19. *Hypericum polyanthemum* Klotzsch ex Reichardt, Fl. Bras. 12(1): 189. 1878. NEOTYPE: Brazil, *s.loc.*, 1823–1828, *Sellow s.n.* (K000815950 [photo!]).

Figs. 3c–d

Description: Small herb or subshrub, multi-stemmed, usually diffusely branched at base, sometimes single-stemmed, unbranched or branched from base to apex; eglandular, rarely few glands nearby or at inflorescence. Leaves opposite-decussate, rarely 3-whorled, free, chartaceous, patent, linear to narrowly oblong, apex obtuse to rounded, base subcordate-amplexicaul, margin not thickened; venation usually hyphodromous, sometimes actinodromous, midrib prominent beneath. Inflorescence 3–30 flowers, primary pedicels 1–3.5 mm long; bracts and bracteoles reduced. Flowers 12–20 mm in diameter. Petals 5, yellow, usually tinged in red below. Sepals 5, unequal, rarely subequal, usually distally recurved, two outer broadly elliptic to elliptic and three inner narrowly elliptic to elliptic or oblong, linear glands dense, distally punctiform. Stamens arranged in a continuous ring; connective not prolonged. Styles 3, 4 or 5, straight. Capsule ovoid to globose. Seeds yellow.

Geographical distribution and ecology: Argentina (CR), Brazil (RS and SC), and Uruguay (AR, CL, RI, and TA). Acronyms for the Argentinean, Brazilian, and Uruguayan political divisions are given in Table 3. Here we report the first record of *H. polyanthemum* for Argentina, increasing its known distribution by more than 100 km to the west. The species is more often found in parts of rocky outcrops where there is an accumulation of organic matter and moisture and less frequently in dry and stony grasslands, in either case from sea level to 1,100 m.

Conservation status: H. polyanthemum was already regionally evaluated for its extinction risk in Rio Grande do Sul state (Decreto 52.109 2014). The assessment was made according to IUCN Red List Criteria and regional adjustments using the LIVE System. However, no global assessment has yet been made for this species. Furthermore, although it has different criteria and objectives, it is worth noting that *H. polyanthemum* (called by its synonym *H. rivulare* Arechav.) was also included in the lists of priority species for conservation of Uruguay (Soutullo et al. 2009, 2013). Afforestation (e.g., *Pinus*, *Acacia*, and *Eucalyptus*), mining and agricultural activities may be considered the main threats to this species. Our field knowledge and herbaria revision allowed us to trace the EOO polygon of the taxon reliably (EOO > 198 thousand km^2). On the other hand, for *H. polyanthemum*, our best estimate of AOO is still underestimated. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum from our assessment. The species is possibly declining in parts of its range, but it is still unlikely that any global population decline could meet (or be close to meeting) the threshold for Vulnerable. Therefore, considering the EOO datum, *H. polyanthemum* currently qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum polyanthemum differs from *H. austrobrasiliense*, species morphologically more similar, by its leaves with subcordate-amplexicaul base (vs. leaves with parallel-sided base), and the strongly unequal and distally recurved sepals (vs. equal to subequal sepals, never recurved) (Fig. 3). *H. polyanthemum* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: ARGENTINA. Prov. Corrientes: Dpto. San Martín, Tres Cerros, 16 Sep 1979, *A. Schinini et al. 18595* (CTES!, MBM!). BRAZIL. Rio Grande do Sul: Bagé, Rincão do Inferno, 14 Sep 2017, *C. Rabuske and M. Köhler 67* (ICN!). Santa Catarina: Sombrio, 9 Oct 1945, *R. Reitz 1965* (US [photo!]). URUGUAY. Dpto. Artigas: naciente del arroyo Pintado Grande, 29 Oct 1991, *Brescia et al. s.n.* (MVFA 22050!). Dpto. Cerro Largo: Sierra de Ríos, 21 Oct 1992, *Izaguirre et al. s.n.* (MVFA 21073!). Dpto. Rivera: Arroyo Lunarejo, 15 Nov 1983, *C. Brussa et al. s.n.* (MVJB 21369!). Dpto. Tacuarembó: Valle Edén, 26 Jan 2013, *N. O'Leary 651* (SI!).

20. *Hypericum rigidum* A.St.-Hil., Fl. Bras. Merid. 1: 336. 1828. LECTOTYPE: Brazil, Paraná: "crescit ad rivulos prope urbem Curityba, in parte australi provinciæ Sancti Pauli", 1820, *A. de Saint-Hilaire C2-1631 pro parte* (P00798956 [photo!]; isolectotype: P00798957 [photo!]).

Figs. 11d–e

Description: Shrub to subshrub, single-stemmed, usually naked below and diffusely branched at apex; eglandular. Leaves opposite-decussate, free, chartaceous to coriaceous, patent, narrowly to broadly oblong, narrowly to broadly elliptic, apex acute, obtuse or rounded, base truncate, cuneate or subcordate, margin not thickened; 1–6 pairs of secondary veins emerging from leaf base and ascending laterally to the midrib, secondary veins also emerging from the median region of the midrib and branching into connected arches, midrib prominent beneath. Inflorescence 1–20 (–33) flowers, primary pedicels 4–20 mm long; bracts and bracteoles foliaceous, rarely reduced. Flowers 15–20 (–25) mm in diameter. Sepals 5, equal, not recurved, narrowly oblong, linear and punctiform glands sparce. Petals 5, yellow to dark orange. Stamens arranged in a continuous ring; connective not prolonged. Styles 5, straight. Capsule ovoid. Seeds yellow.

Geographical distribution and ecology: Brazil (RS, SC, PR, SP, MG, and RJ). Acronyms for the Brazilian political divisions are given in Table 3. Here we report the first record of *H. rigidum* for Rio de Janeiro state (Brazil), increasing its known distribution by more than 50 km to the east. The species is habitat specialist, occurring in floodplains, bogs, peatlands, riverbanks, or near water bodies (wetlands) of Brazilian Atlantic Forest and Cerrado, occurring mainly from 900 and 1,700 m a.s.l.

Conservation status: H. rigidum was already included in a regional Red List of Rio Grande do Sul state (Decreto 52.109 2014). The assessment was made according to IUCN Red List Criteria and regional adjustments using the LIVE System. However, no global assessment has yet been made for this species. Individuals of this species are found in small and isolated subpopulations, almost all located on disturbed areas. Habitats suitable (wetlands) for *H. rigidum* have been severely converted mainly into agricultural areas (e.g., soybean) and afforestation (e.g., *Pinus*). Such economic activities are extremely compromising for heliophytic species as *H. rigidum* and, probably represent the main threat for this and many other *Hypericum* species. Considering that *H. rigidum* occurs in severely fragmented habitats and has experienced or will tend to experience global populational decline soon, it may be considered a species of elevated conservation concern. Under the criterion B, *H. rigidum* does not meet the subcriterion B1 (EOO > 495 thousand km^2) but meet the subcriterion B2 (AOO 260 km^2), qualifying as Endangered − EN B2ab(ii,iii,iv,v) (IUCN 2012).

Notes: Hypericum rigidum is characterized by the foliaceous bracts, a very long primary pedicel, and a characteristic venation pattern. Foliaceous bracts and venation pattern are characteristics shared with *H. microlicioides*, of which can be differentiated by having patent leaves (vs. adpressed leaves), smaller flowers arranged in cymose inflorescences (vs. large solitary flowers), and primary pedicels much longer (Fig. 11). Despite the wide morphological variation of *H. rigidum*, we dispense the use of infraspecific categories and treat the species in a broad sense (Vogel Ely et al. 2018). *H. rigidum* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: BRAZIL. Minas Gerais: Passa Quatro, 22 Apr 1948, *A. Barbosa 144* (NY [photo!]). Paraná: Tijucas do Sul, Rincão, 28 Apr 1974, *G. Hatschbach 34336* (MBM!, RB!). Rio Grande do Sul: São Francisco de Paula, 13 Nov 2015, *C. Vogel Ely and S. Bordignon 435* (ICN!). Santa Catarina: Porto União, 3 Feb 1957, *L.B. Smith and R.M. Klein 10719* (US [photo!]). São Paulo: São Paulo, 9 Jan 1946, *F.K. Rawitscher 182* (SPF [photo!]).

21. ***Hypericum robsonii*** H.A.Keller & S.Crockett, Phyton (Horn) 55(1): 20. 2015. HOLOTYPE: Argentina, Misiones Province: Department of Candelaria, Loreto, 31 Oct 2013, *H.A.Keller, Ramírez & Franco 11752* (CTES [n.v.]; isotype: BM [n.v.])

Figs. 4c–d

Description: Small herb, multi-stemmed, diffusely branched at base; eglandular. Leaves 3–4-whorled, free, chartaceous, patent, linear or narrowly elliptic to narrowly oblong, apex strongly acute to acuminate, base paralled-sided or slightly attenuate, margin not thickened; venation hyphodromous, midrib prominent beneath. Inflorescence reduced to 1 flower, primary pedicels 2–10 mm long; bracts and bracteoles foliaceous. Flowers c. 20 mm in diameter. Sepals 6 (7) 8, equal to subequal, not recurved, narrow triangular, linear glands absent, punctiform glands dense. Petals 6 (7) 8, yellow. Stamens arranged in a continuous ring, connective not prolonged. Styles 3, 4 or 5, straight. Capsule usually pyriform or obovoid. Seeds yellow to light brown.

Geographical distribution and ecology: Argentina (MI). Acronyms for the Argentinean political divisions are given in Table 3. *H. robsonii* was only found growing in sandy grasslands at 118 m a.s.l. (Keller and Crockett 2015).

Conservation status: H. robsonii was already assessed for the IUCN Red List, qualifying as Critically Endangered (Keller and Crockett 2015). The species does not occur in any protected area, and despite the threats and restricted range, this species has not yet been included in any official Red List.

Notes: Hypericum robsonii is a small plant, characterized by its patent leaves, arranged in three to four whorls, solitary flowers with six to eight sepals and petals, and capsules usually pyriform or obovoid (Figs. 4c, d). *H. robsonii* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: ARGENTINA. Prov. Misiones: Dpto. Candelária, Loreto, 2 Dec 2013, *H.A. Keller et al. 11874* (CTES, ICN!).

22. ***Hypericum salvadorense*** N.Robson, Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 79. 1990. HOLOTYPE: Brazil, Rio Grande do Sul: São Salvador, Dec 1941, *Leite 734* (NY00075924 [photo!]).

Figs. 13c–e

Description: Shrub to subshrub, single-stemmed, usually naked below and diffusely branched at apex; eglandular. Leaves opposite-decussate, rarely 3- whorled, free, chartaceous to coriaceous, patent, narrowly oblong to oblong, narrowly ovate to ovate, rarely obovate, apex obtuse to rounded-cucullate, base subcordate, rarely parallel-sided, margin not thickened; venation hyphodromous, midrib not prominent. Inflorescence 3–31 flowers, primary pedicels 0.5–2 mm long; bracts and bracteoles foliaceous. Flowers 8–12 mm in diameter. Sepals 5, subequal to unequal, often distally recurved, two outer broadly rhombic to ovate and three inner oblong to elliptic, (2) 4 (6) linear glands, distally punctiform. Petals 5, light yellow to yellow. Stamens arranged in a continuous ring; connective not prolonged. Styles 3 (4), straight. Capsule ovoid to globose. Seeds brown.

Geographical distribution and ecology: Brazil (RS and SC). Acronyms for the Brazilian political divisions are given in Table 3. Rupicolous species, found in rocky outcrops from 100 to 1,200 m a.s.l.

Conservation status: H. salvadorense was already included in a regional Red List of Rio Grande do Sul state (Decreto 52.109 2014). However, no global assessment has yet been made for this species. Individuals of this species are found in isolated subpopulations, almost all located on disturbed areas. For *H. salvadorense*, many threats are acting on different subpopulations. Although livestock seems a good way to maintain the native grasslands, *H. salvadorense* seems threatened by this activity. Livestock farming seems to be responsible for the reduction in the number of individuals of this species. That is, rocky grasslands in which *H. salvadorense* occurs often has little supply of forage stimulating the cattle to eat the aboveground part of plants, and probably reducing the reproductive success of this species. Cattle trampling can also be considered a threat factor, since hinders seedling recruitment. We realized the threatening effects of livestock when we observed the contrasting number of mature individuals from adjacent areas with and without cattle. Habitat loss by the invasive alien species (e.g., *Urochloa*) and afforestation are threats that were also noted acting on different *H. salvadorense* subpopulations. Therefore, under the criterion B, *H. salvadorense* did not meet the subcriterion B1 (EOO 40,794 km^2) but met the subcriterion B2 (AOO 48 km^2), qualifying as Endangered − EN B2ab(iii,iv,v) (IUCN 2012).

Notes: Hypericum salvadorense differs from *H. pedersenii*, species morphologically more similar, by having broad unequal or subequal sepals that usually are recurved (vs. narrow equal sepals, not recurved), and leaves with subcordate base (vs. leaves with attenuate to parallel-sided base) (Fig. 13). *H. salvadorense* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: BRAZIL. Rio Grande do Sul: Glorinha, Maracanã, 5 Nov 2015, *C. Vogel Ely and S. Bordignon 396* (ICN!); Encruzilhada do Sul, Cerro São Salvador, 27 Nov 2012, *C. Vogel Ely et al. 114* (ICN!). Santa Catarina: Painel, 29 Jan 2015, *C. Vogel Ely and K. Helmicki 388* (ICN!).

23. *Hypericum tamariscinum* Cham. & Schltdl., Linnaea 3: 124. 1828. LECTOTYPE: Uruguay, "in provincia Montevideo Brasiliae australis", 1821–1826, *Sellow 617* (HAL0015024 [photo!]; isolectotype: M-0112222 [photo!].

Figs. 12d–e

Description: Subshrub, multi-stemmed, difuselly branched at base, rarely at apex; eglandular. Leaves opposite-decussate, free, chartaceous to coriaceous, frequently adpressed and imbricate, narrowly oblong to oblong, narrowly ovate to ovate, narrowly elliptic to elliptic, rarely obovate, apex obtuse to rounded, base subcordate-amplexicaul or parallel-sided, margin not thickened; venation hyphodromous, midrib slightly prominent beneath. Inflorescence c. 18–95 flowers, primary pedicels 1–2 mm long; bracts and bracteoles reduced. Flowers 2–5 mm in diameter. Sepals 5, unequal, not recurved, elliptic to broadly elliptic, 4–6 linear glands, distally punctiform. Petals (4) 5, light yellow to yellow. Stamens arranged in a continuous ring; connective not prolonged. Styles (2) 3 or 4, straight. Capsule globose or ovoid. Seeds yellow to light brown.

Geographical distribution and ecology: Brazil (RS) and Uruguay (CL, LA, and MA). Acronyms for the Brazilian and Uruguayan political divisions are given in Table 3. *H. tamariscinum* occurs in dry and stony grasslands or rocky outcrops from sea level to 200 m a.s.l.

Conservation status: Some records of *H. tamariscinum* included on this evaluation are very old, and we could not verify if they still exist in nature (more than 100 years since the last collection). Therefore, since most *Hypericum* species occur on disturbed areas, field effort is needed to identify which subpopulations are still extant. One subpopulation we know in the field occurs in a livestock area and is surrounded by afforestation of *Eucalyptus*, which probably is the main threat to this species. For the other two living subpopulations, we could not detect threats. Therefore, under the criterion B, *H. tamariscinum* does not meet the subcriterion B1 (EOO > 109 thousand km^2) but meet the subcriterion B2 (AOO 28 km^2), qualifying as Endangered − EN B2ab(i,ii,iii,iv) (IUCN 2012).

Notes: Hypericum tamariscinum is a small leafy plant, about 30 cm tall, and characterized by the condensed inflorescences with numerous tiny flowers (Figs. 12d, e). This species differs from *H. myrianthum*, species morphologically more similar, by having multiple stems generally arising at the base, shorter internodes often hidden by the leaves that usually have subcordate-amplexicaul base (vs. leaves with cuneate to parallel-sided base), none or few lateral inflorescences (vs. many lateral inflorescences), and calyx with prominent veins (vs. calyx without prominent veins). *H. tamariscinum* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: BRAZIL. Rio Grande do Sul: Capão do Leão, 1 Nov 2012, *F.P. Torchelsen s.n.* (ICN 157797!). URUGUAY. Dpto. Cerro Largo: Isla de Zapata, 24 Jan 1877, *J. Arechavaleta 3434* (MVM!). Dpto. Lavalleja: Fuente Salus, Nov 1941, *A. Lombardo 6144* (MVJB!). Dpto. Maldonado: Sierra de las Animas, 19 Jan 1996, *M. Bonifacino s.n.* (MVFA 25455!).

24. *Hypericum teretiusculum* A.St.-Hil., Fl. Bras. Merid. 1: 331. 1828. LECTOTYPE: Brazil, [Paraná], "prope flumen Tarerè [Itararé], in parte australi provinciæ Sancti Pauli", 1820, *A. de Saint-Hilaire C2-1385* (P00798964 [photo!]; isolectotype: P00798965 [photo!]).

Figs. 7c–d

Description: Subshrub, single-stemmed, branched from base to apex; single-stemmed. Leaves opposite-decussate, free to ⅓ connate at the base, chartaceous to coriaceous, patent; broadly ovate to broadly elliptic, apex acute to rounded, base truncate, rounded or subcordate, margin not thickened; venation brochidodromous, midrib prominent beneath. Inflorescence 10–60 (–80) flowers, primary pedicels 3–4 mm long; bracts and bracteoles reduced. Flowers 15–20 (–25) mm in diameter. Sepals 5, equal to subequal, not recurved, ovate, elliptic or narrowly oblong to oblong, linear glands dense, distally punctiform. Petals 5, yellow to golden yellow. Stamens arranged in a continuous ring; connective not prolonged. Styles 5, straight. Capsule ovoid. Seeds yellow to light brown.

Geographical distribution and ecology: Argentina (MI), Brazil (RS, SC, PR, and SP) and Paraguay (GU). Acronyms for the Argentinean, Brazilian, and Paraguayan political divisions are given in Table 3. Here we report the first record of *H. teretiusculum* for Argentina, and although the possible occurrence of this species has already been indicated for São Paulo state (Robson 1990; Bittrich 2003), here we also report the first record of *H. teretiusculum* for this Brazilian State, increasing its known distribution by more than 50 km to the north. *H. teretiusculum* inhabits dry grasslands from 100 to 1,100 m a.s.l.

Conservation status: H. teretiusculum was already included in a regional Red List of Rio Grande do Sul state (Decreto 52.109 2014). The assessment was made according to IUCN Red List Criteria and regional adjustments using the LIVE System. However, no global assessment has yet been made for this species. Individuals of this species are usually found in small and isolated subpopulations, located mainly on disturbed areas (e.g., roadsides). Considering that afforestation and agricultural activities are accelerating the fragmentation of suitable habitats of this species, we can expect some populational decline soon. Roads construction, or even its maintenance, can also be considered an imminent threat to those subpopulations that occur roadsides. Our field knowledge and herbaria revision allowed us to trace the EOO polygon of the taxon reliably (EOO > 365 thousand km^2). On the other hand, for *H. teretiusculum,* our best estimate of AOO is still underestimated. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum from our assessment. The species is possibly declining in parts of its range, but it is still unlikely that any global population decline could meet (or be close to meeting) the threshold for Vulnerable. Therefore, considering the EOO datum, *H. teretiusculum* currently qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum teretiusculum is more commonly confused with *H. caprifoliatum* and *H. connatum,* of which can be differentiated by the brochidodromous venation of leaves and narrowly triangular bracts that are bigger than 2 mm in length (*H. caprifoliatum*), and by the absence of leaves with thickened margin (*H. connatum*) (Fig. 7c, d). Heterophylly is common in this species. *H. teretiusculum* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: ARGENTINA. Prov. Misiones: Dpto. Apóstoles, Apóstoles, 8 Dec 1986, *C.C. Xifreda and S. Maldonado 383* (SI!). BRAZIL. Paraná: Ponta Grossa, 6 Jan 2016, *C. Vogel Ely et al. 505* (ICN!); Porto Amazônas, 16 Dec 1929, *Gurgel* (RB 120878!). Rio Grande do Sul: Cachoeira do Sul, 14 Dec 2015, *C. Vogel Ely et al. 146* (ICN!); São Francisco de Paula, 21 Nov 2012, *S. Bordignon and G. von Poser s.n.* (ICN 157789!). Santa Catarina: Bom Retiro, 19 Jan 2013, *C. Vogel Ely et al. 494* (ICN!); Vargem, 1 Nov 2015, *C. Vogel Ely and R. Trevisan 412* (ICN!). São Paulo: Itapeva, 23 Apr 2008, *J.B. Baitello et al. 2141* (HUEFS!). PARAGUAY. Dpto. Guairá: Villarrica, 5 Oct 1905, *E. Hassler 8758* (K [photo!]).

25. ***Hypericum ternum*** A.St.-Hil., Fl. Bras. Merid. 1: 330. 1828. LECTOTYPE: Brazil, Paraná: [Palmeira], “prope pagulum vulgò Fregesia nova, in parte australi provinciæ Sancti Pauli dictâ Distrito de Curityba”, Mar 1820, *A. de Saint-Hilaire C2-1585* (P00798962 [photo!]; isolectotype: P00798963 [photo!]).

Figs. 8c–d

Description: Subshrub, single-stemmed, branched asymmetrically at apex, eglandular**.** Leaves opposite-decussate or 3-whorled, free, coriaceous, imbricated and adpressed, narrowly elliptic to elliptic, narrowly oblong or narrowly ovate, apex acute, base subcuneate, subcordate or parallel-sided; margin not thickened; venation hyphodromous, midrib not prominent. Inflorescence 3–7 flowers, primary pedicels 1–2 mm long; bracts and bracteoles reduced. Flowers 10–20 mm in diameter. Sepals 5, subequal, not recurved, narrowly ovate to ovate or narrowly oblong to oblong, linear glands sparce, punctiform glands dense. Petals 5, light yellow to yellow. Stamens arranged in a continuous ring; connective not prolonged. Styles 3, straight. Capsule globose. Seeds light brown.

Geographical distribution and ecology: Brazil (RS, SC, PR, SP, and MG). Acronyms for the Brazilian political divisions are given in Table 3. *H. ternum* inhabits dry and stony grasslands of Brazilian Atlantic Forest and Cerrado, occurring mainly between 800 and 1,800 m a.s.l.

Conservation status: H. ternum was already included in a regional Red List of Rio Grande do Sul state (Decreto 52.109 2014). The assessment was made according to IUCN Red List Criteria and regional adjustments using the LIVE System. However, no global assessment has yet been made for this species. Some subpopulations of *H. ternum* occurs within protected areas (e.g., Parque Estadual da Serra do Papagaio). Nevertheless, habitats suitable for *H. ternum* are being reduced mainly due to agricultural activities (e.g., soybean) and afforestation (e.g., *Pinus, Eucalyptus,* and *Malus*). These economic activities are extremely compromising for heliophytic species as *H. ternum* and, probably represent the main threat for this and many other *Hypericum* species. Herbaria revision and field knowledge allowed us to trace the EOO polygon of the taxon reliably (EOO > 276 thousand km^2). On the other hand, for *H. ternum,* our best estimate of AOO is still underestimated. Therefore, we choose to adopt a realistic attitude and exclude the inaccurate AOO datum. The species is possibly declining in parts of its range, but it is still unlikely that any global population decline could meet (or be close to meeting) the threshold for Vulnerable. Therefore, considering the abundance of the species within its distribution range and the EOO datum, *H. ternum* currently qualifies as Least Concern – LC (IUCN 2012).

Notes: Hypericum ternum is sometimes confused with *H. cordiforme*, species morphologically most similar, of which can be differentiated by its stem with many lateral branches (vs. stem without or with few lateral branches), arranged asymmetrically (vs. symmetrically arranged), short internodes, and narrow leaves that are usually imbricated and adpressed, often arranged in three whorls (vs. cordiform leaves that are more often patent and never arranged in three whorls) (Figs. 8c, d). Heterophylly is common in this species. *H. ternum* belongs to the southeast South America clade (Fig. 1).

Additional specimens examined: BRAZIL. Minas Gerais: Alagoa, Parque Estadual Serra do Papagaio, 9 Nov 2007, *L. Echternacht et al. 1538* (RB!); Cachoeira do Campo, 28 Jun 1941, *M. Barreto and A.P. Viegas 6365* (UEC!, NY [photo!]). Paraná: Curitiba, 23 Nov 1970, *G. Hatschbach 25605* (MBM!); Lapa, Serrinha, 13 Oct 1946, *O. Curial 488* (MBM!); Palmeira, 20 Oct 1989, *V. Nicolack and J. Cordero 63* (HUEFS [photo!]). Rio Grande do Sul: Cambará do Sul, Itaimbezinho, 3 Dec 1971, *M.L. Porto et al.* (ICN 9316!). Santa Catarina: Balsa Nova, 12 Oct 1999, *A. Dunaiski Jr. and W. do Amaral 1375* (UPCB!); São Bento do Sul, Rio Vermelho, 24 Nov 2013, *P. Schwirkowski 81* (FURB!). São Paulo: [São José do Barreiro], Serra da Bocaína, 23 Apr 1953, *A.C. Brade 20699* (HB!, P [photo!]).

ACKNOWLEDGEMENTS

CVE thanks Neotropical Grassland Conservancy for financial support in the field activities and herbaria revision, and to Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES, finance code 001) and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, grant 141635/2015-0) for awarding her scholarships. SALB thanks for his Research Productivity grant. We are deeply grateful to Eudes Maria Stiehl-Alves and Leonardo Nogueira da Silva for their helpful assistance in laboratory activities and phylogenetic analyses, and to all who directly or indirectly assisted us in the numerous field trips and herbaria revision.

COMPLIANCE WITH ETHICAL STANDARDS

Conflict of interest: The authors declare that they have no confict of interest.

INFORMATION ON ELECTRONIC SUPPLEMENTARY MATERIAL

Online Resource 1 Bayesian and maximum likelihood topology trees based on nuclear and chloroplast DNA sequences (ITS, At1G13040, petD, and trnL). a Bayesian tree. b Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

Online Resource 2 Bayesian and maximum likelihood topology trees based on nuclear DNA sequences (ITS and At1G13040). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

Online Resource 3 Bayesian and maximum likelihood topology trees based on chloroplast DNA sequences (*petD* and *trnL*). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

Online Resource 4 Bayesian and maximum likelihood topology trees based on nuclear DNA sequences (ITS). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

Online Resource 5 Bayesian and maximum likelihood topology trees based on nuclear DNA sequences (At1G13040). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

Online Resource 6 Bayesian and maximum likelihood topology trees based on chloroplast DNA sequences (*petD*). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

Online Resource 7 Bayesian and maximum likelihood topology trees based on chloroplast DNA sequences (*trnL*). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

Online Resource 8 Species list, collection data and voucher information used to construct the species richness map (xls file).

Online Resource 9 Area of occupancy **(**AOO) and extent of occurrence (EOO) values of all threatened species with more than one location obtained through GeoCAT webtool.

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Appendix 1 Vouchers of *Hypericum* and outgroups used for molecular analyses and GenBank/EMBL accession numbers for *petD*, *trnL*, ITS, and AtG13040 sequences.

H. aciculare Kunth, Quizhepe and S. Lægaard 36 (BM), *petD* LT904551, ITS HG004649; *H. acostanum* N.Robson, Harling and Andersson 22231 (BM), *petD* LT904552, ITS LT904641; *H. adpressum* W.P.C.Barton, Crockett H-105 (UGA), *petD* LT904553, ITS AY555865.2, AtG13040 LT904447; *H. andinum* Gleason, Solomon 16104 (BM), *petD* LT904554, *trnL* LT904487, ITS HG004725; *H. apocynifolium* Small, Crockett H-82 (UGA), *petD* LT904555, ITS AY555883.2, AtG13040 LT904448; *H. arbuscula* Stanley & Steyerm., Hernández and Chacón 544 (BM), *petD* LT904556, ITS HG004734; *H. austrobrasiliense* Vog.Ely, Boldrini & Bordignon. Vogel Ely and Bordignon 430 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. austrobrasiliense* Vog.Ely, Boldrini & Bordignon. Vogel Ely et al. 498 (ICN), ITS [available soon]; *H. austrobrasiliense* Vog.Ely, Boldrini & Bordignon. Mota et al. 159 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. austrobrasiliense* A.St.-Hil., Sobral s.n. (2007)(BM), ITS HG004772; *H. bordignonii* Vog.Ely and Boldrini, Vogel Ely and Bordignon 360 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. boreale* (Britton) Bickn., Sanchez 62 (MA), *petD* LT904557, ITS KC709374, *H. brachyphyllum* (Spach) Steud., Crockett H32ITS (UGA), ITS AY555870.2; *H. brasiliense* Choisy, Al Gentry and Solomon 44755 (BM), *petD* LT904558, ITS HG004770; *H. brasiliense* Choisy, Vogel Ely and Bordignon 397 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. brasiliense* Choisy, Vogel Ely, Miotto and Coelho 504 (ICN), *petD* [available soon], *trnL* [available soon], AtG13040 [available soon]; *H. brasiliense* Choisy, Kummrow and Silva 3245 (BM), *petD* LT904563, *trnL* LT904491, ITS HG004771; *H. brevistylum* Choisy, Solomon 15221 (BM), *petD* LT904559, *trnL* LT904488, ITS HG004740; *H. bryoides* Gleason, Nürk et al. 626 (ANDES, BM), *petD* LT904560, *trnL* LT904489, ITS LT904642, AtG13040 LT904449; *H. buckleyi* M.A.Curtis, Crockett H-171 (UGA), *petD* LT904561, ITS LT904643; *H. callacallanum* N.Robson, Colin Hughes 3109 (B, BM, MOL, Z), *petD* LT904562, *trnL* LT904490, ITS HG004727, AtG13040 LT904450; *H. canadense* L., Crockett 19 (UGA), ITS HE653433; *H. caprifoliatum* Cham. & Schltdl. Vogel Ely and Bordignon 402 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. cardonae* Cuatrec., Nürk and Atchison 528 (ANDES, BM), *petD* LT904564, *trnL* LT904492, ITS HG004690, AtG13040 LT904451; *H. carinatum* Griseb., Vogel Ely et al. 453 (ICN), *petD* [available soon], *trnL* [available soon], AtG13040 [available soon]; *H. carinatum* Griseb., Vogel Ely 483 (ICN), *petD* [available soon], *trnL* [available soon], AtG13040 [available soon]; *H. carinosum* R.Keller, Nürk et al. 642 (ANDES, BM), *petD* LT904565, *trnL* LT904493, ITS LT904644, AtG13040 LT904452; *H. cavernicola* L.B.Sm., Vogel Ely and Bordignon 433 (ICN), ITS [available soon], AtG13040 [available soon]; *H. cavernicola* L.B.Sm., Vogel Ely and Bordignon 481 (ICN), *petD* [available soon], *trnL* [available soon], AtG13040 [available soon]; *H. chapmanii* W.P. Adams, Crockett H31ITS (UGA), ITS AY555869.2; *H. cistifolium* Lam., Crockett H43ITS (UGA), ITS AY555881.2; *H. connatum* Lam., Serrano et al. 6893 (BM), *petD* LT904566, *trnL* LT904494, ITS HG004774; *H. connatum* Lam., Vogel Ely 390 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. cordiforme* A.St.-Hil., Vogel Ely and Trevisan 419 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. cordiforme* A.St.-Hil., Vogel Ely and Bordignon 434 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. costaricense* N.Robson, Davidse 24985 (BM), *petD* LT904567, *trnL* LT904495, ITS HG004684; *H. crux-andreae* (L.) Crantz, Crockett H36ITS (UGA), ITS AY555874.2; *H. cuatrecasii* Gleason, Nürk et al. 609 (ANDES, BM), *petD* LT904568, *trnL* LT904496, ITS

LT904645, AtG13040 LT904453; *H. cymobrathys* N.Robson, Nürk and Atchison 562 (ANDES, BM), *petD* LT904569, *trnL* LT904497, ITS LT904646, AtG13040 LT904454; *H. decandrum* Turcz., Nürk and Atchison 664 (ANDES, BM), *petD* LT904570, *trnL* LT904498, ITS LT904647, AtG13040 LT904455; *H. densiflorum* Pursh, Crockett 172 (UGA), *petD* LT904571, ITS AY555886; *H. denudatum* A.St.-Hil., Vogel Ely and Bordignon 427 (ICN), *petD* [available soon], *trnL* [available soon], AtG13040 [available soon]; *H. denudatum* A.St.-Hil., Vogel Ely et al. 484 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. dichotomum* Lam., Thompson 11251 (BM), *petD* LT904572, *trnL* LT904499, ITS HG004760; *H. dolabriforme* Vent., Crockett H-170 (UGA), *petD* LT904573, ITS AY555889; *H. drummondii* (Grev. & Hook.) Torr. & A. Gray, Crockett H-176 (UGA), ITS LT904648; *H. fasciculatum* Lam., Crockett H30ITS (UGA), ITS AY555868.2; *H. fauriei* (Blume) Makino, Nürk 455 (GAT), *trnL* LT904548, ITS HE653663; *H. frondosum* Michx., Crockett H-165 (UGA), *petD* LT904575, ITS AY555887; *H. galioides* Lam., Crockett H26ITS (UGA), ITS AY555864.2; *H. garciae* Nürk et al. 629 (ANDES, BM), *petD* LT904576, *trnL* LT904501, ITS LT904650, AtG13040 LT904456; *H. gentianoides* (L.) Britton, Sterns & Poggenb., Nürk 457 (GAT), *petD* LT904577, *trnL* LT904502; *H. gentianoides* (L.) Britton, Sterns & Poggenb., Bordignon s.n. (2015) (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. gladiatum* N.Robson, Nürk and Atchison 579 (ANDES, BM), *petD* LT904578, *trnL* LT904503, ITS LT904651, AtG13040 LT904457; *H. gleasonii* N.Robson, Nürk and Atchison 561 (ANDES, BM), *petD* LT904579, *trnL* LT904504, ITS LT904652, AtG13040 LT904458; *H. globuliferum* R.Keller, Gehrke 246 (Z), *pet* D LT904580, ITS LT904653; *H. gnidioides* Seem., Hamilton et al. 885 (BM), *petD* LT904581, *trnL* LT904505, ITS HG004738; *H. goyanesii* Cuatrec., Nürk and Atchison 495 (ANDES, BM), *petD* LT904582, *trnL* LT904506, ITS LT904654, AtG13040 LT904459; *H. gramineum* G.Forst., CHR 513231 (in: Heenan 2008), ITS EU352256; *H. harlingii* N.Robson, Øllgaard et al. 90595 (BM), *petD* LT904583, *trnL* LT904507, ITS HG004729; *H. hartwegii* Benth., JØrgensen et al. 1246 (BM), *petD* LT904584, ITS HG004731; *H. horizontale* N.Robson, Nürk et al. 615 (ANDES, BM), *petD* LT904585, *trnL* LT904508, ITS LT904655, AtG13040 LT904460; *H. humboldtianum* Steud., Nürk and Atchison 659 (ANDES, BM), *petD* LT904586, *trnL* LT904509, ITS LT904656, AtG13040 LT904461; *H. hypericoides* subsp. *hypericoides* (L.) Crantz, Proctor 30665 (BM), *petD* LT904587, ITS HG004779; *H. irazuense* Kunze ex N.Robson, Garwood et al. 316 (BM), *petD* LT904588, ITS HG004733; *H. japonicum* Thunb. ex Murray, Masuda 3360 (KYO), *petD* LT904589, *trnL* LT904510, ITS HE653512; *H. juniperinum* Kunth, Nürk and Atchison 536 (ANDES, BM), *petD* LT904590, *trnL* LT904511, ITS LT904657, AtG13040 LT904462; *H. kalmianum* L., Nürk 397 (GAT), *petD* LT904591, *trnL* LT904512, ITS HG004780; *H. lalandii* Choisy, Gehrke BG207 (Z), *petD* LT904592, *trnL* LT904513, ITS LT904658; *H. lancifolium* Gleason, Nürk and Atchison 580 (ANDES, BM), *petD* LT904593, *trnL* LT904514, ITS HG004682, AtG13040 LT904463; *H. lancioides* subsp. *congestiflorum* (Triana & Planch.) N.Robson, Nürk et al. 643 (ANDES, BM), *petD* LT904594, *trnL* LT904515, ITS LT904659, AtG13040 LT904464; *H. laricifolium* Juss., Nürk and Atchison 656 (ANDES, BM), *petD* LT904595, *trnL* LT904516, ITS LT904660, AtG13040 LT904465; *H. lissophloeus* W.P. Adams, Crockett H-125 (UGA), *petD* LT904596, *trnL* LT904517, ITS AY555885, AtG13040 LT904466; *H. llanganaticum* N.Robson, Øllgaard et al. 38628 (BM), *petD* LT904597, ITS HG004650; *H. lloydii* (Svenson) W.P. Adams, Crockett 1 (UGA), *petD* LT904598, *trnL* LT904518, ITS AY555867.2; *H. lobocarpum* Gatt., Crockett H38ITS (UGA), ITS AY555876.2; *H. lorentzianum* Gilg ex R.Keller, Vogel Ely and Neves 455 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. lorentzianum* Gilg ex R.Keller, Vogel Ely et al. 352 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. loxense* subsp. *loxense* Benth., JØrgensen et al. 1351 (BM), *petD*

LT904599, ITS HG004735; *H. lycopodioides* Triana & Planch., Nürk and Atchison 557 (ANDES, BM), *petD* LT904600, *trnL* LT904519, ITS HG004715, AtG13040 LT904467; *H. magniflorum* Cuatrec., Cleef 4743 (BM), *petD* LT904601, ITS HG004751; *H. maguirei* N.Robson, Maguire and Maguire 61707 (BM), *petD* LT904602, *trnL* LT904520, ITS HG004732; *H. majus* (A.Gray) Britton, Rastetter s.n. (MA), *petD* LT904603, ITS KC709350; *H. marahuacanum* subsp. *marahuacanum* N.Robson, Nürk and Atchison 665 (ANDES, BM), *petD* LT904604, *trnL* LT904521, ITS LT904661, AtG13040 LT904468; *H. mexicanum* L., Nürk et al. 639 (ANDES, BM), *petD* LT904605, *trnL* LT904522, ITS LT904662, AtG13040 LT904469; *H. microlicioides* L.B.Sm., Vogel Ely et al. 509 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. microsepalum* (Torr. & A.Gray) A.Gray ex S.Watson, Crockett H-63 (UGA), *petD* LT904606, ITS LT904663; *H. mutilum* L., Crockett 173 (UGA), *petD* LT904607, *trnL* LT904523, ITS LT904664; *H. mutilum* L., Vogel Ely and Bordignon 399 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. mutilum* L., Vogel Ely et al. 489 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. myrianthum* Cham. & Schltdl., Vogel Ely et al. 482 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. myricariifolium* Hieron., Nürk and Atchison 526 (ANDES, BM), *petD* LT904608, *trnL* LT904524, ITS HG004723, AtG13040 LT904470; *H. myrtifolium* Lam., Crockett Hyp-7 (UGA), *petD* LT904609, ITS LT904665; *H. nitidum* subsp. *exile* Lam., Crockett H-84 (UGA), *petD* LT904610, ITS LT904666; *H. nudiflorum* Michx., Crockett H50ITS (UGA), ITS AY555888; *H. parallelum* N.Robson, Nürk et al. 620 (ANDES, BM), *petD* LT904611, *trnL* LT904525, ITS LT904667, AtG13040 LT904471; *H. pedersenii* N.Robson, Vogel Ely and Bordignon 479 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. pedersenii* N.Robson, Vogel Ely and Bordignon 480 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. phellos* subsp. *phellos* Gleason, Nürk et al. 624 (ANDES, BM), *petD* LT904613, *trnL* LT904527, ITS LT904669, AtG13040 LT904473; *H. philonotis* Cham. & Schltdl., Förther 10060 (BM), *petD* LT904614, ITS HG004764; *H. pimeleoides* Planch. & Linden ex Triana & Planch., Nürk and Atchison 559 (ANDES, BM), *petD* LT904615, *trnL* LT904528, ITS LT904670, AtG13040 LT904474; *H. piriai* Arechav., Vogel Ely and Lucas 392 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. polyanthemum* Klotzsch ex Reichardt, Sobral s.n. (2007) (BM), *petD* LT904616, ITS HG004773; *H. polyanthemum* Arechav., Vogel Ely and Lucas 391 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. polyanthemum* Klotzsch ex Reichardt, Lucas and Larocca s.n. (2015) (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. pratense* Cham. & Schltdl., Amith and Santiago 1102 (BM), *petD* LT904617, *trnL* LT904529, ITS HG004765; *H. prolificum* L., FB 1243 (in: Pilepic et al. 2011), ITS FJ694217; *H. prostratum* Cuatrec., Nürk and Atchison 499 (ANDES, BM), *petD* LT904618, *trnL* LT904530, ITS HG004685, AtG13040 LT904475; *H. quitense* R.Keller, Holm-Nielsen et al. 29216 (BM), *petD* LT904619, *trnL* LT904531, ITS HG004736; *H. rigidum* A.St.-Hil., Hatschbach 48170 (BM), ITS HG004775; *H. rigidum* A.St.-Hil., Vogel Ely and Bordignon 435 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. rigidum* A.St.-Hil., Vogel Ely et al. 493 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. ruscoides* Cuatrec., Nürk et al. 616 (ANDES, BM), *petD* LT904620, *trnL* LT904532, ITS LT904671, AtG13040 LT904476; *H. sabiniforme* Trevir., Nürk et al. 649 (ANDES, BM), *petD* LT904621, *trnL* LT904533, ITS LT904672, AtG13040 LT904477; *H. salvadorense* N.Robson, Vogel Ely et al. 114 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. salvadorense* N.Robson, Vogel Ely and Bordignon 396 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. scioanum* Chiov., Gehrke 168 (Z), *petD* LT904622, *trnL* LT904534, ITS LT904673, AtG13040 LT904478; *H. selaginella* N.Robson, Nürk et al. 644 (ANDES, BM), *petD* LT904623, *trnL* LT904535, ITS LT904674, AtG13040 LT904479; *H. silenoides* Juss., Hughes 3113 (HEID, B, MOL, Z), *petD* LT904624, *trnL* LT904536, ITS HG004769, AtG13040 LT904480; *H. sphaerocarpum* Michx., Crockett H-162 (UGA), *petD* LT904625, *trnL* LT904537, ITS AY555878.2; *H. sprucei* N.Robson, JØrgensen et al. 2218 (BM), *petD* LT904626, *trnL* LT904538, ITS HG004648; *H. strictum* Kunth, Nürk et al. 648 (ANDES, BM), *petD* LT904627, *trnL* LT904539, ITS LT904675, AtG13040 LT904481; *H. struthiolifolium* Juss., Smith 4126 (BM), *petD* LT904628, *trnL* LT904540, ITS HG004756; *H. suffruticosum* W.P. Adams, Crockett 156 (UGA), ITS HE653637; *H. tamariscinum* Cham. & Schltdl., Vogel Ely and Lucas 508 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. tenuifolium* Pursh, Crockett 126 (UGA), *petD* LT904629, ITS LT904676, AtG13040 LT904482; *H. teretiusculum* A.St.-Hil., Vogel Ely and Trevisan 412 (ICN), *petD* [available soon], *trnL* [available soon], AtG13040 [available soon]; *H. teretiusculum* A.St.-Hil., Schaefer and Bordignon s.n. (2016)(ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. ternum* A.St.-Hil., Nicolack and Cordeiro 63 (BM), *petD* LT904630, ITS HG004776; *H. ternum* A.St.-Hil., Vogel Ely and Trevisan 416 (ICN), *petD* [available soon], ITS [available soon], AtG13040 [available soon]; *H. ternum* A.St.-Hil., Vogel Ely et al. 491 (ICN), *petD* [available soon], *trnL* [available soon], ITS [available soon], AtG13040 [available soon]; *H. terrae-firmae* Sprague & Riley, Monro 741(BM), *petD* LT904631, *trnL* LT904541, ITS HG004759; *H. tetrapetalum* Lam., Crockett H44ITS (UGA), ITS AY555882.2; *H. tetrastichum* Cuatrec., Nürk and Atchison 574 (ANDES, BM), *petD* LT904632, *trnL* LT904542, ITS HG004666, AtG13040 LT904483; *H. thesiifolium* Kunth, Burger and Liesner 6439 (BM), *petD* LT904633, *trnL* LT904543, ITS HG004767; *H. thuyoides* Kunth, Nürk and Atchison 498 (ANDES, BM), *petD* LT904634, *trnL* LT904544, ITS LT904677, AtG13040 LT904484; *H. valleanum* N.Robson, Nürk et al. 623 (ANDES, BM), *petD* LT904635, *trnL* LT904545, ITS LT904678, AtG13040 LT904485; *H. virginicum* Raf., Mitchel and Focht 8507 (GH), *trnL* LT904550, ITS HE653667; *H. walteri* (J.F.Gmel.) Gleason, Crockett H-163 (UGA), *petD* LT904639, ITS LT904680; *H. woodianum* N.Robson, Nürk and Atchison 502 (ANDES, BM), *petD* LT904636, *trnL* LT904546, AtG13040 LT904486; outgroup: *H. calcicola* (Standl. & Steyerm.) Breedlove & E.M.McClint., Breedlove and Thorne 21104 (BM), *petD* LT904637, *trnL* LT904547, ITS LT904679; *H. elodes* L., Scheriau Hyp0568 (HEID), *petD* LT904574, *trnL* LT904500, ITS LT904649; *H. perforatum* L., Nürk 483 (GAT), *petD* LT904612, *trnL* LT904526, ITS LT904668, AtG13040 LT904472.

Table 3. Acronyms used for the political divisions of Argentina, Bolivia, Brazil, Paraguay and Uruguay.

ARGENTINA		BOLIVIA		BRAZIL		PARAGUAY		URUGUAY	
Province	**Acronym**	**Department**	**Acronym**	**State**	**Acronym**	**Province**	**Acronym**	**Department**	**Acronym**
Buenos Aires	BA	Chuquisaca	CH	Bahia	BA	Alto Paraguay	AY	Artigas	AR
Chaco	CH	La Paz	LP	Espírito Santo	ES	Alto Paraná	AP	Canelones	CA
Córdoba	CO	Tarija	TA	Goiás	GO	Asunción	AS	Cerro Largo	CL
Corrientes	CR			Minas Gerais	MG	Caaguazú	CG	Colonia	CO
Entre Rios	ER			Paraná	PR	Canindeyú	CY	Durazno	DU
Formosa	FO			Rio de Janeiro	RJ	Concepción	CO	Florida	FA
Jujuy	JJ			Rio Grande do Sul	RS	Cordillera	CL	Lavalleja	LA
Misiones	MI			Santa Catarina	SC	Guairá	GU	Maldonado	MA
Salta	SA			São Paulo	SP	Itapúa	IT	Montevideo	MO
San Luis	SL					Misiones	MI	Paysandú	PY
Santa Fé	SF					Paraguarí	PA	Rio Negro	RN
Tucumán	TU							Rivera	RI
								Rocha	RO
								Salto	SA
								San José	SJ
								Soriano	SO
								Tacuarembó	TA
								Treinta y Tres	TT

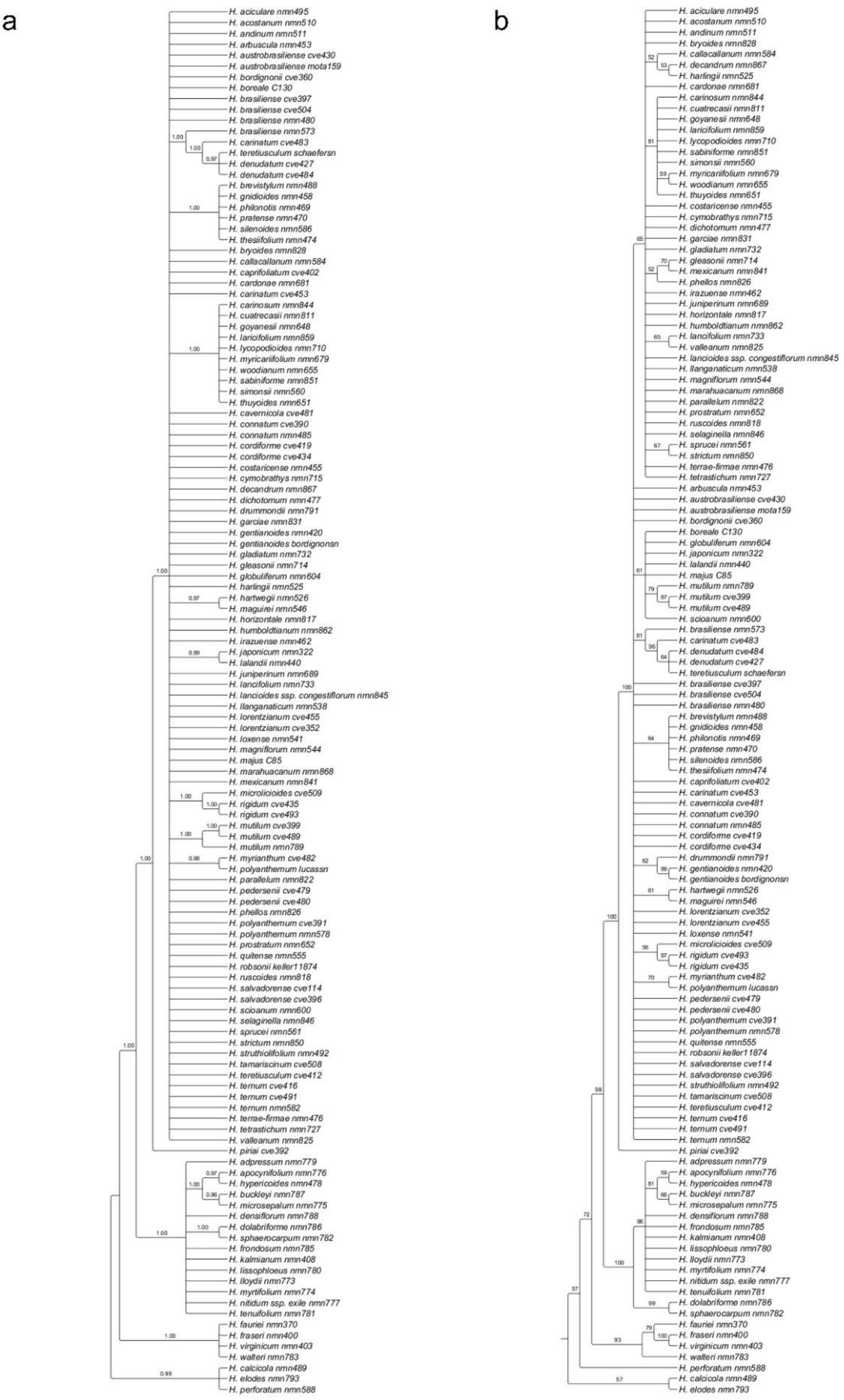
Political divisions in which no species were found were not added here.

Information on Electronic Supplementary Material

Online Resource 1 Bayesian and maximum likelihood topology trees based on nuclear and chloroplast DNA sequences (ITS, At1G13040, *petD*, and *trnL*). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

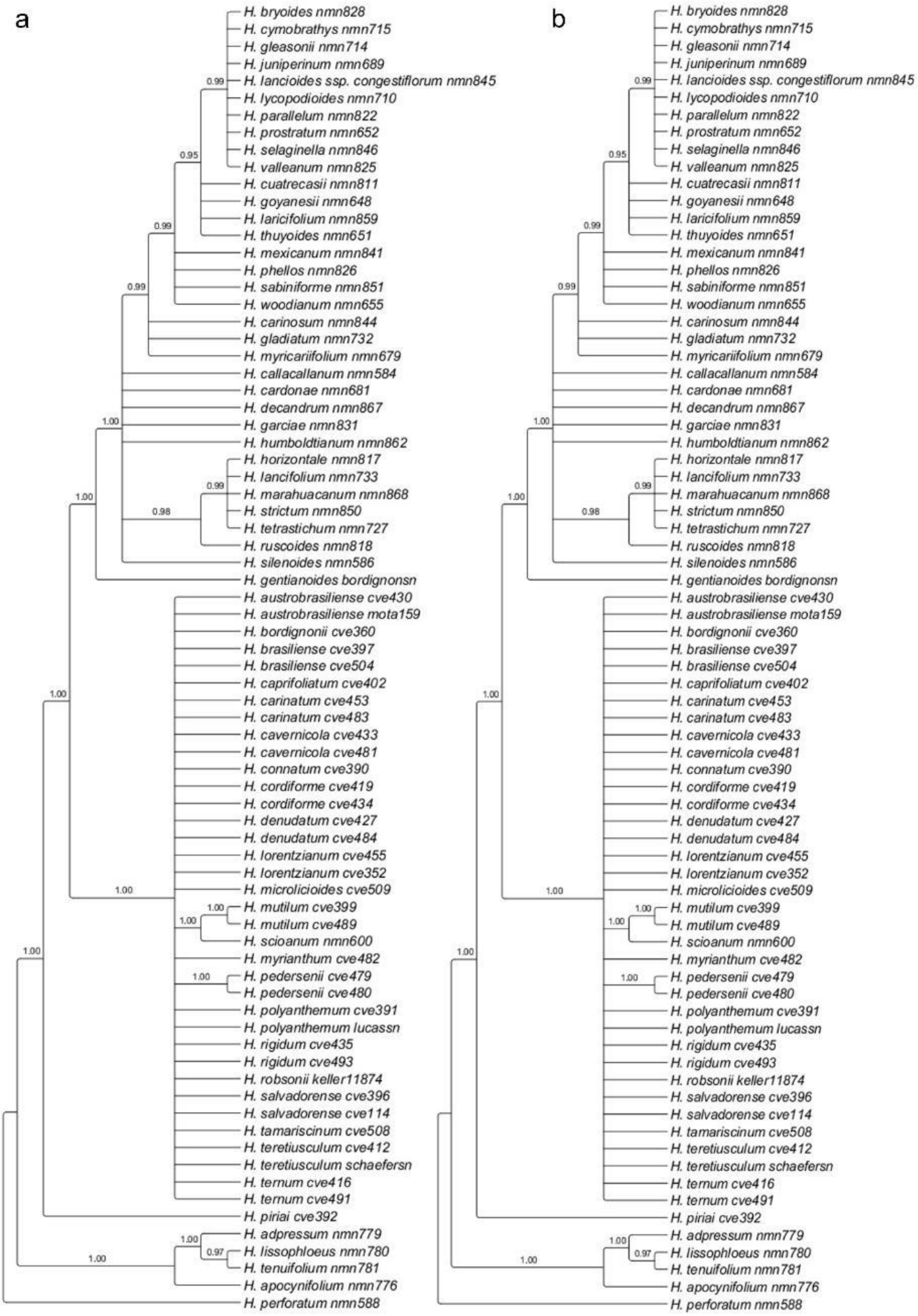
Online Resource 2 Bayesian and maximum likelihood topology trees based on nuclear DNA sequences (ITS and At1G13040). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

Online Resource 3 Bayesian and maximum likelihood topology trees based on chloroplast DNA sequences (*petD* and *trnL*). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

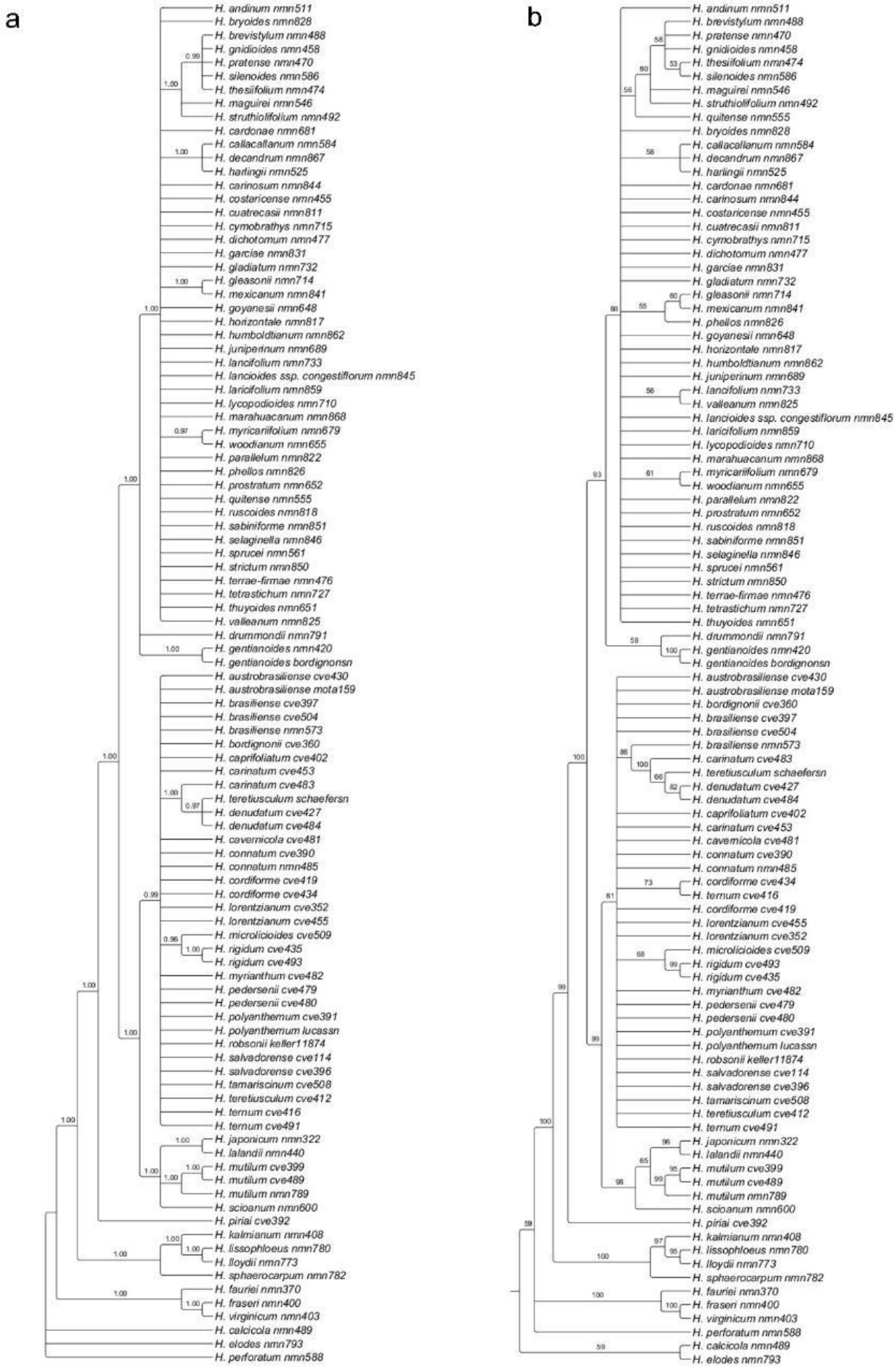


Online Resource 4 Bayesian and maximum likelihood topology trees based on nuclear DNA sequences (ITS). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

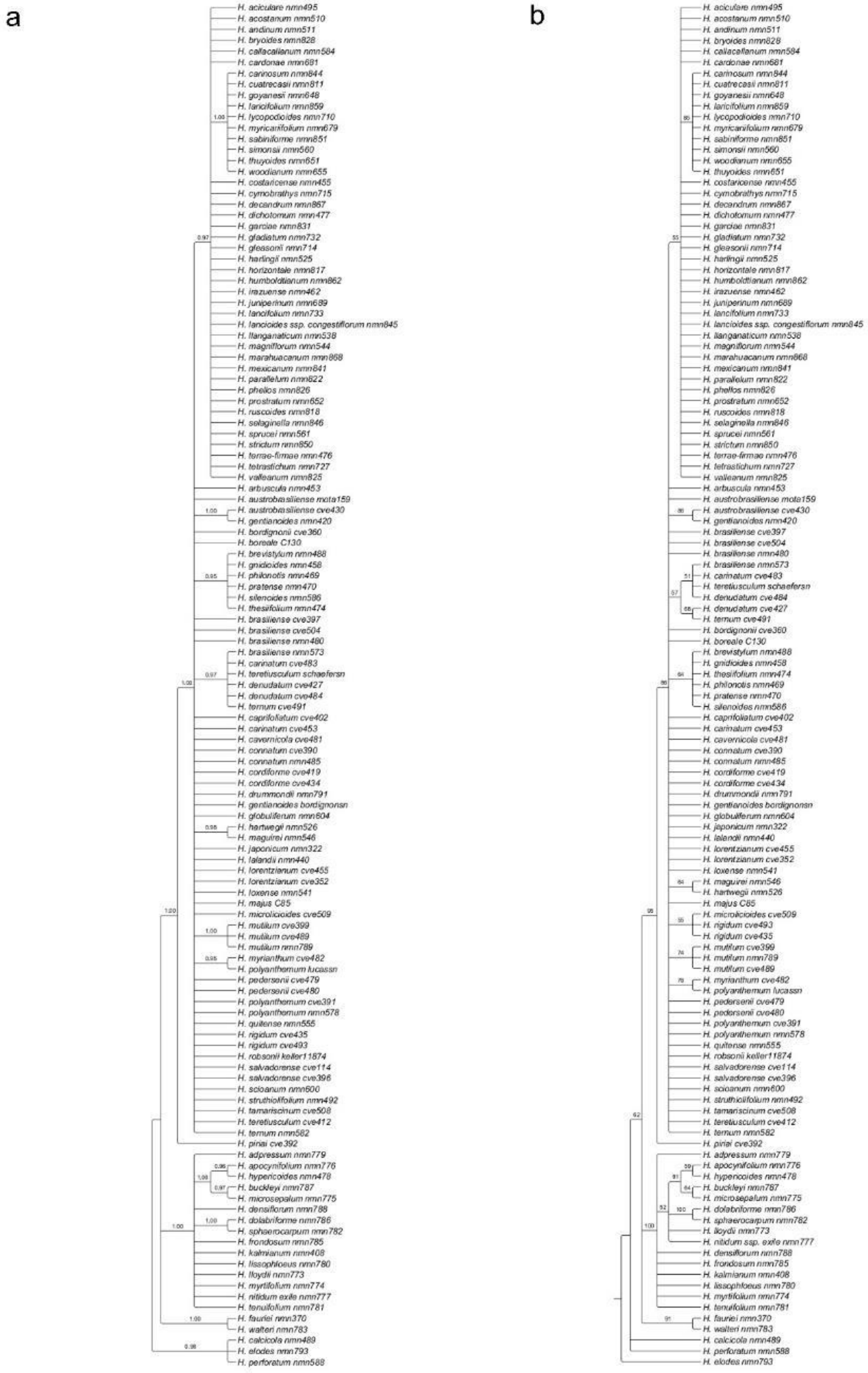
Online Resource 5 Bayesian and maximum likelihood topology trees based on nuclear DNA sequences (At1G13040). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.



Online Resource 6 Bayesian and maximum likelihood topology trees based on chloroplast DNA sequences (*petD*). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.

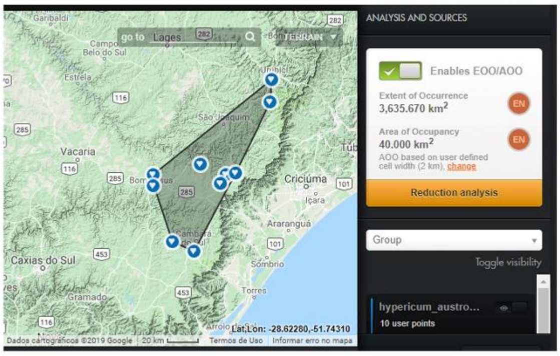


Online Resource 7 Bayesian and maximum likelihood topology trees based on chloroplast DNA sequences (*trnL*). **a** Bayesian tree. **b** Best maximum likelihood tree. Bayesian posterior probabilities and ML bootstrap support are given above the branches.



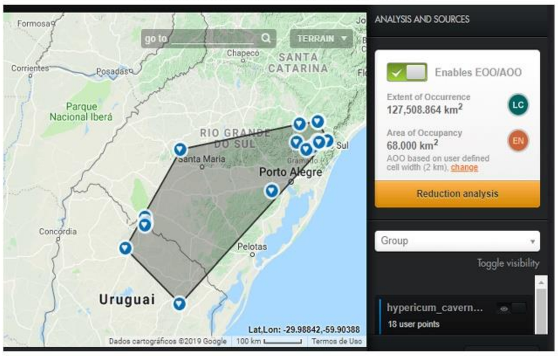
Online Resource 9 Area of occupancy **(**AOO) and extent of occurrence (EOO) values of all threatened species with more than one location obtained through GeoCAT webtool.

Hypericum austrobrasiliense **Vog.Ely, Boldrini & Bordignon**



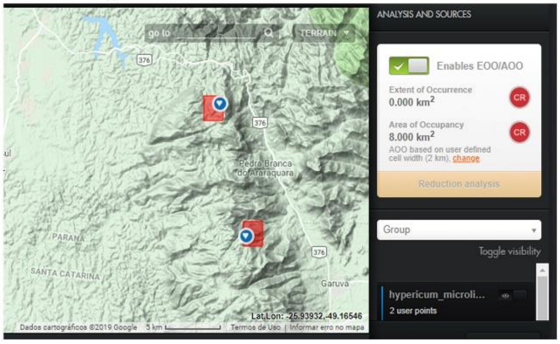
Enables EOO/AOO
Extent of Occurrence 3,635.670 km^2 EN
Area of Occupancy 40.000 km^2 EN
AOO based on user defined cell width (2 km), change
hypericum_austro... 10 user points
Lat.Lon: -28.62280,-51.74310

Hypericum cavernicola **L.B.Sm**



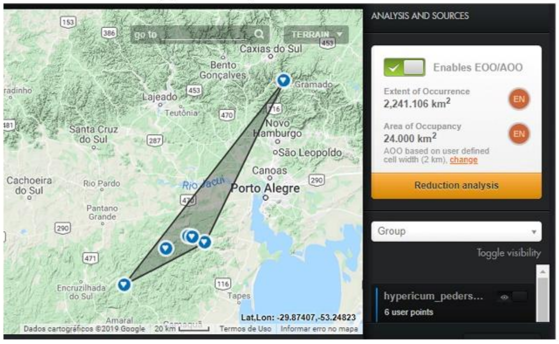
Enables EOO/AOO
Extent of Occurrence 127,508.864 km^2 LC
Area of Occupancy 68.000 km^2 EN
AOO based on user defined cell width (2 km), change
hypericum_cavern... 18 user points
Lat.Lon: -29.98842,-59.90388

Hypericum microlicioides **L.B.Sm**



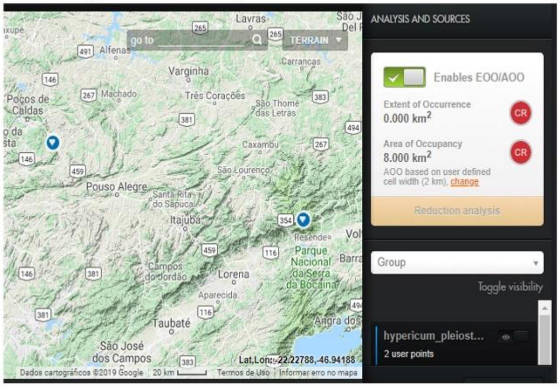
Enables EOO/AOO
Extent of Occurrence 0.000 km^2 CR
Area of Occupancy 8.000 km^2 CR
AOO based on user defined cell width (2 km), change
hypericum_microli... 2 user points
Lat.Lon: -25.93932,-49.16546

Hypericum pedersenii **N.Robson**



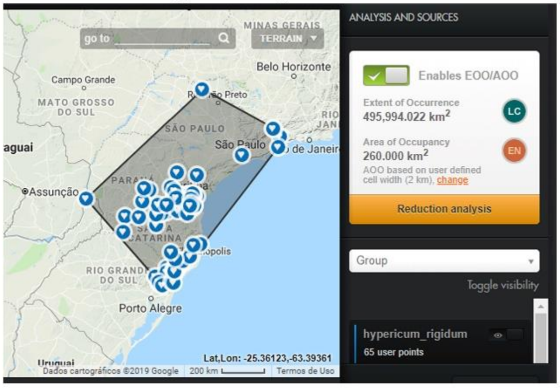
Enables EOO/AOO
Extent of Occurrence 2,241.106 km^2 EN
Area of Occupancy 24.000 km^2 EN
AOO based on user defined cell width (2 km), change
hypericum_peders... 6 user points
Lat.Lon: -29.87407,-53.24823

Hypericum pleiostylum **C.Rodr.Jim.**



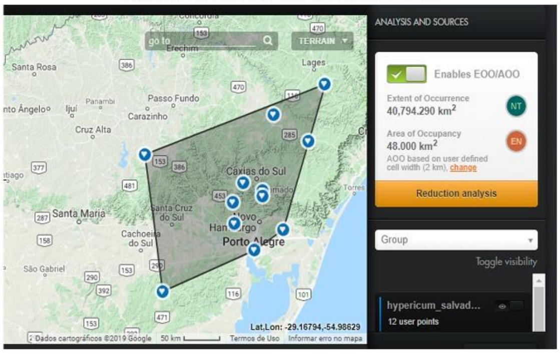
Enables EOO/AOO
Extent of Occurrence 0.000 km^2 CR
Area of Occupancy 8.000 km^2 CR
AOO based on user defined cell width (2 km), change
hypericum_pleiost... 2 user points
Lat.Lon: -22.22788,-46.94188

Hypericum rigidum **A.St.-Hil.**



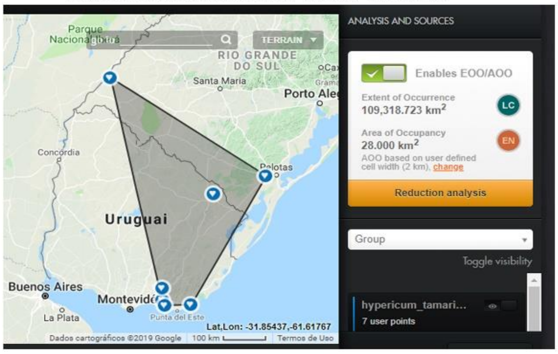
Enables EOO/AOO
Extent of Occurrence 495,994.022 km^2 LC
Area of Occupancy 260.000 km^2 EN
AOO based on user defined cell width (2 km), change
hypericum_rigidum 65 user points
Lat.Lon: -25.36123,-63.39361

Hypericum salvadorense **N.Robson**



Enables EOO/AOO
Extent of Occurrence 40,794.290 km^2 NT
Area of Occupancy 48.000 km^2 EN
AOO based on user defined cell width (2 km), change
hypericum_salvad... 12 user points
Lat.Lon: -29.16794,-54.98629

Hypericum tamariscinum **Cham. & Schltdl.**



Enables EOO/AOO
Extent of Occurrence 109,318.723 km^2 LC
Area of Occupancy 28.000 km^2 EN
AOO based on user defined cell width (2 km), change
hypericum_tamari... 7 user points
Lat.Lon: -31.85437,-61.61767

Capítulo II — Tratamento Nomenclatural de espécies sul-americanas de *Hyperiucm*

PARTE I — REASSERTING THE PRIORITY OF *HYPERICUM CORDIFORME* A.ST.-HIL. (HYPERICACEAE) OVER *H. CORDATUM* (VELL.) N.ROBSON

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ABSTRACT

Priority concerning the publication of St. Hilaire's name *Hypericum cordiforme* over *H. cordatum* is confirmed since its effective publication in *Flora Brasiliae Meridionalis* (1828) predates the publication of Vellozo's name *Receveura cordata*, the basionym of *H. cordatum*, in *Florae fluminensis* (1829). We also provide a second-step lectotypification for *H. cordiforme* and a lectotypification and epitypification for *Receveura cordata. Hypericum cordiforme* var. *genuinum* is for the first time determined to be an invalid name, and *H. cordatum* subsp. *kleinii* is placed in the synonymy of *H. cordiforme.*

KEYWORDS

Flora Brasiliae Meridionalis, *Florae fluminensis*, Malpighiales, nomenclatural priority, synonymization, typification.

INTRODUCTION

Hypericum L. (Hypericaceae) is a nearly cosmopolitan genus with over 500 species ranging from annual herbs up to trees (Robson, 1981, 2012). A robust worldwide monograph of *Hypericum* by Norman K. B. Robson was published in several parts from 1977 to 2016 (see: Carine & Christenhusz, 2010; Robson, 2016). Despite the genus having been thoroughly studied from a taxonomic perspective, some nomenclatural problems persist within it.

Here, we address nomenclatural issues pertaining to a species of *Hypericum* distributed in the Brazilian states of Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina and Rio Grande do Sul, for which the name *H. cordatum* (Vell.) N.Robson has been accepted by recent authors (e.g., Robson, 1990; Bittrich, 2003; Slusarski et al., 2007).

THE PRIORITY OF *HYPERICUM CORDIFORME* OVER *H. CORDATUM*

Saint Hilaire (1828) described *Hypericum cordiforme* in *Flora Brasiliae Meridionalis*, published on September 29, 1828 (see Brandão, et al. 2012; Dwyer, 1955; Pastore, 2014; Pignal, et al. 2013, for a detailed discussion on Saint Hilaire's *Flora Brasiliae Meridionalis*). Vellozo (1829) described 1,640 plant species from areas that today are part of the Brazilian states of Rio de Janeiro and São Paulo in *Florae fluminensis*, which although it bears the date 1825 was not "effectively published" as defined in the Shenzhen Code (Turland et al., 2018) until some time between September 7 and November 28 of 1829 (see Borgmeier, 1937; Carauta, 1973; Lima, 1995; Bediaga & Lima, 2015, for a detailed discussion on Vellozo's *Florae fluminensis*). One of the species published in *Florae fluminensis, Receveura cordata* Vell., was subsequently transferred to *Hypericum* by Robson (1990), thus establishing the combination *H. cordatum* (Vell.) N.Robson. Although St. Hilaire's name was accepted by a number of authors (e.g., Reichardt, 1878; Smith, 1958; Rodríguez Jiménez, 1980), Robson (1990) placed *H. cordiforme* in the synonymy of *H. cordatum*, and subsequent authors have followed suit (e.g., Bittrich, 2003; Slusarski et al., 2007). While we agree with Robson that the two names are synonymous, we disagree that Vellozo's epithet has priority, since *H. cordiforme* has an older effective date of publication (1828 vs. 1829).

NOMENCLATURAL TREATMENT

Hypericum cordiforme A.St.-Hil., Fl. Bras. Merid. 1: 330. 1828 ("1825"). Type: Brazil, São Paulo, "in pascuis prope urbem Sancti Pauli", 1816–1821, *St.-Hilaire 1172* (first-step lectotype, designated by Robson, 1990: P, cited "holotype and isotype"; **second-step lectotype, here designated:** P barcode P01901409; isolectotype: P barcode P01901411; probable isolectotype: P barcode P01901410).

Receveura cordata Vell., Fl. Flumin. 1: 237. 1829. *Hypericum cordatum* (Vell.) N.Robson, Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 59. 1990. **Lectotype, here designated**: Brazil. [Rio de Janeiro or São Paulo]: "Habitat campis apricis mediterraneis"; [illustration] Original parchment plate of Flora Fluminensis in the Manuscript Section of the Biblioteca Nacional, Rio de Janeiro [cat. no.: mss1198654_122] and later published in Vellozo, Fl. Flumin. Icon. 5: t. 119. 1831. – **Epitype, here designated:** Brazil. São Paulo, São Roque, Bairro Caete, 2 Dec 1987, *S. Tsugaru B2244 & Y. Otsuka* (NY barcode no. 477006; isoepitype OOM no. 45255, n.v.).

Hypericum cordiforme var. *genuinum* Briq., Annu. Conserv. Jard. hot. Genève 20: 391. 1919, **nom. inval.**

Hypericum cordatum subsp. *kleinii* N.Robson, Mus. Brit. Nat. (Nat. Hist.), Bot. 20(1): 60. 1990. Type: Brazil, Santa Catarina, Lajes, 2 Dec 1956, *L. B. Smith & R. Klein 8100* (holotype: US; isotype: NY). **syn. nov.**

Hypericum cordiforme was described by St.-Hilaire based on its own collections from São Paulo. These specimens were deposited at P and indicated as "holotype and isotype" of *H. cordiforme* by Robson (1990). As specified in Article 9.10 of the Shenzhen Code (Turland et al., 2018), Robson's use of the terms holotype and isotype must be corrected to lectotype and isolectotype, respectively. However, since Robson did not actually identify the "holotype" from the duplicates at P (barcodes P01901409, P01901411 and probably P01901410 as well), nor did he annotate the specimen as such, a second-step lectotypification is required (see Article 9.17 in Turland et al., 2018). Both specimens belong to the same species and have the same collection number (*St.-Hilaire 1172*), except for P01901410 which is probably also na isolectotype but has no collection number. We chose the sample P01901409 as the lectotype because this sheet is the most complete morphologically (with flowers, fruits, and lateral branches) and has Saint-Hilaire's own notes written on the label.

The original parchment illustration of *Receveura cordata* housed in the Biblioteca Nacional in Rio de Janeiro was chosen as lectotype because it is the only surviving "original material" (see Article 9.4 in Turland et al., 2018), all of Vellozo's specimens apparently having been lost sometime after their arrival in Europe (Lima, 1995; Pastore, 2013; Pellegrini et al., 2015). While reproductions of the *Florae fluminensis* illustrations were effectively published in 1831, these do not constitute original material for the names published in that work, since the effective date of publication for the names, including *R. cordata*, is 1829 (see Knapp et al., 2015).

In comparison to contemporaries, such as Linnaeus, Vellozo provided much more detailed descriptions for the species that he described in *Florae fluminensis* (Pellegrini, 2015). However, the loss of all of Vellozo's specimens and the frequently inaccurate depiction of morphological features in the original illustrations of the species described often make it difficult to apply Vellozo's names (Borgmeier, 1937; Lima, 1995; Buzatto et al., 2013; Pastore, 2013). In the case of *Receveura cordata* (=*Hypericum cordiforme*), while the distinctive leaf shape of the species is accurately depicted, the inflorescences, which are always composed of mono- or dichasial cymes in *H. cordiforme,* are not. Furthermore, the presence and arrangement of the lateral branches and the arrangement of the leaves on the stem are essential characters for distinguishing *H. cordiforme* from *H. ternum* A.St.-Hil., with which it is easily confused (Robson, 1990; Vogel Ely et al., 2018). Therefore, due to the inaccuracy and ambiguity of the lectotype, we elected to designate an epitype. The specimen chosen (*S. Tsugaru B2244 & Yasuo Otsuka*, NY barcode no. 477006) was selected because it was collected in São Paulo (Vellozo's lost material having originated from localities now contained within the modern states of São Paulo and Rio de Janeiro), is representative of the morphological characters of *H. cordiforme*, and satisfies the morphological concept presented in the protologue of *R. cordata*.

In his treatment of *H. cordiforme,* Briquet (1919: 390) wrote: "*On peut distinguer dans cette espèce les trois variétés suivantes* [The following three varieties can be distinguished in this species]". As indicated by the epithet, he apparently considered his var. *genuinum* (Pp. 391) to be the typical variety, although he cited his own collections in the protologue (*Guillemin 315*). Article 26.1 of the Code requires that the typical variety bear the same epithet of the species to which it belongs, thus rendering Briquet's *H. cordiforme* var. *genuinum* invalid.

Although Robson (1990) distinguished two subspecies within *H. cordatum*, we decided against recognizing the corresponding taxa within *H. cordiforme* because the subspecies do not occupy separate geographic areas and the purported diagnostic differences display continuous variation among populations and are in some cases bridged by single specimens.

ACKNOWLEDGMENTS

CVE thanks the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for awarding her Doctoral scholarship (grant 141635/2015–0), IIB for her Research Productivity Fellowship, and JRVI for financial support from the Neotropical Grassland Conservancy. Thanks are also due to Ana Isabel D. Correia and Maria Cristina Duarte, curators of the LISU and LISC herbaria, for their helpful assistance with our search for Vellozo's specimens, to Laurence Loze for sending us images of specimens deposited at G, and to Laurent Gautier (curator at G) for his valuable comments on Briquet's work. We are also grateful to the Editor-in-Chief, Benjamin Torke, Marco Pellegrini and an anonymous reviewer whose comments and suggestions helped to greatly improve this manuscript, and to Jefferson Prado for kindly assisting us in interpreting the International Code of Nomenclature for algae, fungi, and plants.

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PARTE II — CLARIFYING THE NOMENCLATURE OF NON-ANDEAN SOUTH AMERICAN *HYPERICUM* (HYPERICACEAE)

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Nomenclature of non-Andean South American *Hypericum*

ABSTRACT

An updated taxonomic and nomenclatural framework is essential to develop most studies within biology fields. To stabilize the application of *Hypericum* names and avoid future problems, we critically reviewed the protologues, the main Floras in which the studied names are listed, and type specimens of all names described for non-Andean South America (Argentina, Brazil, Paraguay, and Uruguay). Application of the term holotype is corrected to lectotype for seventeen names and type is corrected to lectotype for six names ("inadvertent lectotypifications"). For *H. paraguense* the term lectotype is corrected to neotype, for *H. polyanthemum* the term isotype is corrected to neotype and for *H. nudicaule* the term type is corrected to neotype ("inadvertent neotypifications"). For twenty-five names, lectotypifications are provided, including one re-lectotypification (*H. brasiliense* var. *angustifolium*) and twenty second-step lectotypifications. Neotypes are designated for four names. Five new synonyms are proposed (*H. campestre* subsp. *pauciflorum, H. campestre* subsp. *tenue, H. rigidum* subsp. *bracteatum, H. rigidum* subsp. *meridionale,* and *H. rigidum* subsp. *sellowianum*), and two superfluous names are detected (*H. bolivianum* and *H. connatum* var. *obscurum*).

KEYWORDS

lectotypifications; neotypifications; nomenclature, superfluous names, synonymizations.

INTRODUCTION

Hypericum L. includes approximately 500 species distributed worldwide (Robson, 2016). In South America, *Hypericum* has two centers of species richness: Andean páramo and southeastern South American grasslands (Robson, 1987, 1990), which is why the species are informally divided into Andean and non-Andean groups. Recent changes in the circumscription within the genus *Hypericum* have allocated all South American species in the subgenus *Brathys* (Robson, 2016). However, these South American species are also formally included within the two largest, non-monophyletic (Meseguer & al., 2013; Nürk & al., 2013), sections of the genus: *Brathys* and *Trigynobrathys* (Robson, 1987, 1990).

Some important Floras and revisions of the genus for South America were published in the last 60 years (Smith, 1958; Rodríguez Jiménez, 1973, 1980; Robson, 1987, 1990; Bittrich, 2003; Ulibarri, 2005; Slusarski & al., 2007). However, many of them have synonyms and even species concept divergent. Additionally, a substantial proportion of the South American *Hypericum* names were described by different authors, based on specimens collected by different botanists, who have distributed their collections to several herbaria of the world. All this, hinders the access to type specimens, impairing a complete nomenclatural treatment. No holotype exists for most South American *Hypericum* names, and therefore lectotypifications have to be made. Many inadvertent lectotypifications or inadvertent neotypifications (Prado & al., 2015) have already be done in previous revisions (Rodríguez Jiménez, 1973; Robson, 1987, 1990); nevertheless, several nomenclatural gaps persist in the South American *Hypericum* names.

Herein, after analyzing the protologues and carefully studying the type specimens of all non-Andean South American *Hypericum* names, we performed a detailed nomenclatural treatment to enhance the nomenclatural stability of these names.

MATERIALS AND METHODS

This work is based on the analysis of relevant literature (i.e., protologues, and main Floras in which the studied names are listed) and examination of type specimens preserved in different herbaria of the world. Some original materials were accessed through online databases of herbaria (B, BM, BR, C, E, FI, G, GH, GOET, HAL, HBG, K, L, LINN, M, MICH, MO, MPU, MU, NY, P, PH, S, UPS, US, W, WIS and WU), and others were examined in the following herbaria: CTES, HBR, ICN, MBM, MVFA, MVM, R and RB. Nomenclatural treatment follows the rules of the Shenzhen Code (Turland & al., 2018).

In selecting lectotypes, we have carefully checked the conformity of the type specimens with the description in the protologue. Isolectotypes are only cited when there is no doubt that they are duplicates of the lectotype. The terms “possible isolectotypes” or “possible isoneotypes” were applied for sheets liable to be duplicates of lectotypes or neotypes that does not have a collector number. Otherwise, the term “probable isolectotype(s)” is used when there are signs that the sheet is duplicate of the lectotype, but the collector number is missing in the probable duplicate but present in the lectotype. When a sheet was chosen as a lectotype among several syntypes that were collected from different locations and/or by different collectors, and at different dates, the item “remaining syntypes” was added. We indicated “†” for all type specimens that have not been found or that were destroyed. The acronym “n.v.” (= “non vidi”) was placed beside those specimens that have not been checked by the authors.

In the following account, all accepted *Hypericum* from non-Andean South America were ordered alphabetically and written in bold. For all new typifications, synonyms or names listed as illegitimate for the first time, we provide a discussion and a brief justification. For many Sellow and Saint Hilaire types, the dates and collection localities were updated based on Herter (1945).

NOMENCLATURAL TREATMENT

Application of the term holotype is corrected to lectotype for seventeen names, and type is corrected to lectotype for six names ("inadvertent lectotypifications", see Prado & al., 2015). For *H. paraguense* the term lectotype is corrected to neotype, for *H. polyanthemum* the term isotype is corrected to neotype, and for *H. nudicaule* the term type is corrected to neotype ("inadvertent neotypifications", see Prado & al., 2015). For twenty-five names, lectotypifications are provided, including one re-lectotypification (*H. brasiliense* var. *angustifolium*) and twenty second-step lectotypifications. Neotypes are designated for four names. Five new synonyms are proposed (*H. campestre* subsp. *pauciflorum, H. campestre* subsp. *tenue, H. rigidum* subsp. *bracteatum, H. rigidum* subsp. *meridionale,* and *H. rigidum* subsp. *sellowianum*), and two superfluous names are detected (*H. bolivianum* and *H. connatum* var. *obscurum*).

1. ***Hypericum austrobrasiliense*** Vog.Ely, Boldrini & Bordignon in Phytotaxa 192(4): 290. 2015 – Holotype: BRAZIL. Rio Grande do Sul, Bom Jesus, margem da BR-285, 12 December 2007, *S. Bordignon & G. L. von Poser 3454* (ICN barcode 00000239!; isotypes: K barcode K000543822!; MBM barcode 409615!; RB barcode RB01112719!). — Image of holotype available at http://reflora.jbrj.gov.br/reflora/geral/ExibeFiguraFSIUC/ExibeFiguraFSIUC.do?idFigura=87919726

2. ***Hypericum bordignonii*** Vog.Ely and Boldrini in Syst. Bot. 40(4): 989. 2015 – Holotype: BRAZIL. Rio Grande do Sul, Porto Alegre, Morro Santa Teresa, 2 December 2013, *C. Vogel Ely and S. Bordignon 360* (ICN barcode 00003526!; isotypes: RB barcode RB01408745!, US!, and NY barcode 03090956!). — Image of NY-isotype available at http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=3373251

3. ***Hypericum brasiliense*** Choisy in Prodr. 1: 547. 1824. ≡ *Sarothra brasiliensis* (Choisy) Y.Kimura in Nakai & Honda, Nov. Fl. Jap 10: 71. 1951 – Neotype (designated by Rodríguez Jiménez in Mem. Soc. Ci. Nat. La Salle 33: 120. 1973): BRAZIL. Rio de Janeiro, 1830, *Gaudichaud 1* (G barcode G00355062 [image!]). — Image of neotype available at http://www.ville-ge.ch/musinfo/bd/cjb/chg/adetail.php?id=260044&base=img&lang=en
= *Hypericum laxiusculum* A.St.-Hil. in Pl. Usuel. Bras. 1, t. 62. March 1828 – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 73. 1990; **second-step designated here**): BRAZIL. [Paraná], Campos Gerais, Fazenda Fortaleza, February [1820] 1816–1822, *A. de Saint-Hilaire C2-1457*^{ter} (P barcode P02440242 [image!]; isolectotypes: P barcode P02440243 [image!], MPU barcode MPU022179 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p02440242

= *Hypericum campestre* Cham. & Schltdl. in Linnaea 3: 122. April 1828 – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 76. 1990; **second-step designated here**): BRAZIL. [Paraná or Santa Catarina], “ad fluvium Rio Negro aliisque pluribus locis”, [1828] 1814–1831, *Sellow s.n.* (HAL barcode HAL0014522 [image!]; isolectotypes: W barcode W0061475 [image!], K barcode K000221188 [image!], M barcode M-0112210 [image!]). — Image of lectotype available at https://herbarium.univie.ac.at/database/detail.php?ID=140497

= *Hypericum linoides* A.St.-Hil. in Fl. Bras. Merid. 1: 333. September 1828 (“1825”). ≡ *Hypericum brasiliense* var. *linoides* (A.St.-Hil.) C.Rodr.Jim. Mem. Soc. Ci. Nat. La Salle 33: 126. 1973 – **Lectotype** (first-step designated by Rodríguez Jiménez in Mem. Soc. Ci. Nat. La Salle 33: 126. 1973, corrected from “type”; **second-step designated here**): BRAZIL. Rio Grande do Sul, “crescit ad ripas rivuli vulgò Garapuita, in parte occidentali provinciæ de Rio Grande de S. Pedro do Sul”, February [1821] 1816–1822, *A. de Saint-Hilaire C2-2575*[4] (P barcode P00798950 [image!]; isolectotypes: P barcodes P00798951 & P00798952 [images!], MPU barcode MPU022173 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p00798950

= *Hypericum punctulatum* A.St.-Hil. in Fl. Bras. Merid. 1: 334. September 1828 (“1825”). ≡ *Hypericum brasiliense* var. *latifolium* Reichardt in Martius, Fl. Bras. 12(1): 193. 1878. ≡ *Hypericum brasiliense* var. *punctulatum* (A.St.-Hil.) R.Keller in Bull. Herb. Boissier ser. 2, 3: 1126. 1903 – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 73. 1990, corrected from “holotype”; **second-step designated here**): BRAZIL. “in campis haud longè ab urbe Mantiqueira, in provinciâ Minas Geraës”, 1816–1822, *A. de Saint-Hilaire B1-123* (P barcode P02440246 [image!]; isolectotypes: P barcodes P02440245 & P02440247 [images!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p02440246

= *Receveura graveolens* Vell. in Fl. Flumin. 1: 237. 1829 – **Lectotype (designated here):** BRAZIL. [Rio de Janeiro or São Paulo]; [illustration] Original parchment plate of Flora Fluminensis in the Manuscript Section of the Biblioteca Nacional, Rio de Janeiro [cat. no.: mss1198654_123] and later published in Vellozo, Fl. Flumin. Icon. 5: t. 120. 1831.

= *Hypericum brasiliense* var. *angustifolium* Reichardt in Martius, Fl. Bras. 12(1): 193. 1878 – **Lectotype (designated here):** BRAZIL. Serra do Cuiaba, August 1825, *A.L.P da Silva Manso 360* (BR barcode BR0000008676535 [image!]). Remaining syntypes: BRAZIL. s. loc., 1839, *J. Pohl s.n.* (M barcode M-0112203 [image!]). BRAZIL. s. loc., s. dat., *J. Pohl s.n.* (BR barcode BR000000867612 [image!]). — Image of lectotype available at https://plants.jstor.org/stable/viewer/10.5555/al.ap.specimen.br0000008676535

= *Hypericum stylosum* Rusby in Bull. New York Bot. Gard. 4: 326. 1907. ≡ *Hypericum bolivianum* R.Keller in Bull. Herb. Boissier ser. 2, 8: 189. 1908, **nom. illeg. superfl.** (Art. 52.1–2 of the ICN, Turland & al., 2018) – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 73. 1990, corrected from “holotype and isotypes”; **second-step designated here**): BOLIVIA. Dpto. La Paz, Prov. Nor Yungas, Coripati [Coripata], 30 March 1894, *M. Bang 2107* (NY barcode 00075931 [image!]; isolectotypes: NY barcodes 00075928, 00075929 & 00075933 [images!], US barcodes 00114108 & 00114053 [images!], W barcodes W0051668 [images!], WU barcode 069237 [image!], GH barcode 00067652 [image!], MO barcode MO-279733 [image!], K barcode

K000221212 [image!], E barcode E00394831 [image!], PH barcode PH00015340 [image!], WIS barcode v0255848 [image!], MICH barcode 1115545 [image!], BM barcode BM000624717 [image!]). — Image of lectotype available at http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=125983

= *Hypericum anceps* Larrañaga in Pub. Inst. Hist. Geog. Urug. 2: 239. 1923 – Neotype (designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 86. 1990): URUGUAY. s. loc., s. dat., *J. Arechavaleta s.n.* (US-fragment barcode 01106010 [image!]; isoneotype: MVM No. 570!). — Image of neotype available at http://n2t.net/ark:/65665/3f2e01da1-a493-4de5-aae0-c2c20b368c6f

= *Hypericum campestre* subsp. *pauciflorum* N.Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 76. 1990, **syn. nov.** – Holotype: BRAZIL. Paraná, Quatro Barras, Rio Taquarí, 28 June 1982, *P.I. Oliveira 565* (BM barcode BM000624770 [image!]; isotypes: MU barcode MU000000210 [image!], C barcode C10009471 [image!], MBM barcode 077944!). — Image of holotype available at http://data.nhm.ac.uk/object/51be3d87-3d7f-447d-af2d-00ff738981cc

= *Hypericum campestre* subsp. *tenue* N.Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 77. 1990, **syn. nov.** – Holotype: PARAGUAY. [Dpto. Concepción], Villa Sana, Swischen Rio Apa und Rio Aquidaban, 30 January 1909, *Fiebrig 4895* (BM barcode BM000549682 [image!]; isotypes: K barcode K000634800 [image!], G barcodes G00306599 & G00306600 [images!]). — Image of holotype available at http://data.nhm.ac.uk/object/c4287d94-0f69-40d8-bf45-ce69d3b3ee6a

Hypericum brasiliense is an extremely variable species, which may be related to the different environments it occupies, as well as to the presence of apomixis and different levels of ploidy observed in this species (Moraes & al., 2009). As a result, the definition of *H. brasiliense*'s concept and its synonyms is somewhat controversial. For some authors, *H. brasiliense* can be distinguished from *H. campestre* by capsule's characteristics and sepals that exceed the fruits (Chamisso & Schlechtendal, 1828; Reichardt, 1878). Other authors, however, distinguish *H. brasiliense* from *H. campestre* for almost the same capsule's characteristics but argue that in the first species, the sepals do not exceed the fruits (Smith, 1958; Robson, 1990; Ulibarri, 2005). Our field observations do not confirm these morphological differences, that is, we observed in different localities individuals with fruits and calyx varying widely within the same population and even within the same specimen. Equally important, is note that *H. brasiliense* and *H. campestre* types have sepals exceeding capsules. Thus, we consider *H. campestre* synonymous of *H. brasiliense* (as well as Rodríguez Jiménez, 1973, 1980; Bittrich, 2003; Slusarski & al., 2007). We also consider *H. linoides* synonymous of *H. brasiliense* (as well as Ulibarri, 2005), since we find no clear limits separating these names. The remaining *H. brasiliense*'s synonyms are more widely accepted (see Rodríguez Jiménez, 1973; Robson, 1990).

For *H. laxiusculum,* Robson (1990) cites the lectotype in P, but the existence of three sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose the sample P02440242 as the lectotype because this sheet has Saint Hilaire's handwriting on the label and the data matches the protologue. The sheet P02440244 also seems to be part of the original material of *H. laxiusculum* because it has Saint Hilaire's handwriting on the label. However, we did not include P02440244-sheet as a probable isolectotype of *H. laxiusculum* because first, the collector number is missing, and second, the specimen morphology is more similar to *H. carinatum* than to *H. brasiliense*. Therefore, we are not convinced that P02440244 is a duplicate of P02440242, P02440243, and MPU022179.

For *H. campestre,* there is no collection number cited in the protologue. Robson (1990) mentioned the B-destroyed specimen (Sellow 1655) as lectotype and the K specimen (Sellow s. n.) as "isotype". However, as one of the sheets cited by Robson (1990) has a collection number and the other does not, they should not be considered duplicates. Furthermore, as the designated lectotype is destroyed, and no duplicates apparently exist, a second-step lectotypification is required (Art. 9.17 of the ICN, Turland & al., 2018). The chosen lectotype and all isolectotypes have Schlechtendal's handwriting on the label. Both subspecies of *H. campestre* described by Robson (1990) were here synonymized with *H. brasiliense* because it is tough to apply the morphological limits established in the protologue in the specimens found in nature and the herbaria.

One inadvertent lectotypification of *H. linoides* by Rodríguez Jiménez (1973) cited the type in P, but the existence of three sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). Although the collector number is missing from exsiccate P00798950, we chose this sheet as lectotype of *H. linoides* because it is morphologically complete and has Saint Hilaire's handwriting with data that matches the protologue on the label.

One inadvertent lectotypification of *H. punctulatum* by Robson (1990) cited the "holotype" in P, but the existence of three sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose the sample P02440246 as the lectotype because this sheet has Saint Hilaire's handwriting on the label and the data matches the protologue.

For *Receveura graveolens* the original parchment illustration housed in the Biblioteca Nacional in Rio de Janeiro was chosen as lectotype because it is the only surviving original material (Article 9.4 in Turland & al., 2018). Vellozo's original collections were sent to the Museu Real de Lisboa between 1797 and 1798, but yet no original material has been found in Portugal or Paris (Lima, 1995; Pastore, 2013; Pellegrini & al., 2015).

For *H. brasiliense* var. *angustifolium* there is no information of the type cited in the protologue. However, we found three sheets with Reichardt's handwriting, of which we choose the sheet with more information (BR0000008676535) to be the lectotype. Robson (1990) cites *Saint Hilaire 2158* from P as "holotype" of *H. brasiliense* var. *angustifolium,* but we found no evidence that Reichardt used this material to describe the new variety. Thus, we proceeded a re-lectotypification of *H. brasiliense* var. *angustifolium*.

One inadvertent lectotypification of *H. stylosum* by Robson (1990) cited the "holotype" in NY, but the existence of four sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose the sample NY00075931 as the lectotype because it is morphologically the most complete sheet. *H. bolivianum* has the same type as *H. stylosum,* which makes it an illegitimate superfluous name (Art. 52.1–2 of the ICN, Turland & al., 2018).

4. ***Hypericum caprifoliatum*** Cham. & Schltdl. in Linnaea 3: 125. 1828 – **Lectotype** (first-step designated by Rodríguez Jiménez in Mem. Soc. Ci. Nat. La Salle 33: 127. 1973, corrected from "type and isotype"; **second-step designated here**): BRAZIL. "Brasiliae meridionalis provinciis", 1814–1831 [1823–1828], *Sellow s.n.* (BR barcode BR0000008677112 [image!]; isolectotype: HAL barcode HAL0014527 [image!]). — Image of lectotype available at http://www.br.fgov.be/RESEARCH/COLLECTIONS/HERBARIUM/detail.php?ID=435790

For *Hypericum caprifoliatum*, there is no collection number cited in the protologue. One inadvertent lectotypification of *H. caprifoliatum* by Rodríguez Jiménez (1973) mentioned the G specimen (Sellow 1356) as the type and the BR (Sellow s. n.) specimen as "isotype". Subsequently, Robson (1990) mentioned the B-destroyed specimen (Sellow 1356) as "holotype" and the BR (Sellow s. n.), G (Sellow 1356) and S (Sellow 1356) specimens as "isotypes". However, we have two caveats regarding these determinations. First, the BR (BR0000008677112) specimen does not have collection number; therefore, it should not be considered a duplicate of Sellow 1356 (Art. 9.5 of the ICN, Turland & al., 2018). Second, the specimens in G (G00355623) and S (S03-1990 & S11-31752) have the Sellow's collector number added belatedly and did not have Schlechtendal's annotations on the label; thus, we are not convinced that they are original material and, therefore, should not be considered for typification purposes. Consequently, a second-step lectotypification, prioritizing the specimen cited by Rodríguez Jiménez (1973) as "isotype" seems appropriate (Art. 9.17 of the ICN, Turland & al., 2018). The chosen lectotype (BR0000008677112) is morphologically complete and has Schlechtendal's handwriting on the label, as well as its isolectotype (HAL0014527).

5. ***Hypericum carinatum*** Griseb. in Symb. Fl. Argent. 41. 1879 – Lectotype (designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 84. 1990, corrected from "holotype"): ARGENTINA. Córdoba, Sierra Achala, N. Cuesta de Copina, 22 February 1877, *G. Hieronymus 881* (GOET barcode GOET000923 [image seen on JStor!]). — Image of lectotype available at https://plants.jstor.org/stable/viewer/10.5555/al.ap.specimen.goet000923

= *Hypericum paraguense* R.Keller in Bull. Herb. Boissier ser. 2, 8: 181. 1908 – Neotype **(**designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 84. 1990): PARAGUAY. Dpto. Concepción, prope Concepción, September 1901, *E. Hassler 7395* (G barcode G00381661 [image!]). — Image of neotype available athttp://www.ville-ge.ch/musinfo/bd/cjb/chg/adetail.php?id=303429&lang=fr

= *Hypericum altissimum* R.Keller in Engler, Bot. Jahrb. Syst. 58: 199. 1923 – **Lectotype (**first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 85. 1990, corrected from "holotype and isotypes"; **second-step designated here**): PARAGUAY. Prope Asuncion, S. Izabel, "in campo sicco juxta ripam fluvii Paraguay", 17 September 1893, *C. A. M. Lindman in herb. Regnelli Ser. I, No. 2061* (S barcode S03-1987 [image!]; isolectotypes: S barcode S11-31744 [image!], R barcode R000078970!, GH barcode GH00067650 [image!]). — Image of lectotype available at http://herbarium.nrm.se/img/fbo/large/S03-001001/S03-1987.jpg

= *Hypericum megapotamicum* Malme in Ark. Bot. 23A(4): 17. 1930 – **Lectotype (designated here)**: BRAZIL. Rio Grande do Sul, Canoas prope Porto Alegre, 30 November 1901, *G. O. A. Malme in herb. Regnelli Ser. II, No. 665* (S barcode S03-2000 [image!]; isolectotype: S barcode S11-31746 [image!]). Remaining syntype: BRAZIL. Rio Grande do Sul, Povo Novo prope Pelotas, 12 Nov 1901, *Malme in herb. Regnelli Ser. II, No. 410* (S barcode S11-32601 [image!]). — Image of lectotype available at http://herbarium.nrm.se/img/fbo/large/S03-001001/S03-2000.jpg

There is no collection number cited in the protologue of *H. carinatum*. Therefore, as we do not know if the gathering "*Hieronymus* 881" was represented only by a single specimen, we consider the holotype indication by Robson (1990) an inadvertent lectotypification.

For *H. paraguense*, there is no information of the type cited in the protologue. The species description occurred briefly within the species key. Robson (1990) cited the specimen in G as lectotype, but there is no evidence that R.Keller used this specimen in species description. Thus, we consider Robson's lectotype indication an inadvertent neotypification.

For *H. altissimum*, there is a herbarium number cited in the protologue (2061). One sheet with this number was destroyed in B during the Second World War, and duplicates exist in S, R and GH herbaria. One inadvertent lectotypification of *H. altissimum* by Robson (1990) mentioned the B-destroyed specimen "holotype", while the specimens in S and GH were called "isotypes". However, as the B-sheet was destroyed and duplicates exist, a second-step lectotypification is required (Art. 9.17 of the ICN, Turland & al., 2018). We chose S03-1987 as lectotype because it is morphologically complete.

There are syntypes of *H. megapotamicum* deposited in the S herbarium. All syntypes have a herbarium number cited in the protologue (410 & 665). We chose S03-2000 as lectotype because it is morphologically complete and has a duplicate specimen (S11-31746).

6. ***Hypericum cavernicola*** L.B.Sm. in Wrightia 2: 90. 1960 – Holotype: URUGUAY. Tacuarembó, Gruta de los Cuervos, 17 December 1907, *Berro 4862* (US barcode 00037001 [image!]; isotypes: MVFA barcodes 0000039! & 0000040!, K barcode K000221233 [image!]). — Image of holotype available at http://n2t.net/ark:/65665/3ef38cbc0-afc3-45d1-8141-4159303e2514

7. ***Hypericum connatum*** Lam. in Encycl. 4: 168. 1797. ≡ *Brathys connata* (Lam.) Spach. in Hist. Nat. Vég. 5: 450. 1836. ≡ *Hypericum connatum* var. *obscurum* Briq. in Annu. Conserv. Jard. hot. Genève 20: 389. 1919, **nom. illeg. superfl.** (Art. 52.1–2 of the ICN, Turland & al., 2018). ≡ *Sarothra connata* (Lam.) Y.Kimura in Nakai & Honda, Nov. Fl. Jap 10: 71. 1951 – **Lectotype** (first-step designated by Rodríguez Jiménez in Mem. Soc. Ci. Nat. La Salle 33: 129. 1973, corrected from "type and isotype"; **second-step designated here**): URUGUAY. Montevideo, "Cette singulière espèce croît naturellement sur le morne de Montevideo", May 1767, *Commerson s.n.* (P barcode P00798959 [image!]; isoletotypes: P barcode P00798960 [image!], P barcode P00798961 [image!], P barcode P00670152 [image!], MPU barcode MPU022193 [image!], LINN barcode LINN-HS 1244.21 [image!], FI barcode FI005984, only the specimen from the lower left corner [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p00798959

= *Hypericum chlorifolium* A.St.-Hil. in Fl. Bras. Merid. 1: 329. 1828 ("1825"). ≡ *Hypericum connatum* var. *chlorifolium* (A.St.-Hil.) Reichardt Fl. Bras. 12(1): 192. 1878 – Holotype: BRAZIL. São Paulo [Paraná], Campos Gerais, prope Fazenda Fortaleza, February [1820] 1816–1822, *A. de Saint-Hilaire C2-1476bis* (P barcode P02440251 [image!]). — Image of holotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p02440251

= *Hypericum connatum* var. *paraguariense* Briq. in Annu. Conserv. Jard. hot. Genève 20: 390. 1919 – Lectotype (designated by Rodríguez Jiménez in Mem. Soc. Ci. Nat. La Salle 33: 130. 1973, corrected from "type and isotypes"): BOLIVIA. Dpto. Tarija, [Prov. Aniceto Arce], Bermejo, 3 December 1903, *Fiebrig 2361 pro parte* (G barcode G00418923 [image!]). Remaining syntypes: PARAGUAY. [Dpto. Alto Paraná] Tacurupucú, [1885−1895], *E. Hassler 2272* (G barcode

G00448822 [image!]). PARAGUAY. [Dpto. Canindeyú], Sierra de Maracayú, San Blas (Yerutí), December [1898−1899], *E. Hassler 5731 [5751]* (G barcodes G00448823 & G00448824 [images!], BM barcode BM000549678 [image!]). PARAGUAY. Chaloló, December [1900], *E. Hassler 6783* (G barcodes G00448826 & G00448827 [images!], BM barcode BM000816135 [image!]). PARAGUAY. [Dpto. Guairá] Cordillera de Villarrica, January [1905], *E. Hassler 8758* (G barcodes G00448828, G00448829 & G00448829_a [images!], BM barcode BM000816136 [image!]). PARAGUAY. [Dpto. Caaguazú], Yhú, November [1905], *E. Hassler 9686* (G barcodes G00448830 & G00448830_a [images!], BM barcode BM000549679 [image!]). PARAGUAY. s. loc., s. dat., *E. Hassler 6203* (G barcodes G00448821 & G00448821_a [images!]). — Image of two syntypes (*E. Hassler 8758* [BM000816136] & *E. Hassler 9686* [BM000549679]) available at http://data.nhm.ac.uk/object/65d7e136-dae4-4674-9f96-a62b03e6bed8

= *Hypericum connatum* var. *fiebrigii* Briq. in Annu. Conserv. Jard. hot. Genève 20: 390. 1919 – Lectotype (designated by Rodríguez Jiménez in Mem. Soc. Ci. Nat. La Salle 33: 130. 1973, corrected from “type and isotypes”): BOLIVIA. Dpto. Tarija, [Prov. Aniceto Arce], Bermejo, 3 December 1903, *Fiebrig 2361 pro parte* (G barcode G00418922 [image!]; isolectotypes: SI!, NY barcode 00084888 [image!], S barcode S11-32617 [image!], U barcode U0002411 [image!], US barcode 00114060 [image!], W barcode W19220001760 [image!]). — Image of NY-isolectotype available at http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=236161

= *Hypericum cyathifolium* Larrañaga in Pub. Inst. Hist. Geog. Urug. 2: 239. 1923 – **Neotype (designated here):** URUGUAY. Soriano, Vera, January 1898, *M. B. Berro 240* (US barcode 03004550 [image!]; isoneotypes: MVFA! [two sheets without barcode or herbarium number]). — Image of neotype available at http://n2t.net/ark:/65665/3bb4a17ee-948d-4f90-9d10-824a87a0ee15

One inadvertent lectotypification of *H. connatum* by Rodríguez Jiménez (1973) cited the type and isotype in P, but the existence of three sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose the sample P00798959 as the lectotype because this sheet has Commerson’s handwriting on the label and the data matches the protologue.

For *H. chlorifolium*, only one sheet that matches the protologue apparently exists (P02440251), which is why it is called holotype (McNeill, 2014).

As observed by Robson (1990), Briquet cites *H. connatum* Lam. as a synonym of his variety *H. connatum* var. *obscurum* and, by consequence, Briquet’s name is an illegitimate superfluous name (Art. 52.1–2 of the ICN, Turland & al., 2018). Describing other two new varieties for *Hypericum connatum* (*H. connatum* var. *paraguariense* Briq. and *H. connatum* var. *fiebrigii* Briq.), Briquet cited the vouchers, but not the herbaria in which type specimens should be deposited (Briquet, 1919). One inadvertent lectotypification of both varieties by Rodríguez Jiménez (1973: 130) cited the types in G, and according to Briquet’s notes, there is only one sheet of each taxon in this herbarium. Therefore, the sample G00418923 is the lectotype of *H. connatum* var. *paraguariense,* while G00418922 is the lectotype of *H. connatum* var. *fiebrigii*. It should be noted that for *H. connatum* var. *paraguariense,* Robson (1990: 58) proposed a substitute lectotype, arguing that, except for the lectotype, all other syntypes are from Paraguay (as well as the epithet suggests). Although the arguments made by Robson (1990) are valid, the lectotypification made by Rodríguez Jiménez (1973) did not violate the ICN rules (Art. 9.19 of the ICN, Turland & al., 2018), and should be followed.

According to Dr. C. Diego Legrand (in Smith, 1958: 314), there is no type specimen for *H. cyathifolium*, nor the other Larrañaga's names. Therefore, since there is no original material to be used as lectotype, a neotype is required (Art. 9.8 of the ICN, Turland & al., 2018). We chose the sheet US03004550 as the neotype because this specimen is from the same region where Larrañaga worked (Uruguay).

8. ***Hypericum cordiforme*** A.St.-Hil. in Fl. Bras. Merid. 1: 330. 1828 ("1825") – Lectotype (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 59. 1990, corrected from "holotype and isotype"; second-step designated by Vogel Ely & al. in Brittonia 70(4): 380, 2018): BRAZIL. São Paulo, "in pascuis prope urbem Sancti Pauli", 1816–1822, *A. de Saint-Hilaire C1-1172* (P barcode P01901409 [image!]; isolectotype: P barcode P01901411 [image!]; probable isolectotype: P barcode P01901410 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p01901409

= *Receveura cordata* Vell. in Fl. Flumin. 1: 237. 1829. ≡ *Hypericum cordatum* (Vell.) N.Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 59. 1990 – Lectotype (designated by Vogel Ely & al. in Brittonia 70(4): 380, 2018): BRAZIL. [Rio de Janeiro or São Paulo]: "Habitat campis apricis mediterraneis"; [illustration] Original parchment plate of Flora Fluminensis in the Manuscript Section of the Biblioteca Nacional, Rio de Janeiro [cat. no.: mss1198654_122] and later published in Vellozo, Fl. Flumin. Icon. 5: t. 119. 1831 – Epitype (designated by Vogel Ely & al. in Brittonia 70(4): 380, 2018): BRAZIL. São Paulo, São Roque, Bairro Caete, 2 Dec 1987, *S. Tsugaru B2244 & Y. Otsuka* (NY barcode 477006 [image!]; isoepitype: OOM No. 45255 n.v.). — Image of epitype available at http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=210163

= *Hypericum cordiforme* var. *genuinum* Briq. in Annu. Conserv. Jard. hot. Genève 20: 391. 1919, nom. inval. (Art. 24.3 and 26.1 of the ICN, Turland & al., 2018).

= *Hypericum cordatum* subsp. *kleinii* N.Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 60. 1990 – Holotype: BRAZIL. Santa Catarina, Lajes, 2 December 1956, *L. B. Smith & R. Klein 8100* (US barcode 00170339 [image!]; isotype: NY barcode 00084889 [image!]). — Image of holotype available at http://n2t.net/ark:/65665/33ec91c49-9ac5-4bd8-a253-f6ad7ea16fb0

For a detailed discussion on *H. cordiforme* and its synonyms see Vogel Ely & al. (2018b).

9. ***Hypericum denudatum*** A.St.-Hil. in Fl. Bras. Merid. 1: 336. 1828 ("1825") – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 71. 1990, corrected from "holotype", **second-step designated here**): BRAZIL. Paraná, [near Tibagi, Barra do Iapó] "in pratis ad ripas amnis Yapò, haud longè à tugúrio Barra do Yapò, in parte provinciæ Sancti Pauli dictâ Campos Geraës", February [1820] 1816–1822, *A. de Saint-Hilaire C1-1530* (P barcode P00798948 [image!]; isoletotype: P barcode P00798949 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p00798948

One inadvertent lectotypification of *H. denudatum* by Robson (1990) cited the "holotype" in P, but the existence of two sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose the sample

P00798948 as the lectotype because this sheet is morphologically complete and has location data equal to the protologue written by Saint-Hilaire on the label.

10. ***Hypericum gentianoides*** (L.) Britton, Sterns & Poggenb. in Prelim. Cat. Pl. 9. 1888. ≡ *Sarothra gentianoides* L. in Sp. Pl. 1: 272. 1753. ≡ *Hypericum sarothra* Michx. in Fl. Bor.-Amer. 2: 79. 1803, nom. illeg. superfl. (Art. 52.1–2 of the ICN, Turland & al., 2018). ≡ *Sarothra hypericoides* Nutt. in Gen. N. Amer. Pl. 1: 204. 1818, nom. illeg. superfl. (Art. 52.1–2 of the ICN, Turland & al., 2018). ≡ *Brathys gentianoides* (L.) Spach in Ann. Sci. Nat., Bot. sér. 2, 5: 367. 1836 – Lectotype (designated by Rodríguez Jiménez in Mem. Soc. Ci. Nat. La Salle 33: 112. 1973): U.S.A. s. loc., s. dat., *Pehr Kalm s.n.* (LINN No. 391-1 [image!]). — Image of lectotype available at http://linnean-online.org/3686/

= *Hypericum nudicaule* Walter in Fl. Carol. 190. 1788 – Neotype (designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 45. 1990): U.S.A., Carolina, s. dat., *Walter f. 60 no. 649* (BM barcode BM001024260 [image!]). — Image of neotype available at http://data.nhm.ac.uk/object/eba354e5-7ed8-4f67-bbb7-441a40842075

For *H. nudicaule*, there is no information of the type cited in the protologue; thus, we consider that Robson (1990) did an inadvertent neotypification. For a detailed discussion on *H. gentianoides* and its synonyms see Robson (1990).

11. ***Hypericum legrandii*** L.B.Sm. in J. Wash. Acad. Sci. 48: 314. 1958. ≡ *Hypericum ericoides* Arechav. in Anales Mus. Hist. Nat. Montevideo 4: 18. 1902, hom. illeg., non L., 1753 – Lectotype (designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 64. 1990, corrected from “holotype and isotype”): URUGUAY. Rivera, 17 December 1901, *Berro 1720* (MVM No. 2767!; isolectotypes: US barcode 00074199 [image!], MVFA! [three sheets without a barcode or herbarium number]). — Image of US-isotype available at http://n2t.net/ark:/65665/3c551b4aa-a839-4ed2-9e98-f9d78da49dfc

12. ***Hypericum lorentzianum*** Gilg ex R.Keller in Bot. Jahrb. Syst. 58(3): 199. 1923 – **Neotype (designated here**): BRAZIL. s. loc., 1814–1831, *Sellow s.n.* (S barcode S03-1999 [image!]). — Image of neotype available at http://herbarium.nrm.se/specimens/S03-1999

For *H. lorentzianum* there is no information of the type cited in the protologue, it contains only an indirect description of the species. That is, a brief diagnosis of the new species with *H. campestre* and *H. altissimum* is provided (see Smith, 1958), which hinders the understanding of the species’ concept. Robson (1990) called the B-destroyed specimen (Sellow 4341) as “holotype” and the S (Sellow s.n., S03-1999) and P (Pedersen 5384, P04896121) specimens “isotypes”. However, as all sheets have different collection numbers, they should not be considered duplicates (Art. 9.5 of the ICN, Turland & al., 2018). Furthermore, only the B-destroyed specimen (Sellow 4341) has R.Keller annotations written on the label, which allows us to recognize this specimen as original material. Consequently, since we have not found any duplicates of the destroyed “holotype” in any other herbaria, the specimens cited as “isotypes” should be considered for neotypification since there is no evidence that they are part of the original material. It is worth highlighting that we do not consider an inadvertent neotypification by Robson (1990) because the two sheets cited as “isotypes” are not duplicates.

13. ***Hypericum microlicioides*** L.B.Sm. in J. Wash. Acad. Sci. 48(10): 311. 1958 – Holotype: BRAZIL. Santa Catarina, Campo Alegre, Morro Iquererim, 10 December 1956, *L. B. Smith & R. Klein 8535* (US barcode 00037003 [image!]; isotypes: NY barcode 00075913 [image!], P barcode P02442084 [image!], HBR barcode HBR0017818 [image!], R barcode R000197296!). — Image of holotype available at http://n2t.net/ark:/65665/3085a8243-1dea-4eba-aca0-b501260d1ef2

14. ***Hypericum mutilum*** L. in Sp. Pl. 2: 787. 1753 – Lectotype (first-step designated by Rodríguez Jiménez in Mem. Soc. Ci. Nat. La Salle 33: 79. 1973; **second-step designated here**): U.S.A. Virginia, s. dat., *Clayton 232* (BM barcode BM000042223 [image!]; isolectotype: BM barcode BM000540494 [image seen on JStor!]). — Image of lectotype available at http://data.nhm.ac.uk/object/9362415d-e9fd-42d1-a3cf-3295dcb05317

= *Hypericum euphorbioides* A.St.-Hil. in Fl. Bras. Mer. 1: 332, t. 69. September 1828 (“1825”) – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 116. 1990, corrected from “holotype”, **second-step designated here**): BRAZIL. São Paulo, “ad ripas fluminis Parahyba, prope Sebastianopolim et ad rivulos prope Jondiahi, in provinciâ Sancti Pauli”, 1816–1822, *A. de Saint-Hilaire C1-1076* (P barcode P01901514 [image!]; isolectotypes: P barcodes P01901515 & P01901516 [images!], MPU barcode MPU022186 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p01901514

= *Hypericum euphorbioides* var. *minus* A.St.-Hil. in Fl. Bras. Mer. 1: 332. September 1828 (“1825”) – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 116. 1990, corrected from “holotype”, **second-step designated here**): BRAZIL. Rio de Janeiro, “prope prædium vulgò Fazenda da Barra Seca, in provinciâ Rio de Janeiro”, 1816–1822, *A. de Saint-Hilaire B2-231* (P barcode P01901512 [image!]; isolectotypes: P barcodes P01901511 & P01901513 [images!], MPU barcode MPU022187 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p01901512

= *Hypericum euphorbioides* var. *floribundum* A.St.-Hil. in Fl. Bras. Mer. 1: 332. September 1828 (“1825”) – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 116. 1990, corrected from “holotype”, **second-step designated here**): BRAZIL. Minas Gerais, “ad ripas fluminis Paranahiba, in parte occidental provinciæ Minas Geraës”, 1816–1822, *A. de Saint-Hilaire C1-921* (P barcode P01901509 [image!]; isolectotype: P barcode P01901510 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p01901509

For *H. mutilum*, Rodríguez Jiménez (1973) indicated the lectotype in BM, but the existence of two sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). At first impression, it seems that Robson (1980) made the second-step of lectotypification but, in fact, he also did not indicate which sheet would be the lectotype. Thus, although there are notes on the sheets of who is the lectotype, they were added belatedly, and the handwriting is neither from Rodríguez Jiménez’s nor from Robson’s.

Inadvertent lectotypifications of *H. euphorbioides, H. euphorbioides* var. *minus* and *H. euphorbioides* var. *floribundum* by Robson (1990) cited the “holotypes” in P, but the existence of more than one sheet each in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose the sheets P01901514, P01901512 and P01901509 (respectively) as the lectotypes of these three names because these samples are complete morphologically and have location data equal to the protologue written by Saint-Hilaire on the label.

For a detailed discussion on *H. mutilum* and its synonyms around the world see Robson (1990).

15. ***Hypericum myrianthum*** Cham. & Schltdl. in Linnaea 3: 123. April 1828. ≡ *Sarothra myriantha* (Cham. & Schltdl.) Y.Kimura in Nakai & Honda, Nov. Fl. Jap. 10: 233. 1951 – **Lectotype (designated here):** [URUGUAY]. "in campis pratisque provinciarum meridionalium Brasiliae, Montevideo, etc., ad fluvium Rio Negro, alibique frequentem", 1814–1831 [19 December 1822 – 5 March 1823], *Sellow s.n.* (HAL barcode HAL0014759 [image!]; possible isolectotypes: HAL barcode HAL0014757 [image!], HBG barcode HBG-517645 [image!], K barcode K000221236 [image!], L barcode L.2412670 [image!], W barcodes W0061472 & W18890315758 [images!]).

There are specimens of *H. myrianthum* deposited in the herbaria HAL, HBG, K, L, and W that might be considered original material. All these specimens have Schlechtendal's handwriting on the label; however, without collection data or Sellow's collector number, we cannot assume that these sheets are all isolectotypes (possible isolectotypes). The "holotype" *Sellow 3343*, cited by Robson (1990) with a question mark, was not found in B. A possible duplicate sheet with two plants exists in S (S11-32679 & S12-12769); however, as this sheet does not have Schlechtendal's annotations on the label, nor any other information that refers to the protologue, it should not be considered for typification purposes.

16. ***Hypericum pedersenii*** N.Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 72. 1990 – Holotype: BRAZIL. Rio Grande do Sul, Arroio dos Ratos, Faxinal, 10 November 1977, *Pedersen 11972* (BM barcode BM001207325 [image!]; isotypes: MBM barcode 163948!, G barcode G00355547 [image!], MO barcode MO2018350 [image!], CTES barcodes CTES0001808 & CTES0001809 [images were seen on JStor!]). — Image of holotype available at http://data.nhm.ac.uk/object/46853b88-ea8d-4ffd-9f31-2e822085d71c

17. ***Hypericum piriai*** Arechav. in Anales Mus. Nac. Montevideo 3: 108. 1898 – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 16(1): 28. 1987, corrected from "holotype"; **second-step lectotype, here designated**): URUGUAY. Maldonado, "colinas de Pan de Azúcar cerca del Castillo de Piriápolis", s. dat., *J. Arechavaleta s.n.* (MVM No. 564!; isolectotypes: MVM No. 564!, US-fragment barcode 00114095 [image!]).

= *Hypericum hilaireanum* L.B.Sm. in J. Wash. Acad. Sci. 48: 314. 1958, nom. nov. ≡ *Hypericum tenuifolium* A.St.-Hil. in Fl. Bras. Merid. 1: 337. 1828 ("1825"), hom. illeg., non Pursh., 1813 ("1814") – Lectotype (designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 16(1): 28. 1987, corrected from "holotype"): BRAZIL. São Paulo [Paraná], "in pascuis siccis prope urbes Sancti Pauli, Villa do Castro et Curityba, in provinciâ Sancti Pauli", March [1820] 1816–1822, *A. de Saint-Hilaire C1-1174* (P barcode P01901373 [image!]). Remaining syntypes: BRAZIL, [Paraná], "Curityba", [1820] 1816–1822, *A. de Saint-Hilaire 1538*

(MPU barcode MPU022444 & P barcode P04685104 [images!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p01901373

One inadvertent lectotypification of *H. piriai* by Robson (1987) cited the "holotype" in MVM, but the existence of two sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). Since there are no barcodes or herbarium numbers to differentiate the two sheets deposited in MVM, we added a label to indicate which one is the lectotype. The lectotype also has a pin fixing the specimen and lacks an envelope containing petals and seeds.

Hypericum hilaireanum is a replacement name for *Hypericum tenuifolium* A.St.-Hil. (1828), a posterior homonym of *Hypericum tenuifolium* Pursh. (1813). Robson (1990) called the P specimen holotype of *H. tenuifolium* A.St.-Hil. (≡*H. hilaireanum*), but there is no collection number cited in the protologue. Therefore, we consider Robson (1990) did an inadvertent lectotypification.

18. ***Hypericum pleiostylum*** C.Rodr.Jim. in Mem. Soc. Cienc. Nat. La Salle 33(94–95): 118. 1973 – Holotype: BRAZIL. Minas Gerais, Caldas, November 1869, *A. F. Regnell in herb. Regnelli Ser. III, No. 1732* (UPS No. V-930159 [image!]; isotype: UPS No. V-930160 [image!]). — Image of paratype (Mosén 823) available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p04685585

In a first impression, it may seem that *H. pleiostylum* would need lectotypification. However, as the type labels are of a model not used by UPS herbarium, they were probably added by Rodríguez Jiménez.

19. ***Hypericum polyanthemum*** Klotzsch ex Reichardt in Martius, Fl. Bras. 12(1): 189. 1878 – Holotype: BRAZIL. "in Brasilia meridional", *Sellow 2898* (B† [image!]) – Neotype (designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 75. 1990, corrected from "isotype"): BRAZIL, s. loc., 1814–1831 [1823–1828], *Sellow s.n.* (K barcode K000815950 [image!]). — Image of neotype available at http://specimens.kew.org/herbarium/K000815950

= *Hypericum rivulare* Arechav. in Anales Mus. Hist. Nat. Montevideo 3: 109. 1898 – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 75. 1990, corrected from "holotype"; **second-step lectotype, here designated**): URUGUAY. "habita em orillas del arroyo Tambores, en las cercanias del valle Eden", s. dat., *J. Arechavaleta 666* (MVM No. 563!; isolectotypes: MVM No. 563!, US-fragment barcode 00037005 [image!]).

For *Hypericum polyanthemum*, there is a collection number cited in the protologue (Sellow 2898). One sheet with this collection number was destroyed in B during the Second World War, and no duplicates apparently exist in any other herbaria. Robson (1990) called the B-destroyed specimen holotype and the K specimen (K000815950) isotype. However, as this specimen in K does not have a collection number, it should not be considered a duplicate of the holotype (Art. 9.5 of the ICN, Turland & al., 2018). In this way, since we have not found any duplicates of the holotype from B in any other herbaria, the cited specimen at K should be considered an inadvertent neotypification by Robson (1990).

One inadvertent lectotypification of *H. rivulare* by Robson (1990) cited the "holotype" in MVM, but the existence of two sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). Since there are no barcodes or herbarium numbers to differentiate the two sheets deposited in MVM, we added a label to indicate which one is the lectotype. The lectotype also has the Arechavaleta's collector number on the lower labels, and the MVM label is affixed to the upper left corner.

20. ***Hypericum rigidum*** A.St.-Hil. in Fl. Bras. Merid. 1: 336. 1828 ("1825") – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 51. 1990, corrected from "holotype"; **second-step lectotype, here designated**): BRAZIL. São Paulo [Paraná], "crescit ad rivulos prope urbem Curityba, in parte australi provinciæ Sancti Pauli", March [1820] 1816–1822, *A. de Saint-Hilaire C2-1631* pro parte (P barcode P00798956 [image!]; isolectotype: P barcode P00798957 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p00798956

= *Hypericum rigidum* var. *brevifolium* A.St.-Hil. in Fl. Bras. Merid. 1: 336. 1828 ("1825"). ≡ *Hypericum rigidum* subsp. *bracteatum* N.Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 55. 1990, **syn. nov.** – Holotype: BRAZIL. São Paulo [Paraná], "crescit ad rivulos prope urbem Curityba, in parte australi provinciæ Sancti Pauli", March [1820] 1816–1822, *A. de Saint-Hilaire C2-1631* pro parte (P barcode P00798958 [image!]). — Image of holotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p00798958

= *Hypericum sellowianum* R.Keller in Bot. Jahrb. Syst. 58: 195. 1923. ≡ *Hypericum rigidum* subsp. *sellowianum* (R.Keller) N.Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 54. 1990, **syn. nov.** – **Neotype (designated here):** BRAZIL. Paraná, Piraí do Sul, Fazenda Nova Era, 15 February 2013, *M.L. Brotto et al. 944* (RB barcode RB00779965!; isoneotype: MBM barcode MBM381713!). — Image of neotype available at http://jabot.jbrj.gov.br/v2/templaterb2.php?colbot=RB&codtestemunho=779965&arquivo=00779965.jpg

= *Hypericum meridionale* L.B.Sm. in J. Wash. Acad. Sci. 48: 311. 1958, nom. nov. ≡ *Hypericum rufescens* Klotzsch ex Reichardt in Martius, Fl. Bras. 12(1): 194. 1878, hom. illeg., non Lam., 1797. ≡ *Hypericum rigidum* subsp. *meridionale* (L.B.Sm.) N.Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 52. 1990, **syn. nov.** – Syntypes: BRAZIL. "Brasilia meridionali", s. loc., 1814–1831, *Sellow 4402, 4537, 4689, 4938, 5406* (B†) – **Neotype (designated here**): BRAZIL. "Brasilia", s. loc., 1814–1831, *Sellow s.n.* (HAL barcode HAL0014987 [image!]; possible isoneotypes: P barcode P01901360 [image!], K barcode K000815951 [image!], L barcode L.2404890 [image!], W barcode W0061479 [image!], S barcode S03-2006 [image!]). — Image of neotype available at http://141.48.4.202/djatoka/jacq-viewer/viewer.html?rft_id=hal_0014987&identifiers=hal_0014987

For *Hypericum rigidum* and *H. rigidum* var. *brevifolium* there are no collection numbers cited in the protologue. However, Saint Hilaire's handwriting on the label of some specimens allows us to indicate precisely the collection number of the types. One inadvertent lectotypification of *H. rigidum* by Robson (1990) mentioned the "holotype" in P, but the existence of two sheets in P requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose P00798956 (*var. α*) as lectotype because it is morphologically complete and has Saint Hilaire's handwriting on the label. The P00798958-sheet (*var. β*) is considered holotype of *H. rigidum* var. *brevifolium* because it is the only specimen available of this taxon (McNeill, 2014).

For *Hypericum sellowianum*, the gathering Sellow 468 is cited in the protologue. One sheet with this collection number was destroyed in B during the Second World War, and we have not found duplicates in any other herbaria. Robson (1990) called the B-destroyed specimen holotype, but this single specimen lacks flowers and inflorescences that were described in the protologue, suggesting that species description was made based on more specimens. For the B specimen to be a holotype, we would have to assume that Sellow's gathering was a single specimen (McNeill, 2014), and this does not seem to be the case. Therefore, as no original material has yet been found, choosing a neotype seems necessary (Art. 9.8 of the ICN, Turland & al., 2018). We chose the sheet RB00779965 as the neotype of *H. sellowianum* because this specimen is morphologically consistent with the protologue and has a well-conserved duplicate in the MBM herbarium.

Hypericum meridionale is a replacement name for *Hypericum rufescens* Klotzsch ex Reichardt (1878), a posterior homonym of *Hypericum rufescens* Lam. (1796). According to article 7.4 of the Code (Turland & al., 2018), a replacement name is typified by the type of the replaced synonym. Therefore, since there are five collection numbers cited in the protologue of *H. rufescens* Klotzsch ex Reichardt and these syntypes have never been found (Smith, 1958; Robson, 1990), the indication of a neotype seems appropriate. However, a B-destroyed specimen was indicated by Robson (1990) as lectotype, arguing that photography in F (9141) would nullify the need for neotypification. We disagree with this point of view because the B-destroyed specimen does not correspond to any of the syntypes mentioned in the protologue. Similarly, the specimens mentioned by Smith (1958) in his publication containing the avowed substitute name do not have nomenclatural standing (Article 7.8 in Turland & al., 2018). All possible isoneotypes proposed here for *H. meridionale* are part of the Sellow collection but do not have a collector number; thus, we cannot assume that these materials are all duplicates (possible isoneotypes).

The three new synonyms proposed here for *H. rigidum* were based on morphometric and ecological approaches that demonstrated geographic, ecologic and morphologic overlap among these taxa (Vogel Ely & al., 2018a).

21. ***Hypericum robsonii*** H.A.Keller & S.Crockett in Phyton (Horn) 55(1): 20. 2015 – Holotype: ARGENTINA. Misiones Province, Department of Candelaria, Loreto, 31 October 2013, *H. A. Keller, Ramírez & Franco 11752* (CTES n.v.; isotype: BM n.v.) — Image of paratype (H.A. Keller & al. 11874!) available at http://reflora.jbrj.gov.br/reflora/geral/ExibeFiguraFSIUC/ExibeFiguraFSIUC.do?idFigura=87950944

22. ***Hypericum salvadorense*** N.Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 79. 1990 – Holotype: BRAZIL. Rio Grande do Sul, São Salvador, December 1941, *Leite 734* (NY barcode 00075924 [image!]). — Image of holotype available at http://sweetgum.nybg.org/science/vh/specimen_details.php?irn=435219

23. ***Hypericum tamariscinum*** Cham. & Schltdl. in Linnaea 3: 124. April 1828. ≡ *Hypericum pelleterianum* var. *tamariscinum* (Cham. & Schltdl.) Arechav. in An. Mus. Hist. Nat. Montevideo 3: 107. 1898. ≡ *Hypericum myrianthum* subsp. *tamariscinum* N.Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 83. 1990 – **Lectotype (designated here)**: URUGUAY. "in provincia Montevideo Brasiliae australis", 1814–1831 [1821–1826], *Sellow 617* (HAL barcode HAL0015024 [image!]; isolectotype: M barcode M-0112222 [image!]. — Image of lectotype

available at http://141.48.4.202/djatoka/jacq-viewer/viewer.html?rft_id=hal_0015024&identifiers=hal_0015024

= *Hypericum pelleterianum* A.St.-Hil. in Fl. Bras. Mer. 1: 334, t.70. September 1828 ("1825") – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 84. 1990, corrected from "holotype", **second-step designated here**): URUGUAY. [Dpto. Maldonado, Piriápolis], "in lapidosis montis Paô de Assucar [Pan de Azúcar], in parte orientali provinciae Cisplatinae", [1820] 1816–1822, *A. de Saint-Hilaire C2-2133* (P barcode P01901489 [image!]; isolectotypes: P barcodes P01901490 & P01901491 [images!]; probable isolectotype: MPU barcode MPU022168 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p01901489

= *Hypericum notiale* L.B.Sm in J. Wash. Acad. Sci. 48: 311. 1958, nom. nov. ≡ *Hypericum parviflorum* A.St.-Hil. in Fl. Bras. Merid. 1: 333. September 1828 ("1825"), hom. illeg., non Salisb., 1796, nec Willd., 1802 – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 84. 1990, corrected from "holotype and isotypes", **second-step designated here**): BRAZIL. Rio Grande do Sul, "crescit ad ripas amnis Ibicuy, in provincia Missionum", February [1821] 1816–1822, *A. de Saint-Hilaire C2-2621* (P barcode P01901505 [image!]; isolectotype: P barcode P01901507 [image!]; probable isolectotypes: P barcode P01901506 [image!], MPU barcode MPU022169 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p01901505

Although the collector number is missing from exsiccate HAL0015024, we chose this sheet as lectotype of *H. tamariscinum* because morphologically it suits better the protologue and has Schlechtendal's handwriting on the label. The "holotype and isotypes" *Sellow 617*, cited by Robson (1990), were not found in B, K, and W herbaria. Two possible duplicate sheets exist in S (S03-2011) and BM (BM000624771); however, both have the Sellow's collector number added belatedly and do not have the Schlechtendal's annotations on the label, which is why they were not considered for typification purposes.

One inadvertent lectotypification of *H. pelleterianum* by Robson (1990) cited the "holotype" in P, but the existence of three sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose the sample P01901489 as the lectotype because this sheet is complete morphologically and has Saint-Hilaire's notes written on the label. MPU022168 is probably also an isolectotype but has no Saint-Hilaire's collection number.

Hypericum notiale is a replacement name for *Hypericum parviflorum* A.St.-Hil. (1828), a posterior homonym of *Hypericum parviflorum* Salisb. (1796). One inadvertent lectotypification of *H. notiale* by Robson (1990) cited the "holotype" in P, but the existence of three sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose the sample P01901505 as the lectotype because this sheet is complete morphologically and has Saint-Hilaire's collection number. MPU022169 and P01901506 are probably also isolectotypes of *H. notiale* but do not have a collector number on the sheets.

24. ***Hypericum teretiusculum*** A.St.-Hil. in Fl. Bras. Merid. 1: 331. 1828 ("1825"). ≡ *Sarothra teretiuscula* (A.St.-Hil.) Y.Kimura in Nakai & Honda, Nov. Fl. Jap. 10: 71. 1951 – **Lectotype** (first-step designated by Rodríguez Jiménez in Mem. Soc. Ci. Nat. La Salle 33: 128. 1973, corrected from "type"; **second-step designated here**): BRAZIL. São Paulo [Paraná], "prope flumen Tarerè [Itararé], in parte australi provinciæ Sancti Pauli", January [1820] 1816–1822, *A. de Saint-Hilaire*

C2-1385 (P barcode P00798964 [image!]; isolectotype: P barcode P00798965 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p00798964

= *Hypericum subliberum* L.B.Sm. in J. Wash. Acad. Sci. 48: 311. 1958 – Holotype: BRAZIL. Santa Catarina, near the municipal boundary between Curitibanos and Campos Novos, 5 December 1956, *L. B. Smith & R. Klein 8318* (US barcode 00037006 [image!]; isotypes: NY barcode NY00075935 [image!], HBR barcode HBR0017712!, R barcode R000112756!). — Image of holotype available at http://n2t.net/ark:/65665/363f51ee6-1a31-4d4c-8c55-805ef700bd36

One inadvertent lectotypification of *H. teretiusculum* by Rodríguez Jiménez (1973) cited the type in P, but the existence of two sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose P00798964 as lectotype because it is morphologically complete and has Saint Hilaire's handwriting on the label.

25. ***Hypericum ternum*** A.St.-Hil. in Fl. Bras. Merid. 1: 330. 1828 ("1825") – **Lectotype** (first-step designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 62. 1990, corrected from "holotype"; **second-step designated here**): BRAZIL. Paraná, [Palmeira], "prope pagulum vulgò Fregesia nova, in parte australi provinciæ Sancti Pauli dictâ Distrito de Curityba", March [1820] 1816–1822, *A. de Saint-Hilaire C2-1585* (P barcode P00798962 [image!]; isolectotype: P barcode P00798963 [image!]). — Image of lectotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p00798962

= *Hypericum cordiforme* var. *hilairei* Briq. in Annu. Conserv. Jard. hot. Genève 20: 391. 1919 – Holotype: BRAZIL. Minas Geraes, Serra do Papagaio "in pascuis montis vulgà Papagayo, in parte autrali provinciæ Minas Geraës", 1816–1822, *A. de Saint-Hilaire D-541* (P barcode P01901459 [image!]). — Image of holotype available at http://coldb.mnhn.fr/catalognumber/mnhn/p/p01901459

= *Hypericum cordiforme* var. *glazioui* Briq. in Annu. Conserv. Jard. hot. Genève 20: 391. 1919 – Lectotype (designated by Robson in Bull. Brit. Mus. (Nat. Hist.), Bot. 20(1): 62. 1990, corrected from "holotype and isotypes"): BRAZIL. Minas Gerais, Serra do Capanema à Caraça, [1884–1885], *Glaziou 14534* (G barcode G00355539 [image!]; isolectotypes: K barcode K000815953 [image!], P barcode P01901460 [image!], BR barcode BR000000867709 [image!]). — Image of lectotype available at http://www.ville-ge.ch/musinfo/bd/cjb/chg/adetail.php?id=260278&base=img&lang=fr

Hypericum ternum was described from only one specimen (*Descrip. ex unico specimine*). However, this specimen was later split into two sheets that can be found in the P herbarium (P00798962 & P00798963). This becomes evident since some of the morphological characteristics described in the protologue are present in only one of the sheets (e.g., 3-whorled leaves in P00798962 and paired leaves in P00798963). One inadvertent lectotypification of *H. ternum* by Robson (1990) cited the "holotype" in P, but the existence of two sheets in this herbarium requires a second-step lectotypification (Art. 9.17 of the ICN, Turland & al., 2018). We chose P00798962 as lectotype because this sheet is morphologically complete and has location data equal to the protologue written by Saint-Hilaire on the label.

For *H. cordiforme* var. *hilairei* (≡ *H. cordiforme* A.St.-Hil. [var. β]) only one sheet that matches the protologue apparently exists (P01901459), which is why it is called holotype (McNeill, 2014).

For *H. cordiforme* var. *glazioui* one inadvertent lectotypification by Robson (1990) cited the “holotype” in G (G00355539).

AUTHOR CONTRIBUTIONS

CVE conceived the idea as part of her Ph.D. thesis, gathered the relevant literature, reviewed the herbaria, and wrote the manuscript with help and comments by SALB and IIB. — ORCID: CVE, https://orcid.org/0000-0001-9094-9524

ACKNOWLEDGEMENTS

CVE thanks Neotropical Grassland Conservancy for financial support in the field activities and herbaria revision and to Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for awarding her Ph.D. scholarship (grant 141635/2015-0). SALB thanks for his Research Productivity Fellowship. We thank Jefferson Prado for his valuable assistance with nomenclatural issues, Rafael Trevisan for his helpful assistance with doubts in Latin, and Héctor A. Keller for kindly donating us a paratype of *Hypericum robsonii*. We are also grateful to all herbaria directors, curators, and assistants who made this work possible, especially to Eduardo Marchesi (MVFA), Manuel Garcia (MVM), Norma B. Deginani (SI), Liliana Delfino (MVJB), Ruy V. Alves (R), Robert Vogt (B), Sara Edwards and Liz Brogan (K), Ann Bogaerts and Sofie De Smedt (BR), Laurent Gautier, Fred Stauffer, and Laurence Loze (G), Mats Hjertson (UPS), Rusty Russell and John Boggan (US), and Caroline Loup (MPU), for sending us specimens or high-resolution images and for providing some critical information for the present study.

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Conclusões e Perspectivas

A presente tese fez significativas contribuições para o entendimento da taxonomia e história evolutiva de representantes sul-americanos do gênero *Hypericum*, através da investigação de aspectos filogenéticos, taxonômicos e nomenclaturais. Tais abordagens mostraram que as espécies sul-americanas não andinas de *Hypericum* formam um grupo monofilético que é fortemente sustentado em nossas análises e que a espécie morfologicamente distinta, *H. piriai*, fica posicionada separada do clado andino e do clado do sudeste sul-americano, provavelmente representando uma terceira linhagem que colonizou a América do Sul. Ou seja, nossas análises filogenéticas demonstram que as espécies de *Hypericum* sul-americanas agruparam dentro de três clados que não são diretamente relacionados, e pela sua posição filogenética provavelmente foram submetidas a três histórias biogeográficas independentes, contrastando desta forma com os resultados de Meseguer et al. (2013, 2015) e de Nürk et al. (2013b, 2017). Esses resultados foram baseados em uma amostragem quase completa das espécies sul-americanas não andinas e representa um importante incremento às filogenias anteriores.

Nossos estudos também resultaram em novidades taxonômicas e nomenclaturais, dentre as quais podemos mencionar a **sinonimização de seis nomes** [*Hypericum campestre* subsp. *pauciflorum* N.Robson, *H. campestre* subsp. *tenue* N.Robson, *H. cordatum* subsp. *kleinii* N.Robson, *H. rigidum* var. *brevifolium* A.St.-Hil., *H. rigidum* subsp. *meridionale* (L.B.Sm.) N.Robson, e *H. rigidum* subsp. *sellowianum* (R.Keller) N.Robson], **o restabelecimento da prioridade nomenclatual de *Hypericum cordiforme* A.St.-Hil**. sobre *H. cordatum* (Vell.) N.Robson, **a indicação de seis lectótipos** [*Hypericum brasiliense* var. *angustifolium* Reichardt, *H. megapotamicum* Malme, *H. myrianthum* Cham. & Schltdl., *H. tamariscinum* Cham. & Schltdl., *Receveura cordata* Vell., e *R. graveolens* Vell.] e **21 casos envolvendo segundo passo de lectotipificação** [*Hypericum altissimum* R.Keller, *H. campestre* Cham. & Schltdl., *H. caprifoliatum* Cham. & Schltdl., *H. connatum* Lam., *H. cordiforme* A.St.-Hil., *H. laxiusculum* A.St.-Hil., *H. denudatum* A.St.-Hil., *H. euphorbioides* A.St.-Hil., *H. euphorbioides* var. *minus* A.St.-Hil., *H. euphorbioides* var. *floribundum* A.St.-Hil., *H. linoides* A.St.-Hil., *H. mutilum* L., *H. notiale* L.B.Sm, *H. pelleterianum* A.St.-Hil., *H. piriai* Arechav., *H. punctulatum* A.St.-Hil., *H. rigidum* A.St.-Hil., *H. rivulare* Arechav., *H. stylosum* Rusby, *H. teretiusculum* A.St.-Hil., e *H. ternum* A.St.-Hil.], **quatro indicações de neótipos**

[*Hypericum cyathifolium* Larrañaga, *H. lorentzianum* Gilg ex R.Keller, *H. meridionale* L.B.Sm., e *H. sellowianum* R.Keller**], um epítipo** [*Receveura cordata* Vell.], além da **identificação de dois nomes supérfluos** [*Hypericum bolivianum* R.Keller e *H. connatum* var. *obscurum* Briq.] e **um nome inválido** [*Hypericum cordiforme* var. *genuinum* Briq.].

Do ponto de vista da conservação, foi possível identificar onze espécies ameaçadas, sendo estas as espécies que demandam ações de conservação mais urgentes [*H. austrobrasiliense* – CR, *H. bordignonii* – CR, *H. cavernicola* – EN, *H. legrandii* – CR (Possivelmente Extinta), *H. microlicioides* – CR, *H. pedersenii* – EN, *H. pleiostylum* – CR (Possivelmente Extinta), *H. rigidum* – EN, *H. robsonii* – CR, *H. salvadorense* – EN, e *H. tamariscinum* - EN]. Embora as demais espécies não tenham se enquadrado em nenhuma categoria de ameaça da IUCN, isso não quer dizer que elas não requeiram estratégias de conservação ao longo de diferentes pontos de sua distribuição global. Pelo contrário, tanto as espécies quanto os ambientes em que elas ocorrem demandam medidas protetivas imediatas, sejam elas áreas de proteção ambiental dentro dos diferentes países sul-americanos em que ocorrem, ou mesmo medidas que promovam a conservação dessas espécies e ambientes dentro de áreas privadas, dois importantes desafios a serem conquistados.

Em suma, embora nossos resultados tenham levado a novidades no âmbito da sistemática, da nomenclatura e da conservação, eles também levantaram novos questionamentos acerca da história evolutiva e taxonomia desse gênero tão diverso. Assim, visando aumentar o conhecimento sobre as espécies sul-americanas de *Hypericum*, nos parece relevante acessar e comparar as histórias biogeográficas das linhagens sul-americanas de *Hypericum*, suas trajetórias de diversificação, ecologia e morfologia a fim de identificar as semelhanças e diferenças evolutivas responsáveis pela contrastante riqueza de espécies, além de identificar sinapomorfias morfológicas, químicas e moleculares para os clados sul-americanos. Nos parece igualmente importante investir em mais abordagens integrativas a fim elucidar dificuldades taxonômicas acerca de espécies complexas ou complexo de espécies (ex. *H. brasiliense* s.l. e *H. myrianthum/H.tamariscinum*), além do investimento em pesquisas taxonômicas envolvendo as espécies de *Hypericum* andinas, que ainda foram pouco apreciadas em estudos nesse âmbito mas que apresentam muito potencial para identificação de novidades taxonômicas e nomenclaturais.

ANEXOS: PRODUÇÃO BIBLIOGRÁFICA DURANTE O DOUTORADO

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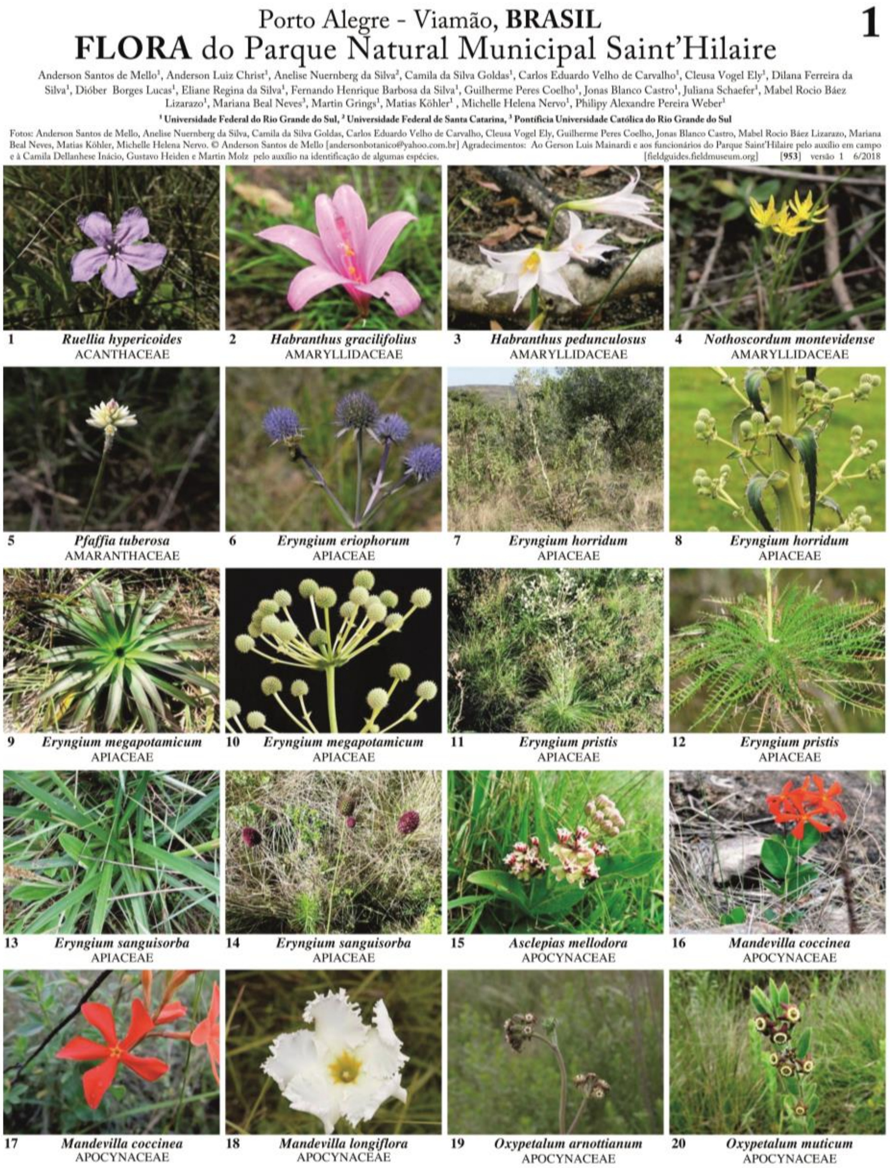

Porto Alegre - Viamão, **BRASIL**
FLORA do Parque Natural Municipal Saint'Hilaire

1

Anderson Santos de Mello[1], Anderson Luiz Christ[1], Anelise Nuernberg da Silva[2], Camila da Silva Goldas[1], Carlos Eduardo Velho de Carvalho[1], Cleusa Vogel Ely[1], Dilana Ferreira da Silva[1], Dióber Borges Lucas[1], Eliane Regina da Silva[1], Fernando Henrique Barbosa da Silva[1], Guilherme Peres Coelho[1], Jonas Blanco Castro[1], Juliana Schaefer[1], Mabel Rocio Báez Lizarazo[1], Mariana Beal Neves[3], Martin Grings[1], Matias Köhler[1], Michelle Helena Nervo[1], Philipy Alexandre Pereira Weber[1]

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Fotos: Anderson Santos de Mello, Anelise Nuernberg da Silva, Camila da Silva Goldas, Carlos Eduardo Velho de Carvalho, Cleusa Vogel Ely, Guilherme Peres Coelho, Jonas Blanco Castro, Mabel Rocio Báez Lizarazo, Mariana Beal Neves, Matias Köhler, Michelle Helena Nervo. © Anderson Santos de Mello [andersonbotanico@yahoo.com.br] Agradecimentos: Ao Gerson Luis Mainardi e aos funcionários do Parque Saint'Hilaire pelo auxílio em campo e à Camila Dellanhese Inácio, Gustavo Heiden e Martin Molz pelo auxílio na identificação de algumas espécies. [fieldguides.fieldmuseum.org] [953] versão 1 6/2018

1 *Ruellia hypericoides* ACANTHACEAE

2 *Habranthus gracilifolius* AMARYLLIDACEAE

3 *Habranthus pedunculosus* AMARYLLIDACEAE

4 *Nothoscordum montevidense* AMARYLLIDACEAE

5 *Pfaffia tuberosa* AMARANTHACEAE

6 *Eryngium eriophorum* APIACEAE

7 *Eryngium horridum* APIACEAE

8 *Eryngium horridum* APIACEAE

9 *Eryngium megapotamicum* APIACEAE

10 *Eryngium megapotamicum* APIACEAE

11 *Eryngium pristis* APIACEAE

12 *Eryngium pristis* APIACEAE

13 *Eryngium sanguisorba* APIACEAE

14 *Eryngium sanguisorba* APIACEAE

15 *Asclepias mellodora* APOCYNACEAE

16 *Mandevilla coccinea* APOCYNACEAE

17 *Mandevilla coccinea* APOCYNACEAE

18 *Mandevilla longiflora* APOCYNACEAE

19 *Oxypetalum arnottianum* APOCYNACEAE

20 *Oxypetalum muticum* APOCYNACEAE

III. Apresentação oral de trabalhos em eventos científicos

Em 2018, duas apresentações orais contemplando resultados dessa tese foram apresentados no XII Congresso Latinoamericano de Botánica em Quito no Equador.

XII Congreso
Latinoamericano de Botánica
Quito - Ecuador, 21 al 28 de Octubre del 2018

Checklist of *Hypericum*
(Hypericaceae) from Brazil

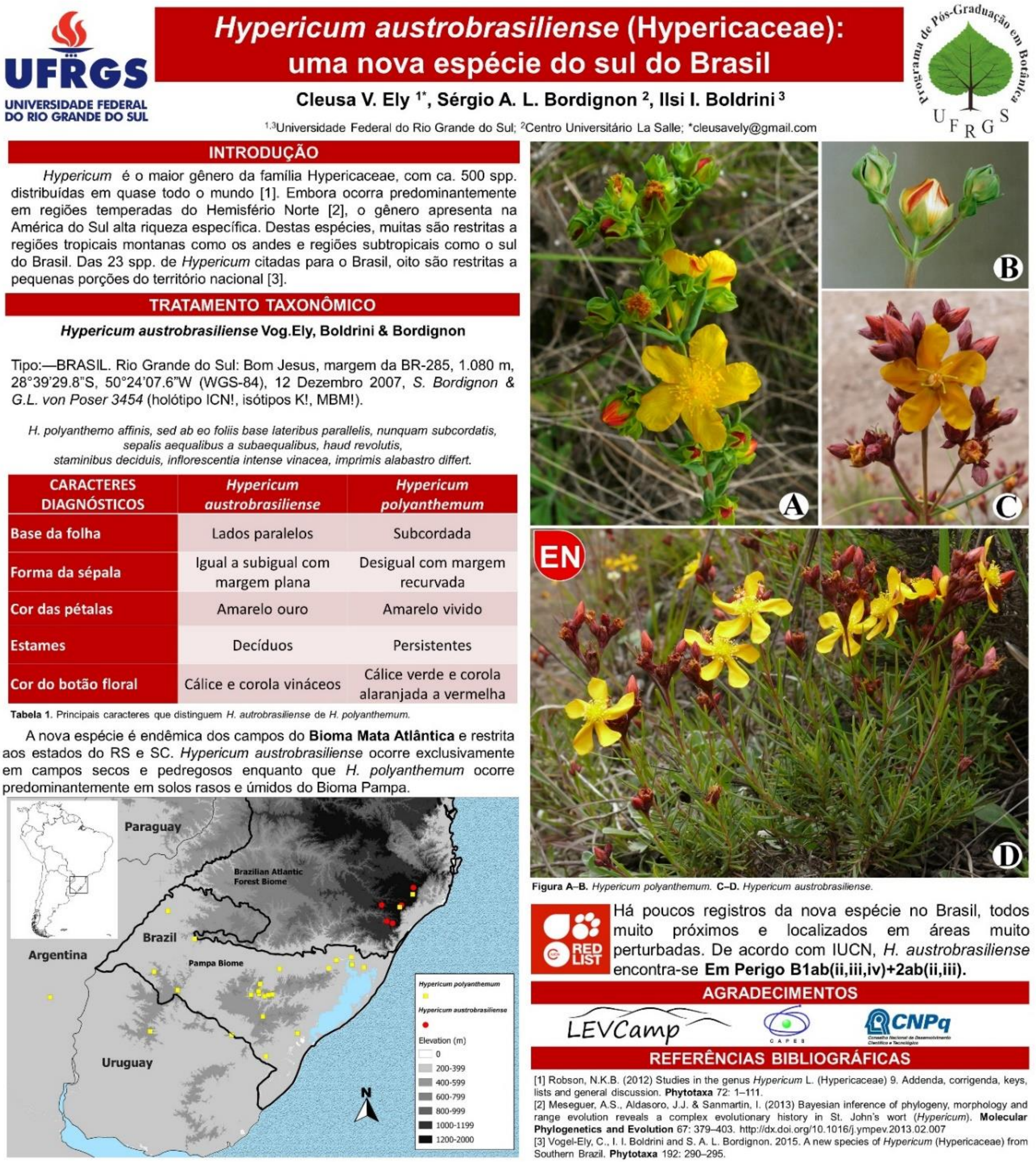
Cleusa Vogel Ely
Ilsi Iob Boldrini
Sérgio A. L. Bordignon

XII Congreso
Latinoamericano de Botánica
Quito - Ecuador, 21 al 28 de Octubre del 2018

Phenotypic variation in *Hypericum*
rigidum (Hypericaceae)

Cleusa Vogel Ely
Ilsi Iob Boldrini
João R. V. Iganci
Bianca O. Andrade

IV. Resumos publicados em anais de eventos



UFRGS
UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL

Hypericum austrobrasiliense (Hypericaceae): uma nova espécie do sul do Brasil

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Programa de Pós-Graduação em Botânica UFRGS

INTRODUÇÃO

Hypericum é o maior gênero da família Hypericaceae, com ca. 500 spp. distribuídas em quase todo o mundo [1]. Embora ocorra predominantemente em regiões temperadas do Hemisfério Norte [2], o gênero apresenta na América do Sul alta riqueza específica. Destas espécies, muitas são restritas a regiões tropicais montanas como os andes e regiões subtropicais como o sul do Brasil. Das 23 spp. de *Hypericum* citadas para o Brasil, oito são restritas a pequenas porções do território nacional [3].

TRATAMENTO TAXONÔMICO

***Hypericum austrobrasiliense* Vog.Ely, Boldrini & Bordignon**

Tipo:—BRASIL. Rio Grande do Sul: Bom Jesus, margem da BR-285, 1.080 m, 28°39'29.8"S, 50°24'07.6"W (WGS-84), 12 Dezembro 2007, *S. Bordignon & G.L. von Poser 3454* (holótipo ICN!, isótipos K!, MBM!).

H. polyanthemo affinis, sed ab eo foliis base lateribus parallelis, nunquam subcordatis, sepalis aequalibus a subaequalibus, haud revolutis, staminibus deciduis, inflorescentia intense vinacea, imprimis alabastro differt.

CARACTERES DIAGNÓSTICOS	*Hypericum austrobrasiliense*	*Hypericum polyanthemum*
Base da folha	Lados paralelos	Subcordada
Forma da sépala	Igual a subigual com margem plana	Desigual com margem recurvada
Cor das pétalas	Amarelo ouro	Amarelo vivido
Estames	Decíduos	Persistentes
Cor do botão floral	Cálice e corola vináceos	Cálice verde e corola alaranjada a vermelha

Tabela 1. Principais caracteres que distinguem *H. autrobrasiliense* de *H. polyanthemum.*

A nova espécie é endêmica dos campos do **Bioma Mata Atlântica** e restrita aos estados do RS e SC. *Hypericum austrobrasiliense* ocorre exclusivamente em campos secos e pedregosos enquanto que *H. polyanthemum* ocorre predominantemente em solos rasos e úmidos do Bioma Pampa.

Figura A–B. *Hypericum polyanthemum.* **C–D.** *Hypericum austrobrasiliense.*

Há poucos registros da nova espécie no Brasil, todos muito próximos e localizados em áreas muito perturbadas. De acordo com IUCN, *H. austrobrasiliense* encontra-se **Em Perigo B1ab(ii,iii,iv)+2ab(ii,iii).**

AGRADECIMENTOS

LEVCamp
CAPES
CNPq Conselho Nacional de Desenvolvimento Científico e Tecnológico

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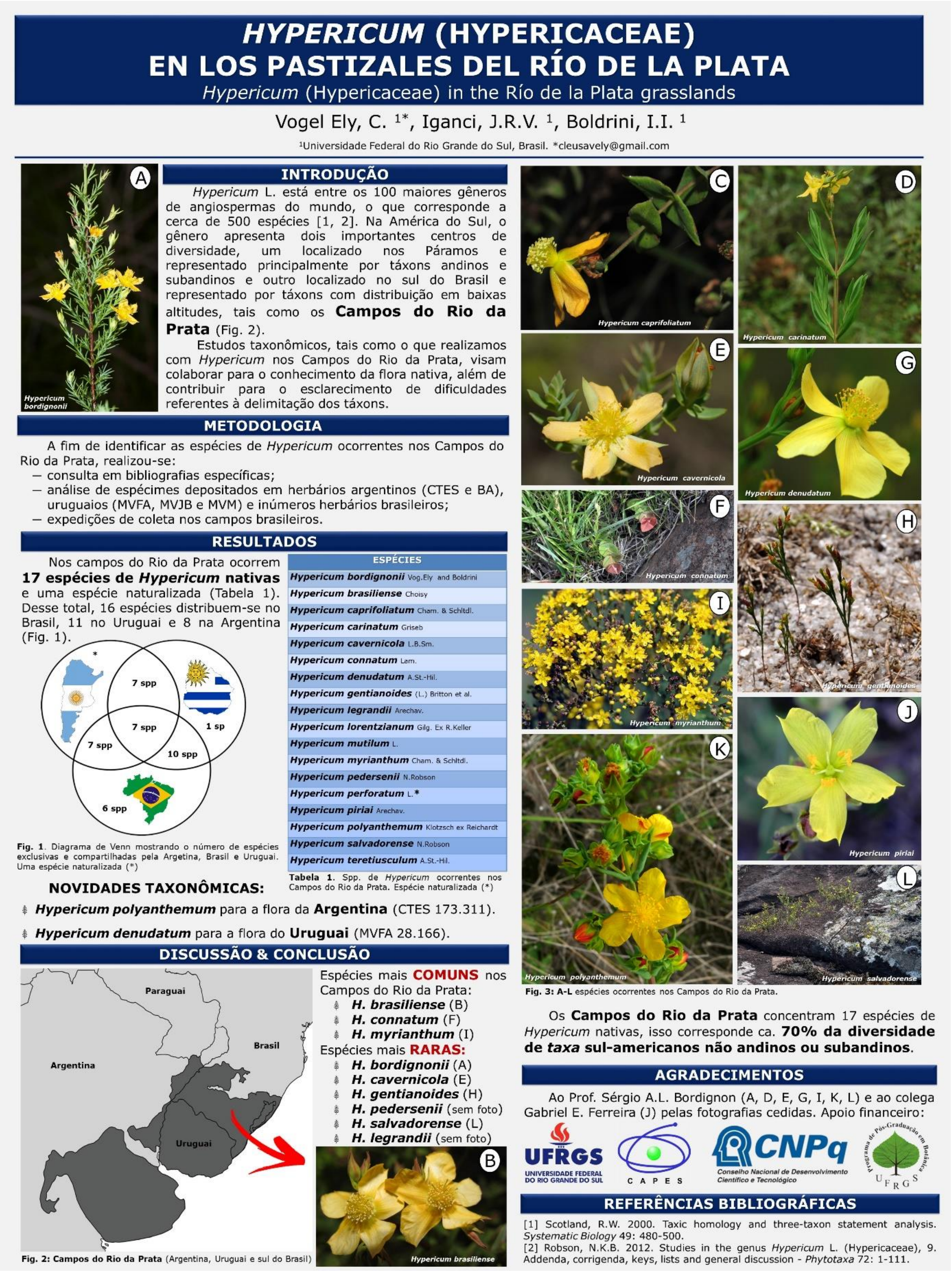

HYPERICUM (HYPERICACEAE) EN LOS PASTIZALES DEL RÍO DE LA PLATA

Hypericum (Hypericaceae) in the Río de la Plata grasslands

Vogel Ely, C. [1]*, Iganci, J.R.V. [1], Boldrini, I.I. [1]

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INTRODUÇÃO

Hypericum L. está entre os 100 maiores gêneros de angiospermas do mundo, o que corresponde a cerca de 500 espécies [1, 2]. Na América do Sul, o gênero apresenta dois importantes centros de diversidade, um localizado nos Páramos e representado principalmente por táxons andinos e subandinos e outro localizado no sul do Brasil e representado por táxons com distribuição em baixas altitudes, tais como os **Campos do Rio da Prata** (Fig. 2).

Estudos taxonômicos, tais como o que realizamos com *Hypericum* nos Campos do Rio da Prata, visam colaborar para o conhecimento da flora nativa, além de contribuir para o esclarecimento de dificuldades referentes à delimitação dos táxons.

METODOLOGIA

A fim de identificar as espécies de *Hypericum* ocorrentes nos Campos do Rio da Prata, realizou-se:

- consulta em bibliografias específicas;
- análise de espécimes depositados em herbários argentinos (CTES e BA), uruguaios (MVFA, MVJB e MVM) e inúmeros herbários brasileiros;
- expedições de coleta nos campos brasileiros.

RESULTADOS

Nos campos do Rio da Prata ocorrem **17 espécies de *Hypericum* nativas** e uma espécie naturalizada (Tabela 1). Desse total, 16 espécies distribuem-se no Brasil, 11 no Uruguai e 8 na Argentina (Fig. 1).

Fig. 1. Diagrama de Venn mostrando o número de espécies exclusivas e compartilhadas pela Argetina, Brasil e Uruguai. Uma espécie naturalizada (*)

ESPÉCIES
Hypericum bordignonii Vog.Ely and Boldrini
Hypericum brasiliense Choisy
Hypericum caprifoliatum Cham. & Schltdl.
Hypericum carinatum Griseb
Hypericum cavernicola L.B.Sm.
Hypericum connatum Lam.
Hypericum denudatum A.St.-Hil.
Hypericum gentianoides (L.) Britton et al.
Hypericum legrandii Arechav.
Hypericum lorentzianum Gilg. Ex R.Keller
Hypericum mutilum L.
Hypericum myrianthum Cham. & Schltdl.
Hypericum pedersenii N.Robson
Hypericum perforatum L.*
Hypericum piriai Arechav.
Hypericum polyanthemum Klotzsch ex Reichardt
Hypericum salvadorense N.Robson
Hypericum teretiusculum A.St.-Hil.

Tabela 1. Spp. de *Hypericum* ocorrentes nos Campos do Rio da Prata. Espécie naturalizada (*)

NOVIDADES TAXONÔMICAS:

- ***Hypericum polyanthemum*** para a flora da **Argentina** (CTES 173.311).
- ***Hypericum denudatum*** para a flora do **Uruguai** (MVFA 28.166).

DISCUSSÃO & CONCLUSÃO

Espécies mais **COMUNS** nos Campos do Rio da Prata:

- ***H. brasiliense*** (B)
- ***H. connatum*** (F)
- ***H. myrianthum*** (I)

Espécies mais **RARAS:**

- ***H. bordignonii*** (A)
- ***H. cavernicola*** (E)
- ***H. gentianoides*** (H)
- ***H. pedersenii*** (sem foto)
- ***H. salvadorense*** (L)
- ***H. legrandii*** (sem foto)

Fig. 2: Campos do Rio da Prata (Argentina, Uruguai e sul do Brasil)

Fig. 3: A-L espécies ocorrentes nos Campos do Rio da Prata.

Os **Campos do Rio da Prata** concentram 17 espécies de *Hypericum* nativas, isso corresponde ca. **70% da diversidade de *taxa* sul-americanos não andinos ou subandinos**.

AGRADECIMENTOS

Ao Prof. Sérgio A.L. Bordignon (A, D, E, G, I, K, L) e ao colega Gabriel E. Ferreira (J) pelas fotografias cedidas. Apoio financeiro:

UFRGS UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
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69º CNBot
Congresso Nacional
BOTÂNICA
XII Encontro de Botânicos do Centro-Oeste

A FAMÍLIA HYPERICACEAE NA FLORA DO BRASIL 2020

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[1]Universidade Federal do Rio Grande do Sul, RS; [2]Universidade Estadual de Campinas, SP;
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Hypericaceae possui distribuição cosmopolita e está representada por sete gêneros e aproximadamente 600 espécies (Stevens 2001 em diante). No Brasil ocorrem dois gêneros: *Hypericum* L. e *Vismia* Vand. No âmbito do projeto Flora do Brasil 2020, foram geradas descrições e chaves de identificação para os representantes da família. Além disso, foram incluídos dados sobre distribuição geográfica, hábitat e imagens das espécies.

Ocorrem 53 espécies de Hypericaeae no Brasil (Vogel Ely *et al.* 2018), sendo 23 de *Hypericum* (Figs. 1-3), com diversidade concentrada no sul do país (Fig. 8), e 30 de *Vismia* (Figs. 4-7), com maior diversidade na região amazônica (Fig. 9).

Novas espécies foram recentemente descritas para a família, evidenciando que estudos no grupo devem ser continuados:

- ***Hypericum austrobrasiliense*** Vog.Ely, Boldrini & Bordignon
- ***H. bordignonii*** Vog.Ely & Boldrini
- ***Vismia atlantica*** L.Marinho & M.V.Martins
- ***V. conduplicata*** M.V.Martins & G.H.Shimizu

Figura 8. Distribuição de *Hypericum* no Brasil.

Figura 9. Distribuição de *Vismia* no Brasil.

Figura 1. Hábito arbustivo de *Hypericum salvadorense* N.Robson (Bordignon, S.A.L.).

Figura 2. Flor de *Hypericum connatum* Lam. (Ely, C.V.).

Figura 3. Frutos de *Hypericum lorentzianum* Gilg ex R.Keller (Ely, C.V.).

Figura 4. Glândulas punctiformes na folha de *Vismia cauliflora* A.C.Sm. (Martins, M.V.).

Figura 5. Flor aberta de *Vismia macrophylla* Kunth (Bittrich, V.).

Figura 6. Exsudato no fruto de *Vismia gracilis* Hieron. (Shimizu, G.H.).

Figura 7. Ramo reprodutivo de *Vismia magnoliifolia* Cham. & Schltdl. (Martins, M.V.).

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