UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
DEPARTAMENTO DE BOTÂNICA
PROGRAMA DE PÓS-GRADUAÇÃO EM BOTÂNICA
SISTEMÁTICA, EVOLUÇÃO E ECOLOGIA DE ALGAS, PLANTAS E FUNGOS

A SYSTEMATIC STUDY OF THE EASTERN SOUTH AMERICAN SPECIES OF *VALERIANA* (VALERIANACEAE)

[ESTUDO SISTEMÁTICO DAS ESPÉCIES DE *VALERIANA* (VALERIANACEAE) DO LESTE DA AMÉRICA DO SUL]

CASSIO RABUSKE DA SILVA

ORIENTADOR: DR. JOÃO RICARDO VIEIRA IGANCI
COORIENTADORA: DRA. TATIANA TEIXEIRA DE SOUZA-CHIES

PORTO ALEGRE
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Porto Alegre, 30 de abril de 2020

APROVADA EM: ___/___/___

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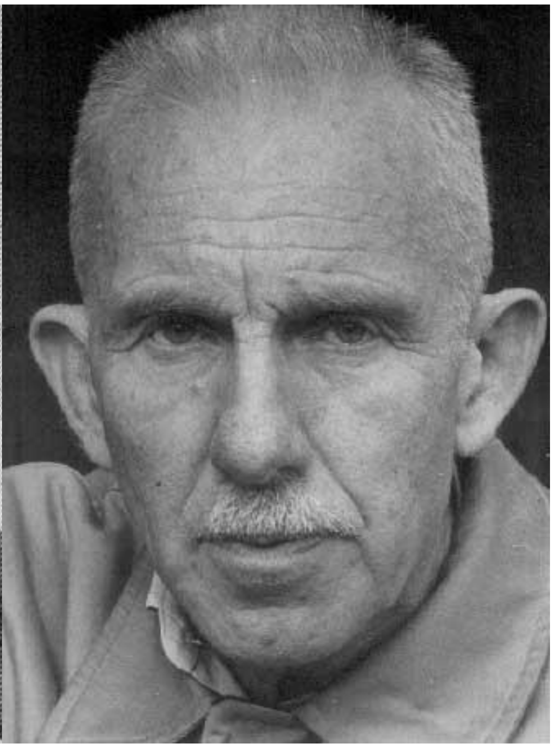
DEDICATÓRIA

Dedico essa dissertação primeiramente ao meu sobrinho, Matteo Francisco Rabuske, nascido no dia 27 de fevereiro de 2019. Dedico ainda a Uilson Dorisete Santos Brocca, eterno amigo e ornitólogo amador, falecido no dia 23 de dezembro de 2019, enquanto escrevo, após longa convalescência e luta contra o câncer. Ainda, com profunda admiração profissional, *in memoriam* da valerianóloga argentina Olga Helena Borsini (1916–1981), e do valerianólogo estadunidense Frederick Gustav Meyer (1917–2006), nomes fundamentais ao conhecimento de *Valeriana* nas Américas[1].

Olga Helena Borsini



Frederick Gustav Meyer

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[1] Imagens extraídas dos obituários de Borsini e Meyer, respectivamente Correa (1981) e https://www.pwrc.usgs.gov/resshow/perry/bios/MeyerFrederick.htm.

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“Our knowledge of the family has been considerably improved by the
new species of Valerianaceae from South America in recent years (...).
Sometimes the individual groups of forms show very different kinship
relationships from those assumed earlier, and several new independent
groups of forms have become known.” [our translation]
Karl Otto R. P. P. Graebner, in his Valerianaceae Andinae (1906: 436)

“The conclusions drawn below are thought to be the most logical that
can be drawn at this time, though not necessarily final.”
Boysen Larsen, in A taxonomic revision of *Phyllactis* and *Valeriana*
sect. *Bracteata* (Valerianaceae) (1989: 432)

Resumo: [Estudo sistemático das espécies de *Valeriana* (Valerianaceae) do leste da América do Sul] Um estudo sistemático do gênero *Valeriana* no leste da América do Sul é apresentado. O primeiro capítulo inclui uma breve análise histórica da família com especial enfoque nos táxons sul-americanos de *Valeriana*, a fim de esclarecer o posicionamento taxonômico infragenérico das espécies. Uma chave para os subgêneros e seções de *Valeriana* é aqui fornecida pela primeira vez, enfatizando a delimitação taxonômica desses táxons. Adicionalmente, nós discutimos os conceitos e os caracteres-chave historicamente utilizados na definição de categorias específicas e infraespecíficas (híbridos, subespécies, variedades e formas) dentro do gênero. No segundo capítulo apresentamos uma revisão das espécies de *Valeriana* com ocorrência na região leste da América do Sul. A morfologia e a anatomia das espécies são discutidas, e novos caracteres com potencial para tratamentos taxonômicos são explorados. Nós confirmamos a ocorrência de 18 espécies nativas da região, sendo três delas novas para a ciência: *Valeriana aparadensis*, *V. caparaoensis* e *V. sobraliana*. Diversas lectotipificações inadvertidas ou incompletas foram encontradas na literatura. Um neótipo, 10 lectótipos e um epítipo são propostos. As descrições das espécies foram expandidas e são acompanhadas de uma chave para identificação de espécies, figuras, etimologia, comentários sobre morfologia, fenologia, distribuição e habitat, conservação, além de referências a imagens úteis para o diagnóstico das espécies. As avaliações preliminares do risco de extinção foram atualizadas, utilizando as categorias e critérios da Lista Vermelha da IUCN. Adicionalmente, são apresentados quatro estudos como apêndices, complementando os capítulos principais. Dois deles correspondentes a novas espécies para a ciência, previamente publicados no contexto da dissertação. Outros dois artigos são apresentados na versão de manuscritos submetidos, os quais constituem revisões taxonômicas das espécies de Caprifoliaceae e Valerianaceae com ocorrência nativa ou naturalizadas no município de Santa Maria, Rio Grande do Sul, Brasil.

Abstract: [A systematic study of the eastern South American species of *Valeriana* (Valerianaceae)] A systematic study of the genus *Valeriana* in eastern South America is presented. The first chapter includes a brief historical analysis of the family with a focus on the South American taxa of *Valeriana*, in order to clarify the taxonomic infrageneric position of the species. A key to the subgenera and sections of *Valeriana* is provided for the first time, emphasizing the taxonomic delimitation of these taxa. Additionally, we discuss the concepts and key characters historically used in the definition of specific and infraspecific categories (hybrids, subspecies, varieties and forms) within the genus. In the second chapter we present a review of the species of *Valeriana* occurring in the eastern region of South America. The morphology and anatomy of the species are discussed and new characters with potential for taxonomic treatments are explored. We confirmed the occurrence of 18 species native from this region, three of which are new to science: *Valeriana aparadensis, V. caparaoensis* and *V. sobraliana*. Several inadvertent or incomplete lectotypifications has been found in the literature. A neotype, 10 lectotypes and an epitype are proposed. The descriptions of the species have been expanded, and are accompanied by a key to the species, figures, etymology, comments on morphology, phenology, distribution and habitat, conservation, in addition to references of images useful for the diagnosis of the species. The preliminary risks of extinction assessments have been updated, using the IUCN Red List categories and criteria. Additionally, four studies are presented as appendices, complementing the main chapters. Two of them corresponding to new species, previously published in the context of the dissertation. Two other articles are presented in the submitted manuscript version, which constitute taxonomic reviews of the species of Caprifoliaceae and Valerianaceae occurring natively or naturalized in the municipality of Santa Maria, Rio Grande do Sul, Brazil.

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LISTA DE ABREVIATURAS E SIGLAS

AOO	Area of Occurrence
B	Herbarium Berolinense (Botanic Garden and Botanical Museum Berlin-Dahlem), Berlin, Germany
BAB	Herbario del Instituto de Recursos Biológicos (Instituto Nacional de Tecnologia Agropecuaria), Buenos Aires, Argentina
BBB	Herbario del Departamento de Biología, Bioquímica y Farmacia (Universidad Nacional del Sur), Bahía Blanca, Argentina
BHL	Biodiversity Heritage Library
BM	The Natural History Museum Herbarium, London, England
C	Museum Botanicum Hauniense (University of Copenhagen), Copenhagen, Denmark
BR	Meise Botanic Garden Herbarium (National Botanic Garden of Belgiun), Meise, Belgiun
CAPES	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior
CGE	Campos Gerais
CNPq	Conselho Nacional de Desenvolvimento Científico e Tecnológico
CORD	Herbario del Museo Botánico Córdoba, Córdoba, Argentina
CR	Critically Endangered
CRI	Herbário Pe. Dr. Raulino Reitz (Universidade do Extremo Sul Catarinense), Criciúma, Santa Catarina, Brazil
CTES	Herbário do Instituto de Botánica del Nordeste, Corrientes, Argentina
EFC	Herbário da Escola de Florestas Curitiba, Curitiba, Paraná, Brazil
EOO	Extent of Occurrence
F	Herbário do Field Museum of Natural History, Chicago, United States
FLOR	Herbário da Universidade Federal de Santa Catarina, Florianópolis, Santa Catarina, Brazil
FURB	Herbário Dr. Roberto Miguel Klein (Universidade Regional de Blumenau), Blumenau, Santa Catarina, Brazil
FZB	Fundação Zoobotânica do Rio Grande do Sul
G	Geneva Herbarium (Conservatoire et Jardin botaniques de la Ville de Genève), Geneva, Switzerland
HAS	Herbário Alarich Schultz (FZB-RS), Porto Alegre, Rio Grande do Sul, Brazil

HBG	Herbarium Hamburgense (University of Hamburg), Hamburg, Germany
HBR	Herbário Barbosa Rodrigues, Itajaí, Santa Catarina, Brazil
HCF	Herbário da Universidade Tecnológica Federal do Paraná, Curitiba, Paraná, Brazil
HTG	High Altitude Tropical Grasslands
HUCS	Herbário da Universidade Federal de Caxias do Sul, Caxias do Sul, Rio Grande do Sul, Brazil
HUEFS	Herbário da Universidade Estadual de Feira de Santana, Feira de Santana, Bahia, Brazil
HURG	Herbário da Universidade de Rio Grande, Rio Grande, Rio Grande do Sul, Brazil
ICN	Herbário do Instituto de Ciências Naturais (UFRGS), Porto Alegre, Rio Grande do Sul, Brazil
IPNI	International Plant Names Index
IUCN	International Union for Conservation of Nature
K	Kew Herbarium (Royal Botanic Gardens Kew), London, England
LabTax	Laboratório de Taxonomia de Angiospermas (UFRGS)
LC	Least Concern
LL	Lundell Herbarium (University of Texas), Austin, United States
LP	Herbário do Museo de La Plata (Facultad de Ciencias Naturales y Museo), La Plata, Argentina
MBM	Herbário do Museu Botânico Municipal, Curitiba, Paraná, Brazil
MPUC	Herbário do Museu da Pontifícia Católica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil
MVFA	Herbário Bernardo Rosengurtt (Facultad de Agronomía, Universidad de la República), Montevideo, Uruguay
NY	New York Botanical Garden Herbarium, New York, United States
P	Muséum National d’Histoire Naturelle Herbarium, Paris, France
PACA	Herbário Porto Alegre Colégio Anchieta (Unisinos), São Leopoldo, Rio Grande do Sul, Brazil
PEL	Herbário da Universidade Federal de Pelotas, Capão do Leão, Rio Grande do Sul, Brazil
PPGBot	Programa de Pós-Graduação em Botânica (UFRGS)
R	Herbário do Museu Nacional do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil

RB	Herbário do Jardim Botânico do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil
S	Swedish Museum of Natural History, Stockholm, Sweden
SHG	Subtropical Highland Grasslands
SI	Herbário do Instituto de Botánica Darwinion, Buenos Aires, Argentina
SPF	Herbário da Universidade de São Paulo, São Paulo, São Paulo, Brazil
TPL	The Plant List
UFRGS	Universidade Federal do Rio Grande do Sul, Brazil
UPCB	Herbário do Departamento de Botânica da Universidade Federal do Paraná, Curitiba, Paraná, Brazil
US	United States National Herbarium (Smithsonian Institution), Columbia, United States
VU	Vulnerable

ÁREAS GEOGRÁFICAS

N. Am.	North America
C. Am.	Central America
S. Am.	South America
ESA	Eastern South America

ARG	Argentina
BAI	Buenos Aires province, Argentina
COS	Corrientes province, Argentina
ERI	Entre Rios province, Argentina
MIS	Misiones province, Argentina
RNE	Río Negro province, Argentina
SFE	Santa Fe province, Argentina

BRA	Brazil
BAH	Bahia state, Brazil
DFE	Distrito Federal, Argentina
ESP	Espírito Santo state, Brazil
MGE	Minas Gerais state

PAR	Paraná state, Brazil
MTS	Mato Grosso do Sul state, Brazil
RGS	Rio Grande do Sul state, Brasil
RJA	Rio de Janeiro state, Brazil
SCA	Santa Catarina state, Brasil
SER	Sergipe state, Brazil
SPA	São Paulo state, Brazil
PRY	Paraguay
APA	Alto Paraná department, Paraguay
CAU	Caaguazú department, Paraguay
ITA	Itapuá department, Paraguay
URY	Uruguay
CAS	Canelones department, Uruguay
FLA	Florida department, Uruguay
PAY	Paysandú department, Uruguay
RIV	Rivera department, Uruguay
SJO	San José department, Uruguay
SOR	Soriano department, Uruguay

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GENERAL INTRODUCTION

One of the basic challenges on systematic botany is to define the global richness of plants (Judd *et al.* 2016). According to Joppa *et al.* (2011), estimating the number of species, in addition to be an "intrinsically interesting question", is an essential step in setting conservation priorities. In this sense, estimates point the Neotropics as the richest biogeographic region in plant species in the World, with around 100,000 species, although this richness is not evenly distributed (Pennington *et al.* 2010, Hughes *et al.* 2013). A broad and consistent analysis of species-rich genera, especially those with worldwide or Neotropical distribution, represent a major challenge for systematic studies. This is in many cases due to the scarcity of taxonomic revisions, works that constitute the basis of several systematic botany approaches, especially regarding the taxa from the megadiverse and third world countries (Crisci *et al.* 2019).

Valerianaceae Batsch (1802) comprehends currently five to 14 accepted genera, distributed mainly in the temperate zones of the northern hemisphere (Europe, Asia, Mediterranean Region, and North America), as well as on the southern hemisphere, including Africa (mountains of the south and southeast regions), Central and South America, being absent in Australia and Polynesia (Kutschker 2011, Weberling & Bittrich 2016) (Table 1). Eight to 11 genera have been historically described for South America (Eriksen 1989). However, almost all of them are currently considered synonyms of *Valeriana*, and transferred to infrageneric categories, although the latter have been poorly addressed in systematic studies since the treatments of Larsen (1986) and Eriksen (1989). The species number under Valerianaceae varies widely in the literature, ranging from more than 300 up to 400 species (Killip 1937, Ferguson 1965, Bacigalupo 1974, Meyer 1976, Xena de Enrech 1992, Scalon *et al.* 2002, Hidalgo *et al.* 2010, Jacobs *et al.* 2010 for the *Valeriana* clade, Kutschker 2011, Bell *et al.* 2012, Weberling & Bittrich 2016). Precisely, the sum of numerical species-number estimates by Weberling & Bittrich (2016) points about 366 to 376 species of worldwide Valerianaceae, although the oscillation in the estimated number of species and the existence of infraspecific taxa are strong indications that a good part of these groups requires revisions.

Despite advances in systematics over the past three decades, especially in taxonomy and molecular phylogeny, *Valeriana* Linnaeus (1753: 31) remains a paraphyletic genus and its circumscription in Dipsacales is still controversial. This is especially due to inconsistencies in the morphological characterization of half the taxa within the order (Bell 2004, Hidalgo *et al.* 2004, Bell & Donoghue 2005a, APG III 2009, Kutschker 2011, Judd *et al.* 2016, APG IV 2016). In this context, we consider that the most parsimonious position is for the maintenance of Valerianaceae, according to Bell & Donoghue (2005a, 2005b), Kutschker (2011), Bell *et al.* (2012), Bell *et al.* (2015), Weberling & Bittrich (2016) and Bell & Gonzalez (2018).

TABLE 1. Estimated number of genera and species under the worldwide Valerianaceae. Data according to Weberling & Bittrich (2016).

Genera	**species number**	**distribution**
Patrinia Juss.	25	central Asia and the Himalaya to eastern Asia
Nardostachys DC.	1	western Himalaya to southwestern China
Centranthus DC.	10 (plus several infraspecific taxa)	southern Europe, Mediterranean and southwestern Asia
Valerianella Mill. [=*Fedia* Gaertn. (1791), *nom. cons.*, *non* Adanson (1763). *Pseudobetckea* (Höck) Lincz. (1958). *Siphonella* (Torrey & A. Gray) J.K. Small (1903).]	60–70 (plus several infraspecific taxa)	mainly in southwestern Asia, the Mediterranean and Europe, but also in North America, rare in South America
Valeriana L. [= *Aretiastrum* (DC.) Spach (1841). *Astrephia* Dufr. (1811). *Belonanthus* Graebn. (1906). *Phuodendron* (Graebn.) Dalla Torre & Harms (1905). *Phyllactis* Pers. (1805). *Plectritis* (Lindl.) DC. (1831). *Porteria* Hook. (1851). *Stangea* Graebn. (1906).]	270 (plus several infraspecific taxa)	Eurasia, Americas and southern Africa
total number	366–376	

Valeriana is considered the richest genus under Valerianaceae, although the worldwide species number presents a great oscillation in the literature, varying between 155 to 300 species (Höck 1882, Meyer 1951, Ferguson 1965, Xena de Enrech 1992, Devesa *et al.* 1997, Barrie 2003, Kutschker 2008b, Hidalgo *et al.* 2010, Weberling & Bittrich 2016, Sylvester *et al.* 2018). It is followed by *Valerianella* Mill. (1754), with 60 to 70 species (Weberling & Bittrich 2016).

Valeriana is also considered the most widely distributed genus, occurring in all continents (except Oceania), especially in Eurasia, North, Central and South America (including some Caribbean islands), as well as in mountains of southeastern and northern Africa (Meyer 1951, 1958; Bacigalupo 1974; Xena de Enrech 1992; Kutschker 2008b; Weberling & Bittrich 2016). It is especially diverse in alpine zones of the Old World and in the South American Andes, the latter being considered the most important diversification center of *Valeriana* (Eriksen 1991; Weberling 2003; Bell 2004; Bell & Donoghue 2005a, 2005b; Kutschker 2011; Kutschker & Morrone 2012). The most probable center of origin of the genus is in Asia, in the Himalayan mountain range, from where it radiated to Europe, Africa and New World, occupying the southern Andes about 13.7 mya (Bell *et al.* 2012).

The occupation of South America is considered the largest radiation event for the genus, which entered the subcontinent even before the formation of the Panama Isthmus, in a process of steppingstones (Bell & Donoghue 2005a). Despite this, there is no agreement in the literature regarding the estimated number of South American species, ranging from 175 (Eriksen 1991) to about 250 (Bell *et al.* 2012). In South America, the northern Andes apparently gathers most species (Meyer 1958, Cronquist 1981, Sobral 1999a). Eriksen (1989) argue that this prevalence is because the group had in these environments a "great opportunity to perform adaptive radiation". According to Meyer (1965), *Valeriana* is more widespread above 1000 m elevation in the equatorial areas of Colombia, Ecuador, Peru and Venezuela, descending close to sea level in the southern Chile. Plus, the author defines three centers of species diversity in the Andean region, as follows:

a. a northern center, which extends from Venezuela, Colombia, Ecuador and reaches its southern limit in northeastern Peru. According to Meyer, "the genus manifests its maximum morphological diversity in this area, where the shrubby members are best developed; also, species with an herbaceous habit are abundant, and caespitose cushion-forming species occur on the highest paramos". In a later study, Meyer (1979) will again refer to the "shrubby members" of this diversity center as "an extremely interesting group", because apparently each species would have "a fairly local distribution";
b. a more central diversity center in Peru (excluding the northeastern region), and Bolivia;
c. a third southernmost diversity center in Chile and Andean portions of Argentina, which has been attested by Kutschker & Morrone (2012).

Meyer (1965) also points what he called an “secondary and disjunct center of diversity”, composed by “a wholly different set of taxa”, which extends from southeastern Brazil to Buenos Aires. The existence of an eastern South American diversity center of *Valeriana* is also pointed by Sobral (2000) and Rabuske-Silva (2018).

There is no doubt that most species of *Valeriana* have an essentially Andean distribution in South America, most of them endemic from the mid- and lowlands (Bell *et al.* 2012). According to Weberling (2003), an assessment of the species number in the Andean regions sums up about 170 species. *Valeriana* is the 7th genus in diversity in the North Andean Páramo (54 spp.), a vegetation zone where Valerianaceae had rapid speciation and from where it had multiple irradiation movements to other regions of South America (Eriksen 1989, Luteyn 1999, Bell & Donoghue 2005a, Kutschker & Morrone 2012). Only in the Venezuelan paramos, from the 14 cataloged species (11 shrubs and three herbs), nine are endemic (Xena de Enrech 1993). Another important Andean center of diversification is central Chile and the Neuquén province, Argentina, both with 25 endemic species (Kutschker & Morrone 2012). Recent taxonomic revisions and checklists indicate 40 species occurring in southern South America (Kutschker 2011, Bell *et al.* 2012), and 84 in the Southern Cone (Argentina, southern Brazil, Chile, Paraguay, and Uruguay), of which at least 66 are restricted (Kutschker 2008a, Zuloaga *et al.* 2019). These numbers are considerable when compared to Asian countries, which constituted the main genus diversity/irradiation center, such as China (21 taxa, 13 restricted) (Shu 2011, Jung 2013), Taiwan (three taxa, a single one restricted) (Jung 2013) and Japan (two taxa, none restricted) (Jung 2013). It is remarkable even when compared to the known data for North and Central American, as well as to the megadiverse North Andean Paramo (Table 2). Nevertheless, knowledge about the Andean valerians still has several gaps, constantly revealed by the publication of new species and new records, most of them being the result of floristic studies carried out in the region (e.g. see Saldivia & Rojas 2006, Acosta *et al.* 2015 and Sylvester *et al.* 2018).

Therefore, as mentioned by Meyer (1951) more than half a century ago, *Valeriana* remains taxonomically poorly known as a whole, and there are strong reasons given by the data to consider this statement as still valid. Descriptions in many cases are incomplete, unstructured for comparison, with key characters often unreliable, requiring revisions (Weberling 2003, 2004, 2005, 2007). This lack of knowledge is reflected in the discrepant species numbers found in the literature and frequent misidentifications in herbaria. Plus, a large number of species have subspecies, varieties and forms described in the literature, although these taxa have been the target of many taxonomic revisions, which have led to the elevation to the ranking of species or even synonymizations (Borsini 1944; Meyer 1951). Several new species and updated occurrences have been published in recent decades as new areas are being sampled and herbarium collections reviewed (e.g. see Eriksen 1991; Sobral 1999a, 1999b, 2000; Saldivia & Rojas 2006; Bernal 2009; Méndez 2010; Nagahama *et al.* 2016; Sylvester *et al.* 2018; Rabuske-Silva & Külkamp 2018; Rabuske-Silva & Iganci 2019; Rabuske-Silva *et al.* 2020). Nevertheless, the number of synonyms and dubious species seems to be high, balancing the number of species in many taxonomic reviews (e.g. see Meyer 1951, Kutschker 2011, and Rabuske-Silva 2018).

TABLE 2. Species number of *Valeriana* in different regions of North, Central and South America.

Regions	**number of species**	**references**
North America and West Indies	31	Meyer (1951)
Mesoamerica (which includes southern Mexico and Central America)	15	Barrie (2011)
Caribbean Islands (West Indies)	2–3	Meyer (1951)
North Andean Paramo	54	Luteyn (1999)
Andes	± 170	Weberling (2003)
Eastern South America	18	our data
Southern Cone	84	Kutschker (2008a), Zuloaga *et al.* (2019)
Southern South America	40	Kutschker (2011)

Given the lack of cohesion in the estimated numbers of diversity on a continental scale for South America, the regional floras reveal the great diversity of *Valeriana* in the region, suggesting some diversity patterns. The literature points to Peru as the country with the highest richness of the genus in South America (and maybe worldwide), with 73 species, 45 of them restricted to this country (Kutschker 2011) (Table 3). Graebner (1906a), pioneering in the early twentieth century, after analyzing many materials from South America, states categorically about the Peruvian Andes: "There is no doubt that the family owns its development center in these areas". However, as mentioned by Killip (1937), a good part of the Peruvian valerians has only collections of the type specimens, being, therefore, practically unknown in nature.

Peru is followed by Argentina with 45 to 48 species, being 14 to 15 of them restricted (Borsini 1944, Xifreda 1999), Chile with about 45 taxa (Borsini 1966, Saldivia & Rojas 2006), and Bolivia with 37 taxa (Jørgensen *et al.* 2014). Regarding Central America, the most diverse country is Mexico, with about 40 taxa (Barrie 2003). Panamá has six to seven species, none restricted (Meyer 1976, Correa *et al.* 2004), and Nicaragua has five catalogued species (Barrie 2009).

TABLE 3. Ranking of richness and endemism of *Valeriana* (Valerianaceae) in South American countries.

countries	**species number**	**restricted species**	**references**
Peru	73	45	Kutschker (2011)
Argentina	45–48	14–15	Xifreda (1999)
Chile	45	[unknown]	Saldivia & Rojas (2006)
Bolivia	37	[unknown]	Jørgensen *et al.* 2014
Ecuador	35	9	Jorgensen & Eriksen (1999)
Colombia	29	9	Bernal (2009)
Brazil	17	14	Iganci *et al.* (2020)
Venezuela	16	9	Xena de Enrech (1992)
Paraguay	3	0	Kutschker (2008a)
Uruguay	2	0	Our data

Apparently, there are no revisions, catalogs or checklists for the genus in Suriname and French Guiana (as a whole) in South America, as well as specific studies from Belize, Costa Rica, El Salvador, Guatemala and Honduras in Central America. Despite this, an analysis of the Guiana shield flora revealed only a single species with two varieties recently considered synonymous, *Valeriana scandens* L., although the region (including adjacent Brazilian Amazonian mountains) is still poorly known floristically (Xena de Enrech 2007). The Caribbean Islands (or West Indies, according to Meyer 1951) apparently don't have more than two species, the referred *V. scandens* and *V. domingensis* Urban, and a hybrid between both species, *V.* × *ekmanii* F.G.Mey. (Meyer 1951, Acevedo-Rodríguez 2005). Despite this, Barrie (2011) indicate 15 taxa to Mesoamerica.

Regarding the regional floras, Weberling (2003) points to the large number of taxa that seem questionable, "especially when the area of distribution stops at the political borders of a country, while for the country beyond the borderline a very similar species is reported". In this sense, a dataset based on a broad taxonomic revision is an imperative for a better understanding of the richness and the geographic distribution of *Valeriana* species in the Neotropics.

In this sense, large-scale review studies depend on approaches that go beyond circumscriptions based on political boundaries. Studies with biogeographic, ecological or macro-regional circumscriptions are possible solutions, although they also carry limitations, such as the existence of widely distributed taxa. Another possibility is the circumscription based on an infrageneric classification system of *Valeriana*, which, despite the limitations inherent in the current state of knowledge, constitutes an important tool that helps in the circumscription of morphological groups and identification of taxa, and therefore in the description of the diversity of *Valeriana* in the Neotropics. Modern literature based on molecular approaches indicates that several infrafamilial categories of Valerianaceae do not constitute natural groups, specially tribes and subtribes (Bell *et al.* 2012, Weberling & Bittrich 2016). However, infrageneric categories were rarely addressed in these studies. Although the establishment of a new infrageneric classification based on modern molecular results is still considered premature (Weberling & Bittrich 2016), *Valeriana* has a recent classification system proposed by Eriksen (1989), which is rarely addressed in taxonomic studies. This is most likely due to the lack of historical revision studies of Valerianaceae, as well as the lack of literature addressing the taxonomic and morphological circumscription of the 14 sections under *Valeriana* proposed by this author.

In this study we present a systematic study of the eastern South American *Valeriana*. The study begins with a brief historical analysis of Valerianaceae with a special focus on South American taxa, in order to contribute to the historical knowledge of this group as a whole, as well as to the systematic positioning of the species analyzed here in detail. An identification key to subgenera and sections of *Valeriana* defined by Eriksen (1989) is provided for the first time. In order to clarify the circumscription of taxa under *Valeriana* as a whole, we evaluated the key characters historically used in the circumscription of species and infra-specific categories. The morphology and anatomy of the South American valerians is discussed, and new potential morphological characters were explored and described. Infrageneric position are suggested for all species occurring in the study area. Species descriptions have been expanded and incremented to make them better comparable and more reliable. The descriptions are accompanied by a key for identification of species, figures, maps, comments on morphology, phenology, distribution and habitat, etymology (when referred in the literature), conservation, besides references of illustrations and images useful to the diagnosis of the species. The preliminary risks of extinction assessments have been updated using the IUCN Red List categories and criteria (IUCN Standards and Petitions Subcommittee 2017). Three new endemic species from the study area were found and described. A new species, endemic from the canyon region of southern Brazil, *Valeriana aparadensis,* is described and illustrated in the second chapter. Plus, two articles bringing the other two new endemic species from the study area are included here as appendices. Additionally, other two articles are presented in the submitted manuscript version, which constitute taxonomic reviews of the species of Caprifoliaceae and Valerianaceae occurring natively or naturalized in the municipality of Santa Maria, Rio Grande do Sul, Brazil.

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Chapter I - Historical analysis of the systematics of Valerianaceae, with a special focus on the genus *Valeriana*

Historical analysis of the systematics of Valerianaceae, with a special focus on the genus *Valeriana*

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Abstract

In this study we present a historical overview of the classification systems of Valerianaceae with focus on the South American *Valeriana* and closely related taxa. We selected a series of taxonomic treatments of revisive or non-revisive (floristic) nature, and analyzed the taxonomic conceptions of each author and study, as well as its main goals and conclusions. Finally, we propose the first identification keys for infrageneric categories (subgenera and sections) under *Valeriana*, briefly commenting some of these categories. Here we provide a tool that facilitates the identification and inclusion of species of the genus in their respective infrageneric categories, in order to make them better testable in studies based on molecular approaches. Additionally, we propose a study of the specific and infraspecific categories under *Valeriana* (subspecies, varieties, forms and hybrids), discussing the concepts and the morphological key characters to the identification of each category. These theoretical tools aim to make these categories clearer and the taxonomic inferences more reliable, minimizing the large oscillation in the richness of taxa currently observed in the group.

Keywords: Caprifoliaceae, Categories, Dipsacales, History, Taxonomy.

Introduction

Valerianaceae Batsch (1802) has been the subject of a series of studies based on molecular approaches, which have shed light on the evolutionary and biogeographic relationships within the group (Bell *et al.* 2012). Since the advent of molecular phylogeny in the late 20th century, several studies have been proposed to evaluate the circumscription of groups traditionally recognized under Valerianaceae, as well as the positioning of these taxa under Dipsacales (Judd *et al.* 1994; APG 1998, 2003, 2009, 2016; Bell *et al.* 2001; Bell 2004; Hidalgo *et al.* 2004, 2010; Bell & Donoghue 2005a, 2005b; Bell *et al.* 2012, 2015; Bell & Gonzalez 2018). At the beginning of the 21st century, taxonomic inferences were established from these phylogenies, some also based on chemical and morphological approaches, proposing a significant reduction in the number of families under the order, from at least five to two (Judd *et al.* 2016, Weberling & Bittrich 2016). Considering inconsistencies in the morphological characterization of half the taxa within Dipsacales, here we opted for maintaining Valerianaceae, according to Bell (2004), Bell & Donoghue (2005a), Kutschker (2011), Bell *et al.* (2012), Bell *et al.* (2015), Weberling & Bittrich (2016) and Bell & Gonzalez (2018).

Likewise, major changes have been proposed in Valerianaceae, especially at the generic level. Studies suggest the exclusion of *Triplostegia* Wall. ex DC., once this genus is more closely related to Dipsacaceae (Hidalgo *et al.* 2004; Bell and Donoghue 2005; Jacobs *et al.* 2011, Weberling & Bittrich 2016). The phylogenies in general tend to confirm the monophylly of the two earliest diverging genera of Valerianaceae (100% bootstrap): *Patrinia* Raf., the sister group of the rest of the family, and *Nardostachys* DC., the next diverging genus (e.g. see Bell *et al.* 2012). These two genera are followed by the divergence of the large *Valeriana* core group (Jacobs *et al.* 2010). *Valeriana* L. resulted in a paraphyletic genus, including taxa traditionally recognized as *Centranthus* DC., *Fedia* Gaertn., *Plectritis* (Lindl.) DC., and *Valerianella* Mill. A small group of European species related to *Valeriana celtica* L. emerges as cohesive and sister to the *Valeriana* core group (Bell 2004; Bell & Donoghue 2005a, 2005b; Jacobs *et al.* 2010, Bell *et al.* 2012). This *V. celtica* clade is followed by a clade containing *Valerianella* + *Fedia*, and this by another clade containing *Centranthus*. These last three genera are well morphologically circumscribed and widely recognized, although *Fedia* is eventually referred as a synonym of *Valerianella* (Weberling & Bittrich 2016). *Plectritis*, also historically circumscribed based on a pool of reproductive characters which are considered key in Valerianaceae, emerges in a clade nested within the South American *Valeriana* (Bell *et al.*

2001, 2012; Bell & Donoghue 2005a).

As mentioned by Weberling & Bittrich (2016), there is a tendency towards the synonymization of several genera described under the South American Valerianaceae, such as *Aretiastrum* (DC.) Spach, *Astrephia* Dufr., *Belonanthus* Graebn., *Phuodendron* (Graebn.) Dalla Torre & Harms, *Phyllactis* Pers., *Plectritis*, *Porteria* Hook. and *Stangea* Graebn. However, most of these names are poorly known or not even addressed in systematic studies. Even the circumscription of some well-known names widely varies in the literature, eventually being treated under infrageneric categories. Plus, the morphological variation in the *Valeriana* core group, or in the number of "shape circles" in Valerianaceae as a whole (as referred by Graebner 1906b), including habits, inflorescences, flowers, and fruits, is very wide, with some of these groups being described based on striking vegetative or reproductive key characters (e.g. *Aretiastrum*, *Belonanthus*). Although it is difficult to support most of them as genera (Eriksen 1989), the knowledge about these groups still needs more detailed studies.

However, while a modern revision of the infrageneric classification system of *Valeriana* based on the results of molecular approaches is still considered premature (Weberling & Bittrich 2016), the historical infrageneric categories established by Höck (1882, 1897, 1901), Graebner (1899, 1906a, 1906b), and Eriksen (1989) have been relegated to disuse, with rare exceptions in the last two decades (e.g. Bernal 2009). Plus, Christenhusz *et al.* (2018) proposed large-scale taxonomic inferences on the *Valeriana* clade, disregarding the morphological and evolutionary cohesion of *Centranthu*s, *Valerianella* + *Fedia* clade, and *Plectritis*, as well as *Belonanthus* Graebn. and *Phuodendron* Graebn., two genera poorly addressed in morphological studies and phylogenies. These authors proposed the synonymization of these six genera under *Valeriana*, and, consequently, the formal recombination of dozens of names. Infrageneric categories were not suggested, although *Belonanthus* and *Phuodendron* were considered sections of *Valeriana* by Eriksen (1989).

In this context of several changes, resulting in the advent of new approaches and analysis tools, the systematic studies require historical subsidies to guide the best choices in terms of taxonomic inferences within Valerianaceae, especially regarding infrafamilial and infrageneric categories names. Genera with worldwide distribution such as *Valeriana*, with 155 to 300 species referred in the literature (Höck 1882, Meyer 1951, Ferguson 1965, Xena de Enrech 1992, Devesa *et al.* 1997, Barrie 2003, Kutschker 2008b, Hidalgo *et al.* 2010, Weberling & Bittrich 2016, Sylvester *et al.* 2018), impose a great challenge to large-scale taxonomic inferences. It is particularly difficult when dealing with the South American *Valeriana*, which reaches about 175 species, two-thirds of the global richness of this genus

(Eriksen 1991, Kutschker 2011, Kutschker & Morrone 2012, Rabuske-Silva & Iganci 2019). Most of these species are taxonomically poorly known and sampled, with descriptions hardly comparable or unreliable, requiring revisions (Weberling 2003, 2004, 2005 and 2007). New species of *Valeriana* are often published as new areas are explored and herbaria collections revisited (e.g. see Eriksen 1991; Sobral 1999b, 2000; Saldivia & Rojas 2006; Bernal 2009; Méndez 2010; Nagahama *et al.* 2016; Sylvester *et al.* 2018; Rabuske-Silva & Külkamp 2018, Rabuske-Silva & Iganci 2019). Plus, the clades recovered for the South American *Valeriana* have shown low support, due to the still reduced sampling of taxa and the necessity of more molecular markers, or even new approaches based on next generation sequencing (NGS) (Bell & Donoghue 2005a, 2005b; Bell *et al.* 2012; Bell & Gonzalez 2018).

The choice of morphological key characters in the establishment of species and infraspecific categories of *Valeriana*, such as subspecies, varieties, forms and even hybrids, is also a subject that requires a historical study. The characters recognized as useful to each of these categories vary in the literature, resulting in different conceptions which are inherent to the morphological concept of species (Cronquist 1978, Aldhebiani 2018). These distinct conceptions have evident impacts on studies addressing diversity and conservation of *Valeriana*, overestimating or underestimating the richness of taxa, and should therefore be minimized with the support of theoretical tools. In this sense, it is important to understand these infraspecific classifications, and especially the key characters which best suit each category.

Based on this, we present a historical overview of the classification systems of Valerianaceae, with a focus on the South American taxa currently considered under *Valeriana*. We selected a series of revisions, including floristic surveys and publications of new species, and analyzed the taxonomic conceptions applied by each author, its main goals and conclusions. Identification keys for subgenera and sections of *Valeriana* are here proposed for the first time, based on the most recent classification system proposed by Eriksen (1989). This aims to facilitates the identification and classification of *Valeriana* taxa in their respective infrageneric categories, as well as to test their position in studies with molecular approaches. Additionally, we propose a study of the specific and infraspecific categories under *Valeriana*, discussing the concepts and key characters applied in the identification of each category, in order to make these categories clearer for systematic studies.

Materials and methods

The studies were compiled based on literature review, with special focus on the available studies on the South American *Valeriana*. The bibliographic survey was carried out in the digital archives of the BHL (http: //www.biodiversitylibrary.org/), and JSTOR (2000 onward) (https://www.jstor.org/) online databases, as well as in the physical libraries of the Universidade Federal do Rio Grande do Sul, Botany Department, and MBM herbarium. Forty-two studies published between the 18th and 20th centuries, from 23 distinct authors, were selected to be closely analyzed in our survey (Table 1). The classification system and the key characters used by each author were described and discussed. In some cases, dichotomous keys were translated and made available, as well as summary tables, in order to clarify the classification systems. Additionally, comments about the studies published in the early 21st century were provided. The key characters of specific and infraspecific categories were obtained by analyzing dichotomous keys published in taxonomic studies from the beginning of the 20th century to the current year, since they are generally more detailed than in previous classic studies. Regarding species, identification keys with less than three taxa were discarded, in order to avoid characters that are only valid in very particular cases. However, for infraspecific categories, these keys were analyzed, once the number of studies on subspecies, varieties, forms and hybrids of *Valeriana* is quite small.

Results and discussion

Valerianaceae before the 18th century

In ancient Greece the plants of the group currently concerning Valerianaceae were known as *Phou* (Øou) or *Phu* (Meyer 1951). The term apparently means to "be born", but it may be related to a Pontic Word related to the penetrating odor of its roots (Miller 1754). The name *Valeriana* appears in the works of the ancient Greek philosopher and botanist Theophrastus (372 BC–287 BC), as well as in the encyclopedia *De Materia Medica*, written by the physician Dioscorides (ca. 40–90), and in the encyclopedia *Naturalis Historia*, made by the Roman naturalist Plinius (23–79) (Borsini 1944, Meyer 1951, Kutschker 2011).

In the Middle Ages (14th and 15th centuries) some species came to appear in the early pharmacopoeias and medical books from Europe, especially from Germany. Meyer (1951: 378) found "an interesting but stylized black and white wood-block print of *Valeriana* in the *Herbarius Latinus*, printed in 1484 at Mainz [Germany] and a hand-colored print in *Gart der*

TABLE 1. List of selected references with the respective historical periods.

Historical period	**selected references**
18th century	Tournefort (1719), Linnaeus (1753, 1762), Adanson (1763), Jussieu (1789), Necker (1790), Moench (1794), and Ruiz & Pavón (1798).
Early 19th century	Batsch (1802), Candolle (1805 and 1830), Peerson (1805), Dufresne (1811), Kunth (1818), Dumortier (1829), Hook (1851), and Weddell (1857).
Late 19th and early 20th century	Höck (1882, 1891, 1902), and Graebner (1899, 1906a and 1906b).
20th century	Briquet (1914), Stuckert & Briquet (1918), Killip (1937), Borsini (1944, 1946, 1962a, 1962b, 1963, 1966a, 1966b, 1999), Meyer (1951, 1958, 1960, 1965, 1976, 1979), Larsen (1986), and Eriksen (1989).

Gesundheit[2] of 1487, printed in Augsburg [Germany], by Hannsen Schönsperger[3]”. Color illustrations of two undetermined species of Valerianaceae are found in the *New Kreüterbuch*[4] written by Fuchs (1543)[5], both species under the common name *Baldrian*.

Valerianaceae in the 18th century

In the early 18th century, Tournefort (1719)[6] for the first time circumscribed the species popularly called *Nardus* and *Phu* into two genera, *Valeriana* and *Valerianella*, the latter meaning literally “small valerian”. According to Borsini (1944: 291), the first genus includes all the species known by Tournefort under this group, while *Valerianella* was based exclusively on a small European species with triloculate fruit and eppapose calyx, later described by Linnaeus (1753) as *Valeriana cornucopiae* L.[7] These two genera previously conceived by Tournefort (*Valeriana* and *Valerianella*) were later unified by Linnaeus in the first edition of the *Species Plantarum* (Linnaeus 1753), within the conserved name *Valeriana* (Borsini 1944, Meyer 1951, Kutschker 2011). Linnaeus established this genus in a broad conception, treating 22 taxa, which includes 16 species, plus six varieties of *V. locusta* L., all assembled under the *Triandria Monogynia*. Later, in the second edition (Linnaeus 1762), the number of taxa rises

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[2] Translated from German as “*Garden of Health*”.

[3] Hannsen Schönsperger's identification is confusing in the literature and refers to at least two people, father and son, German publishers and book dealers, who lived in Augsburg between the late 15th and early 16th centuries.

[4] Translated from the German as “*The New Herbal*”.

[5] German physician and botanist Leonhart Fuchs (1501–1566).

[6] French botanist Joseph Pitton de Tournefort (1656–1708).

[7] In the end of the 18th century, this species was transferred to the new genus *Fedia* by Gaertner (1790).

to 24, being 18 species, plus the same referred six varieties. This study includes the description of *V. scandens*, the first and only species of the genus from the New World described by Linnaeus (Meyer 1951, Barrie 1989a).

As previously observed by Meyer (1951: 378), in view of the diversity of morphological diversity available at the time, the Linnaeus treatments of *Valeriana* were conservative. Despite this, the analysis of the 24 taxa described under this genus by Linnaeus reveals a remarkable agreement and ordering of several morphotypes, later recognized as genera by several authors. The first two species of the *Species Plantarum* list (Linnaeus 1753), *V. rubra* L. and *V. calcitrapa* L., were later considered under the genus *Centranthus* by Candolle[8] (1805) and Dufresne (1811) respectively. The third species, *V. cornucopiae* L. was considered under *Fedia* by Gaertner (1790) and *Valerianella* by Loiseleur-Deslongchamps (1806). From the 4th to the 13th species of the list, at least based on our selected studies, species apparently continue to be considered under the genus *Valeriana*[9]. However, *V. chinensis* L., the 14th species, is currently considered under the genus *Boerhavia* (Nyctaginaceae), according to the IPNI. From the 15th to 17th species, including the six varieties described under *V. locusta* are later treated under *Valerianella*. The 18th species of the list, *V. sibirica* L., was combined into the type species of the genus *Patrinia*. The arrangement by Linnaeus indicates that this author had already observed some morphological and geographical particularities within *Valeriana*, although he chose to keep all the taxa under the same genus.

The diagnosis of *V. scandens* as provided by Linnaeus (1762) has only few general diagnostic features, namely, the 3-staminate flowers, ternate leaves and the scandent stem. The referred origin of the type specimens is the city of Cumana[10], northern Venezuela. Nor does Loefling's description have striking features (except for the habit) that suggest the segregation of a new genus for this single species endemic from the New World. Although several synonyms have been later described under *V. scandens* (as well as several varieties), and *lato* or *stricto sensu* treatments have historically been applied, this taxon has always been included in the same genus proposed by Linnaeus (Rabuske-Silva 2018).

Adanson[11], in his *Familles des Plantes* (1763), positioned the genus *Valeriana* in the Scabiosae family, Section II, which includes species with corymbose inflorescences. This author conserves the name *Valeriana* as previously conceived by Tournefort (1719), bringing

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[8] Swiss botanist Augustin Pyramus de Candolle (1778–1841).

[9] There are no new combinations proposed in the literature and in the analyzed databases.

[10] Currently capital of the Sucre state.

[11] French botanist Michel Adanson (1727–1806).

the pre-Linnaean genus *Phu* as conceived by Dioscorides in *De Materia Medica*, as a synonym. This group also includes two new genera, *Fedia*[12] and *Polypremum*[13] Adans. *Fedia* is based on the features of *V. sibirica,* the four stamens and the 2–3-loculate fruits. The latter, as previously referred by Borsini (1944: 291), was treated in order to reestablish the name *Valerianella* with another name. In fact, Adanson included the genera *Locusta* Riv. and *Valerianella* Tourn. in the synonymy of *Polypremum*[14]. This author provides a rich description of Scabiosae, highlighting the correspondence between the sporicity and morphology of the inflorescences of *Valeriana*. According to Adanson, the inflorescences display a different shape in individuals with hermaphrodite flowers and individuals with pistillate ones, due to abortive structures observed in both. The note about the calyx is also noteworthy: "*Valeriana* has this particularity that the calyx bristles of sterile hermaphrodite flowers[15] always remain coiled, and they only bloom on feminine flowers" (Adanson 1763: 148). This observation regarding abortion of reproductive structures is quite pioneering in the taxonomic history of the group[16]. Adanson also observed that the corolla of pistillate flowers falls shortly after the end of the fruit maturation, and it is only after the fall of the corolla that the bristles of the calyx can unfold at the apex of the fruit. Three morphological groups are treated as genera, in contrast to the unified (or *sensu lato*) conception of *Valeriana* as treated a decade earlier by Linnaeus (1753). All the three genera are separated by several features, such as calyx (pappose or eppapose), corolla length (long or short), presence or absence of spur, number of stamens and number of fruit locules (Table 2).

Jussieu[17](1789: 195), in *Genera Plantarum*[18], treated the genus *Valeriana* T.L.[19] under the Classis XI (Dicotyledones Monopetalae), Order I, group II, in a new family, Dipsaceae[20].

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[12] According to Devesa *et al.* (1997), the name *Fedia* was created by Adanson (1763: 152) "without giving any explanation", the name probably being related to the genus *Phu* (or *phoú*), plant from Ponto, according to Dioscorides, or from Crete, according to Plinio, and that would be later related to the *Valeriana phu* L. Other authors consider the name related to *haedus* or *fedus*, which means "the goat", alluding to the stench exhaled by the plant, or to some Arabic word. The name *Fedia* was later legitimized by Gaertner (1790).

[13] *Polypremum* literally means "plant with many branches", as previously referred by Borsini (1944: 291).

[14] The name *Polypremum* was previously established by Linnaeus (1753) and currently belongs to Buddlejaceae. Therefore, the name established by Adanson (1763) is invalid (IPNI 2020).

[15] Here considered simply as staminate flowers.

[16] The same was later referred by Borsini (1944, 1963) regarding the ovary in staminate flowers. Indeed, the precise definition of an aborted structure and therefore of the mating system is still quite controversial for many species of *Valeriana*, differing in the literature of the genus (see Sobral 1999a; Duarte-Silva 2006; and Duarte-Silva *et al.* 2010b, 2011).

[17] French botanist Antoine Laurent de Jussieu (1748–1836).

[18] The complete name of this work is *Genera Plantarum: secundum ordines naturales disposita, juxta methodum in Horto regio parisiensi exaratam.*

[19] Which apparently means a hybrid reference to Tournefort [Tourn.] (1719) and Linnaeus [L.] (1753, 1762).

[20] Name currently considered under the spelling Dipsacaceae Juss.

TABLE 2. Morphological differences between the genera *Valeriana*, *Polypremum*, and *Fedia*, according to Adanson (1763).

Genus	**calyx**	**corolla**	**stamens**	**fruits**
Valeriana Tour. (1719)	10 to 20 long hairy bristles	long tube, with spur, 5-lobed	1 to 3	capsule, 1-loculate
Polypremum Adans. (1763, inval. name)	2–6 teeth	short tube, 5-lobed	1 to 3	capsule, 2–3-loculate
Fedia Adans. (1763, inval. name.)	entire	short tube, 5-lobed	4	capsule, 2–3-loculate

This group is composed solely by *Valeriana*, being *Valerianella* T.[21] considered in the synonymy of the first one[22]. Plus, in the same publication, Jussieu described Caprifoliaceae Juss. (as Caprifolia)[23]. Dipsacaceae (Order I) is followed by Rubiaceae (Order II), and next to Caprifoliaceae (Order III). Therefore, the author creates two important families currently considered under Dipsacales (APG IV 2016), placing them close together. This classification in which Dipsacaceae, Caprifoliaceae and shortly later Valerianaceae (described in 1802 by Batsch) are treated next to Rubiaceae will be quite common until the late 20th century. Modern approaches based on molecular phylogenies have shown that these taxa belong to different orders, the three first to Dipsacales, Campanulids clade, and the last one to Gentianales, Lamiids clade (Judd *et al.* 2016, APG IV 2016).

The genus *Valeriana* is described by Jussieu (together with *Valerianella*) in a broad hybrid conception of both Tournefort and Linnaeus treatments. Despite this, the diagnosis of the genus *Valeriana* is clearly based on the *sensu lato* conception of Linnaeus. The differentiation between *Valeriana* and *Valerianella*, based on the Tournefort conceptions, is only referred on the comments. The key characters referred to differentiate *Valeriana* from *Valerianella* are basically the flowers and fruits. The first one has long-calcarate flowers, fruits with one seed[24], and a pappus-like calyx, while the latter has short-calcarate flowers and fruits

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[21] As previously referred, a reference to the treatment of Tournefort (1719).

[22] The group I includes the genera *Morina, Dipsacus, Scabiosa, Knautia* and *Allionia*. These genera are currently considered under other families of Dipsacales.

[23] Caprifoliaceae is considered by some authors the largest family of Dipsacales, where are eventually included the genera traditionally recognized under Valerianaceae (e.g. see APG 2009, 2016; Judd *et al.* 2016).

[24] From the Latin "*1-spermi*". However, the author most likely refers to the 1-loculate fruit.

with 2–3 seeds[25], eppapose. Based on this observation, Jussieu raises the following question regarding the genus *Valeriana*: "a genus to be divided?"[26]. Only a single species is mentioned in the diagnosis of the genus, *V. dioica* L.

Necker[27](1790), in the *Elementa Botanica*[28], placed the genus *Valeriana* as conceived by Linnaeus under the Sphanidophytorum group, together with other three new genera, *Kentranthus* Neck., *Mitrophora*[29] Neck., *Odontocarpa*[30] Neck., and *Mouffetta* Neck. *Mitrophora* is described based on a single species, *V. cornucopiae*, included under *Fedia* by Gaertner (1790). *Odontocarpa*, as referred by Borsini (1944: 292), has the same morphological circumscription of *Valerianella*. Therefore, even apparently unaware of the treatment and genera proposed by Adanson (1763), Necker recognizes five genera within the *Valeriana* group (Table 3).

TABLE 3. Genera under the *Valeriana* (Sphanidophytorum) group (Valerianaceae) and some of their diagnostic features, according to Necker (1790).

Genera	**calyx**	**corolla**	**stamens**
Valeriana L.	pappose	regular	3
Kentranthus Necker	pappose	calcarate and bilabiate	1
Mitrophora Necker	[dubious]	ringentiform and galled	2
Odontocarpa Necker	epappose (dentate)	infundibuliform	3
Mouffetta Necker	[dubious]	regular (tubulose)	3 or 4

This means an important increase over previous treatments, which considered all the known species only under the genus *Valeriana* (Linnaeus 1753), or divided as *Valeriana* and *Valerianella* (Tournefort 1719 and partially by Jussieu 1789), as well as into *Valeriana*, *Polypremum* (the same of *Valerianella*, as conceived by the previous authors) and *Fedia* (Adanson 1763). Until Necker, only eppapose species were segregated from *Valeriana* to new

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[25] From the Latin "*2–3-spermi*". However, the author most likely refers to the 2–3-loculate fruit.

[26] From the Latin "*an genus dividendum?*".

[27] Belgian botanist Noel Martin Joseph de Necker (1730–1793).

[28] The complete name of this work is *Elementa botanica: genera genuina, species naturales omnium vegetabilium detectorum eorumque characteres diagnosticos ac peculiares exhibentia, secundum systema omologicum seu naturale, evulgata...*

[29] *Mitrophora* literally means "corolla resembling an mitra", as referred by Borsini (1944: 292).

[30] *Odontocarpa* is a reference to "dentate fruits", as referred by Borsini (1944: 292).

genera. Apparently, *Kentranthus*[31] is the first split of the species provided with pappose calyx. Although this genus has been clearly and objectively segregated, essentially based on the small number of stamens and distinct corolla shape (calcarate and bilabiate), his diagnosis of *Valeriana* remains quite brief and broad. All the genera *Mitrophora*, *Odontocarpa* and *Mouffetta* are eppapose, although the author does not provide clear and comparable calyx features. These genera are easily separated by the corolla shape and number of stamens (Table 3).

Moench[32] (1794), in the second volume of *Methodus*[33], treated the three genera, *Valeriana*, *Fedia* and *Valerianella*. The treatment of the genus *Valeriana* is based on the previous conceptions of Tournefort (1719), Linnaeus (1753, 1762) and Gaertner (1790), placing the genus in the group of species with inferior ovary and incrustate achenes[34]. Moench cites in his treatment five Linnean species, all with a brief diagnosis: *Valeriana rubra* L., *V. calcitrapa* L., *V. officinalis* L., *V. dioica* L., and *V. phu* L. Therefore, the author includes under *Valeriana* two species 1-staminate[35] and with calcarate corolla, referred by the author as a frequent feature in the genus: *V. rubra* and *V. calcitrapa*. The author disregarded or was not aware of the treatment of *Kentranthus* proposed by Necker (1790)[36]. Plus, the author considers only species with pappose calyx. The three genera are segregated basically due to the calyx and corolla shape, as well as the stamens number, the number of infertile loci being the same between *Fedia* and *Valerianella*, but differing in *Valeriana* (Table 4).

Ruiz[37] & Pavón[38] (1798) in the *Flora Peruviana, et Chilensis*[39], describes 20 species from expeditions in Chile and Peru, being 17 new to Science, all under *Valeriana*. Although the classification system presented is entirely based on the Linnaeus' system, this work is extremely important as it describes, for the first time, South American species with striking features in the group, not observed in the Old World species until then. These taxa would be

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[31] This genus composed exclusively by European species will be legitimized by De Candolle (1830) under the spelling currently used (*Centranthus*).

[32] German botanist Conrad Moench (1744–1805).

[33] The complete name of this work is *Methodus plantas horti botanici et agri Marburgensis*.

[34] From the Latin "*semen incrustatum*".

[35] From the Latin "*floribus monandris*".

[36] Necker was a Belgian botanist while Moench was German. The difference in nationality and the brief period between both studies (four years) may be explanations for the study of the former having been disregarded by the latter.

[37] Spanish botanist Hipólito Ruiz López (1754–1815).

[38] Spanish botanist José Antonio Pavon (1754–1844).

[39] The complete name of this work is *Flora peruviana, et chilensis, sive descriptiones, et icones plantarum peruvianarum, et chilensium, secundum systema linnaeanum digestae, cum characteribus plurium generum evulgatorum reformatis.*

TABLE 4. Genera, key characters and species considered by Moench (1794) under Valerianeae.

Genera	calyx	corolla	stamens	achenes (ovary)	species treated
Valeriana L.	pappose	often calcarate	1–3	1-loculate	*Valeriana rubra* L., *V. calcitrapa* L., *V. officinalis* L., *V. dioica* L. and *V. phu* L.
Fedia Gaertn.	eppapose, lobes bipartite, emarginate	almost labiate	2	3-loculate (one fertile)	*V. cornucopiae* L.
Valerianella Tour.	eppapose	frequently regular	3–4	3-loculate (one fertile)	*V. sibirica* L.

later thoroughly examined by several authors, including Persoon (1805), Höck (1882, 1897, 1902), Graebner (1899, 1906a, 1906b) and Eriksen (1989), and serve as a basis for a new genus (*Phyllactis* Pers.), two sections [*Belonanthus* (Graebn.) Eriksen, and *Phyllactis* (Pers.) DC.] and several series.

Valeriana is treated by Ruiz & Pavón as the first genus of the Classis III, Triandria Monogynia, next to *Heteranthera* Ruiz & Pav. (Pontederiaceae Kunth) and *Commelina* L. (Commelinaceae Mirb.). No description or diagnosis of the genus is proposed. The ordering of the species, although not alphabetical, is certainly not random, as previously referred to the Linnaeus' *Species Plantarum*. The first two species described (*V. rigida* Ruiz & Pav. and *V. tenuifolia* Ruiz & Pav.) plus *V. spathulata* Ruiz & Pav. will be later segregated into a new genus *Phyllactis* Persoon (1805), mainly due to their striking habit, bracts and trifid corolla. This group will remain cohesive until the taxonomic approaches of Larsen (1986), as a genus, and Eriksen (1989), as a section. *Valeriana spathulata* will be later treated under the genus *Belonanthus* Graebn. by Schmale (1936) and Killip (1937), due to its caespitose habit, as well as its rather long and narrow trifid corolla. The key characters employed by Ruiz & Pavón to circumscribe the species are mainly habit, presence or absence of a main axis developed, leaves shape (basals and distals)[40], inflorescence shape, and rarely the number of corolla lobes (*V. rigida*, *V. tenuifolia* and *V. spathulata*) and bracts shape (*V. globiflora* Ruiz & Pav.), not always all of them referred to and comparable. Fruit features are described with varying degrees of

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[40] Referred in Latin by the authors as "*foliis radicalibus*" and "*foliis caulinis*".

detail, referring the calyx type, number of feathery segments of the pappus, the two-dimensional shape, lateral view shape (if compressed or not), and number of striae (costae).

Therefore, the few species known in the second half of the 18th century were still mostly assembled under the Linnaean system (Jussieu 1789, Ruiz & Pavón 1798). Despite this, some treatments propose a larger number of genera within the group, ranging from three (Adanson 1763, Moench 1794) to five (Necker 1790), although infrageneric categories are not yet treated. Both the genera *Centranthus* (still spelled *Kentranthus*) and *Fedia* are established. By the end of the 18th century, at least four other generic names have been described from species until then considered under *Valerianella*: *Polypremum*, *Mitrophora*, *Odontocarpa* and *Mouffetta*, all currently considered invalid names according to the IPNI. Therefore, at least eight genera were described in the group in this early period (1753–1798)[41]. Plus, the early essays on intergeneric relationships are proposed, as well as the first essay on the interfamilial relationships (Adanson 1763), based essentially on species from Europe and in a small number from Asia. In addition, the first South American species, especially from the north of the Andean mountain range, are described, although the impact on systematics was rather incipient. In this sense, the work of Ruiz & Pavón (1798) stands out for the important contributions in terms of varied and previously unknown morphological types described in the group. Regarding descriptions and diagnoses, some features are explicitly or implicitly defined as morphological key characters of genera, species and varieties in the *Valeriana* group. In the analyzed treatments are referred especially the habit, inflorescences, flowers and fruits. The flowers features play a fundamental role, namely the number of stamens (1-staminate, 2-staminate, or 3-staminate), the corolla type (regular or calcarate) and later the number of corolla lobes (3-fide or 5-fide). The fruit is gradually observed not only from the presence or absence of a pappose calyx and is described in details of form and number of locules, feathery segments of the calyx and costae.

Valerianaceae in the early 19th century

Several studies stand out for their contributions to Valerianaceae as a whole in the first half of the 19th century, especially Batsch (1802), Candolle (1805 and 1830), Peerson (1805), Dufresne (1811), Kunth (1818), Dumortier (1829), Hook (1851) and Weddell (1857). During this period the name Valerianaceae is fixed by Batsch, and a large amount of species collected in North,

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[41] This number is based strictly on *Valeriana* and related species, not those of more distant morphology, later considered in other families closely related to Valerianaceae, such as *Knautia* L. [Dipsacaceae].

Central and South America, especially from the Andes, become available to the analysis of the main European botanists. Plus, at least 18 of the 47 genera listed in the IPNI are described under the group (about 38 %). In less than one century, from Linnaeus (1753) to Candolle (1830), the number of worldwide Valerianaceae species jumped from 16 to at least 127 (excluding varieties).

Batsch[42] (1802), in the *Tabula affinitatum regni vegetabilis*, describes Valerianaceae under the Classis VI (Monopetalae), Order VIII (Marcidae), which includes other two families: Jalapinae and Aggregatae. Here Valerianaceae includes only three Linnean genera: *Allionia* L., currently under Nyctaginaceae, as well as *Morina* L., currently under Morinaceae or Caprifoliaceae, and *Valeriana*. Therefore, only the genus *Valeriana* still remains in the family as originally conceived. It is unclear why Batsch (1802) considered all the species belonging to the *Valeriana* group under the same genus, disregarding the previously mentioned studies.

In this context, two studies by Candolle[43] (1805, 1830), the *Flore Française*[44] (Candolle 1805), and specially the *Prodromus*[45] (Candolle 1830), drastically changed the understanding of the family. In the first, Candolle (1905) places Valerianeae[46] as the 59° family of his treatment, between Dipsaceae[47] and Rubiaceae. The treatment of Valerianeae is based on the Dipsacearum of Jussieu (1789), Scabiosarum of Adanson (1763), and Agragatarum of Linnaeus (1753). The pioneer recognition of the *Valeriana* group as a family is credited to Jussieu (1789), not to Batsch (1802)[48]. Four genera and 21 species native from France were recognized by Candolle under Valerianae: *Valeriana* (12 spp.), *Centranthus* (2 spp.), *Fedia* (as conceived by Gaertner 1790) (1 spp.) and *Valerianella* (as conceived by Miller 1754) (6 spp.). *Valeriana* is analyzed from an overview of the previous conceptions of Linnaeus (1753), Jussieu (1789), Gaertner (1790), Necker (1790), and Lamarck[49] (1791)[50]. The diagnosis of this

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[42] German botanist August Johann Georg Karl Batsch (1761–1802).

[43] Swiss botanist Augustin Pyramus de Candolle (1778–1841).

[44] The entire name is *Flore française, ou descriptions succinctes de toutes les plantes qui croissent naturellement en France, Disposées selon une nouvelle Méthode d'Analyse, et précédées par un Exposé des Principes élémentaires de la Botanique*.

[45] The entire name is *Prodromus Systematis Naturalis Regni Vegetabilis, sive enumeratio contracta ordinum generum specierumque plantarum huc usque cognitarium, juxta methodi naturalis, normas digesta; Pars quarta Sistens Calyciflorarum Ordines X*.

[46] The authority of the family name Valerianeae is dubious.

[47] Under this family, De Candolle (1805) treated two genera, *Dipsacus* L. and *Scabiosa* L.

[48] However, the family (as Valerianaceae) was considered validated by Batsch (1802).

[49] French naturalist Jean-Baptiste Pierre Antoine by Monet de Lamarck (1744–1829).

[50] In the same way, the genus *Centranthus* is analyzed from the previous conception of Necker (1790), including two species treated under *Valeriana* by the Linnaeus, Jussieu, Lamarck and Gaertner: *Centranthus ruber* (L.) DC. and *C. angustifolius* (L.) DC. In fact, the genus *Centranthus* was only legitimized by De Candolle in the *Prodromus* (1830), whit the referred species. The genus *Fedia* was also analyzed from multiple prior perspectives, including species conceived by Moench under the genus *Fedia*, as well as species considered by Adanson and

genus includes only species with pappose calyx, spurless, with 3 stamens (rarely 1) and 1-loculate fruit. In this sense, the diagnosis is similar to that treated by Necker (1790). Very little resembles the conception of the other authors considered in the genus treatment, because all considered *Valeriana lato sensu*, including species with a wide morphological variation, including 1–4 stamens, a corolla with regular, gibbous or calcarate base, fruits 1–3-loculate, pappose or eppapose. *Centranthus* differs from *Valeriana* basically by having one stamen and corolla with a long spur. *Fedia* differs from these genera by the two stamens, by the 3-loculate ovary (two of which are frequently aborted), as well as by the fleshy achene, with a "rudiment of a perisperm". According to Candolle (1805), two species from Siberia with yellow corolla and four stamens, and differences in features of the achene should be separated from *Fedia*, as treated by Adanson (1763). The diagnosis of *Valerianella* seems to be the most confusing with that of *Valeriana*, since the only striking feature to distinguish both genera is the presence or absence of a pappose calyx. Despite the overlap in the number of stamens treated in *Valeriana* and *Centranthus,* the two genera are easily differentiated by the long-calcarate corolla present in the latter (Table 5).

TABLE 5. Genera under Valerianeae and some of their diagnostic features, according to Candolle (1805).

Genera	**calyx**	**corolla**	**stamens**	**fruit**
Valeriana L.	pappose	regular	3 (rarely 1)	1-loculate
Centranthus DC.	pappose	calcarate	1	[dubious]
Fedia Gaertn.	eppapose (dentate)	[dubious]	2	3-loculate (two frequently aborted)
Valerianella Mill.	epappose (dentate)	regular	3	3-loculate (two frequently aborted)

As we can infer from the studies analyzed so far, the circumscription of *Fedia* varied dramatically from its original conception by Adanson (1763) until Candolle (1805). Adanson conceived the genus with 4-staminate flowers and 2–3-loculate achenes, based on a single species, *V. sibirica*. Gaertner (1790), legitimizes the genus with a broader description, the flower being described as 2–5-staminate and the achenes as 1-loculate due to abortion. This

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Gaertner under Fediae, and conceived by Linnaeus, Jussieu and Lamarck under Valerianae. The last genus treated, *Valerianella*, was analyzed from the conceptions of Vaillant and Moench (under *Valerianella*), as well as the conception of Fediae by Gaertner, and from Valerianae by Linnaeus, Jussieu and Lamarck.

author includes four species, *F. olitoria*, *F. cornucopiae*, *F. sibirica*, and *F. coronata* and treated the coronate calyx as a striking feature of *Fedia*. Necker (1790), based solely on *Valeriana cornucopiae*, describes the new genus *Mitrophora*, restricting this to a circumscription of 2 stamens. Moench (1794) considers only *V. cornucopiae* under *Fedia* as described and legitimized by Gaertner, however restricting the circumscription to 2-staminate flowers and a calyx with bipartite lobes. This configuration based essentially on the number of stamens, calyx and number of fruit locules observed under *Fedia*, as established especially by Moench, was used as a basis for the *Flore Française* of De Candolle (1805) and subsequent works.

Despite the important generic synthesis established by Candolle (1805), his work was restricted to a regional flora. It is undoubtedly in the *Prodromus* (Candolle 1830) that the classification systems of Valerianaceae as a whole would be more detailed. In his first worldwide treatment of this family, the author defined 11 genera and several sections and series. Plus, treated the impressive number of 127 species, 82 of them concerning to *Valeriana,* most of them from South America, plus 10 species from North America, the largest number of genera and species treated so far. As observed by Meyer (1951), the classification system of Candolle (1830) is “essentially the same arrangement as the most recent one by Höck (1902)”. Only three of the 11 treated genera have species from South America, *Astrephia*, *Valeriana* (under the three sections) and the new genus *Betckea* DC. (Table 6).

For the first time, *Valeriana* is divided into three sections, *Phyllactis* (Pers) DC., *Aretiastrum* DC. and *Phu* DC., all presenting South American representatives. Four species occurring in eastern South America are treated, all included in the section *Phu*: *V. chamaedryfolia* Cham. & Schltdl., *V. polystachya* Sm., *V. salicariifolia* Vahl, and *V. scandens*. All the species are separated into informal series with phrasal names, essentially based on the habit and the shape of the leaves.

Persoon (1805), in the *Synopsis plantarum*, recognizes two genera under Valerianaceae, Class III, *Triandria*, *Monogynia*: *Valeriana* (42 spp.) and the new genus *Phyllactis* Pers. (3 spp.). *Valeriana* is divided by Persoon into two groups (sections?), *Valerianae* (27 spp.) and *Fedia* (15 spp.), essentially distinguished by the calyx type. The first is treated as a group with pappose calyx, and *Fedia* as a group with calyx absent or dentate. Two species occurring in eastern South America are treated, *V. scandens* and *V. polystachya*, in *Valerianae* and *Fedia*, respectively. Regarding the new genus *Phyllactis*, three species are treated, all endemic to the South American Andes and described by Ruiz & Pavon (1798) under *Valeriana*: *Phyllactis*

TABLE 6: Synthesis of the classification system of Valerianeae adopted by Candolle (1830). *Categories with South American species.

Genus	**sections**	**series**	**species number**
Patrinia Juss. (1807 nom. cons.)			5
Nardostachys DC.			2
Dufresnia DC.			1
Valerianella Moench. (1794 nom. ileg.)		*Locustae*	6
		Psilocaelae	7
		Platycoelae	8
		Selenocoelae	3
Astrephia Dufr. *			2
Fedia Moench (1794 nom. ileg.)			3
Plectritis (Lindl.) DC.			1
Centranthus DC.			5
Valeriana L. *	*Phyllactis* (Pers.) DC. *		4
	Aretiastrum DC. *		2
	Phu (or *Valeriana vera*) DC. *	(many, phrase named)	76
Betckea DC. *			1
Triplostegia Wall. ex DC.			1
Total			127 spp.

rigida (Ruiz. & Pav.) Pers., *P. tenuifolia* (Ruiz. & Pav.) Pers., and *P. spatulata* (Ruiz. & Pav.) Pers. The author argues that *P. rigida* and *P. tenuifolia* have striking features that do not correspond to the genus *Valeriana*, such as a small rosulate habit, involucrate bracts and flowers with trifid corollas. Despite treating a diversified set of species, including some from

South America (e.g. *V. chaerophylla* Sm.[51], *V. hyalinorhiza* Ruiz. & Pav., and *V. pilosa* Ruiz. & Pav.) and a single one from Africa (*V. capensis* Thunb.), Persoon is conservative in his analysis of the group, including under *Valeriana* (*Valerianae* group) species with 1–4 stamens, plus two species recognized under *Centranthus* (*V. rubra* and *V. angustifolia*) at that time. Nevertheless, the recognition of *Phyllactis* is based on the combination of vegetative and reproductive features, which indicates a possible reason why other taxa with very particular habits in the genus *Valeriana*, such as lianescent (*V. scandens*), but lacking striking features in flowers, were not segregated by Persoon.

Kunth (1818), in the *New Genera and Species Plantarum*[52], treated 22 taxa under Valerianeae Juss.[53] (next to Rubiaceae), divided into three genera: *Centranthus* (as conceived by Necker 1790[54]), *Valeriana* (as conceived by Candolle 1805[55]), and *Fedia* (as conceived by Gaertner 1790) (Table 7). Despite the reference to Gaertner (1790), the genus *Fedia* curiously includes a single South American species, *F. chaerophylloides* (Sm.) Kunth, from Venezuela[56]. Kunth included species of a wide range of habits and with 3–4-fide corolla in *Valeriana*, thus including *Phyllactis* (as proposed by Persoon 1805) as a synonym, plus *Astrephia*, as conceived by Dufresne (1811). It implies that, according to Kunth's classification system, combined characteristics of habit, inflorescences type and number of corolla lobes do not define a genus under Valerianeae, not even formal sections or series. Comparing the three genera in this family, what apparently defines a genus is basically the corolla shape (bilabiate or not), presence of spur or gibbosity, number of stamens, calyx type (pappose or dentate), and number and shape of achene locules. As expected, this implies a rather conservative view concerning the systematic treatment of South American species. Despite the conservative view, an important contribution of Kunth (1818) was the description of four suffrutescent vines from

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[51] The same as *V. chaerophylloides* Sm.

[52] The complete name of this work is *Nova genera et species plantarum quas in peregrinatione ad plagam aequinoctialem orbis novi collegerunt,/descripserunt, partim adumbraverunt Amat. Bonpland et Alex. de Humboldt.; Ex schedis autographis Amati Bonplandi in ordinem digessit Carol. Sigismund. Kunth. Accedunt tabulae aeri incisae, et Alexandri de Humboldt notationes ad geographiam plantarum spectantes.; Tomus tertius.*

[53] The reference to Jussieu as author of Valerianeae is unclear. As commented above, this author in the *Genera Plantarum* (1789: 195) treated the genus *Valeriana* “T.L.” under a new family, Dipsaceae.

[54] As previously referred, this author treated this genus under *Kentranthus*. The spelling *Centranthus* was conceived by De Candolle (1805). This is a clear reference to the treatment of this genus according to De Candolle's conception, as referred by Kunth to *Valeriana*. The Necker authority was most likely cited in reference to the origin of the term, as referred to by De Candolle. Nevertheless, as previously mentioned, the treatments of both genera by De Candolle (1805) were clearly based on Necker (1790).

[55] The author does not refer to publication dates. However, the use of *Centranthus* and the treatment of the three genera clearly refers to De Candolle's *Flore Françeise*.

[56] This species was previously described as *Valeriana* by Smith (1791) and treated in the same genus by Persoon (1805) and others authors. A few years later was transferred to *Astrephia* by Dufresne (1811) and treated in the same genus by De Candolle (1830).

TABLE 7. The classification system of Valerianeae according to Kunth (1818).

Genus (spp.)	1th split	2th split	3th split	4th split
Centranthus Necker (1 spp: *Centranthus latifolius*)				
Valeriana DC. (= *Astrephia* Duf. and *Phyllactis* Pers.) (20 spp.)	I. *Acaules* (1 spp: *V. rigida*)			
	II. *Caulescentes*	I) *Suffruticosae et fruticosae*	a. *procumbentes* (species 2–3) b. *erectae* (4–7) c. *scandentes* (8–11)	
		II) *Herbaceae*	a. *caule erecto*	*) *Foliis simplicibus et integris* (12–15)
				**) *Foliis pinnatifidis, pinnatis et bipinnatifidis* (species16–21)
			b. *caule scandente* (species 22: *V. scandens*)	
Fedia Gaertn. (=*Valerianella* DC.) (1 spp: *Fedia chaerophylloides*)				

northern South America[57]. These species (including the lianescent *V. scandens*) represents a considerable amount of the currently known 7–8 lianescent species included in the genus

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[57] Species numbered 8 to 11: *Valeriana tomentosa* Kunth (from Peru), *V. clematitis* Kunth (Colombia, Peru), *V. crassifolia* Kunth (Colombia), *V. laurifolia* Kunth (Colombia), all of them under the groups Caulescentes /

Valeriana. Regarding the habit of the 20 species of *Valeriana* analyzed by Kunth (1818), the herbaceous predominates (11 spp.). Only six species of shrubs to subshrubs were analyzed, all from northern South America.

Dumortier (1829: 32) in the *Analyse des Familles des Plantes*[58] treated Valerianaceae under the Classis 5 (Gynocorollae), Order F (Dipsariae), which is shared with Dipsaceae. This order comprises a group with other three orders (Rubiarieae[59], Viburnarieae[60] and Samolinarieae), previously defined by Jussieu. Both families of Dipsariae are divided based on the flowers disposition. Valerianaceae is divided into two tribes, based exclusively on the presence or absence of pappose calyx (Table 8).

TABLE 8. Tribes and genera under Valerianaceae, including the striking feature distinguishing the tribes, according to Dumortier (1829).

Tribes	**genera**	**striking feature**
Fedieae	*Valerianella*, *Fedia*, *Nardostachys*, *Patrinia* and *Astrephia*	eppapose calyx[61]
Valerianeae	*Valeriana* and *Centranthus*.	pappus-like calyx[62]

Dumortier (*l.c.*) does not provide any information about the authors of the seven considered genera, nor the genera diagnosis. His work stands out for proposing, apparently for the first time, the division of the family into tribes. In addition, it recognizes seven genera, a high number when considering other surveys of that time, being comparable only to Candolle (1830) *Prodromus*. If based on the generic conception of previous studies analyzed here, the South American species are considered under the genera *Astrephia* and *Valeriana*.

Weddell (1857) includes Valerianeae in the Order IV of *Chloris andina*[63]. The author recognizes *Valeriana* and *Phyllactis*, each with three sections and informal internal groups (Table 9). Regarding the distribution of the family, he provides one of the first global accurate

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Suffruticosae et fruticosae / caule scandente. On the other hand, *V. scandens* was treated under the group Caulescentes / Herbaceae / caule scandente.

[58] The complete name of this work is *Analyse des Familles des Plantes, avec L'Indication des Principaux Genres qui S'y Rattachent*.

[59] Including Operculariaceae, Gardeniaceae and Rubiaceae.

[60] Including Caprifoliaceae and Viburnideae.

[61] From the Latin "*calice dressé*".

[62] From the Latin "*calice se deróulant*".

[63] Complete name of this work: *Chloris andina: essai d'une flore de la region alpine des Cordillères de l'Amérique du Sud*.

assessments, which, with slight modifications, is consistent with the currently recognized distribution of Valerianaceae. Concerning the distribution, he wrote:

> *Although the plants in this family are almost equally divided between the old world and the new world, they are not evenly distributed, for in the former we have not yet observed to the best of my knowledge south of the Equator [Line], and that, in the second, it is South America, by contrast, that claims the largest number of them. In the Andes, where the Valerianeae are more abundant than elsewhere, they are regularly distributed throughout the length of the chain, the alpestre and alpines almost equally provided* (Weddel 1857: 17).

However, Meyer (1958) points at least three endemic species in eastern and southern Africa, all south of the Equator Line, two of them published only in the late 19th century. Weddel, for some reason, was unaware of the third, *V. capensis*, previously referred in the treatment of Persoon (1805). The two genera treated under Valerianeae by him are separated basically by the presence or absence of a pappose calyx. The sections within *Valeriana* were given informal names (or phrase names), although Meyer (1958) was aware of several previous classification systems, such as Candolle (1830). In fact, the author cited as reference the previous analysis of *Valeriana* from Linnaeus (1753) and Ruiz & Pavón (1798), as well as *Valeriana* and *Astrephia* as treated by Dufresne (1811) and the Valerianeae section III of Candolle (1830). This implies in a series of quite distinct views regarding the morphological circumscription of these taxa, as previously mentioned.

The three sections of *Valeriana* bring together 28 species, separated primarily by habit. Herbaceous species represent the majority (19 spp.), and are classified in series (formal or not) by the type of basal leaves (entire or pinnately lobed). The species with entire basal leaves (13 spp.) are classified according to the type of inflorescence. This infrageneric classification based essentially on habitats, leaves and general form of the inflorescence is remarkable on history of the classification systems of *Valeriana*, resembling that of Kunth (1818). As demonstrated above, many previous treatments had already incorporated flower and fruit features in the diagnosis of sections (e.g. Persoon 1805, Candolle 1830). Despite this, in addition to providing an accurate description of the family's geographic distribution, Weddell (1857) also indicates a general profile of the genus *Valeriana* in South America: many herbaceous, fewer shrubs and subshrubs, and very few lianas. In fact, only two lianescent species are reported, previously described by Kunth (1818), *V. clematitis* and *V. laurifolia*, from Ecuador.

Three sections are recognized under *Phyllactis* with formal names, two of them being new (*Euphyllactis* and *Valerianopsis*). *Aretiastrum*, described by Candolle (1830) as a section of the genus *Valeriana*, was transferred as a section of the genus *Phyllactis*. This change on *Aretiastrum* apparently did not affect later studies on Valerianaceae, having predominated the referred original conception of Candolle (1830). Although, *Valerianopsis* had great repercussions on systematics of Valerianaceae, at least until the late 19th and early 20th centuries. This section was slightly altered by Höck (1882) in a treatment later adopted by Graebner (1899) [i.e. *Valerianopsis* Wedd. emend. Höck]. Plus, Müller (1885) transferred *Valerianopsis* to the status of genus to encompass the Brazilian Valerianaceae species with eppapose calyx [i.e. *Valerianopsis* (Wedd.) C.A.Müll.]. In turn, Eriksen (1989) restores the taxon to its original condition as section. Therefore, *Phyllactis* is based on the original conception of Persoon (1805), plus *Phyllactis* and *Astrephia* by Dufresne (1811), Valerianae by Ruiz & Pavón (1798), as well as *Betckea* and Valerianae by Candolle (1830). Weddel (1857) makes some important comments about the choice of the characters employed in the broad diagnosis and infrageneric categories of *Phyllactis*:

> *When Persoon established his genus* Phyllactis, *he evidently only had in mind the character provided by the welding of the floral bracts, and although he seems to have known the conformation of calyx in the assembled plants, he did not attach much importance to it, since the* Fedia *and the* Valerianella, *which has a similar calyx, are true valerians for him. The absence of calyx with coiled and feathered teeth in some species was also observed by Ruiz and Pavón [1798]; but this character, to which Dufresne [1811], in his* Dissertation sur les Valerianes, *had given all the value it deserves, nevertheless seems to have escaped the* Prodromus *author [Candolle 1830], without whom he certainly would not have hesitated to adopt the genus he occupies. I will not return here to the opinion expressed by M. Clos (Fl. Chile, III, 242) [Clos 1847], about the character on which* Betckea *was founded. The ovary of* B. samolifolia *DC., in fact, is no different from that of* Phyllactis, *from which this plant will be considered congenital*[64]*. The remarks I made above (page 8) about the value of characters taken from the relative length of the reproductive organs and corolla in the genus* Valeriana *are also applicable here* (Weddel 1857: 28).

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[64] A better translation can be "of the same genus".

TABLE 9: Synthesis of the classification system of Valerianeae adopted by Weddell (1857).

Genus	**section**	**internal section 1**	**internal section 2**
I. *Valeriana* [28 spp.]	§ 1. *Caules frutescentes v. suffrutescentes* (7 spp.)		
	§ 2. *Caules fruticosi, scandenties* (2 spp.)		
	§ 3. *Caules herbacei, non scandentes* [19 spp.]	A. *Folia inferiora indivisa* [divided in two parts] (13 spp.)	a. *inflorescentia e cyma s. glomerulo unico aut pluribus capituliformibus spiciformibusve confecta* (7 spp.)
			b. *Inforescentia e cymulislaxifloris confecta* (6 spp.)
		B. *Folia inferiora pinnatilobata* (6 spp.)	
II. *Phyllactis* Pers. [16 spp.]	§ 1. *Euphyllactis* Wedd. (6 spp.)		
	§ 2. *Aretiastrum* DC. (1 spp.: *Phyllactis aretioides*)		
	§ 3. *Valerianopsis* Wedd. (9 spp.)	A. *Acaules, caudice lignoso ramosissimo* (2 spp.)	
		B. *Fruticosae, ramis floriferis foliosis*	a. *Folia indivisa* (2 spp.)
			b. *Folia pinnatifida* (1 spp.: *Phyllactis pinnatifida*)
		C. *Herbaceae, caulibus floriferis parce foliatus*	a. *Folia inferiora indivisa* (3 spp.)
			b. *Folia inferiora profunde triloba* (1 spp.: *Phyllactis mandoniana*)

Therefore, in the brief period between Batsch (1802) and Weddell (1857), the first essay on the division of Valerianaceae into tribes (*Fedieae* and *Valerianeae*) was made (Dumortier (1829), as well as the first treatments of infrageneric categories under the main considered genera (Persoon 1805, Kunth 1818, Candolle 1830, and Weddell 1857). The generic categories are treated in a very varied way. The species of the group were treated only under *Valeriana* by Batsch (1802), under two genera (*Valeriana* and *Phyllactis*) by Weddell (1857), three genera (*Centranthus*, *Valeriana* and *Fedia*) by Kunth (1818), four genera (*Valeriana*, *Valerianella*, *Fedia* and *Centranthus*) by Candolle (1830), and finally under 11 genera (*Patrinia*, *Nardostachys*, *Dufresnia*, *Valerianella*, *Astrephia*, *Fedia*, *Plectritis*, *Centranthus*, *Valeriana*, *Betckea* and *Triplostegia*) by Candolle (1830), in the largest treatment of Valerianaceae at that time. Some genera have drastically changed their circumscription since their original conception, such *Valerianella* and *Fedia*, the latter changed at least four times from Adanson (1763) to Candolle (1805), and later treated in a completely different way by Kunth (1818), assuming a conception similar to the current one from Candolle (1830).

The description of the genus *Phyllactis* by Persoon (1805) played a variable role, although it would assume a major importance in the Valerianaceae systematics in the late 19th and 20th centuries (e.g. see Eriksen 1989), the same being observed with *Astrephia*. However, both *Astrephia* and *Phyllactis* are eventually recognized as genera (the first by Dumortier 1829 and Candolle 1830, the second by Persoon 1805), occasionally as synonyms of *Valeriana* (Kunth 1818) or sections (the second by Candolle 1830), or even the first name as synonymous of the latter (Weddell 1857).

Valerianaceae in the late 19th and early 20th centuries

It is at the end of the 19th century that the most extensive and complete family analysis was made, in the form of detailed monographs specifically about the family, including a significant number of South American species. Many of the remaining questions throughout the 19th century would be analyzed by two of the most prominent valerianologists in history, Höck (1882, 1891, 1902) and Graebner (1899, 1906a and 1906b).

Höck[65] (1882) produced one of the studies that had the greatest impact on Valerianaceae classification systems, the *Beiträge zur Morphologie, Gruppirung und geographischen*

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[65] German botanist Fernando Höck (1858–1915).

Verbreitung der Valerianaceen (Contributions to the morphology, grouping and geographical distribution of Valerianaceae). In the 72 pages of this study, Höck analyzed the impressive number of 192 species of Valerianaceae. According to this author, the treatment of *Valeriana* “in terms of their morphological and geographical conditions” was the suggestion of Engler[66], but that the analysis of the other family genera pointed to several taxonomic inconsistencies, which led him to “work evenly on all the genera of Valerianaceae in order to get an overview of the whole family”[67].

Regarding *Valeriana*, Höck accounted 159 species worldwide, being 114 of them from the Neotropics (about 72% of the total), and 30 species specifically from North America and West Indies, seven decades later revised by Meyer (1951). Despite this, Meyer (1951: 377) wrote:

> *His disposition [Höck 1882] of the North American species was limited by a paucity of material, and, while conservative, it hardly fulfilled the need of a detailed account based upon abundant field data and herbarium specimens.*

Concerning the Neotropical species, Höck himself admits that he did not have access to “many of the rarer species of *Valeriana* and *Phyllactis* from Central and South America”, although the survey's overall results, he said, were little affected because “they are almost exclusively related to the general relations of the species”. Despite the reported scarcity[68] of material, Ferguson (1965: 221) observes that from the seven sections considered by Höck under *Valeriana*, six are “entirely South American”: *Hybocarpos* Höck, *Pseudastrephia* Höck, *Valerianopsis* Wedd. emend. Höck[69], *Phyllactis* Pers., *Porteria* Hook. and *Aretiastrum* DC[70] (Table 10). From the 110 species and 15 series included in the section *Euvaleriana* Höck, the largest of all, about half the species (65 spp.), divided in 10 series, are restricted to the Neotropics. These numbers demonstrate the great representativeness of Neotropical taxa in Höck's (1882) treatment, most of them from South America. On representativeness, this author

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[66] German botanist Heinrich Gustav Adolf Engler (1844–1930), Höck's professor and mentor at the time.

[67] Höck (1882) analyzed live specimens of *Valeriana*, *Valerianella*, *Centranthus* and a single specimen of *Fedia cornucopiae* Dufr. from the local Botanical Garden, as well as specimens from the local university herbarium and from Engler's personal herbarium, plus “all Valerianaceae from the University of Berlin Herbarium, except for *Valerianella* and *Fedia* species, and several rarer species of the genus *Valeriana* and *Nardostachys* through friendly mediation by the same gentleman [Engler], from the Munich University herbarium”.

[68] From the German "*Mangel*".

[69] Originally described by Weddell as a section of the genus *Phyllactis*, as previous referred.

[70] The only exception is the section *Phyllactis,* which according to the Höck’s circumscription have a single species endemic from North America.

TABLE 10: Synthesis of the classification system of Valerianaceae adopted by Höck (1882). *Categories with South American species.

Genus	sections	series
Patrinia Juss. [13 spp.]	1. *Centrotrinia* Maxim. [2 spp.]	
	2. *Paleopatrinia* Höck [10 spp.]	1. *P. rupestris* [4 spp.] 2. *P. scabiosaefoliae* [5 spp.] 3. *P. ovatae* [1 sp.]
	3. *Monandropatrinia* Höck [1 sp.]	
Nardostachys DC. [2 spp.]		
Plectritis (Lindl.) DC. [5 spp.]*	1. *Euplectritis* Höck [3 spp.]	
	2. *Betckea* (DC.) Höck * [2 spp, a single one from S. Am.]	
Fedia Moench[71] (1794 nom. ileg.) [1 sp.]		
Astrephia Dufr. [1 sp. from S. Am.]*		
Valeriana L. (159 spp.)*	1. *Euvaleriana* Höck [116 spp.]*	1. *V. tuberosae* [2 spp.] 2. *V. dioicae* [16 spp.] 3. *V. officinalis* [14 spp.] 4. *V. montanae* [11 spp.] 5. *V. ciliatae* [2 spp.] 6. *V. lapathifoliae* [2 spp., all from S. Am.]* 7. *V. carnosae* [6 spp., all from S. Am.]* 8. *V. polemonioidis* [4 spp., all from S. Am.]* 9. *V. radicalis* [4 spp., all from S. Am.]* 10. *V. laxiflorae* [11 spp., all from S. Am.]* 11. *V. microphyllae* [6 spp., all from S. Am.]* 12. *V. scandentis*

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[71] The same author as referred by De Candolle (1830).

		[10 spp., all from C. Am. and S. Am.]* 13. *V. mexicanae* [15 taxa: 14 spp. and 1 var., all from C. Am. and S. Am.]* 14. *V. sorbifoliae* [4 spp., all from C. Am. and S. Am.]* 15. *V. ceratophyllae* [3 spp., all from C. Am.]*
	2. *Hybocarpos* Höck [14 spp., all from S. Am]*	
	3. *Pseudastrephia* Höck [4 spp., all from S. Am.]*	
	4. *Valerianopsis* Wedd. emend. Höck [15 spp., all from S. Am.]*	1. *V. macrorhizae* [6 spp., all from S.Am.]* 2. *V. connatae* [4 spp., all from S. Am.]* 3. *V. polystachyae* [5 spp., all from S. Am.]*
	5. *Phyllactis* (Pers.) DC. emend Höck* [10 spp., almost all from S. Am.]	1. *V. densae* [2 spp., all from S. Am.]* 2. *V. rigidae* [7 spp., all from S. Am., and a single species from N. Am.]*
	6. *Porteria* (Hook.) Höck [4 spp., all from S.Am.]*	
	7. *Aretiastrum* DC. [2 spp., all from S. Am.]*	
Centranthus DC. [11 spp.]	1. *Macrocentron* Lge. [8 spp.]	1. *C. rubri* [7 spp.] 2. *C. nervosi* [1 sp.]
	2. *Calcitrapa* Lge. [3 spp.]	

chose not to include in his monograph an analysis of the genus *Valerianella*, since it has already been examined in other specific studies (Miller 1754).

In the identification key to the genera under Valerianaceae provided by Höck, it is possible to observe a tendency to segregate both the Asian genera *Patrinia* and *Nardostachys* in a segregated group, and the genera *Plectritis*, *Fedia, Valerianella, Astrephia*, *Valeriana* and *Centranthus*, with species from both the Old and New World, in another group, both cohesive and divided based on vegetative and reproductive features, although some of them overlapping. It is also observed a tendency to divide this latter group in other two groups, especially according to the calyx type and locules number, although many species included by the author under the genus *Valeriana* have entire leaves and epappose calyx (e.g. species of Sect. 4. *Valerianopsis*). Four species occurring in eastern South America are treated, *V. scandens* (included in the section *Euvaleriana*, series *V. scandentis*), as well as *V. chamaedryfolia, V. polystachya*, and *V. salicariifolia* (in section *Valerianopsis*, series *V polystachyae*).

Höck (1897) in his treatment of Valerianaceae for the *Die natürlichen Planzenfamilien*[72], brings a few changes and inclusions in the family classification system. The section *Siphonella* Torr. & Gray. was added under the genus *Plectritis*, with two species from Arkansas, United States. This section was originally treated as a section of *Fedia* by these authors. Höck (1897) includes his first treatment of the genus *Valerianella*, which was divided into 12 sections: *Pseudobetckea* Höck, *Eriocephalae* Boiss., *Coronatae* Boiss., *Euvalerianella* Höck, *Sclerocarpae* Boiss., *Physocoelae* Krok., *Cornigerae* Soy. Will. and *Locustae* DC. Plus, this author provides a comparative analysis of vegetative and reproductive characters of Valerianaceae, besides detailed illustrations of the key characters treated under the group.

The tendency to establish divisions in tribes, already observed in early publications (Höck 1882), is formalized by Höck (1902) in the *Verwandtschaftsbeziehungen der Valerianaceen und Dipsacaceen* (Relationship between Valerianaceae and Dipsacaceae). In this study, Höck treated the division of Valerianaceae into five tribes and 11 genera (Table 11). The diagnosis of the tribes provided by Höck (1902) are quite broad in order to encompass genera with distinct features. This study constitutes an important increase in relation to the binary tribal division initially proposed by Dumortier (1829).

Therefore, in the three studies analyzed here, Höck treated almost 200 species of Valerianaceae, dividing them into five tribes, and these initially into eight genera, later into 11. The genus *Plectritis* was initially divided into two sections (*Euplectritis* and *Betckea*). Later there was the addition of a new section, *Siphonella*. The only species from South American

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[72] The complete name of this work is *Die natürlichen Planzenfamilien nebst ihren Gattungen und wichtigeren Arten insbesondere den Nutzpflanzen bearbeitet unter Mitwirkung zahlreicher hervorragender Fachgelehrten*.

TABLE 11. Tribus and genera under Valerianaceae, including their respective distributions, according to Höck (1902).

Tribus	**genera**	**distribution**
Plectritideae	*Plectritis, Aligera*	America
Valerianelleae	*Valerianella, Fedia*	northern hemisphere
Valerianeae	*Centranthus, Valeriana, Astrephia*	all continents except Oceania
Patrinieae	*Patrinia, Nardostachys*	Asia and Eastern Europe
Triplostegieae	*Triplostegia, Hoeckia*	South and Central Asia and New Guinea

Plectritis was treated under the section *Betckea*, and its species category was questioned in the study of 1891. The author considered a single species under *Astrephia*, maintaining the circumscription when compared to previous studies. The author treated the division of *Valeriana* into seven sections. *Euvaleriana* was divided into 15 series, all related to species with striking morphological types. The section *Phyllactis* was divided into two series and the circumscription was slightly changed from that proposed by Candolle (1830). Höck's effort to describe the number and arrangement of fruit locules is notorious. This is certainly due to the similarity of the fruits in terms of external morphology among some genera, as in *Centranthus* and *Valeriana*, although floral characters are described as distinct. In this sense, Höck (1897) provides some impressive illustrations of the genera within Valerianaceae.

Graebner[73] published three fundamental studies for understanding Valerianaceae in less than two decades, between 1899 and 1906. The first major review is the *Beiträge zur Kenntnis der süd- und centralamerikanischen Valerianaceae* (Contributions to the knowledge of the South and Central American Valerianaceae) (Graebner 1899). It is therefore a work focused both on the systematic treatment of Valerianaceae and description of new species. According to this author, this study is the result of the ordering and determination of the Valerianaceae collections from the Royal Herbarium[74], which "presented a whole series of almost undefined plants as new". He further notes that many species described by previous authors were erroneously or imprecisely circumscribed, as "they did not have so much comparative material"

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[73] German botanist Karl Otto Robert Peter Paul Graebner (1871–1933).

[74] *Kgl. Herbariums*, now the Berlin Herbarium.

(Graebner 1899: 425). The new species mentioned by the author were described from the collections of Lehmann[75] and Hieronymus[76], which provided important increments, especially for the new section *Galioides* Graebn. Also important to Graebner were the collections made by Ule[77], from southern Brazil, as well as the collections of Bang[78], from Bolivia, Philippi[79], Ehrenberg[80], Hartweg[81], from Colombia, Ecuador, Guatemala, Mexico, and Jameson[82]. This pool of the 19th century collections provided a more accurate view of Valerianaceae when compared to the earlier classification systems. In his first work on this family, Graebner proposes two new sections under *Valeriana* (sect. *Galioides* and sect. *Phuodendron*) and describe 12 new species (Table 12).

All four sections treated by Graebner (1899) in *Valeriana* have species native from eastern South America. A new species described for southern Brazil, *V. catharinensis*, is included in the section *Euvaleriana* ser. *V. laxiflorae* Höck. The four forms considered under *V. scandens* by Mueller (1885) were included in the section *Euvaleriana* ser. *V. scandentis* Höck. Two new species from the southeastern region of Brazil, *V. glaziovii* Graebn. and *V. itatiaiae* Graebn. are included in the section *Valerianopsis* (Wedd.) Höck. Finally, a new species of shrub from southern Brazil, *V. ulei*, is described in the new section *Phuodendron* Graebn.

Graebner (1906a), in *Valerianaceae Andinae*, received and analyzed a series of collections from Weberbauer[83], almost all from the Peruvian Andes, which, according to Graebner, “increased much our knowledge about the family”. The author considers that “there is no longer any doubt that the family has its development center in these areas”. Regarding the changes on Valerianaceae, Graebner states that “sometimes the individual groups of forms show very different kinship relationships from those assumed earlier, and several new independent groups of forms have become known.” He also provides important comments

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[75] Probably a reference to the amateur botanist Friedrich Carl Lehmann (1850–1903), who collected many species in Colombia and Ecuador, sending material collected to Berlin.

[76] Georg Hans Emmo Wolfgang Hieronymus (1846–1921), German botanist who collected in Argentina, Brazil and Uruguay.

[77] Reference to the German botanist Ernst Heinrich Georg Ule (1854–1915).

[78] Reference to Miguel Bang (1853–1895).

[79] Probably a reference to Federico Philippi (1838–1910, German zoologist botanist who collected in Chile.

[80] Probably a reference to Carl August Ehrenberg (1801–1849), who collected plants in Central America and sent them to the Berlin Museum, not his elder brother, the biologist Christian Gottfried Ehrenberg (1795-1876).

[81] Reference to the German botanist Karl Theodor Hartweg (1812–1871).

[82] Probably a reference to the Scottish-Ecuadorian botanist William Jameson (1796–1873) who lived and collected in Ecuador.

[83] German botanist August Weberbauer (1871–1948).

TABLE 12: Synthesis of the Valerianaceae classification system adopted by Graebner (1899).

Genus	**sections**	**series**	**species**
Valeriana L.	*Euvaleriana* Höck	*Valeriana lapathifoliae* Höck	*Valeriana leptothyrsos* Graebn. (Bolivia) *V. lindaviana* Graebn. (Chile) *V. knautioides* Graebn. (Mexico)
		V. polemonioidis Höck	*V. polemonioide*s Kunth
		V. laxiflorae Höck	*V. catharinensis* Graebn. (Brazil)
		V. scandentis Höck	*V. scandens* L. f. *genuina* C. Müll. (Brazil) *V. scandens* L. f. *dentata* C.Müll. (Brazil) *V. scandens* L. f. *angustiloba* (Ehrb.) C.Müll. (Brazil) *V. scandens* L. f. *subcordata* C.Müll. (Brazil)
		V. mexicana Höck	*V. tuberifera* Graebn. (Bolivia)
	Galioides Graebn.		*V. bonplandiana* Wedd. (Peru?) *V. hieronymi* Graebn. (Ecuador) *V. microphylla* H.B.K. (Colombia and Ecuador) *V. alophis* Graebn. (Colombia and Peru) *V. gonatolophis* Graebn. (Peru) *V. amphilophis* Graebn. (Peru) *V. hirtella* H.B.K. (Ecuador)
	Valerianopsis Wedd. emend. Höck		*V. glaziovii* Graebn. (Brazil) *V. itatiaiae* Graebn. (Brazil)
	Phuodendron Graebn.		*V. ulei* Graebn. (Brazil)

about the key characters treated in his classification system to define generic and infrageneric categories:

> *As genera, I have listed only those groups which possess not only pronounced, geographically separate communities, but also sufficient floral morphological*

> *characteristics and a characteristic completely different habit. All the rest I have considered for the time being as sections, although at least most of them would be good genera in the eyes of many authors. Therefore, I chose names for them, which can also be used as genus names.* Graebner (1906a: 436)[84].

Therefore, this author considered habit, flowers and distribution as key characters to define a genus. A notable example is *Belonanthus*, restricted to the Bolivian Andes, in which all the species described by Graebner were rosetted, with needle-shaped flowers. Despite this, the treatment of sections is not so clear in this work. For example, the new sections *Aspleniopsis* and *Galioides*, both described under the genus *Valeriana*, do not necessarily differ in terms of habit and distribution, but essentially in leaf and inflorescence aspects. This implies in a broad conception of sections, and therefore difficult to sustain as natural groups. Likewise, the previous division of *Stangea* into two groups of sections (I and II) is based essentially on vegetative features. Graebner treated two new genera, seven new sections, 37 new species and two new varieties (*Valeriana connata* var. *nutans* Graebn. and *V. plectritoides* var. *subgracilior* Graebn.). Also, he recombined two species previously considered under *Valeriana*, *Aretiastrum aretioides* (Kunth) Graebn. and *A. sedifolium* (D. Urv.) Graebn. (Table 13).

Graebner (1906b), in *Die Gattungen der natürlichen Familie der Valerianaceae* (The genera of the natural family Valerianaceae), argues that the large number of proposals for genus circumscriptions observed after Linnaeus (1753) is mainly due to the small number of species known at the time, as well as the morphotypes being restricted to a limited area (Graebner 1906b: 464). In agreement with Höck (1882), he argues that the groups were delimited based on the analysis of features that, when more broadly examined in the genus, were very unstable, such as the presence or absence of pappus in the achenes or the excessive development of bracts. However, in this study Graebner recognizes the pioneering survey by Höck (1882), which demonstrated the clear accumulation of "shape circles"[85] of Valerianaceae in the Andes, suggesting a division into tribes. The discovery that in the Andes, morphologically very different taxa (or groups) can be found in sympatry or "side by side, each in numerous forms that are often difficult to divide", had major repercussions on the systematics of Valerianaceae. However, it is undoubtedly the increase in the number of taxa collected in the second half of the 19th century that would cause the greatest need for further taxonomic changes. Graebner

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[84] Our translation.

[85] From the German "*Formenkreise*".

(1906b) writes: “Recently, our knowledge of the family has been greatly enhanced by some large South American collections containing many new species”. The author refers especially to the collections of Weberbauer, from the Peruvian Andes, and Ule, from the highlands of the Eastern South America, as well as the collection of Sodiro[86], from the Ecuadorian Andes. With those collections that brought new species and new morphological types to Germany, Graebner states that “the whole family experiences a different illumination”.

Graebner (1906b) argues that it is necessary to separate Valerianaceae primarily by the formation of tribes, the same three previously designated by Höck (1901: 408): *Patrinieae*, *Triplostegieae* and *Valerianeae* Höck emend. Graebner (1906b)[87]. The first two tribes, according to Graebner, gather perennial species with 3-loculate fruits, and have “excellent”[88] morphological cohesion around the number of stamens, usually four (with the exception of a single species of *Patrinia*, which has a single one). They are abundantly distributed in northern, middle and eastern Asia (Graebner 1906b: 464). The tribe *Patrinieae* includes two genera, *Patrinia* and *Nardostachys*, which are devoid of a calyx (or eppapose)[89], plus have developed bracteoles reaching the length of the achenes. The tribe *Triplostegieae* includes two genera, *Triplostegia* Wall. ex DC. and *Hoeckia* Engl. & Graebn., which have a visible calyx on each flower. *Valerianeae*, in turn, was divided primarily into five new subtribes, and these into 11 genera (Table 13). It is characterized by presenting three stamens (eventually one or two) and includes shrubs and both perennial and annual herbs.

The three selected treatments (Graebner 1899, 1906a, and 1906b) present distinct approaches and circumscriptions, being fundamental to analyze them together. The main effort is to delimitate the “shape circles” observed in the group, especially regarding species from the megadiverse Neotropics. It comprises the following ten categories (from most general to most restricted):

Family (*Familie*) / Tribe (*Tribus*) / Subtribe (*Subtribus*) / Genera (*Gattungen*) / Group (*Gruppe*) / Section (*Sektionen*) / Series (Ser.) / Species (*Arten*) / Variety (var.) / Form (f.)

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[86] Italian clergyman and botanist Luis Sodiro (1836–1909).

[87] The abbreviation used by Graebner in this case is “*erw.*”, from the German “*erweitert*”, which means “expanded”.

[88] From the German “*ausgezeichnet*”.

[89] From the German “*Außenkelch*”.

TABLE 13: Synthesis of the classification system of Valerianaceae adopted by Graebner (1906a and 1906b).

Tribes	**subtribes**	**genera**	**sections**
Patrinieae Höck		*Patrinia* Juss.	*Centrotrinia* Maxim *Paleopatrinia* Höck *Monandropatrinia* Höck
		Nardostachys DC.	
Triplostegieae Höck		*Triplostegia* Wall. ex DC.	
		Hoeckia Engl. & Graebn.	
Valerianeae Höck emend. Graebn.	*Plectridinae* Graebn.	*Plectritis* DC.	
		Aligera Sucksd.	
		Valerianella Hall.	
	Fediinae Graebn.	*Fedia* Mönch [or Moench]	
	Valerianinae Graebn.	*Valeriana* L.	*Euvaleriana* Höck *Galioides* Graebn. *Phuocaprifolium* Graebn. *Hybocarpus* Höck *Sphaerophu* Graebn. *Aspleniopsis* Graebn. *Valerianopsis* Wedd. emend. Höck *Porteria* (Hook) Höck
		Phuodendron Graebn. (1899 [1906b][90])	
		Stangea Graebn.	Group I: *Eustangea* Graebn. *Aizoostangea* Graebn. Group II:

		Rhizomatostangea Graebn.
	Aretiastrum (DC.) Spach	
	Phyllactis Pers.	
	Belonanthus Graebn.	
Centranthinae Graebn.	*Centranthus* DC.	*Macrocentron* Lange *Calcitrapa* Lange
Astrephinae Graebn.	*Astrephia* Dufr.	

The Graebner's classification system is clearly based on Höck's treatments, although he proposed some significant changes and increments when compared to previous studies. Graebner considered only three tribes under Valerianaceae (*Patrinieae*, *Triplostegieae* and *Valerianeae*) as opposed to the five previously considered by Höck (1902), who also considered *Plectrideae* and *Valerianelleae*. The genera considered by Höck in these last two tribes were included by Graebner (1906b) under *Valerianeae*, in the subtribes *Plectridinae* (*Plectritis*, *Aligera*, *Valerianella*) and *Fediinae* (*Fedia*). Furthermore, Graebner proposed five subtribes within Valerianeae. These were basically divided by the number of locules in the fruits, the number of stamens, as well as the shape and size of the flower pedicels. The author considered the impressive number of 16 genera under Valerianaceae, the largest treated so far, although only three were described by him (*Belonanthus*, *Phuodendron*, and *Stangea*), all under the *Valerianinae* subtribe. In a broad view, Graebner (1906b) proposed the division of *Valerianinae* into two well-defined groups, which is also adopted by Killip (1937)[91]. The first is composed by *Phyllactis* and *Belonanthus* and has as the main key character the 3 (rarely 4)-lobed corollas. The second group, composed by *Valeriana* and the other related genera, has the 5-lobed corollas as the main key character. Four genera (*Patrinia*, *Valeriana*, *Stangea* and *Centranthus*) were divided into sections, accounting 18 in total, although the author has described only seven of them, four under *Valeriana* and three under the new genus *Stangea*. Only a few forms and varieties were considered by the author.

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[90] Graebner (1906b: 476) mentions that the protologue of *Phuodendron* would be the work of 1899 (page 436), although, on this occasion, the taxon was described as a section of the genus *Valeriana*. In fact, these taxa were transferred to genus by Graebner in 1906b.

[91] Killip (1937) considered under *Valerianinae* species with corolla 5 (rarely 6–8)-lobed.

Valerianaceae in the 20th century

Concerning the American Valerianaceae as a whole, the 20th century was marked especially by floristic studies, mostly regional, addressing the flora of countries, states, and provinces, as well as by checklists, morphological analyzes and descriptions of several new taxa, especially from the Andean region. In this sense, little attention was observed regarding the discussion and proposition of changes in the generic and infrageneric classification systems treated by classical authors such as Candolle (1830), Höck (1882, 1891, and 1902) and Graebner (1899, 1906a, and 1906b). Important examples of studies from the 20th century on the Neotropical Valerianaceae are Reiche (1902), Briquet (1914), Stuckert & Briquet (1918), Killip (1937), Borsini (1944, 1946, 1962a, 1962b, 1963, 1966a, 1966b, 1999), Meyer (1951, 1960, 1965, 1976, 1979), Weberling (1960, 1961), Barrie (1989a, 1989b), Larsen (1986) Eriksen (1989, 1991), Xena de Enrech (1992, 1993), and Sobral (1999a, 1999b, 2000). This scenario would change at the end of the 20th century, especially with the revisionist studies of Larsen (1986) and Eriksen (1989), which once again shed light on the generic and infrageneric classification systems under Valerianaceae. These studies were followed by a wide range of molecular approaches that took place from the 1990s to the present.

Briquet (1914), in the *Decades Plantarum Novarum vel Minus Cognitarum*, treated 36 species of Valerianaceae, being 21 new (plus a single variety from Bolivia), almost all from South America (Bolivia, Colombia, Ecuador, Peru, Venezuela) and Central America (Mexico). Only a few taxa from Asia (Korea and China) were described. Plus, the author discusses the taxonomic circumscription of all the treated species, especially based on the most recent classification systems of Höck (1882, 1891, 1902) and Graebner (1899, 1906a, 1906b). Despite these important contributions, his work stands out for its detailed historical analysis of *Porteria*, described by Hooker (1851). According to Briquet, "few groups of Valerianaceae have been as differently understood as the genus *Porteria*", referring to conflicts between this genus, *Amblyorhinum* Turcz., described by Turczaninow (1852)[92], and *Phyllactis*. Briquet argues that two species of *Porteria* were included in *Phyllactis* in *Chloris Andina* by Weddell (1857), and that confusions in the inclusion of taxa in this group would have occurred from a series of studies published so far. Thus, *Porteria* was eventually transferred to a section of *Phyllactis*

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[92] Russian botanist Nicolai Stepanowitsch Turczaninow (1796–1863), who later recognized the priority of *Porteria* over *Amblyorhinum*.

(Bentham & Hooker 1873), or *Valeriana* (Graebner 1906a). In order to solve these taxonomic impasses, the author proposes a new section, *Pseudoporteria* Briq., based on three northern Andean species. The difference between the sections *Pseudoporteria* and *Porteria* is essentially the presence of a pappose calyx in the first, and an eppapose (annular) calyx in the last one. While Briquet's treatment helps to understand the historical problems surrounding the "*Porteria* group", the proposed resolution describing a new section eventually created other taxonomic impasses[93].

Stuckert & Briquet (1918) in the *Énumération des Valérianacées de L'Argentine* treated 33 species included in the three genera, *Plectritis*, *Valerianella* and *Valeriana*, also recognizing sections and series (Table 14). According to these authors, the genus *Plectritis* is represented in South America by *P. samolifolia* Höck, and by the variety *P. samolifolia* var. *pusilla* Speg., the latter published by Spegazzini (1901) based on collections from the Argentine Patagonia. A single introduced species of *Valerianella* is examined. However, the work stands out by its attempt to include the species under several previous infrageneric categories treated by Höck (1882), plus the section *Aretiastrum* from Candolle (1830). This attempt reveals ambiguities in the classical infrageneric classification of Valerianaceae. For example, Stuckert & Briquet (1918) includes *V. effusa* Griseb. in the section *Polemonioideae*, and two species previously considered under this section are considered dubious. Despite this, all species of *Valeriana* from Argentina fit on the South American series of Höck (1882) from the number six to 13[94]. From the three series conceived by Höck under *Valerianopsis*, two occur in Argentina (series 1 and 3). In addition, this study demonstrates the high diversity of *Valeriana* in Argentina, and how little geographically circumscribed are the series conceived by Höck (1882). New sections or series are not described.

Despite the reduced generic representation of Valerianaceae in the Argentinean flora, at least as conceived by Stuckert & Briquet (1918), the recognition of many genera of the South American Valerianaceae in the early 20th century is remarkable. Killip (1937), in the *Flora of Peru*, recognizes about 16 genera under the family worldwide. The family treatment is based on the classic studies of Dufresne (1811), Weddell (1857), Höck (1882), Graebner (1906a and

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[93] Eriksen (1989: 186) include *Pseudoporteria* under the synonymy of the section *Galioides* Graebn., included under *Valeriana* subg. *Phyllactis* (Pers.) Borsini emend. Eriksen (1989). On the other hand, the same author includes the section *Porteria* under *Valeriana* subg. *Valeriana*.

[94] The only exception is the South American series of number 11, *V. microphyllae* Höck (1882), exclusive from the northern South America, and the series number 14, *V. sorbifoliae* Höck (1882), exclusive from the Central America and northern South America, which, according to these authors, does not occur in Argentina. The series of number 15, *V. ceratophyllae*, the last one of the section *Euvaleriana* Höck (1882), is exclusive from Central America (Mexico).

TABLE 14. The classification system of Valerianaceae adopted by Stuckert & Briquet (1918).

Genus	section	series	taxa
Plectritis (Lindl.) DC.			*P. samolifolia* var. *pusilla* Speg. (1902)
Valerianella Poll.			*V. olithoria* Poll. (1776)
Valeriana L.	*Euvaleriana* Höck	6. *Lapathifoliae* Höck	*V. lapathifolia* Vahl
		7. *Carnosae* Höck	5 spp., one new
		8. *Polemonioideae*[95] Höck	2 spp. and 3 new varieties for *V. effusa*
		9. *Radicales* Höck[96]	1 spp. and 1 var.
		10. *Laxiflorae* Höck	4 spp.
		12. *Scandentes*[97] Höck	*V. scandens* L.
		13. *Mexicanae* Höck	Only *V. urticaefolia*, which is considered dubious in the region
	Hybocarpos Höck		3 spp. and 1 var.
	Valerianopsis Wedd. emend. Höck	1. *Macrorrhizae* Höck	4 spp.
		3. *Polystachyae* Höck	6 spp., 2 new
	Aretiastrum DC.		1 spp. and 1 var.

1906b), and Briquet (1914). Regarding the ranking of the *Valeriana* species richness in South America, Peru is notably the most diverse country, with about 73 to 74 species, 45 of them restricted (Killip 1937, Kutschker 2011). Most of the genera or sections historically described for South America in Valerianaceae have species representatives or are restricted to this country, which makes it of special interest to the taxonomy of the family. Killip (1937) recognizes the impressive number of six genera in the Peruvian territory: *Aretiastrum*,

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[95] Höck cited this series as *V. polemonioidis*.
[96] Described by Höck as the series *V. radicalis*.
[97] Referred by Höck as the series *V. scandentis*.

Astrephia, *Belonanthus*, *Phyllactis*, *Stangea* and *Valeriana*. It corresponds essentially to all the genera gathered by Graebner (1906b) under the subtribes *Valerianinae* and *Astrephinae* (except for the monospecific Brazilian *Phuodendron*). Regarding the high species richness observed in Peru, Killip (1937: 287) notes that "many [species] are know from only a single specimen, and an adequate concept of the family and of the lines of separation between the species is impossible until further collecting has been done". Despite the remarkable similarity with the identification key to the genera of *Valerianinae* proposed by Graebner (1906b), Killip's identification key (Killip 1937) has significant changes and increments, making it more objective.

Borsini[98] was certainly one of the most prolific South American valerianologists. She produced several taxonomic revisions and morphological analyzes of South American Valerianaceae, especially from Argentina, Brazil and Chile, describing 18 new species, being a single one under *Stangea*[99] and 17 species of *Valeriana* (Correa 1981, TPL, IPNI). When compared to the previous analyzed works, Borsini presents a more conservative generic approach. There are few references about the classification system adopted by this author (Borsini 1942, 1944a and 1966). In one of the few passages, Borsini (1942: 354) states: "According to Stuckert & Briquet (1919) [1918], I prefer to follow Höck's criterion which seems to me to be the most appropriate, considering that the presence or absence of pappus-like calyx does not justify the segregation of distinct genera, especially since the unit of all other characters is very large". Despite the clear preference for the classification system developed by Höck (1882), Borsini does not treat categories widely used by this author, such as sections and series.

The first treatment of Valerianaceae by Borsini (1942) addressed the species occurring in the province of Tucumán, northwestern Argentina (Correa 1981). *Valeriana* is considered with eight species, and two varieties, including *Phyllactis* in the synonymy. She cites as references the studies by Linnaeus (1753), Candolle (1833[100])[1830], Endlicher (1836–1840), Bentham & Hooker (1873), and Höck (1897). Despite the synonymization of *Phyllactis*, Borsini (1942) did not consider 3(4)-lobed corollas, only 5-lobed. The description of *Valeriana* is quite broad and encompasses species with pappose and eppapose calyx.

Borsini (1944) recognizes four genera with occurrence in Argentina, *Plectritis*, *Valeriana, Stangea,* and *Valerianella*, only the first three considered native. In this study,

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[98] Argentinean botanist Olga Helena Borsini (1916—1981).

[99] *Stangea calchaquina* Borsini (1944).

[100] *Prodromus*, edition of 1833.

Valeriana is divided into two subgenera for the first time, *Valerianastrum* Borsini and *Phyllactis* (Pers. emend. Wedd.) Borsini, based exclusively on the presence or absence of a pappose calyx, and on the life forms (*sensu* Raunkiaer 1934). However, the described life forms overlap. Both subgenera have hemicryptophytes, although therophytes are only observed in *Valerianastrum*. The number of corolla lobes were disregarded as key character. In the identification key to the genera, *Stangea* firstly diverges from the other Argentine Valerianaceae, including the introduced *Valerianella*, basically by the shape and size of the inflorescence, as well as by the size and consistency of the flowers. Plus, the author segregates *Valeriana* and *Plectritis* from *Valerianella* by characters such as fruit locules number and branch type. The validity of the number of locules in the diagnosis of genera under Valerianaceae would be discussed and refuted by this same author in a later study (Borsini 1966a). *Valeriana* and *Plectritis* are differentiated exclusively by the shape of the bracteoles and the type of calyx, the latter overlapping. The achene in cross-section is used for species differentiation within the group, also to differentiate the genera of Valerianaceae from Argentina.

Borsini (1962a) treated 15 species from Brazil, including a new species, *V. reitziana* Borsini[101], all under *Valeriana*, without mentioning the categories of subgenera. If applied the conceptions of Borsini (1944), *V. scandens* is the only species belonging to *Valerianastrum*. The remaining species, devoid of a pappose calyx, are included in *Phyllactis*. In this sense, Borsini (1962a) disregarded the division established by Müller (1885), who had conceived Brazilian species as divided into two genera according to the presence or absence of a pappose calyx: *Valeriana* and *Valerianopsis* (respectively)[102].

Borsini (1963) recognizes the existence of 12 genera and about 430 species under Valerianaceae, only *Valeriana* with nine species occurring in the state of Santa Catarina, Brazil. However, this author does not mention any infrageneric classification for these taxa. The description of *Valeriana* is based on Linnaeus (1753), Candolle (1830), Endler (1836–1840), Bentham & Hooker (1873), Höck (1897) and Borsini (1944). Besides the previously considered *Phyllactis*, *Valerianopsis* and *Phuodendron* are included in the synonymy of the genus for the first time. Despite the two new synonyms, changes and increments in the description are not extensive.

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[101] A second new species for the Brazilian flora, *V. kurtziana* Borsini, was described in another article in the same publication of the *Lilloa* magazine (Borsini 1962b).

[102] As previously mentioned, this last name was established by Weddell (1857) as a section of the genus *Phyllactis*, being applied by Muller in an amended and quite distinct conception from the originally conceived one.

Borsini (1966a) discusses the validity of *Astrephia* in a detailed review of the taxonomic history of this taxon, from Dufresne (1811) to Höck (1882) and Reiche (1902). This genus had already been considered under the synonymy of *Valeriana* by Borsini (1956), but without further discussion. Thus, Borsini (1966a) discusses the validity of the number of carpels and the number of fruit locules for the conception of genera under Valerianaceae. According to this author, the number of carpels and locules may vary in number (from one to three), and shape (sterile greater than, smaller or equal to fertile), also according to the stage of development, even in a single individual, as observed in *Valeriana bridgesii* Hook & Arn. Because of this, Borsini argues that the development of carpels and locules has no generic value for Valerianaceae, and the genus *Astrephia* should be considered a synonym of *Valeriana*. This synonymization had a variable impact in the later studies, being occasionally accepted or not.[103]

Borsini (1966b) treated the 45 Chilean Valerianaceae as divided into three genera. *Valeriana* is divided into two subgenera, *V.* subgen. *Valeriana* and *V.* subgen. *Phyllactis,* including the previously described subgenus *Valerianastrum* under the synonymy of *V.* subg. *Valeriana*. The number of synonyms under *Valeriana* is extended from previous work, including *Phyllactis*, *Betckea*, and *Astrephia*. In the identification key to the subgenera of *Valeriana,* Borsini used as key character mainly the presence or absence of the pappose calyx, excluding the life forms as previously considered by Borsini (1944). In the diagnosis of the two subgenera, the calyx description is refined and some additional characters are covered, including the same life forms, due to the inclusion of the therophyte life form under the subgenus *Phyllactis*. However, this treatment is basically the same as the previous ones.

Meyer[104] produced reviews of Valerianaceae species in North, Central and South America, as well as in Africa, from the 1950s to the 1970s. This author published at least 22 new names in the family, including varieties, subspecies, and even a hybrid, *Valeriana* × *ekmanii* F.G.Mey. In his first study of the group, Meyer (1951) observed that since the worldwide approaches of Höck (1882) and Graebner (1899, 1906a, and 1906b), "no up-to-date general classification exists for the genus *Valeriana*". He recognizes seven to nine genera belonging to the worldwide Valerianaceae, differentiated essentially by the number of stamens.[105] The genus *Valeriana* is described based on Tournefort (1811) [1719], Linnaeus

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[103] For example, Meyer (1976) keeps *Astrephia* segregated from *Valeriana*, according to the proposition of Weberling (1960). Despite this, Weberling & Bittrich (2016) choose to keep the first synonymous with the second (respectively), as previously proposed by Borsini (1966a).

[104] American botanist Frederick Gustav Meyer (1917–2006).

[105] According to Meyer (1951), these patterns in the number of stamens are the evolutionary result of a reduction from a 5-merous flower, for example: *Nardostachys* (Asian genus, 4 stamens), *Valeriana* (3), and *Centranthus* and *Fedia* (both Mediterranean genera, with 2 stamens).

(1753), Candolle (1830), and Höck (1882). Considering the surveys here analyzed, *Hemesotria* Raf., *Oligacoce* Willd. ex DC., and *Amplophus* are referred as synonym of *Valeriana* for the first time. In this work, Meyer (1951) treated 31 species of *Valeriana*, divided into seven series, two of them created by Höck (1882)[106], and five new to Science (Table 15). All series have representative species in the Neotropics, although only two reach South America: *Officinales* Höck and the new *Clematites* F.G.Mey.

Some points are worth mentioning about the description of *Valeriana* as provided by Meyer (1951). All species under this genus are considered herbaceous and the corollas exclusively 5-lobed. For the first time the roots and rhizomes present detailed descriptions, being considered of taxonomic value. Anthers are described in detail, considering the size and variation in the number of locules (2-lobed or 4-lobed). In contrast, the number of locules observed in the cross-section of the fruit receives less consideration (already a trend observed in Borsini's previously analyzed studies), and the number of costae has a uniform description. All the seven series are primarily divided into two groups, based on the type of habit, roots, number and shape of the anthers. This represents an important advance when compared to Höck (1882), making the organization of the series under *Valeriana* more objective.

The circumscription of the two series treated by Höck (1882) (*V.* ser. *Officinalis* and *V.* ser. *Ceratophyllae*) was slightly altered by Meyer (1951). For example, *Valeriana capitata* Pall. ex Link and *V. sitchensis* Bong. were included in the *V. ser. Montana* by Höck (1882), and in *V.* ser. *Officinales* by Meyer (1951). *Valeriana galeottiana* Martens., considered under *V.* ser. *Ceratophyllae* by Höck (1882), is considered a synonym of *V. pratensis* Dierb., the type species of the new section *Pratensis*. The new *V.* ser. *Sorbifoliae* includes *V. scandens*, a species considered by Höck in the *V.* ser. *Scandentis*. The *V.* ser. *Clematites* includes two species with occurrence in South America, *V. clematitis* Kunth and *V. urticifolia* Kunth. The first was previously included in *V.* ser. *Scandentis*, and the last in the *V.* ser. *Mexicanae* by Höck (1882).[107]

Meyer (1958) recognizes only “three well-defined and quite unrelated species” of *Valeriana*, all restricted to the African continent. This author highlights the apparent morphological relationship of two of them with species from South America. The eppapose calyx of *V. kilimandscharica* Engl., and the scrambling habit of *V. volkensii* Engl., are pointed

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[106] There is variation in the spelling used for naming the series. For example, “*V. officinalis*” is the spelling used by Höck (1882), while the name adopted by Meyer (1951) is simply “*Officinales*”.

[107] The reformulations of the series considered by Höck (1882) under *Valeriana* are commonly observed in group studies, and deserve specific research. It is necessary that reformulations such as those discussed in the study by Meyer (1951) be better known.

TABLE 15. The seven series treated by Meyer (1951) under the genus *Valeriana*, with theirs respectives type species, distribution and species number.

Series	**type species**	**distribution**	**species**
Officinales Höck	*Valeriana officinalis* L.	circumboreal, including North America, Europe and Asia	8
Edules F.G.Mey.	*V. edulis* Nutt.	North and Central America, from Canada to Costa Rica	3
Ceratophyllae Höck	*V. ceratophylla* Kunth	Mexico	3
Clematites F.G.Mey.	*V. clematitis* Kunth	Mexico, except for *V. urticaefolia,* which occur in Central and northern South America	5
Densiflorae F.G.Mey.	*V. densiflora* Benth.	Mexico, except for *V. pulchella*, which occurs also in Costa Rica and Panama	5
Sorbifoliae F.G.Mey.	*V. sorbifolia* Kunth	North and Central America, as well the Caribbean Islands (“West Indies”)	5
Pratenses F.G.Mey.	*V. pratensis* (Benth.) Steud.	Mexico	2

as unique among Old World species.[108] Despite these apparent intercontinental morphological relationships, the author did not propose the inclusion of these two species under any series. *Valeriana capensis*, native from southern Africa, was included in the series *Officinales*.

Meyer (1960) describes his first and only species from eastern South America, *V. glechomifolia* F.G.Mey, which also remained unpositioned in the pre-existing series of the genus. However, in the protologue the author makes some important comments about his taxonomic concept of South American *Valeriana*, as well as about the placement of *Phyllactis*:

> *Students of South American* Valeriana *reserved the segregate genus* Phyllactis *for species with coronate calyx. My own studies previously on North American species and now on these of South America*[109] *indicate that single character differences, especially*

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[108] According to Meyer (1958), these species from East African snow mountains are only comparable to the South American Andean species. The first *V. kilimandscharica*, is only compared to *V. alypifolia* Kunth and *V. grisiana* Wedd. (Colombia and Ecuador) and *V. volkensii* to *V. decussata* (Peru).

[109] Five years later new species from South America will be published (Meyer 1965).

> *floral differences, are insufficient in differentiating segregate genera. Indeed, the specialized calyx, either coronate or pappus-like, and more especially the sculpturing of the cypselate achene combine with vegetative characters in the differentiation of species of South American* Valeriana (Meyer 1960: 198).

It is not clear who are the “students” which Meyer refers to, since the authors analyzed here treated species with eppapose calyx under variable taxonomic categories, rarely exclusively in *Phyllactis* (Persoon 1805).[110] Although in this passage Meyer claims not to recognize floral characters as sufficient for the segregation of genera under Valerianaceae, the number of stamens is the main key character cited by him to differentiate the genera in a previous study (Meyer 1951).

Meyer (1976) treated two genera, *Astrephia* and *Valeriana*, the first with a single species, *A. chaerophylloides*, and the last one with five taxa (four species and one variety of *V. scandens*). He recognizes about 14 genera and 400 species within Valerianaceae. According to this author, five genera occur in the Old World, and the impressive number of nine genera in the New World, “where the greatest morphological diversity in the family occurs, including species with a woody and also a cushion-forming habit”. According to the literature referred by Meyer, this plurigeneric conception is based on his own treatment of 1951, as well as on both the treatments of Killip (1937) and Weberling (1960). The two genera found in Panama are segregated basically due to the achenes disposition and by the inflorescences shape. Regarding *Astrephia*, the author considers that “the genus is wholly distinct from other members of the family, primarily by the few-flowered, long-pedunculate inflorescences and the achenes which are connate” (Meyer 1976: 583). Moreover, the author states that there is a greater morphological similarity of *Astrephia* with the genera *Plectritis* and *Valerianella*. As previously referred, this approach disregards the study published a decade earlier by Borsini (1966a), proposing the synonymization of *Astrephia* under *Valeriana*. There is no doubt that the achenes adnate to the base of the peduncle, the more distal strikingly usually connate, as observed by Meyer, are an impressive feature in Valerianaceae. However, the shape of the inflorescences and the small number of flowers in these, combined with the conation of the achenes, is far from a consensus for the definition of a genus under the family. In the description of *Valeriana* the author includes the shrub habit (although considered rare), and the leaves are

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[110] As previously referred, Borsini (1944 and further treatments) treated *Phyllactis* as a subgenus of *Valeriana*, based essentially on the absence of the coronate calyx.

described in more detail than the previous treatments, although inflorescences are described very broadly. As in previous studies, only 5-lobed corolla are considered under *Valeriana*. For this reason, it is not clear how the author considers the positioning of species with 3-lobed corolla, historically included in the segregated *Phyllactis*, disregarded as a genus by Meyer (1960).

Larsen (1986) analyzes seven species traditionally recognized in the genus *Phyllactis*. This author employed both a morphological and a cladistic analysis, which results in the division of the seven species into two well defined groups: *Phyllactis* (3 spp.) and the new *Valeriana* sect. *Bracteata* B.B.Larsen (4 spp.). Plus, the author described a new species for Science, *V. spiroflora* B.B.Larsen, and two new combinations, *V. convallarioides* (Schmale) B.B.Larsen and *Phyllactis rigida* var. *tenuifolia* (Ruiz & Pav.) B.B.Larsen. She argues that "since the works of Höck (1882) and Graebner (1906b), the Neotropical species of Valerianaceae have not been thoroughly investigated", the same as claimed by Meyer (1951). According to Larsen (1986: 427), "the classifications proposed by them [Höck and Graebner] need revision". The author produces a detailed analysis of the taxonomic history of the group, as well as brief analysis of morphology, cytology and phytochemistry, plus phytogeography and evolution of the species under the group. The author argues that her analysis of the synapomorphies of *Phyllactis* indicates that the group is monophyletic, "showing little or no intergradations with *Valeriana*" which led her to decide to maintain the group as a separate genus.

Larsen (1986) recovers the original conception of *Phyllactis* conceived by Persoon (1805), producing a richly detailed description and including only species with involucrate flowers and 3-fide (rarely 4-fide), with short lobes. The description of the habit considered only those species that are acaulescent to subacaulescent, eventually caespitose, with leaves arranged in a rosette, a type of habit quite remarkable in Valerianaceae. Another highlight is the narrowly linear-lanceolate or spatulate leaves, always leathery and rigid, which gives the overall appearance of these plants. The description of synflorescences plays an important role, constituting about one third of the entire description. Only species devoid of a pappose calyx are recognized.[111] Four other species traditionally recognized under *Phyllactis* are treated in *Valeriana*, in the new section *Bracteata*.

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[111] Only three species and a new variety are included by Larsen under *Phyllactis*, a much narrower conception than previous studies: *P. rigida* var. *rigida*, *P. rigida* var. *tenuifolia* (Ruiz & Pav.) B.B.Larsen, *P. pulvinata* Rauh & Willer and *P. dorotheae* Weberling.

Eriksen (1989), in *Notes*[112], argues that the last revision of Valerianaceae was carried out by Graebner (1906b), and although much systematic research followed in the second half of the twentieth century, "an approach towards a conclusion by coordinating the results has never been attempted". The author summarizes her purpose in "draw this conclusion, aiming at a uniform generic concept throughout the family" (Eriksen 1989: 179). She analyzed 14 genera traditionally recognized under the family[113]. In conclusion, Eriksen segregated six of them as sections of *Valeriana* (*Astrephia, Aretiastrum, Phyllactis, Belonanthus, Stangea* and *Phuodendron*), thus recognizing eight genera within the family (Table 16). Thus, Eriksen conceives *Valeriana* as firstly divided into two subgenera, *Valeriana* and *Phyllactis*, as previously conceived by Borsini (1944 and 1966b), but with significant changes. The division established by Borsini (1944) was based essentially on the presence or absence (respectively) of a pappose calyx. In contrast, Eriksen (1989) divided the two subgenera according to the anthers type, the first one being tetrasporangiate, observed in Asian, European, African and North American species, as previously referred by Meyer (1951). Eriksen treated the subgenus *Phyllactis* as strictly bisporangiate, the anthers with both the tecae composed of a single small locus, observed between the South American species, except in the section *Astrephia* (Northern Andes and Central America) and *Porteria* (Venezuela). This anther-based division led to most sections being included in *Phyllactis* (14 in all), and only three sections were eventually recognized under *Valeriana* (sections *Valeriana*, *Astrephia* and *Porteria*). These changes halve the 14 genera considered under the family by several authors.

Therefore, Eriksen considers all the genera previously treated in *Valerianinae* by Graebner (1906b) as sections of *Valeriana*, mostly in the subgenus *Phyllactis*. The inclusion of *Astrephia* as a section of the subgenus *Valeriana*, excludes, therefore, the existence of the subtribe *Astrephinae* as conceived by Graebner (1906b). As previously referred, Meyer (1960) considers the eppapose calyx as insufficient for the recognition of *Phyllactis* as a genus, while Borsini (1944 and 1966b) treated the presence or absence of plumose pappus as the main character for the division of the subgenera *Valeriana* (or *Valerianastrum*) and *Phyllactis*. Eriksen (1989) emended the circumscription of the subgenus *Phyllactis*, making it broader than that treated by Borsini (1944), including species with both calyx eppapose and pappose.

Despite advances in the treatment proposed by Eriksen (1989), the lack of descriptions or diagnoses of the sections makes it difficult to circumscribe these taxa. Many of them are

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[112] The complete name of this work is *Notes on generic and infrageneric delimitation in the Valerianaceae*.

[113] The complete list of genera is *Triplostegia, Patrinia, Nardostachys, Fedia, Centranthus, Valerianella, Plectritis, Valeriana, Astrephia, Aretiastrum, Phyllactis, Belonanthus, Stangea* and *Phuodendron*.

TABLE 16. Classification system of *Valeriana* (Valerianaceae) proposed by Eriksen (1989).

Subgenus	**sections**
Valeriana Borsini	*Valeriana* *Astrephia* (Dufr.) Eriksen *Porteria* (Hook.) Benth. & Hook. f.
Phyllactis (Pers.) Borsini emend. Eriksen	*Phyllactis* (Pers.) DC. *Aretiastrum* DC. *Amplophus* (Raf.) Eriksen *Valerianopsis* Wedd. *Hybocarpos* Höck *Pseudastrephia* Höck *Galioides* Graebn. *Phuodendron* Graebn. *Stangea* (Graebn.) Eriksen *Belonanthus* (Graebn.) Eriksen *Phuocaprifolium* Graebn. *Sphaerophu* Graebn. *Aspleniopsis* Graebn. *Bracteata* B.B.Larsen

originally based on short descriptions or diagnoses, and eventually based in not comparable or reliable characters. These inconsistencies are considered by Eriksen only in the definition of these taxonomic entities as genera. The author states: “It is very understandable that former taxonomists have been tempted to describe new genera for the very odd life forms found among Valerianaceae in the Andes, but it is also evident, that the characters circumscribing the South American genera have a low taxonomic value”. Eriksen (1989: 184) further points out that these genera were “from time to time” considered as sections by Höck (1882) and Graebner (1906a). In considering these entities valid and as sections, Eriksen (1989) approximates the conception of section to that established by Höck (1882) to define series. Plus, the author did not treat *Hoeckia* Engl. & Graebn. and *Aligera* Sucksd, considered by Graebner (1906b). *Phuodendron* is conceived by Eriksen (1989: 181) as provided with pappose achenes. However, the only species historically treated under this section (or genus), *V. ulei*, has eppapose calyx (Sobral 1999a, Rabuske-Silva 2018).

Valerianaceae in the early 21st century

Since the late 20th and early 21st centuries, many studies with molecular approaches have shed light on questions addressed in classical taxonomic studies. Current problems are the establishment and circumscription of natural groups at different taxonomic levels, the validity of some characters in the circumscription of taxa, as well as the evolutionary relationships and the biogeography of the group, especially concerning the South American *Valeriana*.

In the same context, there was a profusion of taxonomic, morphological, anatomical, ecological, chemical and ethnobotanical studies, with varied approaches. Regarding new species of Valerianaceae, at least 16 species of Neotropical *Valeriana* were described for Science, the majority coming from South America, corresponding to near one species described per year (Sobral 2000, Barrie 2003, Weberling 2003, under *Belonanthus*, Bernal 2009, Méndez 2010, Nagahama *et al.* 2016, Rabuske-Silva & Külkamp 2018, Sylvester *et al.* 2018, Rabuske-Silva & Iganci 2019, Rabuske-Silva *et al.* 2020). These species were described in distinct conditions, from herbaria reviews to ecological studies in botanically under-explored areas, and even eventually observed for the first time during fieldwork expeditions. Curious cases include the description of *V. neglecta* R. Bernal, based on specimens collected in 1844 in the highlands of the Sierra Nevada de Santa Marta, Colombia, a poorly explored region where four species of *Valeriana* have already been discovered (Bernal 2009). Similarly, *V. gaimanensis* N. Nagahama was discovered during floristic studies in an arid area in northern Patagonia, Argentina, an environment where the genus is rarely recorded (Nagahama *et al.* 2016). *Valeriana iganciana* Rabuske & Külkamp was discovered during fieldwork expeditions in the Serra do Tabuleiro, southern Brazil, a plateau where the genus had never been sampled before (Rabuske-Silva & Külkamp 2018). These cases illustrate how little the genus is known in the Neotropical region, especially in South America. During the early 21st century, new occurrences were also published (e.g. Barrie 2003, Saldivia & Rojas 2006), in addition to synonymizations and new combinations (Weberling 2004, 2005; Kutschker 2011; Rabuske-Silva 2018). Several morphological and anatomical studies were published addressing species (e.g. Weberling 2003, 2004, 2005, 2007; Duarte-Silva 2006), species groups (e.g. Weberling 2003, 2007; Kutschker 2011; Rabuske-Silva 2018), as well as specific features, such as flowers, fruits, and pollen (e.g. Duarte-Silva *et al.* 2010a, 2010b, Jacobs *et al.* 2010).

A series of new studies addressing floras and checklists have been developed in the Neotropical region. Although published at the turn of the century, Xena de Enrech (1992, 1993), Borsini (1999), Jørgensen & Eriksen (1999), Xifreda (1999), and Sobral (1999a) deserve to be especially mentioned, the last one resulting in two new species of *Valeriana* (Sobral 1999b, 2000). In the 21st century, we highlight the studies of Scalon *et al.* (2002), Kutschker (2008a, 2011), Novara (2008), Barrie (2011), Jørgensen *et al.* (2014), Rabuske-Silva (2018), and Zuloaga *et al.* (2019).

Phylogenetic studies have been increasing during this period, using traditional molecular markers, and, more recently, a growing number of new markers and sampled taxa (Bell *et al.* 2012, Bell & Gonzalez 2018). Despite this, the relationships between species have been difficult to resolve, which is apparently due to the still small number of molecular markers, low clade support, and the low sampling of species from the megadiverse South America (Bell 2004; Hidalgo *et al.* 2004; Bell & Donoghue 2005a, 2005b; APG III 2009; Bell *et al.* 2012, 2015; APG IV 2016). Recently, Bell & Gonzalez (2018) published the first study using a next-generation molecular approach, confirming some pre-established hypotheses about the evolution of *Valeriana* in South America and pointing some future directions, but still with few species sampled (14 in total).

Infrafamilial relationships and categories

Recent phylogenetic studies moved forward on the infrafamilial categories under Valerianaceae. Regarding the tribes established by Höck (1902) and Graebner (1906b), phylogenies suggest that they do not have support. Bell & Donoghue (2005) and Bell *et al.* (2012) point the lack of phylogenetic support for *Patrinieae*, traditionally composed by *Patrinia* and *Nardostachys*, being considered paraphyletic. This is because *Patrinia* emerges as sister of the rest of the family (100% bootstrap support). *Nardostachys* emerges as the next branch, being sister of the *Valeriana* clade. *Triplostegia* is also suggested as more closely related to Dipsacaceae, and should be removed from Valerianaceae (Hidalgo *et al.* 2004, Bell & Donoghue 2005a). It excludes *Triplostegieae*, established by Höck (1902), and composed of *Triplostegia* and *Hoeckia*. Likewise, the phylogenies recovered by Bell *et al.* (2012) suggest that there is no support for *Valerianeae* and for the five tribes established by Graebner (1906b). For these reasons, Weberling & Bittrich (2016) chose to abandon the infrafamilial classification in their treatment, a position followed here.

South American species were historically included in two subtribes of *Valerianeae*, *Astrephinae* and *Valerianinae* (Graebner 1906b). Although *Astrephinae* has no support in molecular studies, it is worth mentioning the case of *V. chaerophylloides*, one of the few species historically included under *Astrephia* and *Astrephinae*, which emerges as sister to the Southern

Andean Clade recovered by Bell *et al.* (2012). As previously referred, Meyer (1976) points that this species, native from the northern South America and portions of the Central America, including the Galapagos Islands, has remarkable morphological features in *Valeriana*, such as the achenes adnate at the base. Eriksen (1989) chose to transfer *Astrephia* to the section of the same name, under *Valeriana* subg. *Valeriana*, based on the anthers 4-loculate.

Infrageneric categories

In the 20th century *Valeriana* was significantly expanded with the inclusion of genera traditionally recognized under the subtribe *Valerianinae*, such as *Phuodendron*, *Stangea*, *Aretiastrum*, *Phyllactis* and *Belonanthus* (Borsini 1944, Eriksen 1989, Weberling & Bittrich 2016). In this sense, it is appropriate to observe the divergent conceptions of internal groups (genera, subgenera, sections and series), in order to analyze a recircumscription of historical pre-existing categories, based on modern phylogenetic approaches. Although not so explicit, *Valerianinae* (or *Valeriana sensu lato*) was historically divided in three possible ways, each of them based on different key characters (Table 17).

TABLE 17. Three historical ways to divide the *Valerianinae* subtribe (or *Valeriana sensu lato*), the respective formed groups, and their key characters.

Authors	**group**	**divisions**	**key characters**
Graebner (1906a)	*Valerianinae* subtribe	Group I. *Phyllactis* and *Belonanthus*	corolla 3(4)-lobed
		Group II. *Valeriana* and related genera (*Aretiastrum*, *Phuodendron*, *Stangea*)	corolla 5(6–8)-lobed
Borsini (1944 and 1966b)	*Valeriana sensu lato*	Subg. *Valeriana* (= *Valerianastrum*)	calyx pappose
		Subg. *Phyllactis*	calyx eppapose
Eriksen (1989)	*Valeriana sensu lato*	Subg. *Valeriana*	anthers tetrasporangiate
		Subg. *Phyllactis*	anthers bisporangiate

The first division is understood from the identification key proposed by Graebner (1906a), in which the genera under *Valerianinae* are divided into two informal groups, primarily according to the number of corolla lobes, if 3(4)-lobed or 5(6–8)-lobed. The first group is composed of *Phyllactis* and *Belonanthus* and the second group is composed by *Valeriana* and related genera (*Aretiastrum*, *Phuodendron*, *Stangea*), although these two groups were never formally named by Graebner. We observed variations in the number of corolla lobes in several species during our survey, and the correspondence with the available phylogenetic trees indicates that their recognition as natural groups is not supported (Bell 2004, Bell *et al.* 2012).

The second way was established by Borsini (1944 and 1966b), and consists of the division of *Valeriana sensu lato* into two subgenera, *Valeriana* (= *Valerianastrum*), and *Phyllactis*, according to the calyx type, if pappose or eppapose. However, there is no phylogenetic support for the infrageneric division of *Valeriana* based on calyx type, since the reduced calyx emerges several times in different recovered clades (Bell 2004, Bell & Donoghue 2005a, Jacobs *et al.* 2010, Bell *et al.* 2012).

The third way consists of the division of the genus *Valeriana* according to the types of anthers, whether tetrasporangiate or bisporangiate, established by Eriksen (1989). These two groups were considered as two subgenera, *Valeriana* and *Phyllactis*, respectively. These subgenera were, in turn, divided into several sections. It is still unclear whether this division of *Valeriana* has phylogenetic support, especially due to the low sampling of South American taxa in phylogenies, poor taxonomic knowledge of South American species, and the fact that the anther type is rarely described in the genus literature. This seems to be the most consistent possibility according to our current knowledge, but it certainly requires testing based on integrative approaches. Some taxa occurring in northern South America do not fit in the geographic patterns established by Eriksen (1989), according to Weberling & Bittrich (2016), such as *V. chaerophylloides*. Nevertheless, the biogeography of several species with distribution in both South America and Central America still require studies.

Regarding the morphology (key characters), almost all the South American genera of Valerianaceae are weak supported, as previously referred by several authors (Borsini 1944, 1966; Meyer 1951; Eriksen 1989). In this sense, we agree that it is a better choice to keep *Valeriana* in a broad concept, taxonomic position that has been endorsed by phylogenetic analyzes (Bell & Donoghue 2005a, Bell *et al.* 2012). However, it is worth mentioning the case of *Plectritis*, which has striking morphological particularities in flowers and fruits, and is restricted to North America with a single controversial representative in South America. This genus needs further systematic studies to evaluate the support as a genus, being currently considered valid and a cohesive group in the phylogenies recovered by Bell *et al.* (2012), although considered synonymous of *Valeriana* in several taxonomic studies (e.g. Weberling & Bittrich 2016).

The conceptions of sections, especially those proposed by Höck (1882, 1901) and Graebner (1899, 1906a, 1906b), later analyzed by Larsen (1986) and Eriksen (1989), are very similar to those taxonomically conceived as series by Höck (1882) and Meyer (1951). We agree that a good option is to keep the sections synthesized and assembled by Eriksen (1989) until further analysis test whether these groups are natural or not. In this sense, we provide here a key to the delimitation of subgenera and sections previously established by Eriksen (1989), in order to make the delimitation of these taxa clearer and more objective in *Valeriana* studies.

Identification key to the subgenera of *Valeriana*

Anthers tetrasporangiate………………………………………………….…...….subg. *Valeriana*
Anthers bisporangiate…………………………………………………….....….subg. *Phyllactis*

Identification key to the sections of *Valeriana* subg. *Valeriana*

1. Inflorescence few-flowered, terminal and long-pedunculate; mature achenes connate at the last branches of the inflorescences, in cross section the two empty cells equaling or larger than the perfect cell…………………………..……………………………….…...sect. *Astrephia*
- Inflorescences multi-flowered, axillary and sessile; mature achenes free, never connate, in cross section the two empty cells much smaller than the perfect cell..2
2. Bracteoles smaller or the same size, or only slightly larger than the flowers, never hiding them………………………………...………………………………..….........sect. *Valeriana*
- Bracteoles quite large, hidden by the flowers…………………..….……......…..sect. *Porteria*

Identification key to the sections of *Valeriana* subg. *Phyllactis*

1. Subshrubs, always acaulescent to subacaulescent, eventually forming cushion or mats[114], about 2–3 cm to 15 cm high; roots frequently thickened and napiform, eventually rhizomatous; leaves coriaceous, frequently arranged in basal rosettes[115] (except for *Aretiastrum* and

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[114] Some species of *Valeriana s.l.* form large and dense globe-shaped cushions, which is result of the "periodical acrotonic ramification of the rosettes" (Weberling & Bittrich 2016: 385). Weberling & Stützel (2006: 203) point four species of Valerianaceae with the herbaceous habit of a cushion plants: *Valeriana supina* L. (Europe), the Argentinian species *V. corynodes* Bors. and *V. descolei* Bors., as well as *V. magellanica* Hombr. [= *Aretiastrum magellanicum* (Hombr. & Jacq.) Skottsb.].

[115] According to Weberling & Bittrich (2016: 385), most of the species of *Valeriana s.l.* are herbaceous, half-rosette plants, sometimes subrosulate. Despite this, several high-elevation Andean species have the basal leaves arranged in typical rosettes. This is due to the main stem remains extremely short in this species (ibiden). As exposed by these authors, as well as above in this work, only a few South American genera under *Valeriana s.l.* have species with this striking feature, which are *Phyllactis* Pers., *Aretiastrum* (DC.) Spach, *Belonanthus* Graebn., and *Stangea* Graebn. Neotropical species with strikingly rosulate leaves are *V. pilosa* Ruiz & Pav. (Colombia,

Bracteata); flowers free or arranged in quite congested inflorescences; achenes frequently eppapose…………………………....…………………………………………………….…….....2

- Herbs, subshrubs or shrubs, rarely small trees, never as cushion or mats plants, about 10–300 cm; roots various; leaves various; flowers always arranged in synflorescences; inflorescences an cyma capituliform, umbelliform, paniculiform or spike like; achenes pappose or eppapose…….……………………………………………………………………...……....6

2. Corolla 3-fide, rarely 4-fide (with the exception of the section *Bracteata*, which displays a corolla 3-5(6)-fide); calyx eppapose….………….....….………………………….……………...3

- Corolla 5-fide, rarely 6-8-fide; calyx pappose…….…………………....….…………………….5

3. Tube of the corolla long and slender, 3:1 to 6:1, needle-like……………......sect. *Belonanthus*

- Tube of the corolla short, up to 3:1, stouter…………………….………….……………..….4

4. Bracts coriaceous and rigid; first order bracts erect or nearly so, fused in pairs at the base, with membranous base and apex of leaf-like texture; bracts of high orders and bracteoles similar but smaller and gradually connate nearly to the truncate apex…...........….sect. *Phyllactis*

- Bracts chartaceous, connate at the base; outermost bracts sub-reflexed or reflexed; bracts of high orders and bracteoles absent or irregularly present…………...……..…...…sect. *Bracteata*

5. Cushion or mats plants; stems woody, the distal portion herbaceous; leaves closely imbricate throughout the stem, 3-angled toward the apex, connate, up to 5 mm long; flowers a few (1–5) at the apex of the branches, solitary and hidden among the distal leaves; stamens subexserted, corolla always yellow, anthers ovate……………………………………….….sect. *Aretiastrum*

- Small rosette plants, solitary or caespitose, eventually forming hemispheric tufts (*Aizoostangea* group), never cushion or mats plants; stems or scapes woody, very short and stout; leaves ovate, obovate or eventually spatulate, arranged in basal rosettes, above 10 mm long; corolla white; flowers disposed in a inflorescence usually flat-topped and much broader than long; corolla white to purple, rarely yellow, stamens included, anthers linear……………………………………………………………….………...sect. *Stangea*

6. Achenes verrucose, warty or tuberculate[116]……………………………….……….….......7

- Achenes with smooth or at most papillose indument……………………………….…..…..8

Ecuador, Peru and Venezuela), *V. rigida* Ruiz & Pav. (Bolivia, Ecuador and Peru), *V. secunda* Eriksen (Ecuador) and *V. tatamara* Killip (Colombia and Ecuador).

[116] The terms tubercles (from the Latin "*tuberculo*") and warty appendages (from the Latin "*Verrucosus*"), which are related to the fruit indument, are ambiguous. Such as used by Höck, it appears to be related to any salient structure under the epidermis, including papillae, which are common in species of *Valeriana*. Papillose indument is not commonly referred in the literature of Valerianaceae as synonymous of tubercles or warty appendages.

7. Herbs annual, from napiform roots, the rhizomes never profusely branched; inflorescences corymbose, congested when fruiting; fruit on both sides or on one side with tubercles, or at most warty…………......…………………………………………………….....sect. *Hybocarpos*

- Herbs perennials, roots never napiform, the rhizomes profusely branched, internodes short at the branches base, the distals elongated; inflorescence corymbose, during fruiting often more lax; fruits ovate, small, on all sides tuberculate[117]….................................sect. *Pseudastrephia*

8. Stamens generally exserted, eventually subexserted; achenes eppapose, eventually pappose (*Valerianopsis*, series *V. macrorhizae* and *V. connatae*)................................……………......9

- Stamens generally included or rarely exserted; achenes always pappose………...…..…....10

9. Dioecious shrubs, eventually as subshrubs; leaves coriaceous, entirely dentate; inflorescences corymbose, eventually paniculiform, the paracladia never spike like……..…………………..…………………………………......…....sect. *Phuodendron*[118]

- Dioecious or gynodioecious perennials herbs or subshrubs; leaves never coriaceous, at most slightly coriaceous; inflorescences small and glomeruliform, arranged in spike like inflorescences, or many spike like inflorescences forming thyrsoid panicles……………………..…...…………………………………...sect. *Valerianopsis*

10. Voluble or scandent species……………………………….………..…………………11

- Herbs, subshrubs or shrubs………………………...…………………..………..……...12

11. Voluble subshrubs; leaves always entire; achenes small, up to 1 mm long…………………………………………………….………......……sect. *Phuocaprifolium*[119]

- Scandent herbs; leaves entire, trilobed or trifid; achenes always larger than 1 mm long…………………………………………………….…………….……..sect. *Amplophus*[120]

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[117] This section has only four species, two of them described by Höck, all endemic from the Chilean Andes: *V. lobata* Höck, *V. crispa* Ruiz & Pav., *V. astrephioides* Höck and *V. floribunda* Phil. The description of this section is quite broad and ambiguous. The absence of gibbosity is most likely due to the reduced size of the flowers of the analyzed species, which makes this structure inconspicuous, which is common in many genus species. The type species of this section, *V. crispa* (see Eriksen 1989: 186) has glabrous and papillose fruits (e.g. see Kutschker 2008b: 21, figure 1, H), which makes it doubtful the term tuberculate, as previously mentioned.

[118] This section was described based on a single species from the Brazilian highlands, *V. ulei* Graebn. Is precariously described, based on scarce material, and devoid of pistillate flowers and fruits. Because of this, the author questions the best position of this species, whether belonging to a new section or a new genus. Reading the notes concerning this species reveals that Graebner was impressed by the shrubby habit, with strongly woody branches and coriaceous leaves. We include here the occasional subshrub habit, as well as the possibly more lax, paniculiform inflorescences, as these features have been observed in various collections of *V. ulei*.

[119] Graebner (1906a: 440) described this section based on a single species collected by Weberbauer in the Peruvian Andes, *V. pardoana* Graebn. Eriksen (1989) chose as lectotype *V. tomentosa* Kunth. We are not aware of any other species described so far for this section, nor with similar morphology. Therefore, only these two species are here considered under this section.

[120] Valerianaceae display at least two types of lianescent habit (see Weberling & Bittrich 2016: 385): a) herbaceous climbers, with apparently a single species, *V. scandens*, and several varieties eventually considered valid; b) suffrutescent vines (sometime called woody lianas), with about seven species, including *V. naidae* and *V.*

12. Shrubs to subshrubs, always higher than 20 cm high; rhizome narrow to slightly thickened; leaves entire, imbricate or lax, subrounded, obovate-oblong, or linear-lanceolate, the petioles absent or quite small, up to 10 mm long; habit resembling species of the genus *Galium* [Rubiaceae]…………………………………………………………..…sect. *Galioides*[121]

- Herbs perennials, up to about 20 cm high; rhizome quite thickened; leaves divided or incise, eventually the basal leaves entire (*Sphaerophu*), clearly petiolate, the petioles larger than 10 mm long; habit rosulate to subrosulate….…………………………………………….…..13

13. Stem base with several leaves, the leaflets entire, crenate or incise; inflorescences arranged in clearly separated globular heads (globose capitulum), sessile or short-pedunculate, never aggregate………..………….…………………………..….........sect. *Sphaerophu*[122]

- Stem base nude, the apex with 2 small opposite pinnate leaves, the sections dentate; inflorescences with internodes sub-null, ovate or subglobose…………..…sect. *Aspleniopsis*[123]

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subincisa, according to Barrie (2003), and *V. clematitis*, according to Weberling & Bittrich (2016). The known lianescent species in the Neotropics (and thus apparently throughout the genus) are: *Valeriana clematitis* Kunth (northeastern Mexico, Guatemala, Costa Rica, Panama and Colombia), *V. laurifolia* Kunth (Mexico to Peru) [referred by Meyer (1951) as a synonymous of *V. clematitis*, and considered a valid name by Xena de Enrech (1992)], *V. naidae* Barrie (Mexico), *V. scandens* L. (=*V. candolleana* Gardn.) (from southeastern United States to northeastern Argentina), *V. subincisa* Benth. (Guatemala, Mexico). According to Xena de Enrech (1992: 259), *V. laurifolia* is "perhaps the most common species in the northern Andes" (our translation).

[121] This section historically includes at least seven species, most native from the Ecuadorian Andes: *Valeriana alophis* Graebn. (Colombia and Ecuador), *V. amphilophis* Graebn. (Peru), *V. bonplandiana* Wedd. (Ecuador), *V. gonatolophis* Graebn. (Ecuador), *V. hieronymi* Graebn. (Ecuador), *V. hirtella* Kunth (Ecuador) and *V. microphylla* Kunth (Colombia and Ecuador). Graebner (1899: 429) argues that the section *Galioides* includes very polymorphic forms. *Valeriana hirtella* differs in many aspects from all other species, notably from *V. bonplandiana*, being "so differently that, unbeknownst to the links, a union seems quite impossible". In fact, the section could be divided into two groups (A and B), due to differences regarding the leaves, stems and inflorescences, as conceived in the key proposed in the referred study by Graebner. Still on the differences, the author points that Höck (1882), in his "excellent work", divides these species even into different sections, placing *V. hirtella* and *V. microphylla* in the section *Euvaleriana*, while *V. bonplandiana* is treated in the section *Porteria*. Eriksen (1989: 186) maintains the recognition of the section *Galioides*, choosing as lectotype *V. microphylla*. Jørgensen and Eriksen (1999) include practically all species of this section, except for *V. hirtella*, in the synonymy of *V. microphylla*. According to Graebner (1899: 433), the name *Galioides* was "a suggestion of Prof. K. Schumann, due to the striking resemblance of all species to certain members of the genus *Galium* L. [Rubiaceae]".

[122] *Valeriana micropterina* Wedd. was the first species described under this section, considered by Weddell (1857) under the *Valeriana* sect. *Eu-Valeriana*. However, by Hock's (1882) definition, it is belongs to *Valeriana* sect. *Valerianopsis*. On the other hand, *Valerianopsis* is treated by Weddell (1857) as a section under the genus *Phyllactis*. Regarding the diagnosis and the key characters of *Sphaerophu*, Graebner (1906a) explain: "Of the true *Valerianopsis*, the Section *Sphaerophu* is distinguished by the large flowers, always arranged in clearly separated globular heads, and by the very different habits. Also, they are always herbs, shrubs or shrubs" [our translation]. Five species are described under this section, *V. sphaerophora* Graebn. (Peru), *V. sphaerocephala* Graebn. (Peru), *V. poterioides* Graebn. (Bolivia), *V. plectritoides* Graebn. (Peru), *V. plectritoides* var. *subgracilior* Graebn. (Peru).

[123] This section was described as new by Graebner based on a single species native from Peru, *V. trichomanes* Graebn. The shape of the leaves of these species is very similar to those of *Asplenium trichomanes* L. or *A. viride* Huds. (Aspleniaceae), as referred by the author. The diagnosis, as well as the line-drawing of the opened flowers observed in the type specimen of *V. trichomanes* indicate that is apparently a dioecious species.

Specific and infraspecific concepts and key characters

The criteria for the definition of species, as well as infraspecific categories (subspecies, variety, form, and even hybrids) under *Valeriana* are little approached and far from consensual, or clear in systematic studies. Choosing the most appropriate specific and infraspecific category for a taxon in *Valeriana* represents a challenge due to the large polymorphism of several species, and likely recent speciation processes (Rabuske-Silva 2018). Most of species are little known in nature, and poorly sampled in herbaria (Weberling 2003). Even when satisfactorily sampled and with relatively known geographic distribution, the morphological key characters employed in the segregation of subspecies, varieties, and forms vary among the treatments.

Going beyond the theoretical concept implied in each category, the choice of objective key characters can help or even serve as a framework for solving various deadlocks in taxonomic inferences, especially that involving revisions of morphological complexes established in the late 19th and early 20th centuries. These complexes, groups, or "shape circles" (as referred by Graebner 1906b) were established especially by European botanists from numerous collections made in South America, generating a large number of species names questioned in their validity throughout the 20th and early 21st centuries. Most of these classical botanists, such as Höck and Graebner, apparently never collected in South America, and therefore never made field observations about interpopulational morphological variation. Often two individuals from the same population of a given species of *Valeriana*, assembled in the same exsiccate or collected in the same place, were segregated as two distinct taxonomic entities based on slight variations (e.g. the case of *V. salicariifolia* and related species in Müller 1885). The limited knowledge about the geography of these countries and mountain ranges, such as the Andes or the Brazilian Serra do Mar, constitutes a challenge even to contemporary local botanists. The literature points to the emergent need for integrative approaches, treating the systematic correlation between aspects of distribution and habit (geographical relief, elevation, soil type), morphology, anatomy, floral visitors, and other ecological aspects that are the subject of systematic botany and conservation.

A total of 136 infrageneric names are registered under *Valeriana* in the IPNI (2020). Of these, 55 were described as subspecies, 76 as varieties, and only 5 described as forms. Moreover, a single hybrid was found in the literature. Here we present a brief analysis of the key characters historically addressed in the literature in order to clarify these concepts.

Species

Here we employ the morphological concept of species, in which a species is considered the smallest group of natural populations that is separated by morphological features that do not overlap, or in other words, “populations separated from each other by a distinct discontinuity in the series of biotype” (Aldhebiani 2018, based on Cronquist 1978). We found 858 species names under *Valeriana* (including infrageneric categories) in TPL, as well as about 950 species names in the IPNI. These numbers include accepted species, synonyms and unresolved taxa[124]. When compared to the recognized valid species number of *Valeriana,* about 270 species, according to Weberling & Bittrich (2016), we have that about 28 to 30% of the historically described taxa are considered valid. This reflects the need for an analysis of the criteria treated for species segregation, as well as to relegate them to the condition of synonyms.

Currently, the species under *Valeriana* are generally described based on a large but variable number of vegetative and reproductive features. However, as in the classic works of the 18th century floral characters were used primarily for the establishment of genera, and characters such as calyx (pappose or not), corolla (regular or not), stamens (number) and achenes (number of locules) were little employed in the segregation of species, predominating at the time the use of differences in habit, vegetative characters and general shape of inflorescence, bracts and bracteoles (e.g. see Necker 1790, Moench 1794).

Ruiz & Pavón (1798) treated in the definition of species mainly habit, presence or absence of the main stem, leaf shape (basal and distal), inflorescence type and rarely the number of the corolla lobes (*V. rigida, V. tenuifolia* and *V. spathulata*) and bracts shape (*V. globiflora* Ruiz & Pav.), not always all of them referred and comparable. Fruit characters are not referred in the diagnosis, but are described with varying degrees of detail. For some species it is just referred the calyx type. As referred above, in this early period in the systematic of Valerianaceae the fruit is gradually observed beyond the presence or absence of a pappose calyx. Achenes are gradually being described in external and internal detail, although these characteristics have been little used for species differentiation.

With the increasing number of researchers and collections available to European botanists in the early 19th century, a large number of specific taxa were described. However, the characters used in defining a species still closely resemble those already mentioned to late

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[124] These numbers are discrepant due to distinct inclusion methods and criteria and data updating system, with numerical data certainly underestimated. During this study we observed that a series of names are not included in the referred virtual databases.

18th century authors. In this sense, Weddell (1857: 17) makes some important comments about the use of floral characters for the definition of species under *Valeriana*, specially stamens and pistil length, as well as the corolla shape:

> *I did not use, for the distinction of the species of this genus* [Valeriana], *the character taken from the length of the stamens and the pistil in relation to the corolla, since it is susceptible to misleading. In fact, some valerians, and these are much more numerous than we think, have polygamous flowers, which leads the organs to report developmental variations that could lead, if we were not warned, to give the species a character that, in fact, belongs only to the individual. It seemed to me, in a word, that most valerians could present individuals with hermaphrodite (or more rarely male [staminate]) flowers with exserted stamens (the style is usually short), and others with flowers all females whose, on the contrary, the style alone is salient, the stamens included and an style exserted, which, in every individual I have at my disposal, is the opposite that has come up. Now it is more than likely that one of us has seen only female [pistillate] flowers and the other hermaphrodite flowers. I should add that we should not rely too much on the characters assumed by the shape and size of the corolla, as flowers of different sexes also have very remarkable differences in this respect.*

Paradoxically, Weddell (1857) used the mating system (hermaphrodite, polygamous or polygamo-dioecious) and the corolla shape as key characters to compare species (campanulate or infundibuliform, narrow base or not, gibbose or not, and others) in the diagnoses of several species. Despite this, the cast of characters employed in the conception and description of a species would be significantly expanded from the revisions of Graebner (1899 and 1906a). This author employed many diverse characters such as habit, roots, leaf, inflorescences, bracts, flowers and fruits, i.e. all morphological elements available. However, as observed in other contemporary works, apparently no emphasis is given to geographic distribution and habitat, with the type locality only referred in the synopses. Because of this, many sympatric and syntopic taxa have been segregated, now considered synonymous, being essentially morphological variations of polymorphic taxa (e.g. see the broad list of synonyms for *V. microphylla*, many of them described by Graebner). From the 19th to the 20th century, descriptions and synopses of new species of *Valeriana* (and related taxa, now considered synonymous) would be significantly expanded (e.g. see Briquet 1918, Stuckert & Briquet 1918, Killip 1937, Borsini 1942).

In the 20th century the subject of key characters in the definition of specific and infraspecific categories would be eventually addressed in the taxonomic revisions of *Valeriana*. Features such as leaves, inflorescences, calyx and fruits were the most applied in these studies (Table 18).

On the creation of new species and varieties, Borsini (1944: 280) discuss the criteria that would become the most used during the 20th century:

> *Stuckert & Briquet (1919) [1918] created species and varieties based on the shape of the leaves. This character was also considered by Höck (1882) for the identification of certain groups of* Valeriana *'due to the uniformity in the structure of flowers and fruits'. We do not share Höck's criterion, because in certain groups of species there is a certain relationship between the shape or shapes that their leaves can present, but this character can lead to errors in herbarium specimens, since the same individual, depending on the body part and degree of development, can present morphological variations so large that a simple observation we have no doubt in considering them as distinct species (Borsini 1942). For this reason, we take as distinguishing specific characters those presented especially by the fruit, whose general aspect, shape, size and pubescence is particular in each species.*[125]

Although Borsini (1944) claims the use of the fruit as the most reliable character for species delimitation, other key characters would be further associated in the segregation of species studied by this author. For example, *V. grisebachiana* Borsini, a new species from Argentina, was segregated from its related species, *V. lasiocarpa* Griseb., essentially by fruit features, stem leaves and habit (Borsini 1942). *Valeriana calchaquina* Borsini was described in the same occasion, the author not having access to fruits[126]. In another case, *V. hunzikeri* Borsini was described by Borsini (1960), based on "differences in fruit, leaves, etc.", without establishing the most morphologically similar species, claiming that "the characters do not match any of the species from the referred publication [Borsini 1944]". *Valeriana kurtziana* Borsini was described by Borsini (1962b) and segregated from *V. polystachya* based on fruit characters as well as bracts and bracteoles, although the author makes a brief reference to aspects of distribution. Another striking case is *V. reitziana* Borsini, described as new based

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[125] Our translation.

[126] Nevertheless, *V. calchaquina* remains a valid species, although sometimes considered under the correlate genus *Stangea* (Kutschker 2008a).

TABLE 18. Key characters and features treated by several authors to define species under *Valeriana*.

Key characters	**features**	**references**
distribution	localities	Meyer (1951, 1958), Larsen (1986), Barrie (2003)
habitat		Meyer (1951), Sobral (1999), Barrie (2003), Rabuske-Silva (2018)
mating system	type	Devesa *et al.* (1997), Barrie (2003, 2011), Novara (2008)
habit	herb or shrub, erect or prostrate	Reiche (1902), Borsini (1942, 1962a, 1963), Meyer (1951, 1958, 1976), Bacigalupo (1974), Xena de Enrech (1992), Sobral (1999), Scalon *et al.* (2002), Barrie (2003, 2011), Novara (2008), Kutschker (2011), Nagahama *et al.* (2016), Rabuske-Silva (2018), Sylvester *et al.* (2018)
life cycle	annual, biennial, or perennial	Meyer (1951), Barrie (2003), Novara (2008), Kutschker (2011), Acosta *et al.* (2015)
height		Meyer (1951), Sobral (1999), Barrie (2003), Novara (2008), Kutschker (2011), Shu (2011), Rabuske-Silva (2018), Sylvester *et al.* (2018)
glandular hairs	presence or absence	Shu (2011)
roots, rhizomes or stolons	type, presence or absence, size, branched or not	Reiche (1902), Killip (1937), Meyer (1951, 1976), Devesa *et al.* (1997), Barrie (2003, 2011), Shu (2011), Rabuske-Silva (2018)
stems	woody or herbaceous (consistence?), voluble or erect, simple or branched, indument, color (green or brown, or red or magenta), shape (winged, terete or quadrangular)	Reiche (1902), Killip (1937), Borsini (1962, 1963), Meyer (1951, 1958), Devesa *et al.* (1997), Sobral (1999), Barrie (2003, 2011), Shu (2011), Jung (2013), Rabuske-Silva (2018), Sylvester *et al.* (2018)
basal leaves	shape, disposition, texture	Reiche (1902), Killip (1937), Borsini (1942, 1962, 1963), Devesa *et al.* (1997), Sobral (1999), Scalon *et al.* (2002), Barrie (2003), Kutschker (2011), Shu (2011), Acosta *et al.* (2015), Nagahama *et al.* (2016), Rabuske-Silva (2018), Sylvester *et al.* (2018),
distal (or upper, or cauline) leaves	shape, texture, sike, margins, color	Reiche (1902), Killip (1937), Borsini (1962, 1963), Devesa *et al.* (1997), Sobral (1999), Scalon *et al.* (2002), Barrie (2003), Kutschker (2011), Shu (2011), Nagahama *et al.* (2016), Rabuske-Silva (2018), Sylvester *et al.* (2018)
leaves in general	cauline or basal, divided or undivided, shape, texture, indument, margins, nerves (number) and color	Reiche (1902), Killip (1937), Borsini (1942, 1962, 1963, 1966), Meyer (1951, 1958, 1976), Bacigalupo (1974), Larsen (1986), Xena de Enrech (1992), Devesa *et al.* (1997), Sobral (1999), Scalon *et al.* (2002), Barrie (2003, 2011), Novara (2008), Shu (2011), Jung (2013), Acosta *et al.* (2015), Sylvester

		et al. (2018)
petioles	presence, size, comparative size with the leaf blade	Killip (1937), Borsini (1962, 1963), Meyer (1951), Xena de Enrech (1992), Barrie (2011), Novara (2008), Kutschker (2011), Shu (2011), Rabuske-Silva (2018)
segments of the leaves (lateral leaflets or lobes)	shape, number, disposition	Reiche (1902), Killip (1937), Meyer (1951), Devesa *et al.* (1997), Sobral (1999), Barrie (2003), Novara (2008), Kutschker (2011), Shu (2011), Jung (2013), Acosta *et al.* (2015), Rabuske-Silva (2018), Sylvester *et al.* (2018)
distal segment of the leaves (terminal leaflet or lobe)	shape, size or comparative size	Killip (1937), Meyer (1951), Sobral (1999), Barrie (2003), Kutschker (2011), Shu (2011), Jung (2013), Rabuske-Silva (2018), Sylvester *et al.* (2018)
inflorescence (or synflorescence)	shape (sometimes only of the distal third), size, density of flowers, shape of the branch of the inflorescence in cut, winged or not, indument	Reiche (1902), Killip (1937), Meyer (1951, 1976), Larsen (1986), Xena de Enrech (1992), Sobral (1999), Barrie (2003), Kutschker (2011), Shu (2011), Acosta *et al.* (2015), Nagahama *et al.* (2016)
paracladia (or inflorescence branches)	length, shape, number	Killip (1937), Larsen (1986), Barrie (2003), Kutschker (2011), Shu (2011)
bracts and bracteoles	shape, indument, length when comparing to the fruit	Killip (1937), Borsini (1942), Meyer (1951), Sobral (1999), Barrie (2003, 2011)
flowers in general	shape, size, color	Borsini (1942), (Meyer 1951), Xena de Enrech (1992), Barrie (2011), Kutschker (2011), Sylvester *et al.* (2018)
corolla	shape, size, size and number of lobes (eventually comparing with the corolla tube length), color, indument, texture	Reiche (1902), Killip (1937), Borsini (1963), Meyer (1951, 1976), Larsen (1986), Devesa *et al.* (1997), Barrie (2003, 2011), Shu (2011)
stamens	size, included or exserted	Meyer (1951, 1976), Scalon *et al.* (2002), Barrie (2003)
anthers	bilobulate or tetralobulate, color	Xena de Enrech (1992), Barrie (2003), Sylvester *et al.* (2018)
achenes	shape, size, number of costae, shape of the session, indument, winged or unwinged and eventually the color	Reiche (1902), Killip (1937), Borsini (1942, 1962, 1963, 1966), Meyer (1951, 1958), Bacigalupo (1974), Xena de Enrech (1992), Devesa *et al.* (1997), Sobral (1999), Barrie (2003, 2011), Novara (2008), Kutschker (2011), Shu (2011), Acosta *et al.* (2015), Nagahama *et al.* (2016), Rabuske-Silva (2018), Sylvester *et al.* (2018)
sterile locules	developed or not	Reiche (1902), Borsini (1966), Kutschker (2011)
calyx	shape, eventually the number of lobes, rarely the size	Borsini (1942, 1962, 1963, 1966), Meyer (1951, 1958), Bacigalupo (1974), Xena de Enrech (1992), Devesa *et al.* (1997), Sobral (1999), Barrie (2003,

		2011), Novara (2008), Kutschker (2011), Acosta *et al.* (2015), Nagahama *et al.* (2016), Rabuske-Silva (2018)
bristles	number, length and eventually texture	Killip (1937), Devesa *et al.* (1997), Nagahama *et al.* (2016)

essentially on fruit, flower and branch pubescence characters, with geographical distribution disregarded for species differentiation (Borsini 1962a). Still, *V. chilensis* Borsini was segregated from *V. fonkii* Phil. due to differences in the fruits, leaves and bracteoles (Borsini 1966b).

Regarding the use of inflorescence size in species differentiation, Borsini (1944: 281) argues that “it cannot be used as a differential character of species when it only refers to the size of their development”. Plus, “the morphology of leaves and inflorescences as differential characters of this family has led the authors who deal with it to errors”, which is due to the particularities in the development of these structures that make them quite polymorphic according to Borsini (1944: 284). This author also makes important observations about error induction through the analysis of exsiccates: “In one individual we have found that according to the part of his body that was herborized, he had the characters corresponding to distinct taxonomic entities. The most constant specific value character is given by the fruit, since its general shape, size after ripening, pubescence, number of ribs or wings, pappus shape, etc., provide the most constant data for each species” (Borsini *l.c.*). This perspective is briefly referred by Kutschker (2011) and Rabuske-Silva (2018), although exceptions are recognized by these authors. Concerning exceptions, the inflorescences shape and /or size were treated as key characters by Larsen (1986), Sobral (2000) and Rabuske-Silva & Iganci (2019). In this sense, the reduced taxonomic value of leaves should be relativized because, as stated by Meyer (1951: 381), “the leaves are the most variable of all the taxonomic criteria [under *Valeriana*], although the characteristic variational pattern is often diagnostic for species determination”. We believe the same applies to the variation displayed by inflorescences. Therefore, in order to apply both leaf and inflorescence morphology in the definition of a species, and to make good use of them, it is imperative to know in depth the morphological variability of the analyzed taxon, and whenever possible to observe populations in nature.

Some features are widely mentioned, despite not being considered key characters, and deserve an analysis regarding their taxonomic relevance to define species. Characters rarely used but with great potential in taxonomic studies are mating system, habit, life cycle, height, presence of glandular hairs, roots, and rhizomes (including stolons). The mating system, although often referred as controversial in the analyzed treatments, is eventually employed to differentiate some taxa (e.g. Devesa *et al.* 1997, Barrie 2003, 2011, Novara 2008). This character seems to be quite promising, given that the reduction of reproductive structures played an important role in the evolution of the group (Bell *et al.* 2012). Regarding the leaves, the use of petioles and distal segments is uncommon when compared to their potential (in this case, in pinnately lobed leaves). Leaves are most often described in their general form, with no differentiation between basal and distal or caulinar leaves. However, it is increasingly common to use the shape of the basal and distal leaves described separately, or even the existence of heterophyllous or homophyllous species, although the use of these characters requires parsimony (e.g. Barrie 2003, Rabuske-Silva 2018).

Reproductive characters, except achene and calyx, are not frequently employed. For example, the length, shape, and number of paracladia (or inflorescence branches) are poorly referenced, although variation in these characters can be a very practical character in species differentiation. Morphological aspects of flowers, such as shape, size, lobes, color, indument, and texture have been increasingly cited, the same does not occur with the stamens (size and proportion when compared to the corolla tube) and anthers (bilobulate or tetralobulate, color). Many of the characters referred here may widely vary in each species and are not easily measurable. The lack of descriptions of several characters in the literature makes descriptions unmatched and unhelpful for other approaches in systematic botany, such as studies on pollination, polyploidy, ontogeny, and ecology in general.

Recent studies have applied a large number of characters in their analyzes. A notorious example is the study of Nagahama *et al.* (2016), which selected 22 quantitative characters and six characters defined as semiquantitative in a morphometric analysis of a new species of *Valeriana* from Argentina[127]. These authors argue that some of these features have traditionally been used for species delimitation by Borsini (1944, 1966, 1999) and Kutschker (2008, 2011), without specifying which ones. Plus, it disregarded two qualitative morphological characters, leaf texture and fruit surface, despite recognizing their importance for species delimitation.

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[127] The characters analyzed by the authors are: plant height, root length, root width, length of petioles of basal leaves, length of blades of basal leaves, width of blades of basal leaves, number of teeth on basal leaf margin, length of teeth on basal leaf margin, length of petioles of upper leaves, length of blades of upper leaves, width of blades of upper leaves, number of teeth on upper leaf margin, length of teeth on upper leaf margin, number of internodes on inflorescence stem, length of ramified zone of inflorescence stem, number of internodes of ramified zone of inflorescence stem, length of basal bract, width of basal bract, length of bracteoles, width of bracteoles, number of branches on the inflorescence stem, length of the first branch on the inflorescence stem, fruit length, fruit width, diameter of pappus base, number of pappus bristles, length of pappus bristles, and length of hairs on pappus bristles.

The distribution and habitat of some taxa, when cohesive or restricted, are rarely considered to define species. Some authors treated the distribution as an additional character, associated with other morphological features, for example Meyer (1951, 1958), Larsen (1986) and Barrie (2003). Similarly, habitat may eventually be referred or even used to differentiate some taxa with very particular environmental preferences. Examples of studies that treated habitat for species differentiation are Meyer (1951), Larsen (1986), Sobral (1999), Barrie (2003), Rabuske-Silva (2018), Rabuske-Silva & Külkamp (2018), Rabuske-Silva & Iganci (2019) and Rabuske-Silva *et al.* (2020).

To summarize what has been discussed so far, as previously mentioned by Meyer (1960: 198), it is recommended "the specialized calyx, either coronate or pappus-like, and more especially the sculpturing of the cypselate achene combine with vegetative characters in the differentiation of species of South American *Valeriana*". When substantial variations in the achenes are not observed, infraspecific categories are a better choice. Similarly, when differences are limited solely to controversial achene features such as pubescence or size, especially when these data overlap, these same categories are more appropriate. Given the limited knowledge of a large number of South American valerians, discussing these patterns in taxonomic notes plays a fundamental role whenever the taxon points to the need for further study. These notes may suggest or even direct questions to future studies, including molecular approaches involving phylogeny and phylogeography. According to Larsen (1986: 432), on the taxonomic inferences of her phylogenetic and morphological character analysis of Valerianaceae, the results are "the most logical that can be drawn at this time, though not necessarily final"[128], which may serve as an universal principle for studies on poorly known species of *Valeriana*.

Subspecies

As previously referred, we found 55 names of subspecies under *Valeriana*, according to the IPNI (2020). Beentje (2010) defines subspecies in a broad view as a "subdivision of species, each subspecies being geographically or ecologically isolated from each other and with fewer distinguishing characters than demarcate a species". Meyer (1951) employed a varied range of features to define a subspecies. This category was selected for those taxa that showed variation

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[128] Some taxonomic inferences from Larsen (1986) would be questioned a few years later by Eriksen (1989), who relegated *Phyllactis* to the status of subgenus and section of *Valeriana*.

in the habit, rhizomes, stems, leaves, corolla, achenes, distribution, and / or habitat, eventually referring the floral period and ecological conditions. The author provides detailed notes on these aspects, although leaf characters played a predominant role, whenever related to some geographic isolation provided by some barrier.

Devesa *et al.* (1997) show greater variation in the selection of characters, including as subspecies those taxa with variation in basal and distal leaves, leaf lateral and terminal segments, bracteoles, inflorescence, and the length of flowers in general, especially corolla and anthers. In the same way, Devesa *et al.* (2005) describe a new subspecies of *V. tripteris* L. from the Iberian Peninsula, based on the restricted geographical convergence of a group of morphotypes with distinct leaf morphology, as well as larger hermaphrodite corolla when compared with the typical subspecies. Additionally, these authors argue that these same morphotypes had previously been considered as varieties or subspecies, but do not justify the reason for choosing one category over the other.

Therefore, it seems to us that the category of subspecies is suitable for cases where a given number of samples have a strong correlation and specificity in leaf morphology, or eventually in the form of inflorescence or fruits, clearly distinguishable from the type species. These morphological features must be associated with a certain cohesion in the geographical distribution of the taxa, or even with distinct habitats, which is rare in studies on Valerianaceae. Thus, the distinction between species and subspecies is subtle, and requires parsimony when selecting the most appropriate category for the description of a new taxon, as well as in transferring taxa. More detailed observations regarding possible differences in floral visitors, flowering periods, historical processes of vicariance are promising in studies addressing the subspecies category, being partially discussed by Meyer (1951).

Varieties

Borsini (1944, 1962) questions the creation of entities (varieties and forms) under *V. scandens* based strictly on leaf division. This author considered only the category of species, with a single exception, *V. interrupta* var. *calcitrapifolia* Griseb.[129] (Borsini 1944: 314, Borsini 1942: 364). The criteria used in the maintenance of this taxon by Borsini is unclear. However, Meyer (1951) employed the category of variety for those poorly known taxa, therefore treated as a "temporary

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[129] Currently considered a synonym of *V. calvescens* (Kutschker 2008a: 3096).

category". In the notes of *V. sorbifolia* Kunth (Meyer 1951: 475), he provides some observations about his concept of variety:

> *I have recognized three varieties as provisional categories under* V. sorbifolia*, in order to point out a series of semi-stabilized variants within the range of variation of this species. These variants may actually be potential subspecies, but geographic barriers have not yet been ascertained for these infraspecific taxa.*

In another passage, in the notes of *V. densiflora* Benth. (Meyer 1951: 455), this author reaffirms the provisional connotation of the variety category in his treatment:

> Valeriana densiflora *is interpreted as a polytypic complex, and despite the efforts to pigeon-hole the several classes of variants, the only logical recourse, in view of the restrictions imposed by a paucity of material, has been to group the variants into two varieties,* densiflora *and* affinis. *As used here, this category is provisional, and its chief usefulness lies in pointing out segregating and more or less independent units of variation where genetic and geographic barriers may be acting potentially as the isolating mechanisms.*

Besides being provisional, we can understand that a variety is a category used by Meyer for morphological variants not yet markedly delimited ("semi-stabilized"), being this category not interdependent of genetic and geographic isolation, although these may be incipiently suggested by the data. In practice, Meyer (1951) employed several features to define variety, including distribution, mating system, roots, stems, leaves, and achenes, in this particular case specially the indument. In some cases, the author relies on a single character for choosing this category.

An emblematic case involving varieties is *V. scandens*, for which at least four names have been described. Borsini (1944 and 1962) rather to maintain the varieties of this species under its synonymy, arguing that the creation of these entities was based on the division of the leaf blades, which, in her opinion is a result of "morphological variations". Meyer (1951 and 1976) considers two varieties under *V. scandens*, strictly based on the shape of the leaves (ternate or undivided). This author recognizes that both varieties have essentially the same geographical distribution, but considered them distinct because a few intermediate specimens were observed and leaf types remained comparatively distinct (Meyer 1951: 462). Xena de

Enrech (1992: 262) in turn recognizes three varieties of *V. scandens*, relying equally on leaf divisions, but also indicates differences in distribution and chromosome number, preferring to keep them as independent entities.

Larsen (1986) treats two varieties under *Phyllactis rigida* Pers., based on the shape, size and arrangement of leaves, as well as on the shape and diameter of the synflorescence, plus differences in distribution in the Andean chain.

Forms

The category of form is inexpressively addressed in treatments of *Valeriana*. We found only five form names at the IPNI (2020) database, all belonging to Old World species, none of them in studies by classical authors analyzed here. Beentje (2010) defines form as "a group of plants within a species differing slightly (usually by a single character) from the main population but not sufficiently to be considered a variety or subspecies". However, as *Valeriana* is a group with several polymorphic species, we discourage the use of this category. Analysis of a larger number of elements is preferable for the establishment of more solid formal taxonomic categories.

Hybrids

We found a single case of hybridism described under *Valeriana* (V. × ekmani F.G.Mey.), observed among natural populations of *V. domingensis* Urb. and *V. scandens* located in the Dominican Republic (Meyer 1951). Information about natural hybridization and introgression among species of *Valeriana* is scarce, and these subjects are certainly underestimated in taxonomic studies on the South American species. This is suggested, for example, by studies treating the chromosome number and ploidy *of V. scandens,* which show that populations of *V. scandens* var. *scandens* (individuals with predominantly ternate or trilobed leaves) is basically composed of tetraploid individuals ($2n = 28$), while the var. *candolleana* (individuals with predominantly single leaf) is composed of octaploid individuals ($2n = 56$) (Xena de Enrech 1992).

Conclusions

The understanding of the infrafamilial and infrageneric categories under Valerianaceae depends on the broad analysis of systematic studies, including floristic surveys and publications of new taxa, due to the differences in the conceptions and interpretations of protologues. Concerning the South American valerians, these differences in taxonomic conceptions led to diverse and often overlapping or confusing circumscriptions, as well as the questioning of genera, infrageneric categories, and previously established key characters. In the late 19th and early 20th centuries, authors such as Höck and Graebner expressed doubts regarding the circumscription of some sections and series of *Valeriana*, proposing potentially useful names to be considered as generic categories, although they recognized the limitations and advances in knowledge of their time (Höck 1882, Graebner 1899). Limitations in the knowledge of several taxa are recognized even in the most recent revisions by Larsen (1986) and Eriksen (1989).

The monogeneric treatment of Linnaeus (1753, 1762) predominated during the second half of the 18th century and the beginning of the 19th century, although the bigeneric proposal of Tournefort (1719) was frequently under discussion. Authors such as Adanson (1763), Jussieu (1789), Necker (1790), and Moench (1794), observed the necessity of segregating this large and diverse morphological species group into smaller generic subunits, according to varied key characters, especially from flowers and fruits. This plurigeneric perspective was expanded with the taxonomic contributions of Ruiz & Pavón (1798), describing a considerable number of South American Andean species, which constituted unknown morphotypes to the European botanists. Until then, the knowledge of the taxa in this region was extremely limited to few collections. However, infrageneric categories were not proposed during this context, and even Ruiz & Pavón (*l.c.*) based their treatment on the Linnaean system.

The classification system of the group would be significantly increased in the early 19th century, especially with the description of Valerianaceae by Batsch (1802), and new generic taxa by Peerson (1805), Dufresne (1811), Kunth (1818), Dumortier (1829), Hook (1851) and Weddell (1857), as well as the first infrageneric categories described by Kunth (1818), Candolle (1830) and Weddell (1857). However, it is undoubtedly the *Prodromus* by Candolle (1830) that would mark the treatments that followed throughout the 19th century. This work would be revised only from the studies of Höck (1882, 1897, and 1901), consisting in the first effort specifically focused on the systematic resolution of worldwide Valerianaceae, and by Graebner (1899, 1906a, and 1906b). These revision studies were discontinued, and some problems regarding the generic and infrageneric classification of Valerianaceae, also specific and infraspecific circumscription, remained open.

In the beginning of the 20th century, studies with different approaches arise (floristic, checklists, revisions), some of which complemented with observations about the infrageneric circumscription. Important examples are the studies by Briquet (1914) and Stuckert & Briquet (1918). The development of national botany in several countries in America has generated a series of floristic studies and the description of several new taxa for Science, bringing to light impressive numbers of species richness for this region and morphological types previously unknown. In this sense, the studies by Killip (1937), Borsini (1944, 1946, 1962a, 1962b, 1963, 1966a, 1966b, 1999), Meyer (1951, 1958, 1960, 1965, 1976, 1979), are important contributions, although they represent only one small portion of the studies developed at that time, which require further analysis.

At the end of the 20th century, Larsen (1986) and Eriksen (1989) proposed revision studies, seeking to solve historical problems recurrently mentioned by other 20th century authors. In the first case, the target was the controversial genus *Phyllactis*, one of the first and more important taxa described for South American valerians, in view of the multiplicity of circumscriptions historically observed. Eriksen (1989) proposes a more parsimonious infrageneric classification system for *Valeriana*, including several genera with little morphological support included in the category of sections. However, the biogeographic hypotheses of Eriksen (1989) were analyzed and refuted by Bell *et al.* (2012). Despite this, since the proposition of an infrageneric classification by Eriksen is not necessarily interdependent on her biogeographic analysis, it seems pertinent to maintain her taxonomic inferences based on the morphological analysis. It seems to us that the reduced use of infrageneric categories in more recent taxonomic analysis is due to the lack of syntheses of these categories, as well as identification tools, especially dichotomous keys. Even because the test regarding the monophyly of these taxa depends on the inclusion of species never before evaluated and classified in their respective categories. In this sense, we hope to contribute to the understanding of these taxa.

Regarding to the concepts and key characters used in the delimitation of species and infraspecific categories under *Valeriana*, we observed that there is an overlap in treatments of species and subspecies. There is a tendency to reduce the use of categories such as varieties and forms, which have historically been used in cases of little knowledge of the analyzed taxa (Meyer 1951). In general, there is a wide range of characters used to conceive a species, the fruit being the most important and frequently mentioned in the literature (Borsini 1944).

However, taxonomic studies published throughout the 20th and early 21st centuries have proposed the analysis of features which were questioned by classic authors, such as the shape and length of the inflorescences, floral characters and mating system. In our opinion, these characters, when known in their full variation, can be quite promising, even though requiring caution in their use, especially when the pool of characters is exclusively limited to them.

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Chapter II - *Valeriana* (Valerianaceae) in the eastern South America

This article was formatted according to the rules of the Phytotaxa (Monographs series), with the exception of line spacing.

Valeriana (Valerianaceae) in the eastern South America

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Abstract

We present a taxonomic review of *Valeriana* in eastern South America, including northeastern Argentina, Brazil, Paraguay and Uruguay. The study includes a brief historical analysis of the taxon. Morphology and anatomy are discussed and new characters with potential for taxonomic treatments are explored. We confirmed the occurrence of 18 species of *Valeriana* native from the region, being one of them new to science, *V. aparadensis*, occurring especially in highlands of the Atlantic Rainforest Domain and grasslands of the *Pampas* Domain. Several inadvertent or incomplete lectotypifications were found in the literature, being designated here one neotype, 10 lectotypes and one epitype. A key for identification of the species is provided. The species descriptions are expanded and accompanied by figures, maps, comments on morphology, phenology, distribution and habitat, etymology, conservation, in addition to references to illustrations and images useful for the diagnosis of the species. The preliminary risks of extinction assessments were updated, using the IUCN Red List categories and criteria.

Keywords: Caprifoliaceae, Dipsacales, Highland Grasslands, Montane Cloud Forest, Morphology, Pampas, Taxonomy.

Introduction

Valeriana Linnaeus (1753: 31) is the richest genus of Valerianaceae with about 270 species distributed in Eurasia, Americas and Southern Africa (Weberling & Bittrich 2016). It is especially diverse in alpine zones of the Old World and in the South American Andes, the latter being considered the most important secondary diversification center of *Valeriana* (Eriksen 1991; Weberling 2003; Bell 2004; Bell & Donoghue 2005a, 2005b; Kutschker 2011; Kutschker & Morrone 2012). The most probable center of origin of the genus is in Asia, in the Himalayan mountain range, from where it radiated to Europe, Africa and New World, occupying the southern Andes about 13.7 mya (Bell *et al.* 2012). The occupation of South America is considered the largest diversification event of the genus (Bell & Donoghue 2005a). Despite this, the South American *Valeriana* are poorly known taxonomically, which is reflected in the extremely variable number of species found in the literature, ranging from about 175 to 250 (Eriksen 1991, Bell *et al.* 2012).

There is no doubt that most species of *Valeriana* have an essentially Andean distribution in South America, most of them restricted to the mid- and lowlands (Bell *et al.* 2012). An assessment of the species number in the Andean regions sums up about 170 species (Weberling 2003). *Valeriana* is the 7th genus in species diversity in the North Andean Paramo (54 spp.), a vegetation zone where Valerianaceae had rapid radiation and from where it had multiple diversification events to other regions of South America (Eriksen 1989, Luteyn 1999, Bell & Donoghue 2005a, Kutschker & Morrone 2012). Recent taxonomic revisions and checklists indicate 40 species occurring in southern South America, and 82 in the Southern Cone region (Kutschker 2008a, 2011, 2019; Zuloaga *et al.* 2019). The presence of *Valeriana* in extra-Andean regions, especially in the mountains of eastern South America, has long been reported in the literature (Smith 1791, Chamisso & Schlechtendal 1828, Gardner 1845, Höck 1882, Müller 1885, Graebner 1899, Meyer 1951). This eastern group, remarkably separate from the Andean stock, has been partially analyzed in regional floras, especially from the second half of the 20th century and the beginning of the 21st century, although it has never been analyzed as a whole (Borsini 1962a, 1962b; Sobral 1999a, 2000; Scalon *et al.* 2002, Rabuske-Silva 2018).

Despite advances in systematics over the past three decades, especially using molecular approaches, *Valeriana* remains a paraphyletic genus and its circumscription in Dipsacales is still controversial due to inconsistencies in the morphological characterization of half the clades within the order (Bell 2004, Hidalgo *et al.* 2004, Bell & Donoghue 2005a, APG III 2009, Kutschker 2011, Judd *et al.* 2016, APG IV 2016). Moreover, it remains taxonomically poorly known as a whole, which is reflected in the discrepant numbers of species richness found in the literature and frequent misidentifications in herbaria (Meyer 1951, Weberling 2003). Descriptions in many cases are incomplete, unstructured for comparison, with key characters often unreliable, requiring revisions (Weberling 2003, 2004, 2005, 2007). Thus, here we consider Valerianaceae according to Bell & Donoghue (2005a, 2005b), Kutschker (2011), Bell *et al.* (2012), Bell *et al.* (2015), Weberling & Bittrich (2016) and Bell & Gonzalez (2018).

In this study we present a taxonomic revision of the eastern South American *Valeriana.* A brief historical analysis is provided, and morphological and anatomical aspects are discussed. All species are positioned in infrageneric categories established by Eriksen (1989). A complete morphological description for all the species is provided for the first time. The descriptions are accompanied by a key for identification of species, comments on morphology, phenology, etymology, distribution and habitat, conservation, besides references of illustrations and images useful for the diagnosis of the species. Nomenclature issues are discussed and revised, in order to solve typification problems of some names. Additionally, preliminary risk of extinction assessments are presented using the IUCN Red List categories and criteria (IUCN Standards and Petitions Subcommittee 2017).

Materials and Methods

Study area:—The geographical region used in this study encompasses the eastern region of South America (ESA), which includes the entire territory of Brazil (except for the Amazonia domain), and Uruguay, as well as the eastern Paraguay, including all departments located east of the Paraguay River, and the northeastern Argentina, including the provinces (from north to south) of Misiones, Corrientes, Santa Fe, Entre Rios, Distrito Federal, and Buenos Aires. This area comprises a wide range of biogeographic domains and biomes, being of special interest for this study the Atlantic Rainforest and the *Pampas* domains, *sensu* Iganci *et al.* (2011), region where most species have been recorded (Figure 1).

Review of literature:—The species were compiled based on a review of the main taxonomic studies of *Valeriana* in South America, specially Müller (1885), Borsini (1944, 1946, 1962a, 1962b, 1963, 1966, 1999), Meyer (1960, 1965, 1979), Cabrera (1965), Bacigalupo (1974), Xena de Enrech (1992, 1993), Jørgensen & Eriksen (1999), Sobral (1999a, 1999b, 2000), Xifreda (1999), Scalon *et al.* (2002), Novara (2008), Kutschker (2008a, 2008b, 2011), Jørgensen *et al.* (2014), and Rabuske-Silva (2018), as well as the virtual databases (CRIA 2020, Darwinion 2020, REFLORA 2020, Iganci *et al.* 2020, Tropicos 2020). The bibliographic survey was performed by consulting studies deposited in the library of the Universidade Federal do Rio Grande do Sul (UFRGS), and in the Herbarium library of the Curitiba Municipality Botanical Museum (MBM), but especially in the digital archives of the Biodiversity Heritage Library database (BHL) (http: //www.biodiversitylibrary.org/), and JSTOR (2000 onward) (https://www.jstor.org/).

Review of herbaria:—The occurrence records were confirmed by the analysis of about 2200 exsiccates obtained from herbarium visits, loans, donations or images available at online databases (GBIF 2020, JSTOR 2020, REFLORA 2020). Additionally, approximately 600 exsiccates from adjacent regions, especially from the Andean Region, were examined to clarify doubts regarding morphological similarities and differences regarding the eastern South American taxa, as well as to evaluate the distribution of widely distributed species. We consulted the main *Valeriana* herbaria collections in Brazil (CRI, FLOR, ECT, EFC, FURB, HAS, HBR, HUCS, HURG, ICN, MBM, MBML, MPUC, PACA, PEL, R and RB) and Argentina (BAB, BBB, LP and SI) (acronyms according to Thiers 2020, constantly updated). Donations of duplicates of South American *Valeriana* were requested and sent by the HAS, HUCS, and RB herbaria from Brazil, as well as by the BBB herbarium from Argentina. The types were analyzed through exsiccates and images obtained in virtual databases (JSTOR 2020, REFLORA 2020). The barcode of the exsiccates, when present, was chosen as a priority for inclusion in the material examined. When not referred to the term “barcode”, the sequential number corresponds to the general record of the herbarium collection. In the description of *Valeriana* as a whole, only the relevant synonyms for the eastern South American species are cited.

Fieldwork:—Twelve expeditions to collect samples and images were made in the lowlands and highlands of southern Brazil (Rio Grande do Sul, Santa Catarina and Paraná states), all between March 2018 and November 2019 (Table 1). Additionally, we conducted a fieldwork expedition in the Pampean lowlands of Argentina in November 2019. These expeditions resulted in the collection of 45 specimens of seven eastern South American *Valeriana*, including the new *V. aparadensis*. We also analyzed about 60 samples from 15 Brazilian species of *Valeriana* previously collected between March 2016 and March 2018 by the first author of this study, made in southern and southeastern Brazil. Three native species from southeastern Brazil were observed only in exsiccates, *V. caparaoensis* Rabuske-Silva, Sobral & Iganci (2020: 219), *V. glaziovii* Taubert (1893: 10) and *V. organensis* Gardner (1845: 112). The collected samples were herborized according to Fidalgo & Bononi (1989) and deposited in the ICN herbarium. Duplicates were sent to FLOR, MBM, and RB.

Nomenclatural analysis:—A total of 56 names obtained in the literature and referred to the eastern South American *Valeriana* were analyzed. Nomenclatural decisions were established based on the analysis of the type materials and protologue, as well as on the analysis of the previous typifications referred in the literature. The nomenclatural inferences are in accordance with the standards recommendations of the *International Code of Nomenclature for algae, fungi, and plants* (Shenzhen Code) (Turland *et al.* 2018). Specific issues involving particular typification cases were clarified with the supporting bibliography, especially McNeill (2014) and Prado *et al.* (2015). All names and bibliographic references of the taxa were obtained in the virtual database of *The International Plant Name Index* (IPNI 2020) and checked directly in the protologues.

Morphological analysis and descriptions:—We adopted the morphological concept of species, according to Cronquist (1978) and Aldhebiani (2018), for which a species is considered the smallest group of natural populations that is separated by morphological features that do not overlap. The distinctive features and key characters of each species were obtained based on the comparative analysis of the herbarium collections and the bibliography. Morphological terminology follows Harris & Harris (2006) and Beentje (2010). The selection of useful morphological features for species differentiation was based on the morphological study, plus in the following previous studies of the genus: Müller (1885), Graebner (1899), Borsini (1944, 1962a, 1962b, 1963, 1966a, 1966b, 1999), Meyer (1951, 1958, 1960), Xena de Enrech (1992, 1993), Sobral (1999a, 1999b, 2000), Kutschker (2008b, 2011), Weberling (2003, 2004, 2005, 2007), Weberling & Bittrich (2016), and Rabuske-Silva (2018). The description of the inflorescences was based specially on Müller (1885), Borsini (1944, 1962a), Weberling (1961, 1965, 1983), Larsen (1986), Sobral (1999a, 1999b, 2000), Kutschker (2011), Weberling & Bittrich (2016) and Rabuske-Silva (2018). The fruit characterization was further based on Meyer (1951), Sobral (1999a), Kutschker (2008a, 2008b) and Jacobs *et al.* (2010). Samples were measured using a digital caliper. Millimetric structures such as flowers, fruits and trichomes were observed in a stereomicroscope. Fruits and flowers were measured from fresh material or rehydrated from exsiccates.

Distribution and ecological data:—Information on phenology, geographic distribution and habitat were obtained by consulting literature, herbarium collections and from fieldwork observations. The collections without geographic coordinates were georeferenced by approximation. Collections with no locality data were disregarded for the reconstruction of coordinates. For the elaboration of the maps, the georeferenced data were linked to ArcGIS 10.1, using a single point georeferenced by population in each locality.

Conservation status assessments:—Species were categorized for conservation status based on IUCN Red List categories and criteria (IUCN 2017). Both extension of occurrence (EOO) and area of occupancy (AOO) were estimated in GeoCAT (Bachman *et al.* 2011), based on georeferenced data from documented collections and observation of populations in nature. The data obtained from species only occurring in Brazil were compared to those of Martinelli & Moraes (2013) and Rabuske-Silva (2018).

Figures:—The most representative illustrations (line-drawings) of the species found in the literature were referenced, and photographic images of all species were selected. The figures included in this study were obtained in expeditions, virtual databases, or provided by collaborators. The images of the fruits were obtained in a Leica M165 stereomicroscope, after rehydration. The maps were developed in ArcGIS 10.1, according to the criteria mentioned above.

Results and Discussion

We confirmed the occurrence of 18 species of *Valeriana* native from eastern South America: *Valeriana aparadensis* sp. nov. ined., *V. bornmuelleri* Pilger (1910: 7), *V. caparaoensis* Rabuske, Sobral & Iganci (2020: 219), *V. catharinensis* Graebner (1899: 427), *V. chamaedryfolia* Chamisso & Schlechtendal (1828: 129), *V. eichleriana* (Müller 1885: 348) Graebner (1899: 434), *V. eupatoria* Sobral (2000: 149), *V. glaziovii* Taubert (1893: 10), *V. glechomifolia* Meyer (1960: 197), *V. iganciana* Rabuske-Silva & Külkamp (2018: 275), *V. organensis* Gardner (1845: 112), *V. polystachya* Smith (1791: 51), *V. reitziana* Borsini (1962a: 161), *V. salicariifolia* Vahl (1806: 16), *V. scandens* Linnaeus (1762: 47), *V. sobraliana* Rabuske-Silva & Iganci (2019: 10), *V. tajuvensis* Sobral (1999b: 114) e *V. ulei* Graebner (1899: 436). *Valeriana officinalis* Linnaeus (1753: 31), native from Eurasia, is known in the region only under cultivation, and, therefore, was not described in this work. *Valeriana gilgiana* Graebner (1899: 435) and *V. muelleri* Graebner (1899: 435) are considered new synonyms of *V. salicariifolia*, and *V. kurtziana* Borsini (1962b: 145) a new synonym of *V. polystachya*. A new circumscription of *V. catharinensis* is proposed, and *V. aparadensis*, a new species from southern Brazil, was described and illustrated.

Therefore, the eastern South American *Valeriana* account for about 10% of the genus diversity in South America. All the species, with a single exception of the lianescent *V. scandens*, are endemic from this region. Regarding the distribution and habitat, *Valeriana* in the eastern South America occurs especially in higher elevation habitats of the Atlantic

Rainforest domain, southern and southeastern Brazil, with a few exceptions in the lowlands of the *Pampas* domain. It is remarkable a gradient of growing in the number of species southward in Brazil (Sobral 1999b, 2000; Rabuske-Silva 2018), being Rio Grande do Sul the state with the highest species richness in this country, with 12 species, followed by Santa Catarina (11 spp.) and Paraná (5 spp.). In northeastern Argentina, Uruguay and Paraguay three species were confirmed, *V. polystachya*, *V. salicariifolia*, and *V. scandens*, which are also the most widely distributed in the study area.

Taxonomic history of the eastern South American *Valeriana*

Valeriana scandens was the first *Valeriana* species described in eastern South America, and the first in the New World as a whole, included in the *Species Plantarum* of Linnaeus (1762), and based on collections from Cumana, Venezuela (Barrie 1989a). However, the first endemic species from this region was *V. polystachya*, described by Smith (1791) from collections made in 1767 by the French botanist Philibert Commerson. The specimens analyzed by Smith were collected in the lowlands of the Argentinean *Pampas*, Buenos Aires province ("*in agri bonariensis*"), presumably during Commerson's circumnavigation trip (1766–1769). A few years later, Vahl (1806) described *V. salicariifolia*, based on other collections made by Commerson in the same region. Therefore, the first two endemic *Valeriana* described from the ESA, *V. polystachya* and *V. salicariifolia*, are also the most widely distributed, although until the end of the 18th century registered only on the limits of Buenos Aires.

In the early 19th century, Vellozo (1825: 29) described *V. alpina* Vell., a new lianescent species from Brazil. Although the study covers the current state of Rio de Janeiro and the name is a clear reference to the Brazilian highlands, the origin of the type collection remains unknown. Moreover, the name is illegitimate due to the previous homonym *V. alpina* Adamson (1805: 45), and considered a synonym of *V. scandens* by several authors (e.g. Meyer 1951, Borsini 1962a, Rabuske-Silva 2018). Because of this, the occurrence of *Valeriana* in the Brazilian highlands does not seem to have had much repercussion from Vellozo's study. A few years later, Chamisso & Schlechtendal (1828) described *V. chamaedryfolia*, the first subshrub species from ESA. The description was based on collections made by the German botanist Friedrich Sellow in the "*Brasiliae interioribus regionibus*", most likely made in the granite hills of the Rio Grande do Sul state, southern Brazil (Herter 1945: 128). During this field trip in Brazil, Sellow collected a large number of *Valeriana* species unknown to science, which were described in the second half of the 19th century by Müller (1885), as well as the first records of *V. salicariifolia* in the Brazilian highlands. A second Brazilian subshrub species described was *V. organensis*, collected in 1841 and described in 1845 by the English botanist George Gardner near the apex of the Serra dos Órgãos, Rio de Janeiro state. In the same occasion, Gardner publish a new lianescent species from the same region, *V. candolleana* Gardner (1845: 112). Therefore, until the middle of the 19th century, at least seven species names of *Valeriana* from ESA were recognized. However, Höck (1882), in one of the first revision treatments of Valerianaceae, included under *Valeriana* sect. *Valerianopsis* (series *V. polystachyae*), only three endemic species from this region, *V. salicariifolia*, *V. polystachya* and *V. chamaedryfolia*. No taxonomic treatment has been proposed for the species from the Brazilian highlands described by Vellozo (1825) and Gardner (1845).

A few years later, Müller (1885) transferred seven Brazilian Valerianaceae devoid of setose calyx-lymb to *Valerianopsis* (Weddel 1858) C.A.Müll., including the species treated by Höck (1882), plus *Valeriana organensis*, based on this single character. Thus, under this new genus, Müller described three new species to science, *Valerianopsis angustifolia* C.A.Müll., *V. foliosa* C.A.Müll. and *V. eichleriana* C.A.Müll., all from the Brazilian highlands. The elevation to genus level of *Valerianopsis* had no repercussion in subsequent studies. Throughout the 19th century, several authors proposed new combinations for ESA species, especially for *Valeriana polystachya*, based on the advent of new genera described for South America.

Graebner (1899) treated most of the species restricted to ESA under the section *Valerianopsis*, as previously conceived by Höck (1882). Graebner also included under this section two new endemic species from the Brazilian highlands, *V. glaziovii* and *V. itatiaiae* Graebn. Other two new species, *V. catharinensis* and *V. ulei*, were included under the section *Euvaleriana* (series *V. laxiflorae*) and under the new section *Phuodendron*, respectively. *Phuodendron* was later recognized as a genus by Dalla Torre & Harms (1905: 512) and by Graebner (1906b). These new combinations and genus transferences were not accepted by Borsini (1944, 1962a) and subsequent works in the second half of the 20th century.

In the early 20th century, new species were described from collections in that region. Dusén (1903: 25) described *V. campestris* Dusén, based on collections made by him in the Serra de Itatiaia, Rio de Janeiro state, southeastern Brazil. Pilger (1910) described *V. bornmuelleri* based on collections made by the German botanist Alfred Bornmüller in the Serra Geral plateau, southern Brazil. A few years later Briquet (1919: 424) described a superfluous name based on the same type of *V. bornmuelleri* Pilger, plus *V. glomerulosa* Briquet (1919: 440), the latter based on material collected by the Argentinean botanist Teodoro Juan Vicente Stuckert in the province of Buenos Aires.

New contributions to the knowledge of the species treated here would come from Borsini (1944), but especially from the 1960s. Meyer (1960), based on collections made by the North American botanist Lyman Bradford Smith in 1956 and 1957 in the Serra Geral plateau, described a new striking herbaceous species *V. glechomifolia.* Two years later, the Argentinean botanist Olga Helena Borsini described two new species from ESA, *V. kurtziana* Borsini (1962b: 145) and *V. reitziana,* the first one restricted to the lowlands of southern Brazil and northeastern Argentina, and the second endemic from the highlands of southern Brazil.

The broad taxonomic revisions of the Brazilian Valerianaceae by Müller (1885) and Borsini (1962a) were followed by regional studies for the states of Santa Catarina (Borsini 1963), Rio Grande do Sul (Sobral 1999a) and São Paulo (Scalon *et al.* 2002). The Pampean region of Argentina and Uruguay maintained the same species historically described, except for synonymizations under *V. polystachya* and *V. salicariifolia*, being partially treated by Herter (1927, 1930), Borsini (1944), Cabrera (1965), Bacigalupo (1974), and Cabrera & Zardini (1978). In the late 20th century, two new species of *Valeriana*, all endemic from the Brazilian highlands, were described by Sobral (1999b and 2000), *V. tajuvensis* and *V. eupatoria*. Kutschker (2008a), compiling the Valerianaceae from the Southern Cone, considered 14 taxa with occurrence in northeastern Argentina, Uruguay, Paraguay and southern Brazil, all under *Valeriana*, 12 of them restricted to this region. Rabuske-Silva (2018) considered 14 species of *Valeriana* with natural occurrence in Brazil, proposing new synonyms. In the last decade, three new species were described from the Brazilian highlands, *V. iganciana*, *V. sobraliana* and *V. caparaoensis*. Meyer (1965) points out that the group of *Valeriana* species from ESA would be a “secondary and disjunct center of diversity” in South America, and Sobral (2000) states that the group is significantly distant from the Andean stock. However, exclusive morphological features were never suggested for the group in the literature, and most taxa were never included in infrageneric categories before.

Comparative Morphology

Habit:—All the eastern South American species of *Valeriana* are perennial, rhizomatous and mostly subshrubs (14 spp., about 78% of the total), five of them eventually reaching the size of shrubs (*V. chamaedryfolia, V. eupatoria, V. iganciana, V. tajuvensis* and *V. ulei*). Only four species are strictly herbaceous (*V. bornmuelleri, V. glechomifolia, V. salicariifolia* and *V. scandens*). Most species are erect, although frequently with slightly decumbent branches, and rarely prostrate (*V. glechomifolia*). Only a single species of climbing vine is known until now

(*V. scandens*). *Valeriana tajuvensis* is the largest species recorded for the region, reaching 3 m tall. The smallest species is the herbaceous *V. glechomifolia*, reaching 10 cm tall, smaller in size to Andean species included in sections such as *Aretiastrum*, *Belonanthus*, and *Stangea* (about 2 cm tall).

Indument:—Regarding the type of trichomes, they are usually normal or flagelliform, white or hyaline, tufted or scattered, antrorse or retrorse, appressed or not. They are usually quite inconspicuous, measuring 0.1–2 mm long. Glandular trichomes were observed in the nectariferous tissue located inside the corolla gibbous of *V. scandens* (Duarte-Silva *et al.* 2010b, Rabuske-Silva 2018). The indument is usually glabrous, eventually pubescent, puberulent, puberulous or pilose. Plus, it can be rarely waxy, as observed in the strongly fistulose branches of *V. polystachya*. *Valeriana aparadensis* and *V. catharinensis* can be distinguished by the glabrous or at most puberulous leaves of the former, while in the latter it is quite pubescent. Although taxonomically useful, variations in pubescence are common in many species of the genus and require caution in their use (Eriksen 1991, Weberling 2003).

Roots:—The eastern South American *Valeriana* have two basic types of roots: a) filiform adventitious roots, derived from rhizomes, and b) short tap-roots (based on Meyer 1951) (Figure 2). The roots can be thickened and fibrous or filiform and delicate, according to the species, or even to the specimens development stage. Older individuals of subshrubs and shrubs have a short tap-root, generally associated with a shorter thickened rhizome (Figure 2, C). A typical case is that of *V. ulei*, which inhabits rocky outcrops, canyon walls and ravines. We observed young and fully flowering individuals with long rhizomes, about 10–18 cm long, full of filiform roots, and old specimens with short rhizomes and tap-roots. Despite the importance of roots to traditional medicine, the description of this feature is generally absent or ambiguous in the taxonomic literature. Borsini (1946), based on material collected in Salta, Argentina, described *V. scandens* as rhizomatous, with tuberous roots measuring about 3.5 cm long and 1.5 cm in diameter. Meyer (1951) argues that the characterization of this taxa as rhizomatous is dubious, since this portion is rarely preserved in herbarium materials. Some years later, Borsini (1962a) cites “remarkable tuberous roots” also for the Brazilian specimens of *V. scandens*. Bacigalupo (1974) observed that in the material of *V. scandens* collected in Entre Ríos, Argentina, “no such tuberosities were observed, only thin roots and radicant stoloniferous branches” [our translation]. Rabuske-Silva (2018) observed that older individuals of this species, at least in Brazil, present a narrow and short tap-root surrounded by a large number of filiform roots (Figure 2, A). Both the roots and rhizomes of *V. officinalis,* a European species found in the region under cultivation, are traditionally used in medicinal infusions.

There are no reports of native species from ESA being used for the same purpose. Regarding the color, the roots are usually white to paleaceous. The adventitious filiform roots emitted by the rhizome of *V. salicariifolia* (Figure 2, B) are often darkened in dry material (Sobral 1999a, Rabuske-Silva 2018).

Stems:—The stem has monopodial and dichotomous growth (Figure 3, A) and can be erect or decumbent, woody or herbaceous, eventually long-creeping (*V. bornmuelleri* and *V. glechomifolia*) and rarely climbing (*V. scandens*). Its base usually measures 3–10 mm in diameter, although rarely can reach considerable sizes, up to 15 cm (*V. eupatoria*, *V. tajuvensis*). Rhizomes are observed in all the species from ESA, although more distinguishable in the early stage of development in subshrubs and shrubs. They are usually short, measuring 2 to 20 cm long, in some cases reaching about 100 cm long and profusely branched (*V. salicariifolia*) (Figure 2, B). Fistulous stems (hollow-stemmed) are observed in both herbaceous and woody species, which constitutes a striking feature of *Valeriana* in the region, being very pronounced in *V. polystachya* (Rabuske-Silva 2018) (Figure 3, B). This feature can be inconspicuous in the lignified branches of woody species (e.g. *V. tajuvensis* and *V. ulei*). The defoliated basal portion of the woody branches presents typical annular scars, resulting from the abscission of the caulinar leaves (Figure 3, C). Herbaceous branches may be terete, sulcate or striated and in cross-section they may be circular or angular.

Leaves:—The leaves are opposite and decussate, without interpetiolar stipules. Regarding the division and branching, the leaves can be entire, pinnatifid, pinnatipartite, pinnatisect, pinnately lobed or lyrate. Lobes are sometimes so deep and differentiated that they resemble leaflets of a compound leaf, as observed in *V. aparadensis*, *V. caparaoensis*, *V. catharinensis*, *V. polystachya* and *V. scandens*. The margin can be entire, crenate, serrate, crenate-serrate, lacerate or lobed, and is often revolute to subrevolute and rarely hyaline (*V. iganciana* and *V. salicariifolia*). The teeth are generally antrorse, with regular or irregular shape and size, distributed along the margin of the leaf blade (e.g. *V. chamaedryfolia*) or restricted to the distal third (e.g. *V. eichleriana*, *V. iganciana* and *V. reitziana*). Regarding the two-dimensional shapes, the leaf blades can be elliptic, lanceolate, linear, orbicular to reniform (*V. glechomifolia*), ovate, obovate, oblanceolate (spatulate), or even form varied combinations in a single specimen. They are generally slightly discolorous, and its coloration varies from dark green to light green. The abaxial face is usually lighter, eventually grayish (e.g. *V. salicariifolia*) or with purple tinges, as observed in *V. aparadensis* and *V. caparaoensis*. When dry they can be paleaceous or darkened. The vein color is also variable and may be lighter than the leaf blade (e.g. *V. ulei*) or darker (e.g. *V. catharinensis*), this feature being more visible on the abaxial face. The venation is usually pinnately veined, eventually anastomosing (e.g. *V. catharinensis*) or 3-veined from the base (*V. ulei*). The texture is coriaceous or chartaceous, which is useful for the differentiation of some species, such as *V. eichleriana* and *V. reitziana*, respectively. *Valeriana eichleriana* and *V. iganciana* display a large degree of leaf scleromorphism, possibly an adaptation to the rocky and windy habitats, which gives the wrinkled appearance observed in dry material. The leaf base can be sessile (e.g. *V. eichleriana*), petiolate (e.g. *V. eupatoria*, *V. sobraliana*), or more frequently pseudopetiolate, with eventual inconspicuous basal lobes (e.g. *V. catharinensis*). The pseudopetioles considered in this studyare measured between the node and the first pair of conspicuous basal lobes, disregarding those most inconspicuous, according to Sobral (1999a) and Rabuske-Silva (2018). The leaves base can be attenuate, auriculate (e.g. *V. salicariifolia*), cuneate, obtuse, rounded, rarely subcordate or cordate (*V. scandens*), frequently asymmetrical and lobed, forming the aforementioned pseudopetioles. The leaves apex can be acute, attenuated, acuminate, rounded, obtuse, and rarely truncate to praemorse, as observed in the basal leaves of *V. eichleriana* and *V. reitziana*. Some species may present an apiculum (e.g. *V. salicariifolia*), quite inconspicuous, or a small reflex and pungent projection, touch sensitive (*V. iganciana*).

Kutschker (2011: 249) cites the leaf morphology as one of the most variable aspects in *Valeriana* due to the intraspecific and interspecific polymorphism. Xena de Enrech (1993: 115) considers the leaves as characteristically diagnostic of the 16 species of Venezuelan *Valeriana*, a number similar to that observed in eastern South America, often providing “more diagnostic information than other plant characters” [our translation]. This author mentions as useful features the arrangement of leaves in the branches, composition, shape, margin and apex. Most species of *Valeriana* from ESA have marked heterophylly between basal and caulinar leaves. Basal leaves are considered here as those restricted to the basal portion of the new branches, both in young specimens with undivided branches, as well as in old, profusely branched individuals. They are usually entire, petiolate to subpetiolate, quite congested and subrosulate, due to the shortening of the internodes in the basal portions of the new branches (Borsini 1963). None species display the typical basal rosettes, often observed in Andean species (Kutschker 2011, Rabuske-Silva 2018). Distal or caulinar leaves are here considered all the other leaves of the same branches, being generally lobed and sessile, as well as more lax, due to the larger internodes. Significant morphological differences between the basal and distal leaves are observed in at least seven species: *V. aparadensis*, *V. caparaoensis*, *V. catharinensis*, *V. organensis*, *V. polystachya*, *V. scandens* and *V. sobraliana* (Figure 4, A). Successive branching gives the overall appearance of leaves gathered at the apex of the branches in some woody species (subrosulate), as typically observed in *V. chamaedryfolia*, *V. iganciana*, *V. tajuvensis* and *V. ulei* (Figure 4, B). The old leaves are seasonally senescent, often being observed still attached to the branches (Figure 4, C). We observe that the fall is often due to the breakdown of pseudopetioles, which remain attached to the branches even longer than the released leaf blades. Finally, after a long succession of branches, only the scars of the nodes remain in the most basal portions of the plant. The German biologists Jan Albert Rispens and Jürgen Momsen (personal communication) observed that the uneven size of internodes and leaves is due to unequal development rates in different periods or seasons. Generally, from the base to the apex, the nodes become increasingly lax and the leaf morphology gradually changes towards the base of the inflorescence, as previously observed by Rabuske-Silva (2018).

Inflorescences:—Weberling (1961) defines the basic inflorescence of *Valeriana* as determinate and monotelic truncate (thyrse). Kutschker (2011), based on comparative studies, recognizes indeterminate basic forms of polytelic inflorescences as applicable terms (e.g. capituliform, paniculiform, spike like), treatment followed by Rabuske-Silva (2018). The inflorescences of the eastern South American *Valeriana* may be terminal or axillary, and consist of panicles of dichasial cyme arranged helically, quite congested in some species, as observed in *V. catharinensis*, *V. glechomifolia*, *V. iganciana*, *V. organensis*, *V. sobraliana* and *V. ulei*. They are, therefore, paniculiform (most species), capituliform to umbelliform, and rarely entirely spike like (*V. reitziana*), reaching up to 1 m in length in *V. polystachya*. According to Borsini (1944), the length of the inflorescences should not be used to differentiate species, due to the particularities of the morphology according to the stage of flower development. The secondary branches (or paracladia *sensu* Larsen 1986) may be paniculiform (most species), spike like (several species, e.g. *V. chamaedryfolia* and *V. polystachya*), and eventually glomeruliform and pauciflorous (*V. bornmuelleri*, *V. eichleriana* and *V. reitziana*). Inflorescences with pistillate flowers usually have spike like paracladia. The number of secondary branches is eventually useful in the diagnosis of some species, ranging from 2 to 14 pairs (*V. iganciana* and *V. polystachya*, respectively), although this feature should be used with parsimony, due to the striking polymorphism of the *Valeriana* inflorescences.

Bracts and bracteoles:—As previously observed by Kutschker (2011) and Rabuske-Silva (2018), the concept of bracts and bracteoles is quite variable in the literature of the genus *Valeriana*. Bracts is here considered the modified and specialized leaf structures of rachis, according to Sobral (1999a) and Beentje (2010). Bracteoles are here considered those structures directly associated with flowers. In *Valeriana* as a whole, the proximal bracts generally repeat the shape of the distal leaves, decreasing in size towards the apex of the inflorescence (Borsini

1944). Despite the strong polymorphism of these structures, we observed that the shape gradually becomes linear, elliptical, lanceolate or ovate in the analyzed species. They measure from 10 to 300 mm long at the base of the rachis, reaching a few millimeters near the apex. The base is often connate and lobate, eventually auriculate (e.g. *V. chamaedryfolia* and *V. eupatoria*), and is generally pubescent and eventually glabrous. Eventually, the tufts of trichomes in the nodes can ascend to the middle of the distal bracts and bracteoles. The bracteoles are usually elliptic or ovate, eventually lanceolate, spatulate, oblong or linear, as well as conduplicate, navicular, and are positioned in pairs at the base of flowers and fruits, which remain involved until maturation.

Calyx:—The calyx is 5-merous, gamosepalous, persistent at the top of the achene. In the endemic species from ESA, it is always eppapose (devoid of a plumose or feathery pappus). It is often absent or vestigial, as can be observed in the achenes of *V. aparadensis, V. caparaoensis, V. catharinensis, V. organensis, V. polystachya, V. salicariifolia, V. sobraliana* and *V. ulei*. When the calyx is conspicuous, it is always drastically reduced, slightly dentate or forming a wavy ring, as can be seen in the achenes of *V. bornmuelleri, V. chamaedryfolia, V. glaziovii* and *V. iganciana*, or annular, cup-shaped or saucer-shaped, as observed in *V. eichleriana, V. eupatoria, V. glechomifolia, V. reitziana* and *V. tajuvensis*. The only pappose exception is the widely distributed *V. scandens* with a setose calyx-limb (*sensu* Meyer 1951). The bristles correspond to modified sepals (Weberling & Bittrich 2016), with 12 to 14 segments, tightly rolled in the immature fruit, and unrolled in a pappus-like calyx at the end of the anthesis. When dentate, the calyx usually displays 4–6 unequal-sized teeth (or lobes), quite inconspicuous, corresponding to the sepals.

In exsiccates, the dehydrated annular calyx may exhibit a slight sinuosity, resembling the teeth of a dentate calyx (Rabuske-Silva 2018). In fact, both forms (annular and dentate) seems to be closely related, and the boundaries between them are not always so clear. The variation observed in tooth size is probably related to the flower zygomorphy, sometimes inconspicuous, which confers an actinomorphic aspect to both the calyx and corolla. The calyx may be oblique, due to the dorsal curvature of some achenes. The coloration is greenish in immature fruits, becoming stramineous at the maturation. The pappus-like calyx of *V. scandens* display a pale green color in the immature fruit, becoming whitish with the unfolding of the bristles, as previously observed by Rabuske-Silva (2018).

Corolla:—The corollas are 5(6)-merous, gamopetalous, zygomorphic and epigynous (Figure 4, A). The petals (or lobes) have variable and unequal sizes, and the apex can be acute, obtuse or rounded. Floral buds are obovoid and the prefloration is imbricate. After the anthesis, the corolla tube can be campanulate (bell-shaped), cupuliform or infundibuliform (Figure 5, B–C). Most species display a more or less conspicuous gibbous, up to 0.5 mm wide, more visible in staminate or hermaphrodite flowers (Figure 5, detail in A). The androecium is 3(4)-merous, and the stamens are epipetalous, inserted, subexserted or exserted. After the anthesis, the corolla fall, taking place the anthesis of a new flower contained in the same axis (Weberling 1961) (Figure 5, D).

The eastern South American *Valeriana* exhibit a strong floral dimorphism, as previously observed by several authors (e.g. see Graebner 1899, 1906a, 1906b; Weberling & Bittrich 2016). Most species are dioecious (13 spp.), eventually gynodioecious (*V. bornmuelleri*, *V. glechomifolia*, *V. polystachya* and *V. tajuvensis*), due to abortion of reproductive structures (Borsini 1963). The hermaphrodite and staminate flowers are generally larger than the pistillate ones and measure 0.8–3.3 mm long, the largest observed in *V. sobraliana*. The pistillate flowers are generally campanulate and measure 0.4–2 mm long in the anthesis, the largest observed in *V. caparaoensis*. The treated species can display a variable combination of three basic floral types: hermaphrodite flowers, staminate flowers with a pistilodium and pistillate flowers with vestigial staminodes. The last two flower morphotypes have remarkable variations regarding to reproductive aspects. Duarte-Silva *et al.* (2010b) observed a pattern of three floral morphotypes in *V. scandens*. Besides the hermaphrodite flowers, two morphotypes of pistillate flowers with vestigial staminodes were segregated by morphometric parameters and the presence/absence of pollen in the anthers. This would be the first case of gynomonoecious-gynodioecious sexual expression described for the genus, which raises an important question regarding the sexual diversity of *Valeriana*, as pointed by Rabuske-Silva (2018). The mating system of some species is quite controversial in protologues and taxonomic revisions (e.g. *V. polystachya*), with great implications in studies of ecology, evolution and conservation. The characterization of the sexual expression should be better elucidated as they increase the number of anatomical and morphological studies, plus collections of those taxa that are still poorly sampled (e.g. *V. bornmuelleri* and *V. glechomifolia*). Regarding the color, the corollas are white to cream, eventually greenish, and may eventually display purple pigments in the floral buds and petals, as observed in *V. catharinensis* and *V. iganciana*.

The flowers display a little interspecific morphological variation, although several authors include flowers features as key characters in taxonomic treatments of the genus (e.g. see Meyer 1951, Borsini 1966b, Xena de Enrech 1992). Kutschker (2011) argues that flowers do not constitute a good feature for species diagnosis in the southern Andes. Despite this, considering the comparatively small species number treated here, aspects such as shape, size and indument of flowers are taxonomically useful and reliable. For example, as observed by Rabuske-Silva (2018), *Valeriana bornmuelleri* and *V. tajuvensis* have pubescence restricted to the corolla base of the staminate flowers (Sobral 1999a, 1999b). Otherwise, *Valeriana glaziovii* and *V. glechomifolia* have pubescence restricted to the apex of the corolla lobes (Meyer 1960, Borsini 1962a).

Gibbous:—Eastern South American *Valeriana* generally displays an inconspicuous gibbosity with 0.1–1 mm in length, perceived only as a small protuberance on the side of the corolla tube (Figure 5, A). The exception is *V. scandens*, which has a pronounced gibbosity, up to 1.8 mm long. The gibbosity of *V. scandens* is presumably related to pollination, due to the presence of tissue with nectariferous trichomes (Duarte-Silva *et al.* 2010b). Except for this species, there are no studies confirming the presence of nectariferous tissue, nectariferous chamber or septal rudiments in the other treated species. The corollas of the species of *Valeriana* endemic from ESA are at most classifiable as slightly gibbose, specially the hermaphrodite or staminate flowers, or regular (without an conspicuous gibbosity), in the case of pistillate flowers.

Androecium:—*Valeriana* typically has 3 (rarely 4) stamens, which remain inflected in the floral bud, becoming erect to arcuate during anthesis. In the eastern South American species they are usually exserted, eventually subexserted to inserted (*V. polystachya* and some morphotypes of *V. scandens*). The stamens measure 1–2.5 mm long, eventually reaching twice the length of the corolla tube (e.g. *V. bornmuelleri* and *V. caparaoensis*). Filaments are free, subulated and epipetalous (inserted), adnate to the corolla tube in the basal or distal third. Anthers are bithecals, connate and apparently tetrasporangiate, basifixed or dorsifixed, introrse, white or yellow, 0.3–0.8 mm long. The thecae are more frequently globose, eventually elliptic, with rimose dehiscence. All the treated species have pistillate flowers with three inconspicuous vestigial staminodes, 0.1–0.5 mm long, laminar and apically rounded, without pollen grains (Sobral 2000, Duarte-Silva *et al.* 2011). Pollen indument is a very promising feature for *Valeriana* taxonomy, as pointed out by Xena de Enrech (1993), but there is no information regarding the treated species in the analyzed literature.

Gynoecium:—As observed in the genus as a whole, the ovary is inferior, sessile, tricarpellate, gamocarpellate and trilocular, with only one fertile locule containing an ovule pendulous and anatropous (Sobral 1999a, Jacobs *et al.* 2010, Kutschker 2011, Weberling & Bittrich 2016, Rabuske-Silva 2018). As observed by Borsini (1963) and Bacigalupo (1974) the sterile and atrophied ovary of staminate flowers apparently continues to develop after anthesis, resembling a pedicel or a small achene (Figure 5, detail in A). The style is white to hyaline, cylindrical, erect or arcuate, papillose, generally glabrous, rarely with some sparse hyaline trichomes, as observed in *V. sobraliana* (Borsini 1963, under *V. ulei*; Rabuske-Silva & Iganci 2019). It is generally quite inconspicuous, measuring 0.3–0.7 mm long, eventually reaching 1.4 or 1.8 mm (*V. caparaoensis* and *V. sobraliana,* respectively), exceptionally 1.8–4 mm (*V. scandens*). It may reach, in some cases, twice the length of the corolla tube, as observed in *V. tajuvensis* (Sobral 1999b, Rabuske-Silva 2018). The apex is usually slightly thickened (capitate) before the opening of the lobes. The stigma is trifid, papillose. The lobes are 0.1–0.3 mm long. The pistillodium (staminate flowers) is generally inconspicuous, up to 0.8 mm long (*V. organensis*), eventually resembling a viable pistil (Figure 5, A).

Fruits:—The fruits are achenes, eventually referred as cypselas[130], and can be elliptic, elliptic-oblong, ovate, ovate-elliptic, globose, ovate-globose, subglobose, oblong or pyriform, the latter being restricted to *V. scandens* (Figures 6 and 7). They measure 0.8–4 × 0.3–2.5 mm, the smallest observed in *V. bornmuelleri* and the largest in *V. iganciana*. The base is rounded, cordate or truncate, frequently asymmetric. The apex is generally rounded to obtuse, eventually emarginate to valeculate, as observed in *V. aparadensis, V. caparaoensis*, *V. catharinensis*, *V. sobraliana*, and *V. ulei*, rarely attenuate (*V. scandens*). The emarginate or valeculate apex derives from the development of two lateral wings, which protrude apically (Rabuske-Silva & Iganci 2019, Rabuske-Silva *et al.* 2020). This feature varies according to the maturation stage of these achenes, which confers great heterogeneity of achene shapes in each species. The dorsal (abaxial) face has the fertile carpel and the ventral (adaxial) face the two sterile carpels (Jacobs *et al.* 2010). Recent studies highlight the taxonomic importance of the infertile locules as key characters for genus and species differentiation in Valerianaceae, which have a great influence on the achene shape and a great morphological variation when observed in cross-section (Kutschker 2008b, Jacobs *et al.* 2010). However, among endemic *Valeriana* from ESA, the infertile locules are always quite small and apparently do not offer a good diagnostic character. On the other hand, the achene two-dimensional shape in cross-section may be useful as an additional character to the differentiation of some species. In cross-sections (top view) they are elliptical (flattened dorsiventrally), circular, triquetrous (most species) and more rarely pentagonal. Another striking feature of the *Valeriana* achenes are the ribs (costa), which consist

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[130] The term achene is widely used, although it is sometimes referred to as cypsela. We are aware of the study by Marzinek *et al.* (2008), who established that the correct nomenclature for fruits with a lower ovary is cypsela. However, considering that the term achene is historically widely used under Valerianaceae, we prefer to adopt a broader concept, not segregating these two types, considering both under achene.

of prominent vascular bundles located in the mesocarp, generally visible in the fruit epidermis (Sobral 1999a, Jacobs *et al.* 2010). The eastern South American *Valeriana* can be 3-costate (two ribs in the margins and one central), 5-costate (two lateral ribs and three central) or 6-costate (two lateral, three ventral and one dorsal). Some ribs are not always conspicuous and the count varies in the description of some species (e.g. *V. glechomifolia* and *V. scandens*). In lateral view, the achenes can be erect or dorsally curved, sometimes referred in the literature as concave-convex, which is due to the dorsal projection of the calyx. The indument is generally papillose (Figure 7, D and E).

Seeds:—The variation in the shape of seeds are generally not described in the literature. This is due to the relative morphological homogeneity of these structures (Kutschker 2008b, 2011; Jacobs *et al.* 2010). We observe variations regarding size and shape and eventually in color in some species from the study area. In order to search for new taxonomically useful features, we propose general descriptions of seeds, which can be potentially useful in cases where only the achene is available for identification (damaged material in herbarium, or even ecological studies). However, seed features must be used with parsimony and in a complementary way in the identification of taxa. The seeds of the eastern South American *Valeriana* are elliptic, oblong or pyriform, measuring 1.2–1.5 × 0.7–1 mm. The apex is obtuse, rounded, acute or attenuate, and the base is generally rounded. In cross-section the seeds have the marks of the internal wall of the pericarp, which usually has a sclerified endocarp, as observed in the *Valeriana* species analyzed by Jacobs *et al.* (2010). The expansive growth of the seed imprints in them the general shape observed in the achenes (elliptic, circular, triquetrous, or pentagonal). The surface is smooth, amber or stramineous. The color of the surface seems to be conditioned to the stage of development of the seed. Like the genus as a whole, the species studied also have a straight and long embryo, which is exalbuminous, pendulous, not adhered to the pericarp, besides elliptical, flat and fleshy cotyledons and minute radicles (Kutschker 2008b, 2011; Jacobs *et al.* 2010).

Chromosome number

Eight eastern South American species had their chromosome number determined, seven of them with 2n = 32 reported: *Valeriana catharinensis*, *V. chamaedryfolia*, *V. eichleriana*, *V. glaziovii*, *V. organensis*, *V. polystachya* and *V. salicariifolia* (Rice *et al.* 2015). The exception is *V. scandens* (as *V. scandens* var. *scandens*), with 2n = 28 (Xena de Enrech 1992, Rice *et al.* 2015), and the variety *V. scandens* var. *candolleana*, with 2n = 56 (Xena de Enrech 1992, Rice *et al.* 2015). This is most likely due to origins in different floristic contingents, given that *V. scandens* belongs to a clade of species from Central America, and the other species gathered around *V. polystachya* most likely have the same origin in the clade of South American Andean species recovered by Bell *et al.* (2012).

Phytochemistry

The strong and fetid smell of *Valeriana* is due to the presence of terpenoids and sesquiterpenoids (valepotriates) present in idioblast cells of different plant organs (Cronquist 1981, Sobral 1999a, Weberling & Bittrich 2016). It is remarkable in basal marcescent leaves, as well as in dry and herborized material, being a useful feature for the diagnosis of the genus in nature, quickly verifiable with the leaves maceration (Rabuske-Silva 2018). In some cases, the volatile smell can be felt even at some meters of the specimen in the field work (e.g. *V. bornmuelleri*, *V. eupatoria*). The flowers of some species have sweet, pleasant aroma (e.g. *V. organensis, V. polystachya, V. tajuvensis*). There are no records of medicinal use by traditional communities of any native species of *Valeriana* from ESA. However, many pharmacological studies about Brazilian species, especially with *V. glechomifolia*, have shown the promising potential of these species as an antidepressant (Maurmann 2006, Maurmann *et al.* 2009).

Floral visitors and associated fauna

Studies related to floral visitors, pollinators, predation and associated fauna in *Valeriana* species are scarce. Rabuske-Silva (2018: 28 and 29) points to the presence of Diptera in the flowers of *V. chamaedryfolia* and *V. ulei*, Hemiptera in *V. eupatoria* and *V. salicariifolia,* Araneae in *V. tajuvensis*, as well as Coleoptera, Hymenoptera and Araneae in *V. chamaedryfolia* and *V. salicariifolia*. Despite the absence of studies that confirm the presence of nectariferous tissue in the *Valeriana* species endemic from the region, as confirmed in *V. scandens* (Duarte-Silva *et al.* 2010b), during fieldwork we observe a viscous secretion within the corollas of several species. We also observed Hymenoptera in *V. bornmuelleri*, *V. iganciana*, and *V. polystachya,* as well as Opiliones under the leaves of *V. aparadensis*.

Distribution, richness and endemism

Distribution patterns in eastern South America:—The presence of *Valeriana* in extra-Andean regions, especially in the lowland grasslands of Argentina and mountains of Brazil, has long been reported in the literature (Höck 1882; Müller 1885; Graebner 1899, 1906; Meyer 1951, 1960). The analyzed species present a strong relation between their distribution patterns and mountain ranges, plateaus, massifs, sets of hills or even *pampas* (lowland grasslands) in the study area. The same correlation was previously observed among species of the Venezuelan Andes and Páramos (Xena de Enrech 1993), and southern South America (Kutschker & Morrone 2012). These may be presumably related to vicariant patterns, which occurred with many highland taxa from southern and southeastern Brazil (Safford 1999a, 1999b). However, other speciation processes may be occurring, involving hybridization, polyploidy and reticulated evolution, still little studied for *Valeriana*. The dynamics of expansion and retraction of grasslands and forests in Brazil was conditioned by glacial and interglacial periods (Martinelli 1996, 2007). The advance of forests over grasslands was provided by the warmer and wetter temperatures of the current interglacial period, limiting the grasslands of Andean influence to the tops and high mountain slopes in the tropics and subtropics (Safford 1999a, 2001).

The montane and submontane habitats are preferred by most of the Brazilian species (15 spp.). They occur generally in the highland grasslands (*campos de altitude*) and montane cloud forests (*florestas nebulares*), on canyon edges, mountain peaks and high slopes, generally difficult to access for field collections. The preferred environments are peat bogs, riverbanks, ravines and rocky cliffs, on organic soils or on cracks of rocky outcrops, usually humid and eventually well drained, between 600 and 2890 m elev. These environments are subject to constant winds, orographic fog, low average annual temperatures and freezing in the colder months, temperature and humidity conditions considered moderate to similar to those observed in Andean environments (Safford 1999a, Iganci *et al.* 2011, Barros *et al.* 2015). The fundamental role of natural and periodic burnings for the modification or maintenance of the highland grasslands ecosystems is largely discussed in the literature (e.g. see Safford 2001, Overbeck *et al.* 2007). Nevertheless, its influence on the biological cycle and habit of *Valeriana* is still not clear.

All the 18 treated species occur in the Atlantic Rainforest domain (ARD) (*sensu* Iganci *et al.* 2011), being 13 of them endemic (about 70% of the total). Most of the ARD species occur in the *Campos de Cima da Serra* region (Subtropical Highland Grasslands, SHD), in the Serra Geral Plateau, southern Brazil (14 species), being seven species endemic from this region, about 40% of the total from eastern South America. In the High Altitude Tropical Grasslands

(HTG) in southern and southeastern Brazil (Serra do Mar and Serra da Mantiqueira mountain ranges, plus the Serra do Caparaó massif) six species occur, five of them endemic: *Valeriana caparaoensis, V. glaziovii, V iganciana, V. organensis, V. sobraliana*. The only exception is *V. scandens*, widely distributed in the region. Only two species are considered strictly endemic from the Serra do Mar mountain range: *V. iganciana* and *V. sobraliana*. The first is endemic from the Serra do Tabuleiro plateau, Santa Catarina state, southern boundary of the Serra do Mar mountain range (Rabuske-Silva & Külkamp 2018). *Valeriana sobraliana* displays a cohesive distribution in the coastal mountain range of Paraná and northeastern Santa Catarina states, also in the southern Serra do Mar mountain range (Rabuske-Silva & Iganci 2019). Regarding the other species restricted from HTG, *V. organensis* occurs both in the Serra do Mar and in the Serra da Mantiqueira mountain ranges. *Valeriana glaziovii* is strictly endemic from the Serra da Mantiqueira, states of Minas Gerais and Rio de Janeiro, and *V. caparaoensis* from the Serra do Caparaó massif, between the states of Minas Gerais and Espírito Santo (Rabuske-Silva *et al.* 2020).

Five species were recorded in the lowlands of the *Pampas* domain (PD), also called *Rio de La Plata* grasslands, a wide region of extensive grasslands with sinuous relief and small hills, up to 600 m elevation, between southern Brazil, Uruguay and northeastern Argentina (Iganci *et al.* 2011). These species occur in ecotone regions with the ARD and therefore should not be considered endemic from the PD: *V. bornmuelleri*, *V. chamaedryfolia, V. polystachya, V. salicariifolia* and *V. scandens*. The first two are sparsely distributed in the state of Rio Grande do Sul, Brazil. The other three are shared with Argentina, Paraguay and Uruguay (Kutschker 2008a). *Valeriana polystachya* occurs widely throughout the PD, with some records at lower elevations of the Serra Geral plateau, in the ecotone with the ARD. The eastern South American endemic species of *Valeriana* with the widest distribution is *V. salicariifolia*, occurring both in the lowland grasslands of the PD and in the highland grasslands of the ARD, with southern boundary in the Buenos Aires province, northeastern Argentina, and northern boundary in the state of São Paulo, southeastern Brazil (Scalon *et al.* 2002, Rabuske-Silva 2018, Rabuske-Silva *et al.* 2020).

Two species have populations occurring in isolated areas of neighboring phytogeographic domains or regions. In the north of the study area, a single population of *V. scandens* was recorded in highland swamps (*brejos de altitude*) in the Serra da Guia, state of Sergipe, Brazil. This mountainous region is located within the Caatinga domain, but presents typical species from the ARD restricted to above ca. 600 m elevation (Tabarelli & Santos 2004). The same occur with other population recorded in the municipality of Bonito, Mato

Grosso do Sul, a region with some spots of flora from the ARD within the Cerrado domain. Southwards the study area, populations of *V. polystachya* were recorded in humid areas in the province of Río Negro, Argentina, in the transition zone between the PD and the Patagonia Region (Figure 1).

Origins of the eastern South American *Valeriana*:—The origin of the studied species of the genus *Valeriana* remains poorly known. Of the 18 species, only two were previously included in phylogenetic and biogeography studies: *V. polystachya* and *V. scandens*[131] (Bell *et al.* 2012, Kutschker & Morrone 2012). *Valeriana polystachya* is phylogenetically related to species from the southern Andes, named Southern Andean Clade by Bell *et al.* (2012). *Valeriana scandens* has a center of origin in Central America, with current distribution throughout Tropical America, from Florida, in North America, to the north and northeast of Argentina, in South America (Meyer 1951, 1976; Bell *et al.* 2012). This species belongs to the Central American Clade recovered by Bell *et al.* (2012). It is understood, therefore, that these two species belong to floristic contingents with quite different natural histories. In a broad biogeographical view, all the eastern South American species of *Valeriana* (with the exception of *V. scandens*) can be treated as a restricted group, geographically quite separate from the Andean stock (Sobral 2000, Rabuske-Silva & Iganci 2019).

The data recovered by Bell *et al.* (2012) indicate that *Valeriana scandens* would have radiated from Central America in two directions, one northward and the second southward, reaching the north and northeast of Argentina. Another widely distributed species, although significantly smaller in area when compared with *V. scandens*, is *V. clematitis* Kunth (1818: 327), which occurs from Mexico, spreading through the Andean hillside forests to the Jujuy and Salta departments in northwestern Argentina (Xena de Enrech 1992, 1993; Kutschker 2008a; Zuloaga *et al.* 2019). It is unclear whether *V. scandens* entered and radiated into South America through the Andes (west), such as suggested by the distribution of *V. clematitis*, or through the rainforests of the eastern continent (Amazonian domain and ARD). We have located some records of *V. scandens* on the slopes of the Central and Southern Andean Region (Bolivia and Jujuy, northwest of Argentina), indicating the possibility that both lianescent species, although belonging to distinct clades recovered by Bell *et al.* (2012), may have radiated from same route from the north along the Andean forested slopes. One answer to this subject is still speculative, and depends of studies that correlate the relatively small group of species

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[131] *Valeriana candolleana*, included in the phylogenetic analysis of Bell *et al.* (2012) resulted in the same clade and the same terminal. This name is here considered under the synonymy of *V. scandens*.

emerging in Central America with the current distribution through South America. In this sense, lianescent species may be particularly promising for understanding speciation processes under *Valeriana*.

Valeriana polystachya is positioned among the earlier divergent clades of the Southern Andean Clade, next to species currently restricted to the Southern and Central Andes such as *V. phillipiana* Briquet (1914: 333), and *V. effusa* Grisebach (1874: 19), respectively. The phylogeny recovered by Bell *et al.* (2012) points *V. polystachya* as closely related to *V. phillipiana,* as well as suggesting that the ancestor of *V. polystachya* diversified from the southern Andes in the middle Pliocene (5.3–1.6 mya). Phylogenetic data combined with the Kutschker & Morrone (2012) track analysis indicate that the radiation of this lowland-adapted species occur from the south (PD), later reaching the ecotone with the ARD. This species has unique features among the eastern South American valerians, such as the combination of gynodioecious mating system, hermaphrodite flowers with subexserted stamens, and the ruderal habit, rare among *Valeriana* in South America, which it shares with *V. effusa*.

Infrageneric relationships

Candolle (1830: 633) positioned *V. scandens*, *V. salicariifolia* and *V. polystachya*, under the *Valeriana* sect. *Phu* (or *Valeriana vera*), series II, III, and V, respectively. This author considered only the texture of the stems and the leaf shape for the division of the series. Weddell (1858: 31) briefly described *Valerianopsis* as a section of *Phyllactis* Persoon (1805: 39), gathering shrubs and herbs (rarely with the main stem nule) with bracts with connate base and corolla 5–4-fide. This section originally included nine species from Bolivia, Chile, and Venezuela. Höck (1882) positioned *V. scandens* under *Valeriana* sect. *Euvaleriana* Höck, series *V. scandentis,* which brings together ten species from Central and South America. This treatment brought significant changes regarding the circumscription of *Valerianopsis*, transferring the section to *Valeriana*, expanding its circumscription, and dividing it into three series, all including species restricted to South America: serie *V. macrorhizae*, with six species from the Andes of Argentina, Chile, Peru and Ecuador[132]; serie *V. connatae*, with four species from the Andes of Peru and Colombia[133]; and serie *V. polystachyae*, with five species from the

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[132] The species are *V. coarctata* Ruiz & Pavón (1798: 40), *V. serrata* Ruiz & Pavón (1798: 40), *V. rumicoides* Weddell (1858: 22), *V. macrorrhiza* Poepp. ex Candolle (1830: 635), *V. dinorrhiza* Höck (1882: 54), and *V. mandoniana* Höck (1882: 54).

[133] *Valeriana connata* Ruiz & Pavón (1798: 39), *V. mutisiana* Höck (1882: 54), *V. cordifolia* Höck (1882: 54), and *V. engleriana* Höck (1882: 54).

Andes of Argentina and mountains of the *Pampas*: *V. salicariifolia, V. polybotrya* (Griseb.) Höck (1882: 55), *V. polystachya*, *V. ferax* Höck (1882: 55), and *V. chamaedryfolia*. This treatment was later adopted by Graebner (1899 and 1906).

Müller (1885: 345) elevated sect. *Valerianopsis* to genus [i.e. *Valerianopsis* (Wedd.) C.A.Müll.] to encompass the Brazilian species with eppapose calyx, therefore keeping under *Valeriana* only *V. scandens*. This elevation based solely in the calyx shape was questioned by Borsini (1944, 1962), and not followed by subsequent taxonomic treatments addressing the group (e.g. Borsini 1963, Sobral 1999a, Rabuske-Silva 2018). Stuckert & Briquet (1918: 440) described two new species under the "Series *Polystachyae*", *V. glomerulosa* Briq.[134], from Tucuman, Argentina, and *V. stuckertii* Briq., from Sierra de Córdoba, Argentina. Therefore, until that moment, at least 17 species were considered under *Valerianopsis*, seven of them under the series *Polystachyae*.

Eriksen (1989: 186), positioned *V. scandens* under *Valeriana* subgenus *Phyllactis* (Pers.) Borsini (1944: 302) emend. Eriksen, section *Amplophus* (Rafinesque 1840: 89) Eriksen. Except for this species, only *V. ulei* has, among the species discussed here, a clear position in the classification established by Eriksen, being included in the same subgenus of *V. scandens*, but in the section *Phuodendron* Graebner (1899: 436).

Here we propose a division of the 18 eastern South American *Valeriana* into three sections pre-established by Eriksen (1989), *Amplophus*, *Valerianopsis* (serie *Polystachyae*) and *Phuodendron*, all belonging to the subgenus *Phyllactis*, and separated according to morphological striking features. Moreover, we also present slight increments in the descriptions and an emended description for the serie *Polystachyae*, in order to make them more consistent with the species historically included in each of them.

Identification key to the sections of *Valeriana* in eastern South America

1. Achenes pappose…..………………………………….…………..……....section *Amplophus*
- Achenes eppapose……………………………...……………………………...……..2
2. Inflorescences paniculiform to spike like, the paracladia paniculiform, spike like or glomeruliform…………………………………………...……....….section *Valerianopsis*
- Inflorescences capituliform to umbelliform, rarely lax; paracladia displaying the same general shape…………………………………………………………...…section *Phuodendron*

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[134] A synonymous of *V. polystachya*.

Section I. *Amplophus* (Raf.) Eriksen (1989: 186) Basionym: *Amplophus* Rafinesque (1840: 89). Type:—*Valeriana scandens* L.

Scandent herbs, gynomonoecious-gynodioecious, the branches base herbaceous, at most slightly woody. Leaves entire, trilobed or trifid, chartaceous, margins entire, chartaceous, pinnately veined. Inflorescences long-paniculiform. Flowers with tubular corolla, 5-dentate, the stamens included to slightly exserted. Achenes with apex attenuate, the calyx-limb pappose (pappus-like), with 10–15 bristles.

Notes:—This section is provisionally composed solely by *V. scandens*, the type species treated by Rafinesque (1840) and Eriksen (1989), but as circumscribed, may include other scandent and herbaceous species from Central and northern South America.

Section II. *Valerianopsis* Weddell (1858: 31) emend. Höck (1882: 53) Lectotype:—*Valeriana rumicoides* Weddell (1858: 22) (designated by Eriksen 1989: 186).
=*Valerianopsis* (Wedd.) Müller (1885: 345).

Perennials or annuals herbs or subshrubs, most often polygamo-dioecious, the branches base always woody. Leaves entire, at most pinnately lobed, margins entire, serrate, serrulate, lacerate, or crenulate, chartaceous to coriaceous, pinnately veined. Inflorescences paniculiform to spike like, the paracladia paniculiform, spike like or glomeruliform. Flowers with campanulate to cupuliform corolla, the stamens included, slightly exserted or quite exserted. Achenes with apex rounded, obtuse, eventually emarginate to valeculate, the calyx-limb pappose or epappose, in this case absent, vestigial, annular, or dentate.

Notes:—This section, as here circumscribed, includes about 28 species occurring in the Andes of Argentina, Chile, Colombia, Peru and Ecuador, as well as in the lowlands of the *Pampas* domain and lowlands and highlands of the Atlantic Rainforest domain (Argentina, Brazil, Paraguay and Uruguay). Here we provide, for the first time, a key to the series of *Valerianopsis*.

Identification key to the series of *Valeriana* sect. *Valerianopsis*

1. Achenes eppapose…..……………………………………….……………....serie *V. polystachyae*
- Achenes pappose……………………………………………………………………...……..2

2. Herbs, simple or branched; leaves chartaceous, always lanceolate, attenuate base; flowering branches partially leafy or aphyllous……………………………………....serie *V. macrorhizae*

- Shrubs or subshrubs, generally partially branched; leaves chartaceous or coriaceous, not lanceolate, sessile or slightly petiolate, never long-attenuate; flowering branches leafy……………………………………………………………………......serie *V. connatae*

Serie *Polystachyae* Höck (1882: 55) *here emend.*

Dioecious or gynodioecious herbs, subshrubs, or shrubs. Leaves herbaceous to coriaceous, base sessile, attenuate or petiolate, the basal eventually entire, the distals entire or frequently pinnately lobed. Inflorescences a panicle of spike like thyrses, sometimes congested, always leafy (i.e. with visible leafy bracts). Achene with calyx always eppapose, absent, annular or dentate.

Notes:—This series is endemic from South America, occurring in the Andes of Argentina, lowlands of the *Pampas* domain of Argentina, Uruguay and Brazil, and highlands of the Atlantic Rainforest domain of Brazil. Include at least 17 species, two of them restricted to northwestern Argentina (*V. ferax* and *V. stuckertii*), and 15 restricted to the eastern South America: *V. aparadensis*, *V. bornmuelleri*, *V. caparaoensis*, *V. catharinensis, V. chamaedryfolia, V. eichleriana, V. eupatoria, V. glaziovii, V. glechomifolia, V. organensis, V. polystachya, V. reitziana, V. salicariifolia, V. sobraliana* and *V. tajuvensis*. None of them was sampled in recent molecular phylogenies, but *V. polystachya* (Bell *et al.* 2012), as previously mentioned, from which it is not possible to infer about the monophyly of the group.

Section III. *Phuodendron* Graebner (1889: 436). Holotype: *Valeriana ulei* Graebn.
=*Phuodendron* Graebner ex Dalla Torre et Harms (1905: 512).

Dioecious subshrubs, eventually shrubs, dichotomously branched, the branches base woody. Leaves entire, eventually slightly pinnately lobed, margins serrate to crenulate, strongly to slightly coriaceous, 3-veined like. Inflorescences capituliform to umbelliform, rarely lax; paracladia displaying the same general shape. Flowers with campanulate corolla, the stamens exserted. Achene with apex emarginate to valeculate, or rounded to obtuse, the calyx-limb eppapose, annular to dentate.

Notes:—This series bring together two endemic species from the Atlantic Rainforest domain, occurring in the Serra Geral Plateau and adjacent areas of the Serra do Mar mountain range (Serra do Tabuleiro plateau), southern Brazil. The group was traditionally conceived as monospecific, composed exclusively by *V. ulei*, a species included under *Valeriana* by several authors (e.g. Borsini 1962, 1963a; Kutschker 2008a, Rabuske-Silva 2018). Here we include a recently described species under this group, *V. iganciana*.

Taxonomic treatment

Valeriana Linnaeus (1753: 31). *Valeriana officinalis* Linnaeus (1753: 31): Type of *Valeriana* L. (vide Hitchcock & Green 1929: 117). Lectotype (designated by Kirschner in Jarvis 2007: 913):—Herbarium Joachim Burser VIII: 100 (UPS). Epitype (designated by Kirschner in Jarvis 2007: 913):—CZECH REPUBLIC. Southern Bohemia, Písek, along the railway between Razice and Herman, 380 m elev., 16 August 2006, *J. Kirschner & M. Soukup 1608* (epitype PRA; isoepitypes G barcode G00354312 image!, LD barcode 1219512 image!, LD barcode 1228286 image!, LD barcode 1228346 image!, LD barcode 1228406 image!).

Phyllactis Persoon (1805: 39). Lectotype (designated by Larsen 1986: 435): *Phyllactis rigida* (Ruiz & Pavon 1798: 39) Persoon (1805: 39) [≡*Valeriana rigida* Ruiz & Pav.].

Astrephia Dufresne (1811: 50). Type: *Astrephia chaerophylloides* (Smith 1791: 53) Candolle (1830: 629) [≡*Valeriana chaerophylloides* Sm.].

Valerianopsis (Weddell 1858: 22) Müller (1885: 345). Lectotype (designated by Eriksen 1989: 186): *Valeriana rumicoides* Weddell (1858: 22).

Phuodendron (Graebner 1899: 436) Dalla Torre & Harms (1905: 512). Type: *Phuodendron ulei* Graebner (1906: 476) [≡*Valeriana ulei* Graebner (1899: 436)].

Oligacoce Willd. ex Candolle (1830: 632), *nomen* in hb. Willd.

Herbs, subshrubs or shrubs, 1–300 cm tall, annual or perennial, monoecious, dioecious or gynodioecious, rare with gynomonoecious-gynodioecious mating system (*V. scandens*). **Roots** thickened or filiform, from rhizomes or tap-roots. **Branches** erect or decumbent, eventually voluble, herbaceous or woody, simple or branched, cylindrical or quadrangular, slightly to entirely fistulous, striate or terete, glabrous, pubescent or pilose. **Leaves** isomorphic to strongly heteromorphic, opposite, eventually rosulate to subrosulate, decussate, decurrent; leaf blades entire to pinnately lobed (simple) or trifoliolate (compound), concolor or slightly discolor, margins entire, dentate or serrate, base sessile, petiolate or pseudopetiolate; basal leaves frequently marcescent to absent. **Inflorescences** determinate, axillary or terminal, panicles of dichasial cymes arranged helically, quite congested in some species, paniculiform or capituliform, with 3–8 pairs of secondary branches, secondary branches (paracladia, *sensu* Larsen 1986) paniculiform, glomeruliform or spyke like, eventually staminate (or hermaphrodite) and pistillate inflorescences of different sizes. **Bracts** proximal ones similar to distal leaves, distal bracts entire, eventually pinnately lobed, navicular or flat. **Bracteoles** 2, opposite, glabrous or pubescent, margins entire, eventually finely fimbriated, involving and protecting the fruits until maturation. **Flowers** monoclinous or diclinous, zygomorphous or slightly actinomorphous, epigynous, 5–6-merous; calyx gamosepalous, persistent on the top of the fruit, calyx-limb vestigial, annular, dentate or setose (pappus-like) with 10–15 bristles, tightly inrolled in the immature fruit; corolla gamopetalous, campanulate, cupuliform or infundibuliform, glabrous or pubescent, basally gibbous or not, white, creamy or greenish, (3)5–6-lobed. **Androecium** 3(4)-staminate, stamens epipetalous and alternipetalous, adnate near the base or up to the distal third, exserted, subexserted or included; anthers elliptic or globose, dithecous, dorsifixed, with longitudinal dehiscence; the pistillate flowers eventually with 3 vestigial staminodes, inserted in the basal portion of the corolla, laminar and apically rounded. **Gynoecium** with the ovary inferior, tricarpellate, gamocarpellate and trilocular, with one fertile locule containing an ovule pendulous and anatropous and two sterile ventral cavities; style cylindrical, filiform, usually glabrous, eventually pubescent, slightly to completely exserted; stigma capitate during the anthesis, later becoming trifid, papillose. **Fruit** an achene, transversely triquetrous or biconvex, 3–6-costate, margins eventually winged, glabrous, pubescent or pilose, the indument smooth, papilose or warty. **Seed** exalbuminated, not adhered to the pericarp, indument smooth and stramineous.

Valeriana is represented in eastern South America by 18 species: *Valeriana aparadensis* Rabuske sp. nov., *V. bornmuelleri* Pilg., *Valeriana caparaoensis* Rabuske, Sobral & Iganci, *V. catharinensis* Graebn., *V. chamaedryfolia* Cham. & Schltd., *V. eichleriana* (C.A.Müll.) Graebn., *V. eupatoria* Sobral, *V. glaziovii* Taub., *V. glechomifolia* F.G.Mey., *V. iganciana* Rabuske & Külkamp, *V. organensis* Gardner, *V. polystachya* Sm., *V. reitziana* Borsini, *V. salicariifolia* Vahl., *V. scandens* L., *V. sobraliana* Rabuske & Iganci, *V. tajuvensis* Sobral e *V. ulei* Graebn.

Etymology:—The name *Valeriana* derives from the Latin *valeo*, *valere*, *valui*, *valitum* ("health", "value" or "to be strong") and corresponds to the medieval name used for the species with medicinal use. It can still be derived from Valerius, the first to employ species of the genus in medicine, or still be related to the Roman province of Valeria (Borsini 1944, Meyer 1951, Sobral 1999a, Gledhill 2008).

Identification key to *Valeriana* in eastern South America

1. Climbing vines by twinning stems; corolla with a lateral and prominent gibbosity; achenes with a pappus-like calyx, with 10–15 bristles (*Valeriana* sect. *Amplophus*).....................................*V. scandens*

- Prostrate, erect, or decumbent species; corollas with a lateral and inconspicuous gibbosity; achenes with eppapose calyx, vestigial, annular or slightly dentate, never setose……………………………2

2. Inflorescences capituliform to umbelliform; paracladia displaying the same general shape, rarely lax (*Valeriana* sect. *Phuodendron*)…………………..……………………….…………………...……..3

- Inflorescences paniculiform, eventually quite congested due to the abortion of the most basal pairs of paracladia; paracladia paniculiform, spike like, or glomeruliform (*Valeriana* sect. *Valerianopsis*, ser. *Polystachyae*)…………………………………………..……………………………………4

3. Leaves with dentate margins, teeth 3–4 mm long; achenes ovate to globose, biconvex, 2.8–3.6 mm long, apex rounded to emarginate, calyx vestigial, eventually slightly dentate or forming a wavy ring, 0.05–1 × 0.2–0.3 mm ……..*V. ulei*

- Leaves with entire margins, at most with 1–3 (4) pairs of inconspicuous teeth restricted to the apical portion; achenes elliptical, triquetrous, 3.8–4 mm long, acute apex; calyx annular to slightly dentate, 0.1–0.2 × 0.3–0.4 mm...*V. iganciana*

4. Distal leaves pinnatisect or pinnately lobed...5

- Distal leaves entire, or at most with a pair of basal lobes...15

5. Distal leaves with 1–5 pairs of lateral lobes (eventually restricted to the bracts), the distal lobe larger than the lateral ones………...6

- Distal leaves with 5–12 pairs of lateral lobes, the distal lobe similar in size to the lateral ones…..…12

6. Achenes with emarginate to valeculate apex and truncate to cordate base…………………………....7

- Achenes with rounded apex and base……..10

7. Inflorescences capituliform; leaves slightly to strongly coriaceous…...…8

- Inflorescences paniculiform; leaves from membranous to papyraceous or chartaceous……………....9

8. Basal leaves entire to lyrate, pubescent, petioles reaching at most 1/3 the length of the leaf blade; distal leaves pinnately lobed, lateral lobes 2–5 pairs; staminate flowers up to 2.8 × 2.2 mm; pistillate flowers up to 0.7 × 0.7 mm; achenes ovate……...*V. catharinensis*

- Basal leaves entire, glabrous, petioles reaching 1/3 to 2/3 the length of the leaf blade; distal leaves entire, eventually pinnately lobed with 1–3 pairs of basal to lateral lobes; staminate flowers larger than 3.3 × 2.7 mm; pistillate flowers larger than 1.3 × 1.3 mm; achenes elliptic………………..…*V. sobraliana*

9. Inflorescences with 3–6 pairs of paracladia; staminate flowers 2–2.4 mm long, pistillate flowers 0.8–1 mm long; side wings of achenes 0.7–0.9 mm wide……………………………………*V. caparaoensis*

- Inflorescences with 5–9 pairs of paracladia; staminate flowers 2.8–3 mm long, pistillate flowers 1–1.3 mm long; side wings of achenes 0.1–0.4 mm wide...*V. aparadensis*

10. Achenes ovate, 2–2.5 mm long…………..……………………..............................…*V. organensis*

- Achenes elliptic to globose, up to 1.1 mm long…………….. …………….……………......……..11

11. Leaves glabrous; inflorescences up to 8 pairs of paracladia; staminate flowers larger than 2 mm long; pistillate flowers larger than 0.7 mm long; achenes rounded, 1–1.1 × 1 mm…......*V. chamaedryfolia*

- Leaves pubescent; inflorescences with 9-10 pairs of paracladia; staminate flowers up to 1.8 mm long; pistillate flowers up to 0.4 mm long; achenes elliptic, 0.7–1 × 0.4–0.5 mm……..……….......*V. eupatoria*

12. Herbs or subshrubs; branches up to 3 mm in diameter; distal leaves with lateral lobes up to 14 mm long...13

- Subshrubs or shrubs, eventually treelets (*V. tajuvensis*); branches larger than 5 mm in diameter; distal leaves with lateral lobes larger than 25 mm long……..14

13. Subshrubs; basal leaves subrosulate, distal leaves spars along the branches, lateral lobes 5–8 pairs; staminate flowers with hyaline trichomes at the lobes; achenes 1.2–1.4 × 1–1.2 mm, glabrous, calyx slightly dentate or forming a wavy ring, 0.2–0.3 mm long ……….............................…....*V. glaziovii*

- Herbs; basal and distal leaves spars along branches, never forming subrosettes, lateral lobes 3–6 pairs; staminate flowers with hyaline trichomes at the base of the corolla tube; achenes 1.6–1.8 × 1–1.2 mm, pilose; calyx dentate, 0.4–0.7 mm long...*V. bornmuelleri*

14. Shrubs; distal branches woody, at most slightly fistulous, with sympodial ramification; achenes elliptic, base rounded to slightly cordate, 1.8–2.3 × 1–1.3 mm, the calyx annular to slightly dentate…...*V. tajuvensis*

- Subshrubs; distal branches herbaceous, notably fistulous, with monopodial ramification; achenes oblong, base rounded, 1.7–2.5 × 0.6–0.8 mm, the calyx vestigial......................................*V. polystachya*

15. Leaves orbicular to reniform with crenate margins; achenes densely hairy………....*V. glechomifolia*

- Leaves linear, elliptic, lanceolate, obovate or oblanceolate, with entire or dentate margins; achenes glabrous...16

16. Herbs; rhizomes long and never thickened, 100–1000 × 1.6–4.4 mm, never woody; distal leaves linear-lanceolate to obovate-lanceolate; inhabit swampy areas…………………………*V. salicariifolia*

- Subshrubs or shrubs; rhizomes short and thickened, 20–120 × 3.7–23 mm, strongly woody; distal leaves elliptic, lanceolate, obovate or oblanceolate; inhabit rocky outcrops and hillsides.....................17

17. Leaves coriaceous, wrinkled in dry material; paracladia paniculiform; achenes elliptic, up to 1.8 × 1 mm, 5-costate, calyx dentate..*V. eichleriana*

- Leaves chartaceous, never wrinkled in dry material; paracladia glomeruliform (distal portion); achenes globose, larger than 1.8 × 1.6 mm, 3-costate, calyx vestigial..*V. reitziana*

1. Valeriana aparadensis Rabuske *sp. nov.* Type:—BRAZIL. Rio Grande do Sul: São José dos Ausentes, September 1999 (pist. fl. and im. fr.) *M. Sobral & A. Diniz 8859* (holotype ICN 124759!, isotype MBM 263017!).

Figure 8 plate. Figure 9 map.

The new species is morphologically similar to *V. catharinensis* and *V. caparaoensis*, by presenting heteromorphic leaves with similar size and shape, as well as by the achenes with apex valeculate. It is distinguished from the first by the leaves membranaceous to slightly coriaceous and glabrous to slightly pubescent (*vs.* coriaceous and pubescent leaves), by the inflorescences paniculiform with 5–9 pairs of paniculiform secondary branches (*vs.* inflorescences capituliform to umbelliform, with 2–4 pairs of umbelliform secondary branches), by the slightly larger flowers, the staminate ones 2.8–3 mm long (*vs.* 2–2.8 mm long), the pistillate ones 1–1.3 mm long (*vs.* 0.5–1 mm long) and by the achenes elliptic to ovate and larger, 2.6–2.8 mm long (*vs.* achenes ovate, 2–2.4 mm long). Plus, the new species is restricted to the *Aparados da Serra* region of Rio Grande do Sul and Santa Catarina states, southern Brazil (*vs.* endemic from the Campo dos Padres massif and surrounding areas, Santa Catarina). The new species is also morphologically related to *V. caparaoensis*, which differs by the pinnately lobed distal leaves with slightly less variation, 53–75 × 15–30 mm (*vs.* leaves pinnate to pinnatisect with greater variation, 44–134 × 16– 40 mm), by the inflorescences with a greater number of secondary branches, 5–9 pairs (*vs.* inflorescence with 3–6 secondary branches), by the larger staminate flowers, 2.8–3 × 2–2.2, with larger stamens, 2.8–3 mm long (*vs.* staminate flowers 2–2.4 × 2 mm, stamens 1.6–1.8 mm long), by the larger pistillate flowers, 1–1.3 × 1–1.3 (*vs.* pistillate flowers 0.8–1 × 0.8 mm), by the elliptic to ovate achenes, with smaller side wings, 0.1–0.4 mm wide (*vs.* rounded fruits, side wings 0.7–0.9 mm wide), as well as for the previously mentioned distribution (*vs.* endemic from the Serra do Caparaó massif, southeastern Brazil) (Table 2).

Dioecious subshrubs, 30–70 cm high, perennial, rhizomatous and decumbent. **Branches** fistulous, internodes 20–45 mm long at base and 85–115 mm long at floral axis, 1.8–3.2 mm in diameter; plants glabrous or at most puberulous, especially in the apex of the inflorescences and young lateral branches, normal trichomes 0.1 mm long or 0.1–0.3 mm long, slightly grouped in tufts at the nodes of the inflorescences. **Leaves** heteromorphic, blades elliptic to lanceolate, entire to pinnately lobed at base, 25–122 × 7–25 mm, distal lobe markedly larger than the lateral ones, 25–85 × 12–25 mm, elliptic, cuneate to attenuate base, acute to attenuate apex, basal lobes 1–3 pairs, frequently quite inconspicuous, 1–5.7 × 1–3 mm, elliptic, apex obtuse to acute; petioles 15–40 × 0.5–1.5 mm, reaching half the length of the leaf blade; distal leaves pinnately lobed, 53–75 × 15–30 mm, blades slightly discolor, adaxial face green, abaxial face lightly green, distal lobe gradually becoming smaller and narrower toward the inflorescence base, 22–50 × 8–16 mm, attenuated base and acute to attenuate apex, lateral lobes 3–5 pairs, 3–22 × 1–7 mm, often subopposite, eventually 1–2 inconspicuous lobes at the pseudopetioles base, 1–2 × 1–1.5 mm, subopposite to alternate; margin crenate, serrate or eventually laciniate, teeth 1–6 mm long; central nerve and secondary veins adaxially sulcate, abaxially salient, tertiary veins conspicuous; pseudopetioles 16–27 × 1–2.5 mm, absent toward the apex of the branches. **Inflorescences** lateral and terminal, distally paniculiform, with 5–9 pairs of secondary branches. Staminate inflorescences 105–320 mm long, secondary axes 10–77 mm long, tertiary axes 3–12 mm long. Pistillate inflorescences 35–42 mm long, secondary axes 7–14 mm long, tertiary axes, 2–4 mm long. **Bracts** proximal similar to distal leaves, 25–55 × 8–20 mm, distal bracts linear to lanceolate, navicular, 2–8 × 1.5–5 mm, base eventually with 1–3 inconspicuous lobes and auriculate. **Bracteoles** ovate to lanceolate, 1–1.7 × 0.5–0.6 mm, acute apex, rounded base, glabrous. **Staminate flowers** white to cream, campanulate to infundibuliform, 2.8–3 × 2–2.2 mm; corolla tube 1.7–1.8 mm long, glabrous, gibbous ca. 0.6–0.8 mm length; lobes 5, acute, 0.8–1 × 0.5–0.7 mm, glabrous; stamens 3, 2.8–3 mm long, exserted, adnate to the corolla close to half the length; the anthers globose, 0.5–0.7 mm long; pistilodium 1.2–1.4 mm long, included to slightly exserted, glabrous, stigma trifid, lobes 0.1 mm long; abortive ovary, partially developed at the base of the flowers, 0.3 × 0.3 mm long, similar to a floral peduncle. **Pistillate flowers** white, campanulate, 1–1.3 × 1–1.3 mm; corolla tube 0.5–0.6 mm long, glabrous; lobes ovate with obtuse apex, 0.4–0.5 mm long; vestigials staminodes 3, 0.1 mm long, quite inconspicuous and inserted; style 1.3 mm long, exserted; stigma trifid, papillose, lobes up to 0.1 mm long with rounded apex; ovary 1–1.2 mm long. **Fruits** elliptic to ovate, sometimes slightly rounded, 2.2–2.6 × 1.9–2.3 mm, apex valeculate, base slightly cordate or rounded, both slightly asymmetrical, transversely triquetrous, 3(5)-costate (with two lateral and one or three adaxial vascular bundle, 0.1–0.4 mm wide), two prominent lateral wings, 0.6–0.9 mm wide, slightly oblique, stramineous, glabrous, rarely puberulent to puberulous; calyx vestigial, eventually slightly dentate or forming a wavy ring, 0.3–0.4 × 0.2 mm, the teeth hardly visible. **Seeds** elliptic to lanceolate, acute to attenuate apex, rounded base, 1.2–1.4 × 0.5–0.6, smooth and stramineous indument.

Illustration:—Sobral (1999a: 45), as *V. catharinensis* [line drawing].

Phenology:—Flowering and fruiting from September to April.

Distribution and habitat:—Brazil: Rio Grande do Sul and Santa Catarina. *Valeriana aparadensis* is endemic from the *Aparados da Serra* region of the Serra Geral plateau, Atlantic Rainforest domain. It is restricted to highland grasslands and nebular forests, habitats often covered by fog, occurring in riverbanks (Figure 8, A and B), bogs and forest edges, between 900 and 1828 m elev. It reaches its highest elevation records and its northern boundary of distribution at the top of the Morro da Igreja, municipality of Urubici, Santa Catarina. Its southern distribution limit is the Itaimbezinho Canyon, in the Aparados da Serra National Park, Cambará do Sul, Rio Grande do Sul.

Conservation status:—Endangered (EN, B1abiii,iv). *Valeriana aparadensis* has a relatively large extent of occurrence (EOO = 966,247 km²) and low area of occupancy (AOO = 16,000 km²), being rare and scarce in nature. The records suggest at most five subpopulations, two of them in conservation units (Serra Geral National Park, in Rio Grande do Sul state, and São Joaquim National Park, in Santa Catarina state). Their habitats are threatened by extensive plantations of *Pinus* Linnaeus (1753: 1000), excessive cattle grazing, uncontrolled fire and road expansion (e.g. Serra da Rocinha, São José dos Ausentes, Rio Grande do Sul).

Etymology:—In honor of the canyons region of southern Brazil, popularly called *Aparados da Serra*, meaning cut hills, a reference to the abrupt geography of the Serra Geral plateau in the region (Iganci *et al.* 2011).

Taxonomic notes:—During fieldwork and analysis of herbarium materials we observed morphological differences in vegetative and reproductive traits between specimens of the *V. catharinensis* type locality, Morro da Boa Vista, Rancho Queimado, Santa Catarina, and those from the canyons region, popularly called *Aparados da Serra* (in northeastern Rio Grande do Sul and southeastern Santa Catarina). With the recent description of *V. caparaoensis*, it is also necessary to make some considerations here regarding morphological differences with the new species.

Regarding vegetative traits, the most striking difference between *V. aparadensis* and *V. catharinensis* is the texture, indument and coloration of the leaves, in the first case being thinner and papyraceous, glabrous to slightly pubescent. Instead, *V. catharinensis* has thicker, slightly coriaceous leaves, always markedly pubescent. *Valeriana aparadensis* is almost totally glabrous, except for the inflorescence apex and herbaceous branches, while *V. catharinensis* is completely pubescent. The leaves glabrous, or without pronounced pubescence, give to the leaves of *V. aparadensis* a bright, glossy appearance (Figure 8, C and D), whereas in *V. catharinensis* the leaves are opaque green, eventually whitish due to pronounced pubescence. We did not observe striking differences in leaf shape and size, in both species being quite variable, presenting a gradient between simple basal leaves and distal (cauline) leaves, both divided to a greater or lesser degree, presenting overlap in the number of lobes. Likewise, we do not observe striking differences in leaf margins, in both cases the basal leaves being serrate-crenulate, and the distal (cauline) leaves tending to be serrate to laciniate, both with similar number of teeth.

Regarding reproductive traits, the new species differs from *V. catharinensis* by the distally paniculiform inflorescence with 5–9 pairs of paniculiform secondary branches (*vs.* inflorescences distally capituliform to umbelliform, with 2–4 pairs of umbelliform secondary branches), by the larger flowers, especially the pistillate ones, 1–1.3 × 1–1.3 mm (*vs.* pistillate flowers 0.5–0.7 × 0.7 mm), by the glabrous pistil of the staminate flowers (*vs.* pistilodium pilose in staminate flowers), by the achenes elliptic to rounded, 2.3–2.6 × 2.1–2.3 mm (*vs.* achenes ovate, 2.6–2.8 × 1.7–1.9 mm). Both species have glabrous achenes, although some specimens may eventually display some degree of pubescence. We have not observed pubescent achenes occurring randomly, only in specimens of *V. aparadensis* from Morro da Igreja (*F. Gonzatti 3170*, HUCS!; *R. Trevisan et al. 1606*, FLOR!), municipality of Urubici, and specimens of *V. catharinensis* from Campo dos Padres massif (*B. Rambo 60233*, PACA on 3 sheets!), municipality of Bom Retiro, Santa Catarina.

Although *V. aparadensis* and *V. catharinensis* occur in the southeast of the Serra Geral plateau, they apparently do not occur in sympatry. Moreover, there appears to be a northern boundary for *V. aparadensis* distribution in the Morro da Igreja region, and a southern boundary for *V. catharinensis* distribution in the Campo dos Padres massif, both around the 28°S parallel (Figure 9). Therefore, with the description of *V. aparadensis*, the geographical distribution and morphological circumscription of *V. catharinensis* become close to that described by Borsini (1962a, 1963), who analyzed only materials from the municipalities of Bom Retiro and São Joaquim, state of Santa Catarina, conceiving the species as restricted to that region. Therefore, it differs from the wider distribution and circumscription conceived by Sobral (1999) and Rabuske-Silva (2018), which classify most of the materials analyzed here as *V. catharinensis*.

The new species also presents notable differences in geographic distribution and habitat in relation to another species of the same morphological group, *V. caparaoensis*. This species is endemic from the Serra do Caparaó massif, a mountainous complex on the border between the states of Minas Gerais and Espírito Santo, southeastern Brazil. Therefore, both species are disjunct and belong to different mountain formations. While *V. aparadensis* constitutes an endemism of the basaltic outcrops of the Serra Geral plateau, occurring between 900 and rarely 1828 m elevation, *V. caparaoensis* is endemic from the granitic outcrops of the Caparaó massif, occurring at higher altitudes, between 1800 and 2300 m elevation.

Specimens examined (paratypes):—BRAZIL. **Rio Grande do Sul**: Cambará do Sul, ao norte de Ouro Verde, estrada encruzilhada Araranguá e estrada para Bom Jesus, 5 October 1978, *M. Fleig 1067* (ICN!); Cambará do Sul, na Fortaleza, 18 September 1981, *O. Bueno 3069* (HAS!); Cambará do Sul, Fortaleza, topo dos peraus da Rocinha, 18 September 1981, *O. Bueno 3070* (HAS! MBM!); Cambará do Sul, Cânion Fortaleza, Cachoeira do Tigre Preto, 29°04’21.9”S 49°59’18.7”W, 22 October 2017 (stam. fl.) *C. Rabuske, C.C. Alff & J. Külkamp 337* (ICN!); Cambará do Sul, Cânion Fortaleza, Cachoeira do Tigre Preto, 29°04’21.9”S 49°59’18.7”W, 22 October 2017 (pist. fl.) *C. Rabuske, C.C. Alff & J. Külkamp 338* (ICN!). São José dos Ausentes, Serra da Rocinha, 13 September 1975, *M.L. Porto et al. 1638* (ICN!); São José dos Ausentes, Serra da Rocinha, 21 October 1994, *M.R. Ritter 770* (ICN!); São José dos Ausentes, em beira de desfiladeiro junto à Serra da Rocinha, November 1994, *M. Sobral 7742* (MBM!); São José dos Ausentes, April 1998, *M. Sobral & S.B. Rech 8623* (ICN!, MBM!); São José dos Ausentes, April 1998, *M. Sobral et al. s.n.* (FURB 1090!); São José dos Ausentes, Serra da Rocinha, March 1999, *M. Sobral 8810* (ICN!); São José dos Ausentes, Serra da Rocinha, March 1999, *M. Sobral 8820* (ICN!, MBM!); São José dos Ausentes, Serra da Rocinha, March 1999, *M.Sobral s.n.* (FURB 1833!, MBM 319368!); São José dos Ausentes, September 1999 (stam. fl.) *M. Sobral & A. Diniz* 8860 (MBM!); São José dos Ausentes, cascata entre a Serra da Rocinha e Vale das Trutas, 25 October 2009, *M. Grings & A.M.Z. Lunkes 785* (ICN!). **Santa Catarina**: Aparados da Serra, 1200 m elev., 17 January 1957, *L.B. Smith & R.M. Klein 10231* (HBR!). Bom Jardim da Serra (São Joaquim), na boca da Serra do Rio do Rastro, 21 January 1959, *J. Mattos 6548* (HAS!); Bom Jardim da Serra, Serra do Rio do Rastro, 28°23’14.4”S 49°33’11.2”W, 1445 m elev., 21 October 2017, *C. Rabuske, C.C. Alff & J. Külkamp 341* (ICN!). Timbé do Sul, 30 January 1976, *K.Hagelund 9989* (ICN!, MBM!); Timbé do Sul, 21 September 1979, *K. Hagelund 12935* (ICN!, MBM!). Urubici, Morro da Igreja, 1700 m elev., 16 October 1993, *D.B. Falkenberg 6283* (ICN!, MBM!); Urubici, alto do Morro da Igreja, 8 December 2000, G. *Hatschbach, A.C. Cervi & E. Barbosa 71663* (MBM!); Urubici, Morro da Igreja, cavalgada, 1600 m elev., 11 November 2001, *G. Hatschbach, A.C. Cervi & E. Barbosa 72630* (MBM!); Urubici, Morro da Igreja, 1828 m elev., 14 November 2008, *J.M.*

Silva, J. Cordeiro, C.B. Poliquesi & J. Vaz 7066 (MBM!); Urubici, Morro da Igreja, topo do morro, 28°07’39”S 49°28’55”W, 1770 m elev., 5 November 2013, *A.C. Cervi, E. Barboza & J. Cordeiro 10082* (FLOR!, ICN!, MBM!); Urubici, Parque Nacional de São Joaquim, 28.1238°S 49.4761°W, 1709m, 12 December 2014, *R. Trevisan et al. 1606* (FLOR!); Urubici, Morro da Igreja, 28°07'41.4"S 49°29'05.5"W, 11 December 2016, *F. Gonzatti 3170* (HUCS!).

2. Valeriana bornmuelleri Pilger (1910: 101). *Valeriana bornmuelleri* Briquet (1919: 424) (superfluous name). Lectotype (inadvertently designated by Sobral 1999a: 13):—BRAZIL. Rio Grande do Sul: [Panambi] Neu-Württenberg, Arroio da Ruiz auf Estancia Laurenzo Gomes, in Gebüschen, 18 October 1904, ca. 500 m elev., *A. Bornmüeller 198* (lectotype G barcode G00354564 image!; isolectotypes F 4538311 image!, GH barcode GH00031734 image!, HBG barcode HBG513359 image!, L barcode L0001595 image!, U barcode U0034827 image!).

Figure 10 plate. Figure 11 map.

Gynodioecious herbs, 10–40 cm high, perennial, rhizomatous and decumbent. **Branches** slightly fistulous, internodes 14–42 mm long at base, 35–80 mm long at floral axis, 1.4–1.8 mm in diameter, eventually rooting at the points of contact with the soil; plants glabrous to slightly pubescent, normal trichomes 0.1–0.2 mm long, sparse in the floral branches, concentrated at the base of lobes, margins and midribs (adaxial surface) of leaves, or normal to flagelliform trichomes 0.3–0.5 mm long, grouped in tufts at the nodes of the floral branches, densely packed in fruits. **Leaves** isomorphic, blades elliptic to ovate, pinnatilobed, 10–35 × 6–22 mm, chartaceous, concolor or at most slightly discolor, adaxial face green, abaxial face lightly green, sage to olive in dry material; lateral lobes 3–5 (6) pairs, 3–12 × 1–3 mm, basal ones eventually small, 1–2 × 0.5–1 mm, alternate to subopposite, lanceolate to spatulate, falcate, apex slightly acuminate, partially conduplicated, patent, margin entire to slightly dentate and revolute, terminal lobe of same shape and size; central nerve and secondary veins adaxially sulcate, abaxially salient, tertiary veins not visible; pseudopetioles 2–8 × 0.3–0.8 mm, slightly decurrent. **Inflorescences** lateral and terminal, paniculiform, (4) 6–8 pairs of glomeruliform secondary branches, floral rachis 25–240 mm long, secondary axes 5–50 mm long, tertiary axes 2–25 mm long, similar size in hermaphrodite and pistillate inflorescences. **Bracts** proximal similar in size and shape to distal leaves, 10–20 × 5–12 mm, distal bracts elliptical to long spatulate, 5–2 × 0.5–1 mm. **Bracteoles** linear, lanceolate or spatulate, 1–1.5 × 0.5–0.7 mm, acute apex, attenuate base, margins and base pubescent, with sparse hyaline trichomes 0.2–0.5 mm long. **Hermaphrodite flowers** white to cream, campanulate, 2–2.2 × 1.8–2 mm; corolla tube 0.8–1 mm long, pubescent at base, gibbous ca. 0.3 mm length; lobes acute, 0.6 × 0.4–0.5 mm; stamens 3, 2–2.2 mm long, markedly exserted, adnate to the corolla near the base; anthers globose, 0.5 × 0.5 mm; style 0.9–1.1 mm long, slightly exserted; stigma trifid, papillose, lobes up to 0.2 mm long, rounded apex; ovary 0.8–1 mm long. **Pistillate flowers** white to cream, cupuliform to campanulate, 0.7–1 × 0.7–1 mm; corolla tube 0.3–0.5 mm long, slightly gibbous, glabrous or pubescent at base; lobes ovate, acute apex, 0.3–0.5 mm × 0.3 mm; vestigial staminodes 3, up to 0.2 mm long, laminar and apically rounded, inserted; style 0.7–1 mm long, exserted; stigma bifid or trifid, papillose, lobes up to 0.2 mm long, rounded apex; ovary 0.3–0.4 mm long. **Fruits** elliptic to globose, 1.6–1.8 × 1–1.2 mm, apex rounded to obtuse, base rounded, transversely elliptic to circular, 5–6-costate (with two lateral and one to three adaxial vascular bundles), two lateral and one adaxial winged projections, 0.2–0.3 mm wide, slightly oblique, pilose, hyaline trichomes up to 0.3 mm; calyx dentate, hardly visible teeth, 0.4–0.6 mm wide. **Seeds** elliptic to slightly rounded, rounded apex and base, 1–1.2 × 0.6–0.8 mm, smooth, lustrous and light brown surface.

Illustrations:—Borsini (1962a: 153, 168) [line drawings], Sobral (1999a: 33) [photographic plate], Sobral (1999a: 45) [line drawing], Rabuske-Silva (2018: 48) [photographic plate].

Phenology:—Flowering and fruiting from August to October.

Distribution and habitat:—Brazil: Rio Grande do Sul. *Valeriana bornmuelleri* occurs in the contact zone (ecotone) between the *Pampas* and the Atlantic Rainforest domains. It is restricted to patches of *Araucaria* forest, occurring in varied habitats such as mountain slopes (Figure 10, A), river margins, shrublands, ravines and forest edges, between 200 and 770 m elev.

Conservation status:—Critically Endangered (CR: B1abi,ii,iii). *Valeriana bornmuelleri* is one of the rarest and poorly sampled species among the Brazilian *Valeriana*. It has a large extent of occurrence (EOO = about 90,000.000 km²) and low area of occupancy (AOO = 1,250 km²), being extremely rare and scarce in nature. Five fragmented subpopulations are known so far, none in conservation units. The populations of the type locality, as well as those of the municipality of Livramento sampled by Herter (*G. Herter* 95847, MO 1154750 image!, SI on 2 sheets!), were not located in recent field expeditions. However, we resampled populations (Figure 10) in the municipality of São Francisco de Paula, in the Atlantic Rainforest domain, based on the advices and photographic records made by Sérgio Bordignon (UNILASALLE). The only previous record made in that municipality [*Baptista & Pilz s.n.*

(ICN 119760)], mentioned in the material analyzed by Sobral (1999a) is missing from the collection of the referred herbarium. We recently noticed another population collected by Bordignon in the municipality of Pinheiro Machado, in the *Pampas* Domain. Even with these advances, which slightly increased the number of EOO and AOO obtained in the analysis of Rabuske-Silva (2018), we propose a more restrictive category, due to the scarce populations that we observe in nature. We estimate that there was loss of habitat due to deforestation, extensive agriculture, *Pinus* spp. plantations, excessive cattle grazing and construction of dams.

Etymology:—In honor of the German botanist Alfred Bornmüller (1868–1947) (Pilger 1910).

Taxonomic notes:—*Valeriana bornmuelleri* is morphologically similar to *V. glaziovii*, from which it is distinguished by the gynodioecious mating system (*vs.* dioecious mating system), by the herbaceous habit (*vs.* subshrub habit), by the sparse basal and distal leaves (*vs.* basal leaves arranged in subrosettes, distal leaves sparse) with a thinner and delicate leaf blade, densely to slightly pubescent, with 3–5 (6) pairs of lobes (*vs.* coriaceous and glabrous leaf blade, with 5–8 pairs of lobes), by the staminate flowers with hyaline trichomes at the base of the corolla tube (*vs.* staminate flowers with hyaline trichomes on the petals) and by the pilose achenes, up to 0.8 × 0.4 mm, with vestigial calyx (*vs.* glabrous achenes, 1.2–1.5 × 1–1.2 mm, with dentate calyx).

Nomenclatural notes concerning type specimens:—Schmale (1936) was the first to observe that *V. bornmuelleri* Briquet (1919: 424) is a superfluous name, and that the priority must be given to the binomial described nearly a decade before by Pilger (1910: 101). Since many duplicates were collected by Bornmüeller under the collection number 198, currently deposited in at least six European herbaria, these materials correspond to syntypes. Sobral (1999a: 13) inadvertently designated a lectotype deposited in G, according to Prado *et al.* (2015), and the Article 7.11 of the Shenzhen Code (Turland *et al.* 2018).

Specimens examined:—BRAZIL. **Rio Grande do Sul**: Amaral Ferrador, September 1994, *S. Bordignon s.n.* (ICN 123675!). Pinheiro Machado, distrito de Torrinhas, 31°13’07.2”S 53°30’13.4”W, 11 December 2019; *S. Bordignon s.n.* (UNILASALLE!). Santana do Livramento, Serra de Sant’Anna do Livramento, 210 m elev., 5 September 1935, *G. Herter 95847* (MO 1154750 image!, SI on 2 sheets!, U barcode U0034828 image!, US 1934826 image!). São Francisco de Paula, Pedra Lisa, 28°50’04.6”S 50°37’13.5”W, 773 m elev., 16 October 2018 (herm. fl.) *C. Rabuske-Silva & C.C. Alff 368* (ICN!); São Francisco de Paula, Pedra Lisa, 28°49’58.4”S 50°36’58.0”W, 728 m elev., 16 October 2018 (pist. fl.) *C. Rabuske-Silva & C.C. Alff 369* (ICN!).

3. Valeriana caparaoensis Rabuske-Silva, Sobral & Iganci (2020: 219). Type:—BRAZIL. Minas Gerais. Alto Caparaó, Parque Nacional do Caparaó, trilha para a Cachoeira do Aurélio, 20°28'S 41°50'W, 1834 m, 1 December 2010, *T.M. Machado, R.C. Forzza, J.R. Stehmann & A.M. Amorin 268* (holotype RB barcode RB00744934!; isotypes: BHCB, FLOR barcode FLOR0039832!, MBML 041434!).

Figure 12 plate. Figure 13 map.

Dioic subshrub, 30–90 cm tall, perennial, rhizomatous and decumbent. **Branches** fistulous, 1.6–4 mm diameter, glabrous, striate; internodes 5–40 mm long in the defoliated basal portion, 1–10 mm long between the leaves, becoming distally larger, 18–100 mm long; plants glabrous except for the presence of tufts of hyaline trichomes 0.3–0.8 mm long, denser and conspicuous in the nodes or sparse along the pseudopetioles and leaf blades, mainly in the veins and margins. **Leaves** heteromorphic, blades spatulate, pinnately lobed and lax at base, 23–106 × 10–32 mm, frequently marcescent or absent; distal leaves rosulate to subrosulate, pinnate to pinnatisect, 44–134 × 16–40 mm; blades slightly discolor, adaxial face green, abaxial face light green with purple tinges, grey in dry material; lateral lobes 3–5 (6) pairs, opposite to subopposite, elliptic to linear-lanceolate, falcate, the proximal pair often very reduced, 2–5 × 1.5–1.8 mm, the others 6–28 × 2.5–6 mm, increasing in size towards the apex of the leaf blade; terminal lobe markedly longer than the lateral lobes, 19–62 × 4–15 mm; margins sparsely serrate, teeth 1–3 mm long; central nerve and secondary veins adaxially sulcate, abaxially salient, tertiary veins conspicuous; pseudopetioles 20–40 mm long. **Inflorescences** terminal, paniculiform, (3) 5–6 pairs of secondary branches. Staminate inflorescences 10–34 cm long, secondary axes 16–110 mm long, tertiary axes dichasial, 4–7 mm long. Pistillate inflorescences 17–26 cm long, secondary axes 10–43 mm long, more congested tertiary axes 3–5 mm long. **Bracts** proximal similar to distal leaves, 34–96 × 20–38 mm, distal bracts linear to lanceolate, navicular, 1.5–4 × 0.5–1 mm. **Bracteoles** ovate, 1.2–1.8 × 0.6–0.9 mm, acute to attenuate apex, rounded base, finely fimbriated margins. **Staminate flowers** white to cream, campanulate to cupuliform, 2–2.4 × 2 mm; corolla tube 0.8–1 mm long, glabrous, gibbous ca. 0.4 mm length; lobes 5 (6), acute with different sizes 0.8–1 × 0.6–0.8 mm; stamens 3, 1.6–1.8 mm long, exserted, adnate to the corolla near the base; anthers globose, 0.3–0.4 × 0.3 mm; pistilodium 0.7–1.2 mm long, included to slightly exserted; ovary partially developed at the base of the flowers, 0.3 × 0.3 mm long, similar to a floral peduncle. **Pistillate flowers** white to cream, campanulate, 0.8–1 × 0.8

mm; corolla tube 0.6 mm long, glabrous; lobes ovate with acute apex, 0.5–0.6 × 0.5 mm; vestigial staminodes 3, inserted in the basal portion of the corolla, up to 0.2 mm long, laminar and apically rounded, inserted; style 1.2–1.4 mm long, exserted; stigma trifid, papillose, lobes 0.1–0.2 mm long with rounded apex; ovary 0.3 mm long. **Fruits** globose to ovoid-globose, 2.2–2.4 × 2.2–2.4 mm, apex emarginate to valeculate, base cordate, transversely triquetrous, 3-costate (with two lateral and one adaxial vascular bundle, 0.1–0.3 mm wide), two prominent lateral wings, 0.7–0.9 mm wide, slightly oblique, stramineous, glabrous, eventually slightly hairy in the middle of the abaxial face, hyaline trichomes 0.05 mm long; calyx vestigial, eventually dentate or forming a wavy ring, ca. 0.1 × 0.3 mm, teeth hardly visible. **Seeds** elliptical, acute apex, rounded base, 1.2 × 0.7 mm, smooth and stramineous surface.

Illustrations:—Rabuske-Silva *et al.* (2020: 220) [line drawing], Rabuske-Silva *et al.* (2020: 221) [photographic plate].

Phenology:—Flowering registered sparsely in February, July and from September to December. Fruiting in February.

Distribution and habitat:—Brazil: Espírito Santo and Minas Gerais. *Valeriana caparaoensis* is endemic from the Serra do Caparaó massif, Atlantic Rainforest domain (Figure 12, A). It is restricted to highland grasslands and montane forests, habitats often covered by fog, occurring in moist soils, riverbanks and waterfalls borders, between 1800 and 2300 m elev.

Conservation status:—Critically Endangered (CR: B1bi,ii,iii). *Valeriana caparaoensis* has low extent of occurrence (EOO = 126.260 km²) and low area of occupancy (AOO = 1.750 km²), being rare and scarce in nature. The species occurs in a single conservation unit (Caparaó National Park). Its habitat is endangered by the narrow extent of occurrence and by uncontrolled fire. Until now, the species has not been recorded outside the conservation unit, probably due to the uniqueness of the Caparaó massif environment and historical anthropogenic conversion of the surrounding mountain slopes for coffee plantation.

Etymology—Reference to the type-specimens locality, the Serra do Caparaó massif (Rabuske-Silva *et al.* 2020) [Appendix 2].

Taxonomic notes:—*Valeriana caparaoensis* is morphologically similar to *V. aparadensis*, from which it is distinguished by the leaves pinnate to pinnatisect with greater variation, 44–134 × 16– 40 mm (*vs.* pinnately lobed distal leaves with slightly less variation, 53–75 × 15–30 mm), by the inflorescences with 3–6 secondary branches (*vs.* inflorescences with 5–9 pairs), by the smaller staminate flowers, 2–2.4 × 2 mm, with smaller stamens 1.6–1.8 mm long and pistillodium, up to 1.2 mm long (*vs.* staminate flowers 2.8–3 × 2–2.2 mm, stamens 2.8–3 mm long and pistillodium 1.2–1.4 mm long), by the smaller pistillate flowers, 0.8–1 ×

0.8 mm (*vs.* pistillate flowers 1–1.3 × 1–1.3 mm), and by the globose to ovate-globose achenes with larger side wings 0.7–0.9 mm wide (*vs.* achenes elliptic to ovate, 2.6–2.8 mm long, with less wide side wings, 0.1–0.4 mm wide), as well as for the distribution restricted to the Serra do Caparaó Massif, southeastern Brazil (*vs.* endemic from the canyons of the Serra Geral plateau, southern Brazil) (Table 2).

Valeriana caparaoensis has been neglected as a new species for almost a century since their first record. Although it has been commonly misidentified as *V. polystachya*, a careful analysis of *V. caparaoensis* points to a higher morphological affinity to *V. aparadensis* and *V. catharinensis*. A complete taxonomic discussion of *V. caparaoensis* is presented by Rabuske-Silva *et al.* (2020) [Appendix 2].

Specimens examined:—BRAZIL. **Espírito Santo**: Dores do Rio Preto, Parque Nacional do Caparaó, Cachoeira do Aurélio, 20°28'50.3"S 41°49'45.4"W, 20 October 2012, *T.B. Flores et al. 1329* (ESA, MBML image!, RB image!, UEC image!, VIES image!). **Minas Gerais**: Alto Caparaó?, Serra do Caparaó, 2200 m elev., 20 September 1941, *A.C. Brade 16984* (R image!); Alto Caparaó, Parque Nacional, Córrego José Pedro, September 1997, stam. fl., *L.S. Leoni & H. Safford 3742* (ESA, RB [2 leaves] image!); Alto Caparaó, Parque Nacional, Córrego José Pedro, 2250 m elev., July 1999, *L.S. Leoni 4228* (ESA image!); Alto Caparaó, Parque Nacional, margem do córrego José Pedro, 2200 m elev., 4 November 1999, *L.S. Leoni 4276* (RB image!); Alto Caparaó, Parque Nacional do Caparaó, Divisa MG/ES, Cachoeira Bonita, Córrego José Pedro, 20°24’S 41°50’W, 1960 m elev., 16 February 2000, pist. fl., *V.C. Souza et al. 23237* (RB image!, ESA image!); Alto Caparaó, Parque Nacional do Caparaó, Arredores do Terreirão, 20°25’S 41°49’W, 2300 m elev., 17 February 2000, stam. fl. *V.C. Souza et al. 23290* (RB image!, ESA image!); Alto Caparaó, Vale Encantado, 2100 m elev., 3 October 2005, *L.S. Leoni & M.Y.R. Rocha 6312* (RB image!); Alto Caparaó, Parque Nacional do Caparaó, 20°25'05"S 41°48'59"W, November 2017, stam. fl., *G.P. Coelho 193* (ICN! RB image!); Alto Caparaó, Parque Nacional do Caparaó, 20°25'05"S 41°48'59"W, November 2017, pist. fl., *G.P. Coelho 195* (ICN!).

4. Valeriana catharinensis Graebner (1899: 427), *auct. non.* Sobral (1999a: 13). Lectotype (here designated):—BRAZIL. Santa Catarina: Serra do Mar, Boa Vista, Torfsümpfe, 950 m elev., December 1886, *E. Ule 615* (lectotype HBG barcode HBG-513372 image!).

Figure 14 and 15 plate. Figure 9 map.

Dioecious subshrubs, 30–120 cm high, perennial, rhizomatous and decumbent. **Branches** fistulous, internodes 80–120 mm long at base, 50–120 mm long at floral axis, 2.2–2.5 mm in diameter; plants puberulous to densely pubescent, normal trichomes 0.1 mm long, sparse throughout the plant, or 0.3–0.5 mm long, slightly grouped in the nodes. **Leaves** heteromorphic, blades elliptic, entire to lyrate at base, 58–90 × 15–26 mm, distal lobe markedly larger than the lateral ones, 35–50 × 15–26 mm, elliptic, rounded base, acute apex, basal lobes 1–2 pairs, 8–15 × 4–8 mm, elliptic, apex obtuse to acute; petioles 14–25 × 0.7–1.5 mm, reaching ⅓ the length of the leaf blade; distal leaves pinnately lobed, 15–60 × 10–32 mm, blades slightly discolor, adaxial face green, abaxial face markedly lightly green, distal lobe gradually becoming smaller and narrower toward the inflorescence base, 15–30 × 5–10 mm, cuneate, obtuse or rounded base and acute to attenuate apex, lateral lobes 2–5 pairs, 5–10 × 2–4 mm, often subopposite, eventually with 1–2 inconspicuous lobes along the pseudopetioles, 2 × 1–1.5 mm, alternate; margin serrate to crenate, teeth 1–5 mm long; central nerve and secondary veins adaxially sulcate, abaxially salient, tertiary veins conspicuous; pseudopetioles 1–17 × 0.5–1 mm, absent toward the apex of the branches. **Inflorescences** lateral and terminal, distally capituliform to umbelliform or corymbose, with 2–4 pairs of secondary branches. Staminate inflorescences 130–260 mm long, secondary axes 24–50 mm long, tertiary axes 10–15 mm long. Pistillate inflorescences more congested, 20–40 mm long, secondary axes 17–20 mm long, tertiary axes, 5–7 mm long. **Bracts** proximal similar to distal leaves, 20–35 × 8–12 mm, distal bracts elliptic, navicular, 2–6 × 0.5–2.5 mm, eventually with 1–2 inconspicuous lobes. **Bracteoles** ovate, 1.5–2 × 0.7–1 mm, acute apex, rounded to attenuate base, glabrous. **Staminate flowers** white to cream, campanulate, 2.4–2.8 × 2–2.2 mm; corolla tube 1–1.5 mm long, glabrous, gibbous ca. 0.8–1 mm length; lobes 5, acute, 0.8–1 × 0.7–1.2 mm, eventually with inconspicuous trichomes in the apex; stamens 3, 1.8–2 mm long, exserted, adnate to the corolla close to half the length; the anthers globose, 0.5–0.7 mm long; pistilodium 1.4 mm long, included to slightly exserted, with inconspicuous trichomes near the apex, 0.05–1, stigma capitate; ovary abortive partially developed at the base of the flowers, 0.3 × 0.3 mm long, similar to a floral peduncle. **Pistillate flowers** white, campanulate to rotate, 0.5–0.7 × 0.5–0.7 mm; corolla tube 0.2–0.3 mm long, glabrous; lobes ovate, obtuse apex, 0.2 mm long; vestigial staminodes 3, 0.1 mm long, quite inconspicuous, inserted; style 0.7 mm long, exserted; stigma trifid, papillose, lobes up to 0.1 mm long, rounded apex; ovary 0.7–1 mm long. **Fruits** ovate, 2.6–2.8 × 1.7–1.9 mm, apex valeculate, base slightly cordate, both slightly asymmetrical, transversely triquetrous, 3-costate (with two lateral and one adaxial vascular bundle, 0.2–0.3 mm wide), two prominent lateral wings, 0.7–0.9 mm wide, narrower at the base, about 0.4–0.5

mm wide, slightly oblique, stramineous, glabrous; calyx vestigial, eventually slightly dentate or forming a wavy ring, 0.2–0.4 × 0.4 mm, the teeth hardly visible. **Seeds** ovate to lanceolate, obtuse apex, rounded base, 1.2–1.5 × 0.5–0.7, smooth and stramineous surface.

Illustrations:—Borsini (1962a: 153; 1963: 133) [line drawings], Rabuske-Silva (2018: 48) [photographic plate], Rabuske-Silva & Iganci (2019: 17) [photographic plate].

Phenology:—Flowering and fruiting from October to January.

Distribution and habitat:—Brazil: Santa Catarina. *Valeriana catharinensis* is endemic from the Campos dos Padres massif and surrounding mountains, Serra Geral plateau, Atlantic Rainforest domain. It has records in the municipalities of Anitápolis, Bom Retiro, Rancho Queimado and Rio Rufino. It is restricted to highland grasslands and nebular forests, habitats often covered by fog, occurring in wetlands, streams, bogs, humid slopes, forest edges, eventually being observed in ravines and roadsides, between 900 and 1820 m elev.

Conservation status:—Endangered (EN: B1abiii,iv). *Valeriana catharinensis* has a low extent of occurrence (EOO = about 1,600.680 km²) and low area of occupancy (AOO = 1,250 km²), being rare and relatively scarce in nature. It is known from five localities, none in conservation units. Its habitats are threatened by *Pinus* spp. plantations, excessive cattle grazing, drainage for soil use and uncontrolled fire. However, it is occasionally observed growing on roadsides, displaying a certain tolerance to anthropogenic disturbances.

Etymology:—Refers to the Brazilian state of Santa Catarina, where the type specimen was collected (Graebner 1899).

Taxonomic notes:—*Valeriana catharinensis* is morphologically similar to a group of Brazilian subshrub species with complex specific diagnosis, which includes *V. aparadensis*, *V. caparaoensis* and *V. sobraliana* (Table 2). All these four species are endemic from the highlands of the Atlantic Rainforest domain and share the following morphological features: dioecious mating system, strongly heteromorphic leaves (entire to lobed basal leaves and pinnately lobed distal leaves), inflorescences in a paniculiform thyrse (more or less contracted) and achenes with two large lateral wings and emarginate to valeculate apex.

Despite the similarity between species in this group, *V. catharinensis* is morphologically more similar to *V. sobraliana*, differing by the leaves pubescent and slightly discolorous with adaxial face opaque green (*vs.* leaves glabrous, strongly discolorous, the adaxial face bright green), by the petioles of the basal leaves reaching a maximum of ⅓ of the length of the leaf blade (*vs.* stems reaching ⅓ to ⅔ the length of the leaf blade), by the bracteoles ovate and smaller, 1.5–2 × 0.7–1 mm (*vs.* bracteoles lanceolate, 3–3.2 × 1–1.2 mm), by the staminate flowers smaller 2.4–2.8 × 2–2.2 mm (*vs.* staminate flowers 3.3 × 2.7 mm), by the ovate achenes (*vs.* elliptic achenes). The species also differs by the distribution, in *V. catharinensis* restricted to the Southern Highland Grasslands of basalt soils of the Serra Geral plateau, state of Santa Catarina (*vs.* restricted distribution to the High Altitude Tropical Grasslands of granitic soils of the Serra do Mar mountain range, on the border between the states of Santa Catarina and Paraná).

Valeriana catharinensis long remained a broadly circumscribed and dubious species. Graebner (1899) provided a detailed description, clearly referring to the morphotypes with branches and leaves with dense pubescence and corymbose inflorescences observed in the region of the municipality of Rancho Queimado. Borsini (1962a and 1963) analyzed a syntype photo (LIL) from the material originally deposited in B. This author correctly characterized the morphological circumscription and the distribution of this species, although providing a small description and the illustration of an apparently immature fruit. The author had a small number of specimens for analysis, all from the HBR herbarium. We analyzed these same materials and they are significantly damaged, especially the inflorescences. Sobral (1999a) expanded the morphological circumscription and distribution of *V. catharinensis*, including specimens from the municipalities of Cambará do Sul and São José dos Ausentes, state of Rio Grande do Sul, here related to the new species, *V. aparadensis*. The analysis of the protologue and the remaining type material indicated some notorious peculiarities in the morphology of vegetative and reproductive features of *V. catharinensis*. Plus, recent collections from the most likely type locality were carefully analyzed and indicated a cohesion in the distribution of these singular morphotypes around the region composed by Campo dos Padres massif and adjacent mountains, an area that includes the two locations known as Morro da Boa Vista.

Valeriana catharinensis has entire basal leaves, eventually slightly pinnately lobed or lyrate, gradually becoming entirely pinnately lobed in the branches (stem leaves), sometimes even having a pinnatisect aspect (Figure 15, C and D). Due to the pubescent indument, even more pronounced in young individuals, the leaves have an opaque green color, somewhat grayish. Plus, the species has long inflorescences ending in quite congested thyrses. The distal portion and the lateral branches have a striking capituliform to umbelliform aspect. In some specimens, we observed that the first or second pair of secondary branches abort, leaving only the distal portion of the inflorescence, further accentuating the appearance of a congested and compound umbel (Figure 15, F). During fieldwork we observed that paracladia abortion is quite frequent in this species. It is not clear whether abortion is due to ontogenetic processes or whether it occurs due to predation or other ecological processes. The achenes, when immature, as observed in other species of the *V. catharinensis* group, have a rounded to emarginate apex, gradually becoming valeculate due to the apical projection of the lateral wings. This process influences the general shape of the achenes, which may present some slight variation in shape during its development. In general, mature achenes become ovate.

Nomenclatural notes concerning type specimens:—Regarding the typification, at least two type specimens were collected by *Ule 615*, deposited at B and HBG. Since no herbarium was designated by Graebner (1899: 427), the type specimens correspond to syntypes. Sobral (1999a: 13) inadvertently designated a lectotype deposited at B, according to Prado *et al.* (2015), and the Article 7.11 of the Shenzhen Code (Turland *et al.* 2018). However, this collection was probably destroyed during the Second World War (F neg. 17831, image!). We located a single duplicate of *Ule 615* at HBG (513372, image!), previously classified as lectotype by Focko Weberling through an identification label made in September 1960 (Figure 14). We did not find any literature corresponding to this lectotypification, as required by the Shenzhen Code. Here we designate this remaining exsiccate as a lectotype in order to solve the typification of *V. catharinensis*.

The type locality “Boa Vista” is dubious, since there are at least two mountains with the same name in Santa Catarina state, both in the eastern Serra Geral plateau. In the Serra da Boa Vista, municipality of Rancho Queimado (at the time the municipality of São José) we observed large populations of the species at altitudes compatible with those mentioned by Ule (Figure 15, A). However, there is a single historical collection in another locality called Morro da Boa Vista (or Morro da Bela Vista), located in the Campo dos Padres massif, municipality of Bom Retiro, the highest elevation area of Santa Catarina (*L.B. Smith & R. Reitz 10479*). Ule also mentions in the exsiccate label the locality of “Serra do Mar” (Figure 14), which seems a colloquial designation for a mountainous region that is relatively close to the Atlantic Ocean. However, both the localities referring to Boa Vista are included in the Serra Geral plateau, composed basically by effusive basaltic rocks. It should not be confused with the Serra do Mar mountain range, which extends over the Brazilian coast, composed basically by intrusive granitic rocks.

Specimens examined:—BRAZIL. **Santa Catarina**: Anitápolis, 27°44’47.3”S 49°02’5.6”W, 912 m elev., 17 October 2017 (pist. fl. and fr.) *C. Rabuske et al. 330* (ICN!); Anitápolis, 27°44’47.3”S 49°02’5.6”W, 912 m elev., 17 October 2017 (stam. fl.) *C. Rabuske et al. 331* (ICN!). Bom Retiro, Campo dos Padres, 2000 m elev., 15 December 1948, *R. Reitz 2339* (HBR!); Bom Retiro, Campo dos Padres, 2000 m elev., 15 December 1948, *R. Reitz 3730* (SI 058483!); Bom Retiro, Fazenda Campo dos Padres, 1650 m elev., 17–19 November 1956, *L.B. Smith et al. 7717* (HBR!); Bom Retiro, Campo dos Padres, 23 January 1957, *B. Rambo*

60233 (PACA!); Bom Retiro, between Fazenda Santo Antônio and Fazenda Campo dos Padres, 1400–1650 m elev., 24 January 1957, *L.B. Smith & R. Reitz 10411* (HBR!); Bom Retiro, Campo dos Padres, Morro da Bela Vista, 1821 m elev., 26 January 1957, *L.B. Smith & R. Reitz 10479* (HBR!). Rancho Queimado (São José), Serra da Boa Vista, 1200 m elev., 24 October 1957, *R. Reitz & R.M. Klein 5381* (HBR!, P [barcode P04361380] image!); Rancho Queimado, 27.6753°S 49.1560°W, 1152 m elev., 17 November 2015, *R. Trevisan & L. Pereira-Silva 1657* (FLOR!); Rancho Queimado, Morro da Boa Vista, 27°41'14.1"S 49°08'37.1"W, 972 m elev., 16 October 2017 (pist. fl.) *C. Rabuske et al. 328* (ICN!); Rancho Queimado, Morro da Boa Vista, 27°41'14.1"S 49°08'37.1"W, 972 m elev., 16 October 2017 (stam. fl.) *C. Rabuske et al. 329* (ICN!); Rancho Queimado, beira da BR 282, 27°41'00.2"S 49°06'56.8"W, 919 m elev., 17 October 2017 (stam. fl.) *C. Rabuske et al. 332* (ICN!). Rio Rufino, Fazenda Santo Antônio, RPPN Complexo Serra da Farofa, 1 November 2011, *M.M.P. Floriani 283* (LUSC [barcode LUSC001997] image!). Urubici, no topo da Serra do Corvo Branco, 28°03'7.1"S 49°22'45.3"W, 976 m elev., 16 October 2017 (stam. fl.) *C. Rabuske et al. 324* (ICN!).

5. Valeriana chamaedryfolia Chamisso & Schlechtendal (1828: 129). *Valerianopsis chamaedryfolia* (Cham. & Schltdl.) Müller (1885: 349). Lectotype (inadvertently designated by Sobral 1999a: 14):—BRAZIL. "In Brasiliae interioribus regionibus" [between Rio de Janeiro and Montevideo, according to Herter (1945: 128)], *F. Sellow d188?* (Lectotype HAL barcode HAL0005445 image!; isolectotypes G barcode G00354523 image!, K on 2 sheets barcodes K000588362 and K000588363 images!, M barcode M0189625 image!, MO 1609903 image!, R on 2 sheets barcodes R000097884 and R000097884a images!).

Figure 16 plate. Figure 17 map.

Dioecious subshrubs, 60–110 cm high, perennial, rhizomatous, decumbent to erect. **Branches** fistulous, internodes 7–30 mm long at base, 5–20 mm long at floral axis, 6–30 mm in diameter at base, 1–1.8 mm in diameter at apex; plants glabrous, at most with puberulent young branches and flagelliform trichomes 0.3 mm long grouped in tufts at the nodes. **Leaves** isomorphic to slightly heteromorphic, blades elliptic to lanceolate, chartaceous, entire at base, 16–55 × 8–18 mm, cuneate to obtuse base, acute to attenuate apex; petioles 3–10 × 1–1.5 mm, reaching ¼ the length of the leaf blade; distal leaves pinnately lobate, eventually entire, 42–80 × 10–22 mm, blades slightly discolor, adaxial face green, abaxial face lightly green, sage to olive in dry material; distal lobe lanceolate, gradually becoming narrower toward the inflorescence base, 35–42 × 10–15 mm, cuneate to attenuate base, attenuate apex; basal lobes 1–2 (3) pairs, 1.5–7.5 × 1–2.5 mm, subopposite to alternate; margin serrate, teeth 2.4–8.5 mm long; central nerve adaxially sulcate, abaxially salient, secondary and tertiary veins conspicuous only on the abaxial face; pseudopetioles 10–13 × 1.4–2 mm, decreasing distally, absent toward the apex of the branches. **Inflorescences** lateral and terminal, paniculiform, with (5) 6–8 pairs of secondary branches. Staminate inflorescences 100–165 mm long; secondary axes 7–43 mm long; tertiary axes, 2–20 mm long. Pistillate inflorescences 80–210 mm long; secondary axes 7–22 mm long; tertiary axes, 1.5–7 mm long. **Bracts** proximal similar to distal leaves, 20–35 × 8–12 mm, basal lobes 1–4, close to the nodes; distal bracts lanceolate, 2.8–7 × 0.7–1.2 mm, eventually with a pair of inconspicuous lobes. **Bracteoles** ovate, 0.7–1.2 × 0.4–0.5 mm, acute apex, rounded base, glabrous. **Staminate flowers** white to cream, campanulate, 2–2.3 × 1.8–2.3 mm; corolla tube 1.2–1.4 mm long, glabrous, gibbous 0.7–0.9 mm length; lobes 5, acute, 0.5–0.7 × 0.5–0.7 mm; stamens 3, 1.6–1.9 mm long, exserted, adnate to the corolla in different points; anthers globose, 0.4–0.5 × 0.5 mm; pistilodium 0.9–1 mm long, included; ovary partially developed at the base of the flowers, 0.5 × 0.2 mm long, similar to a floral peduncle. **Pistillate flowers** white to cream, campanulate, 0.6–0.7 × 0.7 mm; corolla tube 0.5 mm long, glabrous; lobes ovate, acute apex, 0.2–0.3 × 0.2 mm; vestigial staminodes 3, inserted in the basal portion of the corolla, up to 0.2 mm long, laminar and apically ovate, inserted; style 0.6–0.7 mm long, slightly exserted; stigma trifid, papillose, lobes 0.1–0.2 mm long, rounded apex; ovary 0.4 mm long. **Fruits** rounded, eventually slightly ovate to elliptic, 1–1.3 × 1–1.3 mm, apex rounded, eventually slightly emarginate, base rounded to truncate, both slightly asymmetrical, transversely triquetrous, 5–costate (with two lateral and three adaxial vascular bundle, 0.05–0.1 mm wide), two prominent lateral wings, 0.1–0.3 mm wide, narrower at the apex and base, about 0.1–0.15 mm wide, slightly oblique, pubescent, hyaline trichomes 0.1 mm; calyx slightly dentate or forming a wavy ring, 0.05–0.1 × 0.2–0.3 mm, teeth hardly visible. **Seeds** oblong, obtuse to rounded apex, rounded base, 0.8–1 × 0.5–0.6, smooth, translucent and stramineous surface.

Illustrations:—Müller (1885: 101) [line drawing], Borsini (1962a: 153, 158) [line drawings], Sobral (1999a: 35) [photographic plate], Sobral (1999a: 45) [line drawing], Rabuske-Silva (2018: 29, 52) [photographic plates].

Phenology:—Flowering and fruiting from September to December.

Distribution and habitat:—Brazil: Rio Grande do Sul. *Valeriana chamaedryfolia* is endemic from the granite and sandstone hills of the Serra do Sudeste massif, in the transition zone (ecotone) between the Atlantic Rainforest and *Pampas* domains. Its restricted to hilly grasslands, occurring in tops and high slopes, in rocky outcrops and moist organic soils, between 100 and 300 m elev.

Conservation status:—Vulnerable (VU: B2abi,ii,iii,iv). *Valeriana chamaedryfolia* has a large extent of occurrence (EOO = 16,340.000 km²) and low area of occupancy (AOO = 1,750 km²), being rare and relatively scarce in nature. Seven subpopulations were recorded, two of them protected in conservation units (Itapuã State Park and Morro Sapucaia Natural Heritage Private Reserve). Its habitat is threatened by urbanization, mining, goat grazing and uncontrolled fires, especially in the north of its distribution area (Metropolitan Region of Porto Alegre). This category agrees with Rabuske-Silva (2018).

Etymology:—The epithet *chamaedrys* literally means "small oak" and was used by Theophrastus to indicate small plants with leaves similar to those of *Quercus* Linnaeus (1753: 994) (Fagaceae) (Gledhill 2008: 101).

Taxonomic notes:—*Valeriana chamaedryfolia* is morphologically similar to *V. eupatoria*, from which it differs by the glabrous indument, at most puberulent in herbaceous branches (*vs.* pubescent indument, quite conspicuous in the branches, leaves, inflorescences and achenes), by the basal leaves up to 45 mm long, rarely reaching 55 mm long, and up to 15 mm wide, rarely reaching 18 mm wide (*vs.* basal leaves larger than 50 × 16 mm), by the inflorescences with up to 8 pairs of secondary branches (*vs.* inflorescences with 9–10 pairs of secondary branches), by the staminate flowers larger than 2 mm long and pistillate flowers larger than 0.7 mm long (*vs.* flowers slightly smaller, the staminate ones up to 1.8 mm long, pistillate ones up to 0.4 mm long) and by the rounded achenes, larger than 1 × 1 mm (*vs.* achenes elliptic, 0.7–1 × 0.4–0.5 mm).

As observed by Sobral (2000), although *V. chamaedryfolia* and *V. eupatoria* are restricted to Rio Grande do Sul state, they do not overlap. *Valeriana chamaedryfolia* grows in the lowlands of the Serra do Sudeste massif, on granite and sandstone soils, always below 300 m elev. *Valeriana eupatoria* grow in the highlands of the Serra Geral plateau, on basaltic soils, always above 800 m elev. (Figure 17). A single collection of *V. chamaedryfolia* (*R. Wasun & V. Wasun s.n.*, HUCS 3384!), from São Francisco de Paula (Serra Geral plateau), was disregarded due to the discrepant characteristics of locality, habitat and habit mentioned in the exsiccate label.

Valeriana chamaedryfolia was included by Höck (1882) in the section *Valerianopsis*, ser. *Polystachyae*, especially due to the leaf dimorphism and inflorescences divided in panicles of spike like secondary branches. However, we observed that inflorescences with staminate flowers have the most basal tertiary branches longer than the distal ones, suggesting a paniculiform conformation to the paracladia. This shape compromises the inclusion of this taxon under the serie *Polystachyae*, which, according to the diagnosis, gathers only taxa with primary and/or secondary spike like axes. The same does not happen with the inflorescences with pistillate flowers, which have more congested tertiary branches, giving a spike like conformation to the paracladia. The same differences in the shape of staminate and pistillate inflorescences are observed in other two species from ESA, both included by Höck in the same series, *V. polystachya* and *V. salicariifolia*. This fact reinforces the option for a slightly broader treatment for the section *Valerianopsis*, adapting its diagnosis to this dimorphism in the inflorescences of the historically related species.

Nomenclatural notes concerning type specimens:—Sobral (1999a: 13) inadvertently designated a lectotype deposited in HAL, according to Prado *et al.* (2015), and the Article 7.11 of the Shenzhen Code (Turland *et al.* 2018). Although the collector number of the type specimens is not cited in the protologue and lectotype, the isolectotype deposited in the R herbarium (R on 2 sheets barcodes R000097884 and R000097884a images!) has labels attached to the specimens with the number "d188". According to Herter (1945: 128), this collection number of Sellow corresponds to the region between Rio de Janeiro (Brazil) and Montevideo (Uruguay).

Specimens examined:—BRAZIL: **Rio Grande do Sul**: Arroio dos Ratos, Fazenda Faxinal, Topo do Cerro Sobrado, 11 November 1979, *K. Hagelund 13166* (ICN!). Bagé, ca. de 12 km de Aceguá, num banhadinho, 2 April 1985, *J. Mattos et al. 28861* (HAS!, MBM!). Porto Alegre, Morro da Polícia, 16 October 1945, *B. Rambo 27017* (ICN!). Santana da Boa Vista, Cerro do Diogo, 10 October 1987, *J.A. Jarenkow & M. Sobral 771* (MBM! PEL). São Leopoldo, 17 October 1949, *B. Rambo 43943* (MO 1628899, P [barcode P06773751] images!); São Leopoldo, Morro do Chapéu, 31 October 1966, *A. Sehnem s.n.* (HUCS 1923!). Sapucaia do Sul, in summo monte Sapucaia, p. S. Leopoldo, 10 November 1948, *B. Rambo 37923* (SI barcode 058485!); Sapucaia do Sul (São Leopoldo), in summo monte Sapucaia próximo de São Leopoldo, 29 November 1948, *B. Rambo 38375* (HBR!); Sapucaia do Sul, Morro Sapucaia próximo de São Leopoldo, no topo, 9 October 1956, *B. Rambo 57458* (HBR!); Sapucaia do Sul, Morro Sapucaia, 29 October 1983, *K. Hagelund 14664* (MBM!); Sapucaia do Sul, Morro Sapucaia, 290 m elev., 19 October 1986 (stam. fl.) *I. Fernandes 215* (ICN!); Sapucaia do Sul, Morro Sapucaia, 290 m elev., 19 October 1986 (pist. fl.) *I. Fernandes 217* (ICN!); Sapucaia do Sul, RPPN Fazenda Morro Sapucaia, 29°50'13.87"S 51°06'19.65"W, 243 m elev., 25 September 2017 (stam fl.) *E. Valduga 806* (ICN!); Sapucaia do Sul, RPPN Fazenda Morro Sapucaia, 29°50'13.87"S 51°06'19.65"W, 243 m elev., 25 September 2017 (pist. fl.) *E.*

Valduga 807 (ICN!). Viamão, Parque Estadual de Itapuã, Alto do Morro da Grota, 20 January 1980, *M. Sobral 149* (HAS!); Viamão, Itapuã, na beira da estrada, December 1982, *M. Sobral 1429* (MBM!); Viamão, Itapuã, em encosta de morro, October 1983, *M. Sobral* 2463 (MBM!); Viamão, Itapuã, 2 December 1984, *M. Sobral 3534* (ICN! SP); Viamão, Itapuã, encosta do Morro do Araçá, June 1998, *M. Sobral & M. Apel 8657* (ICN!); Viamão, Morro do Araçá, November 1998, *M. Sobral et. al. 8767* (ICN! MBM!); Viamão, Morro do Araçá, November 1998, *M. Sobral et. al. 8768* (ICN! MBM!); Viamão, Morro do Araçá, November 1998 (pist. fl. and im. fr.) *M. Sobral 8769* (ICN!); Viamão, Parque Estadual de Itapuã, Morro do Araçá, 10 October 2003, *M. Pinheiro 470* (ICN!); Viamão, encosta sul do Morro do Araçá, 30°21’38.9”S 51°01’56”W, 106 m elev., 09 September 2017 (stam. fl.) *C. Rabuske et al. 281, 282, 283, 287* (ICN!); Viamão, encosta sul do Morro do Araçá, 30°21’38.9”S 51°01’56”W, 106 m elev., 09 September 2017 (pist. fl.) *C. Rabuske et al. 284* (ICN!).

6. Valeriana eichleriana (Müller 1885: 348) Graebner (1899: 434). *Valerianopsis eichleriana* C.A.Müll. Type:—BRAZIL. “Habitat in Brasília, loco non adicto”, *F. Sello 4638* [made in April 1828 in the Paraná state, according to Herter (1945: 131), holotype probably destroyed at B, according to Sobral (1999a: 16) and Rabuske-Silva (2018: 57)]. Lectotype (here designated):—[illustration] Original plate of *Flora Brasiliensis* (Müller 1885: 102). Epitype (here designated):—BRAZIL. Rio Grande do Sul. São José dos Ausentes, Serra da Rocinha, 28°47’55.5” 49°57’12.6”, 1200 m elev., 17 October 2018 (stam. fl.) *C. Rabuske-Silva & C.C. Alff 371* (epitype ICN! isoepitypes FLOR!, MBM! RB!).

Figure 18 plate. Figure 19 map.

Dioecious subshrubs, 35–70 cm high, perennial, rhizomatous, decumbent; rhizomes woody, short, slightly thickened, 40–54 × 15–23 mm. **Branches** fistulous, internodes 7–26 mm long at base, 9–19 mm long at floral axis, 2.8–7.3 mm in diameter; plants glabrous, except for normal to flagelliform trichomes 0.9–1.8 mm long, sparse in the branches or grouped in the grooves, nodes and base of the leaf blades. **Leaves** isomorphic to slightly heteromorphic, strongly coriaceous, wrinkled in dry material, blades entire, obovate to oblanceolate at base, 32–58 × 14–24 mm, base attenuate, apex rounded to obtuse, sessile; distal leaves entire, oblanceolate, 29–52 × 14–20 mm, blades concolor, adaxial and abaxial face lightly green, beige in dry material, base attenuate, apex rounded to obtuse, sessile or slightly petiolate; margin markedly revolute, serrate, teeth 3–8 pairs, 3.2–11.5 mm long, restricted to the distal half or distributed throughout the blade margin; central nerve adaxially sulcate, abaxially salient, secondary veins 1–3 pairs, very inconspicuous, the first pair forming a sharper angle with the central vein (ca. 30°), tertiary veins inconspicuous; petioles, when present, 2–2.8 × 3–4 mm. **Inflorescences** lateral and terminal, distally paniculiform, 4–6 (7) pairs of secondary branches. Staminate inflorescences 165–330 mm long, secondary axes 6–95 mm long, tertiary axes 4–10 mm long. Pistillate inflorescences 135–335 mm long, secondary axes 6–38 mm long, tertiary axes, 4–10 mm long. **Bracts** proximal similar to distal leaves, eventually narrower and lanceolate, 7–25 × 2–8 mm, margin with elongated teeth, similar to lanceolate lobes, 4–12 × 1–3 mm long; distal bracts lanceolate, 1.5–4 × 0.7–1 mm, eventually with 1–2 inconspicuous lobes. **Bracteoles** elliptic to ovate, 1.5–2 × 0.7–1 mm, acute apex, rounded base, glabrous. **Staminate flowers** white to cream, infundibuliform, 2.5–2.7 × 1.8–2 mm; corolla tube 1.4–1.6 mm long, glabrous, gibbous ca. 0.4–0.6 mm length; lobes 5, acute, 0.7–0.9 × 0.6–0.8 mm; stamens 3, 1.6–1.8 mm long, exserted, adnate to the corolla close to the base; anthers oblong to globose, 0.4–0.5 mm long; pistilodium 1.3–1.6 mm long, included to slightly exserted, stigma bifid to trifid; ovary abortive partially developed at the base of the flowers, 0.5 × 0.4 mm long, similar to a floral peduncle. **Pistillate flowers** white to cream, campanulate to rotate, 0.7–0.8 × 0.5–0.6 mm; corolla tube 0.3–0.4 mm long, glabrous; lobes ovate, obtuse to acute apex, 0.2–0.3 mm long; vestigial staminodes 3, unequal sizes, 0.1–0.3 mm long, quite inconspicuous, inserted to subexserted; style 0.7–0.8 mm long, exserted, reaching twice the length of the corolla tube; stigma trifid, papillose, lobes up to 0.1 mm long, rounded apex; ovary 0.7–0.8 mm long. **Fruits** elliptic, 1.6–1.8 × 0.8–1 mm, rounded apex and base, transversely triquetrous, 5–costate (with two lateral and three adaxial vascular bundle, 0.05–0.1 mm wide), two inconspicuous lateral wings, 0.2–0.3 mm wide, stramineous, glabrous, quite papilose; calyx annular to saucer-shaped or slightly dentate, 0.4–0.5 × 0.2–0.3 mm, quite conspicuous on top of the achenes. **Seeds** elliptic to oblong, obtuse apex and base, 1–1.3 × 0.5–0.7, smooth and stramineous surface.

Illustrations:—Müller (1885: 102) [line drawing], Borsini (1962a: 153 and plate 1; 1963: 135) [line drawings], Sobral (1999a: 36) [photographic plate], Sobral (1999a: 45) [line drawing], Rabuske-Silva (2018: 56) [photographic plate].

Phenology:—Flowering and fruiting from August to March.

Distribution and habitat:—Brazil: Rio Grande do Sul, Santa Catarina and Paraná. *Valeriana eichleriana* is endemic from the Serra Geral plateau, Atlantic Rainforest domain. It occurs especially in the *Aparados da Serra* region, in highland grasslands and cloud forests, habitats often covered by fog, being restricted to outcrops of basaltic rocks and wet slopes, from 700 to 1220 m elev.

Conservation status:—Vulnerable (VU: B2abii,iii,iv). *Valeriana eichleriana* has a large extent of occurrence (EOO = about 17,100.000 km²) and low area of occupancy (AOO = 1,500 km²), being rare and scarce in nature. Despite the increase in EOO and AOO in relation to the study by Rabuske-Silva (2018), current knowledge about the species suggests that this category should be maintained. We observed several threats in the environments in which the species occurs, especially extensive plantations of *Pinus* spp., excessive cattle grazing, uncontrolled fire and conversion of hillside areas to expansion of highways. Disturbances regarding the expansion of BR-285 in Serra da Rocinha, on the border between Rio Grande do Sul and Santa Catarina, were responsible for the loss of a large portion of one of the most well-known and historically sampled subpopulation of this species (Figure 18, A). Two subpopulations were recorded in conservation units (Aparados da Serra National Park and Serra Geral National Park).

Etymology:—In honor of the German botanist August Wilhelm Eichler (1839–1887) (Graebner 1899).

Taxonomic notes:—*Valeriana eichleriana* is morphologically similar to *V. reitziana*, from which it differs by the presence of larger flagelliform trichomes 0.9–1.8 mm long, sparse in the branches or grouped in the grooves, nodes and base of the leaf blades (*vs.* smaller normal trichomes, 0.1–1 mm long), by the coriaceous leaves, wrinkled in dry material (*vs.* chartaceous leaves, smooth in dry material) and by the elliptic and smaller achenes, 1.6–1.8 × 0.8–1, 5–costate, with annular to saucer-shaped or slightly dentate calyx (*vs.* globose achenes, larger than 1.8 × 1.6 mm, 3–costate, with vestigial calyx).

Valeriana eichleriana is a striking species, due to its subshrub habit, profusely branched from the thickened base and the small and slightly thickened rhizome. Its leaves are quite coriaceous and trinerved, the margins having teeth increasingly pronounced towards the apex of the branches. The apex of the basal leaves is frequently erose, as described by Borsini (1962a). The base of the distal leaves may eventually display developed teeth, resembling lobes, as observed by Sobral (1999a). The inflorescences are long when compared to the foliated basal portion. The most basal primary branches develop more slowly than the branches that follow the second pair, often being observed on flower buds, while the rest of the inflorescence is already with open flowers (Figure 18, E and F). For this reason, they are generally shorter than the secondary branches. Our observations during fieldwork suggest that this pair of basal branches may in some cases remain stunted or aborted, as observed in other species, such as *V. catharinensis*. In exsiccates these short branches can be hidden by the basal bracts.

Regarding the floral structures, Sobral (1999a) observed that the staminate flowers of some individuals of *V. eichleriana* present a vestigial style and rudiments of an ovary. This is probably due to the abortion of floral structures, a common feature in the genus, as observed by Borsini (1963). We have not observed staminate flowers with well-developed achenes in this species, here classified as dioecious. The most records of *V. eichleriana* are concentrated in the canyons region of northeastern Rio Grande do Sul state. In Santa Catarina state, we have located only two historical collections from the municipality of Lages, both from the 1950's. A recent record from Campos de Palmas, a remnant of Southern Highland Grasslands between the states of Santa Catarina and Paraná, indicates that this species has a greater range of distribution in the highlands of southern Brazil.

Nomenclatural notes concerning type specimens:—According to Sobral (1999a: 16) and Rabuske-Silva (2018: 57) the type located at B was not found and was probably destroyed during the World War II. Since no type material was found, we designated here the illustration of the protologue as lectotype, as recommended by the Shenzhen Code (Turland *et al.* 2018). In addition, we designated an epitype, in order to aid the binomial application based on a physical specimen, since the illustration does not contemplate some key characters such as indument, texture of leaves and achenes, for the differentiation from *V. reitziana*.

Herter (1945: 131) indicates the collection number of Sellow is related to his passage in April 1828 through the municipalities of Vila do Príncipe (currently Lapa), Curitiba, Paranaguá, and Ponta Grossa, in Paraná state. This region is 400 km far from the nearest currently known population of the species, in the highland grasslands of the municipality of Palmas, near the border with the state of Santa Catarina. The remaining collections of the species are concentrated near the border between the state of Rio Grande do Sul and Santa Catarina. Here we choose a collection from Rio Grande do Sul as an epitype, due to the better conditions of the material, and for being more representative of *V. eichleriana*.

Specimens examined:—BRAZIL. **Paraná**: Palmas, Fazenda Rodeio, responsável Sr. Luís, localização das UAL1 e 2 da UAP14, 26°23'08.0"S 51°58'58.0"W, 24 November 2013, S. *Campestrini et al. 618* (FLOR!). **Rio Grande do Sul:** Bom Jesus, Serra da Rocinha p. Bom Jesus, 18 January 1950, *B. Rambo 45419* (HBR!); Bom Jesus, Serra da Rocinha, 19 January 1950, *A. Sehnem 4286* (SI barcode 052137!); Bom Jesus, Serra da Rocinha, 3 February 1953, *B. Rambo 53808* (SI barcode 052138!). Cambará do Sul, Itaimbezinho, 3 February 1973, *J.C. Lindeman & M.L. Porto et al. s.n.* (ICN barcode 00030504!); Cambará do Sul, Itaimbezinho, November 1980, *M. Sobral 488* (ICN!); Cambará do Sul, Aparados da Serra, 6 November 1993, *N.I. Matzenbacher s.n.* (ICN barcode 00030511!); Cambará do Sul, Fortaleza dos

Aparados, estrada Tainhas-Cambará do Sul, August 1998 (stam. fl.) *M. Sobral et. al. 8669* (ICN!); Cambará do Sul, Fortaleza dos Aparados, estrada Tainhas-Cambará do Sul, August 1998 (pist. fl.) *M. Sobral et. al. 8669a* (ICN! MBM!); Cambará do Sul, Fortaleza dos Aparados, August 1998, *M. Sobral s.n.* (FURB 1078!); Cambará do Sul, January 2000, (pist. fl.) *M. Sobral et al. 8979* (ICN!); Cambará do Sul, January 2000, 700–1000 m elev., (stam. fl.) *M. Sobral et al. 8980* (ICN!, MBM!); Cambará do Sul, beira de estrada, December 2000, *M. Sobral & A.L. Silva 9185* (ICN!). São Francisco de Paula, Taimbezinho próximo São Francisco de Paula, 20 February 1953, *B. Rambo 54101* (HBR!); São Francisco de Paula, Vila Seca, 8 March 1994, *N. Silveira 11676* (HAS!); São Francisco de Paula, margens da RS-110, 29°23'26.5"S 50°32'19.1"W, 23 December 2018 (stam. fl.) *C. Rabuske-Silva & C.C. Alff 380* (ICN!). São José dos Ausentes, Serra da Rocinha, March 1999, *M. Sobral 8822* (ICN! MBM!); São José dos Ausentes, Serra da Rocinha, 1212 m elev., February 2017, *G.P. Coelho & D.B. Lucas 139* (ICN!); São José dos Ausentes, Serra da Rocinha, 28°47'55.5" 49°57'12.6", 1200 m elev., 17 October 2018 (pist. fl.) *C. Rabuske-Silva & C.C. Alff 372* (ICN!). **Santa Catarina:** Lages, 10 January 1951, *B. Rambo 49551* (HBR! PACA); Lages, estrada de Rodagem Federal 1, south of Lages, ca. 900 m elev.., 12 February 1957, *L.B. Smith & R. Klein 11284* (NY [barcode 00439743], P [barcode P03504954], images!).

7. Valeriana eupatoria Sobral (2000: 149). Type:—BRAZIL. Rio Grande do Sul: Gramado, Linha Quinze, 29°20'S, 50°53'W, October 1997 (stam. fl.) *M. Sobral & C. Miró 8604* (holotype ICN barcode 00000150!; isotypes: FLOR 41692!, MBM 238791!, MO, RB barcode 00544373 image!, SP, US barcode 00731239 image!).

Figure 20 plate. Figure 17 map.

Dioecious subshrubs or shrubs, 80–150 cm high, perennial, erect or occasionally prostrate. **Branches** fistulous, internodes 8–25 mm long at base, 88–110 mm long at floral axis, 20–50 mm in diameter at base, 1–4 mm in diameter at apex; plants pubescent, normal trichomes 0.1–0.2 mm long, sparse throughout the plant, especially in young branches, leaves and fruits, or flagelliform, 0.3–0.5 mm long, slightly grouped in tufts at the nodes. **Leaves** isomorphic to slightly heteromorphic, blades lanceolate, elliptic-lanceolate or ovate-lanceolate, chartaceous, entire at base, 50–78 × 16–26 mm; petioles 7–21 × 0.8–1.5 mm, reaching at most ⅕ the length of the leaf blade, decreasing distally, absent in the apex of the branches; distal leaves with shape similar to basal leaves, slightly smaller, 30–63 × 8–13 mm, eventually with 1–3 pairs of basal lobes, 2–15 × 1–4 mm, elliptic, subopposite to alternate; blades slightly discolor, adaxial face green, abaxial face lightly green; margins irregularly serrate, teeth 16–25 pairs, 3–7 mm long; central nerve adaxially sulcate or plane, secondary veins conspicuous, 4–6 (8) pairs, abaxially salient, tertiary veins conspicuous. **Inflorescences** lateral and terminal, distally paniculiform, quite lax, 9–10 pairs of secondary branches. Staminate inflorescences 135–600 mm long, secondary axes 12–220 mm long, tertiary axes paniculiform 5–70 mm long. Pistillate inflorescences more congested, 170–360 mm long, secondary axes 5–80 mm long, tertiary axes glomeruliform, 3–35 mm long. **Bracts** proximal similar in size and shape to distal leaves, 25–35 × 5–10 mm, basal lobes 1–4 pairs, close to the insertion with the nodes; distal bracts lanceolate, 4–7 × 1–2 mm. **Bracteoles** lanceolate, 0.4–0.8 × 0.2–0.3 mm, acute apex, attenuate base, margins and base pubescent, sparse hyaline trichomes 0.2–0.5 mm long. **Staminate flowers** white to cream, campanulate to slightly infundibuliform, sometimes slightly rotate, 1.6–1.8 × 2–2.2 mm; corolla tube 0.5–0.7 mm long, glabrous, gibbous ca. 0.3–0.5 mm length; lobes 5, acute to ovate, 0.8–1.2 × 0.7–0.9 mm, slightly unequal; stamens 3, 1.4–1.6 mm long, exserted, adnate to the corolla close to the base; anthers globose, 0.2–0.3 mm long; pistilodium 0.05–0.1 mm long, quite inconspicuous, included, stigma not observed; ovary abortive partially developed at the base of the flowers, 0.2–0.3 × 0.2 mm, similar to a floral peduncle. **Pistillate flowers** white, campanulate, 0.3–0.4 × 0.3–0.4 mm; corolla tube 0.2–0.3 mm long, glabrous; lobes acute, 0.1–0.2 mm long; vestigial staminodes 3, 0.05–0.1 mm long, quite inconspicuous and inserted; style 0.3–0.4 mm long, exserted; stigma trifid, papillose, lobes up to 0.2 mm long, rounded apex; ovary 0.6–0.8 mm long. **Fruits** elliptic, eventually slightly ovate, 1–1.2 × 0.7–0.8 mm, apex rounded to obtuse, base rounded, slightly oblique, transversely triquetrous, 5-costate (with two lateral and three adaxial vascular bundle, 0.05–0.1 mm wide), two inconspicuous lateral wings, 0.1–0.2 mm wide, stramineous, slightly pubescent; calyx annular to slightly dentate, 0.2–0.3 × 0.1 mm, teeth hardly visible. **Seeds** ovate to lanceolate, acute to attenuate apex, rounded base, 0.9–1 × 0.5–0.6, smooth and stramineous surface.

Illustrations:—Sobral (1999a: 37) [photographic plate], Sobral (1999: 45) [line drawing], Sobral (2000: 150–151) [line drawings], Rabuske-Silva (2018: 59) [photographic plate].

Phenology:—Flowering and fruiting from September to December.

Distribution and habitat:—Brazil: Rio Grande do Sul. *Valeriana eupatoria* is endemic from the Serra Geral plateau, Atlantic Rainforest domain. It occurs in nebular forests and *Araucaria* forests, especially in the *Aparados da Serra* region, being restricted to forest edges, river banks, edges of marshes, rocky walls and canyon edges, from 660 to 1180 m elev.

Conservation status:—Endangered (EN: B2abiii). *Valeriana eupatoria* has a large extent of occurrence (EOO = 3,770.000 km²) and low area of occupancy (AOO = 1,500 km²). Its habitats are threatened by deforestation, hydroelectric dams, and uncontrolled fires. Six subpopulations are known so far, one of them protected in a conservation unit (Aparados da Serra National Park). New samples indicate that the EOO and AOO obtained by Rabuske-Silva (2018) should be slightly altered, although the category should be maintained as EN.

Etymology:—Due to the similarity with southern Brazilian species of *Eupatorium* Linnaeus (1753: 836) (Asteraceae) (Sobral 2000: 152).

Taxonomic notes:—*Valeriana eupatoria* is morphologically similar to *V. chamaedryfolia*, as compared in the diagnosis of the latter. *Valeriana eupatoria* is the second largest subshrub under the group of valerians from the eastern South America, commonly reaching about 2 m tall and a frankly shrubby habit. During fieldwork we observed both individuals occurring sparse and in dense populations, in the latter case forming what is popularly called in the region as *capoeiras* or *vassourais* (shrubland).

The species has inflorescences in panicles generally strikingly larger than in *V. chamaedryfolia*, as observed by Sobral (2000), although both species share inflorescences with the same general shape (Figure 20, D and E). The same dimorphism is observed in secondary (and tertiary) branches of the inflorescence, as previously reported for *V. chamaedryfolia* in this study, placing both species under the section *Valerianopsis* (Figure 20, F). Comparing the materials from herbaria and the specimens observed in fieldwork, we realized that most of the collections consist of samples from individuals with smaller inflorescences when compared to the wide range of variation of the species. The primary axis can be divided into secondary to tertiary branches, or even reaching quaternary branches. Although the flowers and fruits are smaller than in *V. chamaedryfolia*, the number of flowers exhibited in a single synflorescence of *V. eupatoria* is strikingly greater than in *V. chamaedryfolia* (although not measured in the scope of this study). The corollas easily fall off branches, in some cases covering the soil around the specimen.

Specimens examined:—BRAZIL. **Rio Grande do Sul:** Cambará do Sul (São Francisco de Paula), Taimbezinho, 5 November 1952, *B. Rambo 52187* (HBR!); Cambará do Sul (São Francisco de Paula), Taimbezinho próximo de São Francisco de Paula, 13 November 1953, *B. Rambo 54488* (HBR!); Cambará do Sul, Itaimbezinho, 11 November 1987, *J. Meyer et al. 133* (HAS!, ICN!). Caxias do Sul, Palanquinho, 28°53’60”S 50°50’01”W, 17 November 2008, *Schmidt s.n.* (PACA 105959!); Caxias do Sul, Criúva, Cânion dos Palanquinhos, 28°04’00”S 50°50’01”W, 950 m elev., 8 November 2014, *F. Gonzatti 1348* (EVB [barcode EVB2029, image!], HUCS 41851!, HCF [barcode HCF000023051 image!], ICN barcode 00030515!, VIES [barcode VIES028948 image!]); Caxias do Sul, Criúva, Cânion Palanquinhos, September 2015, *M. Grings 1879* (HUCS!); Caxias do Sul, Cânion Palanquinhos, 28°54’00”S 50°50’02”W, 950 m elev., 13 October 2016 (pist. fl.) *C. Rabuske et al. 114* (ICN!); Caxias do Sul, Cânion Palanquinhos, 28°54’00”S 50°50’02”W, 950 m elev., 13 October 2016 (stam. fl.) *C. Rabuske et al. 115* (ICN!). Gramado, Linha Quinze, October 1997 (stam. fl.) *M. Sobral & S. Diesel 8487* (ICN!, MBM!); Gramado, Linha Quinze, 1 October 1997 (stam. fl.) *M. Sobral & C. Miró 8600* (FLOR!); Gramado, Linha Quinze, October 1997 (stam. fl.) *M. Sobral & C. Miró 8602* (MBM!); Gramado, Linha Quinze, December 2000, *M. Sobral & A.L. Silva 9175* (ICN!, MBM!). Jaquirana, margem da RS 110, 28°51'36.11"S 50°27'15.80"W, 15 October 2016 (stam. fl.) *C. Rabuske et al. 129* (ICN!); Jaquirana, RS 110, 28°51’37.4”S 50°27’14.7”W, 665 m elev., 16 October 2018 (stam. fl.) *C. Rabuske-Silva & C.C. Alff 366a* (ICN!); Jaquirana, RS 110, 28°51’37.4”S 50°27’14.7”W, 665 m elev., 16 October 2018 (pist. fl.) *C. Rabuske-Silva & C.C. Alff 366b* (ICN!). São Francisco de Paula, Passo do Inferno, 8 November 2000, *V.L. Caetano s.n* (HAS, ICN barcode 00030518!); São Francisco de Paula, Joá, beira de estrada, 830 m elev., 21 September 2002 (stam. fl.) *R. Wasum 1558* (HUCS!, MBM!). São José dos Ausentes (Bom Jesus), 4° distrito, Fazenda Potreirinhos, 4 december 1977, *O.R. Camargo 5553* (HAS!); São José dos Ausentes, Fazenda Potreirinhos, 28°36”23”S 49°58’42”W, 1177 m elev., 25 September 2014, *E. Barboza et al. 4203* (FLOR, HUCS, ICN, MBM!).

8. Valeriana glaziovii Taubert (1893: 10). *Valeriana glaziovii* Graebner (1899: 435) (superfluous name). Lectotype (here designated):—BRAZIL. Rio de Janeiro, Itatiaia, no campo, 21 January 1873, *A.F.M. Glaziou 4847* (lectotype P barcode P00156746 image!; isolectotype R barcode R000010460 image!). Remaining syntypes:—BRAZIL. Rio de Janeiro, Itatiaia, February 1874, *A.F.M. Glaziou 6576* (K barcode K000588364 image!, P barcode P00156747 image!). Additional former syntype [only for *V. glaziovii* Graebn.]:—BRAZIL. Serra do Itatiaia: auf campos, 2000 m elev., March 1894, *E. Ule 3372a* (HBG barcode HBG-513381 image!).

=*Valeriana itatiaiae* Graebner (1899: 435). Lectotype (here designated):—BRAZIL. Serra do Itatiaia: auf hohen Felsen der Agulhas Negras, 2000–2700 m elev., 30 December 1895, *E. Ule 3372b* (lectotype HBG barcode HBG-513380 image!).

=*Valeriana campestris* Dusén (1903: 25). Lectotype (here designated):—BRAZIL. Rio de Janeiro, Serra do Itatiaia, 2200 m elev., 11 June 1902, *P.K.O. Dusén s.n.* (lectotype MO 1105385 image!; isolectotype R 97783 image!).

Figure 21 plate. Figure 13 map.

Dioecious subshrubs, 30–50 cm high, perennial, rhizomatous, decumbent. **Branches** fistulous, terete or slightly sulcate, internodes 2–10 mm long at base, 12–120 mm long at floral axis, 1.5–5 mm in diameter; plants glabrous, eventually with normal trichomes 0.1 mm long, sparse throughout the young branches, or 0.3–0.5 mm long, slightly grouped in the nodes. **Leaves** isomorphic, arranged in subrosettes, blades elliptic to lanceolate, pinnately lobed, 18–85 × 10–30 mm, slightly coriaceous, discolor, adaxial face green, abaxial face lightly green, sage to olive in dry material; lateral lobes 5–8 pairs, 6–14 × 1.6–2 mm, becoming smaller distally, alternate to subopposite, oblong to spatulate, slightly falcate, apex rounded to obtuse, eventually slightly retuse, margin entire to slightly serrate and revolute, teeth 0.5–1 mm long, terminal lobe of same shape and size; central nerve and secondary veins adaxially sulcate, abaxially salient, tertiary veins not visible; pseudopetioles 6–40 × 0.8–1 mm, decurrent, eventually sessile, absent toward the apex of the branches. **Inflorescences** lateral and terminal, paniculiform, (4) 5–7 pairs of secondary branches. Staminate inflorescences paniculiform 120–245 mm long, secondary axes 25–45 mm long, tertiary axes 10–15 mm long. Pistillate inflorescences paniculiform, more congested, 90–120 mm long, secondary axes spike like, 5–24 mm long, tertiary axes capituliform, 3–4 mm long. **Bracts** proximal similar in size and shape to distal leaves, 12–25 × 5–12 mm, distal bracts lanceolate, 1.8–3 × 0.8–1.2 mm. **Bracteoles** lanceolate, 1–1.5 × 0.5–0.7 mm, acute apex, attenuate base, margins glabrous, eventually with sparse hyaline trichomes at base, trichomes 0.05–0.1 mm long. **Staminate flowers** white to cream, campanulate, 1.8–2 × 2–2.2 mm; corolla tube 1–1.3 mm long, glabrous to puberulent, gibbous 0.5–0.6 mm length; lobes 5, acute, 0.7–1 × 0.7–0.9 mm, glabrous to puberulent; stamens 3(4), 1.6–1.8 mm long, included to slightly exserted, adnate to the corolla close to half the length; anthers globose, 0.4–0.6 mm long; pistilodium 1–1.3 mm long, included to slightly exserted, glabrous, stigma slightly capitate, lobes imperceptible; ovary abortive partially developed at the base of the flowers, 0.3 × 0.3–0.4 mm long, obconical, similar to a floral peduncle. **Pistillate flowers** white to cream, campanulate, 0.6–0.8 × 0.5–0.7 mm; corolla tube 0.2–0.3 mm long, puberulous; lobes ovate, acute apex, puberulous, 0.2–0.3 mm long; vestigial staminodes 3, up to 0.1 mm long, quite inconspicuous, inserted; style 0.6–0.8 mm long, notably exserted, twice the length of the corolla tube, puberulous; stigma trifid, puberulous, papillose, lobes 0.1–0.2 mm long, rounded apex; ovary 0.8–1 mm long. **Fruits** elliptic to subglobose, 1.2–1.4 × 1–1.2 mm, apex and base rounded, both slightly asymmetrical, transversely triquetrous, 3–5-costate (with two lateral and one to three adaxial vascular bundle, 0.05–0.1 mm wide), two inconspicuous lateral wings, 0.2–0.3 mm wide, narrower at the base and apex, about 0.1–0.2 mm wide, stramineous, glabrous, quite papillose; calyx slightly dentate or forming a wavy ring, 0.2–0.3 × 0.1 mm, teeth hardly visible. **Seeds** elliptic, acute apex, obtuse base, 0.6–0.7 × 0.3–0.4, smooth and stramineous surface.

Illustrations:—Borsini (1962a: 153, 166) [line drawings], Rabuske-Silva (2018: 62) [photographic plate].

Phenology:—Flowering and fruiting from November to June.

Distribution and habitat:—Brazil: Minas Gerais, Rio de Janeiro and São Paulo. *Valeriana glaziovii* is endemic from the Serra da Mantiqueira mountain range, Atlantic Rainforest domain. It occurs especially in highland grasslands, being restricted to rocky outcrops on mountain tops and high slopes, between 1700 and 2700 m elev.

Conservation status:—Endangered (EN: B2ab i, ii, iii). *Valeriana glaziovii* has a large extent of occurrence (EOO = 1,408.820 km²) and low area of occupancy (AOO = 360 km²), being rare and scarce in nature. Its habitats are threatened by uncontrolled fires. Four to five subpopulations are known so far, three of them protected in conservation units (Campos do Jordão State Park, Ibitipoca State Park and Itatiaia National Park). Most records were made in the Serra de Itatiaia mountain range, Rio de Janeiro state, southeastern Brazil. This category agrees with Martinelli & Moraes (2013) and Rabuske-Silva (2018).

Etymology:—In honor of the French botanist Auguste François Marie Glaziou (1833–1906) (Taubert 1893).

Taxonomic notes:—*Valeriana glaziovii* is morphologically similar to *V. bornmuelleri*, as compared in the diagnosis of the latter.

Nomenclatural note concerning type specimens:—As observed by Schmale (1936), Graebner (1899: 435) described two new species based on collections from the same locality and probably from the same site: *Valeriana glaziovii* Graebn. and *V. itatiaiae* Graebn. The first one corresponds to a homonym of the species described by Taubert, based on the same type material, plus *Ule 3372a*. *Valeriana itatiaiae* was described based on a single collection, *Ule 3372b*. According to Graebner, *V. itatiaiae* differs from *V. glaziovii* Graebn. by displaying robust habit, smaller internodes at the base of the stem, leaves rosulate to subrosulate, larger and ascending lobes, with distinct shape (“non-rectangular”), by the inflorescences in capituliform thyrses, more congested, as well as by the larger flowers with 4 stamens (although doubting the regularity of this feature). We agree with Schmale (1936) that the variation observed by Graebner corresponds to the same species, the valid name being described by Taubert six years earlier. Dusén (1955) recognizes the priority of *V. glaziovii* Taub. against *V. campestris*, described later. The synonyms mentioned here were first established by Schmale (1936) and confirmed by Borsini (1962a) and Rabuske-Silva (2018).

Specimens examined:—BRAZIL. **Minas Gerais**: Serra de Ibitipoca, 15 May 1970, *L. Krieger 8624* (MBM!). Lima Duarte, Parque Estadual do Ibitipoca, Pico do Peão, 21°42’15”S 43° 52’45”W, 1760 m elev., 31 May 2007, *R. Borges 881* (RB image!, K, SPF). **Rio de Janeiro**: Itatiaia, 13 March 1903, *A. Loefgren 5926* (SP image!); Itatiaia, Campo do Itatiaia, 1 May 1906, *Luederwaldt s.n.* (ICN 123696!, SP 11880); Itatiaia, Serra do Itatiaya, 2250 m elev., June 1913, *C.B. Toledo 732* (RB image!); Itatiaia, base das Agulhas, 22–28 November 1938, 2400 m elev., *Markgrat & A.C. Brade 3698* (PACA 54161!; RB 39583 image!); Itatiaia, planalto, 2200 m elev., 1 March 1945, *A.C. Brade 20245* (RB image!); Itatiaia, Parque Itatiaia, 1800 m elev., 16 April 1967, *Lindeman & H. Hass 5166* (MBM!); Itatiaia, Planalto do Itatiaia, Subida das Agulhas Negras, 2400–2500 m elev., 6 February 1969, *D. Sucre 4646* (RB image!); Itatiaia, Parque Nacional do Itatiaia, final da estrada para o Pico das Agulhas Negras, 22°15’S 44°45’W, 2300 m elev., 15 February 1995, *J.M.A. Braga et al. 2065* (RB image!); Itatiaia, Parque Nacional do Itatiaia, Planalto, trilha para as Prateleiras, 22°15’S 44°34’W, 2400 m elev., 24 January 1996, *J.M.A. Braga et al. 3172* (CEPEC, K, MBM!, NY, RB image!). Resende (Itatiaia), Abrigo Rebouças, 30 December 1966, *H. Strang 739 & A. Castellanos 25733* (MBM 58005!); Resende (Itatiaia), planalto near Abrigo Rebouças, ca. 2350 m elev., 1 February 1967, *J.C. Lindeman & J.H. Hass 4136* (MBM!); Resende, Parque Nacional de Itatiaia, Trilha para as Agulhas Negras, 22°23'02.0"S 44°40'25.0"W, 18 November 2017, *G.P. Coelho 211* (ICN!). **São Paulo**: Campos de Jordão, Parque Estadual de Campos de Jordão, 18 March 1975, *Mello Filho & Emmerich s.n.* (R 136942!). Queluz, crista da montanha vizinha à Pedra da Mina, between 22°25’53”S to 22°26’08”S and 44°50’03”W to 44°50’05”W, 2500–2660 m elev., 18 February 1997, *G.J. Shepherd et al. 97-52* (R image!, SPF 122928 barcode SPF00122928, image!; UEC); Queluz, Pedra da Mina, 22°25’41”S 44°50’34”W, 2770 m elev., 19 February 1997, *G.J. Shepherd et al. 9752* (SPF 122.929 barcode SPF00122929, image!).

9. Valeriana glechomifolia Meyer (1960: 197). Type:—BRAZIL. Santa Catarina: Bom Retiro, Campo between Fazenda Campo dos Padres and Fazenda Santo Antônio, Campo dos Padres, 1400–1650 m elev., 21 november 1956, *L.B. Smith & R.M. Klein 7800* (holotype US on 2 sheets, barcodes 00139121 and 01094571 images!; isotypes HBR 24509!, R barcode R000115664 image!).

Figure 22 plate. Figure 23 map.

Gynodioecious herbs, 5–10 cm high, perennial, rhizomatous, prostrate to decumbent. **Branches** slightly fistulous, internodes 4–24 mm long, 0.7–1 mm in diameter, slightly angular and tetragonous (4-aristate), sparsely rooting in the nodes; plants entirely puberulous, normal hyaline trichomes 0.2–0.4 mm long, denser and conspicuous in the nodes. **Leaves** isomorphic, blades orbicular to reniform, 6–20 × 4–15 mm becoming distally smaller, chartaceous, concolor or at most slightly discolor, adaxial face green, abaxial face lightly green, sage to olive in dry material; base truncate to cordate, apex rounded, margins crenate, teeth 1.2–2.3 mm long; central nerve adaxially sulcate, abaxially salient; secondary veins 2–4 pairs, tertiary veins quite inconspicuous; petioles 5–10 × 0.5–1 mm long. **Inflorescences** lateral and terminal, capituliform, 2–4 pairs of secondary branches, floral rachis 7–50 mm long, secondary axes 4–14 mm long, tertiary axes, 4–5 mm long, similar size in hermaphrodite and pistillate inflorescences. **Bracts** proximal similar in size and shape to distal leaves, 6–8.5 × 3–5 mm; distal bracts spatulate 2.5–4.5 × 0.8–1.4 mm. **Bracteoles** spatulate, elliptic, oblong or linear, 1.5–1.8 × 0.4–0.6 mm, acute to attenuate apex, attenuate base, slightly puberulous, trichomes 0.2–0.4 mm long. **Hermaphrodite flowers** white to cream, campanulate to infundibuliform, 1.9–2.5 × 1.8–2.4 mm; corolla tube 0.8–1.1 mm long, glabrous, gibbous 0.3–0.5 mm length, inconspicuous; lobes acute to ovate, unequal, 0.9–1 × 0.4–0.8 mm; stamens 3, 1.6–2 mm long, markedly exserted, adnate to the corolla close to half the length; anthers globose, 0.3–0.4 × 0.3–0.4 mm; style 1.4–1.5 mm long, exserted; stigma 3, papillose, lobes 0.1–0.2 mm long, rounded apex; ovary 0.5–0.7 mm long. **Pistillate flowers** campanulate, 0.8–1 × 0.8–1 mm, slightly pubescent, corolla tube 0.5–0.6 mm long, lobes ovate with acute to rounded apex, 0.4–0.6 × 0.2–0.3 mm; vestigial staminodes 3, epipetalous, inserted in the basal portion of the corolla tube, up to 0.1 mm long, laminar, apically elliptic to rounded; style 1.3–1.5 mm long, quite exserted, twice to three the length of the corolla tube, glabrous; stigma 3, papillose, lobes 0.2–0.3 mm long, rounded apex; ovary 0.8–1.2 mm long. **Fruits** oblong to elliptic, 1.6–1.8 × 0.7–0.9 mm, apex obtuse, base obtuse to rounded, transversely triquetrous or pentagonal, 5–costate (with two lateral and three adaxial vascular bundle, about 0.1–0.2 mm wide), lateral wings absent, slightly oblique, stramineous, uniformly and densely pilose, hyaline trichomes

0.1 mm long; calyx annular to slightly dentate, 0.2–0.3 × 0.1 mm, teeth hardly visible. **Seeds** elliptic, acute apex, rounded base, 1–1.2 × 0.5–0.6, striated and stramineous surface.

Illustrations:—Meyer (1960: 197) [line drawing], Borsini (1962a: 168; 1963: 135) [line drawings], Sobral (1999a: 38) [photographic plate], Sobral (1999a: 45) [line drawing], Rabuske-Silva (2018: 64) [photographic plate].

Phenology:—Flowering and fruiting from November to January.

Distribution and habitat:—Brazil: Rio Grande do Sul and Santa Catarina. *Valeriana glechomifolia* is endemic from the Serra Geral plateau, Atlantic Rainforest domain. It occurs in highland grasslands, being restricted to peat bogs and exposed soils, between 1,100 and 1,620 m elev. The few records suggest a restricted distribution with a southern boundary in the municipality of São José dos Ausentes, Rio Grande do Sul state, and the northern boundary in the Campo dos Padres massif, municipality of Bom Retiro, Santa Catarina state.

Conservation status:—Endangered (EN: B2ab iii). *Valeriana glechomifolia* has a small extent of occurrence (EOO = 347,000 km²) and a low area of occupancy (AOO = 450 km²), being rare and scarce in nature. The records suggest the existence of about six subpopulations, only one of them in a conservation unit (São Joaquim National Park). We estimate that there was loss of habitat due to extensive agriculture, drainage of peat bogs, tree plantations of *Pinus* spp. and intensive livestock. The category of threat agrees with Martinelli & Moraes (2013) and Rabuske-Silva (2018).

Etymology:—Due to the leaves similar to those of *Glechoma hederacea* Linnaeus (1753: 578) (Lamiaceae) (Meyer 1960: 197).

Taxonomic notes:—As observed by Meyer (1960), *V. glechomifolia* has unique features, comparing with other South American species of the genus, which includes a prostrate herbaceous habit, leaf blades orbicular to reniform with crenate margins, and densely pilose achenes (Figure 22). This species is one of the rarest species of *Valeriana* from ESA. Except for the type specimens, we located five records of *V. glechomifolia* in the state of Santa Catarina, all in the region between the São Joaquim National Park, Urubici municipality, and the Campo dos Padres massif, municipality of Bom Retiro. In the state of Rio Grande do Sul, the species presents six records, all of them along the highway RS-020, between the city of São José dos Ausentes and the Silveira district. Although there are few collections of *V. glechomifolia* in the analyzed herbaria, especially from specimens with pistillate flowers, the mating system is clearly gynodioecious. Inflorescences with hermaphrodite flowers have a large pistil, and a large amount of fruits is frequently observed (Figure 22, G). Despite this, some inflorescences that start from lateral branches are remarkably small, about 7–20 mm long, presenting few open flowers (Figure 22, E).

Specimens examined:—BRAZIL. **Rio Grande do Sul**: São José dos Ausentes, campo junto ao arroio Manoel Leão, November 1994, *M. Sobral 7733* (ICN!, MBM!); São José dos Ausentes, ponte sobre o arroio Manoel Leão, November 1994, (pist. fl.) *M. Sobral 7733b* (ICN!); São José dos Ausentes, January 2000, *M. Sobral et al. 8974* (ICN!); São José dos Ausentes, Fazenda Ilgo Burigo, 1100 m elev., 07 October 2002, *E. Boldo 05* (HUCS!); São José dos Ausentes, Lajeadinho, 17 November 2008, *J.M. Silva et al. 7284* (MBM!); São José dos Ausentes, estrada dos Silveira, 28°43’16”S 50°01’11”W, 1212 m elev., 14 November 2015, (hermaf. fl.) *C. Vogel-Ely & S. Bordignon 425* (ICN!). **Santa Catarina**: Bom Retiro, Campo dos Padres, 24 January 1957, *B. Rambo 60238* (PACA on 5 sheets!); Bom Retiro, Campo between Fazenda Campo dos Padres and Fazenda Santo Antônio, Campo dos Padres, 1400–1650 m elev., 24 january 1957, *L.B. Smith & R. Reitz 10383* (HBR!, R image!). Urubici, Rod. SC 430, 10 Km S de Vaca Gorda, 7 December 2000, *G. Hatschbach et al. 71621* (MBM!); Urubici, Rod. SC 420, próximo do alto da serra, 08 November 2001, *G. Hatschbach et al. 72468* (ICN!, PACA!, MBM!, MO image!); Urubici, Parque Nacional São Joaquim, 28°09’43.5”S 48°36’46.4”W, 1624 m elev., 8 December 2013, (hermaf. fl and fr.) *R. Trevisan 1409* (FLOR!).

10. Valeriana iganciana Rabuske-Silva & Külkamp (2018: 275). Type:—BRAZIL. Santa Catarina: São Bonifácio, Parque Estadual da Serra do Tabuleiro, trilha para o Morro das Pedras, 27°49’12.6”S 48°53’57”W, 1130 m elev., 19 August 2017, (stam. fl.) *C. Rabuske, C.C. Alff & L. Nicoleite 279* (holotype ICN 199657!; isotypes FLOR 65734!, RB barcode RB01408747!).

Figure 24 plate. Figure 23 map.

Dioic sub-shrub, 35–70 cm high, perennial, rhizomatous, decumbent in young phenophases, erect in late phenophases. **Branches** non-fistulous at the woody bases, slightly fistulous at the apex, internodes 4–18 mm long at base, 7–50 mm long at floral axis, 3–12 mm in diameter; plants glabrous except for the presence of tufts of hyaline trichomes 0.4–1.2 mm long, denser and conspicuous in the nodes of the floral branches and eventually presence of hyaline and sparse hairs, apressed and ascending, in the margin and central nerve of the abaxial face of the leaves, 0.1–0.8 mm long. **Leaves** isomorphic, blades elliptic, lanceolate, obovate, or more often oblanceolate, 25–54 × 9–20 mm, becoming smaller along the axis of the inflorescence; blades slightly discolor, adaxial face green, abaxial face markedly lightly green, glandular punctate, coriaceous, wrinkled when dried, adaxial surface finely bullate; apex rounded, obtuse, acute or acuminate, partially conduplicated, patent, perceived to the touch; base cuneate, attenuated or obtuse, eventually sessile; margin entire, markedly revolute, sometimes hyaline, 1–3 (4) pairs of inconspicuous teeth restricted to the apical third of the leaf blade, associated with clear spots (hyaline-colored glands) near the margin; teeth 0.2–0.7 mm long; central nerve and adaxially sulcate, abaxially salient; secondary veins inconspicuous, first pair stronger than others, diverging at a narrower angle than the other veins (about 30º); tertiary veins inconspicuous; petioles 11–24 × 1–2 mm. **Inflorescences** terminal, capituliform, two pairs of secondary branches. Staminate inflorescences 10–45 mm long; secondary axes 10–24 mm long; tertiary axes, 2–9 mm long. Pistillate inflorescences 20–28 mm long; secondary axes 20–28 mm long; tertiary axes, 5–7 mm long. **Bracts** proximal similar to distal leaves, 5–15 × 2–15 mm, distal bracts lanceolate to oblanceolate, 1.5–1.7 × 0.6–0.8 mm. **Bracteoles** lanceolate, 2.8–3 × 0.7–1 mm, acute apex, attenuate base, eventually with the apical third vinaceous, glabrous, base with hialine trichomes, ca. 0.1 mm long. **Staminate flowers** white to cream, campanulate, 2–2.4 × 2 mm; corolla tube 0.9–1.2 mm long, glabrous, gibbous 0.2–0.5 mm length; lobes 5, acute, 0.9–1.2 × 0.7–1.2 mm; stamens 3, 1.3–1.6 mm long, exserted, adnate to the corolla in the basal third; anthers ovate to globose, 0.4–0.6 × 0.3–0.4 mm; pistilodium 1.3–1.6 mm long, included; ovary partially developed at the base of the flowers, 0.5 × 0.5 mm long, similar to a floral peduncle. **Pistillate flowers** white to cream, campanulate, 1–1.5 × 0.8–1.2 mm; corolla tube 0.5–0.8 mm long, glabrous; lobes ovate, acute apex, 0.3–0.6 × 0.4–0.5 mm; vestigial staminodes 3, inserted in the basal portion of the corolla, up to 0.2 mm long, laminar, apically rounded, inserted; style 1.3–1.8 mm long, exserted; stigma trifid, papillose, lobes 0.2–0.3 mm long, rounded apex; ovary 1 mm long. **Fruits** elliptic, 3.8–4 × 1.4–2 mm, apex rounded to obtuse, base rounded, both slightly asymmetrical, transversely triquetrous, 5–6-costate (with one abaxial, two lateral and three adaxial vascular bundles, 0.2–0.3 mm wide), two prominent lateral wings, 0.5–0.7 mm wide, stramineous, glabrous, densely papillose; calyx slightly dentate or forming a wavy ring, 0.1–0.2 × 0.3–0.4 mm, teeth hardly visible. **Seeds** examined immature.

Illustrations:—Rabuske-Silva & Külkamp (2018: 277) [line drawing], Rabuske-Silva & Külkamp (2018: 278) [photographic plate].

Phenology:—Flowering and fruiting from July to August.

Distribution and habitat:—Brazil: Santa Catarina. *Valeriana iganciana* is endemic from the Serra do Tabuleiro plateau, Atlantic Rainforest domain. It occurs in highland grasslands of shallow granitic soil, being restricted to rocky and humid outcrops, between 1100 and 1200 m elev.

Conservation status:—Critically Endangered (CR: B1b i,ii,iii). *Valeriana iganciana* is one of the rarest and poorly sampled species amongst the Brazilian *Valeriana*. It has a small extent of occurrence (EOO = nearly 2 km²) and a low area of occupancy (AOO = nearly 4 km²), being rare and scarce in nature. Only one population was sampled so far, near Morro das Pedras, São Bonifácio municipality (type specimens) (Figure 24, A). Although this area is included in a conservation unit (Serra do Tabuleiro State Park), the habitat is endangered by its rarity and low extension of occurrence by climate change in southern Brazil. The category of threat agrees with Rabuske-Silva & Külkamp (2018).

Etymology:—The species is named in honor of the Brazilian botanist João Iganci (1983–) (Rabuske-Silva & Külkamp 2018).

Taxonomic notes:—*Valeriana iganciana* is morphologically similar to *V. ulei*, from which it differs by the distal leaves with entire and hyaline margins, at most with 4 pairs of inconspicuous teeth in the apical third, with apex reflex forming pungent projection, perceptible to the touch (*vs.* dentate margins, not hyaline, 5–7 (10) pairs of conspicuous teeth, 2–4 mm long, the apex not reflex), by the architecture of the inflorescence, which is a compound cyme of only two secondary branches starting from the most basal bracts, never forming a main axis (*vs.* paniculiform inflorescences with 3–4 secondary branches from a main axis), and by the larger achenes, up to 4 mm long, with an annular to dentate calyx (*vs.* achenes up to 2 mm long, the calyx absent or vestigial). They also differ by habitat and distribution area. *Valeriana iganciana* grows on granitic soils of the Serra do Mar mountain range, while *V. ulei* grows on basaltic soils of the Serra Geral plateau (Figure 23).

Valeriana iganciana was first collected in July 2017, in the trail to Morro das Pedras, south of the Serra do Tabuleiro plateau (Rabuske-Silva & Külkamp 2018). These highlands surrounded by forests and difficult access are still poorly sampled in regional herbaria. For this reason, only the population of the type specimens is known, located on the southern boundary of the highland grasslands of Serra do Tabuleiro. However, we presume the occurrence of other populations in the region, due to the existence of similar habitats. The species stands out for its habit of a subshrub with a strongly woody base, generally profusely branched (Figure 24, B). The shape, texture and venation of the distal leaves, as well as the inflorescences, immediately resemble those of *V. ulei*. However, the inflorescences of *V. iganciana* are strikingly umbelliform to capituliform, and have only two pairs of secondary branches (Figure 24, E). The fruits are the largest ever recorded for the genus in eastern South America, reaching 4 mm length, although fruits with this measure are relatively frequent in the Andean region (Kutschker 2011). Due to these morphological features, the species is easily included in the section *Phuodendron*.

Specimens examined:—BRAZIL. **Santa Catarina**: São Bonifácio, Serra do Tabuleiro, 27°49’19.5”S 48°53’50.9”W, 28 July 2017 (stam. fl.) *J. Külkamp et al. 234a* (ICN!, RB!); São Bonifácio, Serra do Tabuleiro, 27°49’19.5”S 48°53’50.9”W, 28 July 2017 (pist. fl.) *J. Külkamp et al. 234b* (ICN!); São Bonifácio, Serra do Tabuleiro, trilha para o Morro das Pedras, 27°49’12.6”S 48°53’57”W, 1132 m elev., 19 August 2017 (stam. fl.) *C. Rabuske et al. 273, 274* (ICN!); São Bonifácio, Serra do Tabuleiro, trilha para o Morro das Pedras, 27°49’12.6”S 48°53’57”W, 1132 m elev., 19 August 2017 (pist. fl.) *C. Rabuske et al.* 275, 276 (FLOR!); São Bonifácio, Serra do Tabuleiro, trilha para o Morro das Pedras, 27°49’12.6”S 48°53’57”W, 1132 m elev., 19 August 2017 (stam. fl.) *C. Rabuske et al. 277, 280* (HUCS!); São Bonifácio, Serra do Tabuleiro, trilha para o Morro das Pedras, 27°49’12.6”S 48°53’57”W, 1132 m elev., 19 August 2017 (pist. fl.) *C. Rabuske et al. 278* (MBM!).

11. Valeriana organensis Gardner (1845: 112). *Valerianopsis organensis* (Gardn.) Müller (1885: 348). Lectotype (here designated):—BRAZIL. Serra dos Órgãos, “in bushy places near the summit of the Organ Mountains”, March 1841, *G. Gardner 5768* (lectotype K on 2 sheets, barcodes K000588365 and K000588366 images!; isolectotypes BM barcode BM000947828 image!, NY barcode NY00278801 image!).

Figure 25 plate. Figure 13 map.

Dioecious subshrubs, 25–80 cm high, perennial, rhizomatous, decumbent. **Branches** fistulous, internodes 2–14 mm long at base, 8–85 mm long at floral axis, 1.5–3.5 mm in diameter; plants glabrous, except for the presence of hyaline trichomes 0.3–0.8 mm long slightly grouped in the nodes of the floral branches. **Leaves** isomorphic to slightly heteromorphic, blades elliptic to lanceolate, entire at base, 20–105 × 5–17 mm, becoming smaller distally, apex and base acute to attenuate, petioles 6–35 × 0.6–2 mm, reaching ⅓ to ½ the length of the leaf blade; distal leaves pinnately lobed, 15–58 × 8–12 mm, blades slightly discolor, adaxial face green, abaxial face markedly lightly green, olive in herbal material; distal lobe gradually becoming smaller and narrower toward the inflorescence base, 15–30 × 5–8 mm, acute to attenuated base and acute apex, lateral lobes 1–3 pairs, 2.3–7.5 × 0.8–2 mm, subopposite; margin entirely serrate, eventually only in the distal half, teeth 5–12 pairs, 0.5–1 mm long, inconspicuous, subrevolute; central nerve and secondary veins adaxially sulcate, abaxially salient, secondary veins 4–6 pairs, first or second pair frequently forming an arc parallel to the central vein, from the base to the distal third of the leaf blade (3-veined-like), tertiary veins slightly conspicuous; pseudopetioles 1–5 × 0.5–1 mm, absent toward the apex of the branches. **Inflorescences** lateral and terminal, paniculiform, distally eventually capituliform to umbelliform, 3–6 pairs of secondary branches. Staminate inflorescences 70–620 mm long, secondary axes 10–150 mm long, tertiary axes 5–40 mm long. Pistillate inflorescences more congested, 60–230 mm long, secondary axes 5–60 mm long, tertiary axes, 5–10 mm long. **Bracts** proximal similar to distal leaves, 24–40 × 5–15 mm, lanceolate, distal bracts pinnately lobed, 15–28 × 5–10 mm, eventually with 2–6 inconspicuous lobes, margins laciniate to biserrate. **Bracteoles** elliptic, 2–3 × 0.8–1 mm, acute apex, rounded to attenuate base, glabrous. **Staminate flowers** white to cream, campanulate to infundibuliform, 2.3–2.5 × 2–2.3 mm; corolla tube 1.3–1.5 mm long, glabrous, gibbous 0.6–1.2 mm length; lobes 5, acute, 0.6–0.8 × 0.6–0.8 mm, glabrous; stamens 3, 1–1.4 mm long, slightly exserted, adnate to the corolla close to the middle of the corolla tube; anthers ovate to globose, 0.5–0.7 mm long; pistilodium 0.6–1 mm long, included, glabrous, stigma capitate to slightly trifid; ovary abortive partially developed at the base of the flowers, 0.7 × 0.4 mm long, similar to a floral peduncle. **Pistillate flowers** white, campanulate, 0.5–0.7 × 0.7 mm; corolla tube 0.2–0.3 mm long, glabrous; lobes ovate, obtuse apex, 0.2 mm long; vestigial staminodes 3, 0.1 mm long, quite inconspicuous and inserted; style 0.7 mm long, exserted; stigma trifid, papillose, lobes up to 0.1 mm long with rounded apex; ovary 0.7–1 mm long. **Fruits** ovate, 2–2.5 × 1.7–2 mm, apex rounded to obtuse, base rounded, both slightly asymmetrical, transversely triquetrous, 5-costate (with two lateral and three adaxial vascular bundle, 0.2–0.3 mm wide), two small lateral wings, 0.4–0.5 mm wide, narrower at the base, about 0.3 mm wide, stramineous, glabrous; calyx vestigial, eventually slightly dentate or forming a wavy ring, 0.2–0.4 × 0.4 mm, teeth hardly visible. **Seeds** ovate, obtuse apex, rounded base, 1.2–1.5 × 0.5–0.7, smooth and stramineous surface.

Illustrations:—Borsini (1962a: 153, 160) [line drawings], Scalon *et al.* (2002: 350) [line drawing], Rabuske-Silva (2018: 67) [photographic plate], Rabuske-Silva & Iganci (2019: 17) [photographic plate].

Phenology:—Flowering and fruiting from September to February.

Distribution and habitat:—Brazil: São Paulo, Rio de Janeiro and Minas Gerais. *Valeriana organensis* is restricted to the Serra dos Órgãos massif (Serra do Mar mountain range), and Serra da Mantiqueira mountain range, Atlantic Rainforest domain. It occurs in highland grasslands, in mountain peaks and high slopes, being restricted to rocky outcrops, between 1800 and 2200 m elev. In the Rio de Janeiro state, it occurs only in the Serra dos Órgãos massif, part of the Serra do Mar mountain range complex. All other records are sparse in the Serra da Mantiqueira mountain range, in the following subunits: Serra do Caraça, Serra de Capanema and Serra de Itacolomi in the state of Minas Gerais, and Pico dos Marins, São Paulo state (Figure 13).

Conservation status:—Critically Endangered (CR: B2ab i, ii, iii, iv). *Valeriana organensis* has a wide distribution (EOO = about 30,000.000 km²) and a low area of occupancy (AOO = 1,250 km²), being rare and scarce in nature. At least five subpopulations were recorded, four of them in conservation units: Serra dos Órgãos National Park (RJ), Itacolomi State Park (MG), Private Reserve of the Natural Heritage of Caraça (MG) and Environmental Protection Area of Serra da Mantiqueira (SP). Its habitat is endangered by uncontrolled fires. This species was considered CR by Martinelli & Moraes (2013) and Rabuske-Silva (2018). The current knowledge suggests that this category should be maintained.

Etymology:—Coming from Serra dos Órgãos massif, Rio de Janeiro state, Brazil (Gardner 1845).

Taxonomic notes:—*Valeriana organensis* is morphologically similar to *V. sobraliana*, from which it differs by the leaves slightly discolours, with margins serrulate to serrate, the veins reticulate in the adaxial face (*vs.* leaves strongly discolours, the margins crenate-serrate, the veins not reticulate in the adaxial face), the petioles reaching at most ⅓ the length of the leaf blade (*vs.* petioles reaching ⅓ to ⅔ the length of the leaf blade), by the bracteoles smaller, up to 2.8 mm × 1 mm, elliptic, with acute apex and rounded to attenuate base (*vs.* bracteoles 3–3.2 × 1–1.2 mm, lanceolate, acute to attenuate apex, eventually caudate, base rounded to subcordate), by the smaller staminate flowers, up to 2.5 × 2.3 mm, the lobes up to 0.8 × 0.8 mm, the stamens 1–1.4 mm long , slightly exserted (*vs.* staminate flowers 3.3 × 2.7 mm, the lobes 1.2 × 1 mm, the stamens 3 mm long, exserted), by the smaller pistillate flowers up to 0.7 × 0.7 mm, the style up to 0.7 mm long (*vs.* pistillate flowers 1.3–1.6 × 1.3–1.4 mm, the style 1.6 mm long) and by the achenes with rounded apex and base and annular calyx (*vs.* achenes with valeculate apex and emarginate to truncate base, vestigial calyx). Plus, in Serra do Mar mountain range *V. organensis* is restricted to the Serra dos Órgãos, Rio de Janeiro state, southeastern Brazil (*vs.* endemic from the mountains of the Serra do Mar between Quiriri, Santa Catarina state, and Serra Capivari Grande, Paraná state, southern Brazil).

The protologue mentions leaves with margins glandular and serrate to dentate, as well as flowers with stamens included. The measurement of glands on the leaf margins of the eastern

South America *Valeriana* is rare in the literature, although frequently observed in the studied species, being conspicuous (see the case of *V. iganciana* above). In *V. organensis*, these glands are reduced to small spots at the apex of the teeth. Regarding the leaf margins, we prefer to treat them as serrulate to serrate, considering that the teeth are smallish when compared to those observed in other species.

We had no access to the types for the analysis, but the images suggest that the specimens collected and studied by Gardner present only inflorescences with pistillate flowers. This possibly explains the description of the stamens as included, considering that in these flowers the stamens are quite reduced and abortive. Staminate flowers have slightly exserted stamens (Figure 25, E). We observed in several specimens that the ovaries in staminate flowers can develop significantly. However, we did not see fully developed seeds within these achenes. For this reason, we considered the species here as dioecious.

Nomenclatural notes concerning type specimens:—We located four remaining syntypes and chose the material deposited at K as the lectotype, as it consists of a material complete and with pistillate inflorescences, fruits and mounted in two sheets. Both materials deposited at K and BM present data presumably written by Gardner, which we interpret from the handwriting used on the collector's personal label (K000588366).

Specimens examined:—BRAZIL. **Minas Gerais**: Catas Altas, Reserva Particular do Patrimônio Natural Santuário do Caraça, Pico Canjerana, 20°08’07S 43°30’47”W, 1926 m elev., 27 October 2008, *C.T. Oliveira 205* (BHCB, RB image!). Ouro Preto, Haut del Itacolomi, 9 February 1884, *A. Glaziou 14923* (MO, P image!); Ouro Preto, Itacolumy, perto de Ouro Preto, 9 February 1884, *A. Glaziou 14928* (R image!); Ouro Preto?, Serra de Capanema, 18 September 1893, *Schwacke 9437* (P image!); Ouro Preto, 15 February 1900, *J.S. Novas s.n.* (ESA 31389 image!). **Rio de Janeiro**: Guapimirim, Parque Nacional da Serra dos Órgãos, Pedra da Baleia, 22°27’41”S 43°01’38”W, 16 November 2017 (stam. fl.) *G.P. Coelho 199* (ICN!). Teresópolis, Parque Nacional da Serra dos Órgãos, trilha para a Pedra do Sino, 22°27’31”S 43°01’29”W, 17 November 2017 (stam. fl.) *G.P. Coelho 202* (ICN!). **São Paulo**: Piquete, Alto dos Marins, 2200 m elev., 10 January 1897, *A. Loefgren 3531* (SP image!); Piquete, Pico dos Marins, Área de Proteção Ambiental da Serra da Mantiqueira, primeiro acampamento após o maciço do 1° mirante, 22°29’55”S 45°07’52”, 2045 m elev., 30 April 2013, *L.N. Gonçalves & P. Duffles 61* (RB!); Piquete, Pico dos Marins, Área de Proteção Ambiental da Serra da Mantiqueira, trilha para o 1° mirante, 22°30’6”S 45°08’10”, 1886 m elev., 6 September 2013, *L.N. Gonçalves, P. Duffles, E. Fernadez & T. Lima 143* (RB!).

12. Valeriana polystachya Smith (1791: 51). *Fedia polystachya* (Sm.) Mirbel (1804: 304). *Astrephia polystachya* (Sm.) Dufresne (1811: 51). *Oligacoce polystachya* (Sm.) Willdenow ex Candolle (1830: 639). *Phyllactis polystachya* (Sm.) Bentham & Hooker (1876: 154). *Phyllactis polystachya* (Sm.) Grisebach (1879: 160). *Valerianopsis polystachya* (Sm.) Müller (1885: 350). Lectotype [first step inadvertently designated by Sobral (1999a: 19), second step here designated]:—ARGENTINA. Buenos Aires, "In agri bonariensis locis aquosis", 1767, *P. Commerson 62?* (lectotype MO 1629350 image!; isolectotypes FI barcode FI004477 image!, G barcode G00354536 image!, LINN barcode LINN-HS74-21 image!, MO 1609917 [fragments] image!, MPU barcode MPU009992 image!, P barcode P00757604 image!).

=*Valeriana glomerulosa* Briquet (1918). Type:—ARGENTINA. Buenos Aires, *T. Stuckert 7637* (holotype LIL; isotype CORD barcode CORD00005177 image!).
=*Valeriana kurtziana* Borsini (1962b: 145). Type:—ARGENTINA. Misiones, Dep. Apóstoles, Pueblo, Arroyo Cuña-Mana, 6 November 1919, *T. Ibarrola 1065* (holotype LIL on 2 sheets, barcodes LIL001556 and LIL001557 images!), *syn. nov.*

Figure 26 and 27 plate. Figure 28 map.

Gynodioecious subshrubs, 60–250 cm high, perennial, rhizomatous, decumbent. **Branches** fistulous, terete to slightly striate, internodes 2–12 mm long at base and 80–125 mm long at floral axis, 2–11 mm in diameter; plants glabrous, except for the presence of hyaline trichomes 0.1–0.3 mm long sparse in the pseudopetioles, leaf lobes and fruits, or slightly grouped in the nodes of the young branches. **Leaves** strongly heteromorphic, blades elliptic to lanceolate, entire and subrosulate at base, 65–185 × 30–35 mm, becoming distally smaller, base attenuate, apex acute, margins entire or dentate, teeth 2–5 mm long, petioles 50–75 × 3–5 mm, reaching ½ to the total length of the leaf blade; distal leaves pinnately lobed, 70–185 × 50–100 mm, blades slightly discolor, adaxial face green, abaxial face markedly lightly green, distal lobe 28–50 × 2–20 mm, attenuate base and apex, lateral lobes (6) 8–14 pairs, 10–80 × 3–8 mm, subopposite, linear to lanceolate; margin entire, serrate or biserrate, teeth 2–8 mm long; central nerve and secondary veins adaxially sulcate, abaxially salient, tertiary veins conspicuous; pseudopetioles 8–20 × 2–3 mm, absent toward the apex of the branches. **Inflorescences** lateral and terminal, distally paniculiform, 4–14 pairs of secondary branches. Hermaphrodite inflorescences 240–1020 mm long, secondary axes 35–230 mm long, tertiary axes (4) 12–72 mm long. Pistillate inflorescences more congested, 230–780 mm long, secondary axes 30–132 mm long, tertiary axes, (3) 6–45 mm long. **Bracts** proximal similar to distal leaves, 22–145 × 12–100 mm, distal bracts ovate to lanceolate, 2–10 × 1–2 mm. **Bracteoles** ovate to oblanceolate, subcarinate, 0.8–1.5 × 0.3–0.5 mm, acute to obtuse apex, rounded to attenuate base, glabrous. **Hermaphrodite flowers** white to cream, campanulate to slightly infundibuliform, 1.2–1.8 × 1.2–1.6 mm; corolla tube 1–1.2 mm long, glabrous, gibbous 0.1–0.2 mm length; lobes 5, ovate, 0.6–0.8 × 0.5–0.6 mm, unequal; stamens 3, 1.2–1.4 mm long, at most slightly exserted, adnate to the corolla close to the base; anthers subglobose, 0.2–0.3 mm long; pistil 0.8–1.1 mm long, included to subexserted, stigma trifid, papillose, 0.1–0.2 mm long, with rounded lobes; ovary 0.3–0.8 × 0.3–0.6 mm long. **Pistillate flowers** white to cream, campanulate, 0.3–0.6 × 0.3–0.4 mm; corolla tube 0.2–0.3 mm long, glabrous; lobes 5, ovate, obtuse apex, 0.2–0.3 × 0.1–0.2 mm long, unequal; vestigial staminodes 3, 0.1 mm long, quite inconspicuous and inserted; style 0.5–0.6 mm long, exserted, twice the length of corolla tube, stigma trifid, papillose, lobes 0.1–0.2 mm long, rounded apex; ovary 0.4–0.7 mm long. **Fruits** oblong, 1.7–2.5 × 0.6–0.8 mm, rounded to obtuse apex and base, transversely triquetrous, 3–5-costate (with two lateral and one or three adaxial vascular bundle, 0.1–0.2 mm wide), lateral wings absent or quite inconspicuous, 0.2–0.3 mm wide, stramineous, glabrous or pubescent, in this case the trichomes restricted to the apex or distributed throughout the achene, especially in the costae, normal trichomes 0.1–0.2 mm long, slightly papillose, spongy parenchymatous tissue; calyx vestigial. **Seeds** oblong, narrowing towards the apex, obtuse to acute apex, rounded base, 1.2–1.4 × 0.4–0.5, smooth and stramineous surface.

Illustrations:—Smith (1791: 51) [line drawing], Borsini (1944: 153; 1962a: 153; 1962b: 146) [line drawings], Borsini (1962a: Lámina 7) [photographic plate], Bacigalupo (1974: 59) [line drawing], Cabrera & Zardini (1978: 594) [line drawing], Sobral (1999a: 39) [photographic plate], Sobral (1999: 46) [line drawing], Rabuske-Silva (2018: 71) [photographic plate].

Phenology:—Flowering and fruiting from September to December.

Distribution and habitat:—Argentina (Buenos Aires, Entre Rios, Misiones, Río Negro, Santa Fé), Uruguay (Canelones, Florida, Paysandú, San José, Soriano) and Brazil (Rio Grande do Sul). *Valeriana polystachya* occurs especially in the lowlands of the *Pampas* domain (Rio de La Plata grasslands), from southern Brazil (Rio Grande do Sul state) to northeastern Argentina (Buenos Aires province, reaching the east of the Río Negro province). In Brazil, some populations reach lower portions of the Serra Geral plateau, in the ecotone between the *Pampas* and the Atlantic Rainforest domains (27°S parallel) (Figure 28). It occurs in dense and sparse populations of hundreds to thousands of individuals, on both well-drained soils and in wetlands, riverbanks, forest edges and ravines, between 70 and 600 m elev. It is often observed along the roadsides of the region between Spring and early Summer.

Conservation status:—Least Concern (LC). *Valeriana polystachya* has a wide distribution (EOO = about 532,000.000 km²) and a large area of occupancy (AOO = 8,000 km²), being frequent and abundant in nature. The species is quite common along the roadsides of the *Pampas* domain in spring and early summer. However, it seems to be less frequent within farms, which is due to the high degree of conversion of these grasslands due to excessive cattle grazing, intensive agriculture, tree plantations, overuse of herbicides and other anthropogenic disturbances.

Etymology:—Due to the large amount of spike like paracladia in the inflorescences (*poly* = many; *stachys* = spikes) (Gledhill 2008: 360). Moreover, due to inflorescences resembling those of *Mentha spicata* L. (Lamiaceae), according to the protologue (Smith 1791: 51).

Taxonomic notes:—*Valeriana polystachya* is morphologically similar to *V. tajuvensis*, from which it differs by the subshrub habit with monopodial ramification, never reaching the shrub habit (*vs.* shrub habit, sympodial ramification), by the distal branches herbaceous and notably fistulous (*vs.* distal branches woody, being only the inflorescences herbaceous, and at most slightly fistulous), by the achenes oblong with rounded base, the calyx being vestigial (*vs.* achenes elliptic with cordate base, the calyx annular to slightly dentate). Plus, differs by the distribution, restricted to the lowlands of the *Pampas* domain, at most reaching the transition zone with the Atlantic Rainforest domain at the west and midwest of Rio Grande do Sul state (*vs.* endemic from the highlands of the Atlantic Rainforest domain, northeastern Rio Grande do Sul state and southeastern of Santa Catarina state).

Borsini (1962a: 165) questions the occurrence of *V. polystachya* in Rio Grande do Sul state, Brazil, arguing that the collections examined correspond to a new species, *V. kurtziana*. This species was described from materials collected in the province of Misiones, Argentina, in the border region with Rio Grande do Sul. According to Borsini, *V. polystachya* would be restricted to Argentina (province of Buenos Aires) and Uruguay, reaching its northern limit of distribution in the district of Canelones, Uruguay. The differences between these two taxa would be the size, shape and indument of the achenes, bracts and bracteoles. However, in our analyzis, these features correspond to the variation randomly observed in the analyzed samples of *V. polystachya*, except for the achene pubescence. This is the only morphological feature that support the segregation of both taxa, although relatively controversial, in addition to aspects related to geographic distribution. The material occurring in northeastern Argentina, including the provinces of Río Negro, Buenos Aires, Entre Rios and Santa Fé, in addition to the analyzed samples from Uruguay, have glabrous fruits, while the material collected in the province of Misiones, Argentina, and the state of Rio Grande do Sul, Brazil, have pubescent fruits. In the protologue of *V. polystachya* it is mentioned by Smith (1791) that the analyzed fruits were immature, the indument not being mentioned. We did not have access to the type materials, except for images, which do not allow the analysis of this feature. However, the origin of the types (Buenos Aires) suggests that these morphotypes certainly have glabrous fruits.

Although the northern populations display pubescent fruits, the degree of pubescence is variable. Borsini (1962b) describes fruits hirsute and pubescent under *V. kurtziana*, with the trichomes "denser at the apex and in the costae" (our translation). Sobral (1999a) describes fruits "with clear trichomes at angles" (our translation) under *V. polystachya*, although his illustration suggests that the trichomes are restricted to the apical portion. Rabuske-Silva (2018) suggests pubescent fruits, with trichomes "sometimes dense at the apex or in the costae" (our translation). The analysis of collections from the state of Rio Grande do Sul suggests that the trichomes may also cover the whole fruit, or be inconspicuous. Therefore, while the glabrous condition in the collections from Argentina is quite fixed, the same is not observed in the northern populations. This variation in the fruit indument was also observed in some specimens and populations of *V. aparadensis* and *V. catharinensis*, as previously reported in this study. Plus, it is not possible through the data collected in the scope of this study to precisely define the area in which the transition from one morphotype to another occurs, as we did not analyze materials from the province of Corrientes, Argentina, and the few analyzed taxa from Uruguay suggest a huge similarity with southern populations (glabrous fruits).

Due to the apparent fixed, although controversial, condition of a single morphological feature (fruit indument), and the need for further studies on the distribution of these morphotypes, we consider that there is no support for the maintenance of *V. kurtziana* as a species, being here considered as a synonym to *V. polystachya*. Studies with genetic and phylogeographic approaches can be promising in shedding light about the morphological variation of the fruits of *V. polystachya*, as well as in other species mentioned, in order to test the possibility of classification in infraspecific categories.

Another controversial subject in the literature is the mating system of *V. polystachya*. Smith (1791) does not describe the flowers in detail and his illustration suggests a monoecious species. Müller (1885) describes the species as "subpoligamous", with staminate and smaller pistillate flowers. Borsini (1944) and Sobral (1999) describe *V. polystachya* as a monoecious species. However, both do not describe the flowers in detail. Borsini (1962a: 165; 1962b: 146) treated *V. kurtziana* as a polygamo-monoecious species, and the flowers were described as staminate and pistillate. However, the illustration suggests both under apparently well-developed achenes. Kutschker (2011) does not specify the mating system, but describes male and female flowers. We agree with Bacigalupo (1974) that classifies *V. polystachya* as a gynodioecious species, therefore with larger hermaphrodite flowers and smaller pistillate flowers in distinct individuals. We have not yet observed these two floral types in the same specimen. This is also evident in the dimorphism between the paracladia with hermaphrodite flowers (paniculiform to spike like, more lax) and those with pistillate flowers (quite spike like and more congested). In nature these features are quite visible, eventually being observed in relatively sparse populations. Mixed populations have the predominance of a single floral type.

Nomenclatural note concerning type specimens:—Sobral (1999a: 19) inadvertently designated an lectotype (not seen by him) deposited at MO, according to Prado *et al.* (2015), and the Article 7.11 of the Shenzhen Code (Turland *et al.* 2018). Kutschker (2011) classifies the numbered material of *Commerson 62* as holotype at P, although the code does not allow the designation of a holotype in this specific case (McNeill 2014). Plus, there is no collector number in the exsiccate deposited at P (barcode P00757604 image!), nor any reference to herbarium in the protologue. Kutschker (*l.c.*) also classified the material deposited at MO (MO 1629350, image!) as isotype, probably following the identification label of Frederick Gustav Meyer, dated 1950. We located seven collections of the French botanist Philibert Commerson (1727–1773) from Buenos Aires, Argentina, dated 1767. Two of them have the collection number 62 (MO 1629359 and MPU barcode MPU009992, images!), not referred in the protologue. Although the other collections are unnumbered (FI barcode FI004477 image!, G barcode G00354536 image!, LINN barcode LINN-HS74-21 image!, MO 1609917 image!, P barcode P00757604 image!), all have convergent data in the exsiccate labels and are probably duplicates, although it is not possible to confirm whether they come from the same collection event, or from different collections made by Commerson in the province of Buenos Aires. However, the unnumbered collection located in LINN corresponds perfectly to the illustration of the species included in the protologue (Figure 26). Considering that the author of the species, the English botanist James Edward Smith (1759–1828) was founder of the Linnean Society of London, which he presided over all his life, this material coming from his botanical collection and evidently used in context of the description is hereby considered as the main original material. Considering that the label data of the exsiccate at LINN converges with the label data of the other presumed duplicates, all of which are here considered as type materials. The exsiccate deposited at MO (MO 1629350) is here designated as the second step lectotype, in order to resolve this nomenclatural pending issue.

Specimens examined:—ARGENTINA. **Buenos Aires**: [Avellaneda], "Barracas al Sud", 23[28?] October 1902, *S. Venturi 201* (BAB 7135!, SI!); [Avellaneda], "Barracas al Sud", 24 November 1902, *S. Venturi 202?* (BAB 7136! [probably a duplicate of BAB 7135!]). Balcarce, Sierra Buenavista, October 1943, *R.M. Crovetto 2955* (BAB!); Balcarce, Cerro de la Virgen, 29 December 1960, *H.A. Fabris 2604* (LP 900176!); Balcarce, Sierra La Barrosa, 23 November 1963, *H.A. Fabris & H. Schwabe 4775* (LP!); Balcarce, Cerro Bachicha, 2 November 1965, *A.L. Cabrera et al. 17178* (LP!); Balcarce, Cerro [Sierra] La Bachicha, 27 November 1985, *C.B. Villamil 3607* (BBB!). Barker, Sierra La Tinta, Cerro La Juanita, 450 m elev., 23/24 December 1941, *R.A Spegazzini 63314* (BAB!); Barker, Depto. Juarez, Cerro El Sombrerito, 1 December 1985, *C.B. Villamil 3758* (BBB!). Benavidez a La Ñata, 2 December 1982, *Múlgura & Cialdelta 284* (SI barcode 052231!). [Berezategui?], Hudson, October 1943, *R.M. Crovetto 2713* (BAB!). Berisso, Los Talas, Camino a los Borrachos, 2 November 1965, *G. Dawson 3447* (LP!). Buenos Aires, Palermo, without date, *C.M. Hicken 1897* (SI 14521!); Buenos Aires, San Fernando, without date, *M.S. Pennington 103* (SI 14579!); Buenos Aires, Quilmes, costa del Río, 3 December 1899, *C.M. Hicken 14520* (SI 14520!); Buenos Aires, Arroyo de Curamatal, 12 December 1899, *C. Spegazzini 5158a* (BAB); Buenos Aires, Esc. Agr. Olavarría, 31 December 1917, *J. Isnardi 27* (BAB!); Buenos Aires, San Isidro, 16 October 1924, *Clos 1113* (BAB!); Buenos Aires, Belgrano, 30 October 1924, *A.R. Millán 143* (SI!); Buenos Aires, Palermo, October 1925, *A. Burkart 438* (SI!); Buenos Aires, arroyo Las Brusquitas, entre Dionísia y Chapadmalal, 25 January 1929, *C.M. Hicken 22708* (SI 22708!); Buenos Aires, Vivero Municipal, Centenario y Pampa, 9 October 1942, *A. Medina 64417* (BAB); Buenos Aires, San Isidro, November 1950, *J.H. Hunziker 4615* (BAB!); Buenos Aires, camino San Fernando a orillas río Las Conchas, 13 November 1952, *O. Boelcke 6644* (SI on two sheets!); Buenos Aires, San Isidro, frente al Yacht Club, 26 October 1964, *J.C. Gamerro 1341* (LP!). Carmen de Patagones, February 1898, *s. col.* (LPS 14685 in LP). Coronel Suarez, Estancia "El Lolén", 12 December 1979, *L.A. Pertusi 86* (LP!). Delta, Zanja de Correa, 25 November 1931, *A. Burkart 2976* (SI barcode 052232!). [Ensenada?], Punta Lara, 28 October 1928, *A.L. Cabrera 475* (LP 012938!); [Ensenada], bosque de Punta Lara, 12 November 1939, *G. Dawson 866* (LP 032509!); [Ensenada], Punta Lara, 2 November 1960, *H.A. Fabris 2424* (LP 909512!); Ensenada, Punta Lara, alrededores de la costa del Río de La Plata, October 1986, *R. Fortunato & M. Sánchez 789* (BAB!); Ensenada, Punta Lara, alrededores de la costa del Rio de La Plata, October 1987, *R. Fortunato et al. 1011* (BAB!). Escobar, camino a Paraná de Las

Palmas, puente sobre Río Luján, 31 October 2004, *Hunell et al. 5797* (SI!). La Plata, alrededores de La Plata, Isla Santiago, January 1895?, *s. col.* (LPS 14686 in LP!); La Plata, December 1902, *s. col.* (LPS 14687 in LP!); [La Plata?], Los Talas, October 1915, *M. Radice 128* (LP 047573!); [La Plata], Isla Martín García, 31 October 1920, *E.C. Clos 214* (BAB!); La Plata, arredores de La Plata, Los Talas, 16 October 1932, *A.L. Cabrera 2356* (LP 012941!); [La Plata?], Playa Municipal, cerca de La Plata, 28 January 1938, *G. Dawson 342* (LP 025873!); La Plata, Isla Santiago, 24 October 1943 [1940?], *A.L. Cabrera 9808* (LP 051653!, SI barcode 052239!); La Plata, Los Talas, 19 November 1962, *M.A. Torres 1094* (LP!); La Plata, Los Talas, 19 November 1962, *M.A. Torres 1095* (LP!); La Plata, Isla Martín García, cerca de la costa meridional, 27 September 1997, *J. Hurrell et al. 3648* (BAB!); La Plata, Isla Martín García, 6 October 2003, *J. Hurrell et al. 5336* (SI 100819!). Mar del Plata, 11 December 1913, *A. Valentini 54* (SI 14548 on two sheets!). Necochea, orillas del Río Quequén, January 1963, *E.D. Gautier 5401* (LP!). Punta Chica, 2 December 1900, *C.M. Hicken 14518* (SI 14518!); Punta Chica, orillas Río de La Plata, 8 November 1951, *O. Boelcke 6385* (SI on two sheets!). [Coronel Rosales?], Río Sauce Grande. 17 October 1990, *C.B. Villamil 7040* (BBB!). [Saavedra], Cerro Cura Malal Grande, zona de los lagos, 465–700 m elev., 12 November 1928, *s. col.* (LP 012962!); [Saavedra], Cerro Cura Malal Grande, up to 700 m elev., 12 November 1928, *A. Scala s.n.* (LP 012963! [probably a duplicate of LP 012962!]); Saavedra, Sierra Curumalal, 19 November 1941, *R.A. Spegazzini s.n. [62913?]* (BAB!); Saavedra, Sierra de Curamalal, 28 November 1963, *H.A. Fabris & H. Schwabe 4886* (LP!); Saavedra, Sierra de Cura Malal, ca. 700 m elev., 21 November 1972, *R. Gómez et al. 1195* (BAB 1195!); Saavedra, Cerro Cura Malal Grande, 17 November 1982, *C.B. Villamil et al. 2572* (BBB!, SI barcode 052241!); Saavedra, Cerro Cura Malal chico, 25 October 1997, *F.R. Tizón 172* (BBB!, ICN!); Saavedra, Establecimiento “Santa Quota”, 8 January 1998 (pist. fl. and fr; hermaf. fl. and fr.) *F.R. Tizón 313* (BBB! ICN!); Saavedra, Arroyo Cochenleufú, 13 December 1998 (pist. fl. and fr.) *F.R. Tizón 661* (BBB!); Saavedra, Abra del Hinojo, 13 December 1998, *F.R. Tizón 681* (BBB!). Tandil, November 1892, *O. Kuntze s.n.* (LP 012960!); Tandil, 3 November 1928, *A. Burkart 2800* (SI!); Tandil, Cerro Los Leones, 22 November 1937, *A.J. Pastore s.n.* (SI 1214!); Tandil, Sierras de Tandil, Cerro Leones, 2 November 1951, *D. Abbiatti 4274* (LP 902314!); Tandil, Cerro Leones, 18 November 1952, *M.M. Job s.n.* (LP on 3 sheets, 906522!, 906523! and 906524!); Tandil, Sierras de Tandil, Cerro Albión, 19 November 1970, *J. Frangi 139* (LP!). [Tigre?], Islas del delta del Tigre, a orillas de las islas, 22 January 1938, *E.D. Gautier 3?* (BAB 62264!); Tigre, 19 October 1945, *A.E. Laufranchi 431* (LP 904329!). [Tornquist?], Sierra Ventana, November 1895?, *s. col.* (LPS 14690 in LP!); [Tornquist?], Sierra Ventana, 21

November 1895?, *N. Alboff s.n.* (LP 012969!); [Tornquist], Sierra de La Ventana, November 1904, *P. Dusén 6329* (SI!); [Tornquist?], Sierra de La Ventana, 7 November 1907, *C.M. Hicken 14522* (SI 14522!); [Tornquist?], Sierra de La Ventana, February 1914, *A. Scala s.n.* (LP 014125!); [Tornquist?], Sierra de La Ventana, Estancia El Pantanoso, orillas de un arroyo, 9–12 November 1932, *Molfino & Clos 46300* (BAB!); Tornquist, Sierra de La Ventana, Arroyo de Los Remansos, 8 November 1938, *A.L. Cabrera 4704* (LP 023024!, SI!); Tornquist, Sierra de La Ventana, Cerro de La Ventana, 17 January 1940, *A.L. Cabrera 5797* (LP 031343!); Tornquist, Sierra de La Ventana, 2 November 1941, *G. Dawson & O. Nuñez 18* (LP 050119!); Tornquist, Sierra de La Ventana, Rio Sauce Grande, 3 November 1941, *A.L. Cabrera 7311* (LP 043615!, SI 100823!); Tornquist, Sierra de La Ventana, Las Piletas, 38°10'S 61°57'W, 500–1100 m elev., *O. Boelcke et al. 12090* (BAB!); Tornquist, Abra de La Ventana, 6 December 1964, *A.L. Cabrera & H.A. Fabris 16483* (LP!); Tornquist, Sierra de La Ventana, Las Piletas, 2 December 1966, *H.A. Fabris & R.L. Pérez Moreau 6713* (LP!); Tornquist, Abra de La Ventana, 19 November 1968, *A.L. Cabrera et al. 19587* (LP!); Tornquist, Sierra de La Ventana, Cerro Napostá, ca. 800 m elev., 17 November 1972, *R. Gómez et al. 11688* (BAB!); Tornquist, Sierra de La Ventana, El Avestruz (Palo Alto), 500 m elev., 1 December 1978, *"Proyecto Ventania 546"* [s. col.] (LP!); Tornquist, Villa Ventana, junto al arroyo, 10 November 1980, *C.B. Villamil 1882* (SI barcode 052238!); Tornquist, Sierra de La Ventana, 26 January 1986, *C.B. Villamil 3934* (BBB!); [Tornquist?], Sierra Ventana, 16 November 1992, (hermaf. fl. and fr.) *C.B. Villamil 7890* (BBB!); Tornquist, margens del Arroyo Sauce Grande, 3 Km Sierra de La Ventana, 15 November 1993? (hermaf. fl.) *C.B. Villamil s.n.* (BBB!); [Tornquist?] camino al refúgio, área intangible, 16 November 1993 (hermaf. fl.) *M.A. Long 427* (BBB! ICN!); [Tornquist?] Sierra de La Ventana, 9 November 1994, *C.B. Villamil et al. s.n.* (BBB!); Tornquist, margen del Arroyo del Loro, entrando a Villa Ventana hacia la izquierda, 22 October 1995, *C.B. Villamil 9358* (BBB!); Tornquist, Arroyo Ventana, 14 November 1995, *J. Sánchez 25* (BBB!); [Tornquist] Sierra de La Ventana, Cordón Esmeralda, 26 October 1996 (hermaf. fl.) *M.A. Long s.n.* (BBB!); [Tornquist] Cordón Esmeralda, 5 November 1996 (hermaf. fl and fr.) *M.A. Long et al. s.n.* (BBB!). Tres Arroyos, Cueva del Tigre, Río Quequén Salado, 5 December 1987 (pist. fl. and fr.) *C.B. Villamil 5509* (BBB!, ICN!). **Entre Rios**: Diamante, quebrada del cementerio, 3 November 1970, *A. Burkart & Troncoso 28055* (SI barcode 052201!). Federación, Chaviyú, 24 November 1976, *N.S. Troncoso et al. 1382* (SI barcode 052210!). Paraná, Parque San Martín, 1 November 1962, *A. Burkart et al. 23837* (SI barcode 052242!). **Río Negro**: Adolfo Alsina, finca "Ya Verán", orillas rio Negro, 8 November 1988, *M.N. Correa et al. 9553* (BAB!); Adolfo Alsina, 100 Km del puente Viedma–Patagones, 19

November 1990, *M.N. Correa et al. 10123* (BAB!); **Santa Fe**: San Lorenzo, arroyo Saladillo Fuentes, 29 November 1981, *Stofella 27* (SI barcode 052351!). BRAZIL. **Rio Grande do Sul**: Agudo, margens da BR 287, após ponte do Rio Jacuí, 29°42'25.1"S 53°17'46.6"W, 29 October 2016, *C. Rabuske 143* (ICN!). Bagé, Casa de Pedra, 15 December 1989, *I. Fernandes 783* (ICN!); Bagé, Casa de Pedra, 15 December 1989, *M.R. Ritter 532* (ICN!); Bagé, acesso à Casa de Pedra, 31°00’54.9”S 53°39’33.7”W, 10 October 2017, *C. Rabuske et al. 293* (ICN!); Bagé, BR 293, 1 Km após trevo de Bagé, 31°17'15"S, 54°04'37"W, 268 m elev., 10 October 2017 (stam. fl.) *C. Rabuske et al. 294* (ICN!); Bagé, BR 293, 1 Km após trevo de Bagé, 31°17'15"S, 54°04'37"W, 268 m elev., 10 October 2017 (pist. fl.) *C. Rabuske et al. 295* (ICN!). Cachoeira do Sul, margem da BR 290, 30°15'05"S 58°47'19"W, 70 m elev., 13 October 2017 (stam. fl.) *C. Rabuske et al. 318* (ICN!); Cachoeira do Sul, margem da BR 290, 30°15'05"S 58°47'19"W, 70 m elev., 13 October 2017 (pist. fl.) *C. Rabuske et al. 319* (ICN!). Caçapava do Sul, 36,5 Km S de C. do Sul, BR 153, Km 45,5, 6 December 1978, *A. Krapovikas & C.L. Cristóbal 34194* (SI barcode 052248!); Caçapava do Sul, estrada próx. a Vila do Ricardinho, December 1994, *M. Sobral et al. 7702* (ICN 121737!); Caçapava do Sul, beira da BR 153, 30°22’05.4”S 53°21’48.0”W, 10 October 2017 (pist. fl.) *C. Rabuske et al. 291* (ICN!); Caçapava do Sul, beira da BR 153, 30°22’05.4”S 53°21’48.0”W, 10 October 2017 (stam. fl.) *C. Rabuske et al. 292* (ICN!). Candelária, margens da RS 287, 29°40'37.4"S 52°43'34.1"W, 29 October 2016, *C. Rabuske 140* (ICN!); Candelária, margens da RS 287, 29°42'52.2"S 52°53'54.0"W, 29 October 2016, *C. Rabuske 141* (ICN!); Candelária, 29°34’48.1”S 52°49’11.4”W, 145 m elev., 14 October 2018, *C. Rabuske-Silva* & *C.C. Alff 359* (ICN!). Cerro Largo, 23 December 1948, *A. Sehnem 3573* (SI!); Cerro Largo para São Luiz, 20 November 1952, *B. Rambo 53186* (SI 160454!). Dom Pedrito, ponte sobre Arroio Santa Maria Chico, 1 November 1981, *O. Bueno 3298* (HAS!); Dom Pedrito, margens da BR 293, 31°09'40"S 54°21'30"W, 269 m elev., 11 October 2017 (stam. fl.) *C. Rabuske et al. 296* (ICN!); Dom Pedrito, próximo ao trevo do município, 30°59'13"S 54°38'09"W, 167 m elev., 11 October 2017 (stam. fl.) *C. Rabuske et al. 299* (ICN!); Dom Pedrito, próximo ao trevo do município, 30°59'13"S 54°38'09"W, 167 m elev., 11 October 2017 (pist. fl.) *C. Rabuske et al. 300* (ICN!). Encruzilhada do Sul, Projeto de Assentamento Farroupilha, próx. ao Arroio Abranjo, 16 December 2007, *M. Grings 454* (ICN!). Frederico Westphalen, 14 November 1977, *B. Irgang s.n.* (ICN 35657!). Giruá, estrada entre Giruá e Santo Ângelo, Km 27, 15 November 1977, *I. Reis 159* (ICN!); Giruá, 14 November 1977, *B. Irgang s.n.* (ICN 35660!). Itaara, margens da RS 158, 29°35'14.8"S 53°45'58.1"W, 467 m elev., 29 October 2016, *C. Rabuske 148* (ICN!). Lajeado, beira da BR 386, November 1998, *M. Sobral et al. 8685* (ICN!). Mariana Pimentel, 9 Km SW de Mariana

Pimentel, Col. do Herval-Guaíba, 12 November 1977, *N.I. Matzenbacher s.n.* (ICN 35391!). Novo Cabrais, margens da BR 287, 29°44'07.3"S 52°57'09.7"W, 29 October 2016, *C. Rabuske 142* (ICN!). Pantano Grande, pequeno banhado na entrada de Pantano Grande, 14 December 1972, *J.C. Lindeman & B. Irgang s.n.* (BAB!, HAS 84478!, ICN 21038!); Pantano Grande, 13 November 1975, *M.L. Porto et al. 1651* (ICN 30076!). Paraíso do Sul, margem da BR 287, 29°44'34.3"S 53°07'37.4"W, 29 October 2016, *C. Rabuske 149* (ICN!). Pelotas, colônia municipal, 7 February 1941, *I. Augusto s.n.* (ICN 19006!); Pelotas, divisa com Canguçú, 20 November 1986, *N. Mattos 30066* (HAS 84498!). Pinheiro Machado, Arroio Lajeado, 9 November 2009, *E. Barboza et al. 2497* (MBM!). Restinga Seca, margens da BR 287, 29°43'19.8"S 53°20'53.1"W, 29 October 2016, *C. Rabuske 145* (ICN!). Rio Pardo, margens da BR 290, 30°13’16.9”S 52°38’38.3”W, 10 October 2017 (stam. fl.) *C. Rabuske et al. 289* (ICN!); Rio Pardo, margens da BR 290, 30°13’16.9”S 52°38’38.3”W, 10 October 2017 (pist. fl.) *C. Rabuske et al. 290* (ICN!). Rosário do Sul, margens da BR 290, 30°09'23"S 55°10'01"W, 125 m elev., 13 October 2017 (stam. fl.) *C. Rabuske et al. 314* (ICN!). Santa Margarida do Sul, margens da BR 290, 30°20'26"S 54°03'03"W, 114 m elev., 13 October 2017 (pist. fl.) *C. Rabuske et al. 317* (ICN!). Santa Maria, São Pedro, 5 Km antes do cemitério, 3 December 1973, *B. Irgang, J. Vals et al. s.n.* (HAS 5243!, ICN 27122!); Santa Maria, Reserva Biológica do Ibicuí-Mirim, Campo dos Barcelos, 18 December 1991, *N. Silveira 11096* (HAS!); Santa Maria, margem da BR 287, 29°43'58.7"S 53°31'22.1"W, 29 October 2016, *C. Rabuske 146* (ICN!). Santana da Boa Vista, Passo dos Neves, 27 September 1985, *B. Irgang et al.* (ICN 66270!). Santana do Livramento, 49 Km E de Livramento, 15 October 1971, *J.C. Lindeman et al. s.n.* (ICN 8572!); Santana do Livramento, 11 October 2009, *A.M. Carneiro et al. 814* (HAS!); Santana do Livramento, beira da BR 293, 30°51’09.0”S 55°31’23.0”W, 212 m elev., 11 October 2017 (pist. fl.) *C. Rabuske et al. 306* (ICN!). Santiago, SE de Santiago, est. para Jaguari, 20 December 1972, *J.C. Lindeman, A. Pott et al. s.n.* (ICN 21142!). São Gabriel, 10 November 1973, *D. Andrade-Lima & B. Irgang s.n.* (ICN 30720!); São Gabriel, 13 October 1971, *J.C. Lindeman et al. s.n.* (HAS 503!, ICN 8364!); São Gabriel, beira da BR 290, 30°19'35"S 54°22'31"W, 93 m elev., 13 October 2017 (pist. fl.) *C. Rabuske et al. 315* (ICN!); São Gabriel, beira da BR 290, 30°19'35"S 54°22'31"W, 93 m elev., 13 October 2017 (stam. fl.) *C. Rabuske et al. 316* (ICN!). Segredo, 29°25’29.5”S 52°56’22.8”W, 553 m elev., 14 October 2018, *C. Rabuske-Silva & C.C. Alff 364* (ICN!). Uruguaiana, margens da BR 290, 29°55'09"S 56°39'02"W, 128 m elev., 13 October 2017 (pist. fl.) *C. Rabuske et al. 312* (ICN!); Uruguaiana, margens da BR 290, 29°55'09"S 56°39'02"W, 128 m elev., 13 October 2017 (stam. fl.) *C. Rabuske et al. 313* (ICN!). URUGUAY. **Canelones**: Arroyo del Sauce at crossing of road (and limestone quarry site) 6 Km south of Km 78 on road west of Solis, 28 November 1943, *H.H. Bartlett 20977* (SI!). **Florida**: San Pedro de Timote, Cerro Colorado, October 1943, *PE 5354* (ICN 123698!, SP!). **Paysandú**: Paysandú, várzeas do Rio San Francisco Grande, 23 m elev., 5 December 2017, *M. Köhler et al. 290* (ICN 198388!). **San José**: Barra Santa Lucia, 0–5 m elev., November 1927, *G. Herter 82339* (SI!). **Soriano**: Juan Jackson, November 1945, *without collector* (ICN 123697!, SP 53839!).

13. Valeriana reitziana Borsini (1962a: 161). Type:—BRAZIL. Minas Gerais, "in cacumine arido graminoso petroso montis Serra de Caracol", 30 February 1875, *H. Mosén 4253* (holotype S on two sheets, barcodes S05-1808 and S12-6553, images!).

Figure 29 plate. Figure 19 map.

Dioecious subshrubs, 40–100 cm high, perennial, rhizomatous, decumbent; rhizomes woody, short, slightly thickened, 20–120 × 3.7–10 mm. **Branches** fistulous, striate, internodes 6–22 mm long at base, 28–116 mm long at floral axis, 0.8–5.2 mm in diameter; plants glabrous, eventually with normal trichomes 0.1–1 mm long, sparse in the branches or grouped in the grooves, nodes and base of the leaf blades. **Leaves** isomorphic to slightly heteromorphic, chartaceous, not wrinkled in dry material, blades entire, obovate to oblanceolate at base, 14–45 × 12–26 mm, base attenuate, sessile, apex rounded to obtuse, eventually praemorse; distal leaves entire, elliptic, lanceolate or oblanceolate, 30–72 × 14–27 mm, blades slightly discolor, adaxial face green, abaxial face lightly green, beige in dry material, glandular punctate, base cuneate to attenuate, sessile, eventually with a pair of basal lobes, lobes lanceolate, 4–18 × 2–4 mm, apex acute to obtuse; margins subrevolute, serrate, teeth 3–10 pairs, 1–2 mm long, restricted to the distal half or distributed throughout the margin; central nerve adaxially sulcate, abaxially salient, secondary veins 1–2 pairs, conspicuous, forming a sharper angle with the central vein (ca. 30°), tertiary veins inconspicuous. **Inflorescences** lateral and terminal, distally paniculiform to spike like, 4–6 pairs of secondary branches. Staminate inflorescences paniculiform, 330–560 mm long, secondary axes spike like, 8–145 mm long, tertiary axes glomeruliform, 3–10 mm long. Pistillate inflorescences spike like, 194–230 mm long, secondary axes glomeruliform, 4–16 mm long, tertiary axes glomeruliform, 4–6 mm long. **Bracts** proximal similar to distal leaves, linear to lanceolate, 11–24 × 5–10 mm, margin with 1 to 3 pairs of elongated teeth, similar to lanceolate lobes, 2–6 × 1–2 mm long; distal bracts lanceolate, 2.4–4.4 × 1.2–2 mm, eventually with 1–2 inconspicuous teeth or lobes. **Bracteoles**

ovate, 1.5–2 × 0.7–1 mm, acute apex, rounded base, glabrous. **Staminate flowers** white to cream, campanulate to infundibuliform, 1.7–2 × 1.7–2 mm; corolla tube 1–1.3 mm long, glabrous, gibbous ca. 0.4–0.5 mm length; lobes 5, acute, 0.5–0.8 × 0.5–0.8 mm; stamens 3, 1–1.4 mm long, exserted, adnate to the corolla close to the base; anthers oblong to globose, 0.6–0.7 mm long; pistilodium 0.3–0.6 mm long, included, inconspicuous, stigma capitate; ovary abortive partially developed at the base of the flowers, 0.3–0.4 × 0.3–0.4 mm long, similar to a floral peduncle. **Pistillate flowers** white to cream, campanulate to rotate, 0.7–0.9 × 0.6–0.9 mm; corolla tube 0.3–0.4 mm long, glabrous, base marked by the annular calyx; lobes ovate, obtuse to acute apex, 0.2–0.3 mm long; vestigial staminodes 3, spatulate, unequal sizes, 0.1–0.3 mm long, inconspicuous, inserted; style 0.7–0.9 mm long, exserted, reaching twice the length of the corolla tube; stigma trifid, papillose, lobes 0.2–0.3 mm long, rounded apex; ovary 0.7–0.8 mm long. **Fruits** ovate to rounded, 1.8–3.3 × 1.2–2.3 mm, rounded to slightly emarginate apex, rounded to cordate base, both slightly asymmetrical, transversely triquetrous, 3–5-costate (with two lateral, eventually one abaxial and three adaxial vascular bundle, 0.05–0.1 mm wide), two conspicuous lateral wings, 0.4–0.6 mm wide, stramineous, glabrous, slightly papillose; calyx annular to saucer-shaped or slightly dentate, 0.1–0.2 × 0.3–0.4 mm, quite conspicuous on the top of the achenes. **Seeds** elliptic, acute apex and obtuse to rounded base, 1.8–2 × 0.8–1, smooth and amber surface.

Illustrations:—Borsini (1962a: 153, 163, Lámina 5; 1963: 136) [line drawings]; Sobral (1999a: 40) [photographic plate], Sobral (1999: 46) [line drawing], Rabuske-Silva (2018: 74) [photographic plate].

Phenology:—Flowering and fruiting from October to February.

Distribution and habitat:—Brazil: Minas Gerais, Paraná, Rio Grande do Sul, Santa Catarina and São Paulo. *Valeriana reitziana* occurs especially along the Serra Geral plateau, Atlantic Rainforest domain, with a single historical record (type specimens) in Serra do Caracol, Serra da Mantiqueira mountain range, Minas Gerais. It occurs in highland grasslands, being restricted to rocky outcrops and wet or dry slopes, between 700 and 1350 m elev.

Conservation status:—Vulnerable (VU: A2c). *Valeriana reitziana* has a wide distribution (EOO = 137,150.000 km²), and a low area of occupancy (AOO = 990 km²), being rare and scarce in nature. At least 14 subpopulations were recorded, most of them historical, one of them in a conservation unit (Ibicuí-Mirim Biological Reserve), where it was collected in the last time in 1990. Its habitat is endangered by extensive agriculture, excessive cattle grazing, uncontrolled fire and dams. This agrees with Martinelli & Moraes (2013), which estimates a loss of at least 30% of natural populations, and with Rabuske-Silva (2018).

Etymology:—In honor of the Brazilian botanist Raulino Reitz (1942–1990) (Borsini 1962a).

Taxonomic notes:—*Valeriana reitziana* is morphologically similar to *V. eichleriana*, as compared in the diagnosis of the latter. Probably the first collection of *V. reitziana* was made by the French botanist Auguste de Saint-Hilaire (1779–1853) in the state of São Paulo, between 1816 and 1821 (*A. Saint-Hilaire 1554*, P 06773772 image!). The collection data suggest that this species was recorded between September and December 1819, in eastern São Paulo, somewhere in the localities of Carmo, Batatais, Itapeva, Casa Branca, Mogi Guaçú, Mogi Mirim, Campinas, Jundiaí, Jaraguá, Tietê, São Paulo (municipality), Sorocaba, or Ipanema (Herter 1945). Since the collection of the type specimens by the Swiss botanist Carl Wilhelm Hjalmar Mosén (1841–1887) in February 1875, no other record was made in the state of Minas Gerais (Rabuske-Silva 2018). The occurrence of *V. reitziana* in southeastern Brazil is restricted to these two historical records. Due to the absence of current records, *V. reitziana* is here considered extinct in the states of Minas Gerais and São Paulo.

The achenes present great variation in size and shape of the apex and the base, as observed in *Hatschbach et al. 10594* (MBM), *Rambo 36161* and *Vogel-Ely et al. 426* (ICN). The few collections with achenes suggest that at the end of maturation the apex becomes slightly emarginate and the base slightly cordate.

Specimens examined:—BRASIL. **Paraná**: Guarapuava, Águas Santa Clara, 17 November 1963, *G. Hatschbach & Pereira 10594* (MBM!); Guarapuava, Fazenda Três Capões, 9 December 1969, *G. Hatschbach 23188* (MBM! MO image!); Guarapuava, Rio Campo Real, 26 October 1980, *G. Hatschbach 43249* (MBM!). Laranjeiras do Sul, Rincão Grande, 12 October 1974, *G. Hatschbach 35193* (MBM!). Palmas, S.Agostinho, 13 December 1966, *G. Hatschbach 15431* (MBM!); Palmas, Horizonte, 3 December 1971 (pist. fl.) *G. Hatschbach 28142* (MBM!); Palmas, Horizonte, 3 December 1971, *G. Hatschbach 28144* (MBM!). Palmeira, Rio Papagaios, Rod. BR 277, 28 November 1986, *G. Hatschbach & A. Souza 50820* (MBM! MO image!); Palmeira, Recanto dos Papagaios, 28 October 1996, *O.S. Ribas & M.F. da Luz 1572* (MBM!); Palmeira, Recanto dos Papagaios, 28 October 2003, *J.M. Silva et al. 3783* (MBM!); Palmeira, Capela Nossa Senhora das Pedras, 10 November 2005, *J.M. Silva et al. 4480* (MBM!); Palmeira, Recanto dos Papagaios, 28 October 2006, *E. Barbosa & E.M. Cunha 1793* (MBM!); Palmeira, Recanto dos Papagaios, 6 October 2008, *J.M. Silva et al. 7012* (MBM!). Tibagi, Rodovia Castro-Tibagi, Km 24, 19 October 1993, *G. Hatschbach & E. Barbosa 59659* (MBM!). **Rio Grande do Sul**: Bom Jesus, Silveira, 10 Km ao norte do distrito, 5 February 1985, *N. Silveira et al. 2048* (HAS!). Cambará do Sul, Cambará para São

Francisco de Paula, February 1948, *B. Rambo 36161* (PACA!). Santa Maria, Reserva Biológica do Ibicuí-Mirim, campo à esquerda da barragem, December 1987, *O. Bueno 5184* (HAS!); Santa Maria, Reserva Biológica do Ibicuí-Mirim, Barragem de Saturnino, 9 November 1988, *N. Silveira 5868* (HAS!); Santa Maria, Reserva Biológica do Ibicuí-Mirim, Campo dos Barcelos, 8 November 1990, *N. Silveira 7895, 7958, 7961, 7977, 7970* (HAS!); Santa Maria, Reserva Biológica do Ibicuí-Mirim, Campo dos Barcelos, à jusante da barragem, 8 November 1990, *M.L. Abruzzi 2113* (HAS!); Santa Maria, Reserva Biológica do Ibicuí-Mirim, Campo dos Barcelos, 8 November 1990, *O. Bueno 5991* (HAS!). São Francisco de Paula, divisa Canela, próx. Cascata do Passo do Inferno, 29°18’03”S 50°45’12”W, 840 m elev., 14 November 2015, *C. Vogel-Ely & S. Bordignon 426* (ICN!). São José dos Ausentes, December 2001, *M. Sobral et al. 9424* (ICN!). Segredo, Serrinha Velha, 27 October 2018, *J. Schaefer & J. S Schaefer 832* (ICN!). Vacaria, Fazenda da Ronda para Vacaria, 30 December 1945, *B. Rambo 34654* (PACA); Vacaria, na Rodovia Caxias-Vacaria, 29 November 1986, *J. Mattos 30474* (HAS!). **Santa Catarina**: Bom Jardim da Serra, January 2000, *M. Sobral et al. 9005* (ICN!); Bom Jardim da Serra, January 2000, *M. Sobral et al. 9013* (ICN!); Bom Jardim da Serra, 700 to 1000 m elev., February 2000, *M. Sobral et al. s.n.* (FURB 1330!, MBM!); Bom Jardim da Serra, Rio Pelotas, Rod. SC-438, 1350 m elev., 11 December 2000, *G. Hatschbach et al. 71797* (MBM!). São Joaquim, Fazenda Invernadinha, margem rio Rondinha, 29 December 1955, *J. Mattos 3389* (HAS!); São Joaquim, Taperinha, 22 January 1956, *J. Mattos 4035* (HAS!); São Joaquim, Mantiqueira, 1 February 1958, *J. Mattos 5405* (HAS!); São Joaquim, Invernadinha, perto das barras dos rios Rondinha e Postinho, December 1963, *J. Mattos s.n.* (HAS 84481!); São Joaquim, Invernadinha, perto das barras dos rios Rondinha e Postinho, 24 January 1966, *J. Mattos 13048* (HAS!). **São Paulo**: province de Saint-Paul., 1816–1821, *A. Saint-Hilaire 1554* (P 06773772 image!).

14. Valeriana salicariifolia Vahl (1806: 16). *Valerianopsis salicariifolia* (Vahl) Müller (1885: 347). *Phyllactis salicariifolia* (Vahl) Spegazzini (1899: 173). Lectotype (inadvertently designated by Sobral 1999a: 21):—ARGENTINA. Buenos Aires, “Habitat in Bonaria”, *P. Commerson s.n.* (lectotype C; isolectotypes MPU barcode MPU009993 image!, P barcode P00757619 image!).

=*Valeriana mulleri* Graebner (1899: 435). *Valerianopsis angustifolia* Müller (1885: 346). Type:—BRAZIL. “Habitat in Brasilia, loco non propius indicato”, *F. Sello 4858* (not found, probably destroyed at B) [made in 1828 between the municipalities of Castro and Fortaleza,

Paraná state, and Itapeva, in São Paulo state, according to Herter (1945: 131)]. Neotype (here designated):—BRAZIL, São Paulo, Itapeva, Estação Experimental, 24°3'22"S 49°4'28"W, 700 m elev., 28 October 2010, *J.B. Baitello, C.R. Lima & R. Cielo-Filho 2541* (neotype UPCB 75566!)
=*Valeriana gilgiana* Graebner (1899: 435). *Valerianopsis foliosa* Müller (1885: 348). Type:—BRAZIL. "Habitat in Brasilia, loco non propius indicato", *F. Sello 538* (holotype B, probably destroyed). Lectotype (here designated):—[illustration] Original plate of *Flora Brasiliensis* (Müller 1885: 102).

Figure 30 plate. Figure 31 map.

Dioecious herbs, 30–150 cm high, perennial, rhizomatous, erect to slightly decumbent; rhizomes herbaceous, branched, reaching long lengths, never thickened, 10–100 × 1.6–4.4 mm; roots often darkened in dry material. **Branches** fistulous, terete to subtetragonal or striate, internodes 7–45 mm long at base, 22–125 mm long at floral axis, 1.6–4.4 mm in diameter; plants glabrous, except for normal trichomes 0.2–0.3 mm long, sparse in the branches, leaves and bracts or grouped in the nodes. **Leaves** isomorphic to slightly heteromorphic, coriaceous, eventually wrinkled in dry material, blades entire and elliptic, spatulate or long-spatulate at base, 8–74 × 4–24 mm, base attenuate, apex rounded to obtuse, sessile; distal leaves entire, linear-lanceolate to obovate-lanceolate, falcate, 56–138 × 5–18 mm, blades discolor, adaxial face green to dark green, abaxial face lightly green, glandular punctate, both eventually with purple tinges, beije in dry material, base attenuate to rounded, frequently auriculate to subauriculate, apex acute, sessile, at most eventually slightly petiolate; margin markedly revolute, more frequently entire, eventually slightly serrate, teeth 3–12 pairs, quite inconspicuous, 0.1–0.3 mm long, distributed throughout the blade margin; central nerve adaxially sulcate, abaxially quite salient, secondary veins 6–8 pairs, very inconspicuous, tertiary veins inconspicuous; petioles, when present, 2–8 × 1–1.2 mm. **Inflorescences** lateral and terminal, distally paniculiform, 4–7 pairs of secondary branches. Staminate inflorescences 210–520 mm long, secondary axes 24–120 mm long, tertiary axes 3–46 mm long. Pistillate inflorescences 186–460 mm long, secondary axes 12–58 mm long, tertiary axes, 2–6 mm long. **Bracts** proximal similar to distal leaves, 20–30 × 1.5–2 mm; distal bracts linear to ovate, 2–7 × 0.7–1 mm, subconate. **Bracteoles** ovate, 1.5–2 × 0.7–1 mm, acute apex, rounded base, subcarenate, glabrous. **Staminate flowers** white to cream, campanulate to slightly infundibuliform, 1.4–1.6 × 1.4–1.6 mm; corolla tube 0.5–0.7 mm long, glabrous, gibbous ca.

0.2–0.3 mm length; lobes 5, acute, 0.5–0.7 × 0.4–0.7 mm, unequal; stamens 3(4), 1.2–1.3 mm long, exserted, adnate to the corolla close to the base; anthers oblong to globose, 0.3–0.4 mm long; pistilodium 0.1–0.15 mm long, quite inconspicuous, included, stigma capitate; ovary abortive partially developed at the base of the flowers, about 0.3 × 0.1 mm long, similar to a floral peduncle. **Pistillate flowers** white to cream, campanulate to rotate, 0.5–0.6 × 0.5–0.6 mm; corolla tube 0.2–0.3 mm long, glabrous; lobes ovate, obtuse to acute apex, 0.2–0.3 mm long, unequal; vestigial staminodes 3, unequal sizes, 0.1–0.2 mm long, quite inconspicuous and inserted; style 0.5–0.6 mm long, exserted, reaching twice the length of the corolla tube; stigma trifid, papillose, lobes 0.2–0.3 mm long, rounded apex; ovary 0.7–0.8 mm long. **Fruits** elliptic, 1.6–1.8 × 0.6–0.8 mm, rounded apex and base, transversely triquetrous, slightly oblique, 3–5-costate (two lateral and one or three adaxial vascular bundle, 0.05–0.1 mm wide), two inconspicuous and membranaceous lateral wings, 0.2–0.3 mm wide, slightly oblique, stramineous, glabrous, papillose; calyx vestigial, eventually conspicuous, annular to slightly dentate, 0.1–0.2 × 0.4–0.5 mm, teeth hardly visible. **Seeds** elliptic, acute to attenuate apex, rounded base, 1.1–1.3 × 0.4–0.5, smooth and stramineous surface.

Illustrations:—Müller (1885: 101) [line drawing], Borsini (1944: Tab. CXXII, CXXIV and CLII; 1962a: Lam. 1 under *V. gilgiana*, and Lam. 3; 1963: 134 under *V. muelleri* and *V. gilgiana*, and 135) [line drawings], Borsini (1962a: Lam. 2, under *V. mülleri*) [photographic plate], Bacigalupo (1974: 59) [line drawing], Sobral (1999a: 41) [photographic plate], Sobral (1999a: 46) [line drawing], Rabuske-Silva (2018: 29, 78) [photographic plates].

Phenology:—Flowering and fruiting from October to January.

Distribution and habitat:—Argentina (Buenos Aires), Paraguay (Caaguazú), Uruguay (Cerro Largo, Río Negro, Rivera, San José) and Brazil (Paraná, Rio Grande do Sul, Santa Catarina, São Paulo). *Valeriana salicariifolia* is widely distributed in ESA, occurring from the lowlands of the *Pampas* domain (Rio de la Plata grasslands) to the highland grasslands of the Atlantic Rainforest domain (Brazil) (Figure 31). In Argentina, it is restricted to the Buenos Aires province, with few records along the banks of the Rio de La Plata. In Brazil the species occurs especially in the highland grasslands of the Serra Geral plateau, Atlantic Rainforest domain. Only a few rare and sparse records were made in the lowlands of the state of Rio Grande do Sul (*Pampas* domain), in the municipalities of Lajeado, Pantano Grande, Pelotas and Quaraí. In Paraguay it is only known from the department of Caaguazú, and sparse records are known in several departments in Uruguay (Kutschker 2008a). The species is restricted to wetlands, peat bogs, riverbanks and streams, often forming populations with hundreds to thousands of individuals, frequently between 900 and 1400 m elev., rarely in lower elevations.

Conservation status:—Least Concern (LC). *Valeriana salicariifolia* has a wide distribution (EOO = about 630,000.000 km²) and a wide area of occupancy (AOO = 20,000 km²). In Brazil the species is naturally abundant and frequent in its distribution area, especially in the *Aparados da Serra* region, Rio Grande do Sul and Santa Catarina states. Despite this, it becomes less frequent towards the north. In southeastern Brazil, it has few records in the state of São Paulo (municipalities of Itapeva and São Caetano) and Minas Gerais (Caldas), many of them historical. In Argentina the species is known from few records. In Paraguay the species seems to be rare, being only registered in the department of Caaguazú, in the southern region. In Uruguay, the species was registered in four departments (Cerro Largo, Río Negro, Rivera and San José) (Kutschker 2008a). In Brazil, the species occurs in at least six conservation units: National Park of Aparados da Serra, National Park of Itaimbezinho, Ecological Station of Aracuri, State Park of Tainhas, Biological Reserve of Serra Geral and National Forest of São Francisco de Paula. Its habitat is endangered by drainage of wetlands for land use and cattle overgrazing. There are no known records of the species in conservation units in Argentina, Paraguay and Uruguay, but field observations suggest that the species may be subject to similar threats.

Etymology:—From the Latin "*salicarius-a-um*", or "*salicinus-a-um*", due to the similarity with the leaves of *Salix* spp. (Salicaceae) (Gledhill 2008: 338).

Taxonomic notes:—*Valeriana salicariifolia* has some particular features in comparison to the other Brazilian species of the genus, especially the combination of herbaceous habit with long rhizomes and erect to slightly decumbent aerial branches, sometimes reaching 150 cm alt., rhizomes and branches herbaceous, and distal leaves linear-lanceolate to oblong-lanceolate. However, it is eventually confused with narrow-leaf morphotypes of *V. reitziana*, from it is distinguished by the coriaceous leaves (*vs.* chartaceous leaves), by the paniculiform paracladia (*vs.* distal portion of the paracladia glomeruliform), and by the elliptic and smaller achenes, 1.6–1.8 × 0.6–0.8 mm (*vs.* achenes globose, 1.8–2.8 × 1.6–2.2 mm).

Valeriana salicariifolia has only three historical records made in the state of Minas Gerais, all from the Swedish botanist Johan Fredrik Widgren, and probably corresponding to a single collection. The identification of *Widgren 182* dated 1845, without municipality or other geographic references (R 97785, M barcode M-0189614 image!) is historically controversial, being determined by Müller (1885) as *Valerianopsis foliosa* (= *Valeriana gilgiana*), and by

Focko Weberling as *Valeriana mulleri* in 1999, according to the exsiccate labels. Borsini (1962) attributes other two exsiccates of *Widgren s.n.*, also from 1845, to the municipality of Caldas, Minas Gerais (MBM, LIL 189922), determined as *Valeriana salicariifolia*. However, the author cites other unnumbered material of the same collector (LIL 189920), same year and same locality, determined as *Valeriana gilgiana*. The impasses regarding the determination of Widgren's collections reveal the confusion between these taxa, gathered here under the synonymy of *V. salicariifolia*.

Spegazzini (1899: 173) points to the occurrence of the species in Carmen de Patagones, department of Río Negro, an ecotone region between the *Pampas* domain and the Patagonia. Bacigalupo (1974) suggests the occurrence of the species in the Sierra de Curamalal, in the south of the province of Buenos Aires, Argentina. These would be the southernmost known records of *V. salicariifolia*. However, we did not find any collection from these regions in the analyzed herbaria. Kutschker (2008a) points the presence of the species in Paraguay only in the department of Caaguazú, referring the same material analyzed here as a voucher (*Hassler 9604*, P photo!). A possible subsequent revision of the herbaria from Paraguay may eventually expand the distribution of *Valeriana salicariifolia* in this country.

Regarding the morphological features, Müller (1885) argues that the differentiation between *Valerianopsis angustifolia* (= *Valeriana mulleri*), *Valerianopsis salicariifolia* (= *Valeriana salicariifolia*) and *Valerianopsis foliosa* (= *Valeriana gilgiana*) is based basically in the shape of the leaves. Other variable characters are mentioned specifically for the differentiation between *V. angustifolia* and *V. salicariifolia*, the first being a less robust species, with fewer branches and inflorescences with a lower number of paracladia. Our analysis indicates a single polymorphic species, sometimes presenting a broad spectrum of sympatric morphological variation. Thus, *V. muelleri* and *V. gilgiana* are here treated as synonyms of *V. salicariifolia*, as previously referred by Rabuske-Silva (2018). Since there are no new collections since the 19th century from Minas Gerais, this species is considered probably extinct in this state.

Höck (1882) included *V. salicariifolia* in the section *Valerianopsis*, series *Polystachyae*, due to the shape of its inflorescences and the fruit with calyx eppapose. This position is maintained here.

Nomenclatural note concerning type specimens:—Sobral (1999a: 21) inadvertently designated an lectotype (not seen by him) deposited at C, according to Prado *et al.* (2015), and the Article 7.11 of the Shenzhen Code (Turland *et al.* 2018). We located other two duplicates of the type materials at MPU and P, therefore considered isolectotypes.

Regarding the synonyms, Müller (1885: 346) designated *Sello 4858* as type specimen of *Valerianopsis angustifolia*. Graebner (1899: 435), when recombination of this binomial under *Valeriana*, he observes that the new name was previously occupied, suggesting a new epithet in honor of the former species author, *V. mulleri*. Since the original material was apparently destroyed at B, and without illustration of *Valerianopsis angustifolia* in the protologue, we designate here a neotype for this binomial, as required by the Shenzhen Code. According to Herter (1945: 131) the collection of *Sello 4858* was made in 1828 between the municipalities of Castro and Fortaleza, Paraná state, and Itapeva, in São Paulo state. Based on the description and collection region of the specimens originally analyzed by Müller, we have selected as neotype the collection *J.B. Baitello et al. 2541* (UPCB 75566!), from the municipality of Itapeva, São Paulo state. A similar case of recombination occurred with another binomial published by Müller (1885: 348): *Valerianopsis foliosa*. Graebner (1899: 435) also proposes the recombination of this name under *Valeriana*. However, the new name (*Valeriana foliosa*) was already pre-occupied, being chosen by Graebner the new binomial *V. gilgiana*. We did not find any collection of *F. Sello 538* at B, and here the illustration of the protologue is designated as lectotype, as required by Shenzhen Code. The collection number makes the analysis of the year and the location dubious, since the number may be related to several collection events according to Herter (1945).

Specimens examined:—ARGENTINA. **Buenos Aires**: Buenos Aires, s. data, *s. col.* (LPS 14683 in LP!); Buenos Aires, s. data, *s. col.* (LPS 14691 in LP!); Buenos Aires, [Río] Paraná Mini, Delta del Paraná, 21 November 1931, *A.L. Cabrera 1913* (LP 012939!). Delta, Canal Guazú, November 1925, *A.C. Scala s.n.* (LP 012946 [pro parte]!); Delta, Río Capitán, 16 December 1928, *A. Burkart 2854* (SI 052305!); Delta, Caraguatá, 15 January 1929, *A. Burkart 3269* (SI barcode 052313!); Delta, Arroyo Mendez Grande, 31 October 1929, *A.C. Scala s.n.* (LP 029390!); Delta, Barca Grande, 4 December 1937, *J. von Reutrell s.n.* (SI barcode 052304!). [Ensenada?], Río Santiago, 28 November 1909, *C.M. Hicken s.n.* (SI 14545 on 2 sheets!). La Plata, alrededores de La Plata, Isla Santiago, January 1886, *s. col.* (LPS 14682 in LP!); La Plata, Isla Santiago, November 1900, *C. Spegazzini 5174* (BAB!); La Plata, Isla Santiago, 17 October 1940, A.*L. Cabrera 9799* (LP 051659!). Tigre, 22 October 1950, *A.E. Laufraschi 877* (SI on 2 sheets!); Tigre, Paraná de Las Palmas, 28 November 1981, *Troncoso & Bacigalupo s.n.* (SI barcode 052301!). Paraná de Las Palmas, costa del río, 15 November 1991, *L.Gurini 67* (BAB!). BRAZIL. **Minas Gerais**: [Caldas?], 1845, *Widgren 182* (R 97785, M barcode M-0189614 image!). **Paraná:** Balsa Nova, Rodeiozinho, 8 November 1976, *G. Hatschbach 39151* (MBM!); Balsa Nova, Ponte dos Arcos, 23 September 2006, *C. Kozera*

3299 & O.P. Kozera (MBM!). Colombo, Rio Canguiri, 3 October 1967, *G. Hatschbach 17249* (MBM!). Campo Largo, Rio Papagaios, 18 December 1960, *G. Hatschbach 7544* (MBM!). Contenda, 4 November 1966, *G. Hatschbach 15246* (MBM!). Coronel Domingo Soares, Estrada de Palmas à Cel. Domingo Soares, WGS 84 26°20’04”S 52°00’00”W, 1077 m elev., 23 September 2013, *J.T. Motta et al. 4082* (MBM! RB). Curitiba, 7 October 1908, *P. Dusén 6814* (LP!); Curitiba, Rio Atuba, 30 October 1973, *G. Hatschbach 32769* (MBM!); Curitiba, Jardim Natalia, 26 December 1973, *G. Hatschbach 33619* (LP!, MBM!); Curitiba, Capão do Centro Politécnico, 14 October 1992, *J. Cordeiro & E. Barbosa 872* (MBM!); Curitiba, Capão do Centro Politécnico, 9 November 1993, *O.S. Ribas & E. Barbosa 609* (FLOR!, MBM!). General Carneiro, Iratim, 6 December 1971, *G. Hatschbach 28317* (MBM!); General Carneiro, Faxinal dos Souzas, 7 December 1971, *G. Hatschbach et al. 28342* (MBM!). Guarapuava, Rio das Pedras, 18 November 1963, *E. Pereira 8002 & G. Hatschbach 10614* (MBM!, R); Guarapuava, Fazenda Campo Real, 1000 m elev., 16 December 1965, *R. Reitz & R. M. Klein 17781* (HBR!). Palmas, S. Agostinho, 13 December 1966, *G. Hatschbach 15415* (MBM!); Palmas, Estrada Palmas para Ponte Serrada, 5 December 1971, *G. Hatschbach et al. 28239* (MBM!, SI!); Palmas, nascente do Rio Dama, Fazenda Coxilhão, 26°34’14”S 51°41’27”W, 1260 m elev., 28 October 2010, *L.P. de Souza 194* (MBM!). Palmeira, Rio dos Papagaios, 27 October 2001, *O.S. Ribas et al. 3708* (MBM!). Pinhais, 13 November 1911, *Dusén 13361* (SI!); Pinhais, Área 4, margem do Reservatório do Iraí, 25 October 2009, *R. Ristow & A.C.L. Miranda 292* (MBM!). Piraí do Sul, Serra das Furnas, 19 December 1961, *G. Hatschbach 8690* (MBM!); Piraí do Sul, Tijuco Preto, 17 November 1970, *G. Hatschbach 25409 & O. Guimarães* (MBM!). Piraquara, Passo do Cercado, 30 October 1949, *G. Hatschbach 1550* (MBM!); Piraquara, entre Roça Nova e Piraquara, October 1964, *N. Saito 458* (MBM!); Piraquara, Rio Bracajuvava, 10 October 1966, *G. Hatschbach 14828* (MBM!); Piraquara, FEA (Fazenda Experimental de Agronomia) 15 October 1969, *N. Imaguire 2249* (MBM!); Piraquara, Pinhaes, 17 October 1969, *G. Hatschbach 22490* (MBM!); Piraquara, Pinhaes, 950 m elev., 23 November 1969, *G. Hatschbach 23038* (MBM!); Piraquara, Borda do Campo, 30 October 1986, *G. Hatschbach 50678 & A. Souza* (MBM!); Piraquara, Medianeira, 12 November 2003, *J. Cordeiro 2153* (MBM!); Piraquara, Recreio da Serra, WGS84 25°26’47”S 49°01’23”W, 927 m elev., 24 October 2013, *M.L. Brotto et al. 1369* (MBM!). Ponta Grossa, Rio Guavirova, 7 October 1969, *G. Hatschbach 22315* (MBM!); Ponta Grossa, arredores do Buraco do Padre, 25°11’13.5”S 49°58’25.1”W, 855 m elev., 16 October 2009, *M.G. Caxambu & E.L. Siqueira 2720* (EFC!, MBM!). São José dos Pinhais, Col. Muricy, 30 November 1978, *G. Hatschbach 41810* (MBM!); São José dos Pinhais, Boneca do Iguaçú, 24 October 1979, *P.I.*

Oliveira 119 (MBM!). São Mateus do Sul, 10 Km para oeste, 760 m elev., 9 February 1966, *G. Hatschbach 13797* (MBM!). Tijucas do Sul, Rincão, 15 October 1961, *G. Hatschbach 8459* (MBM!); Tijucas do Sul, Rincão, 21 October 1977, *G. Hatschbach 40437* (MBM!); Tijucas do Sul, Tabatinga, WGS84 25°48’35”S 49°07’34”W, 907 m elev., 1 November 2013, *J.M. Silva 8488* (MBM!). União da Vitória, São Cristovão, 18 November 1972, *G. Hatschbach 30687* (MBM!). **Rio Grande do Sul:** [Bom Jesus], Santo Inácio, São Salvador, 650 m elev., 22 December 1946, *E. Henz s.n.* (PACA 35771, SI!); Bom Jesus, Fazenda B.Velho, 1 January 1947, *B. Rambo 34655* (PACA!, MO image!); Bom Jesus, estrada Ausentes-Silveira, 18 December 1969, *A. Ferreira & B. Irgang s.n.* (ICN 7448!); Bom Jesus, Capão do Tigre, 19 December 1969, *A. Ferreira & B. Irgang s.n.* (ICN 7333!); Bom Jesus, Fazenda dos Potreirinhos, 4° Distrito, 27 November 1977 (stam. fl.) *O.R. Camargo 5526* (HAS!); Bom Jesus, entre a Serra da Rocinha e a Celulose Cambará, 29 November 1977, *J. Mattos 17922* (HAS!); Bom Jesus, estrada Bom Jesus p/Vacaria, saída de Bom Jesus, 5 January 1978, *M. Fleig 896* (ICN!). [Cambará do Sul], Taimbé, S. Fr. de Paula, 1000 m elev., 19 December 1950, *A. Sehnem 5143* (SI!); Cambará do Sul, 1977, *S. Boechat s.n.* (ICN 41927!); [Cambará do Sul], Taimbézinho, 9 November 1961, *G. Pabst 6672 & E. Pereira 6846* (LP!, R 22490); Cambará do Sul, Itaimbezinho, 28 November 1982, *M. Sobral 1245* (MBM!); Cambará do Sul, Faxinal, December 1983, *M. Sobral & J.R. Stehmann 2688* (ICN!, MBM!); Cambará do Sul, December 1983, *J.R. Stehmann 242* (ICN!); Cambará do Sul, ca. 1000 m elev., 24 December 1984, *J.R. Stehmann & P. Brack 455* (ICN!); Cambará do Sul, na rodovia para São Francisco de Paula, 12 February 1987 (stam fl.) *N. Silveira 4020* (HAS!); Cambará do Sul, Itaimbezinho, 950 m elev., 1 December 1987, *L. Roth 22* (ICN!); Cambará do Sul, Itaimbezinho, 27 December 1988, *J.A. Jarenkow & R.M. Bueno 1187* (FLOR! PEL!); Cambará do Sul, estrada Tainhas-Cambará, próximo ao acesso da Serra do Pinto, 21 November 1997, *R.S. Rodrigues 381* (ICN!); Cambará do Sul, Rio Camisa, 23 November 1998, *C.V.S. Gastel s.n.* (ICN 176861!); Cambará do Sul, December 2000, *M. Sobral & A.L. Silva 9178* (ICN!, MBM!). Caxias do Sul, Vila Oliva, 9 km do povoado direção a Ana Rech, 29 October 1985, *M.L. Abruzzi 998* (HAS!); Caxias do Sul, Ana Rech, Faxinal, 7 December 1988, *R. Wasum et al. 4945* (HUCS, MBM!); Caxias do Sul, estrada entre Rincão das Flores e Criúva, 28°57’54”S 50°55’26”W, 17 November 2008, *R. Schmidt & J. Mauhs s.n.* (PACA 105938!). Esmeralda, 23 January 1979, *L. Arzivenco 472* (ICN!); Esmeralda, Estação Ecológica de Aracuri, 6 November 1982, *J.L. Waechter 1918* (ICN!); Esmeralda, 28°06’44”S 51°07’38”W, 14 October 2016, *C. Rabuske et al. 117* (ICN!); Esmeralda, na saída da cidade, 28°03’01”S 51°11’42”W, 14 October 2016, *C. Rabuske et al. 119* (ICN!). Farroupilha, 12 November 1999, 750 m elev., *L. Scur 155* (HUCS!). Gramado, 26

December 1949, *B. Rambo 44971* (PACA!, MO image!). Jaquirana, próximo a São Francisco de Paula, cascata dos Venâncios, 12 December 2003, *G.H. Silveira 24* (ICN!); Jaquirana, Fazenda da Cachoeira, Cascata do Venâncio, 20 January 2005, *V.C. Souza & V.F. Kinupp 30509* (ESA, ICN!); Jaquirana, Passo do S, Parque Estadual do Tainhas, 30 November 2005, *R.M. Senna et al. 1187* (HAS!); Jaquirana, Passo da Ilha, Parque Estadual do Tainhas, 2 December 2015, *R.M. Senna 1070* (HAS!); Jaquirana, margem da RS 110, 28°53'49.0"S 50°27'34.3"W, 15 October 2016, *C. Rabuske et al. 130* (ICN!). Lajeado, beira da BR 386, November 1998. *M. Sobral et al. 8686* (ICN!). Maquiné, Reserva Biológica da Serra Geral, 24 January 2005, *R. Schmidt 847* (HAS!); Maquiné, Reserva Biológica da Serra Geral, 25 January 2005, *R. Schmidt 851* (HAS!). Muitos Capões, 28°20’51”S 51°18’56”W, 769 m elev., 18 October 2014, *F. Gonzatti 1315* (HUCS! MBM!); Muitos Capões, banhado próximo ao rio Ituim na RS 456, 28°13’41”S 51°05’59”W, 14 October 2016, *C. Rabuske et al. 116* (ICN!). Pantano Grande, ca. 18 Km oeste de Pantano Grande, 11 November 1980, *J. Mattos 22794* (HAS!). Pelotas, Horto do Instituto Brasileiro de Desenvolvimento Florestal, 10 October 1977, *J. Mattos 17403* (HAS!). Quaraí, estrada entre Quaraí e Santana do Livramento, December 1944, *M. Sobral et al. 7699* (ICN!). São Francisco de Paula, Taimbezinho, 13 November 1953, *B. Rambo 54515* (HBR!); São Francisco de Paula, Fazenda Englert próx. a São Francisco de Paula, 1 January 1954, *B. Rambo 54754* (HBR!); São Francisco de Paula, Fazenda Englert próx. a São Francisco de Paula, 2 January 1955, *B. Rambo 56400* (HBR!); São Francisco de Paula, Tainhas, 15 February 1980, *M. Sobral s.n.* (HAS 11188!); São Francisco de Paula, 29 km em direção a Bom Jesus, 18 November 1986 (stam fl.) *M. Neves 777* (HAS!); São Francisco de Paula, 5 Km oeste da cidade, na rodovia para Taquara, 29 November 1988, *N. Silveira 7537* (HAS!, MBM!); São Francisco de Paula, Aratinga, 800 m elev., 25 November 1994, *G. Hatschbach et al. 60362* (MBM!); São Francisco de Paula, FLONA, Arroio Lajeado, 17 December 1998, *C. Mondin et al. 1658* (PACA!); São Francisco de Paula, RS 235 em beira de estrada, 29°22’00”S 50°38’57”W, 800 m elev., 14 November 1999, *R. Wasun 278* (HBR!); São Francisco de Paula, 16 November 2002, *J. Paz 136* (ICN!); São Francisco de Paula, Condomínio Alpes de São Francisco, 16 November 2002, *A. Leonhardt & M.L. Lorscheitter s.n.* (ICN 124218!); São Francisco de Paula, estrada Tainhas-Caxias do Sul, RST 453, 14 November 2003, *V.F. Kinupp 2828 & B.E. Irgang* (ICN!); São Francisco de Paula, 7 December 2005, *V.F. Kinupp & H. Lorenzi 3086* (ICN!); São Francisco de Paula, arredores, 20 November 2008, *J.M. Silva et al. 7409* (MBM!); São Francisco de Paula, no acesso à FLONA, 29°23’28.42”S 50°25’41.56”W, 16 October 2016, *C. Rabuske et al. 131* (ICN!). São José dos Ausentes, banhado junto ao arroio Manoel Leão, November 1994, *M. Sobral 7732* (ICN!, MBM!); São José dos Ausentes, December 1995, *M. Sobral et al. 8095* (ICN!); São José dos Ausentes, ca. 5 km antes da cidade, vindo de Bom Jesus, 27 December 1996, *J.A. Jarenkow 3393* (FLOR!, MBM!, PEL!); São José dos Ausentes, em estrada secundária, 17 December 2002, *M. Molz & P. Colombo s.n.* (ICN 125391!). Vacaria, Rio Santana, 20°20'55"S 50°44'10"W, 27 November 2009, *J. Mauhs s.n.* (PACA 105724!); Vacaria, entre Passo do Socorro e Bela Vista, 18°19'17.31"S 50°46'47.52"W, 15 October 2016, *C. Rabuske et al. 122, 124* (ICN!). **Santa Catarina:** Água Doce, 28.5 km SE de Horizonte, 3 December 1964, *L.B. Smith & R.M. Klein 13456* (HBR!); Água Doce, 28.5 km de Horizonte, 3 December 1964, *L.B. Smith & R.M. Klein 13462* (HBR!). Bom Jardim da Serra, Cambajuva, 1100–1200 m elev., 16 January 1957, *L.B. Smith & R. Reitz 10206* (HBR!, R image!, MO image!); Bom Jardim da Serra, Fazenda da Laranja, 1400 m elev., 10 December 1958, *R. Reitz & R.M. Klein 7713* (HBR!); Bom Jardim da Serra, Fazenda da Laranja, 1400 m elev., 13 January 1959, *R. Reitz & R.M. Klein 8139* (HBR!); Bom Jardim da Serra, estrada para o Cânion das Laranjeiras, 28°19'06.8"S 49°37'07.8"W, 1307 m elev., 3 December 2012, *R. Trevisan 1322* (FLOR!); Bom Jardim da Serra, topo da Serra do Rio do Rastro, 28°24'03.7"S 49°33'07.2"W, 21 October 2017 (infertile) *C. Rabuske et al. 339* (ICN!); Bom Jardim da Serra, 28°25'59.8"S 49°38'54.7"W, 1356 m elev., 21 October 2017 (stam. fl.) *C. Rabuske et al. 340* (ICN!). Bom Retiro, Campo dos Padres, 1900 m elev., 16 December 1946, *R. Reitz 2369* (HBR!, SI 160635!); Bom Retiro, Fazenda Campo dos Padres, 1650 m elev., 17–19 November 1956, *L.B. Smith et al. 7709* (HBR!); Bom Retiro, beira da BR 282, 27°48'16.6"S 49°27'51.6"W, 812 m elev., 16 October 2017 (stam. fl.) *C. Rabuske et al. 327* (ICN!). Campo Alegre, lower fazenda of Ernesto Scheide, 900 m elev., 9 November 1956, *L.B. Smith & R.M. Klein 7465* (HBR!); Campo Alegre, Rodeio Grande, 17 january 1996, *O.S. Ribas et al. 1014* (MBM!); Campo Alegre, estrada de acesso aos Campos do Quiriri, 26°05'31.8"S 49°10'12.9"W, 828 m elev., 20 October 2017 (pist. fl.) *C. Rabuske et al. 333* (ICN!); Campo Alegre, estrada de acesso aos Campos do Quiriri, 26°05'56.5"S 49°10'16.5"W, 828 m elev., 20 October 2017 (stam. fl.) *C. Rabuske et al. 334* (ICN!). Campo Erê, 6 Km west of Campo Erê, ca. 26°22' 53°06', 900–1000 m elev., 6 December 1964, *L.B. Smith & R.M. Klein 13707* (SI 160687!). Cerro Negro, 14 January 1988, *A.Krapovickas & C.L.Cristóbal 42014* (HAS! CTES). Chapecó, Fazenda Campo São Vicente, 24 km west of Campo Erê, 900 to 1000 m elev., 26 December 1956, *L.B. Smith et al. 9501* (HBR!). Irineópolis, Valões, 750 m elev., 25 February 1962, *R. Reitz & R.M. Klein 12473* (HBR!). Lages, 1 km east of Índios, 800 to 900 m elev., 11 February 1957, *L.B. Smith & R.M. Klein 11223* (HBR!); Lages, 27°45'36"S 50°09'41"W, 10 November 2013, *E.D. Santos et al. 271* (FLOR!). Orleans, Serra Rio do Rastro, 29 January 1950, *R. Reitz 3332*

(HBR!, SI barcode 052314!). Ponte Serrada, by road to Xanxerê, 26°55’S 52°03’W, 700 to 900 m elev., 8 November 1964, *L.B. Smith & R.M. Klein 13057* (FLOR!, MO image!, NY image!, R image!, SI 052249!); Ponte Serrada, 8 November 1964, *L.B. Smith & R.M. Klein 13059* (HBR!). Porto União, Fazenda Frei Rogério, 12 km southeast of Porto União, 750 m elev., 18 December 1956, *L.B. Smith & R. Reitz 8688* (HBR!); Porto União, 3 km south from Matos Costa on the road to Calmon (22 km), 900–1100 m elev., 20 December 1956, *L.B. Smith & R. Reitz 8919* (HBR!); Porto União, east of Valões, (Irineópolis) on the road to Canoinhas, 750 m elev., 3 February 1957, *L.B. Smith & R.M. Klein 10717* (HBR!); Porto União, 750 m elev., 27 October 1962, *R. Reitz & R.M. Klein 13669* (HBR!). Rio dos Cedros, Cachoeira Formosa, 26°33’31”S 49°22’16”W, 747 m elev., 28 November 2016, *L.A. Funez 5697* (FURB!). São Joaquim, no Postinho, 9 November 1954, *J. Mattos 1283* (HAS!); São Joaquim, Postinho, 28 December 1955, *J. Mattos 4155* (HAS!); São Joaquim, Varginha, 15 January 1956, *J.R. Mattos 3616* (HBR!); São Joaquim, 30 January 1957, *J. Mattos 5536* (HAS!); São Joaquim, 13 km southwest of São Joaquim, ca. 28°22’S 49°57’W, 1200–1300 m elev., *L.B. Smith & R. Reitz 14353* (SI 052250!); São Joaquim, Fazenda Araucária, na barra do Rio Postinho com o Rio Rondinha, 20 January 2000, *J.R. Mattos 32682* (FLOR!); São Joaquim, Rod. SC-438, 8 km oeste de Cruzeiro, 1300 m elev., 9 December 2000, *G. Hatschbach et al. 71723* (MBM!); São Joaquim, Cruzeiro, 16 November 2008, *J.M. Silva et al. 7252* (MBM!). Urubici, 28°03’07.1”S 49°22’45.3”W, 901 m elev., 16 October 2017, *C. Rabuske et al. 326* (ICN!). **São Paulo**: Province de Sao-Paolo, 1833, *Gaudichaud 965* (P barcode P06773752 image!). São Caetano, 15 November 1913, *A.C. Brade 7068* (R 22891 image!). Itapeva, Estação Experimental, brejo da divisa, 24°02'55.0"S 49°06'41.0"W, 29 September 2010, *J.B. Baitello et al. 2552* (UPCB 75575!); Itapeva, Estação Experimental, Brejo da Divisa, 24°03'22.0"S 49°04'28.0"W, 28 October 2010, *J.B. Baitello et al. 2541* (UPCB 75566!). PARAGUAI. **Caaguazú**: Yhú, nov. 1905, *Hassler 9604* (P image!).

15. Valeriana scandens Linnaeus (1762: 47). Type:—VENEZUELA, Cumana, *Loefling it. 235* (not found; destroyed or probably never seen by Linnaeus, according to Barrie 1989). Neotype (designated by Barrie 1989):—VENEZUELA, Distrito Federal, en sitios abrigados, de colonias de Barrancas, 3 November 1940, *F. Tamayo 1440* (neotype US image!; isoneotypes F barcode F0074664F image!, UC image!).

=*Valeriana alpina* Vellozo (1825: 29). Lectotype (here designated): [illustration] Original parchment plate of *Florae fluminensis* deposited at the Manuscript Section of the Biblioteca Nacional of Rio de Janeiro, and later published in Vellozo (1827: t.68).

=*Valeriana volubilis* Sesse & Moc. ex Candolle (1830: 634) (illegitimate name, *nomen nudum*).

=*Valeriana mikaniae* Lindley (1848: 316). Type:—GUATEMALA, "raised from the rubbish received among Mr. Skinner's Guatemala Orchids", April 1847, *Skinner s.n.* (syntypes CGE, MO).

=*Valeriana regnelli* Sonder (1849: 573) (illegitimate name, *nomen nudum*).

=*Valeriana phaseoli* Braun (1851: 13) (illegitimate name, *nomen nudum*).

=*Valeriana scandens* L. var. *genuina* Müller (1885: 344). Lectotype (here designated):—CUBA, in Cuba orientali, 1856–1857, *C. Wright 277* (lectotype GOET on 3 sheets 9576, 9577 and 9578 images!).

=*Valeriana scandens* L. var. *angustiloba* Müller (1885: 344). Lectotype [inadvertently designated by Meyer (1951: 463) at NY and W; second step designated by F.R. Barrie & A. Kutschker (Kutschker 2019)]:—MEXICO, Orizaba, Engenho, Sierra de La Cruz, 1853, *F. Mueller 769* (lectotype NY 278758 image!; isolectotypes BR 5505227 image!, GH 31729 image!; NY 278757 image!).

=*Valeriana scandens* L. var. *subcordata* Müller (1885: 344). Lectotype (designated by Kutschker 2019):—BRAZIL, Rio de Janeiro, in Serra d'Estrella, *C.F.P. Martius 476* (lectotype M 0189607 image!).

=*Valeriana scandens* L. var. *dentata* Müller (1885: 344). Lectotype [designated by F.R. Barrie & A. Kutschker (Kutschker 2019)]:—MEXICO, San Pedro Oaxacensium, *Karwinsky 321?* (lectotype BR 0000005422104 image!; isolectotypes KFTA 2857 image!, LECB 1676 image!).

=*Valeriana scandens* L. var. *candolleana* (Gardner 1845: 112) Müller (1885: 344). *Valeriana candolleana* Gardner. Lectotype (designated by Eriksen 1989):—BRAZIL, Rio de Janeiro, "in bushy places near the summit of the Organ Mountains", May 1837?, *G.Gardner 461* (Lectotype BM 947827 image!; isolectotypes G 354547 image!, K 588361 image!, K 588387 image!, NY 278780 image!, P 757621 image!).

=*Valeriana bonariensis* Spegazzini (1917: 342). Lectotype [designated by Kutschker 2019):—ARGENTINA: Buenos Aires. Ensenada, Los Talas, November 1896, *s. col.* (LPS-12043 in LP barcode 010715!).

Figure 32 plate. Figure 33 map.

Gynomonoecious-gynodioecious voluble or clambering herbs, ascending up to 30–150 cm high, perennial, rhizomatous; narrow and short tap-root surrounded by a large number of filiform roots. **Branches** fistulous to slightly fistulous, internodes 2–84 mm long at base, 32–430 mm long at floral axis, 0.8–2.8 mm in diameter; plants glabrous, except for the presence of tufts of normal hyaline trichomes 0.3–0.8 mm long, denser and conspicuous in the nodes. **Leaves** slightly to strongly heteromorphic, blades ovate, cordate or sagittate, entire at base, 16–95 × 14–47 mm, cordate base, acute to attenuate apex, eventually falciform, petioles 12–68 × 0.7–1.5 mm, eventually reaching twice the length of the leaf blade; distal leaves entire to lobed (simple) or trifoliolate (compound), sometimes more than one shape in a single specimen, 15–160 × 10–124 mm, blades slightly discolor, adaxial face green, abaxial face lightly green; distal lobe 30–84 × 15–80 mm, often larger than the lateral ones, rounded, acute or attenuate apex, cordate base; lateral lobes (when present) 1–2, 10–64 × 12–42 mm, often asymmetrical, opposite to subopposite; margin entire, dentate or crenate, teeth 2–6 pairs, 2–10 mm long; central vein adaxially sulcate, abaxially salient; secondary veins conspicuous, 3–4 pairs, diverging from the central vein in the basal portion of the leaf blade; tertiary veins conspicuous, eventually inconspicuous; pseudopetioles 25–70 × 0.8–2 mm. **Inflorescences** lateral and terminal, distally paniculiform, 3–12 pairs of dichotomous secondary branches, rachis ca. 60–1200 mm long, secondary axes ca. 30–450 mm long, tertiary axes ca. 10–120 mm long, eventually the flowers inserted alternately in the axes. **Bracts** proximal similar to distal leaves, 10–160 × 8–120 mm, distal bracts linear, 3–6 × 0.5–1 mm. **Bracteoles** ovate, lanceolate or linear-lanceolate, 1.5–2 × 0.7–1 mm, acute to attenuate apex, rounded to attenuate base, glabrous. **Hermaphrodite flowers** white to cream, infundibuliform, 1.8–4.5 × 0.7–3 mm; corolla tube 0.6–2.3 mm long, glabrous, gibbous ca. 0.4–1.8 mm length; lobes 5, ovate, obtuse apex, 0.6–1 × 0.2–1 mm, glabrous; stamens 3, 1.8–3 mm long, exserted to subexserted, adnate to the corolla close to half the length; anthers globose, 0.5–0.7 mm long; pistil 1.8–2.5 mm long, included to slightly exserted, stigma trifid, papillose, lobes 0.4–1 mm long, rounded apex; ovary 0.7–1 mm long. **Pistillate flowers** white, campanulate to cupuliform, 1.6–4.5 × 0.7–3 mm; corolla tube 0.8–2.3 mm long, glabrous; lobes ovate, obtuse apex, 0.4–1 mm long; vestigial staminodes 3, 1.8–2 mm long, conspicuous, inserted; style 2–4.5 mm long, quite exserted; stigma trifid, papillose, lobes 0.4–1 mm long, rounded apex; ovary 0.7–1 mm long. **Fruits** elliptic, 1.5–3.8 × 1–2 mm (disregarding the pappus), apex acute to attenuate, base rounded to slightly cordate, slightly asymmetrical, transversely biconvex, 6–costate (two lateral, three adaxial and one abaxial vascular bundle, 0.1–0.4 mm wide), two conspicuous lateral wings, 0.5–0.8 mm wide, narrower at the apex and base, about 0.4–0.7 mm wide, stramineous, glabrous; calyx-limb setose (pappus-like), 10–15 bristles, about 5–7.8 × 8–14.6 mm, tightly enrolled in the immature fruit, when enrolled ca. 0.6–0.8 × 1.2–1.5 mm. **Seeds** elliptic, acute apex, rounded base, 2–2.4 × 1–1.2, smooth and amber surface.

Illustrations:—Vellozo (1827: t.67) [line drawing], Müller (1885: t.100) [line drawing], Meyer (1951: 464, 466) [line drawings], Borsini (1944: CXXIII, CXXVII; 1962a: 153; 1963: 133) [line drawings], Bacigalupo (1974: 57) [line drawing], Xena de Enrech (1992: 265) [line drawing], Sobral (1999a: 42) [photographic plate], Sobral (1999a: 46) [line drawing], Scalon *et. al.* (2002: 350) [line drawing], Acevedo-Rodríguez (2005: 389) [line drawing], Novara (2008: 5) [line drawing], Rabuske-Silva (2018: 82) [photographic plate].

Phenology:—Flowering and fruiting all year round.

Distribution and habitat:—*Valeriana scandens* has wide distribution in Tropical America, occurring from northern Argentina to Florida, southeastern United States (Meyer 1951). It is assumed to have the widest geographical distribution of the genus (Xena de Enrech 1993, Duarte-Silva *et al.* 2010b). In ESA, the species occurs in all countries analyzed (Argentina, Brazil, Paraguay and Uruguay) (Figure 33). In Argentina, the species occurs in the provinces of Buenos Aires, Corrientes, Distrito Federal, Entre Rios, and Misiones. In Brazil it occurs in the states of Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Rio de Janeiro, Minas Gerais, Espírito Santo, Bahia, Sergipe, Paraíba and Mato Grosso do Sul. In Paraguay, we confirmed records for the departments of Alto Paraná and Itapoá. In Uruguay, the species occurs in the department of Rivera. It inhabits preferably humid and shaded areas, occurring in rainforest understory, waterfalls and peat bogs in the Atlantic Rainforest domain, with some records in the *Pampas* domain. It is often found in areas under anthropogenic disturbance. The collections indicate a wide altitudinal gradient, occurring from sea level up to 1700 m elevation in southern Brazil (Morro da Igreja, Urubici municipality, Santa Catarina state), and reaching 2150 m elevation in southeast Brazil (Pico das Agulhas Negras, Itatiaia, Rio de Janeiro state).

Conservation status:—Least Concern (LC). *Valeriana scandens* display a wide geographic range (EOO = about 3,100,000.000 km², AOO = 48,000 km²). Plus, the subpopulations are frequent and abundant, occurring in a wide variety of habitats in the Atlantic Rainforest domain, including areas under anthropogenic disturbance. Nevertheless, its occurrence in the *Pampas* domain can be considered rare, being restricted to humid forests in slopes of hills and borders of rivers and streams.

Etymology:—Reference to the scandent habit. Present participle of Latin *scando*, *scandere* (Gledhill 2008: 342).

Taxonomic notes:—*Valeriana scandens* has particular features among the eastern South American *Valeriana*, which are the voluble or climbing habit, the monoecious-gynodioecious mating system, the distal leaves frequently trifoliolate (compound) and achenes with a setose calyx-limb with 10–15 bristles (pappus-like calyx). This species has a center of origin in Central America, from where it irradiated to South and North America (Bell *et al.* 2012). Due to their wide distribution and marked polymorphism in vegetative and reproductive traits, many new species and varieties were historically described, all previously included in the synonymy by Borsini (1962a). Despite this, some authors treated the varieties as valid taxa. *Valeriana scandens* var. *candolleana* is recognized by Meyer (1951), Xena de Enrech (1992), and Kutschker (2008a). *Valeriana scandens* var. *subcordata* is recognized by Xena de Enrech (1992). However, the key characters for differentiation are exclusively the shape of the leaves, which are quite variable even in a single individual. Plus, the analyzed material does not indicate a segregated distribution pattern for theses varieties, nor specific habitats or elevations. Xena de Enrech (1992) argues that there is a variation in the chromosome number of at least two varieties, *V. scandens* var. *scandens*, a tetraploid ($2n = 28$) and *V. scandens* var. *candolleana*, which would be an octaploid ($2n = 56$). Studies evaluating the diversity of polyploids under the genus are scarce, although are potentially promising for the systematics of *Valeriana* as a whole.

Regarding the mating system, *V. scandens* is referred in the literature as hermaphrodite or subpolygamous (Müller 1885), monoecious (Scalon *et al.* 2002), monoecious or gynodioecious (Sobral 1999a) or only as gynodioecious (Meyer 1951; Bacigalupo 1974; Cabrera & Zardini 1978; Xena de Enrech 1992, 1993). Duarte-Silva *et al.* (2010b) observed that this species has three floral morphotypes: perfect flowers (hermaphrodites) and two types of pistillate flowers (called 1 and 2), all with viable seeds. Plus, these authors observed different specimens with pistillate flowers, hermaphrodite flowers, and individuals with both pistillate and hermaphrodite flowers. Therefore, it is classified as a gynomonoecious-gynodioecious species, the first case reported in Valerianaceae (Duarte-Silva *et al.* 2010b). For practical reasons, we have gathered and described only two floral types: hermaphrodite and pistillate.

Regarding the distribution of *V. scandens* in ESA, Kutschker (2008) points the presence of the species in the province of Salta, northwest of Argentina, as well as in the departments of Amambay and Concepción, central region of Paraguay. We did not find specimens from these locations, although specimens from nearby regions have been analyzed.

Valeriana scandens is the only species with a popular name in the ESA. *Caimbémini* is the indigenous name used in the province of Corrientes, Argentina, according to Stuckert & Briquet (1918), also referred by Borsini (1944) and Bacigalupo (1974) [as *caimbé-miní*].

Nomenclature notes concerning type specimens:—Three names are here considered illegitimate, *V. volubilis, V. regnelli,* and *V. phaseoli,* all published in the first half of the 19th century, for which we have not found any type specimens. Thus, the synonymization is based on the conference between these names traditionally referred as synonyms of *V. scandens* in the literature, as well as on the diagnosis when referred in the protologue. Additionally, here we propose the resolution of pending issues in the typification of the synonyms, along with some comments:

Valeriana alpina:—Since no type was mentioned in the protologue, we have designated as lectotype the illustration of the species, an original plate of *Florae fluminensis* deposited at the Manuscript Section of the National Library of Rio de Janeiro, and later published in Vellozo (1827: t.68).

Valeriana mikaniae:— According to the protologue, the original material "raised from the rubbish received among Mr. Skinner's Guatemala Orchids" (Lindley 1848: 316). Meyer (1951: 466) referred as type specimens the material deposited under *Skinner s.n.* at CGE and MO, and therefore made the first step of an inadvertent lectotypification of these syntypes, according to Prado *et al.* (2015), and the Article 7.11 of the Shenzhen Code (Turland *et al.* 2018). We have not located images of these materials, and therefore a second step in the lectotypification of this binomial remains open.

Valeriana scandens var. *genuina*:—We located three exsiccates under *Wright 277*, all deposited at GOET. A single exsiccate deposited at YU (YU 65398 image!) displays two collector numbers (276 and 277) and therefore is disregarded as isolectotype.

Valeriana scandens var. *scandens*:—Xena de Enrech (1992) designated a neotype for this taxon, shortly after the typification designated by Barrie (1989), the latter having priority, as required by the Shenzhen Code (Turland *et al.* 2018).

Specimens examined:—ARGENTINA. **Buenos Aires:** Hudson, October 1943, *R.M. Croveto 2709* (BAB!). [La Plata] Río Santiago, cerca de La Plata, February 1905, *Hauman-Merck s.n.* (SI 14523 on 2 sheets!); La Plata, Punta Lara, ribera del Rio de La Plata, 19 & 20 January 1930, *A.L. Cabrera 1337* (LP 012943!); La Plata, Punta Lara, ribera del Rio de La Plata, 14 January 1932, *A.L. Cabrera 2019* (LP 012940!); La Plata, Punta Lara, 1 November 1939, *A.L. Cabrera 5421* (LP 032559!, SI barcode 059838!); La Plata, Punta Lara, 4 January 1940, *G. Dawson 948* (LP 032225!); [La Plata?], Punta Lara, 24 January 1949, *H.A. Fabris*

312 (SI!); [La Plata] Isla Martín García, camino de la selva septentrional costera, 21 November 1997, *J. Hurrell et al. 3727* (BAB!); [La Plata] Isla Martín García, camino de la selva septentrional costera, 21 November 1997, *J. Hurrell et al. 3728* (BAB!); [La Plata] Isla Martín García, selva interior, al oeste del Camino de Los Alamos, 21 November 1997, *J. Hurrell et al. 3726* (BAB!); [La Plata] Isla Martín García, camino de Los Alamos, 15 November 1998, *J. Hurrell et al. 3970* (BAB!); [La Plata] Isla Martín García, cerca del tanque de combustible, 15 November 1998, *J. Hurrell et al. 3971* (BAB!); [La Plata] Isla Martín García, cerca de la cantera, 19 November 1998, *J. Hurrell et al. 4010* (BAB!); [La Plata] Isla Martín García, arenal central, 30 October 1999, *J. Hurrell et al. 4153* (BAB!). **Corrientes**: Bonpland, 18 December 1909, *P. Jorgensen 666* (BAB 31209!); Bonpland, 15 January 1910, *P. Jorgensen-Hansen 666* (BAB 30144!); Bonpland, November 1910, *P. Jorgensen Hansen 666* (BAB 34739!). **Entre Rios**: Concordia, Yuquerí Chico, 19 November 1976, *N.S. Troncoso et al. 1119* (SI barcode 072131!). Delta del Paraná, [Río] Paraná Miní, January 1931, *A. Burkart 3777* (SI barcode 088909!); Delta, [Río] Paraná Miní, 4 December 1931, *A. Burkart 4064* (SI barcode 072132!); Delta del Paraná, Río Ceibo, en el Monte Blanco, 23 November 1931, *A.L. Cabrera 1940* (LP 012942!, SI barcode 052311!); Delta del Paraná, Sección 3a, Arroyo Manzano de Medina, 16 February 1942, *A. Bridarolli 2212* (LP 947675!). **Misiones**: [General Belgrano, Bernardo de Irigoyen], Campina de America, 2 November 1896, *Nicolein s.n.?* (SI!); General Belgrano, Bernardo de Irigoyen, ruta 17, cruce com ruta 14, 19 February 1992, *N.M. Tur & E.R. Guaglianone 2007* (LP!, SI barcode 052303!); General Belgrano, Ruta Prov. 17, de Bdo. de Irigoyen a Eldorado, 28 km de Bdo. de Irigoyen, 26º20'S 53º52'W, 510 m elev., 1 March 1995, *F.O. Zuloaga et al. 5089* (SI!). Guaraní, Predio Guaraní, 26°54'59"S 54°12'18"W, 24 August 1996, *S.G. Tressens et al. 5661* (CTES, ICN!); Guaraní, Parque Provincial Moconá, borde del Arroyo Yabotí, 27°08'S 53°54'W, 140 m elev., 17 June 2003, *F.O. Zuloaga et al. 8035* (SI!). Montecarlo, Ruta 16, en Puerto Piray y San Pedro, 15 October 1977, *A.L. Cabrera et al. 28836* (SI!). San José, January 1942, *A. Bridarolli 2517a* (LP 893443!). San Pedro, Reserva de Biósfera Yabotí, Parque Estricta Esmeralda, Estación Biológica, 26°53'37"S 53°52'41"W, 500 m elev., 27 September 2004, *M.E. Múlgura de Romero 4021* (SI barcode 052254!); San Pedro, Parque Provincial Esmeralda, 26°53'36"S 52°52'42"W, 504 m elev., 27 November 2004, *F.O. Zuloaga & M.J. Belgrano 8229* (SI barcode 059849!); San Pedro, Reserva de Biósfera Yabotí, Parque Provincial Esmeralda, camino al "Pinar" desde la Estación Biológica, 26°53'46"S 53°52'32"W, 550 m elev., 22 November 2006, *M.J. Belgrano et al. 603* (SI 061337!). Santa Ana, 23 November 1912, *Rodriguez 652* (SI!). [Río?] Paraná Guazú, February 1902, *Pennington 1110* [pro parte] (SI!). BRAZIL. **Bahia**: Cravolândia, Assentamento Palestina, área de reserva, 14 August 2001, *D.L. Santana et al. 596* (ALCB, MBM!). **Espírito Santo**: Alto Caparaó, Pico da Bandeira perto de Caparaó, 1500–1600 m elev., 6 September 1977, *G.J. Shepherd et al. 5780* (MBM!); Alto Caparaó, trilha para o Pico da Bandeira, 20°24'58.0"S 41°49'22.0"W, 2146 m elev., 1 October 2016, *C. Rabuske & R. Santos Jr. 112* (ICN!). Castelo, Parque Estadual do Forno Grande, trilha das piscinas para o mirante, 20°30’58”S 41°05’1”W, 1100–1400 m elev., 2 May 2008, *R. Goldenberg et al. 1078* (RB image!, MBML!); Castelo, Trilha para o Forninho, 20°30’58”S 41°05’1”W, 1400–1500 m elev., 14 October 2008, *R.C. Forzza et al. 5306* (RB image!, MBML!, CEPEC image!, UPCB image!); Castelo, trilha para as piscinas, 20°31’10”S 41°05’15”W, 1101–1400 m elev., 7 April 2009, *L. Kollmann et al. 11501* (RB image!, MBML!, CEPEC image!, UPCB image!). Domingos Martins, Parque Estadual da Pedra Azul, Trilha das Piscinas, 13 July 2005, *L. Kollmann & R.L. Kollmann 8045* (MBML!). Santa Teresa, Morro da estação repetidora de TV, 4 September 1985, *W. Boone 732* (MBML!); Santa Teresa, Valsugana Velha, Estação Biológica de Santa Lúcia, 19°58’S 40°32’W, 550–800 m elev., 12 November 1990, *H.Q. Boudet Fernandes et al. 3033* (MBML!, RBR, MO, CEPEC); Santa Teresa, Valsugana Velha, Estação Biológica de Santa Lúcia, 500–950 m elev., 26 September 1994, *C.C. Chamas & R.R. Santos 255* (MBML!); Santa Teresa, cabeceira do Rio Bonito, Terreno da Aeronáutica, Radar, 1030 m elev., 13 June 2001, *L. Kollmann et al. 3938* (MBML!); Santa Teresa, Nova Lombardia, Reserva Biológica Augusto Ruschi, 800 m elev., 26 September 2001, *L. Kollmann et al. 4746* (MBML!); Santa Teresa, Nova Lombardia, Reserva Biológica Augusto Ruschi, Casa de Pedra, 890 m elev., 28 August 2002, *R.R Vervloet et al. 774* (MBML!); Santa Teresa, Nova Lombardia, Reserva Biológica Augusto Ruschi, trilha da cachoeira, 16 October 2002, *R.R. Vervloet & E. Bausen 1224* (MBML!); Santa Teresa, Nova Lombardia, Reserva Biológica Augusto Ruschi, 10 April 2003, *R.R. Vervloet et al. 2214* (MBML!); Santa Teresa, Estação Ecológica de Santa Lúcia, trilha do palmiteiro, 2 September 2005, *L. Kollmann et al. 8280* (MBML!); Santa Teresa, Reserva Biológica Augusto Ruschi, estrada para os municípios de Fundão e Goiopaba-açú, 19°54605’S 40°32,568’W, 22 August 2012, *T.B. Flores & G.O. Romão 998* (MBML!, ESA image!). **Mato Grosso do Sul**: Bonito, Assentamento Guaicurus, 16 June 2006, *J.M. Silva & E. Barbosa 4937* (MBM!). **Minas Gerais**: Lima Duarte, Parque Estadual da Serra de Ibitipoca, Mata Grande, 21°42.11’S 43°53.06’, 1400 m elev., 10 March 2004, *R.C. Forzza et al. 3168* (MBM!, RB); Lima Duarte, Parque Estadual do Ibitipoca, Mata Grande, 25 January 2007, *R.C. Forzza et al. 4453* (MBM!, RB). Monte Verde, estrada para Camanducaia, 19 June 2000, *L.H.Y. Kamino et al. 9* (BHCB, MBM!). Poços de Caldas, Retiro Branco, 23 August 1988, *M. Boruchin s.n.* (MBM 379017!); **Paraná**: Almirante Tamandaré, 23 August 1995, *W. Maschio 86* (MBM!).

Antônio Olinto, Mata da Igreja, 850 m elev., 3 October 2007, *F. Marchett 615* (HUCS!). Balsa Nova, Serra São Luis, 1100 m elev., 18 September 1970, *G. Hatschbach 24726* (MBM!). Bocaiúva do Sul, Serra de S'Ana, 23 March 1983, *G. Hatschbach 46905* (MBM!). Campo Largo, Taquara, 4 March 1990, *O.S. Ribas & J.M.S. Ribas 289* (MBM!). Campo Magro, Caverna de Sumidouro, 14 October 1996, *A.C. Svolenski & G. Tiepolo 292* (EFC!). Campo Mourão, 27 March 2004, *E. Ferreira s.n.* (HCF 1008, MBM 284895!). Campina Grande, Serra do Espia, 5 April 1966, *G. Hatschbach 11138* (MBM!); Campina Grande do Sul, Sítio do Belizário, 17 August 1966, *G. Hatschbach 14608* (MBM!); Campina Grande do Sul, Sítio do Belizário, 17 May 1967, *G. Hatschbach 16403* (MBM!); Campina Grande do Sul, Serra Virgem Maria, base oriental da serra, 12 November 1968, *G. Hatschbach 20279* (MBM!); Campina Grande do Sul, Serra Capivari Grande, 900 m elev., 12 August 1969, *G. Hatschbach 234* (MBM!); Campina Grande do Sul, Serra Capivari Grande, ago. 1985, *J. Cordeiro & J.M. Silva 74* (ICN!); Campina Grande do Sul, Serra Ibitiraquire, Chácara do Bruno, início da subida para o Pico Paraná, 18 October 2005, *E. Barbosa & P.W. Fritsch 1127* (HUCS!, MBM!); Campina Grande do Sul, Mato Limpo, 24°14'13.64"S 48°52'16.22"W, 945 m elev., 8 March 2008, *F. Marinero & M.C. Abbud 178* (MBM!). Castro, 2 March 1966, *G. Hatschbach & H. Haas 13921* (MBM!). Cerro Azul, 22 km ZO, 3 August 1966, *J. Lindeman & H. Haas 1970* (MBM!). Colombo, 25°17'S 49°13'W, 950 m elev., 1 March 2004, *R.F.S. Possette 336* (HFC, MBM!); Colombo, Hotel Betânia, without date, *P.R.P. Andrade s.n.* (MBM 299845!). Contenda, Serrinha, 17 November 1972, *G. Hatschbach 30641* (MBM!); Curitiba, Capanema, 13 November 1973, *R. Kummrow 70* (LP!, MBM!). Curitiba, Parque Barigui, 11 June 1986, *C.B. Poliguesi & E.F. Paciornik 8* (MBM!); Curitiba, Jardim Botânico, 11 October 1992, *J.M. Silva & J. Cordeiro 1046* (HUCS!, MBM!); Curitiba, Jardim Botânico, 22 January 1993, *O.S. Ribas & J. Cordeiro 470* (MBM!); Curitiba, Pilarzinho, 7 February 1993, *O.S. Ribas 489* (MBM!); Curitiba, Campus III UFPR, Jardim Botânico, 910 m elev., 18 March 1999, *Y.S. Kuniyoshi et al. 6281* (EFC!); Curitiba, Capão do Cifloma, 3 September 2015, *R.R. Völtz 588* (EFC!); Curitiba, Alto Boqueirão, 26 September 2015, *R.R. Völtz & G.H. Santos 646* (EFC!); Fazenda, 22 January 1956, *J. Mattos 4128* (HAS!). Florestal, Florestal para Piraquara, 27 June 1946, *G. Hatschbach 794* (PACA!). Galinhas (General Carneiro), 10 February 1966, *G. Hatschbach et al. 13644* (MBM!). Guarapuava, Rio São Jerônimo, 25 March 2003, *C. Kozera s.n.* (EFC 9762!). Guaratuba, Rio Itararé, 950 m elev., 6 July 1958, *G. Hatschbach 4820* (HBR!); Guaratuba, Serra de Araçatuba, Morro dos Perdidos, 890 m elev., 4 June 1998, *E.P. Santos & C.M.S. Coimbra 490* (MBM! UPCB); Guaratuba, Serra de Araçatuba, Morro dos Perdidos, 1210 m elev., 11 September 1998 *E.P. Santos 549* (MBM! UPCB); Guaratuba, Serra de Araçatuba, Morro dos Perdidos, 1000 m elev., 12 March 1999, *L.C. Cândido & M. Hassegawa 22* (MBM! UPCB); Guaratuba, Serra do Mar, linha de transmissão elétrica Curitiba a Joinville, 25°52'55"S 48°56'35"W, 800 m elev., 7 September 2013, *M.E. Engels 1544* (MBM!, UPCB, HCF). Imbituva, 20 September 1969, *M. Klein & U. Eskuche s.n.?* (SI barcode 052312!). Jundiaí do Sul, Fazenda Monte Verde, Mata do Cruzeiro, 3 September 2001, *J. Carneiro 1141* (MBM!). Morretes, Mananciais da Serra, 15 September 1976, *Y.S. Kuniyoshi 3972* (MBM!); Morretes, Marumbi, trilha para o pico, km 60 da ferrovia Curitiba-Paranaguá, 1100 m elev., 9 August 1983, *F.C. Silva 699* (MBM! UPCB); Morretes, Serra da Graciosa, 9 April 1998, *M.C.O. Jorge & V.A.O. Dittrich 1* (MBM!); Morretes, Comunidade do Candonga, Rio Segredo, 8 October 2005, *H.C.L. Geraldino 133* (MBM!). Palmeira, Colônia Quero-quero, 6 May 1973, *G. Hatschbach 31851* (MBM!). Piraquara, Rio Capivary, 9 February 1946, *G. Hatschbach 207* (MBM!); Piraquara, Florestal, 27 June 1948, *G. Hatschbach 974* (MBM!, PACA!); Piraquara, Fazenda Céu Azul, 3 June 1970, *G. Hatschbach 24388* (MBM!); Piraquara, FEA, C. Silvicultura, 4 September 1973, *N. Imaguire 3360* (MBM!); Piraquara, Mananciais da Serra, 1050 m elev., 26 July 1998, *V.A.O. Dittrich 443* (MBM!); Piraquara, Torre do Vigia, 29 September 2004, *E.F. Costa & E. Barbosa 27* (MBM!); Piraquara, Serra Piramirim, subida para o Morro Pão de Ló, 16 August 2011, *E.F. Costa et al. 137* (MBM!); Piraquara, trilha para a Torre Amarela, 2 May 2015, *C.T. Blum 2120* (EFC!). Pitanga, Borboletinha, 19 October 1973, *G. Hatschbach 32875* (MBM!). Ponta Grossa, Parque Vila Velha, 5 September 1966, *G. Hatschbach 14664* (MBM!). Quatro Barras, 4 November 1980, *G. Hatschbach 43274* (MBM!); Quatro Barras, 11 September 1981, *R. Kummrow 1552* (MBM!); Quatro Barras, Morro Mãe Catira, encosta do morro, 24 July 1987, *J. Cordeiro & F.J. Zelma 441* (MBM!); Quatro Barras, Morro Mãe Catira, 1300 m elev., 12 April 1988, *J.M. Silva & J. Cordeiro 529* (HUCS! MBM!); Quatro Barras, Morro 7, 7 July 1988, *J. Cordeiro & O.S. Ribas 548* (MBM!); Quatro Barras, Estrada da Graciosa, próximo ao alto da serra, 8 December 1989, *A.C. Cervi et al. 3050* (MBM!); Quatro Barras, Serra da Baitaca, 21 September 1996, *A.L. Schütz et al. 38* (EFC!). Rio Branco do Sul, Curiola, 12 March 1967, *G. Hatschbach 16124* (MBM!); Rio Branco do Sul, Caverna de Bromados, 13 December 1996, *A.C. Svolenski & G. Tiepolo 333* (EFC!). São José dos Pinhais, Rio Pequeno, 29 April 2005, *D.S. Marques et al. 3B* (MBM 313049!); São José dos Pinhais, Rio Pequeno, 29 April 2005, *D.S. Marques et al. s.n.* (MBM 326685!); São José dos Pinhais, 26 September 2013, *M.E. Engels 1680* (MBM!); São José dos Pinhais, RPPN Nhandara Guaricana, 13 October 2013, *M.E. Engels et al. 1740* (MBM!, RB). Telêmaco Borba, Bota Fora Dois, margem direita da U.H. Mauá, 24°02'S 50°42'W, 680 m elev., 21 September 2008, *M. Kaehler 253* (MBM!, UPCB). Tunas do Paraná, Colônia João XXIII, 27 June 2002, *O.S. Ribas & L.M. Abe 4723* (MBM!). **Rio de Janeiro**: Itatiaia, 2200 m elev., 28 May 1935, *A.C. Brade s.n.* (PACA 54153!); Itatiaia, Planalto, 1800 m elev., 12 June 1962, *E. Pereira 7082* (LP!, R 16797); Itatiaia, Parque Nacional do Itatiaia, estrada para o Pico das Agulhas Negras, 22°15’00”S 44°34’00”W, 2000–2050, 15 February 1995, *J.M.A. Braga et al. 2011* (MBM! CEPEC, K, NY, HUEFS, OUPR); Itatiaia, Parque Nacional de Itatiaia, Pico das Agulhas Negras, 2150 m lev., 1 May 1977, *M. Stella & F. Silvestre 38* (ICN!, SP); Itatiaia, Parque Nacional do Itatiaia, estrada para o Pico das Agulhas Negras, 14 March 2010, *J. Cordeiro & J.M. Silva 3623* (MBM!). Rio de Janeiro, Vista Chinesa, 17 October 1945, *P. Occhioni 493* (HBR!). Teresópolis, Parque Nacional da Serra dos Órgãos, entre os abrigos 4 e 3, 29 April 1962, *E. Santos 1228, E. Fromm 1210 & Z.A. Trinta 186* (LP!, R 23073). **Rio Grande do Sul**: Agudo, Morro Agudo, 27 September 1985, *D. Falkenberg 3352* (FLOR, MBM!). Alto Feliz, Alto Feliz para Caí, 7 March 1933, *B. Rambo 432* (PACA!). Barra do Ribeiro, Morro da Formiga, 50 m elev., 28 November 1977, *N.I. Matzenbacher 537* (ICN!). Barracão, Parque Estadual de Espigão Alto, 24 October 1985, *J.R. Stehmann 711* (ICN!). Bento Gonçalves, 6 October 1957, *O. Camargo 1949* (PACA!); Bento Gonçalves, ponte Rio das Antas entre Bento Gonçalves e Veranópolis, 1 October 1971, *J.C. Lindeman et al. s.n.* (ICN 8176!, HAS 502!). Bom Jesus, RS 110, Ponte Rio das Antas, divisa com Jaquirana, 28°46'17.0"S 50°26'58.0"W, 15 October 2016, *C. Rabuske et al. 125* (ICN!). Camaquã, Distrito de Santa Auta, Sítio Barbosa Lessa, 240 to 360 m elev., 16 October 2000, *C.F. Jurinitz 41* (ICN!). Cambará do Sul, Taimbesinho para São Francisco de Paula, 7 February 1941, *B. Rambo 4394* (PACA!); Cambará do Sul, Taimbesinho para São Francisco de Paula, 14 February 1946, *B. Rambo 32200* (PACA!); Cambará do Sul, Cambará para São Francisco de Paula, 1000 m elev., 25 February 1948, *B. Rambo 36160* (ICN!, PACA!); Cambará do Sul, Desfiladeiro do Faxinal, 29 December 1979, *M. Sobral 96* (HAS); Cambará do Sul, Faxinal, December 1983, *M. Sobral & J.R. Stehmann 2792* (ICN!); Cambará do Sul, próximo a Oswaldo Kroeff, 4 February 1985, *N. Silveira 1904* (HAS!); Cambará do Sul, saída para a Serra do Faxinal, RS 427, 7 February 2018, *C. Rabuske & C.C. Alff 344* (ICN!). Candelária, 29°34’48.1”S 52°49’11.4”W, 145 m elev., 14 October 2018, *C. Rabuske-Silva & C.C. Alff 359* (ICN!). Canela, Caracol para Canela, 21 February 1947, *K. Emrich s.n.* (PACA 35906!); Canela, Parque do Caracol, 28 December 1972, *M.L. Porto s.n.* (ICN 25633!); Canela, 8 km N de Canela, Parque Estadual do Caracol, 28 December 1972, *J.C. Lindeman s.n.* (ICN 21665!); Canela, Parque das Sequóias (Hotel), 23 March 2004, *J.A. Montanha & S.A.L. Bordignon s.n.* (ICN 137556!). Caraá, trilha da nascente do Rio dos Sinos, 10 April 2017, *C. Rabuske & L. Machado 246* (ICN!). Caxias do Sul, Conceição, 750 m elev., 24 October 1987, *M. Rossato et al. s.n.* (HUCS 3351!); Caxias do Sul, Santa Justina, 780 m elev., 27 November 1999, *L. Scur 195* (HUCS!); Caxias do Sul, Ana Rech, 780 m elev., 16 February 2000, *A. Kegler 1099* (HUCS!); Caxias do Sul, Ana Rech, 780 m elev., 16 February 2001, *L. Scur 894* (HUCS!); Caxias do Sul, Ana Rech, 850 m elev., 5 April 2004, *A. Brunetto et al. 62* (HUCS!). Derrubadas (Tenente Portela), Parque Estadual do Turvo, 6 October 1977, *K. Hagelund 11693* (ICN!); Derrubadas, Parque Estadual Florestal do Turvo, próximo a estrada do salto, 27 October 1986, *M.H. Bassan & J. Pilla s.n.* (HAS 84506!); Derrubadas (Tenente Portela), Parque Estadual do Turvo, estrada para o Porto Garcia, 17 October 1989, *N. Silveira 8541* (HAS, MBM!); Derrubadas, Parque Estadual do Turvo, yucumã, 11 September 1990, *N. Silveira 8726* (HAS!); Derrubadas, Parque Estadual do Turvo, trilha de acesso ao Porto Garcia, 26 October 2010, *J. Durigon 245* (ICN!); Derrubadas, Parque Estadual do Turvo, 30 April 2017, *C. Rabuske & L. Machado 209* (ICN!). Dom Pedro de Alcântara, September 1999, *M. Sobral et al. 8839* (ICN!). Esmeralda, Estação Ecológica Aracuri, 29 March 1982, *J. Stehmann s.n.* (ICN 51625!); Esmeralda, Estação Ecológica Aracuri, 23 January 1984, *J.R. Stehmann 310* (ICN!). Farroupilha, 20 December 1956, *O. Camargo 1045* (PACA!). Frederico Westphalen, entre Frederico Westphalen e Tenente Portela, 14 November 1977, *B.E. Irgang s.n.* (ICN 35656!). Fontoura Xavier, 7 November 2018, *C. Rabuske-Silva et al. 373* (ICN!). Garibaldi, Marcorama, Santana, 700 m elev., 7 November 1987, *R. Wasun et al. s.n.* (HUCS 3454!). Gramado, Linha Quinze, December 2000, *M. Sobral & A.L. Silva 9176* (ICN!, MBM!). Ijuí, Pestana para Ijuí, 5 November 1953, *Pivetta 602* (PACA!). Iraí, 24 January 1964, *A. Burkart 25183* (SI on 3 sheets!). Itaara, RPPN Mo'Ã, 29°37'47"S 56°44'17"W, 340 m elev., 10 September 2016, *F. Gonzatti & M.D. Ferrarese 2736* (HUCS!). Jaquirana, RS 110, 28°51'36.11"S 50°27'15.8"W, 15 October 2016, *C. Rabuske et al. 128* (ICN!). Liberato Salzano, Pinhalzinho, 13 April 1997, *T.M. Pedersen 16307* (MBM!). Maquiné, beira da estrada serra para o mar, Rincão dos Kroeff a Maquiné, descida da Serra do Umbú, 20 December 1973, *L.R.M. Baptista et al. s.n.* (ICN 22162!); Maquiné, Barra do Ouro, 20 December 1984, *J. Mattos 26541* (HAS!); Maquiné, Reserva Biológica Serra Geral, Trilha do Encantado, 14 April 2005, *R. Schmidt 1024* (HAS!); Maquiné, Vale do Rio Ligeiro, 6 June 2013, *M. 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Rabuske 206* (ICN!). Veranópolis, Vale do Rio das Antas, 27 November 1980, *J. Mattos & N. Mattos 21877* (HAS!); Veranópolis, Estação Experimental Fitotécnica, 21 October 1983, *J. Mattos 25531* (HAS!). **Santa Catarina**: Angelina, São José, 500 m elev., 15 November 1956, *Smith et al. 7630* (HBR!); Angelina, 27°27’2”S 49°03’00”W, 841 m elev., 7 September 2017, *A. Kassner-Filho et al. 951* (FURB!). Araranguá, Taimbezinho, 900 m elev., 14 February 1946, *R. Reitz 1481* (HBR!). Blumenau, Morro Spitzkopf, 23 April 1953, *R. Reitz & R.M. Klein 569* (HBR!); Blumenau, Morro do Cachorro, 26°46’24”S 49°02’13”W, 330–775 m elev., 11 September 2017, *L.A. Funez et al. 6543* (FURB!). Bom Jardim da Serra, 3 November 1993, *N.I. Matzenbacher s.n.* (ICN 103650!). Bom Retiro, Campo dos Padres, 23 January 1957, *B. Rambo 60126* (PACA!); Bom Retiro, Fazenda Campo dos Padres, 1650 m elev., 25 January 1957, *L.B. Smith & Reitz 10461* (HBR!). Calmon, 16 March 1910, *P. Dusén 9385* (MO, photo!). 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Santos Jr. 181* (ICN!). Orleans, Rio Novo, 27 July 1991, *V.C. Zanette & A.J. Aguiar 1321* (CRI!). Palhoça, Pilões, 200 m elev., 7 September 1956, *Reitz & Klein 3656* (HBR!); Palhoça, Pilões, 200 m elev., 17 September 1956, *Reitz & Klein 3667* (HBR!). Porto União, Rio Negro, 750 m elev., 4 February 1957, *L.B. Smith & R. Klein 10795* (HBR!); Porto União, 2 km south of Calmon, 1000 m elev., 15 March 1957, *L.B. Smith & R. Klein 12172* (HBR!). Praia Grande, Vila Roza, 26 August 1978, *J.L. Waechter 940* (ICN!). Presidente Nereu, Rio Novo, 27°10'49"S 49°13'50"W, 617 m elev., 10 November 2009, *A. Korte & A. Kniess 896* (FURB, MBM!). Rio Fortuna, 28°04'50"S 49°08'13"W, 276 m elev., 29 September 2017, *A. Kassner-Filho et al. 1099* (FURB!). São Bento do Sul, Rio Natal, estrada de ferro próximo à igreja de Rio natal, 26°21'27"S 49°17'45"W, 400 m elev., 7 August 2016, *P. Schwirkowski 1802* (FURB!); São Bento do Sul, Bairro Colonial, 26°13'39"S 49°24'27"W, 800–850 m elev., 23 October 2017, *P. Schwirkowski 2518* (FURB!); São Bento do Sul, saída da cidade, 14 September 2018, *C. Rabuske-Silva et al. 357* (ICN!). São Joaquim, Fazenda Velha, 25 January 1956, *J. Mattos 2664* (HAS!); São Joaquim, Snow Valley, 13 November 2008, *J. Durigon s.n.* (ICN 192044!). São Miguel do Oeste, Canela Gaúcha, 700 m elev., 1 March 1964, *R.M. Klein 5036* (HBR!). Taió, Fazenda Tarumã, 27°00'01"S 50°07'50"W, 802 m elev., 18 February 2010, *A. Korte & A. Kniess 1785* (FURB, MBM!). Timbé do Sul, Serra da Rocinha, 17 November 2008, *J.M. Silva et al. 7347* (HUCS!, MBM!); Timbé do Sul, Serra da Rocinha, 18 March 2016, *C. Rabuske & J. Iganci 01* (ICN!). Trombudo, 29 January 1964, *E. Pereira 8748 & G. Pabst 8023* (LP!, R 31081). Urubici, Morro da Igreja, 1700 m elev., 14 March 1992, *D.B. Falkenberg 5653* (FLOR, ICN!, MBM!); Urubici, Parque Nacional de São Joaquim, 10 February 2007, *G. Hatschbach & O.S. Ribas 79874* (MBM!); Urubici, Morro do Corvo Branco, 3 September 2012, *M. Proença 64* (ICN!); Urubici, topo da Serra do Corvo Branco, 28°03'7.1"S 49°22'45.3"W, 976 m elev., 16 October 2017, *C. Rabuske et al. 325* (ICN!). Vidal Ramos, Sabiá, 10 October 1957, *Reitz & Klein 5097* (HBR!). **São**

Paulo: Cabreúva, 30 July 1983, *T.M. Cerati & H. Cerati 84* (ICN! SP). Campos do Jordão, January 1944, *E. Friederichs s.n.* (PACA 27791!); Campos do Jordão, Reserva do Instituto Florestal, São José dos Alpes, 6 September 1977, *L.S. Kinoshita Gouvêa & M.A. Gouvêa 5904* (MBM!); Campos do Jordão, Santa Cruz, 1650 m elev., 27 October 1992, *L. Capellari et al. s.n.* (HUCS 8707!). Cunha, Pedra da Marcela, 23°08'21"S 44°48'52"W, 1800 m elev., 11 July 2006, *J. Paulo-Souza et al. 5774* (ESA 95452, SI 066036!). Diadema, Parque Estadual das Fontes do Ipiranga, Vila Facchini, 30 September 1982, *M.C.B. Attié et al. 56* (ICN!). Itapetininga, ca. 50 km S de Itapetininga, Reserva Florestal de Carlos Botelho, 26 October 1976, *P.E. Gibbs et al. 3285* (MBM!). Jundiaí, Serra do Japi, 11 August 1976, *H.F. Leitão Filho & G.J. Shepherd 2531* (MBM!); Jundiaí, 10 km SW de Jundiaí, Serra do Japi, 8 October 1976, *H.F. Leitão Filho et al. 3159* (MBM!). São Paulo, antiga São Paulo–Santos, na descida da serra, ca. 600 m elev., 14 October 1961, *G. Pabst 5781 & E. Pereira 5954* (MBM!, RB); São Paulo, Jardim Botânico e Parque do Estado, 14 August 1968, *T. Sendulsky 843* (MBM!, SP); São Paulo, Reserva Biológica, Parque Estadual das Fontes do Ipiranga, 11 August 1978, *S.L. Jung & E.A. Lopes 266* (ICN!); São Paulo, Parque Estadual das Fontes do Ipiranga, 31 August 1982, *M.C.B. Attié 39* (ICN!). Pindamonhangaba, perto do Pico do Itapeva, estrada para Campos do Jordão, 14 December 1982, *J.R. Pirani et al. 276* (ICN!, SP). Ribeirão Grande, Estrada da Leiteria, 2 September 2010, *E.D. Lozano & M.P. Petean 343* (MBM!). Ubatuba, Serra do Mar above Ubatuba, 700 m elev., 22 August 1976, *P.H. Davis et al. 59917* (MBM!). **Sergipe:** Poço Redondo, Serra da Guia, 17 October 2009, *S.M. Costa 632* (ASE image!). PARAGUAY. **Alto Paraná**: Alto Paraná, October 1909, *K. Fiebrig 6178* (SI!). **Itapoá:** Porto Cantera, 230 m elev., 20 November 1948, *J.E. Montes 3340* (SI!). URUGUAI. **Rivera**: Tres Fornos, Tres Fornos para Rivera, 12 January 1941, *B. Rambo 4072* (PACA!).

Additional specimens examined:—ARGENTINA. **Catamarca:** Los Talas, en los campos húmedos, s. data, *C.M. Hicken 1057* (SI!). **Jujuy**: Calilegua, 2 June 1943, *H.H. Bartlett 20368* (SI!). Capital, Lagunas de Yala, 2400 m elev., 4 December 1969, *A.L. Cabrera & R. Kiesling 20200* (LP!); [Capital], Jujuy, Mina 9 de Octubre, 14 January 1988, *F.O. Zuloaga & N. Deginani 3486* (SI 160864!). Ledesma, Camino a Valle Grande, entre Ruta 34 y Arroyo Agua Negra, 13 June 1983, *A.L. Cabrera et al. 33900* (SI!); Ledesma, Camino a Los Cafetales, 18 June 1983, *A.L. Cabrera et al. 34032* (SI!). San Antonio, Valle del Río La Cabaña, sobre el Río Negro, 24°19'56"S 65°26'21"W, 1696 m . elev., 19 February 2018, *C.A. Zanotti & A.M. Panizza 900* (SI barcode 137582!). Santa Bárbara, de Santa Clara a Abra de Los Monteros, 20 June 1973, *A.L. Cabrera & E.M. Zardini 23843* (LP!); Santa Bárbara, de Palma Sola a El Fuerte, 22 February 1985, *R. Kiesling et al. 5558b* (SI!); Santa Bárbara, camino a El Fuerte desde Santa Clara, 24°18’56”S 64°32’3”W, 880 m elev., 12 May 2008, *A. Slanis et al. 67* (SI!). Valle Grande, de San Francisco a Pampichuella, 23°36’00”S 64°57’47”W, 1400 m elev., 19 February 2009, *F.O. Zuloaga 10955* (SI 052237!). BOLIVIA. **Del Sara**: Depto. Santa Cruz, Bosque de Palometillas, 450 m elev., *J. Steinbach 2158* (SI!). NICARAGUA. Volcán Mombacho, 20 February 1903, *C.F. Baker 151* (SI!). PANAMA. **Chiriqui**: La Fortuna hydroelectric project, in forest along ridge top north side of the river, ca. 1,200 m elev., 22 March 1978, *B. Hammel 2180* (MO, SI 160612!). PERU. **San Martín**, camino de Moyobamba a Las Termas, 900 m elev., 29 October 1948, *R. Scolnik 1239* (SI!).

16. Valeriana sobraliana Rabuske-Silva & Iganci (2019: 10). Type:—BRAZIL. Santa Catarina: Garuva, Campos do Quiriri, 26°01’56”S 48°58’45”W, 1350 m elev., 31 October 2013, pist. fl., *E. Barboza, J. Cordeiro, J.M. Silva, & J.T. Motta 4038* (holotype MBM 386461!; isotypes FLOR barcode FLOR0059903!, FURB 44557!, ICN 181820!, RB barcode 00928223 image!).

Figure 34 plate. Figure 35 map.

Dioecious sub-shrubs, 30–100 cm tall, perennial, erect, simple to branched; plants glabrous except for tufts of flagelliform hyaline trichomes 0.3–5 mm long, denser and conspicuous in the nodes or sparse along the axis of the inflorescence. **Branches** fistulous, 2.5–4.2 mm in diameter, glabrous, striate; internodes 4–20 mm long in the basal portion defoliated, 4–46 mm long between the leaves, eventually with two transverse and opposing crests 0.3–0.5 mm wide, connecting the central portion of the nodes. **Leaves** sparse along the branches or in sub-rosette, the most basal marcescent and deciduous in late phenophases, simple, elliptic to lanceolate, eventually ovate, 17–85 × 8–28 mm, becoming smaller distally, chartaceous to coriaceous, discolorous; apex acute to attenuate; base cuneate to attenuate, slightly asymmetrical; petioles decurrent, 6–30 × 1–1.5 mm, reaching ⅓ to ⅔ the length of the leaf blade; central nerve adaxially sulcate, abaxially salient; secondary veins 3–5 (7) pairs; margin entire, revolute, serrate, teeth 5–14 pairs, 1.5–9 × 0.5–3.5 mm, apiculate and glandular apex; gland rounded, concave, up to 0.3 mm in diameter; more distal leaves eventually pinnatifid to pinnately lobed; basal lobes 1–3 pairs, 3–11 × 1–3.5 mm, elliptical, spatulate or lanceolate, sometimes hardly visible, becoming larger distally. **Inflorescence** terminal in compound dichasial cyme, (2) 3–5 pairs of secondary branches, rachis 20–185 mm long, secondary axes 12–65 mm long, tertiary axes dichasial up to 10 mm long. **Bracts** on the lower two nodes of the inflorescence, 18–64 ×

10–23 mm, similar to upper leaves; distal bracts elliptic to lanceolate, navicular, 6–12 × 2–4 mm. **Bracteoles** lanceolate, 3 × 1 mm, green, acute to caudate apex, cordate and decurrent base. **Staminate flowers** white to cream, campanulate, 3.3 × 2.7 mm, corolla tube 1.2–1.4 mm long, lobes 5(6), elliptical, acute apex 1.2 × 1 mm; stamens 3(4), epipetalous, 3 mm long, adnate to the corolla in the basal third; filament 2.3 mm long, anthers globular to oblong, 0.7–0.8 × 0.6 mm, dorsifixed; pistilodium 1.6–1.8 mm long, slightly exserted to exserted, stigma with linear lobes, up to 0.3 mm long; abortive ovary (partially developed) 1–1.6 mm long. **Pistillate flowers** white to cream, campanulate, 1.3–1.6 × 1.3–1.4 mm, lobes 5 (6), acute to rounded with different sizes, 0.6–0.8 × 0.4–0.5 mm; corolla tube 0.7–0.8 mm long, with a small gibbosity of 0.3–0.5 × 0.1–0.2 mm; vestigial staminodes 3, 0.3–0.5 mm long; style 1.6 mm long, exserted; stigma 3, papillose, rounded lobes, 0.1 mm long; ovary 0.7 × 0.5 mm. **Fruits** ovoid, eventually rounded or pyriform, 2.4–3.4 × 1.5–2.5 mm, transversely biconvex, 3–5-costate, finely papillose, glabrous, stramineous; apex emarginate to valeculate, dorsal-curved; base truncate, eventually cordate; side wings 0.3–0.8 mm wide; dorsal costa 0.2–0.3 mm wide; calyx vestigial, eventually forming a hardly visible wavy ring, ca. 0.05 × 0.3 mm. **Seeds** elliptical, rounded apex and base, 1.5 × 0.8–1 mm, smooth and stramineous surface.

Illustrations:—Borsini (1962a: 153, as *V. ulei*) [line drawing], Borsini (1962a: Lam. 4, as *V. ulei*) [photographic plate], Borsini (1963:133, as *V. ulei*) [line drawing], Rabuske-Silva & Iganci (2019: 11) [line drawing], Rabuske-Silva & Iganci (2019: 12) [photographic plate].

Phenology:—Flowering and fruiting from February to December.

Distribution and habitat:—Brazil: Paraná and Santa Catarina. *Valeriana sobraliana* is endemic from the Serra do Mar mountain range, Atlantic Rainforest domain. It occurs especially in the following mountain subunits (from south to north): Serra do Quiriri, Serra Araraquara, Serra de Araçatuba, Serra Marumbi, Serra da Graciosa, Serra do Ibitiraquire and Serra Capivari Grande. Sparse populations were sampled in highland grasslands and montane cloud forest edges, in outcrops of granitic rocks and wet slopes, from 1100 to 1950 m elev.

Conservation status:—Vulnerable (VU: B2ab iii, iv). *Valeriana sobraliana* has a large extent of occurrence (EOO = 1,120.000 km²) and low area of occupancy (AOO = 2,000 km²), being rare and scarce in nature. It has less than 10 subpopulations recorded and occurs in at least four conservation units: Guaricana National Park, Pico do Paraná State Park, Pico do Marumbi State Park and Guaratuba Environmental Protection Area. Its habitats are threatened specially by the expansion of *Pinus* spp. plantations and uncontrolled fire.

Etymology:—In honor of the Brazilian botanist Marcos Sobral (1960–) (Rabuske-Silva & Iganci 2019) (Appendix 1).

Taxonomic notes:—*Valeriana sobraliana* is morphologically similar to *V. organensis*, as compared in the diagnosis of the latter. However, it is often misidentified as *V. ulei*, from which it differs by the dimorphic leaves with secondary veins diverging from the primary at a similar angle, about 45° (*vs.* isomorphic leaves, secondary veins with the first pair stronger than others, diverging at a narrower angle than the other veins, about 30°), by larger staminate flowers, 3.3 × 2.7 mm, with an exserted pistilodium (*vs.* staminate flowers up to 2.5 × 2, absent pistilodium), by the achenes larger than 2.4 mm long (*vs.* up to 2 mm long) and by their distribution restricted to the Serra do Mar mountain range (*vs.* restricted to the *Aparados da Serra* region, southeastern Serra Geral plateau). Eventually, it is also misidentified as *V. catharinensis,* from which it differs by the key characters highlighted in the Table 26.

Borsini (1962a, 1963) based the analysis, description and illustration of *V. ulei* on materials coming exclusively from the Serra do Mar mountain range, Paraná state, southern Brazil. These treatments were the basis to identifying materials collected since the 1940s in this region. Apparently, Borsini did not have access to the type specimen of *V. ulei*, nor to collections from the Serra Geral plateau, states of Rio Grande do Sul and Santa Catarina. Sobral (1999a) observed that the specimens examined by Borsini were possibly a new species. This author considered these specimens morphologically closer to *V. catharinensis*, and eventually to *V. ulei* (according to exsiccate labels). However, Sobral also had no access to the *V. catharinensis* type specimen, relying exclusively on the protologue of this species. The achenes of *V. sobraliana* exhibit a wide variation in shape, according to the stage of development. Usually, in the final stage, the lateral wings protrude apically, resulting in an emarginate to valeculate apex.

Specimens examined:—BRAZIL. **Paraná**: Campina Grande do Sul, Serra do Capivary Grande, 1700 m elev., 6 August 1961, pist. fl., *G. Hatschbach 8175* (MBM!); Campina Grande do Sul, Pico Caratuva, 1950 m elev., 20 May 1967, pist. fl., *G. Hatschbach 16460* (MBM!, LIL); Campina Grande do Sul, Pico Caratuva, 2 August 1967, stam. fl., *G. Hatschbach 16842* (MBM!); Campina Grande do Sul, Serra Ibitiraquire, Abrigo 1, 1600 m elev., 25 September 1969, *G. Hatschbach 22222* (MBM!, HBR!); Campina Grande do Sul, Pico Paraná, 1600 m elev., 2 April 1988, *M.R. Bornschein 16* (MBM!); Campina Grande do Sul, Serra do Capivari, 24 August 1989, stam. fl., *V. Nikolack & O.S. Ribas 10* (FLOR!, MBM!); Campina Grande do Sul, Serra dos Órgãos, Pico Caratuva, 1550 m elev., 4 July 1991, stam. fl., *Y.S. Kuniyoshi & A. Vicentini 5424-b* (MBM!); Campina Grande do Sul, Serra do Ibitiraquire, subida para o Pico Paraná, 1500-1700 m elev., 14 July 1996, stam. fl., *O.S. Ribas & F. Schwerdt 1456* (MBM!); Campina Grande do Sul, Morro Capivari Grande, 1660 m elev., 1 July 1998, stam. fl, *V.A.O. Dittrich 393* (MBM!); Campina Grande do Sul, Serra do Ibitiraquire, Pico Itapiroca, 1800 m elev., 9 August 2000 (stam. fl.) *M. Scheer & A.Y. Mocochinski 454* (MBM!); Campina Grande do Sul, Serra do Ibitiraquire, Pico Paraná, Abrigo 2, 1700 m elev., 18 August 2001 (stam. fl.) *J.M. Silva et al. 3386* (MBM!); Campina Grande do Sul, Serra Capivari Grande, 23 October 2001 (pist. fl. and im. fr.) *E. Barboza et al. 681* (MBM! FURB!); Campina Grande do Sul, Morro Capivari, 21 October 2006 (pist. fl. and fr.) *A.L. Gasper 249* (FURB!); Campina Grande do Sul, Pico Caratuva, 5 August 2009 (pist. fl.) *E.D. Lozano 119* (MBM!); Campina Grande do Sul, Morro Cerro Verde, 5 June 2010 (pist. fl. and fr.) *E.D. Lozano & V. Ariati 249* (MBM!); Campina Grande do Sul, lateral do Caratuva, trilha para o Pico Paraná, 4 July 2010, (stam. fl.) *R. Ristow 713* (MBM!); Campina Grande do Sul, Abrigo II, Pico do Paraná, 10 July 2011 (pist. fl. and fr.) *E.D. Lozano et al. 617* (MBM!). Guaratuba, Serra de Araçatuba, Morro dos Perdidos, 1100 m elev., 18 September 1997 (stam. fl.) *E.P. Santos & H.M. Fernandes 346* (MBM!); Guaratuba, Serra do Araçatuba, 1300 m elev., 25 February 2000 (pist. fl. and fr.) *J.M. Silva et al. 3256* (ICN!, MBM); Guaratuba, Pico Pedra Branca de Araraquara, 25°56’23”S 48°52’22”W, 1160 m elev., 12 August 2014 (fr.) *J. Cordeiro et al. 5229* (MBM!). Morretes, Pico Olimpo, Serra Marumbi, 25 August 1946 (stam. fl.) *O. Curial 29* (MBM!); Morretes, Morro Mãe Catira, Serra Graciosa, 30 March 1947 (stam. fl.) *O. Curial 152* (MBM!); Morretes, Morro Mãe Catira, Serra Graciosa, 30 March 1947 (pist. fl. and fr.) *O. Curial 153* (MBM!); Morretes, Morro Mãe Catira, Serra do Mar, 1500 m elev., 30 March 1957, *Hatschbach 694* (LP 895781!). Piraquara, 23 September 1970 (pist. fl.) *H. Imaguire 2579* (ICN!). Quatro Barras, Morro Mãe Catira, 1200 m elev., 3 August 1988 (stam. fl.) *R. Kummrov & C. Budziak 3039* (MBM!); Quatro Barras, Morro Mãe Catira, 17 August 1989 (stam. fl.) *R. Kummrow et al. 3168* (MBM!, HUCS!); Quatro Barras, Morro Mãe Catira, 900 m elev., 10 July 1991 (stam. fl.) *O.S. Ribas & C.B. Poliquesi 335* (MBM!); Quatro Barras, Serra do Capivari Grande, 1600 m elev., 24 October 1997 (stam. fl. and fr.) *E.P. Santos et al. 405* (MBM!, UPCB); Quatro Barras, trilhas morros Mão Catira e Sete, 3 August 2013 (stam. fl.) *M.E. Engels et al. 1410* (MBM!). São José dos Pinhais, Serra da Igreja, Morro dos Padres, 1320 m elev., 6 August 2001, *M. Scheer et al. 362* (MBM!). **Santa Catarina**: Campo Alegre, Morro do Iquererim, 1400 m elev., 18 October 1957, *Reitz & Klein 5247* (SI 059837!); Campo Alegre, Serra do Quiriri, 29 December 1998, fr., *J.M. Silva et al. 2782* (MBM!); Campo Alegre, Serra Quiriri, 1400 m elev., 29 September 2001, stam. fl., *O.S. Ribas et al. 3642* (MBM!). Garuva, Serra do Quiriri, 1300 m elev., 16 December 2004, stam. fl., *J.M. Silva et al. 4149* (MBM!); Garuva, Serra Quiriri, 1400 m elev., 26 August 2010, stam. fl., *E.F. Costa et al. 104* (MBM!).

17. Valeriana tajuvensis Sobral (1999b: 114). Type:—BRAZIL. Rio Grande do Sul, Morrinhos do Sul, Tajuva, 29°21'S 49°58'W, 500–700 m elev. 19 August 1995 (hermaf. fl.) *J.A. Jarenkow & M. Sobral 2708* (holotype ICN on 2 sheets 144663! and 127903!; isolectotypes MBM 198341!, PEL 14543!, SP barcode SP003402 image!).

Figure 36 plate. Figure 37 map.

Gynodioecious shrubs, 100–300 cm high, perennial, rhizomatous and decumbent. **Branches** woody, slightly fistulous, base with conspicuous leaf scars, internodes 4–26 mm long at base, 12–58 mm long at floral axis, 2–42 mm in diameter; plants glabrous, except for the presence of normal trichomes 0.1 mm long in the inflorescences, corolla base (hermaf. fl.) and achenes, or 0.3–0.5 mm long, slightly grouped in the nodes. **Leaves** isomorphic, tufted at the apex of the branches, blades elliptic to obovate, pinnatisect, 95–175 × 50–72 mm, chartaceous, discolor, adaxial face green, abaxial face lightly green, glandular punctate, sage to olive in dry material; lateral lobes 5–10 pairs, 25–50 × 2–6 mm, becoming smaller toward the base, the basals eventually very small, 1–7 × 0.5–2 mm, alternate to subopposite, linear to lanceolate, falcate, apex acute to attenuate, base attenuate and quite asymmetrical, margin entire and slightly revolute, terminal lobe of same shape and size of the distal lobes, symmetrical; central nerve and secondary veins adaxially sulcate, abaxially salient, tertiary veins not visible; pseudopetioles 15–45 × 0.8–2 mm, slightly decurrent. **Inflorescences** lateral and terminal, distally paniculiform, 6–10 pairs of secondary branches. Hermaphrodite inflorescences 130–245 mm long, secondary axes 15–145 mm long, tertiary axes 5–65 mm long. Pistillate inflorescences 100–180 mm long, secondary axes 14–65 mm long, tertiary axes more congested, 3–12 mm long. **Bracts** proximal similar to the distal leaves, 60–90 × 30–40 mm, distal bracts linear to lanceolate, 3–5 × 1–2 mm. **Bracteoles** elliptic, ovate or lanceolate, 2.2–3 × 0.6–1 mm, acute apex, rounded to attenuate base, glabrous. **Hermaphrodite flowers** white to cream, infundibuliform, 2.2–2.5 × 2.2–2.5 mm; corolla tube 1.8–2 mm long, pubescent, hyaline trichomes ca. 0.1 mm long, restricted to the corolla base, gibbous ca. 0.6–0.7 mm length; lobes 5, acute to rounded, 0.7–0.9 × 0.7–0.9 mm, glabrous; stamens 3, 1–1.3 mm long, exserted, adnate to the corolla close to the base; anthers globose, 0.4–0.5 mm long; pistil 0.8–1.2 mm long, included, glabrous, stigma trifid, papillose, lobes 0.3–0.4 mm long, rounded apex; ovary about 0.4–0.5 mm long. **Pistillate flowers** white, campanulate, 0.6–0.8 × 0.6–0.8 mm; corolla tube 0.2–0.3 mm long, glabrous; lobes ovate, obtuse to acute apex, 0.2–0.3 mm long;

vestigial staminodes 3, 0.1–0.2 mm long, quite inconspicuous and inserted; style 0.7–0.8 mm long, exserted; stigma trifid, papillose, lobes 0.2–0.3 mm long, rounded apex; ovary about 0.5–0.7 mm long. **Fruits** elliptic, 1.8–2.3 × 1–1.3 mm, apex obtuse to rounded, base rounded to slightly cordate, both slightly asymmetrical, transversely triquetrous, 3–6-costate (two lateral, one abaxial and one to three adaxial vascular bundle, 0.05–0.1 mm wide), two lateral wings, 0.6–0.9 mm wide, stramineous, pubescent, hyaline trichomes ca. 0.1 mm long; calyx annular, 0.2–0.4 × 0.2–0.4 mm, teeth hardly visible. **Seeds** pyriform, acute to attenuate apex, rounded base, 1.6–1.8 × 0.5–0.6, smooth and stramineous surface.

Illustrations:—Sobral (1999a: 43) [photographic plate], Sobral (1999: 46) [line drawing]), Sobral (1999b: 115, 116) [line drawings], Rabuske-Silva (2018: 88) [photographic plate].

Phenology:—Flowering and fruiting in August.

Distribution and habitat:—Brazil: Rio Grande do Sul and Santa Catarina. *Valeriana tajuvensis* is endemic from the canyons region of the Serra Geral plateau, Atlantic Rainforest domain. It is restricted to a narrow strip of high mountain slopes, which include, from the south to the north, respectively, the Forqueta mountain, municipality of Maquiné, the Serra da Tajuva, municipality of Morrinhos do Sul and the Serra do Faxinal, between the municipalities of Cambará do Sul and Praia Grande. It occurs between the Ombrophilous Dense Forest and the Nebular Forest, being restricted to forest edges, humid slopes, rocky walls and waterfalls, between 500 and 800 m elevation.

Conservation status:—Critically Endangered (CR: C1 + D1). *Valeriana tajuvensis* has a low extent of occurrence (EOO = 231,280 km²) and low area of occupancy (AOO = 30 km²), with only three known subpopulations. A single subpopulation occurs in a conservation unit, the Serra Geral Biological Reserve, Rio Grande do Sul. This category converges with that pointed by Rabuske-Silva (2018), which points to a significant reduction in the number of individuals and anthropogenic pressure due to urban expansion and cattle grazing in the locality of the type specimens (Serra da Tajuva) (Figure 36, A). In recent expeditions made in August 2018 and July 2019 we observed only a few young individuals in this locality.

Etymology:—Coming from Serra da Tajuva, Morrinhos do Sul municipality, Rio Grande do Sul, Brazil (Sobral 1999b, Rabuske-Silva 2018).

Taxonomic notes:—*Valeriana tajuvensis* is morphologically similar to *V. polystachya*, as compared in the diagnosis of the latter. *Valeriana tajuvensis* eventually reaches the dimensions of a treelet, up to 3 m tall (Figure 36, B), being the largest species of the genus in ESA. It occurs in a transition zone (ecotone) between the Ombrophilous Dense Forest (Atlantic

Rainforest *stricto sensu*) and the Cloud Forest (*Floresta Nebular*), in intermediate elevations between the lowlands and highlands of southern Brazil, between 500 and 800 m elevation. This occurrence is possibly due to environmental particularities and the geographical latitudinal position of the Tajuva canyon. During fieldwork we observed that the montane and submontane flora of the Serra da Tajuva reaches lower elevations (i.e. about 500 m elev.), when compared to the rest of the slope of the Serra Geral plateau, where they start from about 800 m elevation (Iganci *et al.* 2011).

Specimens examined:—BRASIL. **Rio Grande do Sul**: Cambará do Sul, Serra do Faxinal, 12 July 2009, *M. Grings et al. 1191* (ICN!). Maquiné, Reserva Biológica da Serra Geral, Mirante Forqueta, no topo do morro, 6 January 2000, *R.G. Magalhães 508* (HAS!); Maquiné, Reserva Biológica da Serra Geral, Cascata Rio dos Macacos, 12 April 2005, *R. Schmidt 990* (HAS!). Morrinhos do Sul, Tajuva, 550–700 m elev., 19 August 1995, *J.A. Jarenkow & M. Sobral 2702* (MBM!); Morrinhos do Sul, Tajuva, 550–700 m elev., 19 August 1995, *J.A. Jarenkow & M. Sobral 2706* (FLOR!, ICN!, MBM!, PEL!, RB image!, SP image!); Morrinhos do Sul, Tajuva, subida da trilha Tajuva–Josafá, 500–600 m elev., December 1995 (pistil. fl.) *M. Sobral 7934a* (ICN!, MO); Morrinhos do Sul, Tajuva, subida da trilha Tajuva–Josafá, 500–600 m elev., July 1995 (pistil. fl.) *M. Sobral 7934b* (ICN!); Morrinhos do Sul, Tajuva, subida da trilha Tajuva–Josafá, 500–600 m elev., December 1995 (pistil. fl.) *M. Sobral & C. Miró 7945a* (ICN!); Morrinhos do Sul, Tajuva, subida da trilha Tajuva–Josafá, 500–600 m elev., December 1995 (pistil. fl.) *M. Sobral & C. Miró 7945b* (ICN!); Morrinhos do Sul, Tajuva, subida da trilha Tajuva–Josafá, 550–600 m elev., December 1995, *M. Sobral & J.A. Jarenkow 8010* (FLOR!, MBM!, MO image!); Morrinhos do Sul, trilha da Serra da Tajuva, August 2000, *M. Sobral 9058* (ICN! MO image!); Morrinhos do Sul, Serra da Tajuva, 20 January 2017, *C. Rabuske et al. 202* (ICN!); Morrinhos do Sul, Morro da Tajuva, 29°23’44.1”S 50°00’16.2”W, 584 m elev., 17 August 2017, *C. Rabuske et al. 269* (ICN!); Morrinhos do Sul, Morro da Tajuva, 29°23’40”S 49°59’35.7”W, 497 m elev., 17 August 2017, (pist. fl. and fr.) *C. Rabuske et al. 270* (ICN!); **Santa Catarina**: Praia Grande, Serra do Faxinal, SC 450, entre Praia Grande e Cambará do Sul, 800 m elev., 26 March 1997 (hermaf. fl.) *D.B. Falkenberg 9797* (FLOR!).

18. Valeriana ulei Graebner (1899: 436). *Phuodendron ulei* (Graebn.) Dalla Torre & Harms (1905: 512). Lectotype (here designated):—BRAZIL. Santa Catarina, “Stauth at rande der Serra Geral” [Serra do Oratório?], June 1890, *E. Ule 1647* (lectotype HBG barcode HBG-513375 image!).

Figures 38 and 39 plate. Figure 23 map.

Dioecious subshrubs or shrubs, 15–150 cm high, perennial, rhizomatous and decumbent. **Branches** woody (not fistulous) in the basal portion, fistulous in the herbaceous branches, internodes 2.8–20 mm long at base, 2–10 mm long at floral axis, 3.2–7.8 mm in diameter at base, 2.2–2.5 mm in diameter at the apex; plants glabrous, except by the normal trichomes 0.2–0.3 mm long, slightly grouped in the nodes of the herbaceous branches. **Leaves** isomorphic, eventually slightly heteromorphic; basal leaves entire, blades elliptic, lanceolate or oblanceolate, 25–135 × 5–32 mm, base sessile, attenuate, eventually slightly petiolate (pseudopetiolate), apex acute to attenuate, pseudopetioles (when distinguishable) 10–18 × 1.2–2.8 mm, reaching ⅕ the length of the leaf blade; distal leaves entire, blades similar to basal leaves, eventually pinnatipartite to pinnatisect (deeply toothed), teeth resembling lobes, 15–60 × 5–32 mm, blades coriaceous, lustrous, slightly discolor, adaxial face green, abaxial face lightly green; when pinnatisect, the apical tooth (or distal lobe) 15–30 × 5–10 mm, gradually becoming smaller and narrower toward the inflorescence base, acute to attenuated base, acute apex, lateral lobes 1–3 pairs, 6–10 × 1–2.7 mm, subopposite to alternate; margin serrate in ⅔ to ¾ of the length, teeth 5–10 pairs, 1–2.5 mm long, central nerve adaxially sulcate, abaxially salient, secondary veins 1–4 pairs, inconspicuous, frequently hardly visible, first pair forming a more closed angle (~ 30°) than the others and reaching the apical third of the leaf blade (3-veined-like); tertiary veins inconspicuous; pseudopetioles 10–18 × 1.2–2.8 mm, absent toward the apex of the branches. **Inflorescences** lateral and terminal, distally paniculiform, congested or eventually remarkably lax (*C. Rabuske & L. Machado 48*), 2–4 pairs of secondary branches. Staminate inflorescences 25–160 mm long, secondary axes 12–60 mm long, tertiary axes 10–27 mm long. Pistillate inflorescences 20–120 mm long, secondary axes 18–70 mm long, tertiary axes, 10–30 mm long. **Bracts** proximal similar to distal leaves, 8–55 × 2–18 mm, distal bracts lanceolate, navicular, 3–7 × 0.8–2 mm. **Bracteoles** ovate, 1.5–2 × 0.7–0.8 mm, acute apex, rounded base, glabrous. **Staminate flowers** white to cream, campanulate to infundibuliform, 2–2.6 × 2–2.6 mm; corolla tube 0.9–1.4 mm long, glabrous, gibbous 0.5–0.7 mm length; lobes 5, acute, 0.9–1.2 × 0.6–0.9 mm, glabrous; stamens 3, 1.8–2.2 mm long, exserted, adnate to the corolla close to the base; anthers globose, 0.6–0.7 mm long; pistilodium 1.2–1.4 mm long, included to slightly exserted, glabrous, stigma capitate to slightly trifid; ovary abortive partially developed at the base of the flowers, 0.8–1 × 0.3–0.4 mm long, similar to a floral peduncle. **Pistillate flowers** white, campanulate, 1–1.4 × 1–1.4 mm; corolla tube

0.5–0.7 mm long, glabrous; lobes ovate, obtuse to acute apex, 0.4–0.6 mm long; vestigial staminodes 3, 0.2–0.3 mm long, inconspicuous and inserted; style 1–1.4 mm long, exserted; stigma trifid, papillose, lobes 0.2–0.3 mm long, rounded apex; ovary 0.8–1 mm long. **Fruits** ovate to globose, 2.8–3.6 × 1.9–2 mm, apex rounded to emarginate, base truncate to slightly cordate, both slightly asymmetrical, transversely triquetrous, 3–5-costate (two lateral and one to three adaxial vascular bundle, about 0.1–0.2 mm wide), two prominent lateral wings, 0.4–0.5 mm wide, narrower at the apex and base, about 0.3–0.4 mm wide, stramineous, glabrous; calyx vestigial, eventually slightly dentate or forming a wavy ring, 0.05–0.1 × 0.2–0.3 mm, teeth hardly visible. **Seeds** elliptic to lanceolate, obtuse apex and base, narrow and very small when compared to the achenes, 1.6–1.7 × 0.5–0.6, smooth and yellow-greenish surface.

Illustration:—Sobral (1999a: 44) [photographic plate], Sobral (1999: 46) [line drawing], Rabuske-Silva (2018: 91) [photographic plate].

Phenology:—Flowering and fruiting all year round.

Distribution and habitat:—Brazil: Rio Grande do Sul and Santa Catarina. *Valeriana ulei* is endemic from the canyons region of the Southern Highland Grasslands (*Campos de Cima da Serra*), Serra Geral plateau, Atlantic Rainforest domain. It occurs in the highland grasslands and nebular forest edges, being restricted to canyon edges, rocky walls, mountain slopes and ravines, eventually at riverbanks and waterfalls, habitats with seasonal flooding, between 780 and 1770 m elevation.

Conservation status:—Near Threatened (NT). *Valeriana ulei* has a relatively restricted extent of occurrence (EOO = 9,250.000 km²) and area of occupancy (AOO = 6,000 km²), being eventual and scarce in nature. The records suggest the existence of about eight subpopulations, at least three in conservation units: Aparados da Serra National Park, Itaimbezinho National Park and São Joaquim National Park. It is frequently observed in the Serra do Rio do Rastro and in the Serra do Corvo Branco. Plus, it occurs in habitats with little disturbance by anthropogenic activities.

Etymology:—In honor of the German botanist Ernst Heinrich Georg Ule (1854–1915) (Graebner 1899).

Taxonomic notes:—*Valeriana ulei* is morphologically similar to *V. iganciana*, as compared in the diagnosis of the latter. Graebner (1899: 436) positioned *Valeriana ulei* in a new session (*Phuodendron*) based essentially on the shrub habit (woody), coriaceous leaves with margin entire or dentate, inflorescence classified as corymbose and 3-staminate flowers. According to Graebner, “the only known representative of this group is so peculiar in its habit and in its few existing morphological features that there is nothing similar in the Valerianaceae family”. However, he expressed doubts about whether it was a new genus or a new session, because the material available and analyzed had only staminate flowers with “very small female organs”, devoid of fruits and therefore limiting the definition of the mating system. The remaining type specimen image does not allow a precise definition of the type of inflorescence and flowers (Figure 38). However, based on the protologue, the flowers analyzed by Graebner were exclusively staminate, and therefore with pistillodes and abortive ovaries. Considering that the subshrub to shrub habit, the dioecious mating system and the 3-staminate flowers are common to other species in the region, as well as the absence of pistillate inflorescences and fruits in the species description, the description of the section *Phuodendron* becomes quite generic. Because of this, we propose an updated description of this section, although based essentially on habit, in the shape of leaves and inflorescences.

Dalla Torre & Harms (1905: 512) cite for the first time *Phuodendron* as a genus, encompassing only *P. ulei*. A year later, Graebner (1906: 476) also recognizes the elevation of *Phuodendron* from section to genus. Borsini (1962a, 1963) argues that the previously referred features are not enough for the proposition of a new genus, maintaining this species under *Valeriana* and disregarding the category of section. Eriksen (1989: 186) reconsiders *Phuodendron* as a section of *Valeriana* according to the original description, under the subgenus *Phyllactis* (Pers.) Borsini emend. Eriksen.

Nomenclatural note concerning type specimens:—Regarding the typification, we trace the existence of at least two syntypes of *Ule 1647* at B and HBG. The material deposited at B was probably destroyed during the Second World War (Borsini 1962a, Sobral 1999a, Rabuske-Silva 2018). The material deposited at HBG (barcode HBG-513375 image!) has an exsiccate label with a designation of lectotype by Focko Weberling, dated 1962 (Figure 38). We did not find any publication with the corresponding lectotypification, as required by the Shenzhen Code (Turland *et al.* 2018), reason to be here designated this single remaining material of *Ule 1647* as lectotype.

Specimens examined:—BRASIL. **Rio Grande do Sul**: Cambará do Sul, Itaimbezinho, beira do perau, 29 June 1974, *J. Valls & D. Kempf 3303* (ICN!); Cambará do Sul, Parque Nacional de Aparados da Serra, beira de penhasco, 28 July 1978, *J.L. Waechter 889* (ICN!); Cambará do Sul, Aparados da Serra, Arroio Três Forquilhas, May 1981, *D. Meineke s.n.* (ICN barcode 00032428!); Cambará do Sul, Fortaleza, 1 April 1982, *J. Mattos & N. Silveira 23473* (HAS!); Cambará do Sul, Fortaleza, 24 May 1984, *N. Silveira et al. 1247* (HAS!, MBM!); Cambará do Sul, Fortaleza, na orla do penhasco, 1050 m elev., 21 April 1985, *V. Dal Pont et al. s.n.* (HUCS 736!); Cambará do Sul, Fortaleza, no alto do morro, 27 March 1987 (stam. fl.)

J. Mattos et al. 30982 (HAS!); Cambará do Sul, Fortaleza, no alto do morro, 27 March 1987, *J. Mattos et al. 31008* (HAS!); Cambará do Sul, Fortaleza, 28 March 1989 (stam. fl.) *N. Silveira 6647* (HAS!); Cambará do Sul, Fortaleza, beira dos peraus, 7 November 1989, *N. Silveira 7266* (HAS!); Cambará do Sul, Fortaleza, 17 July 1990, *N. Silveira 8925* (HAS, MBM!); Cambará do Sul, Fortaleza, junto aos peraus, 1200 m elev., 16 April 1994, *G. Hatschbach et al. 60613* (MBM!); Cambará do Sul, próximo à Fortaleza, 1000 m elev., 29 May 2005, *F. Marchett 261* (HUCS!); Cambará do Sul, Cânion Fortaleza, borda do perau,29°03'45.9"S 49°57'25.4"W, 25 July 2016 (stam. fl.) *C. Rabuske 42* (ICN!); Cambará do Sul, Cânion Fortaleza, borda do perau, 29°03'45.9"S 49°57'25.4"W, 25 July 2016 (pistil. fl.) *C. Rabuske 43* (ICN!); Cambará do Sul, Cânion Fortaleza, trilha para o mirante, no barranco, 29°04'00.5"S 49°57'28.4"W, 25 July 2016 (pist. fl.) *C. Rabuske 44* (ICN!); Cambará do Sul, Cânion Fortaleza, borda do perau, 29°03'45.9"S 49°57'25.4"W, 25 July 2016 (stam. fl.) *C. Rabuske 45* (ICN!); Cambará do Sul, Cânion Fortaleza, Cachoeira do Tigre Preto, 29°04'21.0"S 49°59'19.8"W, 25 July 2016 (pist. fl. and fr.) *C. Rabuske 46* (ICN!); Cambará do Sul, Cânion da Fortaleza, Cachoeira do Tigre Preto, 29°04'21.0"S 49°59'19.8"W, 25 July 2016, *C. Rabuske 47* (PACA!); Cambará do Sul, Cânion Fortaleza, Trilha da Pedra do Segredo, borda do perau, 29°04'17.0"S 49°59'24.2"W, 25 July 2016 (stam. fl.) *C. Rabuske 48* (ICN!); Cambará do Sul, Cânion Fortaleza, borda do paredão, 29°03’46.7”S 49°57’25”W, 1110 m elev., 22 October 2017, *C. Rabuske et al. 335* (ICN!); Cambará do sul, Cânion Fortaleza, trilha da Pedra do Segredo, Cachoeira do Tigre Preto, 29°04’21.9”S 49°59’18.7”W, 997 m elev., 22 October 2017 (fr.) *C. Rabuske et al. 336* (ICN!). **Santa Catarina**: Bom Jardim da Serra, Serra do Rio do Rastro, 6 May 1991, *N. Silveira 9807* (HAS! MBM!); Bom Jardim da Serra, February 1992, *M. Sobral & C. Miró 7524* (ICN!, MBM!); Bom Jardim da Serra, Serra do Rio do Rastro, November 1994, *M. Sobral et al. 7714* (ICN!); Bom Jardim da Serra, Serra do Rio do Rastro, September 1999 (stam. fl.) *M. Sobral & A. Diniz 8863* (ICN!, MBM!); Bom Jardim da Serra, Serra do Rio do Rastro, January 2001, *M. Sobral & P. Brack 9291a* (ICN!); Bom Jardim da Serra, Cânion das Laranjeiras, borda do cânion, 28°16’20.8”S 49°32’28”W, 1355 m elev., 3 December 2012, *R. Trevisan 1339* (FLOR!). Grão Pará, Serra do Corvo Branco, 860–1160 m elev., 21 July 2009, *R. Santos et al. s.n.* (CRI 10297!); Grão Pará, Serra do Corvo Branco, 28°03'18.0"S 49°22'04.0"W, 1220 m elev., 1 October 2014, *L.A. Funez 3505* (FURB!); Grão Pará, Serra do Corvo Branco, subida da serra, 28°03’33.9”S 49°21’18.4”W, 780 m elev., 16 October 2017, *C. Rabuske et al. 321, 322* (ICN!). Lauro Muller, Serra do Rio do Rastro, 1400 m elev., 14 July 1991, *R.R. Passold s.n.* (FURB 3624!); Lauro Muller, Serra do 12, 7 September 1995, *V. Boff 121* (CRI!); Orleans, Parque Nacional de São Joaquim, estrada para o Morro da Igreja, trilha para a Pedra Furada, 28°07’45”S 49°28’18”W 1740 m elev., 31 October 2014, *P. Fiaschi et al. 4407* (FLOR!). São Cristovão do Sul, BR 116, entre KM 193 e 194, 22°27’18.7”S 50°25’46.2”W, 11 October 2006, *G.B. Ceolin et al. 59* (ICN!). Urubici, alto do Morro da Igreja, 1700 m elev., 8 December 2000, *G. Hatschbach et al. 71655* (MBM!); Urubici, alto do Morro da Igreja, 1700 m elev., 8 December 2000, *G. Hatschbach et al. 71658* (MBM!); Urubici, Morro da Igreja, alto, 1700 m elev., 18 October 2004, *G. Hatschbach et al. 78213* (HUCS!, MBM!); Urubici, Morro da Igreja, 14 November 2008, *J.M. Silva et al. 7087* (MBM!); Urubici, Morro da Igreja, topo do morro, 28°07’39”S 49°28’55”W, 1770 m elev., 5 November 2013, *A.C. Cervi et al. 10066* (FLOR!, ICN, MBM!, RB); Urubici, Morro da Igreja, 11 December 2016, *F. Gonzatti 3169* (HUCS!); Urubici, Serra do Corvo Branco, topo da serra, 28°03’17.2”S 49°22’06.2”, 1090 m elev., 16 October 2017 (pist. fl. and fr.) *C. Rabuske et al. 323* (ICN!).

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Appendix I:—Numeric list of taxa (valid names).

1. *Valeriana aparadensis* Rabuske
2. *V. bornmuelleri* Pilg.
3. *V. caparaoensis* Rabuske, Sobral & Iganci
4. *V. catharinensis* Graebn.
5. *V. chamaedryfolia* Cham. & Schltdl.
6. *V. eichleriana* (C.A.Müll.) Graebn.

7. *V. eupatoria* Sobral
8. *V. glaziovii* Taub.
9. *V. glechomifolia* F.G.Mey.
10. *V. iganciana* Rabuske & Külkamp
11. *V. organensis* Gardner
12. *V. polystachya* Sm.
13. *V. reitziana* Borsini
14. *V. salicariifolia* Vahl
15. *V. scandens* L.
16. *V. sobraliana* Rabuske & Iganci
17. *V. tajuvensis* Sobral
18. *V. ulei* Graebn.

Appendix II:—Index of exsiccate.

Abbiatti, D. 4274 (12). **Abruzzi, M.L.** 998 (14), 2113 (13). **Alboff, N.** s.n. [LP 012969] (12). **Alice, C.** s.n. [ICN 94929] (15). **Andrade, P.R.P.** s.n. [MBM299845] (15). **Andrade-Lima, D.** s.n. [ICN 30720] (12). **Arzivenco, L.** 472 (14), s.n. [ICN 48531] (15). **Attié, M.C.B.** 39 (15), 56 (15). **Augusto, I.** s.n. [ICN 19006].

Baitello, J.B. 2541 (14). **Baker, C.F.** 151 (15). **Baptista, L.R.M.** s.n. [ICN 22162] (15). **Barbosa, E.** 1127 (15), 1793 (13). **Barboza, E.** 681 (16), 2497 (12), 4038 (16), 4203 (7). **Bartlett, H.H.** 20368 (15), 20977 (12). **Bassan, M.H.** s.n. [HAS 84506] (15). **Belgrano, M.J.** 603 (15). **Blum, C.T.** 2120 (15). **Boechat, S.** s.n. [ICN 41927] (14). **Boelcke, O.** 6385 (12, 6644 (12), 12090 (12). **Boff, V.** 121 (18). **Boldo, E.** 05 (9). **Boone, W.** 732 (15). **Bordignon, S.** s.n. [ICN 123675] (2), s.n. (ICN, UNILASALLE) (2). **Borges, R.** 881 (8). **Bornmüeller, A.** 198 (2). **Bornschein, M.R.** 16 (16). **Boruchin, M.** s.n. [MBM 379017] (15). **Boudet Fernandes, H.Q.** 3033 (15). **Brade, A.C.** 7068 (14), 16984 (3), 20245 (8), s.n. [PACA 54153] (15). **Braga, J.M.A.** 2011 (15), 2065 (8), 3172 (8). **Bridarolli, A.** 2212 (15), 2517a (15). **Brotto, M.L.** 1369 (14). **Brunetto, A.** 62 (15). **Bueno, O.** 3069 (1), 3070 (1), 3298 (12), 5184 (13), 5326 (15), 5525 (15), 5991 (13). **Burkart, A.** 438 (12), 2800(12), 2854 (14), 2976 (12), 3777 (15), 4064 (15), 23837 (12), 25183 (15), 28055 (12), 3269 (14).

Cabrera, A.L. 475 (12), 1337 (15), 1913 (14), 1940 (15), 2019 (15), 2356 (12), 4704 (12), 5421 (15), 5797 (12), 7311 (12), 9799 (14), 9808 (12), 16483 (12), 17178 (12), 19587 (12), 20200 (15), 23843 (15), 28836 (15), 33900 (15), 34032 (15). **Caetano, V.L.** s.n. [HAS, ICN barcode 00030518] (7). **Camargo, O.R.** 1045 (15), 1949 (15), 5526 (14), 5553 (7). **Campestrini, S.** 618 (6). **Cândido, L.C.** 22 (15). **Capellari, L.** s.n. [HUCS 8707] (15). **Carneiro, A.M.** 814 (12). **Carneiro, J.** 1141 (15). **Caxambu, M.G.** 2720 (14). **Ceolin, G.B.** 59 (18). **Cerati, T.M.** 84 (15). **Cervi, A.C.** 3050 (15), 10066 (18), 10082 (1). **Chamas, C.C.** 255 (15). **Clos, E.C.** 214 (12). **Coelho, G.P.** 139 (6), 193 (3), 195 (3), 199 (11), 202 (11), 211 (8). **Commerson** 62 (12), s.n. [MPU barcode MPU009993, P barcode P00757619] (14). **Cordeiro, J.** 74 (15), 441 (15), 548 (15), 872 (14), 2153 (14), 3623 (15), 5229 (16). **Correa, M.N.** 9553 (12), 10123 (12). **Costa, E.F.** 27 (15), 104 (16), 137 (15). **Costa, S.M.** 632 (15). **Crovetto, R.M.** 2709 (15), 2713 (12), 2955 (12). **Curial, O.** 29 (16), 152 (16), 153 (16).

Dal Pont, V. s.n. [HUCS 736] (18). **Davis, P.H.** 59917 (15). **Dawson, G.** 18 (12), 342 (12), 866 (12), 948 (15), 3447 (12). **Dettke, G.A.** 427 (15). **Dittrich, V.A.O.** 393 (16), 443 (15). **Duarte-Silva, E.** s.n. [ICN 153433, ICN 153434, ICN 153435, ICN 153436)] (15). **Durigon, J.** 245 (15), s.n. [ICN 192044] (15). **Dusén, P.** 6329 (12), 6814 (14), 9385 (15), 13361 (14).

Emrich, K. s.n. [PACA 35906] (15). **Engels, M.E.** 1410 (16), 1544 (15), 1680 (15), 1740 (15).

Fabris, H.A. 312 (15), 2424 (12), 2604 (12), 4775 (12), 4886 (12), 6713 (12). **Falkenberg, D.B.** 3352 (15), 5653 (15), 5938 (15), 6283 (1), 9797 (17). **Felitto, G.** 832 (15). **Fernandes, I.** 215 (5), 217 (5), 783 (12). **Ferreira, A.** s.n. [ICN 7333] (14), s.n. [ICN 7448] (14). **Ferreira, E.** s.n. [HCF 1008, MBM 284895] (15). **Fiaschi, P.** 4407 (18). **Fiebrig, K.** 6178 (15). **Fleig, M.** 729 (15), 896 (14), 1067 (1). **Flores, T.B.** 998 (15), 1329 (3). **Floriani, M.M.P.** 283 (4). **Fortunato, R.** 789 (12), 1011 (12). **Forzza, R.C.** 3168 (15), 4453 (15), 5306 (15). **Frangi, J.** 139 (12). **Friederichs, E.** s.n. [PACA 27791] (15). **Fromm, E.** 1210 (15). **Funez, L.A.** 3505 (18), 5697 (14), 6543 (15).

Gamerro, J.C. 1341 (12). **Gardner, G.** 461 (15), 5768 (11). **Gasper, A.L.** 249 (16). **Gastel, C.V.S.** s.n. [ICN 176861] (14). **Gautier, E.D.** 3? (12), 5401 (12). **Geraldino, H.C.L.** 133 (15). **Gibbs, P.E.** 3285 (15). **Glaziou, A.F.M.** 4847 (8), 6576 (8), 14923 (11), 14928 (11). **Goldenberg, R.** 1078 (15). **Gómez, R.** 1195 (12), 11688 (12). **Gonçalves, L.N.** 61 (11), 143

(11). **Gonzatii, F.** 1315 (14), 1348 (7), 2736 (15), 3169 (18), 3170 (1). **Grings, M.** 454 (12), 592 (15), 785 (1), 1191 (17), 1879 (7).

Hagelund, K. 9989 (1), 11693 (15), 12935 (1), 13166 (5), 14664 (5). **Hammel, B.** 2180 (15). **Hassler** 9604 (14). **Hatschbach, G.** 207 (15), 234 (15), 694 (16), 794 (15), 974 (15), 1550 (14), 4820 (15), 7544 (14), 8175 (16), 8459 (14), 8690 (14), 10594 (13), 10614 (14), 11138 (15), 13644 (15), 13797 (14), 13921 (15), 14608 (15), 14664 (15), 14828 (14), 15246 (14), 15415 (14), 15431 (13), 16124 (15), 16403 (15), 16460 (16), 16842 (16), 17249 (14), 20279 (15), 22222 (16), 22315 (14), 22490 (14), 23038 (14), 23188 (13), 24388 (15), 24726 (15), 25409 (14), 28142 (13), 28144 (13), 28239 (14), 28317 (14), 28342 (14), 30641 (15), 30687 (14), 31851 (15), 32769 (14), 32875 (15), 33619 (14), 35193 (13), 39151 (14), 40437 (14), 41810 (14), 43249 (13), 43274 (15), 46905 (15), 50678 (14), 50820 (13), 59659 (13), 60362 (14), 60613 (18), 71621 (9), 71658 (18), 71663 (1), 71665 (18), 71723 (14), 71797 (13), 72468 (9), 72630 (1), 78213 (18), 79874 (15). **Hauman-Merck** s.n. [SI 14523] (15). **Henz, E.** s.n. [PACA 35575] (15), s.n. [PACA 35771] (14). **Herter, G.** 82339 (12), 95847 (2). **Hicken, C.M.** 1057 (15), 1897 (12), 14518 (12), 14520 (12), 14522 (12), 22708 (12), s.n. [SI 14545]. **Hunell** 5797 (12). **Hunziker, J.H.** 4615 (12). **Hurrell, J.** 3648 (12), 3726 (15), 3727 (15), 3728 (15), 3970 (15), 3971 (15), 4010 (15), 4153 (15), 5336 (12).

Ibarrola, T. 1065 (12). **Imaguire, H.** 2579 (16). **Imaguire, N.** 2249 (14), 3360 (15). **Irgang, B.** s.n. [HAS 5243, ICN 27122], s.n. [ICN 35656] (15), s.n. [ICN 35657] (12), s.n. [ICN 35660] (12), s.n. [ICN 66270] (12), s.n. [ICN 7865] (15). **Isnardi, J.** 27 (12).

Jarenkow, J.A. 771 (5), 1187 (14), 2249 (15), 2702 (17), 2706 (17), 2708 (17), 3393 (14), 3720 (15). **Job, M.M.** s.n.]LP on 3 sheets, 906522, 906523 and 906524] (12). **Jorge, M.C.O.** 1 (15). **Jorgensen, P.** 666 (15). **Jung, S.L.** 266 (15). **Jurinitz, C.F.** 41 (15).

Kaehler, M. 253 (15). **Kamino, L.H.Y.** 9 (15). **Karwinsky** 321? (15). **Kassner-Filho, A.** 951 (15), 1099 (15). **Kegler, A.** 1099 (15). **Kiesling, R.** 5558b (15). **Kinoshita Gouvêa, L.S.** 5904 (15). **Kinupp, V.F.** 2828 (14), 3086 (14), 3106 (15). **Klein, R.M.** 1979 (15), 2099 (15), 5036 (15), 6116 (15), 6789 (15), 7619 (15), s.n. [SI barcode 052312] (15). **Köhler, M.** 290 (12). **Kollmann, L.** 3938 (15), 4746 (15), 8045 (15), 8220 (15), 11501 (15). **Korte, A.** 896 (15), 1785 (15). **Kozera, C.** 3299 (14), s.n. [EFC 9762] (15). **Krapovickas, A.** 34194 (12, 42014 (14). **Krieger, L.** 8624 (8). **Külkamp, J.** 234a (10), 234b (10). **Kummrow, R.** 70 (15), 1552

(15), 3039 (16), 3168 (16). **Kuniyoshi, Y.S.** 3972 (15), 5424-b (16), 6281 (15). **Kuntze, O.** s.n. [LP 012960] (12).

Laufranchi, A.E. 431 (12), 877 (14). **Leitão Filho, H.F.** 2531 (15), 3159 (15). **Leonhardt, A.** s.n. [ICN 124218] (14). **Leoni, L.S.** 3742 (3), 4228 (3), 4276 (3), 6312 (3). **Lindeman, J.C.** 1970 (15), 4136 (8), 5166 (8), s.n. [ICN barcode 00030504] (6), s.n. [HAS 84478, ICN 21038], s.n. [HAS 503, ICN 8364] (12), s.n. [ICN 8572] (12), s.n. [ICN 21142] (12), s.n. [ICN 8176, HAS 502] (15), s.n. [ICN 21665] (15), s.n. [ICN 8854] (15). **Loefgren, A.** 3531 (11), 5926 (8). **Long, M.A.** 427 (12). **Lozano, E.D.** 119 (16), 249 (16), 343 (15), 617 (16). **Luederwaldt** s.n. [ICN 123696, SP 11880] (8).

Machado, T.M. 268 (3). **Magalhães, R.G.** 508 (17). **Marchett, F.** 261 (18), 615 (15). **Marinero, F.** 178 (15). **Markgrat** 3698 (8). **Marques, D.S.** 3B (15), s.n. [MBM 326685] (15). **Martius, C.F.P. von.** 476 (15). **Maschio, W.** 86 (15). **Mattos, J.** 1283 (14), 2664 (15), 3389 (13), 3616 (14), 4035 (13), 4128 (15), 4155 (14), 5405 (13), 5536 (14), 6548 (1), 13048 (13), 17403 (14), 17922 (14), 21877 (15), 22794 (14), 23473 (18), 24531 (15), 24555 (15), 25531 (15), 25759 (15), 26541 (15), 28861 (5), 30474 (13), 30982 (18), 31008 (18), 32682 (14), s.n. [HAS 84481] (13). **Mattos, N.** 30066 (12). **Mauhs, J.** s.n. [PACA 105724] (14). **Matzenbacher, N.I.** 537 (15), s.n. [ICN barcode 00030511] (6), s.n. [ICN 35391] (12), s.n. [ICN 103650] (15). **Medina, A.** 64417 (12). **Meineke, D.** s.n. [ICN barcode 00032428] (18). **Meyer, J.** 133 (7). **Millán, A.R.** 143 (12). **Molfino** 46300 (12). **Molz, M.** s.n. [ICN 125391] (14). **Mondin, C.** 1658 (14). **Montanha, J.A.** s.n. [ICN 137556] (15). **Montes, J.E.** 3340 (15). **Mosén, H.** 4253 (13). **Motta, J.T.** 4082 (14). **Mueller, F.** 769 (15). **Múlgura** 284 (12). **Múlgura de Romero, M.E.** 4021 (15).

Neves, M. 777 (14). **Nikolack, V.** 10 (16). **Novas, J.S.** s.n. [ESA 31389] (11).

Occhioni, P. 493 (15). **Oliveira, C.T.** 205 (11). **Oliveira, P.I.** 119 (14).

Pabst, G. 5781 (15), 6672 (14), 8023 (15). **Passold, R.R.** s.n. [FURB 3624] (18). **Pastore, A.J.** s.n. (SI 1214] (12). **Paulo-Souza, J.** 5774 (15). **Paz, J.** 136 (14). **Pedersen, T.M.** 16307 (15). **Pennington, M.S.** 103 (12). **Pereira, E.** 5954 (15), 6846 (14), 7082 (15), 8002 (14), 8748 (15). **Pertusi, L.A.** 86 (12). **Pinheiro, M.** 470 (5). **Pirani, J.R.** 276 (15). **Pivetta** 602 (15).

Poliguesi, C.B. 8 (15). **Porto, M.L.** 1187 (15), 1674 (15), 1638 (1), 1651 (12), 2342 (15), s.n. [ICN 21665] (15). **Possette, R.F.S.** 336 (15). **Proença, M.** 64 (15), 118 (15).

Rabuske, C. 01 (15), 42 (18), 43 (18), 44 (18), 45 (18), 46 (18), 46 (18), 47 (18), 48 (18), 73 (15), 74 (15), 112 (15), 115 (7), 116 (14), 117 (14), 119 (14), 121 (15), 122 (14), 124 (14), 125 (15), 128 (15), 129 (7), 130 (14), 131 (14), 139 (15), 140 (12), 141 (12), 142 (12), 143 (12), 144 (7), 145 (12), 146 (12), 148 (12), 149 (12), 151 (15), 181 (15), 202 (17), 206 (15), 207 (15), 209 (15), 246 (15), 269 (17), 270 (17), 271 (15), 272 (15), 273 (10), 274 (10), 275 (10), 276 (10), 277 (10), 278 (10), 279 (10), 280 (10), 281 (5), 282 (5), 283 (5), 284 (5), 287 (5), 289 (12), 290 (12), 291 (12), 292 (12), 293 (12), 294 (12), 295 (12), 296 (12), 299 (12), 300 (12), 306 (12), 312 (12), 313 (12), 314 (12), 315 (12), 316 (12), 317 (12), 318 (12), 319 (12), 321 (18), 323 (18), 324 (4), 325 (15), 326 (14), 327 (14), 328 (4), 329 (4), 330 (4), 331 (4), 332 (4), 333 (14), 334 (14), 335 (18), 336 (18), 337 (1), 338 (1), 339 (14), 340 (14), 341 (1), 342 (15), 344 (15), 359 (15), 366a (7), 366b (7), 372 (6), 380 (6). **Rabuske-Silva, C.** 357 (15), 359 (12), 364 (12), 368 (2), 369 (2), 371 (6), 373 (15). **Radice, M.** 128 (12). **Rambo, B.** 432 (15), 4072 (15), 4394 (15), 4962 (15), 4963 (15), 6591 (15), 6648 (15), 27017 (5), 27208 (15), 32200 (15), 34654 (13), 34655 (14), 36160 (15), 36161 (13), 37899 (15), 37923 (5), 38375 (5), 42029 (15), 42892 (15), 43943 (5), 44182 (15), 44971 (14), 45419 (6), 45707 (15), 49504 (15), 49551 (6), 52187 (7), 53186 (12), 53808 (6), 53818 (15), 54101 (6), 54488 (7), 54515 (14), 54754 (14), 56400 (14), 57458 (5), 60126 (15), 60233 (4), 60238 (9). **Reis, I.** 159 (12). **Reitz, R.** 569 (15), 1481 (15), 2339 (4), 2369 (14), 2664 (15), 3332 (14), 3656 (15), 3667 (15), 3730 (4), 3854 (15), 5097 (15), 5247 (16), 5381 (4), 7713 (14), 8139 (14), 12473 (14), 13669 (14), 16648 (15), 17340 (15), 17781 (14), s.n. [PACA 65520, HBR 16642] (15). **Reutrell, J.** s.n. [SI barcode 052304] (14). **Ribas, O.S.** 289 (15), 335 (16), 470 (15), 489 (15), 609 (14), 1014 (14), 1456 (16), 1572 (13), 3642 (16), 3688 (15), 3708 (14), 4723 (15). **Ristow, R.** 292 (14), 713 (16). **Ritter, M.R.** 770 (1), 532 (12), 1108 (15). **Rodrigues, R.S.** 381 (14). **Rodriguez** 652 (15). **Rossato, M.** s.n. [HUCS 3351] (15). **Roth, L.** 22 (14).

Sánchez, J. 25 (12). **Santana, D.L.** 596 (15). **Santos, E.** 1228 (15). **Santos, E.D.** 271 (14). **Santos, E.P.** 346 (16), 405 (16), 490 (15), 549 (15). **Santos, R.** s.n. [CRI 10297] (18). **Saint-Hilaire, A.** 1554 (13). **Saito, N.** 458 (14). **Scala, A.** s.n. [LP 012946] (14), s.n. [LP 012963] (12), s.n. [LP 014125] (12), s.n. [LP 029390] (14). **Schaefer, J.** 832 (13). **Scheer, M.** 362 (16), 454 (15). **Schmidt, R.** 847 (14), 851 (14), 990 (17), 1024 (15), s.n. [PACA 105938] (14), s.n. [PACA 105959] (7). **Schneider, A.A.** 1317 (15). **Schütz, A.L.** 38 (15).

Schwake 9437 (11). **Schwirkowski, P.** 1802 (15), 2518 (15). **Scolnik, R.** 1239 (15). **Scur, L.** 155 (14), 195 (15), 894 (15). **Seger, G.D.S.** 453 (15). **Sehnem, A.** 3573 (12), 4286 (6), 5143 (14), s.n. [HUCS 1923] (5). **Sello, F.** 538 (14), 4638 (6), 4858 (14), d188? (5). **Sendulsky, T.** 843 (15). **Senna, R.M.** 1070 (14). **Shepherd, G.J.** 97-52 (8), 5780 (15). **Silva, F.C.** 699 (15). **Silva, J.M.** 529 (15), 1046 (15), 2782 (16), 3256 (16), 3386 (16), 3783 (13), 4149 (16), 4480 (13), 4937 (15), 7012 (13), 7066 (1), 7087 (18), 7252 (14), 7284 (9), 7347 (15), 7409 (14), 8488 (14). **Silva-Filho, P.J.S.** 10 (15). **Silveira, G.H.** 24 (14). **Silveira, N.** 1247 (18), 1904 (15), 2048 (13), 3016 (15), 4020 (14), 5741 (15), 5868 (13), 6647 (18), 7266 (18), 7537 (14), 7895 (13), 7958 (13), 7961 (13), 7977 (13), 7970 (13), 8541 (15), 8726 (15), 8925 (18), 9807 (18), 11096 (12), 11676 (6). **Slanis, A.** 67 (15). **Smith, L.B.** 7465 (14), 7630 (15), 7709 (14), 7717 (4), 7800 (9), 8688 (14), 8919 (14), 9501 (14), 10206 (14), 10231 (1), 10383 (9), 10411 (4), 10461 (15), 10479 (4), 10513 (15), 10717 (14), 10795 (15), 11223 (14), 11284 (6), 12027 (15), 12172 (15), 13057 (14), 13059 (14), 13456 (14), 13462 (14), 13707 (14), 14353 (14). **Sobral, M.** 96 (15), 149 (5), 488 (6), 1245 (14), 2463 (5), 2688 (14), 2792 (15), 3534 (5), 7699 (14), 7702 (12), 7714 (18), 7732 (14), 7733 (9), 7733b (9), 7742 (1), 7934a (17), 7934b (17), 7945a (17), 7945b (17), 8010 (17), 8095 (14), 8487 (7), 8600 (7), 8602 (7), 8604 (7), 8623 (1), 8657 (5), 8669 (6), 8669a (6), 8685 (12), 8686 (14), 8767 (5), 8768 (5), 8769 (5), 8810 (1), 8820 (1), 8822 (6), 8839 (15), 8859 (1), 8860 (1), 8863 (18), 8974 (9), 8979 (6), 8980 (6), 9005 (13), 9013 (13), 9058 (17), 9175 (7), 9176 (15), 9178 (14), 9185 (6), 9291a (18), 9424 (13), s.n. [FURB 1078] (6), s.n. [FURB 1090] (1), s.n. [FURB 1330] (13), s.n. [FURB 1833, MBM 319368] (1), s.n. [HAS 11188] (14). **Souza, L.P.** 194 (14). **Souza, V.C.** 23237 (3), 23290 (3), 30509 (14). **Spegazzini, C.** 5174 (14). **Spegazzini, R.A.** 5158a (12), 62913? (12), 63314 (12). **Stehmann, J.R.** 242 (14), 310 (15), 455 (14), 711 (15), s.n. [ICN 51625] (15). **Steinbach, J.** 2158 (15). **Stella, M.** 38 (15). **Stofella** 27 (12). **Strang, H.** 739 (8). **Stuckert, T.** 7637 (12). **Sucre, D.** 4646 (8). **Svolenski, A.C.** 292 (15), 333 (15).

Tamayo, F. 1440 (15). **Tizón, F.R.** 172 (12), 313 (12), 661 (12), 681 (12). **Toledo, C.B.** 732 (8). **Torres, M.A.** 1094 (12), 1095 (12). **Tressens, S.G.** 5661 (15). **Trevisan, R.** 1322 (14), 1339 (18), 1409 (9), 1606 (1), 1657 (4). **Trinta, Z.A.** 186 (15). **Troncoso, N.S.** 1119 (15), 1382 (12), s.n. [SI barcode 052301] (14). **Tur, N.M.** 2007 (15).

Ule, E. 615 (4), 1647 (18), 3372a (8). **Uller, H.F.** 865 (15).

Valduga, E. 806 (5), 807 (5). **Valentini, A.** 54 (12). **Valls, J.** 3303 (18). **Venturi, S.** 201 (12), 202? (12). **Vervloet, R.R.** 774 (15), 1224 (15), 2214 (15). **Villamil, C.B.** 1882 (12), 2572 (12), 3607 (12), 3758 (12), 3934 (12), 5509 (12), 7040 (12), 7890 (12), 9358 (12). **Vogel-Ely, C.** 425 (9), 426 (13). **Völtz, R.R.** 588 (15), 646 (15).

Waechter, J.L. 889 (18), 940 (15), 1918 (14). **Wasun, R.** 278 (14), 864 (15), 1558 (7), 4945 (14), s.n. [HUCS 3454] (15). **Widgren** 182 (14). **Wright, C.** 277 (15).

Zanette, V.C. 1321 (15). **Zanotti, C.A.** 900 (15). **Zuloaga, F.O.** 3486 (15), 5089 (15), 8035 (15), 8229 (15), 10955 (15).

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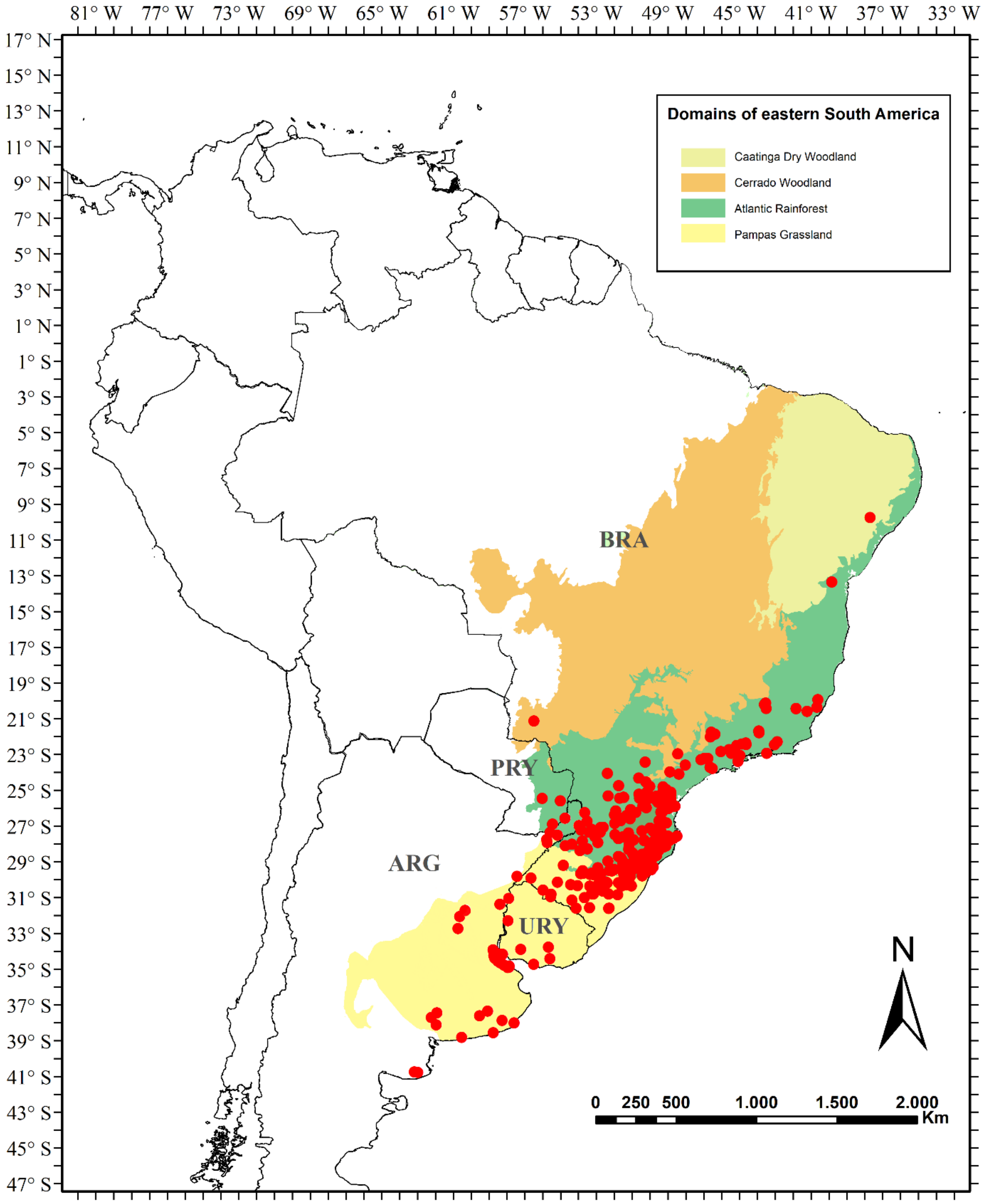


FIGURE 1. Biogeographic domains and distribution of *Valeriana* (spots) in eastern South America. Abbreviations: ARG = Argentina; BRA = Brazil; PRY = Paraguay; URY = Uruguay.

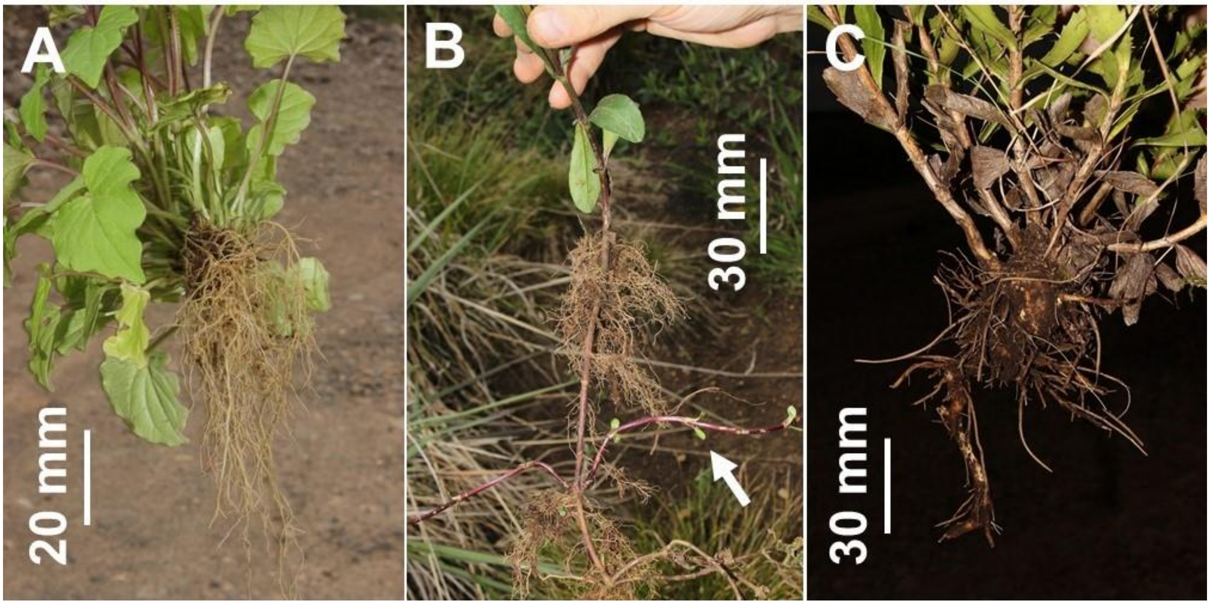


FIGURE 2. Types of roots of *Valeriana* (Valerianaceae) from eastern South America. A. Filiform adventitious roots derived from short rhizomes in *V. scandens*; B. Filiform adventitious roots derived from long rhizomes in *V. salicariifolia*, highlighting (arrow) young lateral branches; C. Short tap-roots of *V. eichleriana*. Photos by Cassio Rabuske da Silva.

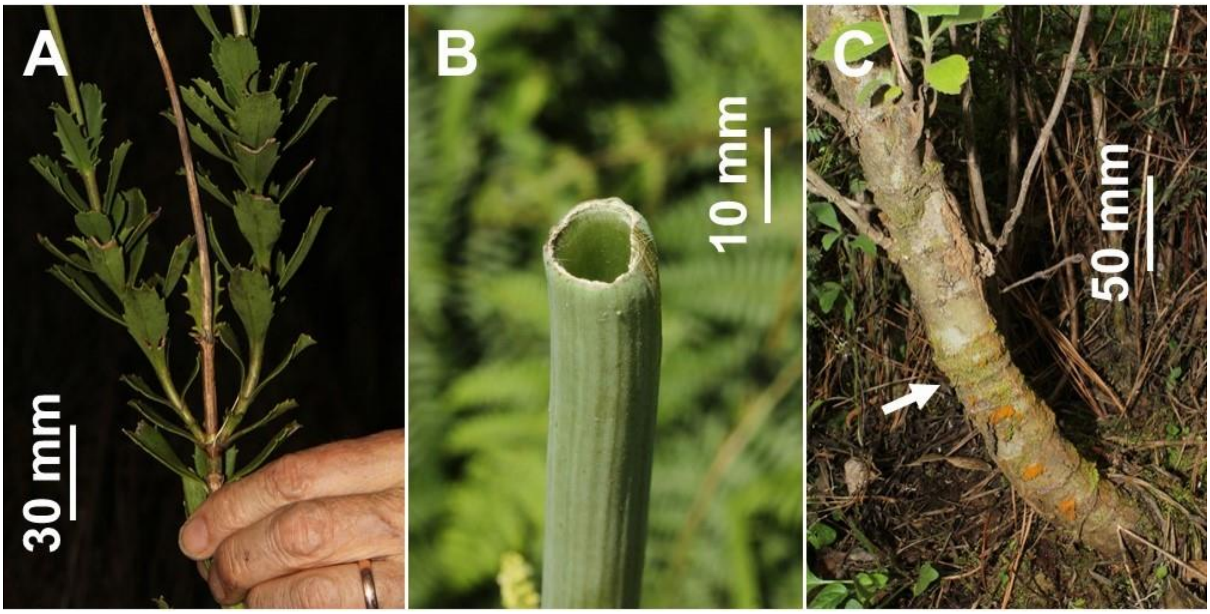


FIGURE 3. Stems of *Valeriana* (Valerianaceae) from eastern South America. A. Dichotomous growth in *V. eichleriana*, highlighting the main senescent axis; B. A cross section in a fistulous stem of *V. polystachya*; C. Base of a branch of *V. eupatoria*, highlighting (arrow) the annual scars. Photos by Cassio Rabuske da Silva.

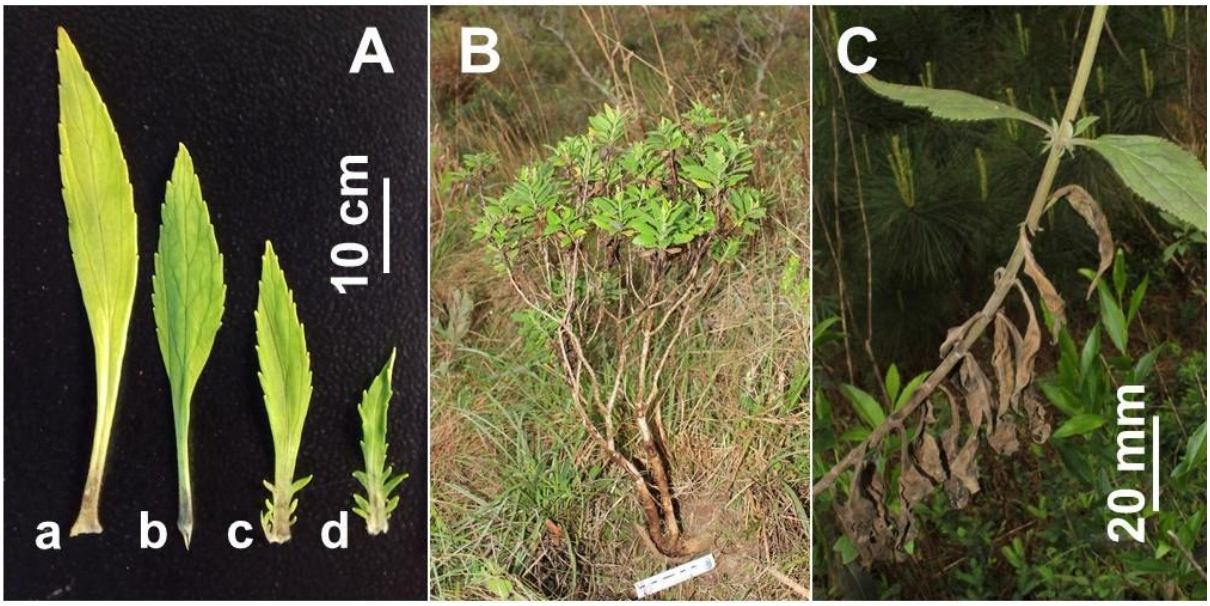


FIGURE 4. Leaves and phyllotaxis of *Valeriana* (Valerianaceae) from eastern South America. A. Variation in the shape of leaves and basal bracts of *V. organensis*; a. Basal leaf at the beginning of the senescence process (yellowing); b and c. Distal leaves; d. The most basal bract. B. Leaves arranged at the apex of the branches in *V. chamaedryfolia*; C. Senescent leaves still attached to the branch in *V. eupatoria*. Photos by Cassio Rabuske da Silva.

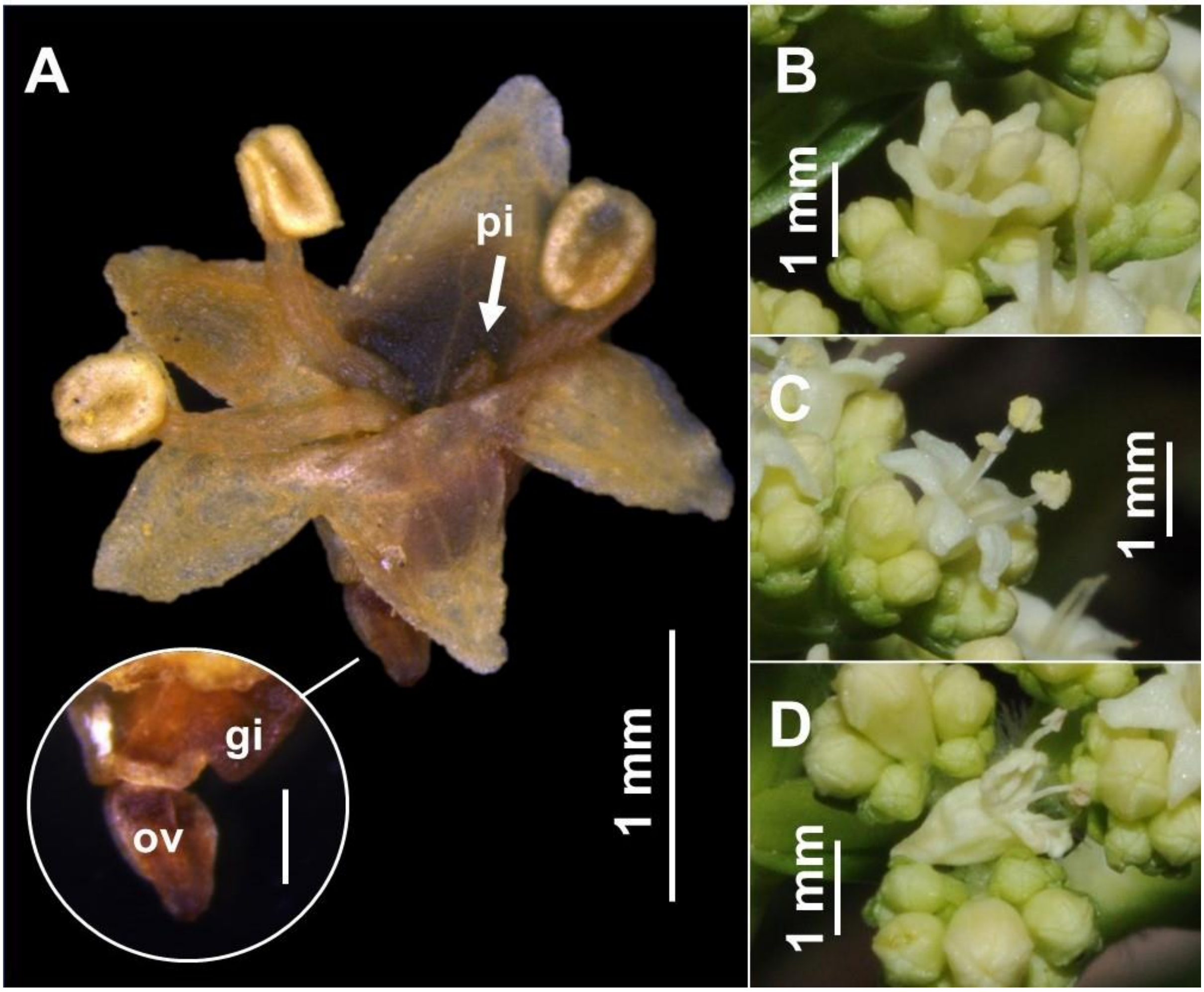


FIGURE 5. Flowers of *Valeriana* (Valerianaceae) from eastern South America. A. Staminate flower of *V. organensis*, highlighting the pistilodium (pi), the gibbous (gi) and the abortive ovary (ov) (0.3 mm scale bar) (RB 553620); B-D. Staminate flowers of *V. catharinensis*; B. Flower buds and a flower at the beginning of anthesis; C. A flower at the end of anthesis, with the anthers releasing pollen; D. Fall of the corolla after the end of anthesis. Photos by Cassio Rabuske da Silva.

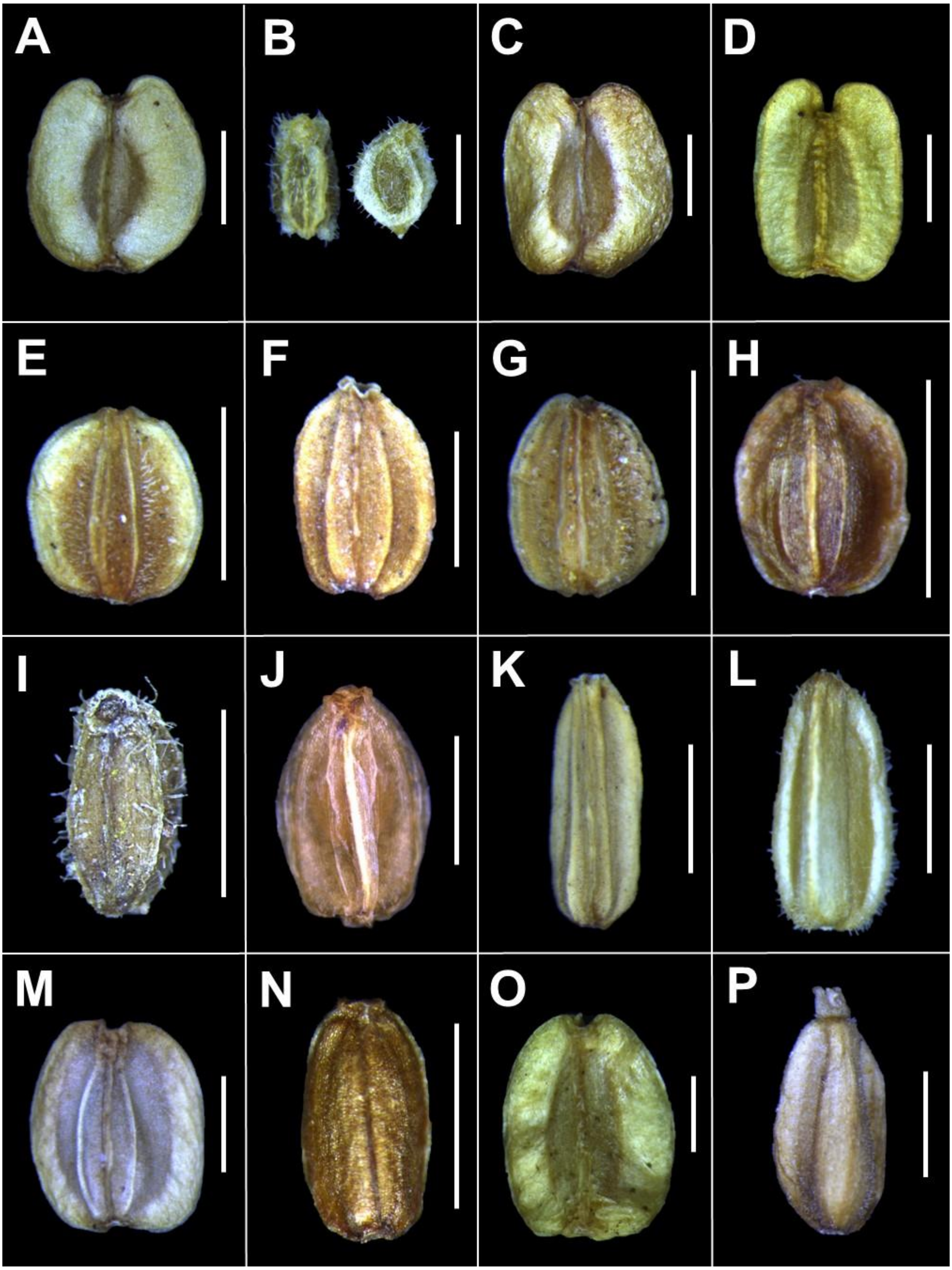


FIGURE 6. Achenes of *Valeriana* (Valerianaceae) (Sect. *Valerianopsis*) from eastern South America. A. *V. aparadensis* (ICN 124759); B. *V. bornmuelleri* in dorsal (left) and lateral (right) view (ICN 189188); C. *V. caparaoensis* (RB 674674); D. *V. catharinensis* (ICN 195428); E. *V. chamaedryfolia* (ICN 123673); F. *V. eichleriana* (ICN 123676); G. *V. eupatoria* (ICN 187697); H. *V. glaziovii* (ICN 123696); I. *V. glechomifolia* (ICN 123310); J. *V. organensis* (RB 553620); K. *V. polystachya* (variant with glabrous indument) (ICN 188388); L. *V.*

polystachya (variant with pubescent indument) (ICN 197046); M. *V. reitziana* (ICN 184851); N. *V. salicariifolia* (ICN 123703); O. *V. sobraliana* (MBM 369718); and P. *V. tajuvensis* (ICN 123672). Scale bars 1 mm. Photos by Cassio Rabuske da Silva.

FIGURE 7. Achenes of *Valeriana* (Valerianaceae) (Sect. *Phuodendron* and *Amplophus*) from eastern South America. A–B. Sect. *Phuodendron*: A. *V. iganciana* (ICN 199661); B. *V. ulei* (ICN 187318); C. *V. scandens* (Sect *Amplophus*), achenes in different stages of development (ICN 123395); D–E. Papillose indument in achenes of *V. catharinensis* (ICN 195428) and *V. salicariifolia* (ICN 123703), Sect. *Valerianopsis*, respectively. Scale bars 1 mm from A to C, and 0.1 mm in D and E. Photos by Cassio Rabuske da Silva.

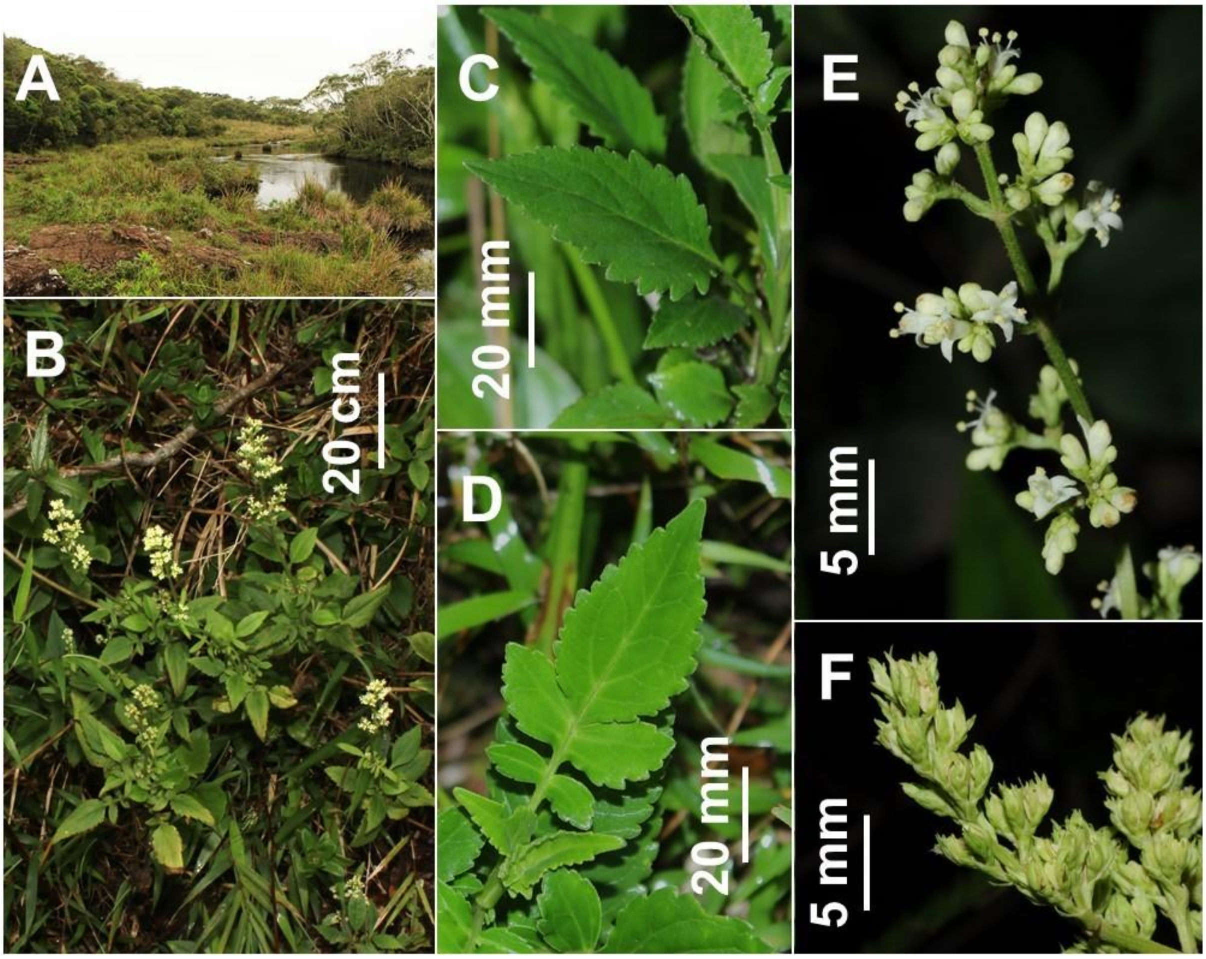


FIGURE 8. *Valeriana aparadensis* (Valerianaceae). A. Habitat at Cachoeira do Tigre Preto, Serra Geral National Park, Rio Grande do Sul, Brazil; B. Habit; C. Basal leaf in adaxial view; D. Distal (caulinar) leaf in adaxial view; E. Distal portion of an inflorescence with staminate flowers; F. Part of a paracladia with pistillate flowers and immature achenes. Photos A–D by Cassio Rabuske da Silva, and E–F by Sérgio Augusto de Loreto Bordignon.

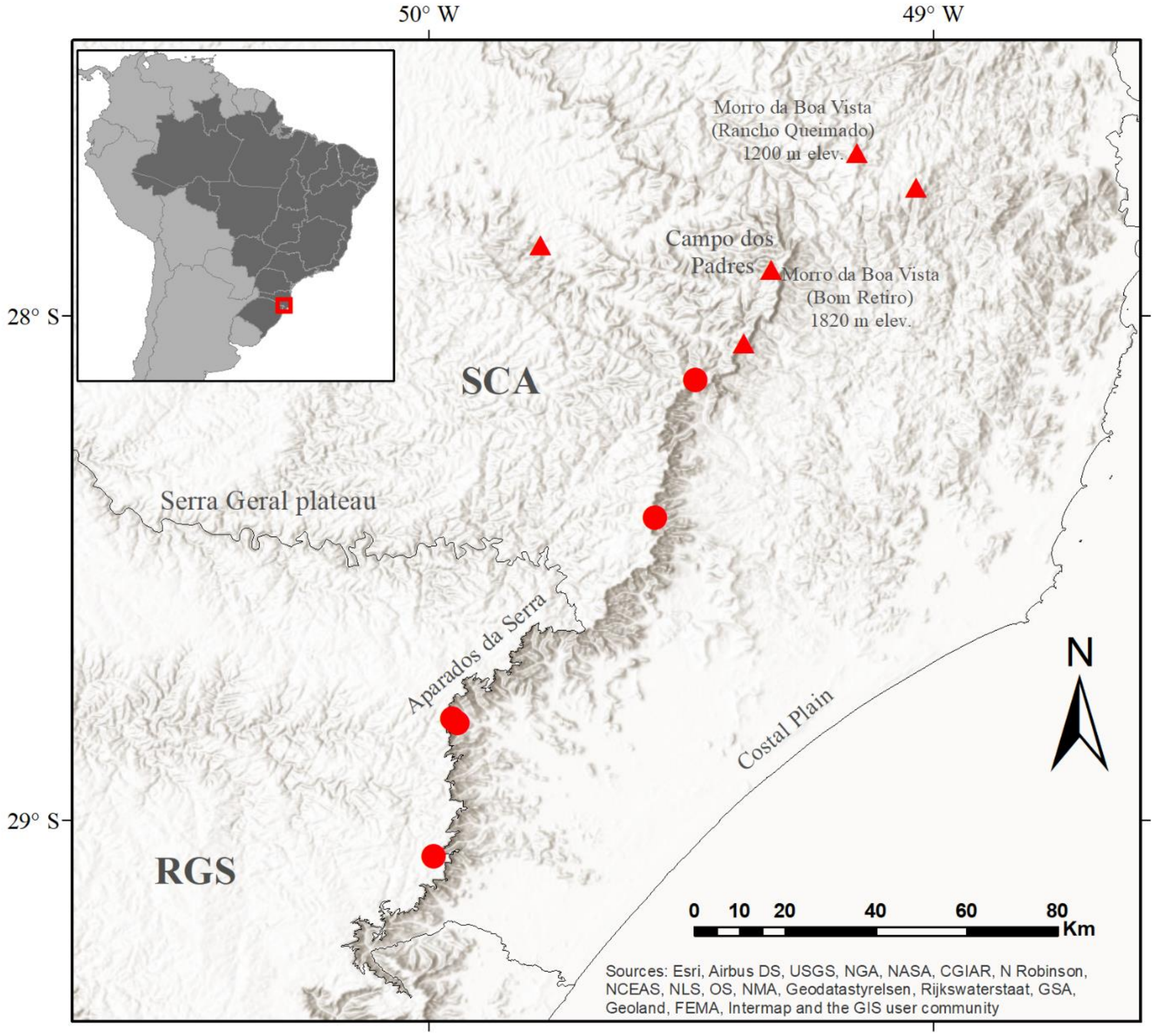


FIGURE 9. Distribution map of *Valeriana aparadensis* (spots) and *V. catharinensis* (triangles) (Valerianaceae). Abbreviations: RGS = Rio Grande do Sul; SCA = Santa Catarina.

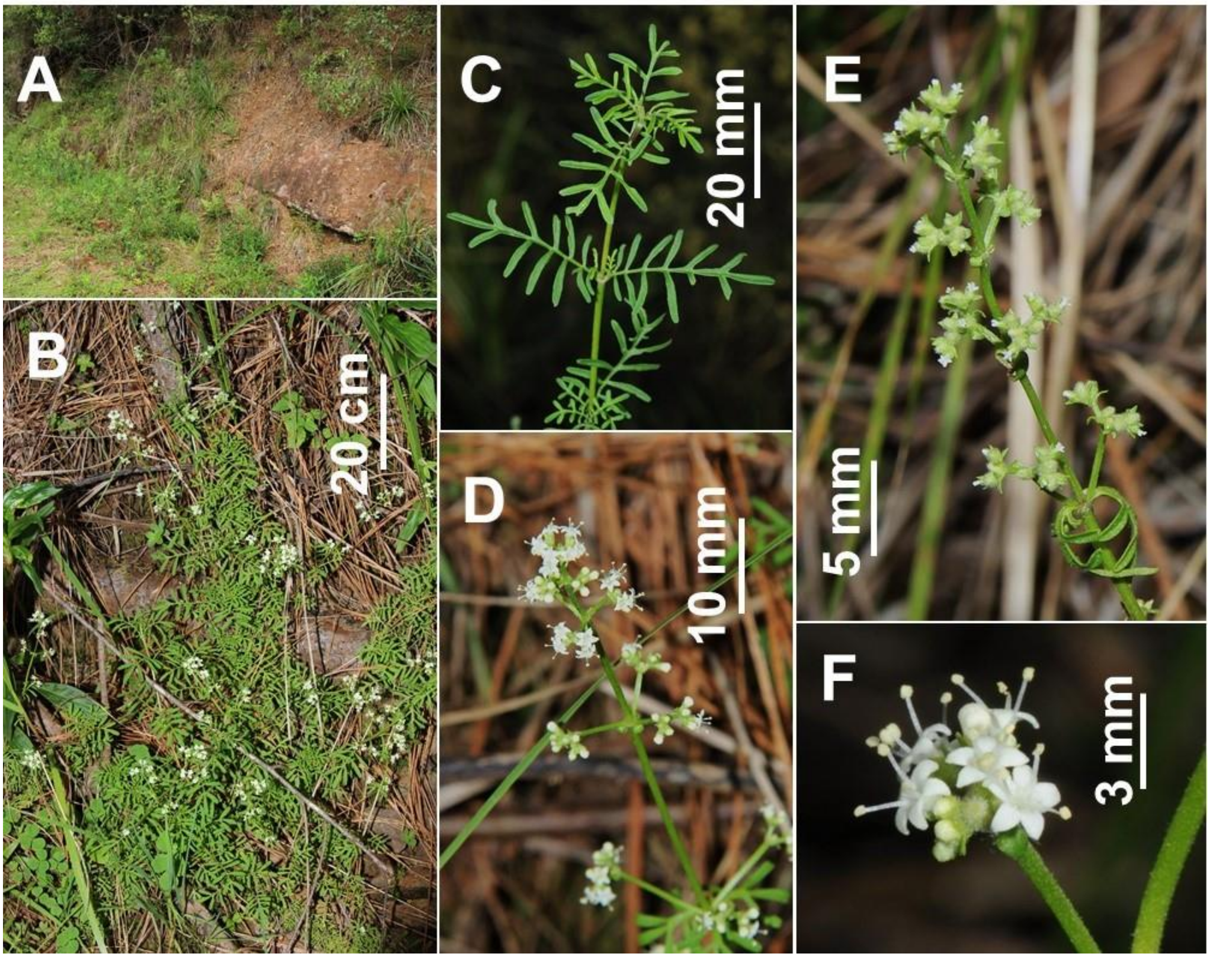


FIGURE 10. *Valeriana bornmuelleri* (Valerianaceae). A. Habitat in a mountain slope in the municipality of São Francisco de Paula, Rio Grande do Sul, Brazil; B. Habit. C. Young branch with distal (caulinar) leaves in adaxial view; D. Inflorescence with hermaphrodite flowers; E. Inflorescence with pistillate flowers and immature achenes; F. distal portion of a paracladia with hermaphrodite flowers and immature achenes. Photos A, B, D and E by Cassio Rabuske da Silva, and photos C and F by Sérgio Augusto de Loreto Bordignon.

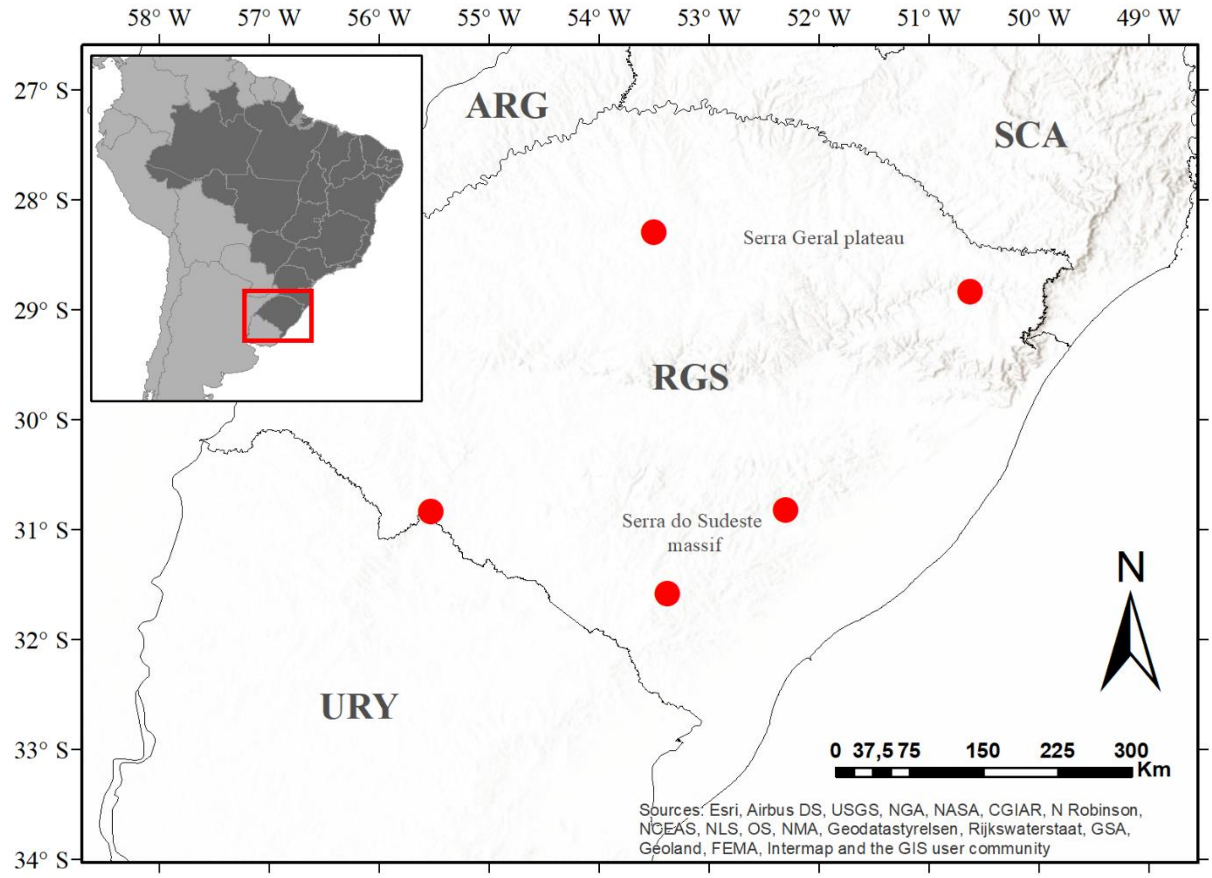


FIGURE 11. Distribution map of *Valeriana bornmuelleri* (Valerianaceae) (spots). Abbreviations: ARG = Argentina; RGS = Rio Grande do Sul; SCA = Santa Catarina; URY = Uruguay.

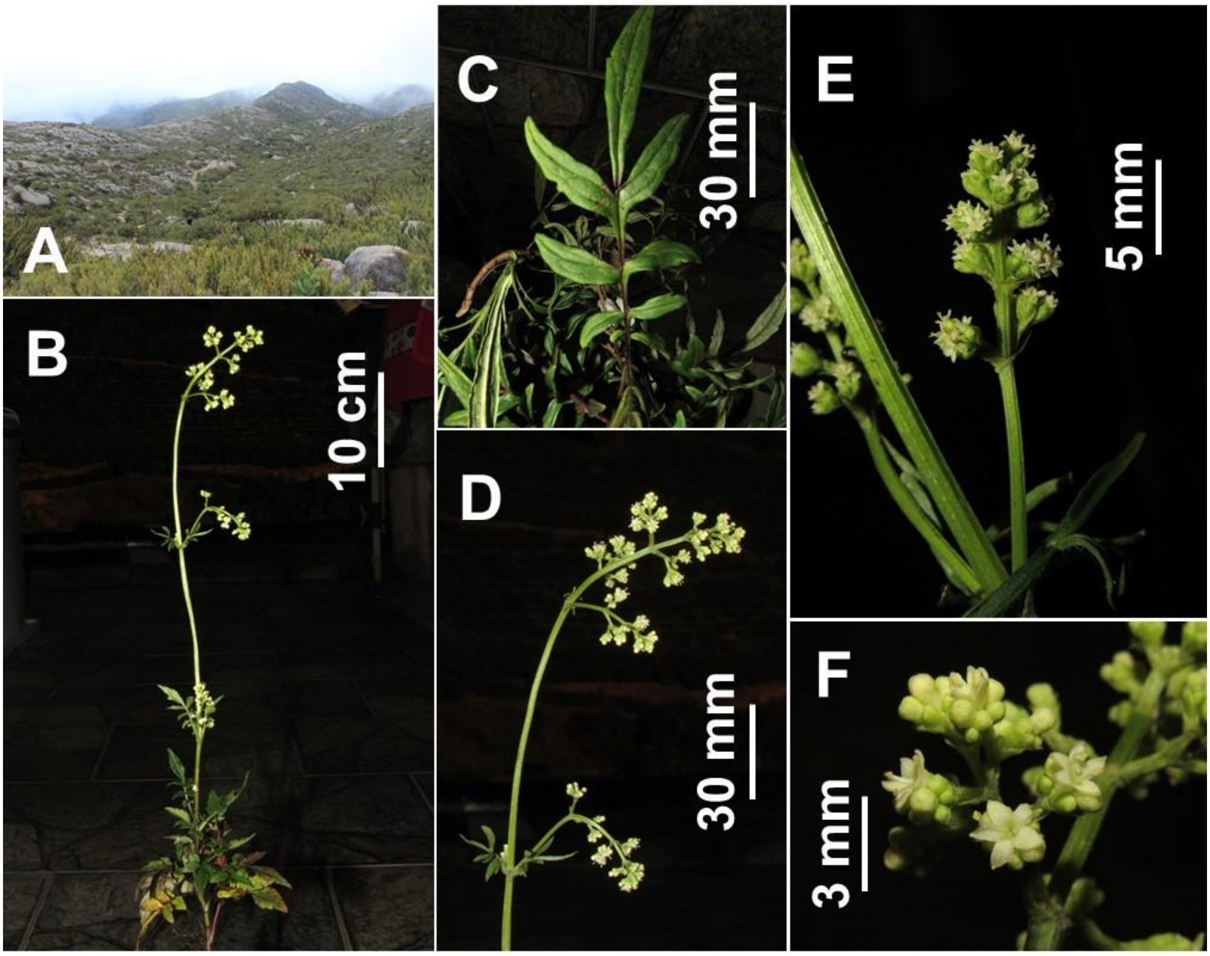


FIGURE 12. *Valeriana caparaoensis* (Valerianaceae). A. Habitat at the Serra do Caparaó massif, Minas Gerais, Brazil; B. Habit; C. Distal (caulinar) leaf in adaxial view; D. Inflorescence with staminate flowers; E. Paracladia with pistillate flowers. F. Staminate flowers and floral buds. Photos A by Cassio Rabuske da Silva, and B–F by Guilherme Peres Coelho.

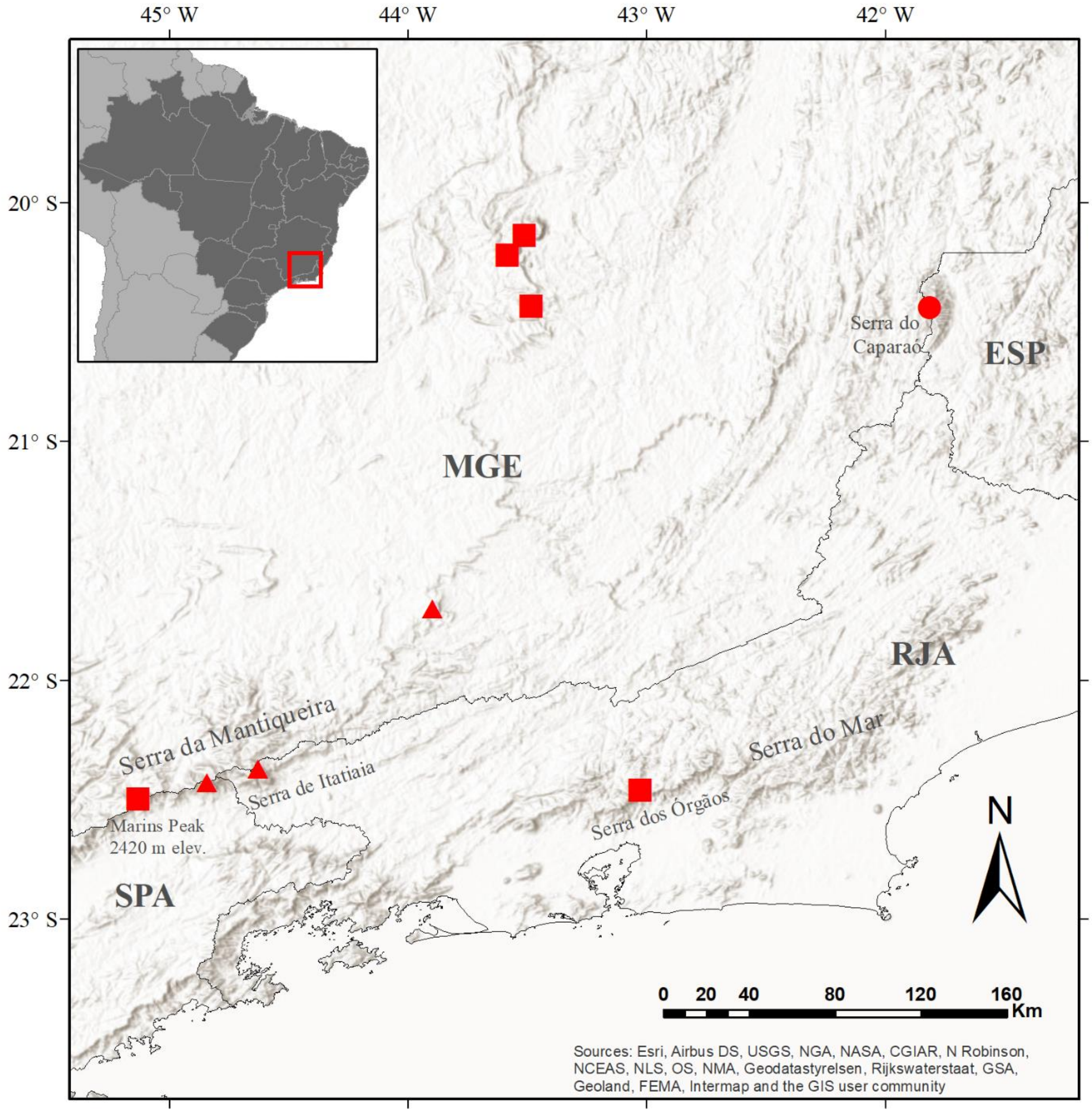


FIGURE 13. Distribution map of *Valeriana caparaoensis* (spot), *V. glaziovii* (triangle) and *V. organensis* (square) (Valerianaceae). Abbreviations: ESP = Espírito Santo; MGE = Minas Gerais; RJA = Rio de Janeiro; SPA = São Paulo.

FIGURE 14. Lectotype of *Valeriana catharinensis* (Valerianaceae) [*Ule 615* (HBG barcode HBG-513372)].

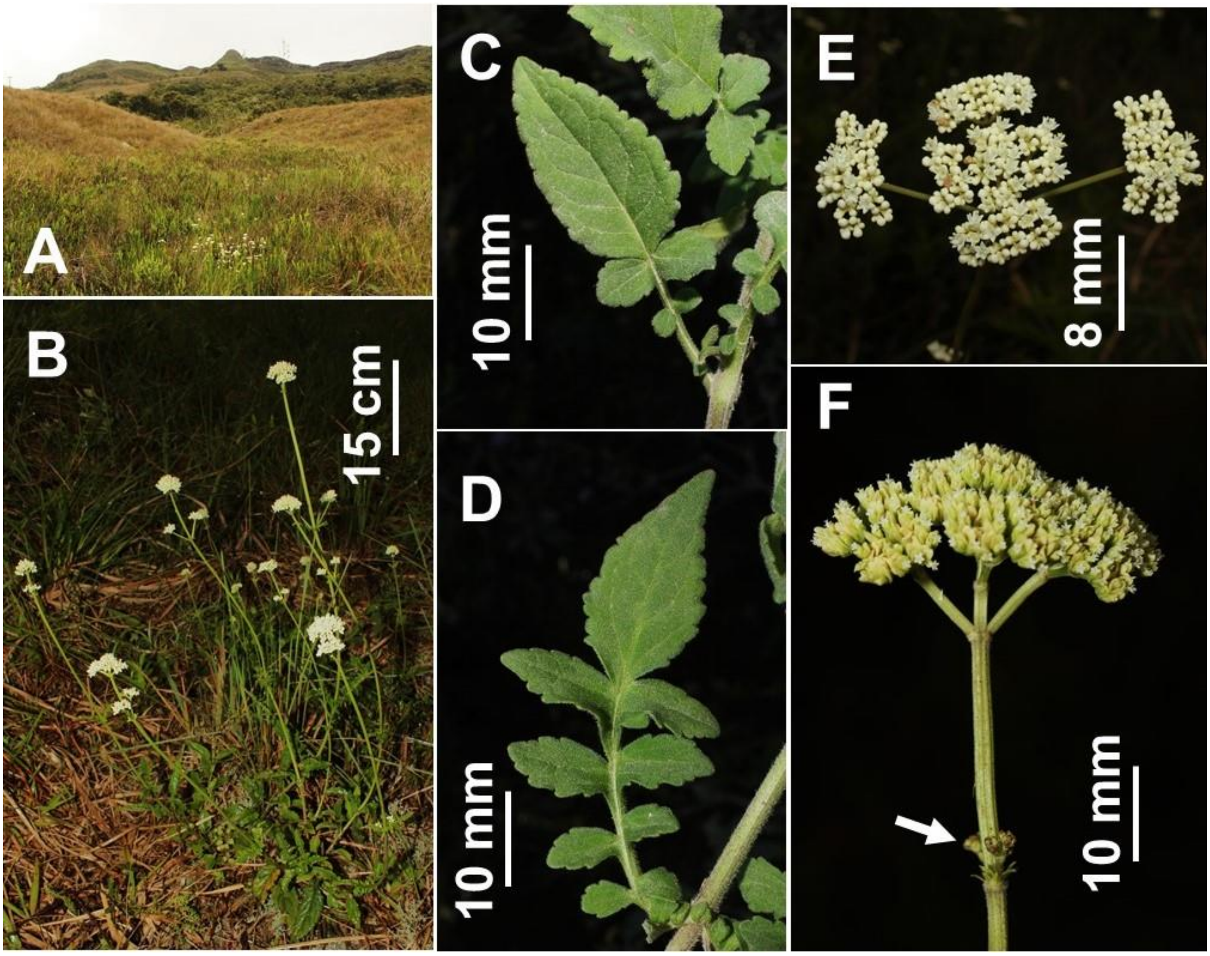


FIGURE 15. *Valeriana catharinensis* (Valerianaceae). A. Habitat at the Morro da Boa Vista, Rancho Queimado municipality, Santa Catarina, Brazil; B. Habit; C. Basal leaf in adaxial view; D. Distal (caulinar) leaf in adaxial view. E. Inflorescence with staminate flowers (top view). F. Inflorescence with pistillate flowers and immature achenes, highlighting (arrow) the first pair of paracladia, aborted during its early stage of development. Photos: Cassio Rabuske da Silva.

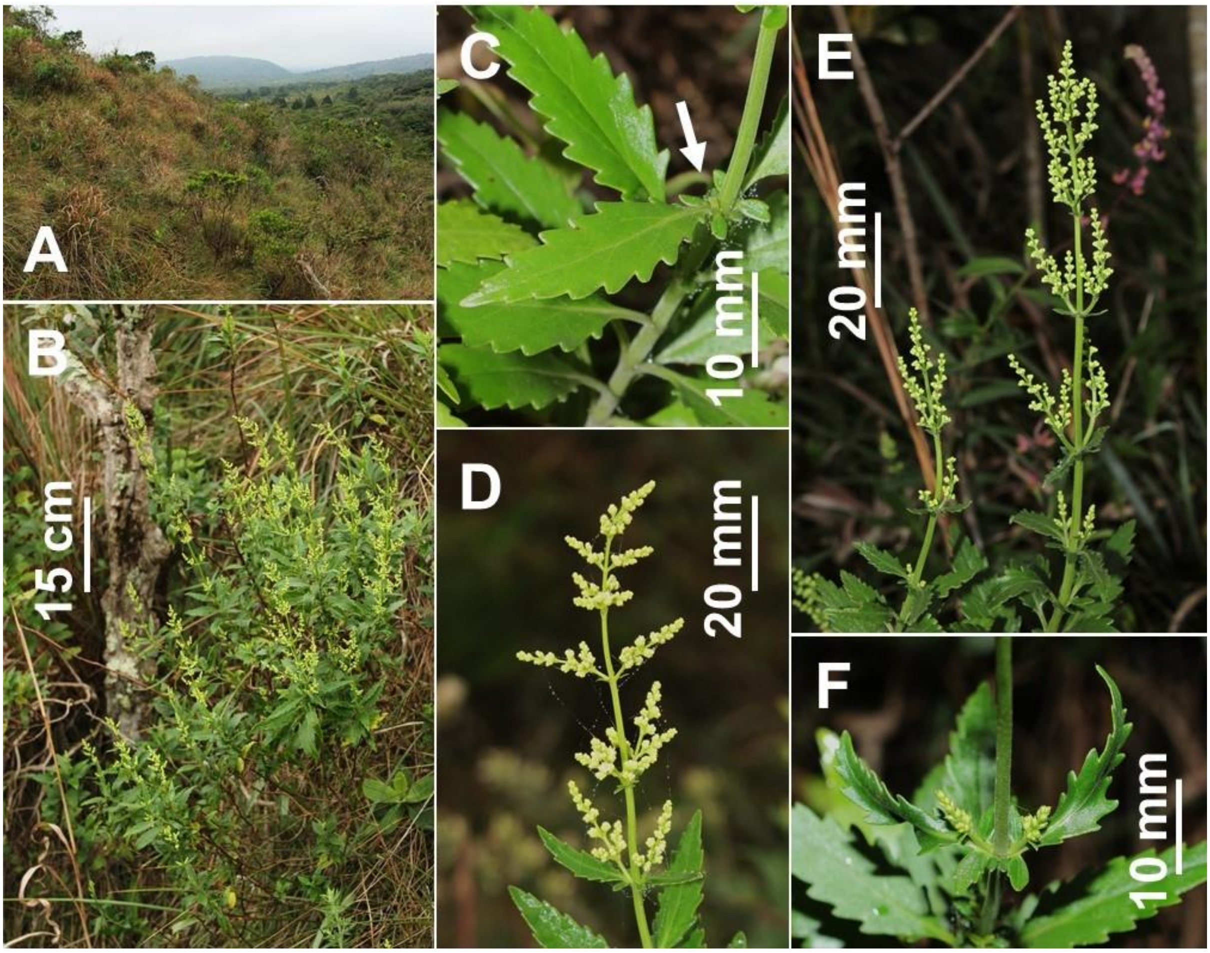


FIGURE 16: *Valeriana chamaedryfolia* (Valerianaceae). A. Habitat in the Morro do Araçá, Itapuã State Park, Viamão municipality, Rio Grande do Sul, Brazil; B. Habit; C. Distal leaves in adaxial view, highlighting (arrow) the basal lobes of a leaf, next to the intersection with a node; D. Inflorescence with staminate flowers; E. Inflorescences with pistillate flowers; F. The most basal pair of bracts with a young pair of paracladia. Photos by Cassio Rabuske da Silva.

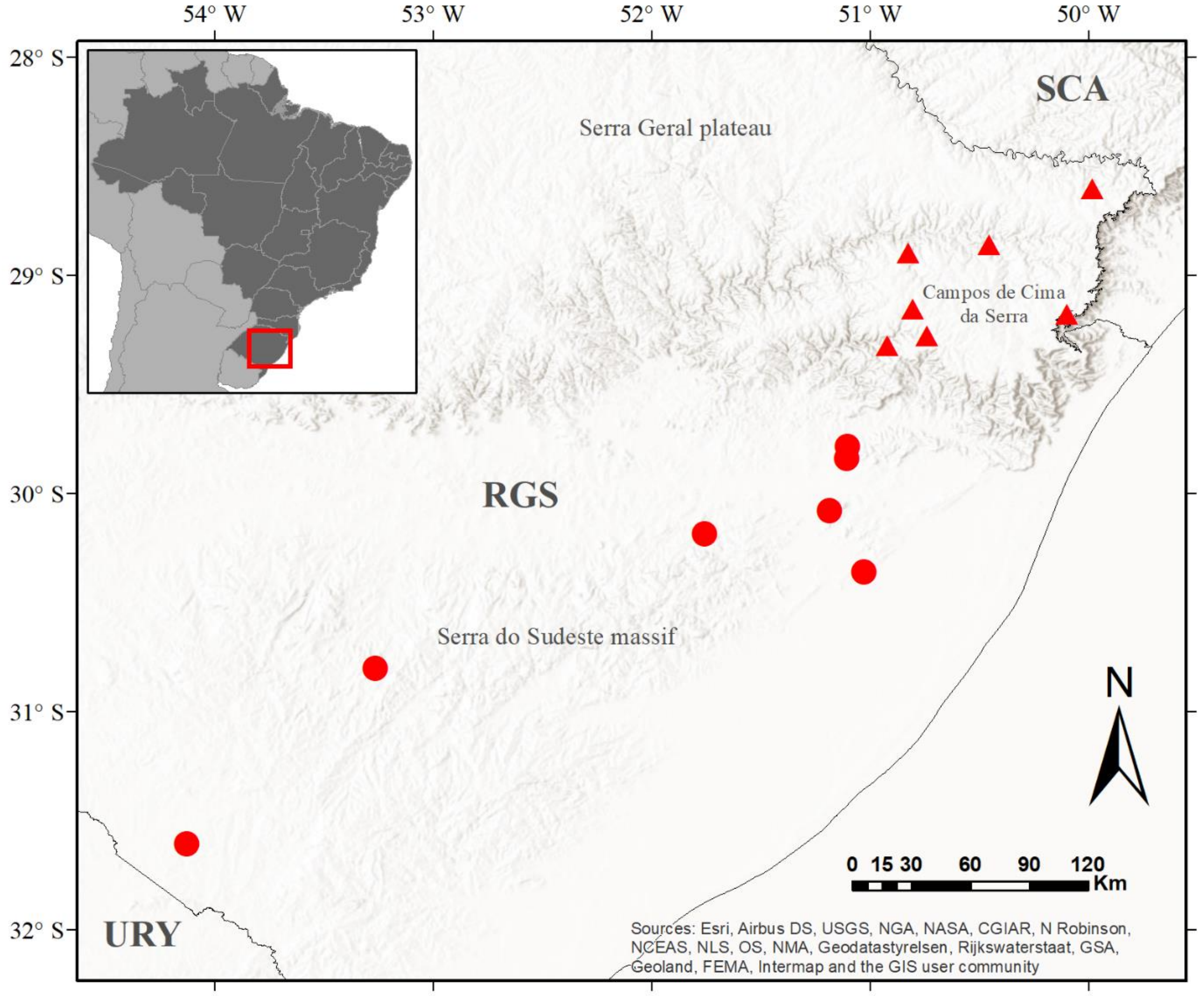


FIGURE 17. Distribution map of *Valeriana chamaedryfolia* (spots) and *V. eupatoria* (triangles) (Valerianaceae). Abbreviations: RGS = Rio Grande do Sul; SCA = Santa Catarina; URY = Uruguay.

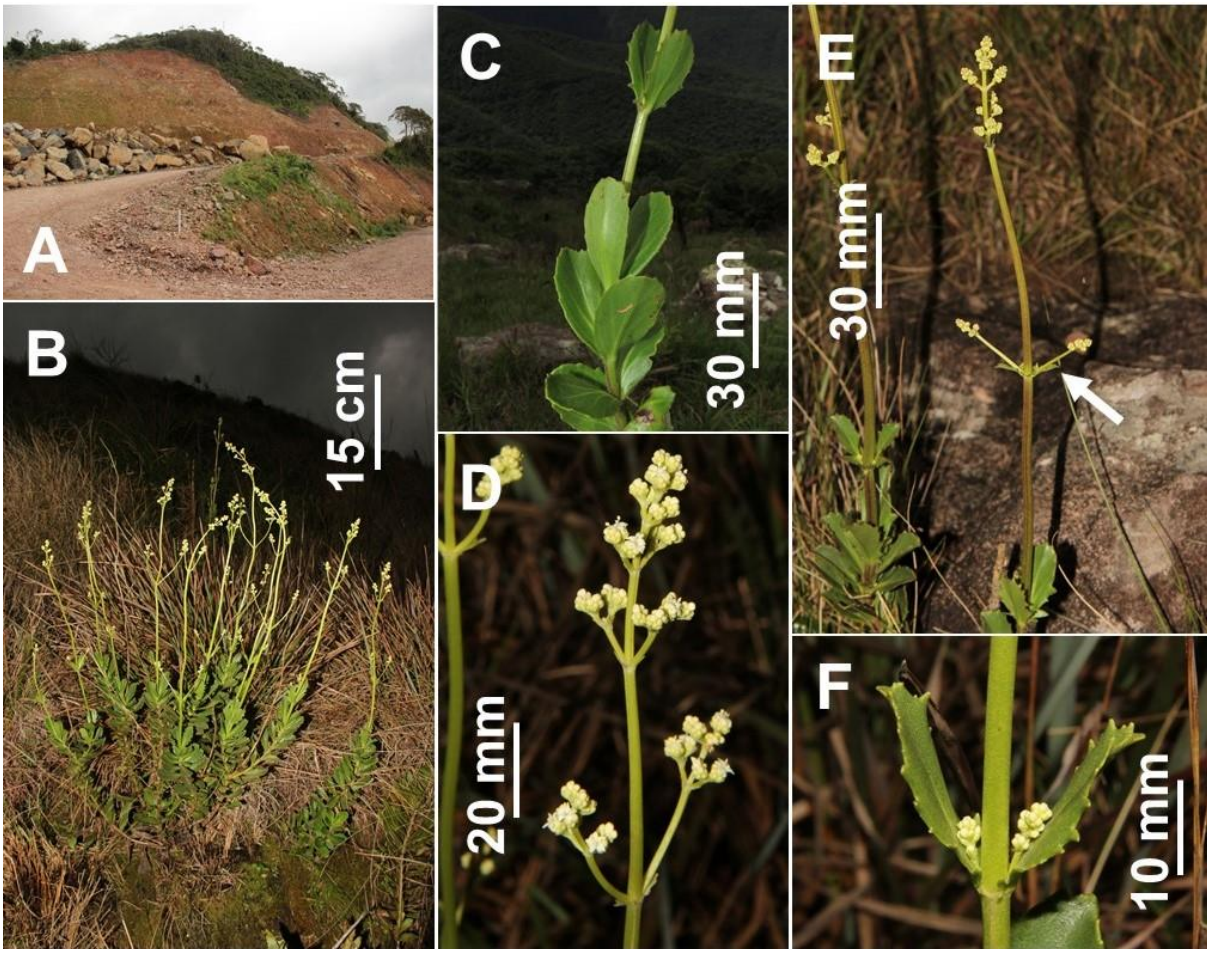
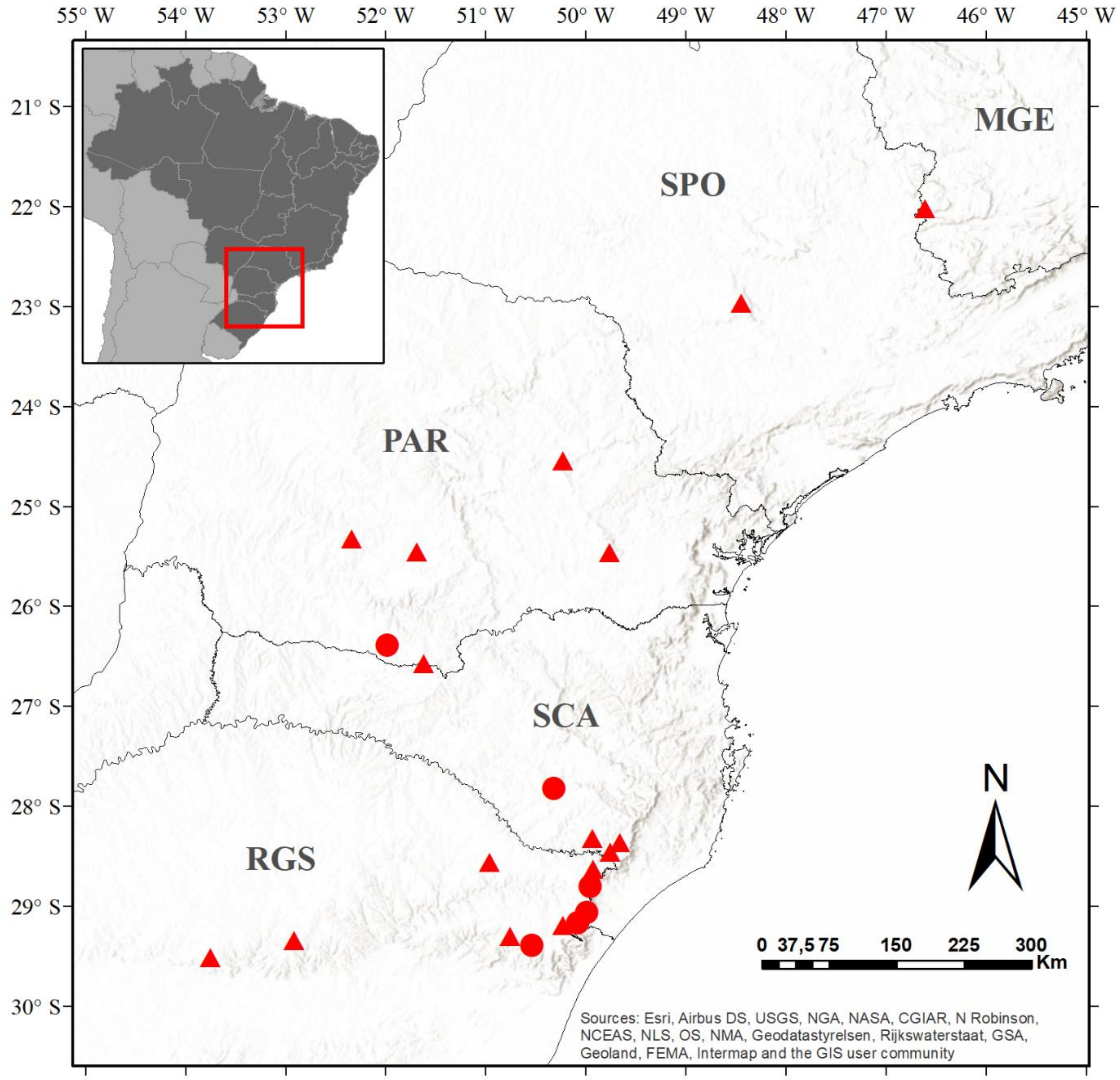


FIGURE 18. *Valeriana eichleriana* (Valerianaceae). A. Habitat at the Serra da Rocinha, São José dos Ausentes municipality, Rio Grande do Sul, Brazil, after disturbance; B. Habit; C. Basal and distal (caulinar leaves); D. Distal portion of an inflorescence with staminate flowers; E. Inflorescence with pistillate flowers, highlighting (arrow) the second pair of paracladia; F. The most basal bracts and pair of paracladia. Photos A–B and D–F by Cassio Rabuske da Silva, and C by Guilherme Peres Coelho.



Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

FIGURE 19. Distribution map of *Valeriana eichleriana* (spots) and *V. reitziana* (triangles) (Valerianaceae). Abbreviations: MGE = Minas Gerais; PAR = Paraná; RGS = Rio Grande do Sul; SCA = Santa Catarina; SPO = São Paulo.

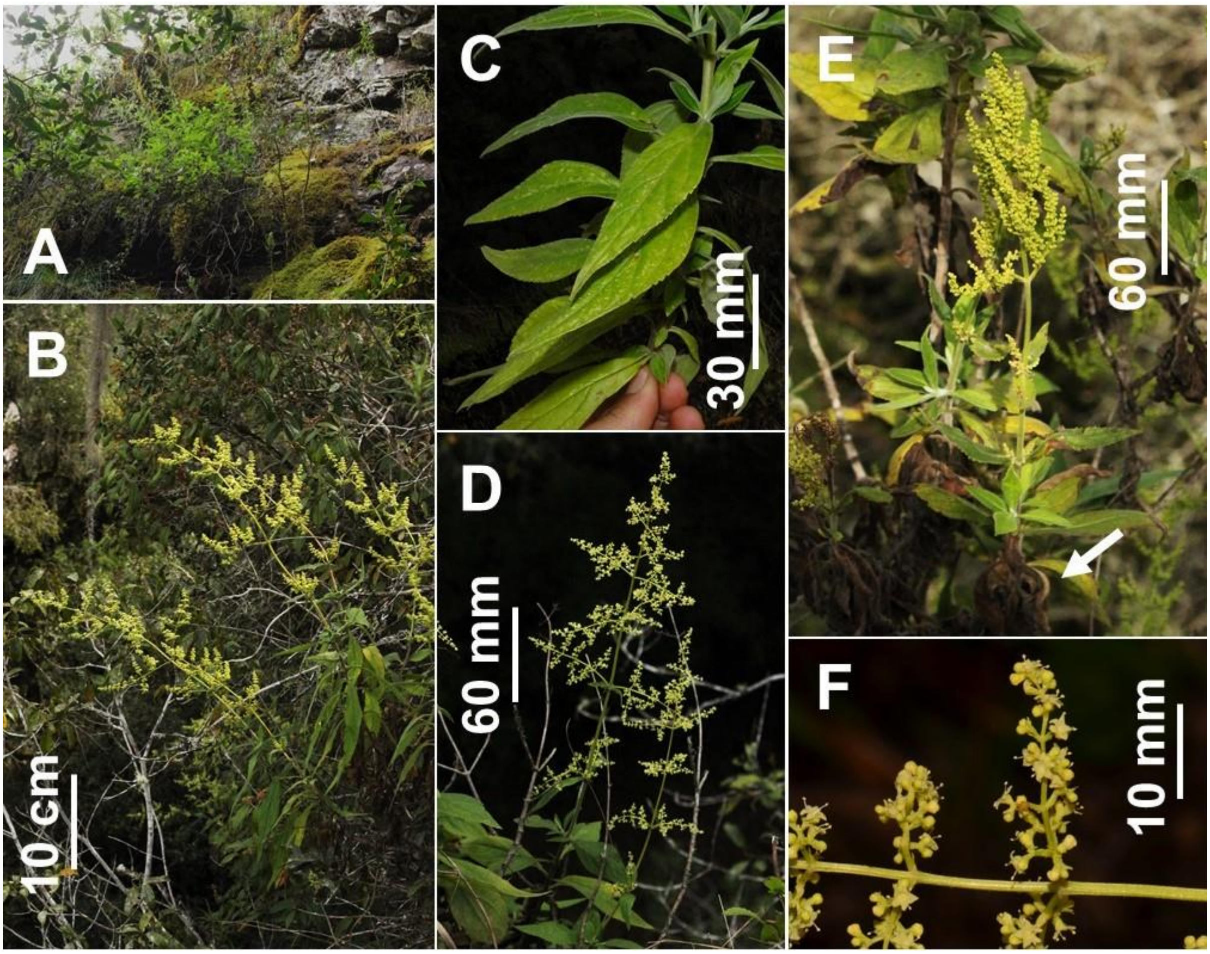


FIGURE 20. *Valeriana eupatoria* (Valerianaceae). A. Habitat at the Canyon Palanquinhos, Caxias do Sul municipality, Rio Grande do Sul, Brazil; B. Habit; C. Leaves in adaxial view; D. Inflorescences with staminate flowers; E. Inflorescences with pistillate flowers; F. Detail of a secondary branch of an inflorescence with staminate flowers, showing the paniculiform tertiary branches. Photos A–B and D–F by Cassio Rabuske da Silva, and C by Martin Grings.

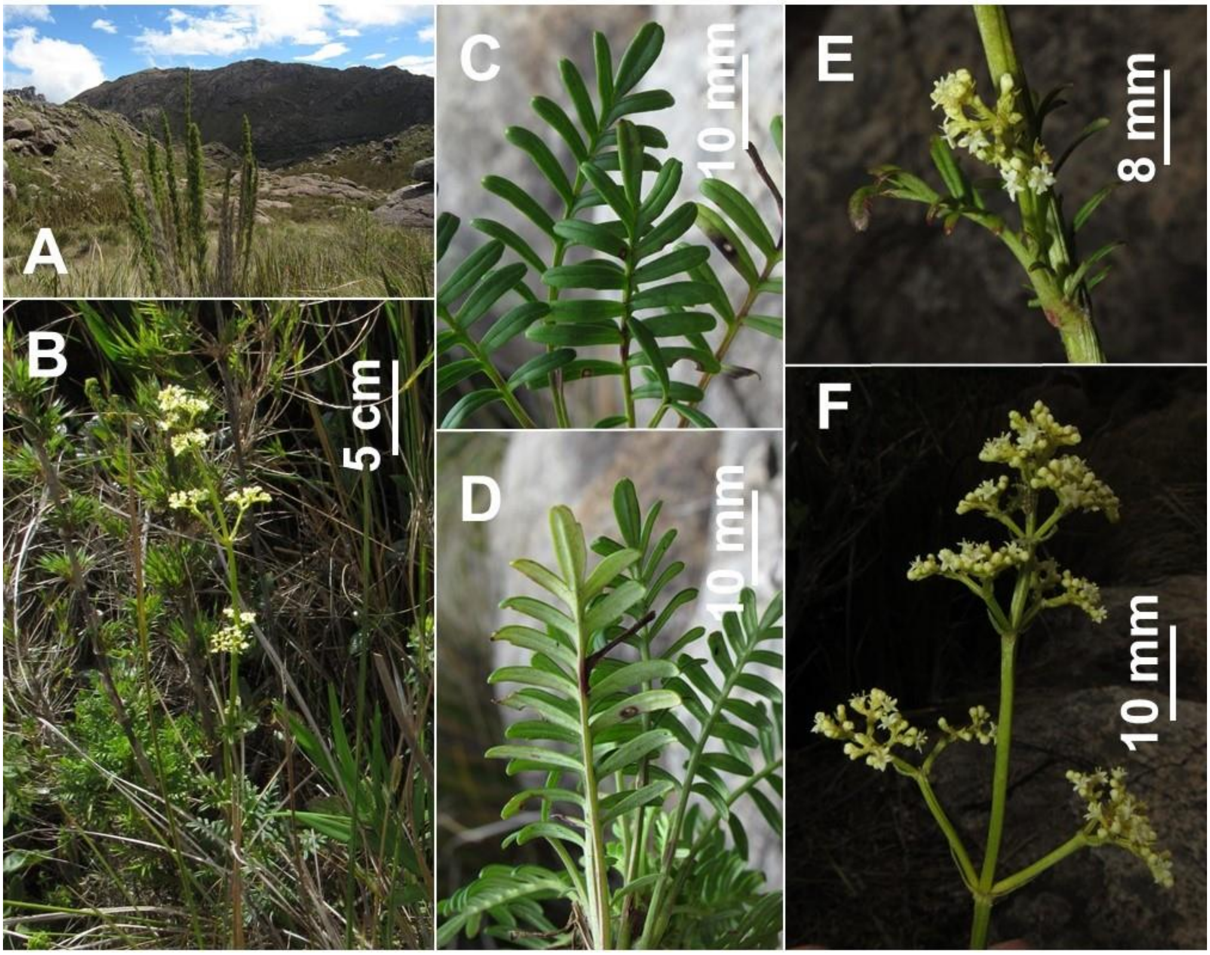


FIGURE 21. *Valeriana glaziovii* (Valerianaceae). A. Habitat at the Itatiaia National Park, Rio de Janeiro, Brazil; B. Habit; C. Basal leaves in adaxial view; D. Basal leaves in abaxial view; E. Bracts; F. Distal portion of an inflorescence with staminate flowers. Photos by Guilherme Peres Coelho.

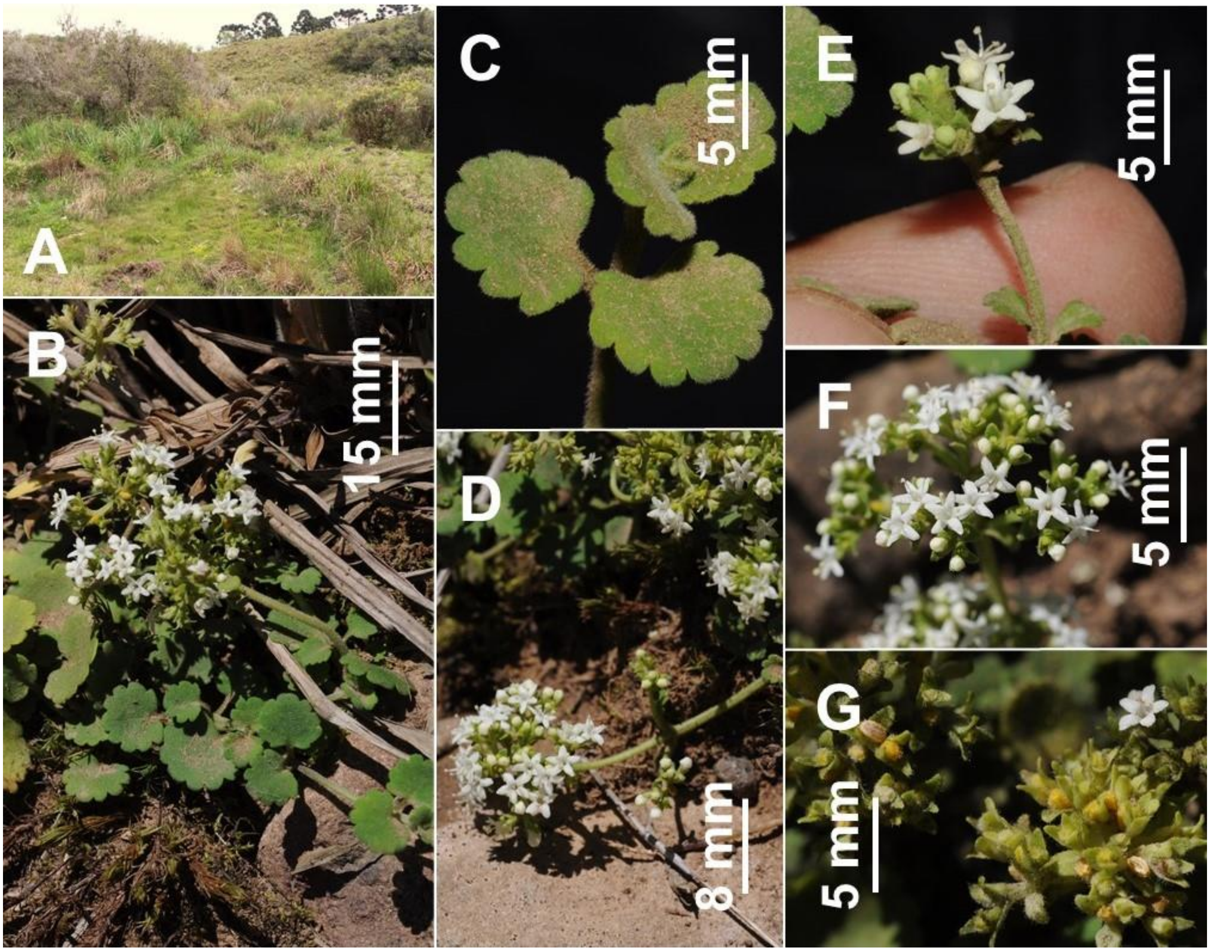


FIGURE 22. *Valeriana glechomifolia* (Valerianaceae). A. Habitat at São José dos Ausentes municipality, Rio Grande do Sul, Brazil; B. Habit; C. Leaves of a young branch in adaxial view; D. Inflorescence with hermaphrodite flowers; E. Small inflorescence with three open hermaphrodite flowers and floral buds; F. Distal portion of a inflorescence with hermaphrodite flowers; G. Detail of an inflorescence with immature and mature achenes still attached to the branches. Photo A by Cassio Rabuske da Silva and B–G by Sérgio Augusto de Loreto Bordignon.

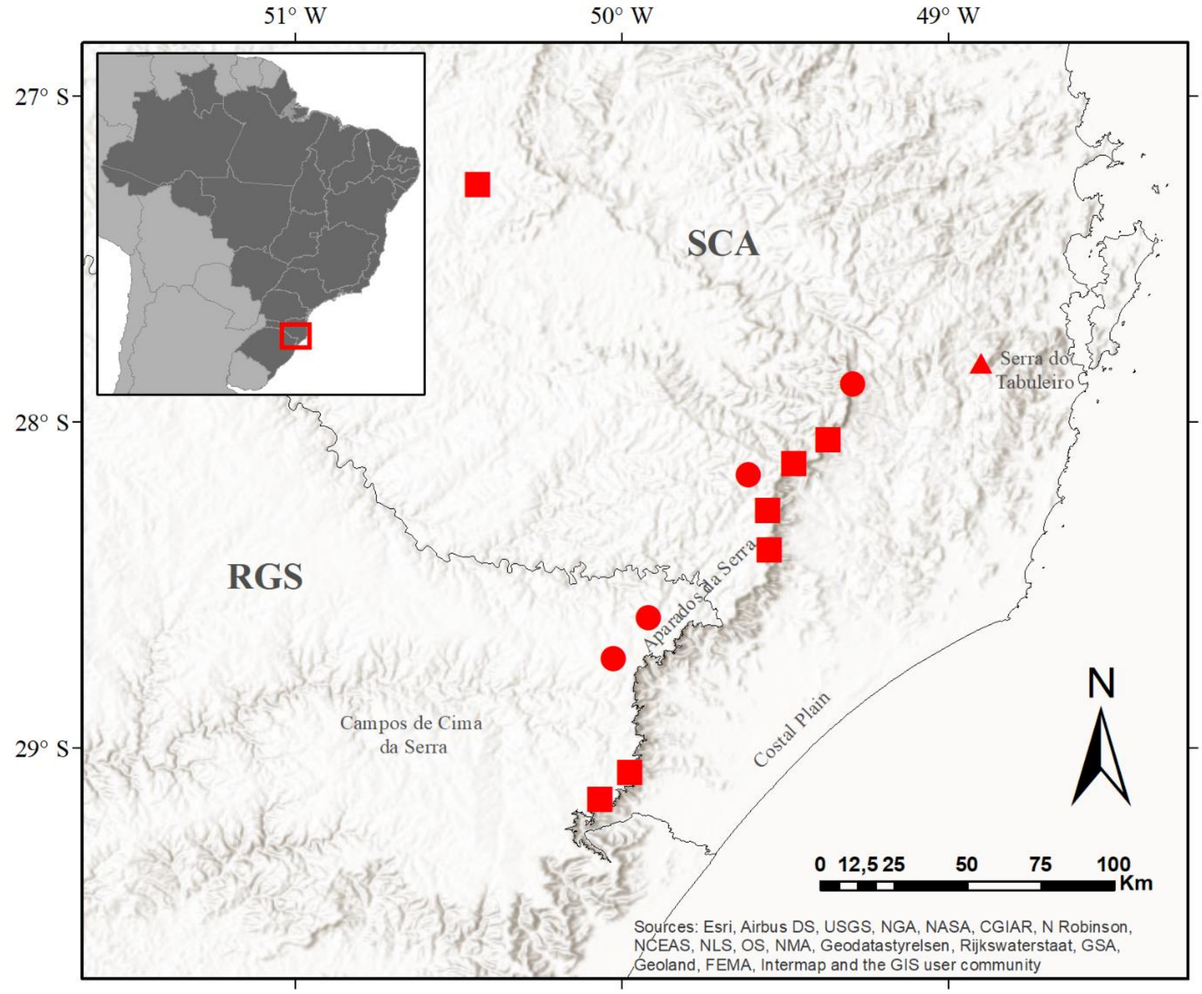


FIGURE 23. Distribution map of *Valeriana glechomifolia* (spot), *V. iganciana* (triangle), and *V. ulei* (square) (Valerianaceae). Abbreviations: RGS = Rio Grande do Sul; SCA = Santa Catarina.

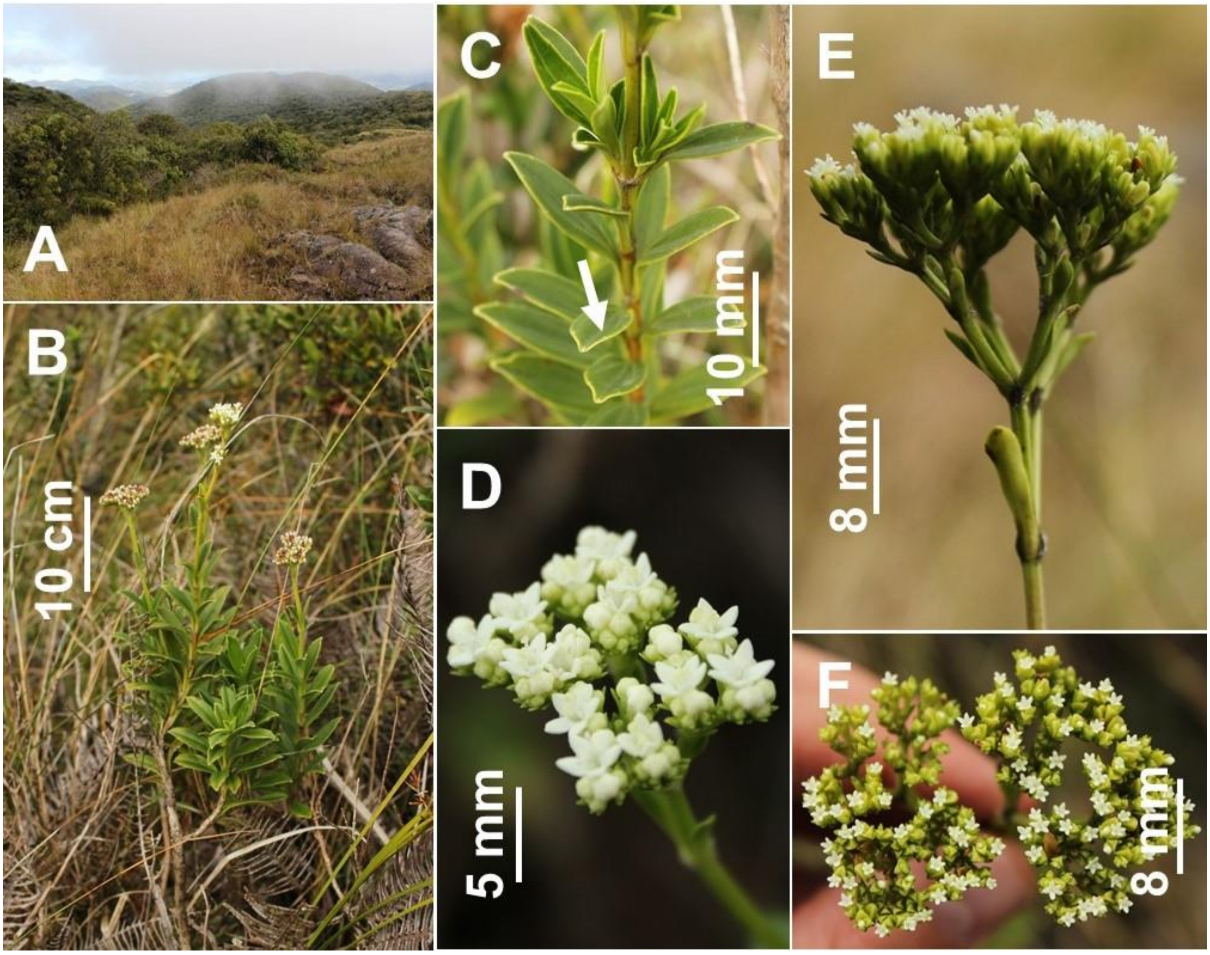


FIGURE 24. *Valeriana iganciana* (Valerianaceae). A. Habitat at the Serra do Tabuleiro State Park, São Bonifácio municipality, Santa Catarina, Brazil; B. Habit. C. Distal (caulinar) leaves in adaxial view, highlighting (arrow) the hyaline glands; D. Inflorescence with staminate flowers (top view); E. Inflorescence with pistillate flowers (lateral view); F. Inflorescence with pistillate flowers, immature and mature fruits (top view). Photos by Cassio Rabuske da Silva.

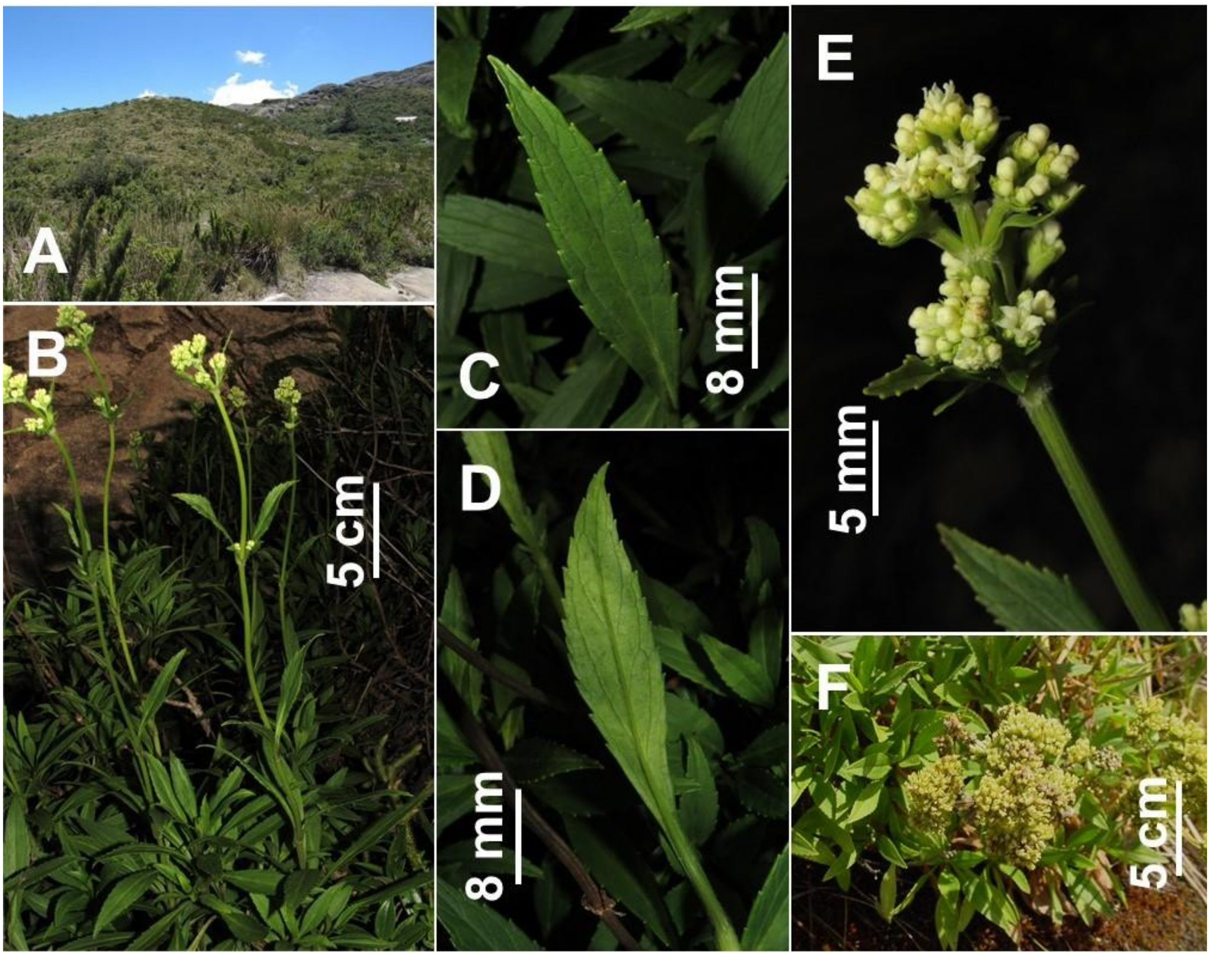


FIGURE 25. *Valeriana organensis* (Valerianaceae). A. Habitat at the Serra dos Órgãos National Park, Rio de Janeiro, Brazil; B. Habit; C. Distal (caulinar) leaf in adaxial view; D. Distal leaf in abaxial view; E. Distal part of an inflorescence with staminate flowers; F. Inflorescence with pistillate flowers. Photos A–E by Guilherme Peres Coelho, and F by Marcos Nadruz.

FIGURE 26. Isolectotype (LINN-HS74-21 image!) (right) and protologue illustration (left) of *Valeriana polystachya* (Valerianaceae).

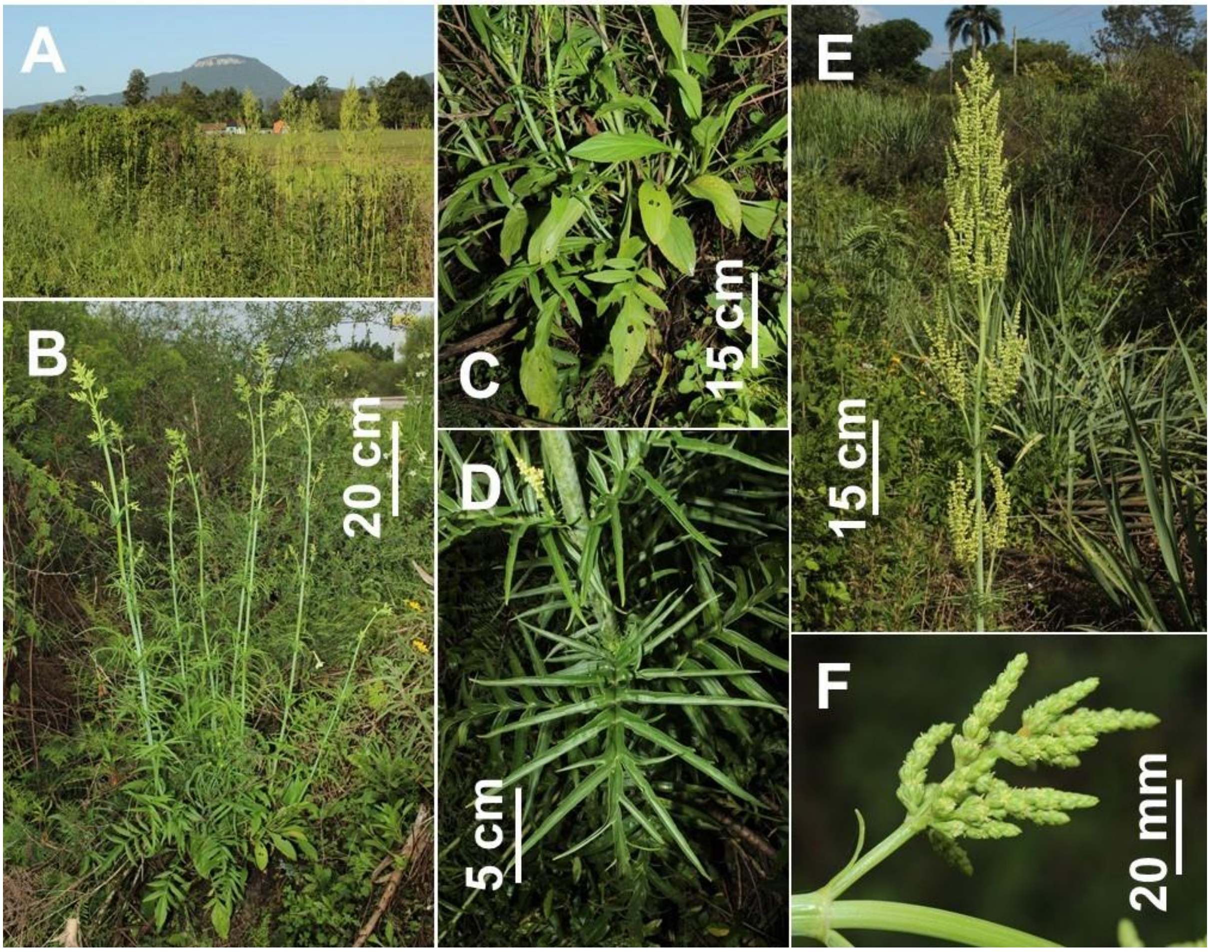
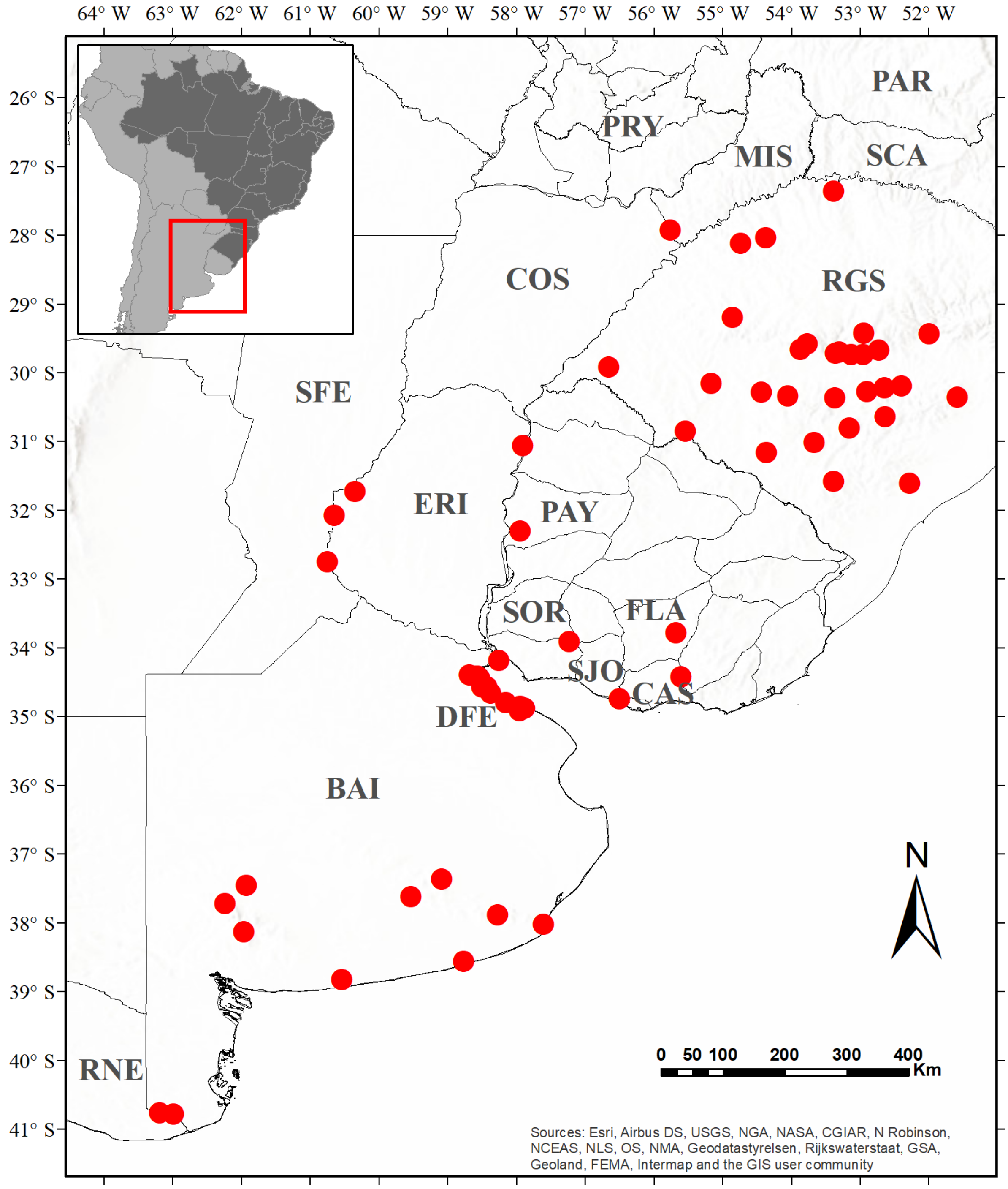


FIGURE 27. *Valeriana polystachya* (Valerianaceae). A. Habitat in the lowlands of Candelária municipality, Rio Grande do Sul, Brazil; B. Habit; C. Basal leaves in adaxial view; D. Distal (caulinar) leaf in adaxial view; E. Inflorescence with hermaphrodite flowers; F. Detail of a paracladia with pistillate flowers. Photos by Cassio Rabuske da Silva.



Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

FIGURE 28. Distribution map of *Valeriana polystachya* (Valerianaceae) (spots). Abbreviations: PRY = Paraguay; [Argentina]: BAI = Buenos Aires; COS = Corrientes; DFE = Federal District; ERI = Entre Rios; MIS = Misiones; RNE = Río Negro; SFE = Santa Fe; [Brazil]: PAR = Paraná; RGS = Rio Grande do Sul; SCA = Santa Catarina; [Uruguay]: CAS = Canelones; FLA = Florida; PAY = Paysandú; SJO = San José; SOR = Soriano;

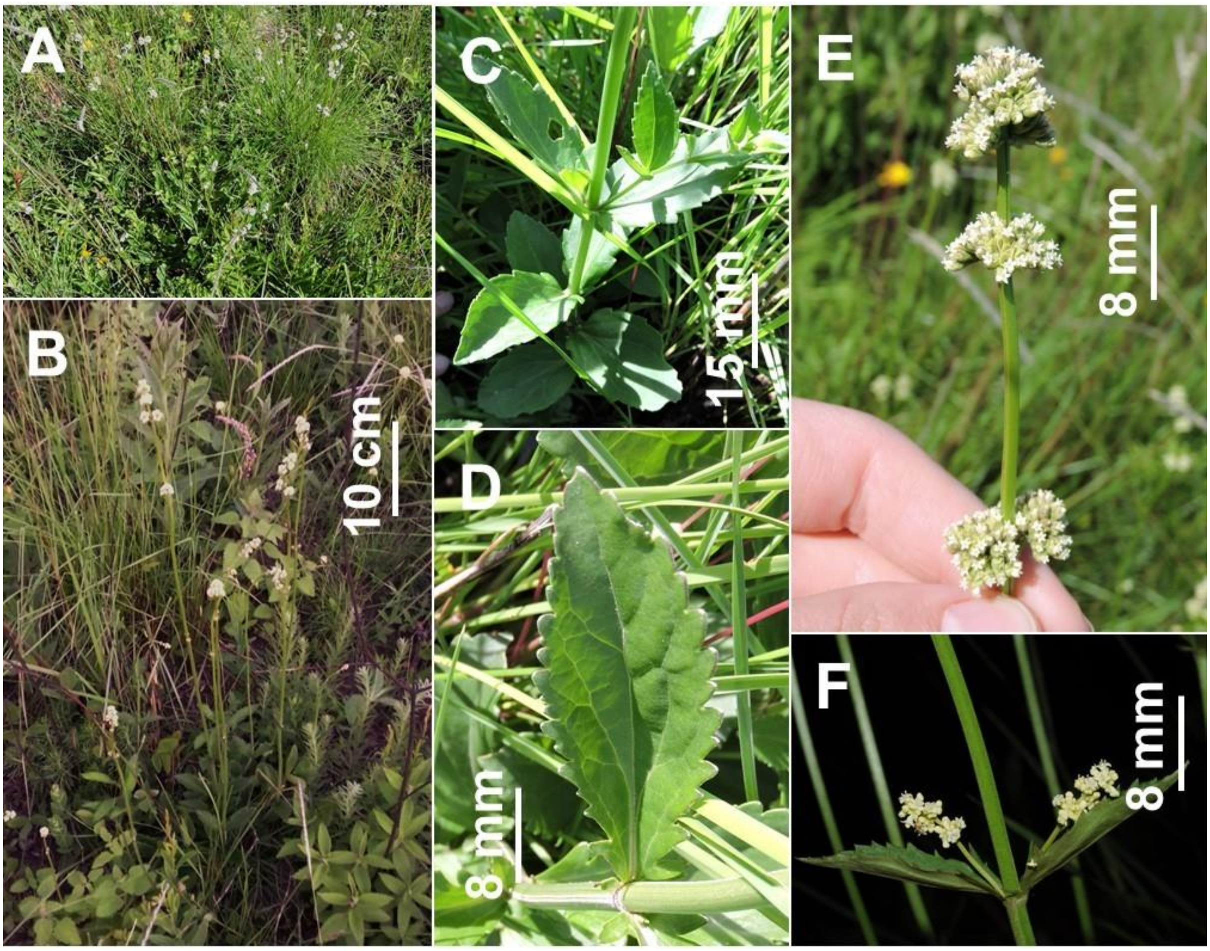


FIGURE 29. *Valeriana reitziana* (Valerianaceae). A. Habitat in the Segredo Municipality, Rio Grande do Sul, Brazil; B. Habit; C. Basal and distal (caulinar) leaves in adaxial view; D. Distal leaf in adaxial view; E. Distal part of an inflorescence with pistillate flowers; F. Bracts and first pair of paracladia of an inflorescence with staminate flowers. Photos A–E by Juliana Schaefer and F by Sérgio Augusto de Loreto Bordignon.

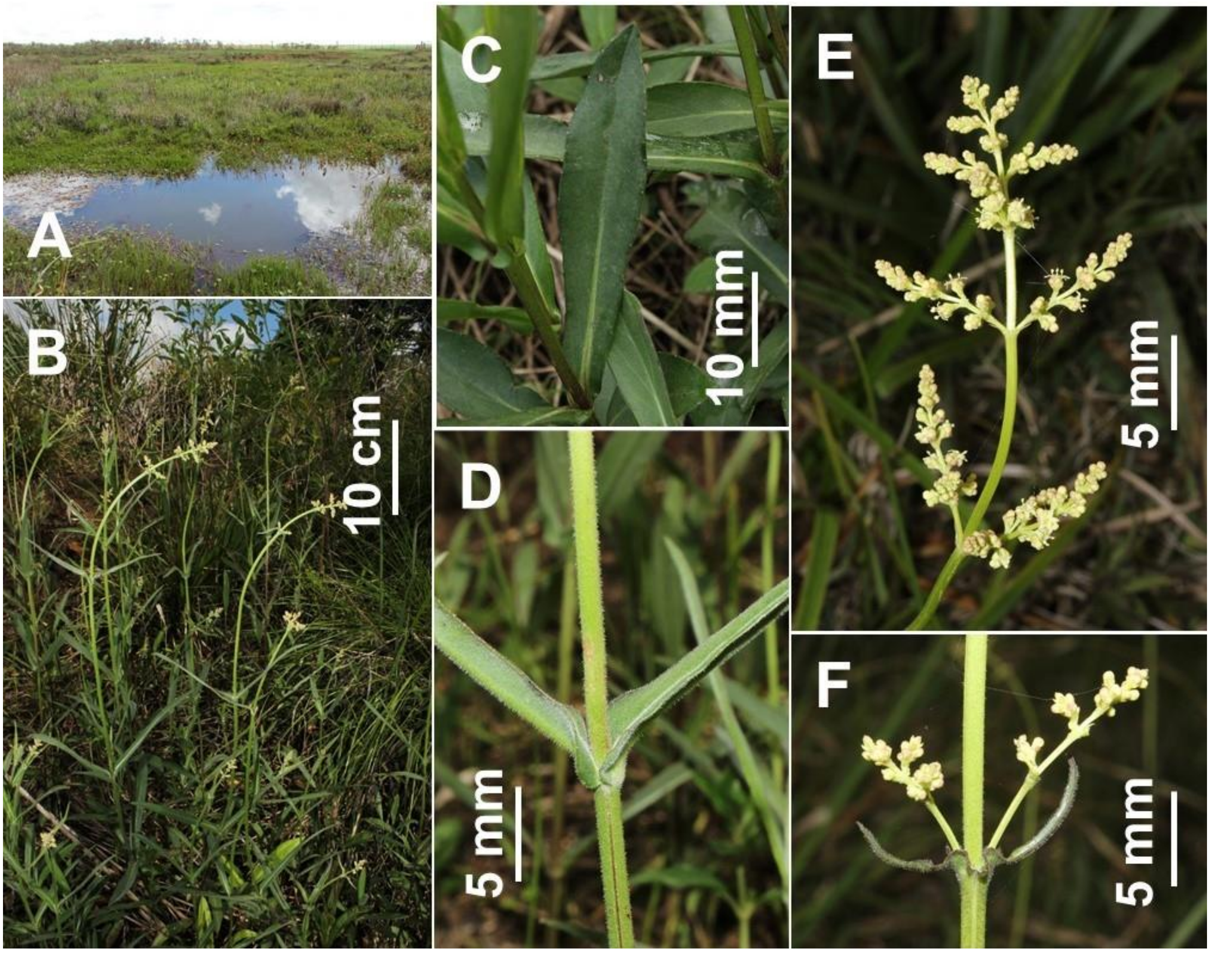


FIGURE 30. *Valeriana salicariifolia* (Valerianaceae). Habitat in Muitos Capões municipality, Rio Grande do Sul, Brazil; B. Habit; C. Distal leaf in adaxial view; D. Detail of a pair of more distal leaves, showing the auriculate bases; E. Distal portion of an inflorescence with staminate flowers; F. First pair of paracladia and bracts of a young inflorescence with staminate flowers still on buds. Photos by Cassio Rabuske da Silva.

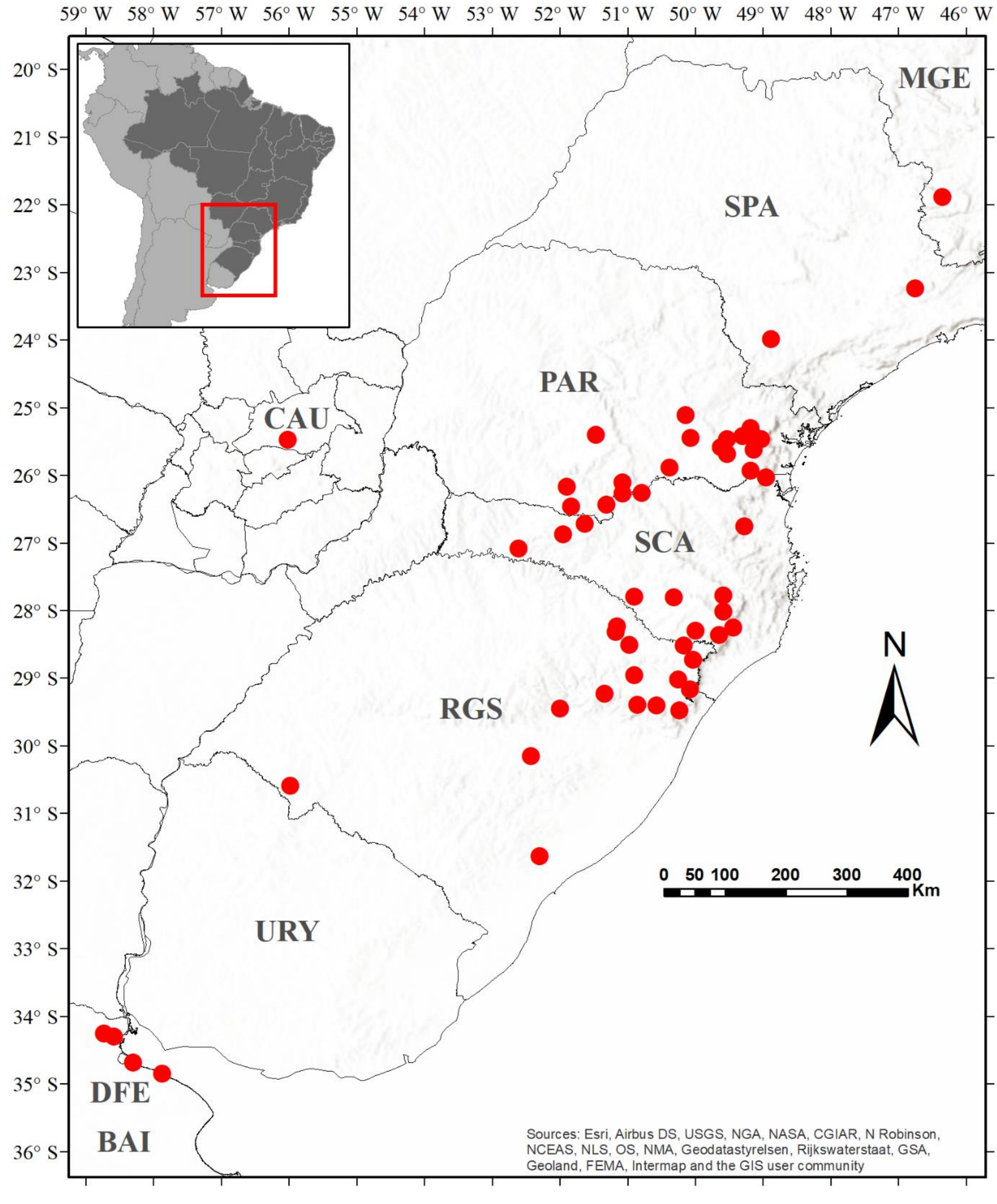


FIGURE 31. Distribution map of *Valeriana salicariifolia* (Valerianaceae) (spots). Abbreviations: URY = Uruguay; [Argentina]: BAI = Buenos Aires; DFE = Federal District; [Brazil]: MGE = Minas Gerais; PAR = Paraná; RGS = Rio Grande do Sul; SCA = Santa Catarina; SPA = São Paulo; [Paraguay]: CAU = Caaguazú.

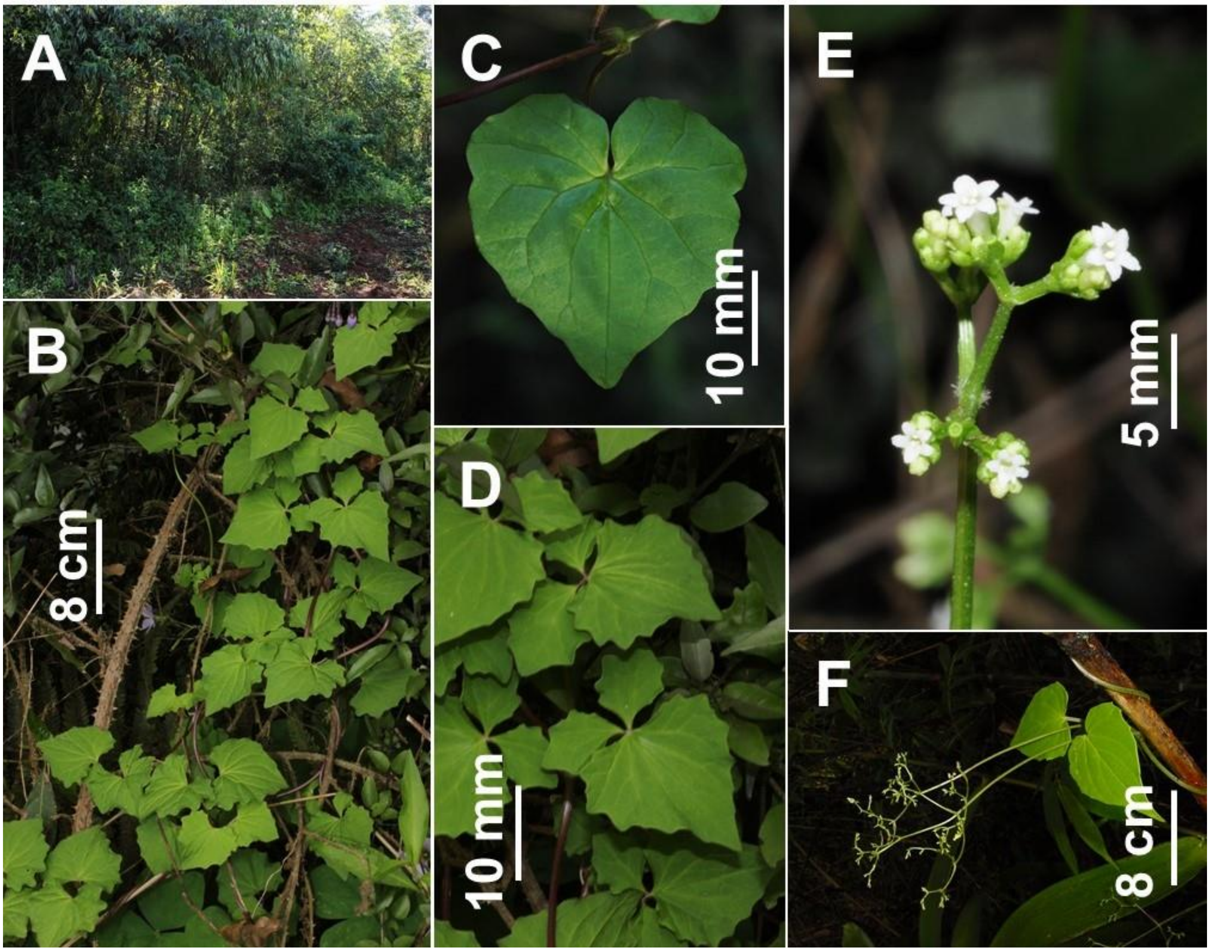
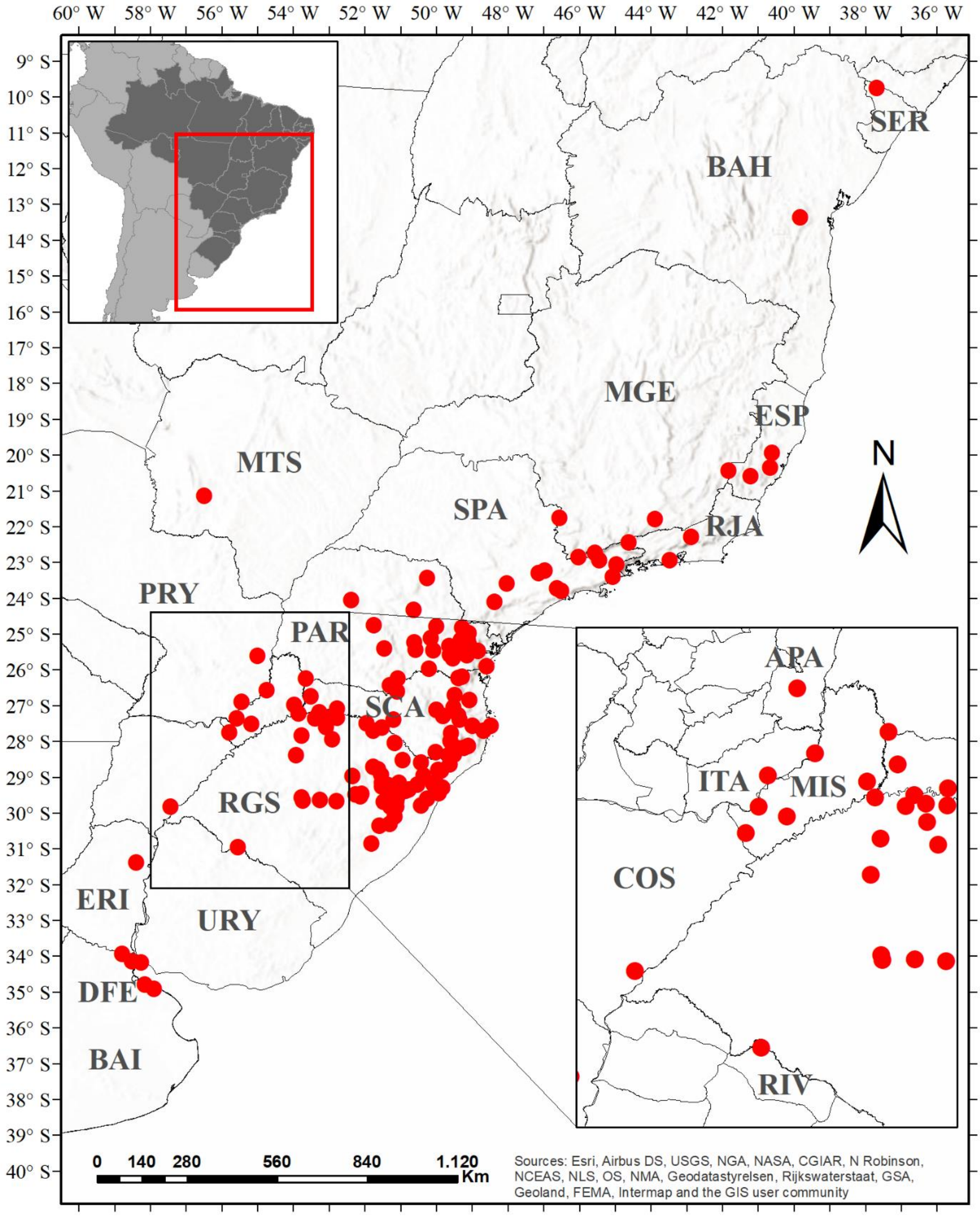


FIGURE 32. *Valeriana scandens* (Valerianaceae). A. Habitat in Morro Reuter municipality, Rio Grande do Sul, Brazil; B. Habit; C. Basal leaf in adaxial view; D. Distal leaves in adaxial view; E. Distal portion of an inflorescence with hermaphrodite flowers; F. A pair of paracladia with immature achenes. Photos A-D by Cassio Rabuske da Silva, E by Sérgio Augusto de Loreto Bordignon, and F by Marcos Nadruz.



Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

FIGURE 33. Distribution map of *Valeriana scandens* (Valerianaceae) (spots) in eastern South America.

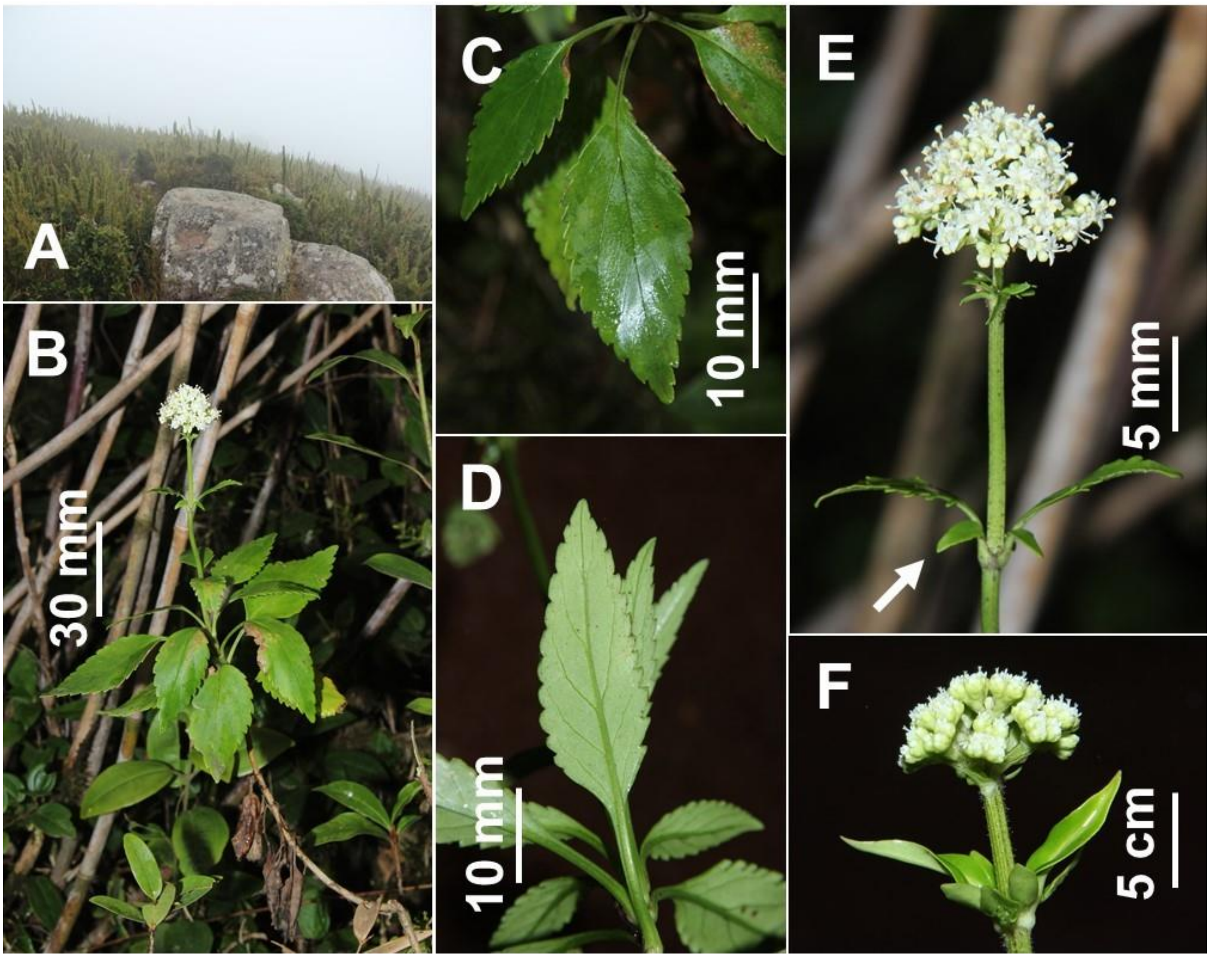


FIGURE 34. *Valeriana sobraliana* (Valerianaceae). A. Habitat at the Pico Caratuva, Campina Grande do Sul municipality, Paraná, Brazil; B. Habit; C. Basal leaves in adaxial view; D. Basal leaves in abaxial view; E. Inflorescence with staminate flowers, highlighting the basal lobes (arrow) of a pair of pinnately lobed distal leaves; F. Inflorescence with pistillate flowers. Photos by Cassio Rabuske da Silva.

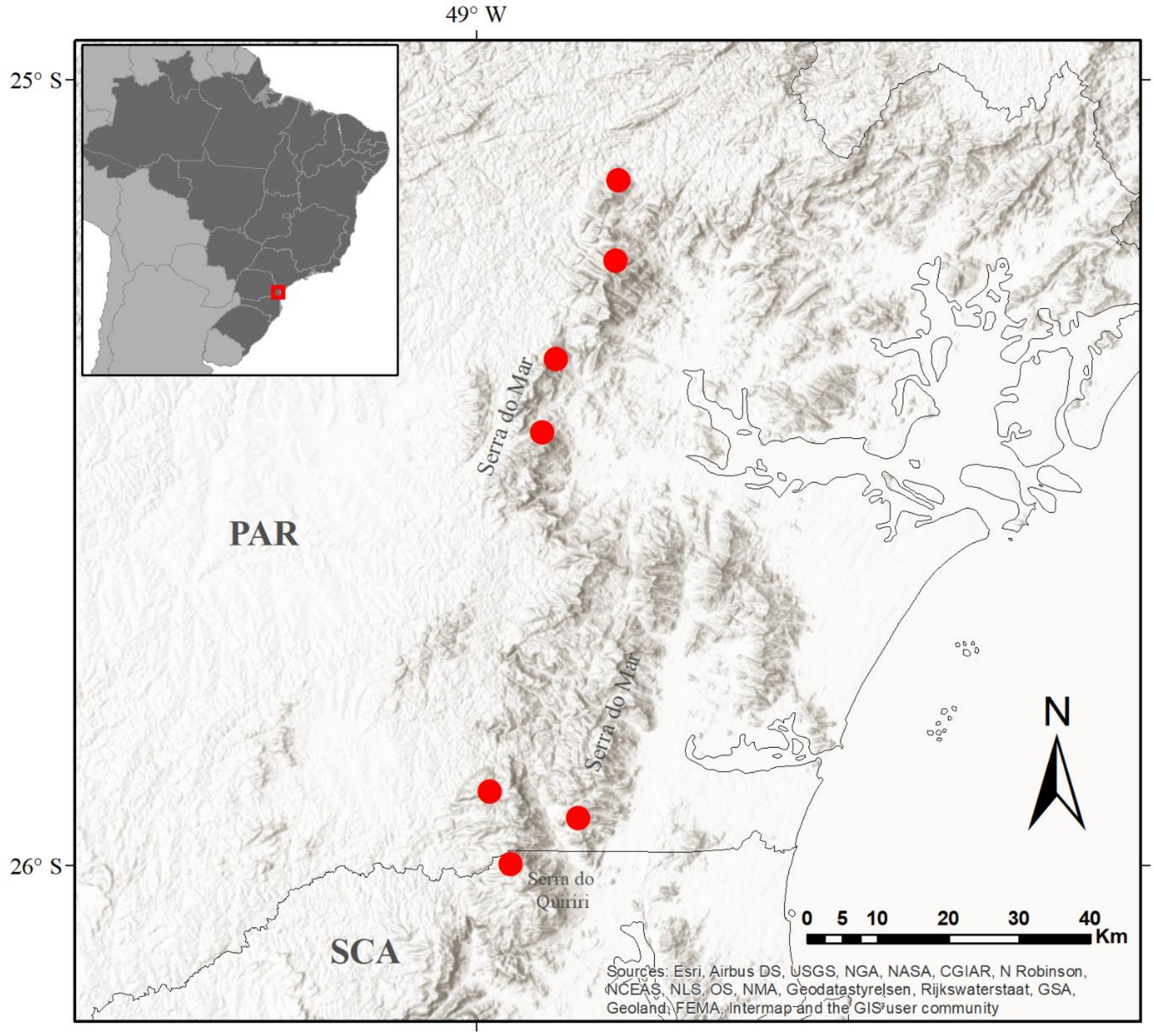


FIGURE 35. Distribution map of *Valeriana sobraliana* (Valerianaceae) (spots). Abbreviations: PAR = Paraná; SCA = Santa Catarina.

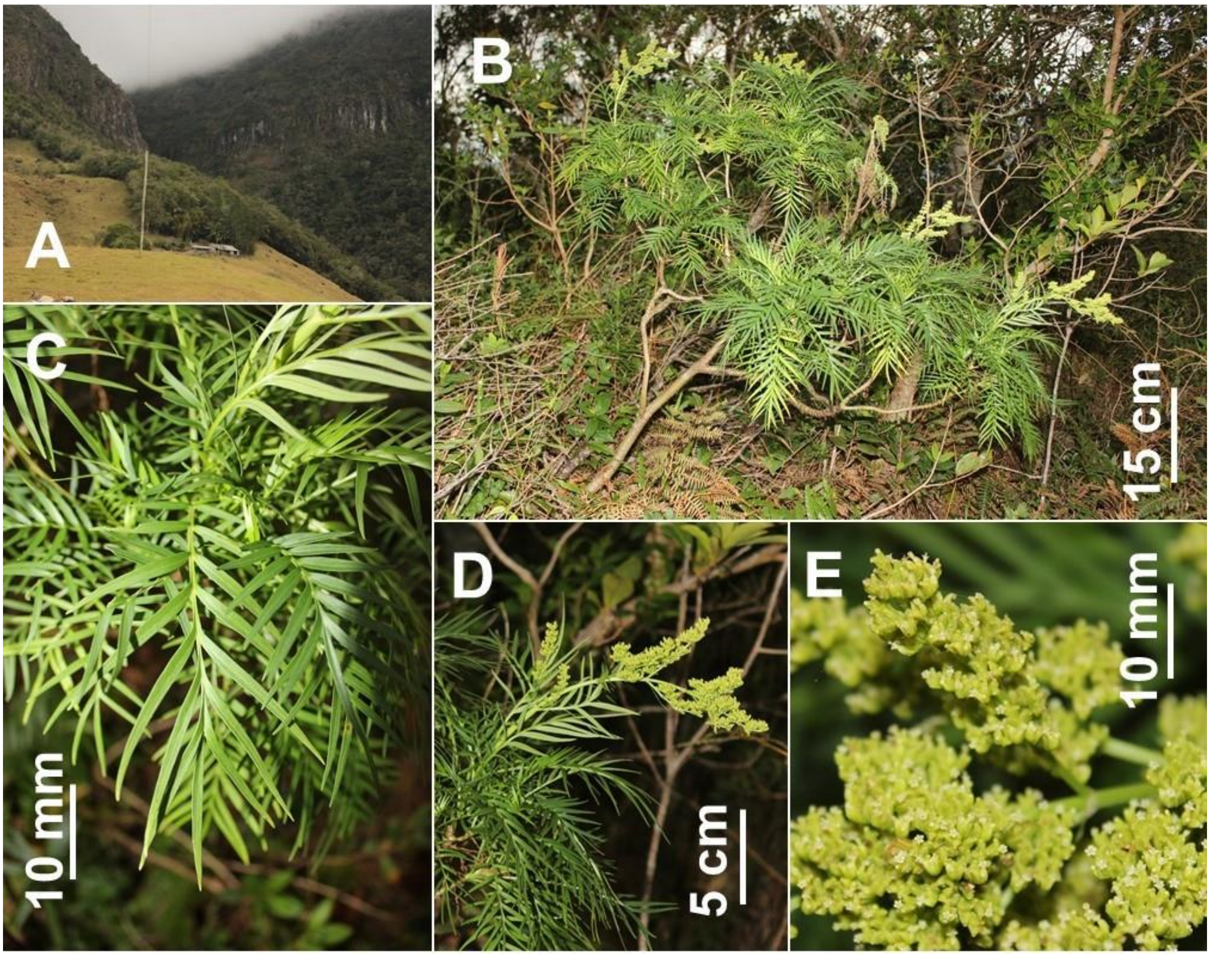


FIGURE 36. *Valeriana tajuvensis* (Valerianaceae). A. Habitat at the Serra da Tajuva, Rio Grande do Sul, Brazil; B. Habit; C. Distal (caulinar) leaves in adaxial view; D. Inflorescence with pistillate flowers; E. Detail of the distal portion of an inflorescence with pistillate flowers and immature fruits. Photos by Cassio Rabuske da Silva.

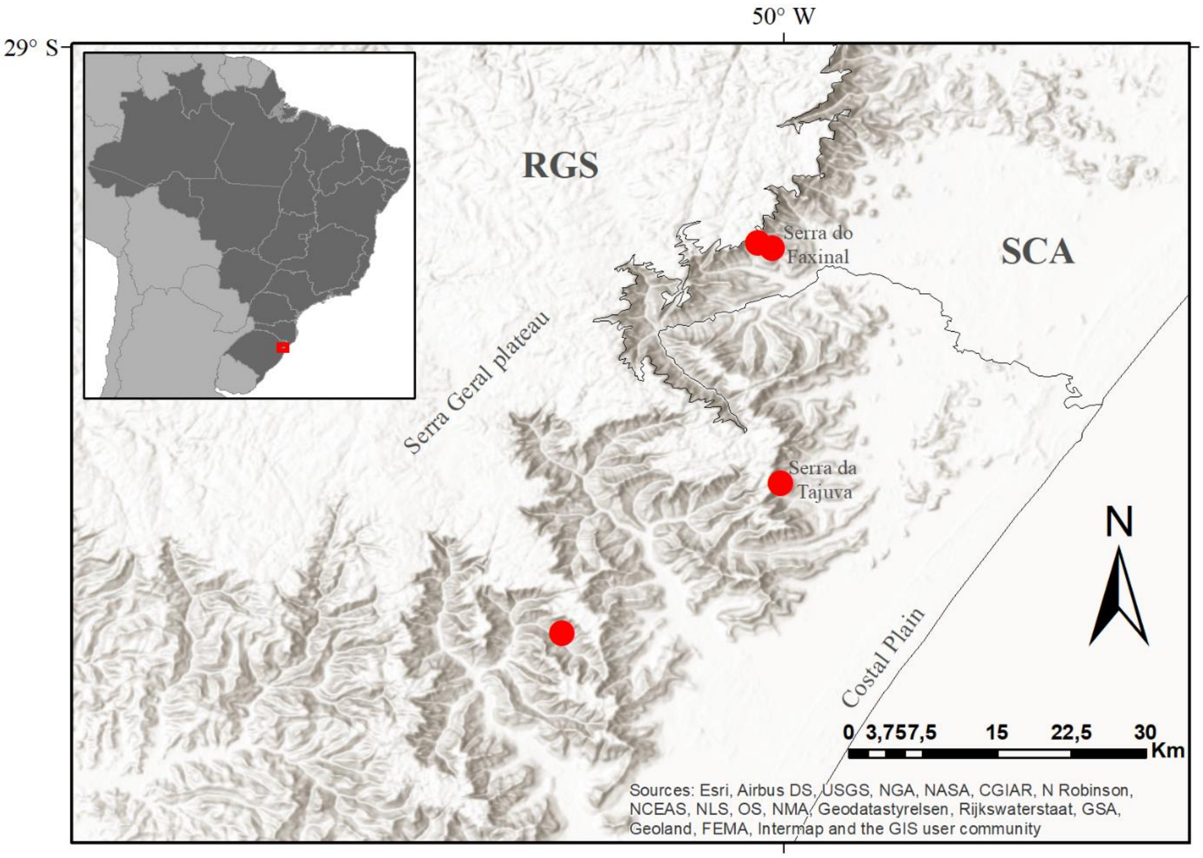


FIGURE 37. Distribution map of *Valeriana tajuvensis* (Valerianaceae) (spots). Abbreviations: RGS = Rio Grande do Sul; SCA = Santa Catarina.

FIGURE 38. Lectotype of *Valeriana ulei* (Valerianaceae) [*Ule 1647* (HBG barcode HBG-513375 image!)].

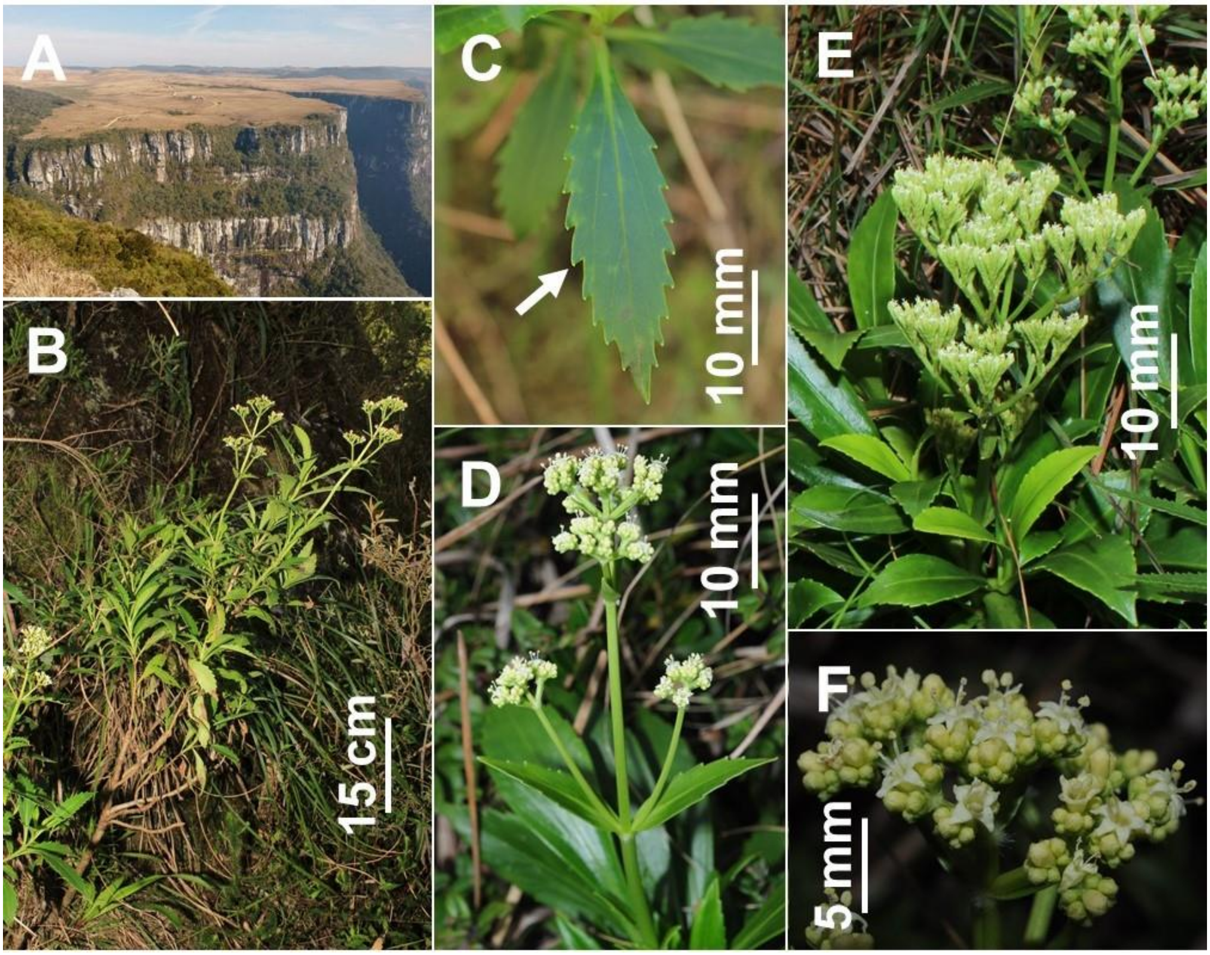


FIGURE 39. *Valeriana ulei* (Valerianaceae). A. Habitat at the Fortaleza canyon, Serra Geral National Park, Rio Grande do Sul, Brazil; B. Habit; C. Distal leaf in adaxial view, highlighting (arrow) a gland at the apex of a tooth. D. Inflorescence with staminate flowers; E. Inflorescence with pistillate flowers; F. Distal portion of an inflorescence with staminate flowers in top view. Photos A–C and E by Cassio Rabuske da Silva, and D and F by Sérgio Augusto de Loreto Bordignon.

TABLE 1. Localities with their respective formations (domains) in which field expeditions were conducted between March 2018 and November 2019. Abbreviations: ARD = Atlantic Rainforest Domain; CF = Cloudy Forest; HTG: High Altitude Tropical Grasslands, PD = *Pampas* Domain; SHG = Southern Highland Grasslands.

Country/state or province	**number of expeditions**	**period**	**domain/formation**
Argentina, Buenos Aires and Entre Ríos	1	November 2019	PD
Brazil, Rio Grande do Sul	7	February, September and October 2018	PD and ARD (SHG and CF)
Brazil, Santa Catarina	2	September and October 2018	ARD (SHG and CF)
Brazil, Paraná	2	September 2018	ARD (SHG and HTG)

TABLE 2. Comparative diagnostic features of *Valeriana aparadensis* with regards to its morphologically most similar species. Abbreviations for Brazilian states: ES = Espírito Santo; MG = Minas Gerais; RS =Rio Grande do Sul; SC = Santa Catarina.

Traits/species	***V. aparadensis***	***V. caparaoensis***	***V. catharinensis***
Basal leaves (mm)	25–122 × 7–25, entire to pinnately lobed	23–106 × 10–32 pinnately lobed	58–90 × 15–26, entire
Distal (caulinar) leaves (mm)	53–75 × 15–30, pinnately lobed	44–134 × 16–40, pinnate to pinnatisect	15–60 × 10–32, pinnately lobed
Pairs of lateral lobes (in distal leaves) (mm)	3–5, 6–28 × 2.5–6	3–6, 3–22 × 1–7	2–5, 5–10 × 2–4
Distal lobe (in distal leaves) (mm)	22–50 × 8–16	19–62 × 4–15	15–30 × 5–10
Paracladia (pairs)	5–9	3–6	2–4
Staminate flowers (length / mm)	2.8–3 × 2–2.2	2–2.4 × 2	2 × 1.5
Pistillate flowers (mm)	1–1.3 × 1–1.3	0.8–1 × 0.8	0.5–0.7 × 0.5
Stamens (mm)	2.8–3	1.6–1.8	1.8
Fruit (size and shape) (mm)	2.2–2.6 × 1.9–2.3, elliptic to ovate, sometimes slightly rounded	2.2–2.4 × 2.2–2.4, globose	2–2.3 × 1.5–2, ovate
Lateral wings of fruits (wide / mm)	0.1–0.4	0.7–0.9	0.5
Distribution	southern Brazil: RS and SC in the Serra Geral plateau (Atlantic Forest domain), between 900 and 1828 m	southeastern Brazil: ES and MG in the Serra do Caparaó massif (Atlantic Forest domain), between 1800 and 2300 m	southern Brazil: SC in the Serra Geral plateau (Atlantic Forest domain), between 900 and 1770 m

Final considerations

The species number of *Valeriana* with occurrence in the lowlands and highlands of eastern South America has grown in recent years, as revisions have been made and new areas sampled. In the 20th century and the beginning of the 21st century, at least 13 new names were published, a good part here considered synonymous. Altogether, there were at least 56 names of taxa published for the region, most of them synonyms already established in the literature. We found 18 species native from the eastern South America, one of them widely distributed in the Neotropics (*V. scandens*). Three species are new to science and discovered in the scope of this study, *V. aparadensis*, *V. caparaoensis* and *V. sobraliana*. This high number of synonyms when compared to the number of valid species seems to be frequent in *Valeriana* and is a strong indication of the need for revisions from other poorly studied regions of the Neotropics. Another point is the need to sample areas that are still little known, especially highland grasslands that are difficult to access in the south and southeast regions of Brazil (Atlantic Rainforest domain), as well as mountains in the north of Brazil and adjacent countries (Amazonian domain). Studies in these areas may bring more taxonomic novelties to the eastern region of South America. These were the circumstances in which *V. iganciana* was discovered in the Serra do Tabuleiro, southern Brazil, although we have shown that similar cases are frequent in South America as a whole.

The analysis of the infrageneric categories of *Valeriana*, as established in the most recent treatment, revealed an impasse in the inclusion of most of the taxa from the study area. This is due to the descriptions of the sections, as well as the taxa on which they are based, being very brief and in some cases ambiguous. These numerous sections need a detailed review in order to assess their morphological and phylogenetic support. Historical study is promising and an important tool in solving these impasses. As a result, the species in the study area were included in the subgenus *Phyllactis*, and positioned into three sections, *Amplophus* (1 species), *Valerianopsis* (15 spp.), and *Phuodendron* (2 spp.).

The morphological analysis revealed a group composed basically of subshrubs and shrubs (78% of the total), with four striking herbaceous species. This eastern South American group also stands out for some morphological peculiarities in relation to the other Neotropical species of *Valeriana*, notably the shape of the inflorescences, mostly paniculiform to spike like, and the calyx exclusively eppapose in endemic species. A small group of two species (*V. bornmuelleri* and *V. glaziovii*) have flowers with trichomes in different portions of the corolla, and four species from the Atlantic Rainforest domain have the fruit with a valeculate apex (*V.*

catharinensis group). These features can reveal some smaller groupings of species, which, however, require molecular analysis to assess whether these groups are natural or not.

We observed that the use of poorly treated characters, such as the measures of petioles length, texture, venation pattern, leaves colour, as well as the length of the corolla and stamens are particularly promising for the taxonomy of the group as a whole. The distribution of species also proved to be a strong indication of speciation, considering that most species do not occur in sympatry, presenting a strong correlation with mountainous formations and grasslands in the study area. In this sense, these features consist of an important increment in the analysis and resolution of the most appropriate category for the inclusion of a given taxa, in order to avoid overly restricted and ambiguous categories under *Valeriana*, specially varieties and forms.

Nomenclatural issues were one of the main challenges of the studied group. Several inadvertent or incomplete lectotypifications have been found in the literature, being designated here a neotype, 10 lectotypes and an epitype. Regarding IUCN's preliminary risks of extinction assessments, we classify one species as Near Threatened, three species as Least Concern, four as Vulnerable, five as Endangered, and five as Critically Endangered. This high number of threatened species (about 78% of the total) reveals the need of specific and urgent studies aiming establishing public policies for the conservation of these taxa.

Appendix I – *Valeriana sobraliana* (Valerianaceae), a new species from Southern Brazil

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Valeriana sobraliana (Valerianaceae), a new species from Southern Brazil

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Abstract

Valeriana sobraliana, a new species from the highland grasslands of the Atlantic Rainforest Domain, Southern Brazil, is described and illustrated. The new species shares morphological affinities with *V. catharinensis*, *V. organensis* and *V. ulei*, but differs mainly by the leaves strongly discolorous and long-petiolate, as well as by the lanceolate and larger bracteoles, by the larger staminate flowers and by the elliptic achenes. It also differs by the distribution restricted to the High Altitude Tropical Grasslands of the Serra do Mar mountain range, Paraná state and border with the Santa Catarina state, in a remarkable disjunction with the other related species. Additionally, we provide the preliminary conservation status assessments using IUCN Red List categories and criteria, as well as a checklist and a key to the species of *Valeriana* in the Paraná state.

Keywords: Atlantic Rainforest Domain, Endemism, Highland Grasslands, Morphology, Taxonomy

Introduction

Valeriana Linnaeus (1753: 31) is a widely distributed genus, occurring especially in Eurasia, North and South America, and southern Africa (Weberling & Bittrich 2016). The total number of species varies between 200 and 270, being the genus amongst the most diverse of flowering plants (Meyer 1951, Kutschker 2008, Weberling & Bittrich 2016). South America constitutes the most important diversity center of *Valeriana*, with about 175 species, two-thirds of the global richness (Eriksen 1991; Bell & Donoghue 2005a, 2005b; Kutschker 2011; Bell *et al.* 2012; Kutschker & Morrone 2012). However, the genus is considered paraphyletic and its circumscription in Dipsacales is still controversial in the literature (Bell 2004, Hidalgo *et al.* 2004, Bell & Donoghue 2005a, Kutschker 2011, APG III 2009, APG IV 2016). Here we opt for the conservation of Valerianaceae according to Bell & Donoghue (2005a), Kutschker (2011), Bell *et al.* (2012), Bell *et al.* (2015), Weberling & Bittrich (2016) and Bell & Gonzalez (2018).

Despite significant advances in taxonomy and molecular phylogeny, we are still far from a continental understanding of the diversity and distribution of South American valerians. New species and new occurrences have been frequently published in recent decades as new areas are being sampled and herbaria collections reviewed (eg. see Eriksen 1991; Sobral 1999b, 2000; Saldivia & Rojas 2006; Bernal 2009; Méndez 2010; Nagahama *et al.* 2016; Sylvester *et al.* 2018; Rabuske-Silva & Külkamp 2018). During the taxonomic revision of *Valeriana* in Brazil (Rabuske-Silva 2018), a new species, collected for the first time in the middle of the 20th century and with a large sampling in regional herbaria, was discovered. The data indicate a cohesive geographical distribution in the High Altitude Tropical Grasslands (HATG, *sensu* Iganci *et al.* 2011) of the Serra do Mar mountain range, in peaks and mountain slopes between the states of Santa Catarina and Paraná, Southern Brazil. The description of *Valeriana sobraliana* is accompanied by a checklist and an identification key to the five known species from the Paraná state, besides images and illustrations of the new species.

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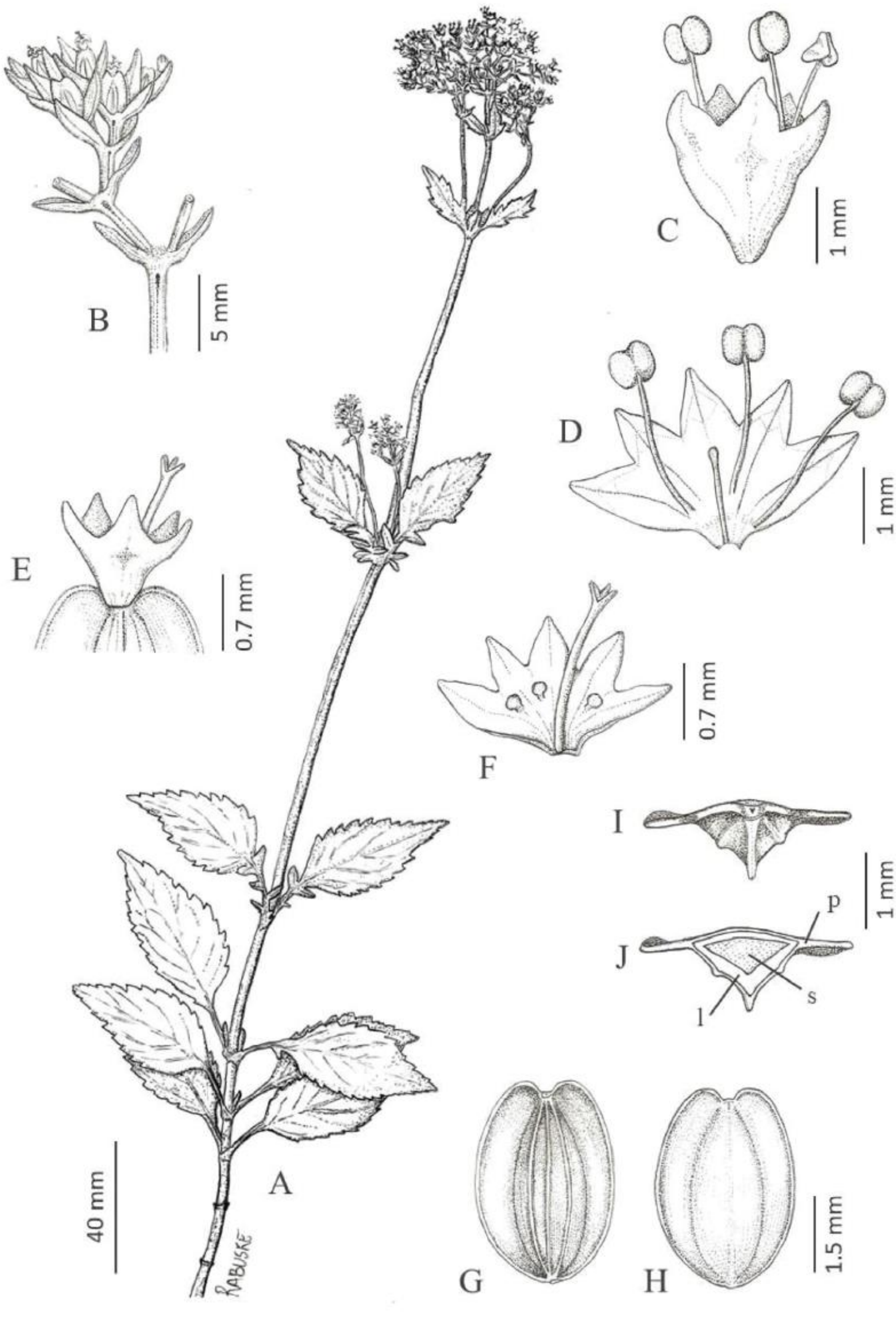

FIGURE 1. Illustration of *Valeriana sobraliana*. A. Branch; B. Detail of inflorescence; C. Staminate flower; D. Staminate flower, opened; E. Pistillate flower on immature fruit; F. Pistillate flower, opened; G. Fruit in adaxial view; H. Fruit in abaxial view; I. Fruit in apical view; J. Fruit in transverse view; l = locule; p = parenchymatous tissue; s = seed (Vouchers: *G.Hatschback 16842*; *E.Barboza et al. 4038*). Drawn by Cassio Rabuske-Silva.

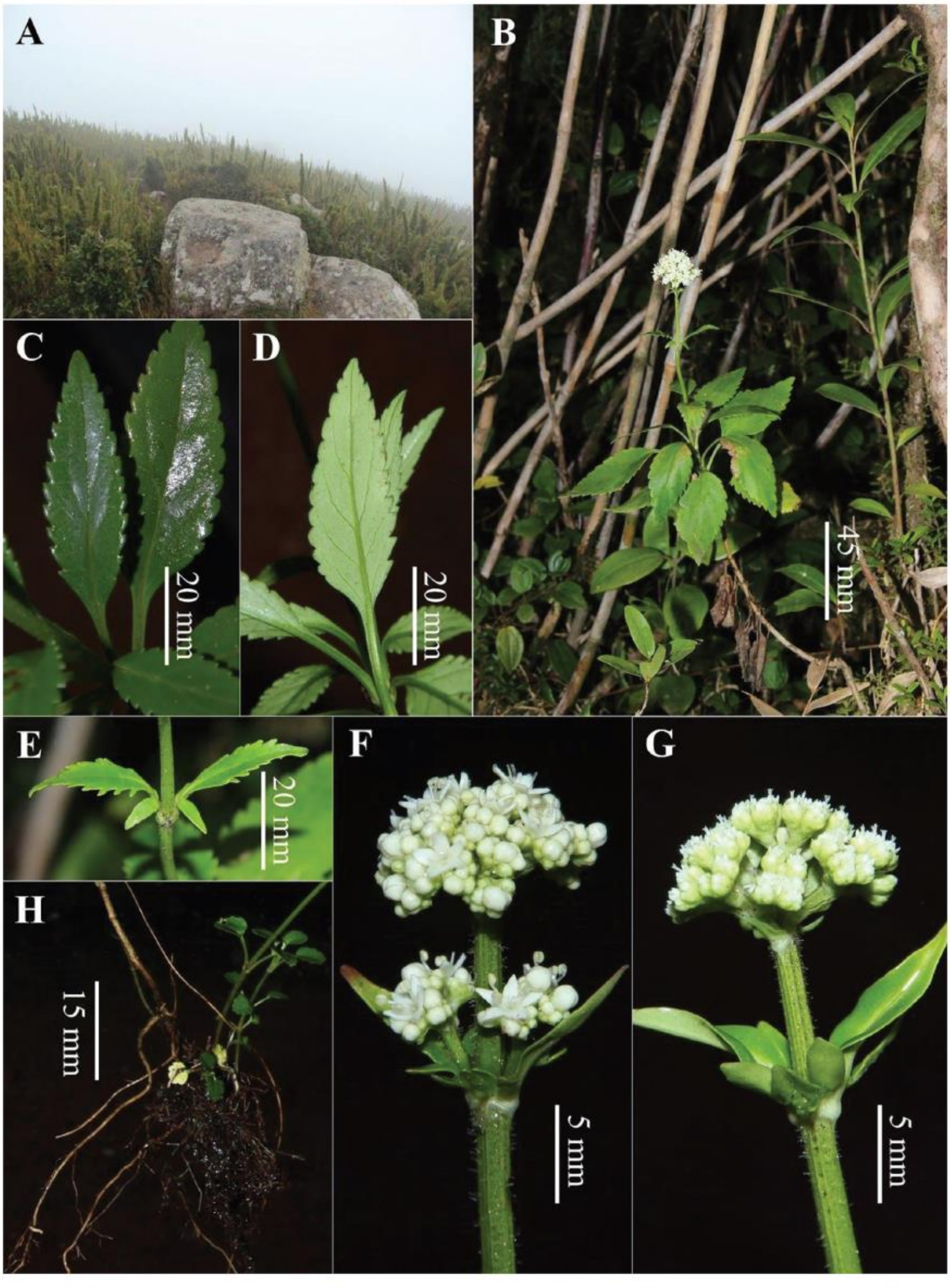

FIGURE 2. *Valeriana sobraliana*. A. Habitat at the top of the Pico Caratuva, Paraná state; B. Habit; C. Leaf in adaxial view; D. Leaf in abaxial view; E. Distal leaves with a pair of basal lobes; F. Inflorescence with staminate flowers; G. Inflorescence with pistillate flowers; H. Roots. Photos by Cassio Rabuske-Silva.

Material and Methods

The new species was found during the taxonomic revision of *Valeriana* in Brazil (Rabuske-Silva 2018, Iganci *et al.* 2018). We examined exsiccates of the following herbaria: CRI, ECT, EFC, FLOR, FURB, HAS, HBR, HUCS, HURG, ICN, MBM, MBML, MPUC, PACA, PEL, RB and UPCB (acronyms according to Thiers 2018, constantly updated). Over 1200 specimens of *Valeriana* from different regions of Brazil were examined. We consulted the taxonomic revisions of the genus *Valeriana* in Brazil (Müller 1885; Borsini 1962, 1963; Sobral 1999a; Scalon *et al.* 2002; Rabuske-Silva 2018) and the main taxonomic studies in South America (Borsini 1944, 1966, 1999; Cabrera 1965; Bacigalupo 1974; Xena de Enrech 1992; Jørgensen 1999; Xifreda 1999; Novara 2008; Kutschker 2008, 2011). Additionally, we conducted a fieldwork expedition in October 2018, in the states of Santa Catarina and Paraná. The species was illustrated to evidence the diagnostic characters. Morphological terminology follows Harris & Harris (2001) and Beentje (2010). *Valeriana sobraliana* also had IUCN Red List status evaluated following IUCN (2017) categories and criteria, using GeoCAT (Bachman *et al.* 2011) for geospatial analysis.

Results

Valeriana sobraliana Rabuske & Iganci *sp.nov.* **(Figures 1, 2 and 3)**

Type:—Brazil. Santa Catarina: Garuva, Campos do Quiriri, 26°01'56"S 48°58'45"W, 1350 m elev., 31 October 2013, pist. fl., *E.Barboza, J.Cordeiro, J.M.Silva & J.T.Motta 4038* (holotype: MBM!, isotypes: FLOR!, FURB!, ICN!, RB!).

The new species is morphologically similar to *Valeriana catharinensis* Graebn. (1899: 427), *V. ulei* Graebn. (1899: 436) and *V. organensis* Gardn. (1845: 112) (Figure 4). It differs mainly by the leaves strongly discolorous, with irregularly crenate-serrate margins and glabrous indument (*vs.* blades at most slightly discolorous, margins serrate or serrulate, and when irregularly crenate-serrate, always pubescent [*V. catharinensis*]), by the petioles reaching ⅓ to ⅔ the length of the leaf blade (*vs.* leaves sessile, pseudopetiolate or petiolate; the petioles, when present, never exceeding ⅓ the length of the leaf blade), by the bracteoles lanceolate and larger, 3–3.2 × 1–1.2 mm, with acute to attenuate apex, eventually caudate, base rounded to subcordate (*vs.* bracteoles ovate or elliptic, 1.5–2.8 × 0.7–1 mm, apex always acute, base rounded or attenuate), by the larger staminate flowers, 3.3 × 2.7 mm, with a pistilodium larger than 1.6 mm long (*vs.* staminate flowers up to 2.8 × 2.2 mm, the pistilodium up to 1.4 mm long), and by the elliptic achenes (*vs.* achenes ovate or globose) (Table 1).

Dioic subshrub, 30–100 cm tall, perennial, rhizomatous, erect, simple to branched; plants glabrous except for tufts of hyaline trichomes 0.3–0.7 mm long, denser and conspicuous in the nodes or sparse along the axis of the inflorescence. **Branches** fistulous, terete, 2.5–4.2 mm in diameter, glabrous, striate, corrugated at floral axis; internodes 4–46 mm long at base and 8–115 mm long at floral axis, eventually slightly winged, wings 0.3–0.5 mm wide, inconspicuous, connecting the nodes. **Leaves** opposite and decussate, sparse along the branches or in distal subrosettes, heteromorphic, the most basal caulinar leaves marcescent and deciduous in late phenophases, simple, blades elliptic to lanceolate, eventually ovate, 17–85 × 8–28 mm, becoming smaller distally, chartaceous or at most slightly coriaceous, strongly discolorous, the adaxial face dark-green, the abaxial face light-green; apex acute to attenuate; base cuneate to attenuate, slightly asymmetrical and falcate; petioles 6–30 × 1–1.5 mm, reaching ⅓ to ⅔ the length of the leaf blade, decurrent; primary vein adaxially sulcate, abaxially salient; secondary veins 3–7 pairs, anastomosing; margin entire, revolute, irregularly crenate-serrate, teeth 5–14 pairs, 1.5–9 × 0.5–3.5 mm, teeth apex apiculate and glandular; apiculum up to 0.2 mm long; teeth glands rounded, concave, 0.2–0.3 mm in diameter; distal leaves eventually pinnatipartite to pinnately lobed; basal lobes 1–3 pairs, 3–11 × 1–3.5 mm, elliptical, elliptic to lanceolate, sometimes hardly visible, becoming larger distally; margin irregularly crenate-serrate, eventually serrate, teeth eventually elongated. **Inflorescence** terminal in compound dichasial cyme, the distal portion capituliform, with 2–5 pairs of secondary branches (paracladia, *sensu* Larsen 1986), rachis 20–185 mm long, secondary axes 12–65 mm long, tertiary axes dichasial up to 10 mm long. **Bracts** on the two lower nodes of the inflorescence, 18–64 × 10–23 mm, similar to upper leaves; distal bracts elliptic to lanceolate, navicular, 6–12 × 2–4 mm. **Bracteoles** lanceolate, 3–3.2 × 1–1.2 mm, green, acute to attenuate apex, eventually caudate, base rounded to subcordate, decurrent. **Flowers** of both sexes sessile, pentamerous, the calyx vestigial, eventually forming a hardly visible wavy ring, ca. 0.05 × 0.3 mm. **Staminate flowers** white to cream, campanulate, 3.3 × 2.7 mm, corolla tube 1.2–1.4 mm long, glabrous, gibbous 0.5–0.7 mm length; lobes 5(6), elliptical, 1.2 × 1 mm, acute apex; stamens 3(4), 2.8–3 mm long, exserted, epipetalous, adnate to the corolla in the basal third, filament 2.1–2.3 mm long, the anthers globose to oblong, 0.7–0.8 × 0.6 mm, dorsifixed; pistilodium 1.6–1.8 mm long, slightly exserted, stigma 3 with linear lobes, up to 0.3 mm long; abortive ovary (partially developed) 1–1.6 mm long. **Pistillate flowers** white to cream, campanulate, 1.3–1.6 × 1.3–1.4 mm, corolla tube 0.7–0.8 mm long, glabrous, with a small gibbosity of 0.3–0.5 × 0.1–0.2 mm; lobes 5 (6), acute to rounded, 0.6–0.8 × 0.4–0.5 mm, slightly unequal; vestigial staminodes 3, 0.3–0.5 mm long, epipetalous, included and inconspicuous, laminar and apically spatulate to clavate; style 1.6 mm long, exserted; stigma 3, papillose, rounded lobes, 0.1 mm long; ovary 0.7 × 0.5 mm. **Fruits** elliptic, 2.4–3.4 × 1.5–2.5 mm, apex emarginate to valeculate, base rounded to truncate, eventually cordate, transversely triquetrous, 3–5-costate (with two lateral and one or three adaxial vascular bundle, 0.2–0.3 mm wide), two prominent lateral wings, 0.3–0.8 mm wide, dorsal costa 0.2–0.3 mm wide, slightly oblique, stramineous, glabrous, finely papillose, uniseminate. **Seeds** elliptical, rounded apex and base, 1.5 × 0.8–1 mm, stramineous, smooth indument.

TABLE 1. Comparative diagnostic features of *Valeriana sobraliana* with regards to its morphologically most similar species. Abbreviations for Brazilian states and mountain formations: MG = Minas Gerais; PR = Paraná; RJ = Rio de Janeiro; RS = Rio Grande do Sul; SC = Santa Catarina; SP = São Paulo; SHG = Southern Highland Grasslands, HATG = High Altitude Tropical Grasslands. Data from Rabuske-Silva (2018).

Traits/Species	*V. catharinensis*	*V. organensis*	*V. ulei*	*V. sobraliana*
Leaves color	slightly discolorous	slightly discolorous	slightly discolorous	strongly discolorous
Leaves venation (adaxial face)	pinnately veined, anastomosing, not reticulate	pinnately veined, anastomosing and reticulate	3-veined-like, slightly anastomosing, not reticulate	pinnately veined, anastomosing, not reticulate
Leaves margins	irregularly crenate-serrate	serrulate to serrate	serrate	irregularly crenate-serrate
Leaves indument	pubescent	glabrous	glabrous	glabrous
Petioles (in basal leaves)	reaching at most ⅓ the length of the leaf blade	reaching at most ⅓ the length of the leaf blade	sessile, or at most reaching ⅕ the length of the leaf blade	reaching ⅓ to ⅔ the length of the leaf blade
Bracteoles	1.5–2 × 0.7–1 mm, ovate, acute apex, rounded to attenuate base	2–2.8 × 0.8–1 mm, elliptic, acute apex, rounded to attenuate base	1.5–2 × 0.7–0.8 mm, ovate, acute apex, rounded base	3–3.2 × 1–1.2 mm, lanceolate, acute to attenuate apex, eventually caudate, base rounded to subcordate
Staminate flowers	2.4–2.8 × 2–2.2 mm, pistilodium 1.4 mm long, included to slightly exserted	2.5 × 2 mm, pistilodium 0.8 mm long, inserted	2–2.6 × 2–2.6 mm, pistilodium 1.2–1.4 mm, included to slightly exserted	3.3 × 2.7 mm, pistilodium 1.6–1.8 mm long, slightly exserted
Achenes	ovate, valeculate apex	ovate, rounded apex	ovate to globose, rounded to emarginate apex	elliptic, emarginate to valeculate apex
Distribution	Serra Geral plateau of RS and SC, in the SHG	Serra do Mar mountain range of MG, RJ and SP, in the HATG	Serra Geral plateau of RS and SC, in the SHG	Serra do Mar mountain range of SC and PR, in the HATG

Distribution and Habitat:—*Valeriana sobraliana* is endemic from the High Altitude Tropical Grasslands of Paraná state and border region with Santa Catarina state, Southern Brazil. Sparse populations were sampled in highland grasslands and montane cloud forest edges, on humid slopes, rocky outcrops and mountain peaks, environments often covered by fog, from 1100 to 1950 m elevation (Fig. 3).

Conservation status:—According to the IUCN (2017) criteria B2ab (iii, iv), the species is classified as Vulnerable (VU). Despite the great number of collections deposited in regional herbaria and the wider extent of occurrence (EOO = 1,120.000 km²), *V. sobraliana* has less than ten subpopulations sampled and reduced area of occupation (AOO = 2000 km²). It occurs at least in four Conservation Units: Guaricana National Park, Pico do Paraná State Park, Pico do

Marumbi State Park and Guaratuba Environmental Protection Area. The main anthropic disturbances in the habitats where the new species occurs are the coverage by *Pinus* spp., plantations and exotic grasses, which often invade natural areas (including Conservation Units), as well as the high incidence of uncontrolled fire, leading to less than ten locations.

Etymology:—The new species is named in honor of the Brazilian botanist Marcos Sobral, great researcher and collector of Valerianaceae in Southern Brazil, the first to mention the morphological specificities of the material here analyzed (Sobral 1999a: 25).

Phenology:—Flowers and fruits from February to December.

Paratypes:—BRAZIL. **Santa Catarina**: Campo Alegre, Serra do Quiriri, 29 December 1998 (pist. fl. and fr.) *J.M.Silva, O.S.Ribas, J.Cordeiro & E.Barbosa 2782* (MBM!); Campo Alegre, Serra Quiriri, 1400 m elev., 29 September 2001 (stam. fl.) *O.S.Ribas, J.M.Silva, E.Barbosa & E.F.Costa 3642* (MBM!). Garuva, Serra do Quiriri, 1300 m elev., 16 December 2004 (stam. fl.) *J.M.Silva, O.S.Ribas & M.R.Bornschein 4149* (MBM!); Garuva, Serra Quiriri, 1400 m elev., 26 August 2010 (stam. fl.) *E.F.Costa, E.Barbosa & J.Cordeiro 104* (MBM!). **Paraná**: Campina Grande do Sul, Serra do Capivary Grande, 1700 m elev., 6 August 1961 (pist. fl.) *G.Hatschbach 8175* (MBM!); Campina Grande do Sul, Pico Caratuva, 1950 m elev., 20 May 1967 (pist. fl.) *G.Hatschbach 16460* (MBM!, LIL); Campina Grande do Sul, Pico Caratuva, 2 August 1967 (stam. fl.) *G.Hatschbach 16842* (MBM!); Campina Grande do Sul, Serra Ibitiraquire, Abrigo 1, 1600 m elev., 25 September 1969, *G.Hatschbach 22222* (MBM!, HBR!); Campina Grande do Sul, Pico Paraná, 1600 m elev., 2 April 1988, *M.R.Bornschein 16* (MBM!); Campina Grande do Sul, Serra do Capivari, 24 August 1989 (stam. fl.) *V.Nikolack & O.S.Ribas 10* (FLOR!, MBM!); Campina Grande do Sul, Serra dos Órgãos, Pico Caratuva, 1550 m elev., 4 July 1991 (stam. fl.) *Y.S.Kuniyoshi & A.Vicentini 5424-b* (MBM!); Campina Grande do Sul, Serra do Ibitiraquire, subida para o Pico Paraná, 1500–1700 m elev., 14 July 1996 (stam. fl.) *O.S.Ribas & F.Schwerdt 1456* (MBM!); Campina Grande do Sul, Morro Capivari Grande, 1660 m elev., 1 July 1998 (stam. fl.) *V.A.O.Dittrich 393* (MBM!); Campina Grande do Sul, Serra do Ibitiraquire, Pico Itapiroca, 1800 m elev., 9 August 2000 (stam. fl.) *M.Scheer & A.Y.Mocochinski 454* (MBM!); Campina Grande do Sul, Serra do Ibitiraquire, Pico Paraná, Abrigo 2, 1700 m elev., 18 August 2001 (stam. fl.) *J.M.Silva, E.Barbosa, O.S.Ribas & E.F.Costa 3386* (MBM!); Campina Grande do Sul, Serra Capivari Grande, 23 October 2001 (pist. fl. and im. fr.) *E.Barboza, O.S.Ribas & E.F.Costa 681* (MBM! FURB!); Campina Grande do Sul, Morro Capivari, 21 October 2006 (pist. fl. and fr.) *A.L.Gasper 249* (FURB!); Campina Grande do Sul, Pico Caratuva, 5 August 2009 (pist. fl.) *E.D.Lozano 119* (MBM!); Campina Grande do Sul, Morro Cerro Verde, 5 June 2010 (pist. fl. and fr.) *E.D.Lozano & V.Ariati 249* (MBM!); Campina Grande do Sul, lateral do Caratuva, trilha para o Pico Paraná, 4 July 2010 (stam. fl.) *R.Ristow 713* (MBM!); Campina Grande do Sul, Abrigo II, Pico do Paraná, 10 July 2011, (pist. fl. and fr.) *E.D.Lozano, T.Bochorny, G.Felitto & D.N.Takigawa 617* (MBM!); Campina Grande do Sul, Pico Caratuva, 25°14'26.6"S 48°49'50.8"W, 1767 m elev., 11 September 2018 (stam. fl.) *C.Rabuske-Silva, G.P.Coelho & C.L.Ribeiro 349* (ICN!). Guaratuba, Serra de Araçatuba, Morro dos Perdidos, 1100 m elev., 18 September 1997 (stam. fl.) *E.P.Santos & H.M.Fernandes 346* (MBM!); Guaratuba, Serra do Araçatuba, 1300 m elev., 25 February 2000 (pist. fl. and fr.) *J.M.Silva, E.Barbosa & J.Cordeiro 3256* (ICN!, MBM); Guaratuba, Pico Pedra Branca de Araraquara, 25°56'23"S 48°52'22"W, 1160 m elev., 12 August 2014 (pist. fl. and fr.) *J.Cordeiro, E.Barbosa & M.L.Brotto 5229* (MBM!). Morretes, Pico Olimpo, Serra Marumbi, 25 August 1946 (stam. fl.) *O.Curial 29* (MBM!); Morretes, Morro Mãe Catira, Serra Graciosa, 30 March 1947 (stam. fl.) *O.Curial 152* (MBM!); Morretes, Morro Mãe Catira, Serra Graciosa, 30 March 1947 (pist. fl. and fr.) *O.Curial 153* (MBM!). Piraquara, 23 September 1970 (pist. fl.) *H.Imaguire 2579* (ICN!). Quatro Barras, Morro Mãe Catira, 1200 m elev., 3 August 1988 (stam. fl.) *R.Kummrov & C.Budziak 3039* (MBM!); Quatro Barras, Morro Mãe Catira, 17 August 1989 (stam. fl.) *R.Kummrow, V.Nicolack et al. 3168* (MBM!, HUCS!); Quatro Barras, Morro Mãe Catira, 900 m elev., 10 July 1991 (stam. fl.) *O.S.Ribas & C.B.Poliquesi 335* (MBM!); Quatro Barras, Serra do Capivari Grande, 1600 m elev., 24 October 1997 (stam. fl. and fr.) *E.P.Santos, A.C.Cervi, C.M.S.Coimbra & E.F.Armando 405* (MBM!, UPCB); Quatro Barras, trilhas morros Mãe Catira e Sete, 3 August 2013 (stam. fl.) *M.E.Engels, E.D.Lozano, M.Bolson, T.Bochorny & L.Bacci 1410* (MBM!). São José dos Pinhais, Serra da Igreja, Morro dos Padres, 1320 m elev., 6 August 2001, *M.Scheer, A.Cavassani & G. Gatti 362* (MBM!). Tijucas do Sul, Morro dos Perdidos, 25°53'27.3"S 48°57'23.9"W, 1420 m elev., 13 September 2018 (stam. and pist. fl.) *C.Rabuske-Silva, G.P.Coelho & C.L.Ribeiro 352* (ICN!).

Comments:—Borsini (1962: 159; 1963: 128) based the analysis, description and illustration of *Valeriana ulei* on material coming exclusively from Paraná state, Southern Brazil. Sobral (1999a: 25) observed that the specimens examined by Borsini had quite different features from those mentioned in the protologue of *V. ulei*, being possibly a new species for Science. The analysis of both protologue and type specimen (HBG barcode HBG-513375, image!) confirmed Sobral's observation. The new species is here described based on its distinct morphology and geographical concision.

Regarding vegetative traits, all four morphologically related species are subshrubs and the most basal caulinar leaves may be grouped into subrosettes (Figure 3, B and 4, A, C and E). Despite these similarities, the leaves have some useful characters for species differentiation. *Valeriana sobraliana* has leaf blades strongly discolorous, with a dark green and waxy adaxial face, and markedly light-green abaxial face. Plus, it is pinnately veined, the veins anastomosing and not reticulate, with a chartaceous or at most slightly coriaceous consistency and glabrous indument (Figure 3, C and D). On the other hand, *V. catharinensis*, although sharing the same type of venation and margins, has slightly discolorous, chartaceous and pubescent leaves (Figure 4, A and B). *Valeriana organensis* shares the same leaves consistency and indument with *V. sobraliana*, but its leaves are slightly discolorous, the venation is anastomosing and reticulate and the margins is serrulate to serrate (Figure 4, C and D). *Valeriana ulei* shares the glabrous indument, although the consistency is strongly coriaceous, and only the primary vein and the first or second pair of secondary veins are visible, the first pair forming a more narrower angle (about 30°) than the others and reaching the apical third of the leaf blade (3-veined-like), slightly anastomosing (Figure 4, E and F).

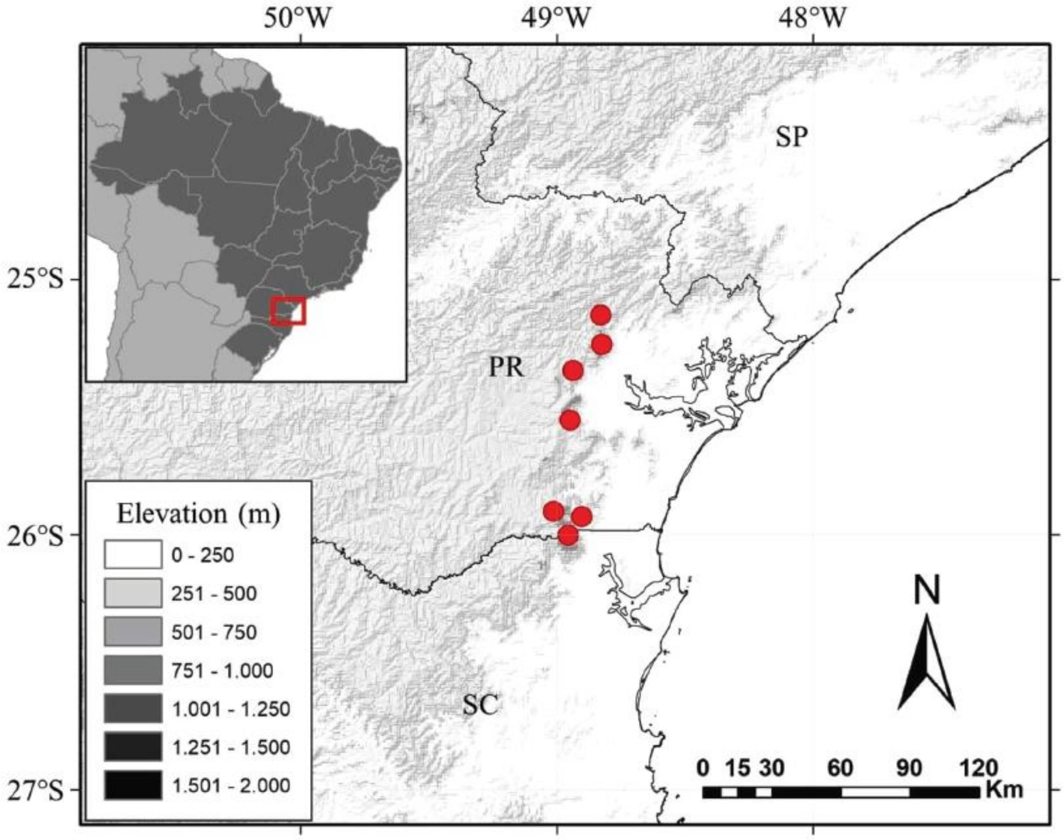

FIGURE 3. Distribution map of *Valeriana sobraliana* in Southern Brazil.

The examined specimens indicate that *V. sobraliana* is a dioecious species, despite the well developed pistilodium observed in staminate flowers. The occurrence of partially developed ovaries, aborted during the anthesis and similar to thickened floral peduncles, is common in staminate flowers of the genus (Borsini 1963). No seeds were observed in these structures, which corroborates this classification. The achenes exhibit considerable variation in shape according to the stage of development. Usually, in the final stage, they acquire the elliptic shape. The lateral wings protrude apically, resulting in an emarginate to valeculate apex (Figure 1, G and H).

Valeriana sobraliana does not occur in sympatry with other species of the genus and presents a geographic disjunction with the morphologically related species. *Valeriana catharinensis* and *V. ulei* are restricted to the Subtropical Highland Grasslands (SHG) and Subtropical Mixed Forest (SMF) of the Serra Geral plateau (*sensu* Iganci *et al.* 2011), which has basaltic rocks. The distribution of *V. sobraliana* corresponds to the exact distribution of the High Altitude Tropical Grasslands (HATG) in the Serra do Mar mountain range of Paraná and border region with Santa Catarina state, between the massifs of the Serra do Quiriri (or Serra do Iqueririm) and the Serra Capivari Grande (south and north respectively) (Maack 1968). Besides, the HATG covers basically granitic rocks. *Valeriana organensis*, despite also occurring in the HATG, is restricted to the states of São Paulo, Rio de Janeiro and Minas Gerais, Southeastern Brazil, occurring in both the Serra do Mar and the Serra da Mantiqueira mountain ranges.

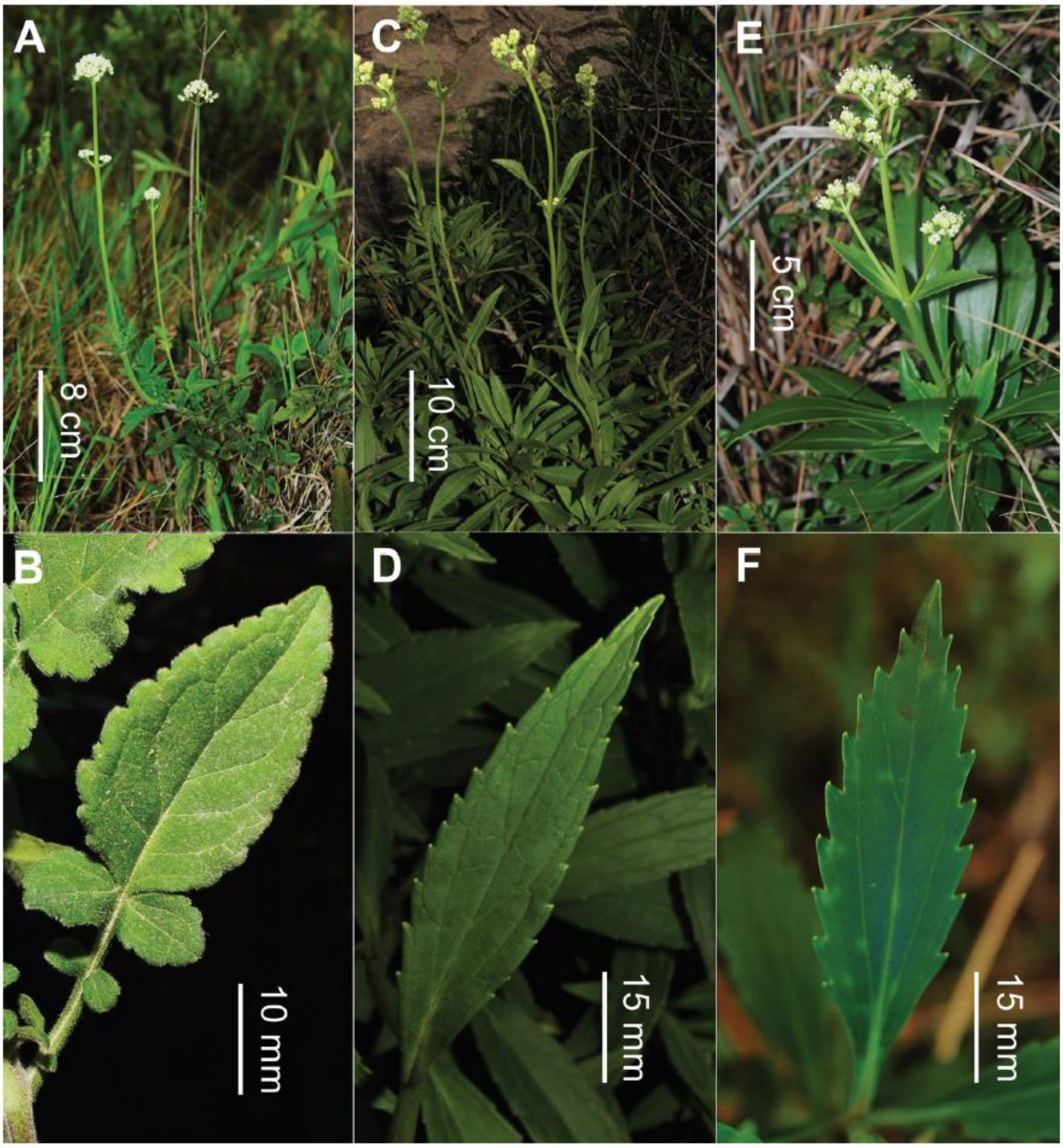

FIGURE 4. Morphologically similar species to *Valeriana sobraliana*: habits and leaves in adaxial view. A–B. *Valeriana catharinensis*; C–D. *V. organensis*; E–F. *V. ulei*. Photos A, B and F by Cassio Rabuske-Silva, C and D by Guilherme Peres Coelho and E by Sérgio Augusto de Loreto Bordignon.

Checklist of *Valeriana* in the state of Paraná:—*Valeriana* shows a decrease in the number of species from Southern to Southeastern Brazil (Rabuske-Silva 2018). Rio Grande do Sul is the state with the highest number of species (12 spp.), followed by Santa Catarina (10 spp.) and Paraná (5 spp., Table 2). In Paraná, three species are threatened according to the IUCN categories and criteria, all of them Vulnerable (VU): *V. eichleriana* (C.A.Müll.) Graebn., *V. reitziana* Borsini and *V. sobraliana* (Rabuske-Silva 2018). This is basically due to the populations of these species being naturally sparse and the conversion of the remaining grasslands for agriculture, livestock and urban occupation. *Valeriana eichleriana*, *V. reitziana* and *V. salicariifolia* Vahl are restricted to the SHG, and *V. sobraliana* is the only species restricted to the HATG. *Valeriana scandens* L., a voluble or clambering species, has the widest distribution, with scattered records in all the state. *Valeriana eichleriana* and *V. reitziana*, two morphologically closely related subshrubs, reach their northern limit of distribution in the SHG of Paraná. *Valeriana eichleriana* is the rarest species in the study area, with only one record from the municipality of Palmas (*S.Campestrini, R.Trevisan, J.P.Ferreira & S.Venturi 618*, FLOR!), on the border with Santa Catarina, parallel 26°S. The populations of this species are concentrated in the Aparados da Serra region, in Rio Grande do Sul, being also one of the rarest species in Santa Catarina, with few historical records in the municipality of Lages. Although the type material of *Valeriana reitziana* was collected in the Serra do Caracol, Minas Gerais state, Southeastern Brazil, this species is considered extinct in this state and is currently restricted to Southern Brazil (Rabuske-Silva 2018). *Valeriana reitziana* reaches its northern distribution limit in the center of the Paraná state, also occurring in the municipality of Palmas, plus in the municipalities of Guarapuava, Laranjeiras do Sul and Palmeira, until the parallel 25°S. *Valeriana salicariifolia*, a species that occurs from northeastern Argentina, restricted to swamps and streams, reaches its northern distribution limit in the state of São Paulo, in the municipality of Itapeva, near the border with Paraná, parallel 23°S (Kutschker 2008, Scalon *et al.* 2002, Rabuske-Silva 2018).

TABLE 2. Checklist of *Valeriana* in the state of Paraná, Brazil.

Species	Conservation status	Voucher
Valeriana eichleriana (C.A.Müll.) Graebn.	VU (B1ab ii,iii,iv)	*S.Campestrini, R.Trevisan, J.P.Ferreira & S.Venturi 618* (FLOR!)
V. reitziana Borsini	VU (A2c)	*G.Hatschbach, A.C.Cervi & E.Barbosa 71797* (MBM!)
V. salicariifolia Vahl	LC	*P.I.Oliveira 119* (MBM!)
V. scandens L.	LC	*G.Hatschbach 46905* (MBM!)
V. sobraliana Rabuske & Iganci	VU (B2ab iii, iv)	*C. Rabuske, G.P.Coelho & C.L.Ribeiro* 352 (ICN!)

Identification key to the species of *Valeriana* in the state of Paraná

1\. Erect or decumbent species; achenes with vestigial, annular or slightly dentate calyx 2
\- Voluble or climbering species; achenes with pappus-like calyx .... *V. scandens*
2\. Subshrubs, rhizomes woody; distal leaves elliptic to lanceolate with dentate margins, teeth larger than 1 mm long; achenes winged; inhabit rocky outcrops, humid slopes and ravines.. 3
\- Herbs, rhizomes herbaceous; distal leaves linear with entire margins, eventually with small teeth, up to 0.5 mm long; achenes non-winged; restricted to peat bogs and streams .... *V. salicariifolia*
3\. Leaves with sessile or attenuate base; staminate flowers up to 2 mm long; pistillate flowers up to 0.5 mm long; achenes up to 1.8 mm long with rounded apex 4
\- Leaves petiolate; staminate flowers 3.3 mm long; pistillate flowers 1.3–1.6 mm long; achenes 2.4–3.4 mm with emarginate to valeculate apex .... *V. sobraliana*
4\. Leaves coriaceous, wrinkled in dry material; inflorescences with paniculiform paracladia; achenes elliptic-globose, up to 1.5 × 1 mm, 5-costate, with annular to dentate calyx .... *V. eichleriana*
\- Leaves chartaceous, never wrinkled in dry material; inflorescences with glomeruliform paracladia; achenes globose, larger than 1.8 × 1.6 mm, 3-costate, with vestigial calyx.. *V. reitziana*

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Appendix II – *Valeriana caparaoensis* (Valerianaceae nom. conserv.), a New Species from Southeastern Brazil

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Valeriana caparaoensis (Valerianaceae nom. conserv.), a New Species from Southeastern Brazil

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Abstract*—*Valeriana caparaoensis, a new species from the High Altitude Tropical Grasslands of Southeastern Brazil, is described and illustrated. The new species is known only from the Serra do Caparaó massif, between the states of Minas Gerais and Espírito Santo, Southeastern Brazil. It shares morphological affinities with *V. catharinensis* and *V. polystachya*, the first restricted to Brazilian Subtropical Highland Grasslands, and the last restricted to Lowland Grasslands of Southern Brazil, Uruguay and Argentina. Besides the great geographical disjunction, the new species differs from the other two species by the pinnately lobed proximal leaves, by the lanceolate distal lobes and longer pseudopetioles in distal leaves, by differences in the size of the flowers, and by the rounded to ovate and broader achenes. Additionally, we provide the preliminary conservation status assessments using IUCN Red List categories and criteria, as well as an updated checklist and a key for *Valeriana* species from Southeastern Brazil.

Keywords—Atlantic Forest Domain, endemism, highland grasslands, montane cloud forest, Serra do Caparaó, taxonomy.

Valeriana L. is the richest genus of Valerianaceae, with about 270 species distributed in Eurasia, the Americas, and Southern Africa (Weberling and Bittrich 2016). South America constitutes the most important diversity center of the genus with ca. 175 species, two-thirds of the global richness, mostly in the Andes (Eriksen 1991; Bell and Donoghue 2005a, 2005b; Kutschker 2011; Bell et al. 2012; Kutschker and Morrone 2012).

In Brazil, the first taxonomic revision of the genus was produced by the German naturalist Carl Alfred Müller in the scope of the monumental *Flora Brasiliensis* (Müller 1885). He described several new varieties for *Valeriana scandens* L., a variable species of wide distribution in tropical America (Meyer 1951; Xena de Enrech 1992, 1993). Müller (1885) considered all other Brazilian species, as well as four new ones which he described, under the genus *Valerianopsis* (Wedd.) C.A.Müll., based only on the absence of pappus-like calyx (Sobral 1999). Borsini (1962), agreeing with Graebner (1899), did not recognize the varieties and the new combination proposed by Müller and incorporated the new species and data produced until then. These pioneering studies were followed by sparse descriptions of new species and regional floras from the states of Santa Catarina (Borsini 1963), Rio Grande do Sul (Sobral 1999), and São Paulo (Scalon et al. 2002).

Currently, 15 species are recognized for the Brazilian flora (Iganci et al. 2018), most of them in montane habitats (highland grasslands) of the Atlantic Forest Domain, southern and southeastern Brazil (Rabuske-Silva 2018; Rabuske-Silva and Külkamp 2018). Despite the low species richness for this genus compared to its representation in other South American countries (Kutschker 2011), the Brazilian species represent a disjunct contingent of the Andean stock (Sobral 2000) with about 80% of the species restricted to the country (12 spp.) (Iganci et al. 2018). This study describes a new species for the Brazilian flora, endemic to the Atlantic Forest Domain and collected for the first time in the middle of the 20th century. The description is accompanied by an illustration, photographs, distribution map, and taxonomic comments. Additionally, we provide preliminary risks of extinction assessments using the IUCN Red List categories and criteria (IUCN 2017), as well as an updated checklist and a key for *Valeriana* species from southeastern Brazil.

MATERIALS AND METHODS

The new species was found during the taxonomic revision of *Valeriana* in Brazil (Rabuske-Silva 2018; Iganci et al. 2018). We examined exsiccates of the following herbaria: CRI, FLOR, ECT, EFC, FURB, HAS, HBR, HUCS, HURG, ICN, MBM, MBML, MPUC, PACA, PEL, and RB (acronyms according to Thiers 2018). Over 1200 specimens of *Valeriana* from different regions of Brazil were examined. We consulted the taxonomic revisions of the genus *Valeriana* in Brazil (Müller 1885; Borsini 1962, 1963; Sobral 1999; Scalon et al. 2002; Rabuske-Silva 2018) and the main taxonomic studies in South America (Borsini 1944, 1966; Cabrera 1965; Bacigalupo 1974; Xena de Enrech 1992; Borsini et al. 1999; Jørgensen 1999; Xifreda 1999; Novara 2008; Kutschker 2008, 2011). Additionally, we conducted a fieldwork expedition in October 2016 in the states of Minas Gerais and Espírito Santo (Serra do Caparaó massif). The species was illustrated to highlight the diagnostic characters. Morphological terminology follows Harris and Harris (2001) and Beentje (2010). IUCN Red List status evaluation follows IUCN (2017) categories and criteria, using GeoCAT (Bachman et al. 2011) for geospatial analysis. The checklist was based on literature and herbarium records.

TAXONOMIC TREATMENT

Valeriana caparaoensis Rabuske, Sobral & Iganci, sp.nov. TYPE: BRAZIL. Minas Gerais. Alto Caparaó, Parque Nacional do Caparaó, trilha para a Cachoeira do Aurélio, 20°28′S 41°50′W, 1834 m, 1 December 2010, *T.M. Machado, R.C. Forzza, J.R. Stehmann & A.M. Amorin 268* (holotype: RB 563103!; isotypes: BHCB 147080, FLOR 39832!, MBML 041434!).

The new species is morphologically similar to *Valeriana polystachya* Sm. and *V. catharinensis* Graebn. It differs from both species by the pinnately lobed proximal leaves (vs. entire or lyrate proximal leaves), by the distal leaves with lanceolate distal lobes and pseudopetioles greater than 20 mm long (vs. linear, linear-lanceolate, or elliptic distal lobes, pseudopetioles up to 20 mm long), by the larger pistillate flowers with 0.8–1 mm length and 0.8 mm width (vs. up to 0.7 mm length and 0.7 mm width) and by the rounded to ovate achenes, wider than similar species, 2.2–2.4 mm wide (vs. oblong or obovate achenes, up to 2 mm wide).

Dioecious subshrub, 30–90 cm tall, perennial, rhizomatous and decumbent; plants glabrous except for the presence of tufts of hyaline trichomes 0.3–0.8 mm long, denser and

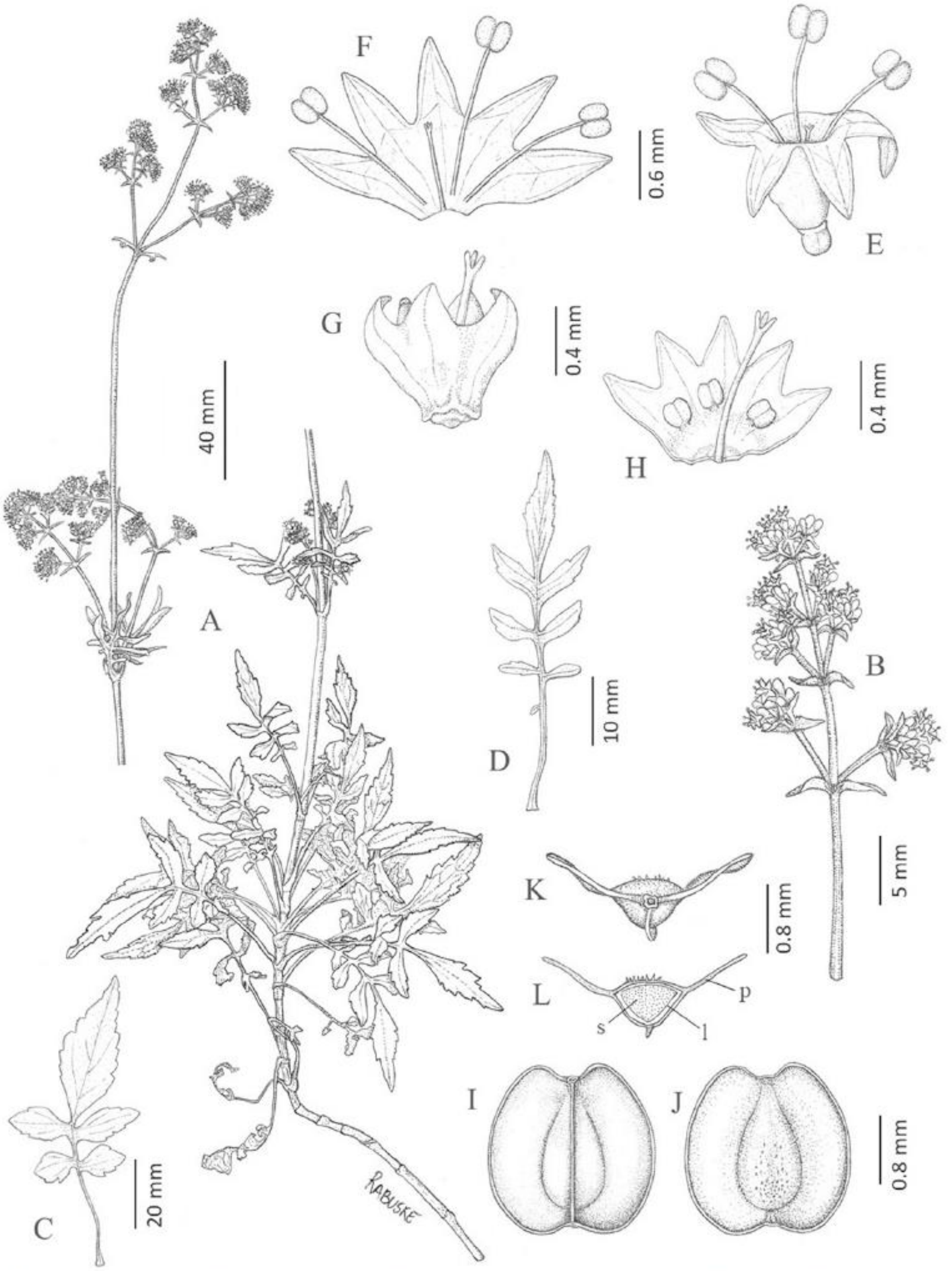

FIG. 1. A–L. *Valeriana caparaoensis*. A. Habit. B. Detail of inflorescence. C. Proximal leaf. D. Distal leaf. E. Staminate flower. F. Staminate flower, opened. G. Pistillate flower. H. Pistillate flower, opened. I. Fruit in adaxial view. J. Fruit in abaxial view. K. Fruit in apical view. L. Fruit in transverse view. l = locule; p = parenchymatous tissue; s = seed. Vouchers: *G.P. Coelho 193* (ICN); *G.P. Coelho 195* (ICN); *T.M. Machado, R.C. Forzza, J.R. Stehmann & A.M. Amorim 268* (BHCB). Drawn by Cassio Rabuske-Silva.

conspicuous in the nodes or sparse along the pseudopetioles and leaf blades, mainly in the veins and margins. **Branches** fistulous, 1.6–4 mm diam, glabrous, striate; internodes 5–40 mm long in the defoliated basal portion, 1–10 mm long between the leaves, becoming distally larger, 18–100 mm long. **Leaves** opposite and decussate; basal leaves (or lowermost leaf pairs) pinnately lobed and lax, 23–106 × 10–32 mm, frequently marcescent or absent; distal leaves pinnately lobed, subrosulate, becoming lax towards the inflorescence base, 44–134 × 16–40 mm; lateral lobes 3–5(–6) pairs, opposite to

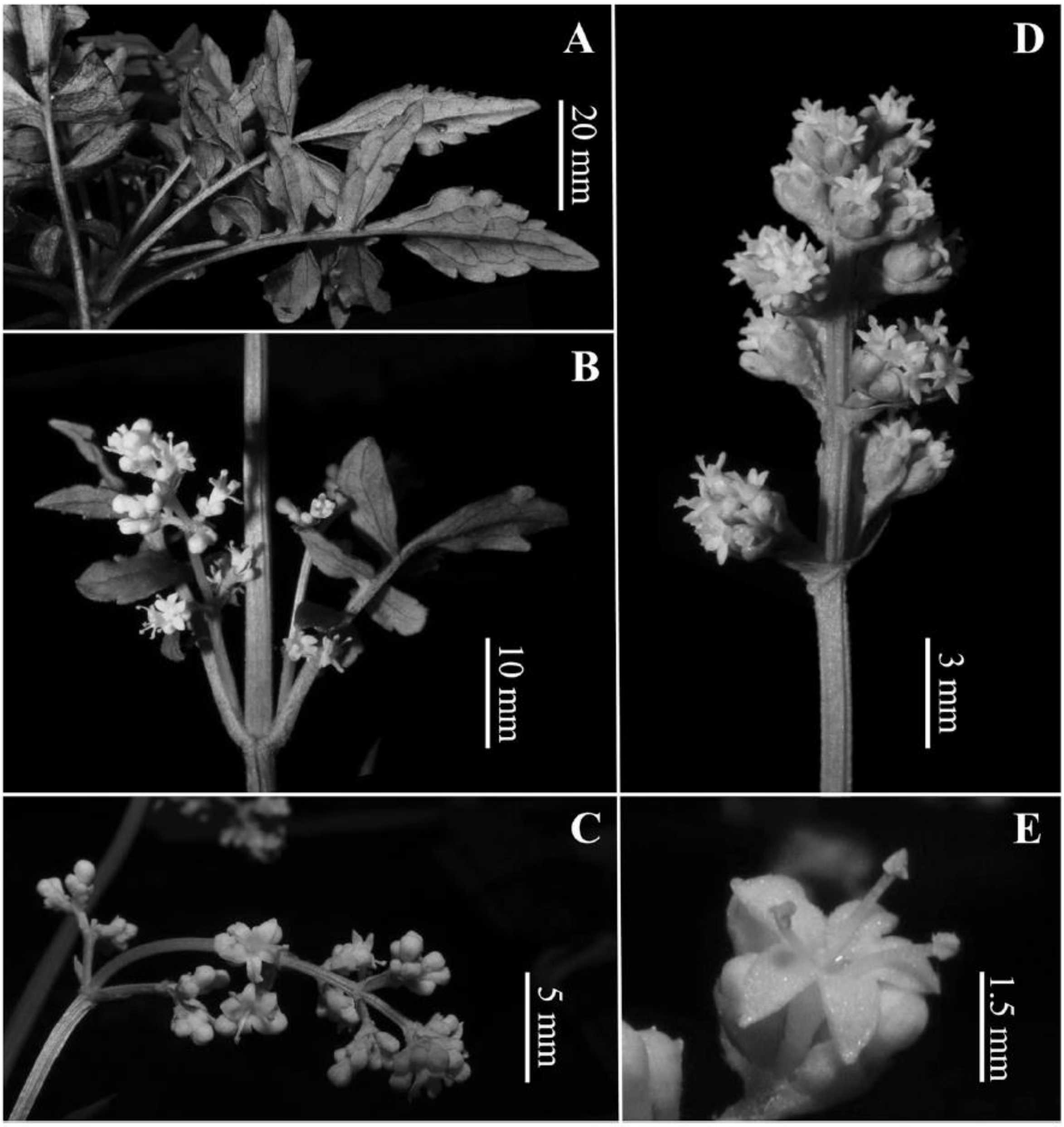

FIG. 2. *Valeriana caparaoensis*. A. Basal leaves in abaxial view. B. Bracts on the lower two nodes of the inflorescence with staminate flowers. C. Curved paracladia with staminate flowers. D. Detail of a paracladia with pistillate flowers. E. Staminate flower. Photos by Guilherme Peres Coelho.

subopposite, elliptic to lanceolate, falcate, the proximal pair often very reduced, 2–5 × 1.5–1.8 mm, the others 6–28 × 2.5–6 mm, increasing in size towards the apex of the leaf blade; distal pair ascending and diverging from the central nerve at an angle of approximately 45°; terminal lobe markedly longer than the lateral lobes, 19–62 × 4–15 mm, lanceolate, apex and base attenuate; margins sparsely serrate, teeth 1–3 mm long; blades slightly discolor, adaxial face green, abaxial face light green with purple tinges, grey in dry material; central nerve adaxially sulcate, abaxially salient; pseudopetioles 20–40 mm long. **Inflorescence** paniculiform with the final units dichasial, with (3–)5–6 pairs of secondary branches (paracladia, sensu Larsen 1986). Staminate inflorescences 10–34 cm long, secondary axes 16–110 mm long, tertiary axes dichasial, 4–7 mm long. Pistillate inflorescences 17–26 cm long, secondary axes 10–43 mm long, with more congested tertiary axes 3–5 mm long. Proximal bracts similar to distal leaves, 34–96 × 20–38 mm, distal bracts linear to lanceolate, navicular, 1.5–4 × 0.5–1 mm. Bracteoles ovate, 1.2–1.8 × 0.6–0.9 mm, acute to attenuate apex, rounded base, finely fimbriated margins.

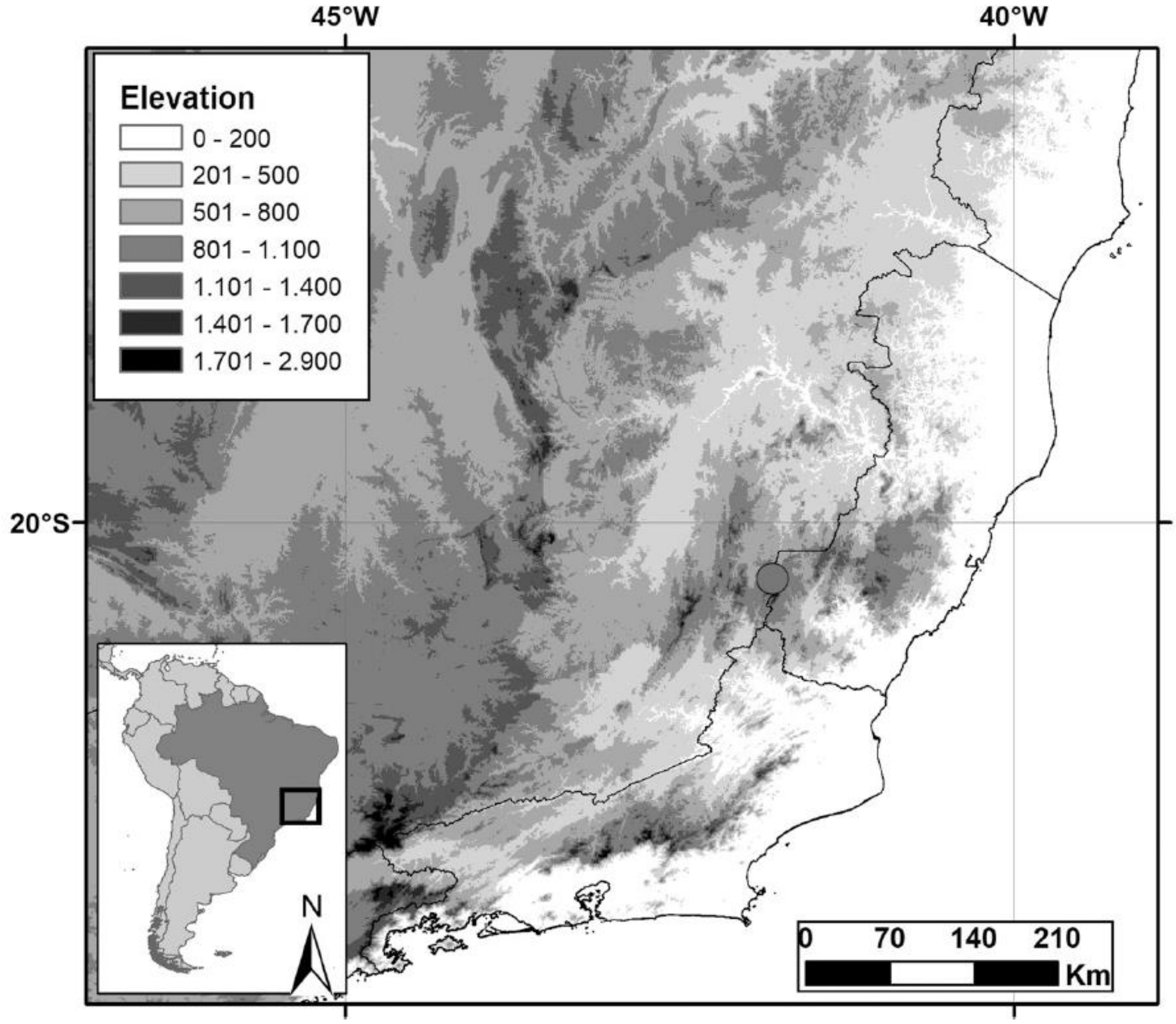

FIG. 3. Distribution of *Valeriana caparaoensis* (gray dot) in Southeastern Brazil.

Flowers of both sexes sessile, zygomorphic, pentamerous, the calyx vestigial, eventually dentate or forming a wavy ring, ca. 0.1 × 0.3 mm, the teeth hardly visible. **Staminate flowers** white to cream, campanulate to cupuliform, 2–2.4 × 2 mm, with a small gibbosity of 0.4 mm length, corolla tube 0.8–1 mm long, the lobes 5(–6), acute with different sizes 0.8–1 × 0.6–0.8 mm; stamens 3, 1.6–1.8 mm long, exserted, epipetalous, alternipetalous, adnate to the corolla near the base; the anthers globose, 0.3–0.4 × 0.3 mm, bithecal; pistilodium 0.7–1.2 mm long, included to slightly exserted; ovary partially developed at the base of the flowers, 0.3 × 0.3 mm long, similar to a floral peduncle. **Pistillate flowers** white to cream, campanulate, 0.8–1 × 0.8 mm, corolla tube 0.6 mm long, the lobes ovate with acute apex, 0.5–0.6 × 0.5 mm; vestigial staminodes 3, epipetalous, inserted in the basal portion of the corolla, up to 0.2 mm long, laminar and apically rounded; style 1.2–1.4 mm long, exserted; stigmas 3, papillose, lobes 0.1–0.2 mm long with rounded apex; ovary 0.3 mm long, unilocular, uniovulate. **Fruits** rounded to ovate, 2.2–2.4 × 2.2–2.4 mm, apex emarginate to valeculate, base cordate, transversely triquetrous, 3-costate (with two lateral and one adaxial vascular bundle, 0.1–0.3 mm wide), two prominent lateral wings, 0.7–0.9 mm wide, stramineous, glabrous, eventually slightly hairy in the middle of the abaxial face, trichomes 0.05 mm long, uniseminate. **Seeds** elliptical, acute apex, rounded base, 1.2 × 0.7 mm, smooth and stramineous indumentum. Figures 1, 2.

Distribution, Habitat, and Ecology—*Valeriana caparaoensis* is currently known only from the Serra do Caparaó massif, located between the states of Minas Gerais and Espírito Santo, southeastern Brazil. It is restricted to the High Altitude Tropical Grasslands and Montane Cloud Forest edges, in the Atlantic Forest Domain (sensu Iganci et al. 2011). Small populations of the species are observed along the access trails to the mountain peaks, always associated with moist soils, riverbanks, and waterfalls, between 1800 and 2300 m above sea level (Fig. 3).

Etymology—The species is named in reference to the type specimen's locality, the Serra do Caparaó massif.

Phenology—Flowers registered sparsely in February, July, and from September to December. Fruits in February.

***Paratypes*—Brazil.**—Espírito Santo: Dores do Rio Preto, Parque Nacional do Caparaó, Cachoeira do Aurélio, 20°28.839′S 41°49.757′W, 20 October 2012, *T.B. Flores, J. Kuntz-Galvão & O.R. Campos 1329* (ESA, MBML, RB!, UEC [image!], VIES [image!]).—Minas Gerais: Serra do Caparaó, 2200 m, 20 September 1941, *A.C. Brade 16984* (R [2 sheets, images!]); Alto Caparaó, Parque Nacional, Córrego José Pedro, stam. fl., September 1997, *L.S. Leoni & H. Safford 3742* (ESA, RB [2 sheets]!); Alto Caparaó, Parque Nacional, Córrego José Pedro, 2250 m, July 1999, *L.S. Leoni 4228* (ESA [image!]); Parque Nacional, margem do córrego José Pedro, 2200 m, 4 November 1999, *L.S. Leoni 4276* (RB!); Alto Caparaó, Parque Nacional do Caparaó, Divisa MG/ES, Cachoeira Bonita, Córrego José Pedro, 20°24′S 41°50′W, 1960 m, pist. fl., 16 February 2000, *V.C. Souza, J.P. Souza, W. Forster & F.F. Mazine 23237* (RB!, ESA [image!]); Alto Caparaó, Parque Nacional do Caparaó, Arredores do Terreirão, 20°25′S 41°49′W, 2300 m, stam. fl., 17 February 2000, *V.C. Souza, J.P. Souza, W. Forster & F.F. Mazine 23290* (RB!, ESA [image!]); Alto Caparaó, Vale Encantado, 2100 m, 3 October 2005, *L.S. Leoni & M.Y.R. Rocha 6312* (RB!); Alto Caparaó, Parque Nacional do Caparaó, 20°25′05″S 41°48′59″W, November 2017, stam. fl., *G.P. Coelho 193* (ICN! RB!); Alto Caparaó, Parque Nacional do Caparaó, 20°25′05″S 41°48′59″W, November 2017, pist. fl., *G.P. Coelho 195* (ICN!).

Key to the Species of *Valeriana* in Southeastern Brazil

1\. Voluble or clambering species; achene with pappus-like calyx . . . . *Valeriana scandens*
1\. Erect to decumbent species; achene with vestigial, dentate, or annular calyx 2
  2. Leaves entire (distal leaves eventually with 1–3 pairs of basal lobes) 3
    3. Herbs with linear to narrow-lanceolate leaves, entire margins, at most with inconspicuous teeth; achene elliptic, up to 1.8 mm long; restricted to wetlands, peat bogs, and riverbanks . . . . *V. salicariifolia*
    3. Subshrubs with elliptical to lanceolate leaves, dentate margins with teeth up to 1 mm long; achene ovate or globose, larger than 1.8 mm long; rock outcrops 4
      4. Leaves coriaceous; paracladia paniculiform (distal portion); achene ovate, 5-costate, annular calyx . . . . *V. organensis*
      4. Leaves chartaceous; paracladia glomeruliform (distal portion); achene globose, 3-costate, vestigial calyx . . . . *V. reitziana*
  2. Leaves pinnatisect 5
    5. Leaves coriaceous, lobes 5–7(8) pairs, the distal lobe similar to the lateral ones; corolla with hyaline trichomes at the apex of the petals; achene elliptic to subglobose, rounded apex, dentate calyx . . . . *V. glaziovii*
    5. Leaves membranous-papyraceous, lobes 3–5(6) pairs, the distal lobe larger than the lateral ones; corolla glabrous; achene rounded to ovate, valeculate apex, vestigial calyx . . . . *V. caparaoensis*

Discussion

This new species has long been neglected. The earliest collection known to us of *Valeriana caparaoensis* was made on the 20th of September 1941, by the German botanist (naturalized Brazilian) Alexander Curt Brade, at that time an official researcher under the position of "naturalist traveler" of the Botanical Garden of Rio de Janeiro. This trip was part of a series of expeditions to the isolated mountains of southeastern Brazil, organized by the institution since 1932 (Martinelli 1989). According to Brade's (1942) travel report, it was believed at the time that the Pico da Bandeira (2892 m elev.), located in the Serra do Caparaó massif, was the highest point in Brazil, now known as the third highest. Brade collected hundreds of plants in the main peaks from September to October 1941, including four specimens of Valerianaceae, later classified by the author as *V. polystachya* (all under *C.A. Brade 16984*). Two specimens related to this material are reported (Sobral 1999), the only one remaining deposited in the herbarium R and quite damaged (the exsiccate referred to the ICN herbarium was not found). According to the exsiccate label, in December 1960, the Argentinean botanist Olga Helena Borsini

Table 1. Comparative diagnostic features of *Valeriana caparaoensis*, *V. catharinensis*, and *V. polystachya*.

Traits/Species	*V. polystachya*	*V. catharinensis*	*V. caparaoensis*
Mating system	Gynodioecious	Dioecious	Dioecious
Stem (diameter / mm)	5–11, glabrous, notably fistulous	2.2–2.5, pubescent to slightly pubescent, slightly fistulous	1.6–2.8(4), glabrous, slightly fistulous
Leaves	Proximal leaves entire, distal leaves pinnately lobed, glabrous	Proximal leaves entire to lyrate, distal leaves pinnately lobed, pubescent	Proximal and distal leaves pinnately lobed, glabrous
Lateral lobes (in distal leaves)	(6)8–14 pairs, linear-lanceolate, attenuate apex, the distal pair ascending	2–4 pairs, elliptic, apex obtuse to acute, the distal pair not ascending	3–5(6) pairs, elliptic to linear-lanceolate, attenuate apex, the distal pair ascending
Distal lobe (in distal leaves)	Linear to linear-lanceolate, apex and base attenuate	Elliptic, base cuneate, obtuse or rounded, apex acute to attenuate	Lanceolate, apex and base attenuate
Pseudopetiole length (in distal leaves) (mm)	5–20	1–17	20–40
Inflorescence (apex)	Paniculiform	Capituliform	Paniculiform
Hermaphrodite or staminate flowers (length / mm)	1.2–1.8 × 1.2–1.6	2.4–2.8 × 2–2.2	2–2.4 × 1.8–2
Pistillate flowers (mm)	0.3–0.5 × 0.3–0.4	0.5–0.7 × 0.7	0.8–1 × 0.8
Stamens	Included to slightly exserted, up to 1.4 mm long	Markedly exserted, 1.8–2 mm long	Markedly exserted, 1.6–1.8 mm long
Fruit (size and shape) (mm)	1.7–2.5 × 0.6–1, oblong, with rounded apex, without lateral wings	2–2.3 × 1.5–2, ovate, with valeculate apex and two prominent lateral wings	2.2–2.4 × 2.2–2.4, rounded to ovate, with emarginate to valeculate apex and two prominent lateral wings
Fruit surface	Glabrous, with sparse trichomes, or entirely pubescent	Glabrous, rarely slightly pubescent on both faces	Glabrous, occasionally slightly pubescent on the abaxial face
Distribution	Southern Brazil: RS; Uruguay, Argentina (Pampas Domain), up to 600 m elev.	Southern Brazil: RS and SC, in the Serra Geral plateau (Atlantic Forest Domain), 900–1770 m elev.	Southeastern Brazil: ES and MG, in the Serra do Caparaó massif (Atlantic Forest Domain), 1800–2300 m elev.

Abbreviations for Brazilian states: ES = Espírito Santo; MG = Minas Gerais; RS = Rio Grande do Sul; SC = Santa Catarina.

TABLE 2. Updated checklist of *Valeriana* in southeastern Brazil.

Species/Traits	Distribution / Mountainous complex	Category of Threat	Voucher
Valeriana caparaoensis Rabuske, Sobral & Iganci *	ES, MG, in the Serra do Caparaó massif	CR	*G.P. Coelho 193* (ICN!)
V. glaziovii Taub.*	MG, RJ, in the Serra da Mantiqueira mountain range	EN	*Lindeman & Hass 4136* (MBM!)
V. organensis Gardn.*	MG, RJ, SP, in the Serra da Mantiqueira and Serra do Mar mountain range	CR	*G.P. Coelho 199* (ICN!)
V. reitziana Borsini*	SP, MG, in the Serra Geral plateau	VU	*H. Mosén 4253* (S [image!])
V. salicariifolia Vahl	SP, in the Serra Geral plateau	LC	*J.B. Baitello 2552* (UPCB [image!])
V. scandens L.	SP, RJ, MG, and ES, widely distributed	LC	*C. Rabuske & R. Santos-Jr. 112* (ICN!)

Abbreviations for Brazilian states: ES = Espírito Santo; MG = Minas Gerais; RJ = Rio de Janeiro; SP = São Paulo. Abbreviations for IUCN category of threat: CR = Critically Endangered; EN = Endangered; LC = Least Concern; VU = Vulnerable.

*Atlantic Forest Domain endemic species. Data according to Rabuske-Silva (2018) and Iganci et al. (2018).

reaffirmed Brade's identification. Curiously, shortly thereafter, Borsini (1962) places the occurrence of *V. polystachya* in Brazil as dubious, considering this species restricted to Argentina and Uruguay, with the northern boundary in the Canelones department. Brade's collection was not considered. Otherwise, Sobral (1999) reconsiders the past extensive occurrence of *V. polystachya*, expanded with Brade's collection.

Apparently, *V. caparaoensis* was re-collected only in September 1997 (*L.S. Leoni & H. Safford 3742*), half a century after its first collection. Since then, it has been periodically sampled, always inside the Caparaó National Park. Besides the remarkable morphological differences referring to *V. polystachya* (Table 1), both species have great geographical disjunction in their distribution areas. *Valeriana polystachya* occurs in lowland grasslands of southern Brazil (Rio Grande do Sul), Uruguay, and Argentina, especially in the Pampas Domain, never exceeding 600 m elev. (Rabuske-Silva 2018). Despite being historically related to *V. polystachya*, the new species is more similar to *V. catharinensis*, an endemic species of the Subtropical Highland Grasslands of the Serra Geral plateau, southern Brazil, which grows on basaltic soils between 900 and 1770 m elev. One of the most striking similarities between *V. caparaoensis* and *V. catharinensis* is the achene with valeculate apex and winged margin, uncommon features among the South American species. The comparative diagnostic features of *V. caparaoensis*, *V. catharinensis*, and *V. polystachya* are presented in Table 1. Furthermore, *V. caparaoensis* does not occur in sympatry with other species of the genus.

Checklist of Valeriana in Southeastern Brazil—In Brazil there are 15 species of the genus *Valeriana*, mostly restricted to southern Brazil (11 species) (Iganci et al. 2018). Here we present an updated checklist of species occurring in southeastern Brazil, including the mountainous complexes where they occur in the states of São Paulo, Rio de Janeiro, Espírito Santo, and Minas Gerais (Table 2). Six species are known to the study area, four of them endemic from the Brazilian Atlantic Forest Domain and extremely threatened: *Valeriana caparaoensis*, *V. glaziovii* Taub., *V. organensis* Gardn., and *V. reitziana* Borsini. The first two are restricted to the Serra do Caparaó massif and the Serra da Mantiqueira mountain range, respectively. *Valeriana organensis* occurs in both Serra do Mar and Serra da Mantiqueira mountain ranges. Regarding the occurrence of *V. reitziana* in southeastern Brazil, this species has only two historical records made in the 19th century, both in São Paulo and Minas Gerais (Serra do Caracol), being apparently extinct in these states. *Valeriana salicariifolia* has a wide distribution from the lowland grasslands of northeast Argentina and Uruguay (Pampas Domain) to the highland grasslands of southern and southeastern Brazil (Atlantic Forest Domain), where it occurs mainly in wetlands, peat bogs, and riverbanks of the Serra Geral plateau. This species is rare in Southeastern Brazil, with few records in the state of São Paulo (Scalon et al. 2002; Rabuske-Silva 2018). *Valeriana scandens* is widely distributed in America, with widespread occurrence throughout the Atlantic Forest Domain and irradiation center in Central America (Bell et al. 2012).

Category of Threat—We recommend the new species to be Critically Endangered (CR) according to IUCN (2017) categories and criteria B1b(i,ii,iii). Its area of occupation (AOO) is 1.750 km^2 and the extent of occurrence (EOO) is ca. 126.260 km^2. Although the area in which it occurs is included in a conservation unit (Caparaó National Park), the habitat is endangered by the narrow extent of occurrence. Until now, the species has not been recorded outside the conservation unit, probably due to the historical anthropogenic conversion of the surrounding mountain slopes.

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AUTHOR CONTRIBUTIONS

All authors contributed equally to the present article, C.R.S. being supervised by J.R.V.I. and M.S.

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Appendix III – Flora de Santa Maria: Caprifoliaceae

This article was submitted in Portuguese to the Flora de Santa Maria book project.

Rabuske-Silva, C. & Iganci, J.R.V. (2020) Caprifoliaceae. *In*: Essi, L. *et al.* (Ed.) Flora de Santa Maria. Vol. 1 [Unpublished].

CAPRIFOLIACEAE JUSS.

Cassio Rabuske da Silva & João Ricardo Vieira Iganci

Ervas, subarbustos, arbustos ou lianas, anuais ou perenes. Folhas opostas, as basais geralmente decíduas, sem estípulas interpeciolares. Inflorescências em tirsos. Flores vistosas, actinomorfas a zigomorfas, tubulosas, brancas, cremes ou róseas, por vezes com brácteas supranumerárias na base do ovário; cálice pentâmero, geralmente reduzido a pequenos dentes persistentes ou decíduos; corola pentâmera, infundibuliforme a campanulada, normal ou ligeiramente bilabiada, com 5 lobos imbricados correspondentes às pétalas, o tubo com uma giba ou pequena espora na porção abaxial; estames 4–5, insertos no tubo da corola; gineceu com pistilo simples e estigma capitado, discóide; ovário ínfero. Fruto do tipo cápsula septicida, drupa ou aquênio.

Caprifoliaceae (*sensu* HOFMANN & BITTRICH, 2016) possui 13 gêneros e ca. 230 espécies distribuídas principalmente em regiões temperadas do hemisfério norte. No Brasil é representada somente por espécies cultivadas como ornamentais, especialmente dos gêneros *Abelia* R. Br., *Lonicera* L., e *Weigela* Thunb., conhecidas respectivamente por abélia, madressilva e veigela. As espécies mais comuns em jardins e praças são *Abelia* x *grandiflora* (Rovelli ex André) Rehder, eventualmente com folhas de duas a três cores em sua forma variegada; *Lonicera japonica* Thunb., uma liana lenhosa de flores brancas a cremes, bastante aromáticas; e *Weigela florida* (Bunge) A. DC., um arbusto de flores róseas que dispõe de muitas variedades (HOFFMAN, 2008). A única espécie com ocorrência espontânea no Brasil, inclusive em Santa Maria, é *Lonicera japonica* Thunb., espécie exótica invasora, nativa da Ásia (REHDER, 1903; RIO GRANDE DO SUL, 2013). O gênero *Scabiosa* L., eventualmente incluído em Caprifoliaceae (*sensu* APG IV), também apresenta uma espécie com ocorrência espontânea no território nacional (*S. atropurpurea* L.), até o momento não registrada no município de Santa Maria.

Lonicera japonica **Thunb.**

Fig. 1.

Erva trepadeira lenhosa. Folhas opostas, elípticas, as basais lobadas e as distais inteiras, verde-escuras, apiculadas, sem estípula interpeciolar. Flores pentâmeras (5-lobadas), zigomorfas, tubulosas e labiadas, pubescentes, brancas a cremes, com 5 estames curvos e estigma capitado.

Frutos bagas escuras com numerosas sementes. É cultivada como ornamental devido a suas flores exuberantes e aromáticas, de onde se alastra para áreas naturais, ocorrendo esparsamente em bordas de matas e beiras de estrada da região.

Nomes populares: madressilva.

Espécime testemunho: Rio Grande do Sul: Santa Maria, 5 novembro 1949, *G.Rau s.n.* (SMDB 567).

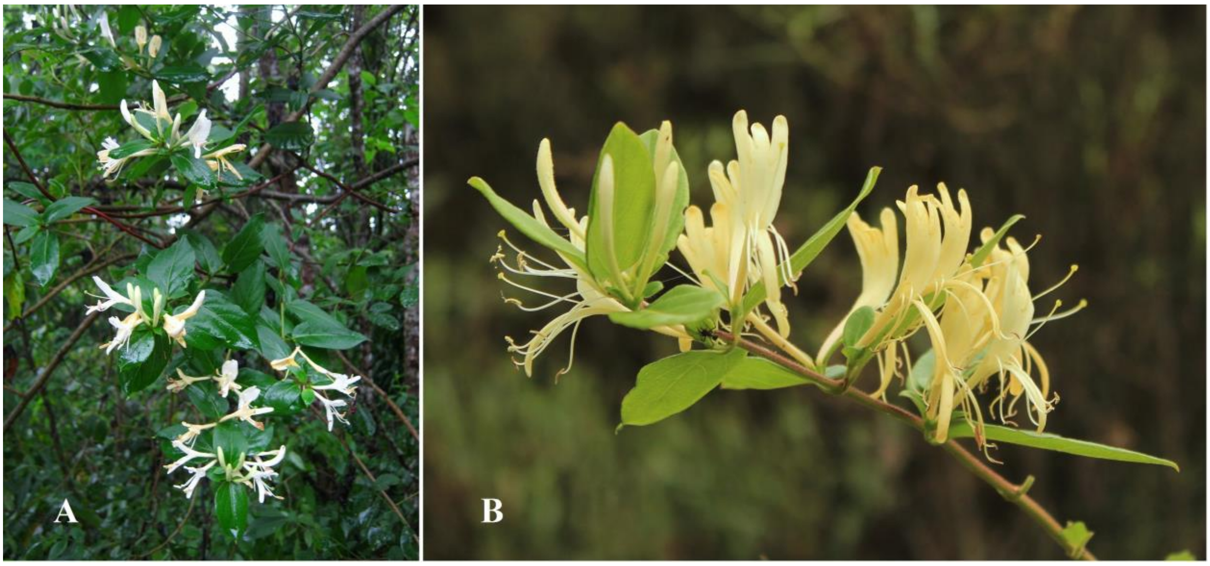

Figura 1: *Lonicera japonica*. A. Hábito; B. Detalhe do ramo. Fotos: Cassio Rabuske da Silva.

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Appendix IV – Flora de Santa Maria: Valerianaceae

This article was submitted in Portuguese to the Flora de Santa Maria book project.

Rabuske-Silva, C. & Iganci, J.R.V. (2020) Valerianaceae. *In*: Essi, L. *et al.* (Ed.) Flora de Santa Maria. Vol. 1 [Unpublished].

VALERIANACEAE BATSCH.

Cassio Rabuske da Silva & João Ricardo Vieira Iganci

Ervas, subarbustos ou arbustos, raramente lianas, anuais ou perenes. Raízes axiais, com raízes secundárias filiformes ou engrossadas, napiformes ou fusiformes. Ramos circulares a quadrangulares, estriados, frequentemente fistulosos, eretos a decumbentes, eventualmente rizomatosos em fenofases jovens, herbáceos ou lenhosos. Folhas opostas, decussadas, sem estípulas interpeciolares, inteiras, pinatissectas, pinatífidas, pinatilobadas ou pinadas, rosetadas a subrosetadas, eventualmente ericoides ou carnosas, glabras ou com tricomas simples a glandulares. Inflorescências em tirsos ou pleiotirsos, indeterminadas, laxas ou bastante congestas, bracteadas. Flores epíginas, monóicas, dióicas ou frequentemente ginodióicas, pentâmeras, zigomorfas, brancas, cremes, amarelas ou róseas; cálice 5-lobado, gamossépalo, bastante reduzido e persistente no topo do fruto, denteado, anelar ou desenvolvido em pápus cerdoso, frequentemente vestigial; corola 3–5-lobada, campanulada ou infundibuliforme, tubo giboso com tecido nectarífero associado; estames 1–4(–5), geralmente insertos no tubo da corola, com anteras tetrasporangiadas, raramente bisporangiadas; ovário ínfero, trilocular, com somente um lóculo fértil portando um óvulo pêndulo e anátropo, os outros dois lóculos estéreis; gineceu com estilete filiforme, estigma 2–3-lobado. Fruto aquênio.

Valerianaceae possui 5–6 gêneros e aproximadamente 400 espécies, distribuídas principalmente em regiões temperadas do hemisfério norte e da América do Sul (especialmente nos Andes), ausentes somente na Austrália e na Polinésia (KUTSCHKER, 2011; WEBERLING & BITTRICH, 2016). No Brasil ocorre somente o gênero *Valeriana* L. com 15 espécies atualmente reconhecidas, principalmente em campos de altitude das regiões Sul e Sudeste (BORSINI 1962; RABUSKE *et al.* 2016). Em Santa Maria são registradas três espécies: *V. polystachya* Sm., *V. reitziana* Borsini e *V. scandens* L. O odor fétido característico do gênero se deve à presença de iridóides (valepotriatos) e é produto da degradação do ácido isovalérico (CRONQUIST, 1981; WEBERLING & BITTRICH, 2016). O uso medicinal (sedativo) de diversas espécies é amplamente relatado na literatura.

Chave para a identificação de espécies da família Valerianaceae em Santa Maria

1. Herbáceas lianescentes; frutos com cálice cerdoso……………………..*Valeriana scandens*
1’. Herbáceas com ramos eretos ou decumbentes; frutos com cálice vestigial……...………..2

2. Folhas pinatissectas; frutos oblongos, pubescentes, 3-costados……..……....*V. polystachya*

2’. Folhas inteiras, no máximo com um par de lobos basais; frutos globosos, glabros, 3-costados..…………………………………………………………………...……...*V. reitziana*

1. ***Valeriana scandens*** **L.**

Fig. 1, a–b.

Erva trepadeira perene. Ramos ascendendo até 1.5 m sobre a vegetação. Plantas com marcante heterofilia, com folhas inteiras ou lobadas, cordadas a sagitadas, geralmente trilobadas, podendo apresentar ampla variação na forma das folhas em um mesmo indivíduo ou folhas isomórficas. Inflorescências em tirsos de até 60 cm compr. com eixos secundários dicotomicamente ramificados. Flores brancas, hermafroditas ou unisexuais, as maiores do gênero no Brasil, com 1.8–4.5 mm compr., a giba bem visível no tubo da corola (plantas monóicas-ginodióicas). Frutos piriformes com cálice persistente e desenvolvido em pápus cerdoso. Espécie de ampla distribuição na América do Sul, sendo a mais comum do gênero no Brasil e em Santa Maria. Ocorre em bordas de mata e em áreas sob distúrbio antrópico, requerendo certo grau de umidade.

Espécime testemunho: Reserva Biológica do Ibicuí-Mirim, à direita da barragem Saturnino de Brito, Santa Maria, *O.Bueno 5326*, 15 março 1988 (HAS 23985).

2. ***Valeriana polystachya*** **Sm.**

Fig. 1, c–d.

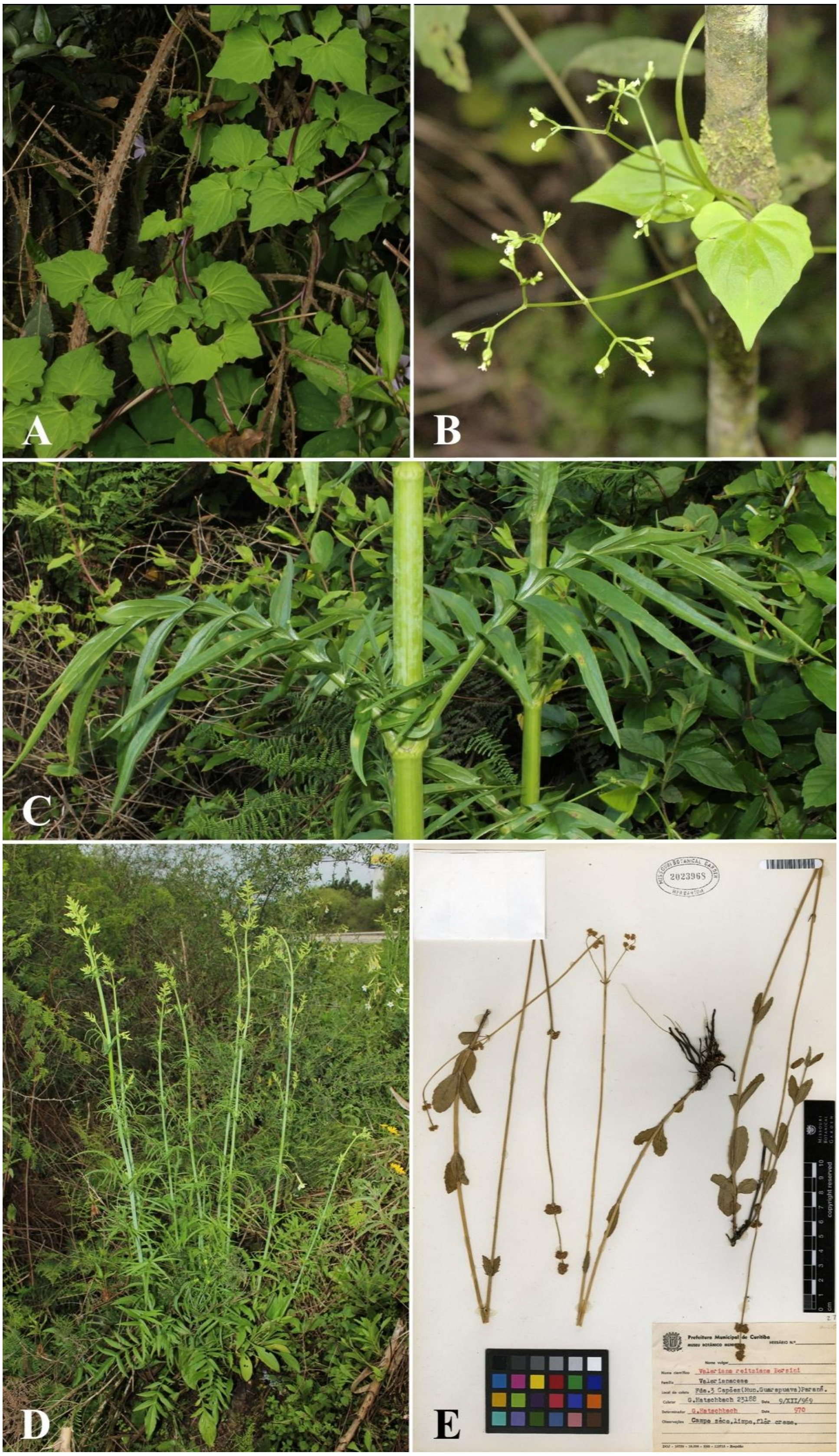
Erva ereta de até 2.5 m de altura, com caule rizomatoso. Ramos aéreos herbáceos e anuais, fistulosos, estriados, de até 11 mm de diâmetro. Plantas glabras, exceto por tufos de tricomas 0.1–0.3 mm nos nós dos ramos aéreos, na base dos lobos das folhas distais e eventualmente dispersos nas lâminas foliares e frutos. Folhas basais e distais marcadamente distintas; folhas basais simples, elípticas, bordo inteiro a denteado; folhas distais pinatissectas a pinatilobadas, os lobos (6–)8–14 pares, linear-lanceolados, falciformes. Inflorescências em tirsos compostos por dicásios cimosos helicoidais com eixo principal de 24–50(–102) cm compr. Flores brancas, campanuladas, as hermafroditas com 1.2–1.8 mm compr. e estames subexsertos, as estaminadas notavelmente menores, com 0.3–0.5 mm compr. (plantas ginodióicas). Frutos oblongos, 5-costados, pubescentes, com cálice vestigial. Espécie com ampla distribuição no bioma Pampa, ocorrendo na Argentina, no Uruguai e no Brasil, onde é restrita ao estado do Rio Grande do Sul. Ocorre em populações densas de centenas a milhares de indivíduos (valerianais). Espécie associada a ambientes úmidos com ocorrência eventual em solos bem drenados, sendo frequente ao longo das faixas de domínio da região, onde apresenta comportamento ruderal.

Espécime testemunho: Margem da BR 287, Santa Maria, *Rabuske 146*, 29 novembro 2016 (ICN 187695).

3. ***Valeriana reitziana*** **Borsini**
Fig. 1, e.

Erva ereta de até 0.5–0.9 m de altura, com caule rizomatoso, xilopodífero, ca. 10 mm de diâmetro. Ramos aéreos herbáceos e anuais, estriados, com tricomas esparsos ou reunidos em estrias dos entrenós e em tufos nos nós. Folhas basais e distais levemente distintas, glabras a pubescentes; folhas basais obovadas, sésseis, com ápice truncado e irregularmente denteado; folhas distais simples, elípticas, lanceoladas ou lanceolado-obovadas, de até 70 mm compr., por vezes com um par de lobos basais, bordo serreado com 3-6 pares de dentes. Inflorescência em tirsos compostos por eixos secundários glomeruliformes. Flores brancas, estaminadas ou pistiladas (plantas dióicas). Frutos globosos, 3-costados, glabros, com cálice vestigial. Espécie restrita aos campos de altitude do sul do Brasil (Rio Grande do Sul, Santa Catarina e Paraná). No Rio Grande do Sul, ocorre principalmente na região dos Campos de Cima da Serra. A ocorrência em Santa Maria é bastante rara, sendo a mais disjunta em relação às populações do nordeste do planalto.

Espécime testemunho: Reserva Biológica do Ibicuí-Mirim, Campo dos Barcelos, Santa Maria, *O.Bueno 5991*, 08 novembro 1990 (HAS 29521).



Prefeitura Municipal de Curitiba
MUSEU BOTÂNICO MUNICIPAL
HERBÁRIO N.º
Nome vulgar
Nome científico Valeriana reitziana Borsini
Família Valerianaceae
Local de coleta Fde.3 Capões(Mun.Guarapuava)Paraná.
Coletor G.Hatschbach 23188 Data 9/XII/969
Determinador G.Hatschbach Data 970
Observações Campo sêco,limpo,flôr creme.

Figura 1: Espécies de *Valeriana* com ocorrência em Santa Maria: *V. scandens* A. Hábito; B. Detalhe da inflorescência. *V. polystachya* C. Detalhe das folhas; D. Hábito. *V. reitziana* E. Hábito (*Hatschbach 23188*). Fotos: Cassio Rabuske da Silva.

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DOI 10.1007/978-3-319-28534-4