UNIVERSIDADE FEDERAL DE MINAS GERAIS
INSTITUTO DE CIÊNCIAS BIOLÓGICAS
Departamento de Botânica
Programa de Pós-Graduação em Biologia Vegetal

DAVID SANÍN ROBAYO

TAXONOMIC REVISION OF *SERPOCAULON* (POLYPODIACEAE), AND PHYLOGENETIC INFERENCE OF *SERPOCAULON TAYRONAE*

Tese apresentada ao Programa de Pós-Graduação em Biologia Vegetal do Departamento de Botânica do Instituto de Ciências Biológicas da Universidade Federal de Minas Gerais, como requisito parcial à obtenção do título de Doutor em Biologia Vegetal.

Área de Concentração Morfologia, Sistemática e Diversidade Vegetal.

BELO HORIZONTE – MG

2020

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Orientador: Prof. Dr. ALEXANDRE SALINO
Universidade Federal de Minas Gerais

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Criolo

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INTRODUÇAO GERAL

TAXONOMIC REVISION OF *SERPOCAULON* (POLYPODIACEAE), AND PHYLOGENETIC INFERENCE OF *SERPOCAULON TAYRONAE*

David Sanín

ABSTRACT

This doctoral dissertation focus on the taxonomic and systematic revision of *Serpocaulon* A.R. Sm., a fern genus that was originally described with 40 species. It is an important fern flora element from the premontane and montane forest of the Neotropics. The genus is characterized by long-creeping (predominantly) rhizomes, clathrate scales, and veins regularly anastomosing (goniophlebioid), the areoles chevron-shaped and with a single, free, included veinlet. Its taxonomy is difficult for several reasons: many names are unclear due to incomplete types and protologues; there is a lack of collections from some regions of the Neotropics; there is great morphological variation within some taxa 'complexes', such as those with *S. catharinae*, *S. eleutherophlebium*, *S. fraxinifolium*, *S. lasiopus*, *S. loriceum* and *S. triseriale*; and finally for the possible hybridization that can obscure species boundaries. A morphological analysis was performed from the study of 2167 specimens deposited in 41 herbaria or collected during field trips made in Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador and Peru. In the same way, the controversial circumscription of *Serpocaulon tayronae* was explored by the phylogenetic inference of two cpDNA markers from a data set of 99 species of Polypodiaceae. As a result of this dissertation, 37 species and five hybrids are now recognized in *Serpocaulon*. From these species, *S. australe* D. Sanín, J.C. Ospina, I.O. Moura & Salino and *S. psychotrium* Mostacero, D. Sanín & A.R. Sm., are described as new. *Serpocaulon demissum* (Fée) D. Sanín is proposed as a new combination. One new hybrid status is here proposed, *S.* ×*semipinnatifidum* (Fée) D. Sanín, and a new hybrid is described, *S.* ×*tabuleirense* D. Sanín & Salino. On the other hand, nomenclatural and chorological results listed 259 names that were found. From these, 75 names were lectotypified (first step 41, second step 34), two neotypes were designated. Moreover, 19 names are newly synonymized, five species were excluded, 24 names were considered as *nomina dubia* and five as *nomina nuda*. The geographic distribution of 27 species was expanded, as well as the elevational range of the genus (0 to 4200 m). The Andes of Ecuador and Colombia are the main center of diversity and the Atlantic Rain forest of Brazil is the center of endemism with three

restricted species (*S. demissum*, *S. glandulosissimum* and *S. meniscifolium*). A taxonomic key, descriptions and taxonomical discussions, local names, uses, illustrations, photographs of the plants in the field, micro-photographs of the spores, and distribution maps of the species are provided in the Chapter 1. In the molecular phylogeny obtained, *Serpocaulon tayronae* was nested in the Pruinose clade of *Campyloneurum*. Morphologically, the long-creeping rhizomes with spreading rhizome scales that have auriculate bases and isodiametric cells are characters that it shares with the Pruinose clade. The new combination *Campyloneurum tayronae* (D. Sanín) D. Sanín is provided in the Chapter 2.

Keywords: *Campyloneurum,* ferns, morphology, nomenclature, molecular phylogeny, Tropical America.

RESUMO GERAL

Esta tese de doutorado lida com a revisão taxonômica do gênero de samambaias *Serpocaulon* A.R. Sm, um gênero de samambaias que foi descrito originalmente com 40 espécies reconhecidas. Esse é um importante elemento da flora de samambaias de bosques premontano e montano do neotrópico. O gênero se caracteriza pelos rizomas longamente reptantes (predominantemente), escamas clatradas com nervuras anastomosadas (gonioflebioides) que apresentam aréolas com forma chevroide e cada uma com uma vênula livre incluída. A sua taxonomia é difícil por vários razões: muitos nomes não são claros devido a os tipos e protólogos incompletos; a ausência de coleções em algumas regiões dos Neotropicos; existe uma grande variação morfológica dentro de alguns táxons "complexos" como *S. catharinae*, *S. eleutherophlebium*, *S. fraxinifolium*, *S. lasiopus*, *S. loriceum* e *S. triseriale*; e finalmente, pela possível hibridização que oculta os limites das espécies. Uma análise morfológica foi desenvolvida em 2167 espécimes depositadas em 41 herbários, ou coletadas em viagens de campo realizados em Argentina, Bolívia, Brasil, Colômbia, Costa Rica, Equador e Peru. Da mesma forma, a controversa circunscrição taxonômica de *Serpocaulon tayronae* foi explorada pela inferência filogenética de dois marcadores plastidiais através de uma matriz de dados com 99 espécies de Polypodiaceae. Como resultados taxonômicos e sistemáticos desta tese, 37 espécies e cinco híbridos são reconhecidos in *Serpocaulon*. Dessas espécies, *S. australe* D. Sanín, J.C. Ospina, I.O. Moura & Salino e *S. psychotrium* Mostacero, D. Sanín & A.R. Sm. são descritas como novas. *Serpocaulon demissum* (Fée) D. Sanín é proposta

como uma combinação nova. Um novo status híbrido e proposto aqui, *S.* ×*semipinnatifidum* (Fée) D. Sanín, e um novo híbrido é descrito, *S.* ×*tabuleirense* D. Sanín & Salino. Por outro lado, os resultados nomenclaturais e corológicos listam 259 nomes que foram encontrados. Deles 75 foram lectotipificados (41 como primeiro passo, 34 como segundo passo), dois neótipos foram designados. Ademais 19 nomes foram sinonimizados, cinco espécies foram excluídas, 24 nomes são considerados como *nomina dubia* e cinco como *nomina nuda*. A distribuição geográfica de 27 espécies foi expandida em países diferentes, assim como a amplitude atitudinal do gênero (0 ate 4200 m). Os Andes do Equador e da Colômbia são os principais centros de diversidade, e a Mata Atlântica do Brasil é o centro de endemismo, com três espécies restritas (*S. demissum*, *S. glandulosissimum* e *S. meniscifolium*). Uma chave de identificação, descrições e discussões taxonômicas, nomes locais, usos, ilustrações, fotografias das plantas no campo, microfotografias dos esporos e mapas da distribuição das espécies são fornecidos no Capítulo 1. Na filogenia molecular obtida, *Serpocaulon tayronae* foi agrupado no clado Pruinose de *Campyloneurum*. Morfologicamente, as escamas do rizoma patentes, que possui bases auriculadas e células isodiamétricas são caracteres que se compartilham com o clado Pruinose. A nova combinação *Campyloneurum tayronae* (D. Sanín) D. Sanín é proposta no Capítulo 2.

Palavras chave: *Campyloneurum,* samambaias, morfologia, nomenclatura, filogenia molecular, América Tropical.

GENERAL INTRODUCTION

Serpocaulon A.R. Sm. (Polypodiaceae) was described from the segregation of *Polypodium* L., based on the molecular phylogenetic analyses of four plastid regions that supported it's monophyly (Smith et al., 2006) and the circumscription of 40 species. The genus is characterized by long-creeping rhizomes, clathrate scales, and regularly anastomosing (goniophlebioid) veins, the areoles chevron-shaped and with a single, free, included veinlet (Smith et al., 2006).

The genus is neotropical, with some species occurring in subtropical regions of South America (Chapter 1). Most of the species exhibits distribution on mountain habitats, especially the Andes, home of nearly three-fourths of the species (Smith et al., 2006; Labiak & Prado, 2008; Sanín, 2018).

The first taxonomic revision of *Serpocaulon* was done by Hensen (1990), who recognized 23 species in the so called '*Polypodium loriceum* complex', presented a phylogenetic hypothesis based on morphology, and included distribution maps, SEM photos of the spores and diaphanization images of the pinnae or segments for some species. Additionally, the author presented 36 new synonyms and clarified typifications for several names. Nevertheless, Moran (1990) considered that Hensen's revision had serious problems: 1. Too few herbaria were consulted, 2. Infraspecific names were not accounted for. 3. Representative specimens, with locality data, were not cited. 4. Too many species that seem distinct to Moran were lumped. Leaving in evidence, the lack of taxonomic, nomenclatural, and systematic work to be done.

The area that is dealing in this study is the Neotropics, geographic region described by Morrone (2014). Correspond to the tropical area of America, in most of South America, Central America, southern and central Mexico and the Antilles. According to the author, this territory extents from 30º N to 45º S. Nevertheless, records of the herbaria consulted here goes from 25º N and 40º S, from the south of Mexico and north of Antilles to the center of Argentina, and only excluding Chile.

Concerning the study area, there are taxonomic revisions available for some countries, as well as checklists and florulas, where in most cases the species were treated as *Polypodium*. For Mexico, Mickel and Beitel (1988) registered three species for Oaxaca. Later, Mickel and Smith (2004), recognized four species for the whole country, including the only known record of *Serpocaulon fraxinifolium* for Mexico. In Flora de Nicaragua, Gómez and Arbeláez (2009) recognized 10 species and recorded misconceptions for some taxa, such as *S. articulatum*, *S. falcaria*, and others. Stolze (1981) recorded five species for the flora of Guatemala. Lellinger (1989) presented 11 species for Costa Rica, Panama and the Colombian Chocó. Moran (1995) recognized 13 species of the *Polypodium loriceum* group in Flora Mesoamericana, and suggested that the center of diversity of this group is the Andes. A similar record of 13 species was presented by Correa et al. (2004) for Panamá.

In the Antilles, Proctor (1985) recorded four species for Jamaica, three for Puerto Rico and the Virgin Islands (Proctor, 1989), and presented important typifications.

In South America, Sanín (2014; 2015) and Sanín and Torrez (2014) described two species and a hybrid from Colombia. *Serpocaulon obscurinervium* D. Sanín is here considered as synonym of *S. concolorum*, whereas *S. tayronae* presents a controversial circumscription (Almeida et al., 2017)

when compared to other species of *Polypodium* with ascending segments and free veins (Sanín, 2015; Chapter 2). Later, Sanín (2018) presented a taxonomic treatment for the 27 taxa registered in Colombia. Between the taxonomic, nomenclatural, and chorological novelties that the author presented, it is possible to account one new species described (*Serpocaulon antioquianum*), one new synonym and one new record for the country. Considering that 65% of the total diversity of the genus inhabit Colombia, Sanín (2018) stands as the most comprehensive treatment for the genus so far. Smith (1995) recognized 11 species in Venezuelan Guayana, whereas Funck et al. (2007) listed 13 species for the Guiana Shield. While in Ecuador, Smith (1983) cited 18 species. Tryon and Stolze (1993) cited only 12 species for Peru (including a broad species concept for *P. loriceum*). In Bolivia, the later contribution was made by Smith et al. (2018), who listed 21 species for that country. Finally, for Argentina, Sanín et al. (2019a) published a new species, *S. australe*, which was segregated from the reinterpretation of *S. gilliesii*, derived in the record that stated the existence of five species in that territory (Sanín et al. 2019a; 2019b).

Brazil deserves special attention, not only because it represents the main center of endemism of *Serpocaulon*, but also for the taxonomic complexity that is illustrated by the literature (Langsdorff & Fischer, 1810; Raddi, 1819; Brade, 1935, 1951; Sehnem, 1970; Pichi-Sermolli & Bizzarri, 2005; Labiak & Prado, 2008; Schwartsburd & Smith, 2013; Sanín & Salino, 2018, 2020). Where with the exception of Langsdorff and Fischer (1810), Brade (1951), Sanín and Salino (2018; 2020), most of the contributions mentioned above published names that are here considered synonyms.

Although those contributions represent an important improvement in the knowledge and comprehension of the genus, there are still problems in our understanding of the species and their taxonomic boundaries. This has been pointed out by several authors, who suggested the necessity for a modern taxonomic revision of the group (Moran, 1990, 1995; Smith et al., 2006; Kreier et al., 2008; Labiak & Prado, 2008; Schwartsburd & Smith, 2013; Sanín, 2018; Smith et al., 2018).

The current contribution deals with these concerns, presenting the taxonomic revision of the fern genus *Serpocaulon* in the Chapter 1, and exploring the phylogenetic and systematic circumscription of *Serpocaulon tayronae* in Chapter 2.

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Polypodium loriceum L. from C. Plumier (1705) in Traite dês Fougeres de L"Ameriique

CAPÍTULO 1

CAPÍTULO 1.

TAXONOMIC REVISION OF *SERPOCAULON* (POLYPODIACEAE)

Revisão a ser submetida para a revista Annals of the Missouri Botanical Garden

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ABSTRACT

A taxonomic revision of *Serpocaulon* A.R. Sm. (Polypodiaceae), a tropical American fern genus is here presented. Our work is based on the morphological analysis of 56 characters recorded from 2167 specimens deposited in 41 herbaria. Field trips were carried out in Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador and Peru, where valuable observations on the habit and habitat of several species were made. Digital images were also consulted. A total of 259 names were found and their nomenclatural types were studied, resulting in the lectotypification of 75 names (first step 41, second step 34 names) and the designation of two neotypes. We recognized 37 species and five hybrids in *Serpocaulon*, one of the hybrids is here provided with a new status (*S.* ×*semipinnatifidum* (Fée) D. Sanín) and another one is described (*S.* ×*tabuleirense* D. Sanín & Salino). Moreover, 19 names are newly synonymized, five species are excluded, 24 names are considered as *nomina dubia* and five as *nomina nuda*. Twenty-seven species expand its distribution in different countries, as well as the elevational range of the genus (0 to 4200 m). The Andes of Ecuador and Colombia are the main center of diversity and endemism, and then, the Atlantic Rain forest of Brazil with three restricted species (*S. demissum*, *S. glandulosissimum* and *S. meniscifolium*). A taxonomic key, descriptions and taxonomical discussions, local names, uses, illustrations, photographs of the plants in the field, micro-photographs of the rhizome scales and the spores, and distribution maps of the species are provided.

Keywords: Lectotypifications, new synonyms, morphology, Neotropics, nomenclature, *Polypodium*, Polypodiineae, taxonomy.

Serpocaulon A.R. Sm. is one of the genera of Polypodiaceae restricted to tropical America (Smith et al., 2006, PPG I, 2016). It was originally described with 40 species segregated from *Polypodium* (Smith et al., 2006). Morphologically, it is characterized by long-creeping rhizomes (short-creeping in some species) clathrate rhizome scales, regularly anastomosing veins (the areoles with a single, free included veinlet), and non-paraphysate sory (Smith et al., 2006).

The genus is distributed from southern Mexico and the Antilles to central Argentina and eastern Brazil. Most of the species occur in the humid forests of the Andes, with several species restricted to that region. The Atlantic rain forest eastern of Brazil is also a center of diversity, as well as Central America.

The monophyly of *Serpocaulon* has been supported by many molecular phylogenetic studies. Schneider et al. (2004) recovered a well-suported clade of eight species, the *Polypodium triseriale* clade, using the DNA regions *rbcL, rps4 and rps4-trnS.* Smith et al. (2006) included molecular data from 15 additional species and provided a more comprehensive phylogenetic hypothesis, based on the named regions and *trnL-F.* This study also included data from previously sequenced species, recovering a clade of 22 species that could be readily separated from other subclades within Polypodiaceae. This result prompted the authors to provide a formal description for *Serpocaulon*, as well as the new combination provided. Kreier et al. (2008) subsequently sampled 31 out of the 40 species that were originally recognized by Smith et al. (2006). They corroborated the monophyly of the genus and presented an interesting hypothesis on the biogeographic history of *Serpocaulon*, suggesting that the genus originated in the Bolivian-Brazilian region and indicated a major role of the Bolivian Andes as a stepping-stone in the colonization of norther regions of the Andes. However, this hypothesis might be biased because there has been an oversampling of Bolivian specimens in that study (ca. 50% of the samples came from Bolivia). Moreover, some of the names that were used in that study are actually synonyms or misidentifications (pers. obs.) and several species were not recovered as monophyletic.

Many authors have mentioned the need of an exhaustive taxonomic revision for this group (Moran, 1990, 1995; Smith et al., 2006; Labiak & Prado, 2008; Kreier et al., 2008; Schwartsburd & Smith, 2013; Sanín, 2018). Hensen (1990) attempted a revision of the *Polypodium loriceum* group (which basically corresponds to *Serpocaulon*) based on morphological characters, and several new species have been described o combined since then (Labiak & Prado, 2008; Rojas-Alvarado & Chaves-Fallas, 2013; Schwartsburd & Smith, 2013; Chaves-Fallas et al., 2015; Sanín, 2015; 2018; Sanín & Torrez, 2014; Sanín & Salino, 2020; Sanín et al., 2019a). Smith et al. (2006) recovered four main linages within the genus and discussed them as clades. *Serpocaulon triseriale* was strongly supported as sister to the remaining 21 species of the genus in that study. The other three clades were composed by one, four, and thirteen species. These groups contrast with the morphology of the species, not only regarding macro-morphological characters, but also for differences in the spores. In addition, they are not consistent with the species morphology, or are superfluous as the distribution of the rhizome scales which depends on the maturity of the rhizome evaluated, or uninformatives as the presence of clathrate rhizome scales.

Smith et al. (2006) suggested several trends in the morphological evolution of *Serpocaulon*, such as the reduction in rhizome diameter, reduction of scale number and size, and increasing dissection of the laminae. The authors stressed that the species from the lowermost branches of their phylogenetic tree, have a preference for low elevations, while the more derived species tend to grow at middle to high elevation in the Andes.

The main objectives here treated are 1) to determine the number of species within this group and provide diagnostic description of each taxon; 2) to identify morphological characters that allow the separation of these taxa; 3) to provide a dichotomous key for all species of *Serpocauon*, as well as drawings and photographs for each species; 4) to carry out a nomenclatural revision involving all the names related to the taxa studied; 5) to present a list of vernacular/indigenous names, as well as registered information of their use; 6) to describe some of the hybrids that have been recorded in hybrids zones or in the literature; 7) to update the knowledge of the habitat and distribution range of each taxa.

MATERIALS AND METHODS

BIBLIOGRAPHY CONSULTED

A revision of the bibliography related with the genus diversity and taxonomy (floras, checklist, taxonomic treatments) was performed. Original description of all names cited in previous taxonomic treatments were studied. Some protologues, images and historical facts were retrieved from Biodiversity Heritage Library (www.biodiversitylibrary.org), the Digital Library of the Real Jardín Botánico de Madrid (https://bibdigital.rjb.csic.es), Hassler & Schmit (http://worldplants.webarchiv.kit.edu/ferns/), IPNI (www.ipni.org), JSTOR (www.jstor.org), and TROPICOS (www.tropicos.org).

The literature and the records from the labels of the herbaria collections were compiled in order to present uses, indigenous and vernacular names, and the taxonomic history.

TAXON SAMPLING

Herbarium specimens, including types of all names related to *Serpocaulon* species (i.e. *Goniophlebium, Marginaria* and *Polypodium*) from the following 41 herbaria were studied: BHCB, BR, CAUP, CESJ, CHOCO, COHA, COL, COR, CR, CUVC, F, FAUC, FMB, HUA, HUQ, INB, IPA, L, LP, MBM, MEDEL, MO, NY, OUR, PSO, Q, QCA, QCNE, QLPS, R, RB, SI, SP, TOLI, UC, UFP, UPCB, UPS, US, USM, and VIC (following Thiers, 2020). In addition, the type specimens from the online databases of JSTOR Global Plants (plants.jstor.org) and the online catalogs of JACQ (https://herbarium.univie.ac.at/database/search.php), REFLORA (www.reflora.jbrj.gov.br), World Ferns (http://worldplants.webarchiv.kit.edu/ferns/) and the following virtual herbaria: AAU (www.aubot.dk/search_form.php), B (ww2.bgbm.org/herbarium/default.cfm), BM (www.nhm.ac.uk/research-curation/scientific-resources/collections/botanical-collections/index.html), COL (www.biovirtual.unal.edu.co/en/collections/search/plants/), KEW (http://apps.kew.org/herbcat/gotoHomePage.do), NY (http://sweetgum.nybg.org/science/vh/), P (https://science.mnhn.fr/institution/mnhn/collection/p/item/search/form?lang=en_US), S (http://herbarium.nrm.se/search/species/) and US (https://collections.nmnh.si.edu/search/botany/) were consulted. A set of photos from the

herbaria PORT, MERF, MY, U, VEN, UCOB, and UPS, was kindly provided by J. Mostacero (VEN), and M. Hjertson (UPS).

Field trips were conducted to record ecological information about the species, observe reproductive and vegetative features, verify type localities, take pictures of the species and herborize material to study. Samples were collected in Bolivia (La Paz province, 2015), Brazil (Bahia, Espírito Santo, Minas Gerais, Paraná, Pernambuco, Rio de Janeiro, and São Paulo states, in 2010 and 2016 to 2020), Colombia (Antioquia, Boyacá, Caldas, Caquetá, Cauca, Chocó, Cundinamarca, Huila, Quindio, Risaralda, Magdalena, Nariño and Valle del Cauca departments, from 2006 to 2020), Costa Rica (Cartago, Guanacaste, Heredia, Puntarenas, and San José provinces, 2011), Ecuador (Pichincha province, 2018) and Peru (Huamanga and Lima provinces, 2018). The material herborized during these field trips was deposited in BHCB, COAH, COL, CUVC, F, FAUC, HUA, HUQ, LPB, NY, PSO, RB, SP, TOLI, and USM.

This revision is based on the morphological analysis of 56 characters (Figures 2–3, 5–10, 12–20) recorded from 2167 specimens deposited in the mentioned herbaria. A database was created to record each studied specimen. Additionally, a database was built with photos of type specimens, and their respective protologues, as well as photos of all the specimens studied.

The morphological terms follow Lellinger (2002), Rödl-Linder (1990), Moran (1995), Sanín (2018), and Sanín et al. (2019a) for macro-morphological characters, and Lellinger (2002), Ramírez-Valencia et al. (2013), and Ramírez-Valencia & Sanín (2016) for the spores. Morphological measurements were taken only from mature (fertile) plants, focusing in features as middle portion of the rhizome (avoiding the apex and/or phylopodies), and middle pinna/segment. However, laminar scales, sporadically appear in the apex of the laminae, reason why, only the first or second pinna/segments were strictly evaluated in each specimen. In the case of *S. levigatum* (the only species with simple laminae), middle portions of the rhizome and laminae were evaluated.

TYPIFICATION AND NOMENCLATURAL ASPECTS

A thorough search for all names that have ever been placed in *Serpocaulon*, *Polypodium*, *Goniophlebium*, or *Marginaria* was carried out. Their original descriptions, as well as all

their types were studied in order to ensure the correct application of names. All accepted names are presented in **bold** and synonyms in *italics*.

Type images are labeled as (image). An exclamation mark (!) means that digital images or type specimens were studied. In the '*Representative specimens'*, the exclamation mark indicates which specimens were actually studied. When a specimen is represented by a fragment, the word (frag.) is included. In F, NY and RB, photos of type specimens from other herbaria were studied, and for those cases the word 'photo' was included. The barcode number of type specimens is indicated with [bc] and is located between the herbaria abbreviations and the barcode number.

Issues related to nomenclature are explained under '*Taxonomic and nomenclatural notes*' after the morphological description of each species, in the taxonomic treatment. The International Code of Nomenclature for algae, fungi, and plants (ICN) (Turland et al., 2018) was followed. The second-step lectotypes were designated following the Art. 9.17, when two or more specimens were at the same collection, or if the first lectotypification author did not indicate clearly a specimen. In addition, the recommendations of McNeill (2014) and Turland (2019) were followed to carry out lectotypifications. Finally, lectotypes were usually designated chosing the more complete and/or fertile specimens.

Some nomenclatural and taxonomic novelties presented in this thesis have already been published (Sanín, 2018; Sanín & Salino, 2018; 2020; Sanín et al., 2019a; 2019b) and this bibliography is indicated along with the novelty. Other novelties indicated in this contribution will be effectively published in works that are currently being prepared (Sanín et al., in prep. a; b; c; chapter 2) and are listed in the literature.

DISTRIBUTION

The distribution of each species is based on herbarium vouchers and compared with literature infromation. When citing specimens are provided in brackets, those geographic coordinates were not given on the original herbarium label. For such specimens, the coordinates were estimated from Google Maps (www.google.com/maps). The distribution maps are based on all the specimens studied and made with ArcMAC version 10.4 (2015). The boxplot showing elevational ranges in meters was generated with RStudio (RStudio Team, 2019).

SPECIES AND HYBRIDS CONCEPTS

The morphological species concept described by Haufler (1989) as 'groups whose boundaries are diagnosed by discontinuities in critical, qualitatively or quantitatively definable features of the available specimens' was considered for the species here proposed. For the hybrids, the concept of Rieseberg et al. (1993) is followed: 'hybrids are a mosaic of parental and intermediate characters rather than solely intermediate ones'.

MORPHOLOGICAL DESCRIPTIONS

The description of the genus *Serpocaulon* presented here considers the morphological characters presented in the species and hybrids cited. Descriptions of species and hybrids are representative of the species and hybrid concepts established in this contribution. In this sense, illustrations are presented to show diagnostic characters. A key with morphological characters were constructed to determine the species here recognized.

RESULTS

TAXONOMIC HISTORY

Serpocaulon was formerly included in *Polypodium* (Hensen, 1990), until Smith et al. (2006) supported its monophyly and diagnosed it morphologically and presented the new conbinations. Therefore, its taxonomic history is primordially linked to it.

First account on a *Serpocaulon* species was from Plumier (1705) who dessignated the polyname '*Polypodium radice subcaerulea et punctate*' (the *Polypodium* with cerulean and punctate rhizome) to a plant that later became the type of *P. loriceum* (= *S. loriceum*). This polyname probably described the strong pruinosity and the attached rounded rhizome scales covering the rhizome of this species. In that manuscript there is a line drawing of a complete plant, with pinnatisect laminae, areolate veins and long-creeping rhizome, which could represent the named species. Petiver (1712) reproduced Plumier's illustration, but the small size and the lack of details of this copy prevents an accurate identification of this species.

Based on the plate presented by Petiver (1712), Linnaeus (1753) described *P. loriceum*, which is a name that has been based applied for many different species since then. Subsequently, Linnaeus (1759) published *P. dissimile* (= *S. dissimile*), and Jacquin (1789) *P. fraxinifolium* (= *S. fraxinifolium*), finishing a three species series from the 18th century (Table 1).

Table 1. Chronological description of the species of *Serpocaulon*.

No.	Basionyms	Year of publication	Type collector	Collection year	Procedence
1	*Polypodium loriceum* L.	1756	*Plumier s.n.*	s.d.	Martinique
2	*Polypodium dissimile* L.	1759	*Anonymous s.n.*	s.d.	Jamaica
3	*Polypodium fraxinifolium* Jacq.	1789	*N.J. von Jacquin s.n.*	s.d.	Cultivated, originally collected in Venezuela
4	*Polypodium triseriale* Sw.	1800 [1801]	*Anonymous s.n.*	s.d.	Oriental Indies
5	*Polypodium levigatum* Cav.	1802	*L. Née s.n.*	s.d.	Ecuador
6	*Polypodium attenuatum* Humb. & Bonpl. ex Willd.	1810	*A. von Humboldt & A. Bonpland s.n*.	s.d.	Venezuela
7	*Polypodium catharinae* Langsd. & Fisch.	1810	*G.H. Langsdorff 12*	s.d.	Brazil
8	*Polypodium latipes* Langsd. & Fisch.	1810	*G.H. Langsdorff & L. Riedel 75*	s.d.	Brazil

9	*Polypodium menisciifolium* Langsd. & Fisch.	1810	*G.H. Langsdorff 15*	s.d.	Brazil
10	*Polypodium sessilifolium* Desv.	1827	*Anonymous s.n*	s.d.	Perú
11	*Polypodium polystichum* Link	1833	*J.H.F. Link s.n.*	s.d.	Cultivated, originally collected in Brazil
12	*Polypodium vacillans* Link.	1833	*Anonymous s.n.*	s.d.	Cultivated, originally collected in Brazil
13	*Polypodium dasypleuron* Kunze	1834	*Poeppig s.n*.	s.d.	Peru
14	*Goniophlebium articulatum* C. Presl	1836	*Anonymous s.n.*	s.d.	Unknown
15	*Polypodium falcaria* Kunze	1844	*H. Galeotti 6336*	1840	México
16	*Polypodium adnatum* Kunze ex Klotzsch	1847	*J.W.K. Moritz 353*	1846	Venezuela
17	*Polypodium lasiopus* Klotzsch	1847	*J.W.K. Moritz 256*	s.d.	Venezuela
18	*Polypodium richardii* Klotzsch	1847	*R. Schomburgk 1651*	1844	Guiana
19	*Goniophlebium eleutherophlebium* Fée	1850–1852	*N. Funck & L.J. Schlim 1102*	s.d.	Venezuela

20	*Polypodium funckii* Mett.	1857	*N. Funck & L.J. Schlim 963*	1846	Nueva Granada [Venezuela]
21	*Polypodium wagneri* Mett.	1864	*H. Wagner s.n.*	s.d.	Panama
22	*Polypodium patentissimum* Mett. ex Kuhn	1869	*R. Spruce 5713*	1869	Ecuador
23	*Goniophlebium demissum* Fée	1872	*A. Glaziou 5651*	1872	Brazil
24	*Polypodium nanegalense* Sodiro	1883	*A.L. Sodiro 10.06*	s.d.	Ecuador
25	*Polypodium subandinum* Sodiro	1893	*A. Sodiro s.n.*	1892	Ecuador
26	*Polypodium maritimum* Hieron.	1904	*E. Lehmann 5035*	s.d.	Colombia
27	*Polypodium ptilorhizon* H. Christ	1905	*L.C. Wercklé s.n.*	1903	Costa Rica
28	*Polypodium crystalloneuron* Rosenst.	1912	*O. Buchtien 2773*	1910	Bolivia
29	*Polypodium glandulosissimum* Brade	1935	*A.C. Brade 10182*	1930	Brazil
30	*Polypodium appressum* Copel.	1941	*Y. Mexia 7821*	1935	Bolivia
31	*Polypodium latissimum* R.C. Moran & B. Øllg.	1995	*B. Øllgaard 99806*	1992	Ecuador
32	*Polypodium concolorum* M. Kessler & A.R. Sm.	2005	*M. Kessler et al. 11922*	1997	Bolivia
33	*Polypodium intricatum* M. Kessler & A.R. Sm.	2005	*M. Kessler et al. 9429*	1997	Bolivia

34	*Serpocaulon rex* Schwartsb. & A.R. Sm.	2013	*P.B. Schwartsburd & L.M. Alves 2596*	2012	Brazil
35	*Serpocaulon antioquianum* D. Sanín	2018	*S.E. Hoyos & J.J. Hernández 816*	1983	Colombia
36	*Serpocaulon australe* D. Sanín, J.C. Ospina, I.O. Moura & Salino	2019	*C.M. Martín & J.C. Ospina 2234*	2018	Argentina
37	*Serpocaulon psychotrium* Mostacero, D. Sanín & A.R. Sm.	unpublished	*L.J. Dorr et al. 7102*	1990	Venezuela

In the 19th century, *Polypodium* represented a complex genus that include more than 150 species (Copeland, 1947). From this large genus, many genera (e.g., *Campyloneurum* C. Presl, *Goniophlebium* C. Presl, *Marginaria* Bory, *Microgramma* C. Presl, *Neurodium* Fée, *Phlebodium* (R. Br.) J. Sm., *Pleopeltis* Humb. & Bonpl. ex Willd. and *Serpocaulon*) were segregated. Nevertheless, 22 species from other genera that currently belongs to *Serpocaulon* were described from the period between 1800–1900 (Table 1). Started with the publication of *P. triseriale* (= *S. triseriale*) by the Sweden pteridologist, O. Swartz in 1800 [1801].

The German contribution was remarkable in this period, not only for collectors like Funck & Schlim, Humboldt, Moritz, Poeppig, Schomburgk, and Wagner, who included several specimens of *Serpocaulon* in their series, many of which are types (Table 1), but also for taxonomic writers like Hieronymus, Humboldt, Klotzsch, Kuhn, Kunze, Link, Mettenius, Jacquin and Willdenow that in this period, published 37% of the species here recognized (Table 2).

French botanists were also very important in the consolidation of the current genus knowledge (Table 1, 2). Bonpland, Desvaux and Fée published four of the 22 species

published in the 19th Century. By their part, Langsdorff and Fischer published three species from Brazil, with accurate specimens and linedrawings. Those names and types had been difficult to trace, probably because of the socialist isolation of Russia, but the situation is getting better with an increasing number of specimen images becoming available on the internet. Sodiro's work in Ecuador resulted in the publication of two species and several synonyms in *Serpocaulon*. Swartz and Christ published one species respectively.

Table 2. Authors of the basionyms of *Serpocaulon*'s species and their nationality.

Author	No. Species	Nationality
G.H. von Langsdorff & F.E.L von Fischer	3	Russian
C. von Linnaeus	2	Swiss
J.H.F. Link	2	German
G. Kunze	2	German
A.L.A. Fée	2	French
G.H. Mettenius	2	German
A.L. Sodiro	2	Italian
M. Kessler & A.R. Smith	2	Peruvian-German and North American
N.J. von Jacquin	1	German-Austrian
O. Swartz	1	Swedish
A.J. Cavanilles	1	Spainsh
F.W.H.A. von Humboldt, A.J.A.G. Bonpland ex C.L. von Willdenow	1	German, French and German
N.A. Desvaux	1	French
G. Kunze & J.F. Klotzsch	1	German
J.F. Klotzsch	1	German
C.B. Presl	1	Czech
G.H. Mettenius ex F.A.M. Kuhn	1	German
G.H.E.W. Hieronymus	1	German
K.H.H. Christ	1	Sweden
E. Rosenstock	1	German

A.C. Brade	1	German-Brazilian
E.B. Copeland	1	North American
R.C. Moran & B. Øllgaard	1	North American and Danish
P.B. Schwartsburd & A.R. Smith	1	Brazilian and North American
D. Sanín	1	Colombian
D. Sanín, J.C. Ospina, I.O. Moura & Salino	1	Colombian (2) and Brazilian (2)
J. Mostacero, D. Sanín & A.R. Smith	1	Venezuelan, Colombian and North American

It is important to mention that C. Presl not just published one species in the 19th century, but also established *Goniophlebium* as a genus restricted to Asia (Presl, 1836), after Blume (1830) considered that species with goniophlebioid veins represented a section within *Polypodium*.

Presl's designation opened the discussion that eventually resulted in the current concept of *Serpocaulon*. Because many species of *Serpocaulon* were subsequently published (*G. articulatum* C. Presl = *S. articulatum*, *G. eleutherophlebium* Fée = *S. eleutherophlebium*, and *G. demissum* Fée = *S. demissum*), or combined from *Polypodium* under *Goniophlebium* (*G. adnatum* (Kunze) T. Moore = *S. adnatum*, *G. catharinae* (Langsd. & Fisch.) J. Sm. = *S. catharinae*, *G. dasypleuron* (Kunze) Moore = *S. dasypleuron*, *G. dissimile* (L.) J. Sm. = *S. dissimile*, *G. fraxinifolium* (Jacq.) T. Moore = *S. fraxinifolium*, *G. lasiopus* (Klotzsch) T. Moore = *S. lasiopus*, *G. latipes* (Langsd. & Fisch.) J. Sm. = *S. latipes*, *G. loriceum* (L.) J. Sm. ex Hook. = *S. loriceum*, *G. meniscifolium* (Langsd. & Fisch.) J. Sm. = *G. triseriale* (Sw.) Wherry = *S. triseriale*, *G. vacillans* (Link) Fée = *S. vacillans*).

In the same way, *Marginaria* was used by Presl (1836) to combine or published names of *Serpocaulon* (v.g. *M. dasypleuron* (Kunze) C. Presl = *S. dasypleuron*, *M. latipes* (Langsd. & Fisch.) C. Presl = *S. latipes*, *M. loriceum* (L.) C. Presl = *S. loriceum*, and *M. meniscifolium* (Langsd. & Fisch.) C. Presl = *S. meniscifolium*).

In the 20th century, a series of six species started to be published with *Polypodium maritimum* Hieron. (= *S. maritimum*) in 1904 and finished with *P. latissimum* R.C. Moran & B. Øllg. (= *S. latissimum*) in 1995. Where also the leadership of the Germans was evident at published three species. Following the North American, Copeland and Moran, who with

Benjamin Øllgaard (from Denmark) published two species, and finally in this order, the Swiss author Christ that published *P. ptilorhizon* (= *S. ptilorhizon*).

Hensen (1990) published the first taxonomic revision of the species group currently recognized as *Serpocaulon.* The Dutch author established species limits to the 23 species that he recognized in the so-called '*Polypodium loriceum* complex'. Hensen's work is important because it compiled most of the names (included synonyms) that are currently assignated to *Serpocaulon*. This helped in the revision of types and protologues that he had access in Europe. Despite Moran (1990) criticized this revision for several arguments, Hensen did not altered the nomenclature of *Polypodium*.

Lellinger (1993) proposed the subgenus *Polygoniophlebium* including species with long-creeping rhizomes, appressed scales and pinnatisect laminae. Lellinger's name, however, was not used by Moran (1995) for Mesoamerica, neider by Moran and Øllgaard (1995) for Ecuador, or by Kessler and Smith (2005) for Bolivia.

Smith started a new era in the botanical knowledge of *Serpocaulon*. Smith et al. (2006) provided a formal description for the genus, finally segregating it from *Polypodium*. Using four DNA regions from 22 out of the 40 known species in the genus, they confirmed the monophyly of the genus and provided new combinations for all species. Smith and collaborators clarified the current genus concept by stressing a character not suggested by previous authors (Blume, 1830; Presl, 1836; Lellinger, 1993), but presented by Hensen (1990) and Moran (1995): 'the clathrate rhizome scales', which in combination with the long-creeping rhizomes, the anastomosing veins (goniophlebioid) with individual areoles chevron-shaped and each with a single, free, included excurrent veinlet (Smith et al., 2006), diagnose *Serpocaulon*.

By creating a smaller, more manageable genus, Smith et al. (2006) stimulated research on the group. New taxa and new combinations have been published in Argentina (Sanín et al., 2019a), Brazil (Labiak & Prado, 2008; Schwartsburd & Smith 2013, Sanín & Salino, 2020), Colombia (Sanín, 2015; 2018; Sanín & Torrez, 2014), and Costa Rica (Rojas-Alvarado & Chaves-Fallas, 2013; Chaves-Fallas et al., 2015).

Since the 40 names established by Smith et al. (2006), Labiak and Prado (2008) presented two new combinations: *S. glandulosissimum* (Brade) Labiak & J. Prado, a species treated by Hensen (1990) under the synonym of *P. catharinae* (= *S. catharinae*), and *S. sehnemii*, which

is here considered a synonym of *S. latipes*. Additionally, they expanded the distribution of *S. levigatum* to Brazil. Later, Schwartsburd and Smith (2013) combined *S. articulatum* (C. Presl) Schwartsb. & A.R. Sm., *S. hirsutulum* (T. Moore) Schwartsb. & A.R. Sm., *S. laetum* (C. Presl) Schwartsb. & A.R. Sm. and described *S. rex* Schwartsb. & A.R. Sm., and a new hybrid between the previously described *S. hirsutulum* and *S. meniscifolium* (*S. ×pubescens* Schwartsb. & A.R. Sm.). From those taxa, *S. hirsutulum*, *S. ×pubescens*, and *S. laetum* are here considered synonyms of *S. meniscifolium* (for the first two names), and *S. latipes* for the later. Sanín & Salino (2020) rediscover and presented as a new combination of *G. demissum* Fée, an endemic species of the Brazilian inselbergs, *S. demissum* (Fée) D. Sanín.

Sanín (2014) described and recorded *Serpocaulon obscurinervium* from Colombia (Sanín et al., 2017; Sanín, 2018), but here it is considered a synonym of *S. concolorum*, which was described previously by Kessler and Smith (2005) from Bolivia. Sanín (2015) described *S. tayronae* from material herborized by H.H. Smith in La Sierra Nevada de Santa Marta. This species is remarkable because it is endemic from that region, possesses free venation, and the rhizome scales are scarcely clathrate. On the other hand, it presents the typical scarce, catenate and patent hairs in the laminae, and long-creeping rhizome of some *Serpocaulon* species. After performing a molecular analysis, this taxon was nested as part of *Campyloneurum* (Chapter two), reason why it is excluded from this revision. Finally, for Colombia, Sanín (2018) presented the revision of *Serpocaulon*, provided taxonomic comments, maps, photographs and illustrations for the 27 taxa listed in that contribution. Additionally, a new species, *S. antioquianum* was presented and a lectotype of *S. patentissimum* was designated.

Nine of 40 species proposed by Smith et al. (2006), are considered as synonyms in the present treatment. Three of them were clarified by Sanín and Salino (2018), consecutively, Schwartsburd and Smith (2013), Sanín (2018), Sanín et al. (2019a), Sanín et al. (in prep. a), published one respectively, and finally, two are here presented.

In total, and after the taxonomic treatment here developed, 37 species and five hybrids for *Serpocaulon* are recognized.

The nomenclature and taxonomy of *Serpocaulon* presents remarkable issues that have difficulted for many years and still represent a problem to clearly understand its diversity. First, the poor exploration of certain areas where the genus could be especially diverse

(Schwartsburd & Smith, 2013), caused by the absence of fern explorers, and the isolation and difficult access to those territories (Sanín, 2015). Second, some type specimens are incomplete by the absence of rhizomes, or lack of original type locality information, and finally, variation, plasticity, distribution and ecological amplitudes, as well as, the frequent hybridization (Rojas-Alvarado & Chaves-Fallas, 2013; Sanín & Torrez, 2014; Chaves-Fallas et al., 2015) of most of *Serpocaulon* species, treated as 'normal' or 'complex' species, were unknown and underrated, promoting concepts that caused a premature establishment of a number species.

USES

The use of *Serpocaulon* species is limited to local records included in herbarium specimens, in the literature, or through personal observations.

Serpocaulon levigatum, *S. loriceum* and *S. triseriale* recorded levels of selligueain A, a proanthocyanidins that provides the sweet taste in rhizomes of *Selliguea feei* Bory (Kinghorn & Soejarto, 2002). Liu et al. (1998) reported anti-inflammatory activity, fatty acids, and selligueain in the mentioned species. Murillo (1983) commented that *S. levigatum* and *S. triseriale* have been used in traditional medicine to eliminate parasites, cough syrups, icteric prevention, and snake bites antidotes.

Serpocaulon levigatum is used by women from centraleastern Peru in ceremonies to pass from childhood to maturity (Navarrete et al., 2006). In the Peruvian deparment of Ayacucho, it is used to cure kidney diseases. In Ecuador, the leaves of *S. levigatum* are very sweet, used to flavouring monkey meat and also to prevent blood coagulation. Finally, in Bolivia it is chewed by the natives, because it has a sweet coconut flavour and may contain an alkaloid.

Rhizomes of *Serpocaulon articulatum* are used in Peru for renal, liver and uterus infections. In the same way, the rhizomes of *S. crystalloneurum* have been used in Bolivia for reduce inflammation of the uterus. *Serpocaulon lasiopus* is recorded at Saraguro culture from Ecuador as a medicine to treat inflammation of the internal female sexual organs. In this case, the plants are crushed and then administered with honey.

The rhizomes of *Serpocaulon dasypleuron* are macerated and used for a snakebites in Peru. Additionally, in Ecuador, the leaves of this species are macerated and mixed with water to produce a shampoo that promotes hais growth.

In Guatemala, the rhizomes of *Serpocaulon dissimile* are used for the treatment of headaches, by putting it on the forehead. *Serpocaulon fraxinifolium* is used by the Cayapa people of Ecuador for removing mucus from the nose and throat, boiling the plant and drinking the decoction. Also, in Ecuador, *S. fraxinifolium* is used to prevent respiratory system disorders (Navarrete et al., 2006).

The ornamental use is also reported in *Serpocaulon*. Sanín (2006) highlighted the ornamental potential that some species have due to their simple propagation, beauty, and the remarkable leaf resistance after cutting. In the same sense, in Belo Horizonte, Brazil, *S. catharinae* was recorded embellishing the city (Figure 1). Silva et al. (2011) commented that *S. triseriale* is used as an ornamental plant that shelters native fauna in Bahia, Brazil.

INDIGENOUS OR VERNACULAR NAMES

Calaguala is the commonly used name for most *Serpocaulon*'s species. This was verified by Murillo (1983) in Colombia, as well as in Honduras (based on herbarium records) with respect to *S. triseriale*. *Serpocaulon falcaria* in Mexico, as well as *S. lasiopus* and *S. levigatum* in Ecuador (Saraguro culture) are also identified by locals with this word. Variations of this vocable were recorded in Guatemala as '*kalahuala'* for *S. dissimile*, or '*jala wala'* in Quechua (Peru) for *S. levigatum*. Navarrete et al. (2006) also mentioned that different Andean cultures may have a similar spelling for this word. For example, in Ecuador it is used calahuala, whereas in Peru it is qalaywala. However, the authors suggested that both names have been adapted to castellan (Navarrete et al., 2006).

In Puno, Peru, *Serpocaulon articulatum* is named as *atoc-zapato*.

Serpocaulon attenuatum is known as *Avento* in Pernambuco, Brazil, or as lengua de ciervo in Lambayeque, Peru.

Serpocaulon dasypleuron is called as *kentawunki* in Peru, or *achu boa* tape 'a Cayapa word' in Ecuador.

Peti chegana or *piti chchikana* are common names used in Bolivia to identified *Serpocaulon crystalloneurum*.

In the Amazon from Peru, *Serpocaulon fraxinifolium* is knowing by an unknown indigenous word as *^sinku^súk.* As well as *Jé yei* remedio tape for the Cayapa culture from Ecuador.

Serpocaulon levigatum is known in Ecuadorian Quechua as *Catchi panga.*
Yashpilla is the indigenous name for *Serpocaulon patentissimum* in Azuay, Ecuador.
In Zulia province of Venezuela, *Serpocaulon psychotrium* recorded the indigenous name of *Uap-hia*.

Serpocaulon vacillans is knowing in Brazil as *amambai* in Mato Grosso do Sul or samambaia-do-brejo in São Paulo.

Finally, the Chacobo culture from the Amazonian province of Vaca Díez from Bolivia, remarkably used two names for *Serpocaulon wagneri*: *xëqui jahëhua* and *mitaisa*.

KARYOLOGY

There are few records of chromosome numbers in *Serpocaulon.* This have been reviewed by Sorsa (1966), Walker (1966, 1985), and Smith and Mickel (1977), who recorded $n = 37$ for *P. dasypleuron* (= *S. dasypleuron*), *P. fraxinifolium* (= *S. fraxinifolium*), *P.* (= *S. loriceum*), *P. ptilorhizon* (= *S. ptilorhizon*), and *P. triseriale* (= *S. triseriale*). And the tetraploid condition, $2n = 74$ was also registered for *P. dissimile* (= *S. dissimile*) and *P. triseriale* (= *S. triseriale*) (Walker, 1985; Smith & Mickel, 1977).

MORPHOLOGY

Growth form. Smith et al. (2006) described the genus as epiphytic or epipetric, infrequently terrestrial. Kreier et al. (2008) stated that *Serpocaulon* is an epiphytic fern genus. However, most of the species of *Serpocaulon* have a secondary hemiepiphytic habit. This kind of habit can be easily confused with the climber habit described by Tsutsumi and Kato (2006) for Davalliaceae or Canestrato et al. (2014) for Dryopteridaceae. Both habits are similar in their early stages, with the spores germinating on the ground to produce a terrestrial gametophytes. In both cases, the gametophytes develop into terrestrial sporophytes that begin growth on the ground and eventually climb on a houst tree. However, while climbing ferns remain attached to the ground after climbing, the secondary hemiepiphytes can disconnect from the soil and live like like holoepiphytes. Tsutsumi and Kato (2006) presented two features to discriminate the two habits: 1) the presence of dimorphic roots on the climbing ferns, i.e. long, branched feeding roots connecting the plants to the soil and short, epiphytic

roots anchoring the climbing rhizome, and 2) the roots of secondary hemiepiphytes are usually monomorphic and epiphytic roots not only adhere to tree trunks but also absorb water and nutrients from the trunk surfaces.

An interesting observation was made in a population of *Serpocaulon polystichum* from Itatiaia, Brazil (Sanín, Moura & Salino obs. pers.), where an individual was found in the soil with two rhizome ramifications that became epiphytic but yet connected with the primary ramification (Figure 2a). The first ramification (number 2 of Figure 2a, b) recorded 1 m long, while the second ramification (number 3 of Figure 2a, c), presented 2 m long. This evidencing the fact that the main habit of growing on *Serpocaulon* is secondary hemiepiphytic (Figure 3a-b). In spite of any gametophyte was found in the mentioned substrate to certify their origin, simple young leaves showing the heteroblastic series behavior were found in a population of *S. patentissimum* in Colombia (Figure 3a), and most important, no long-branched roots anchoring to the soil were found in any species with long-creping rhizomes.

Field collections made in Colombian recorded *S. sessilifolium* as the only holoepiphytic species in the country (Sanín, 2018). This observation can be biased when compared to other countries. However, it is remarkable because species like *S. attenuatum*, *S. australe*, *S. catharinae*, *S. glandulosissimum*, *S. lasiopus*, and *S. triseriale* (species with short-creeping rhizome) can be found as terrestrial (Figure 4a), rupicolous (Figure 4b), or epiphytic (Figure 4c), showing that those species can be opportunistic.

The only species that was only recorded as terrestrial is *S. vacillans* (Figure 3c, 4a). Nevertheless, *S. rex* is also a frequent terrestrial plant, but specimens recollected in Frutal, Minas Gerais (type locality) were recorded as terrestrial and hemiepiphytic.

Roots. Usually roots in *Serpocaulon* are scattered over the ventral side of the rhizome, but in *S. vacillans* (a subterranean creeping rhizome) roots can be found in all sides of the rhizome. Roots are fibrose and densely pilose, the hairs being brown to yellow or ferrugineous (Sanín, 2018). Species as *S. falcaria*, *S. intricatum*, *S. latipes* have long roots (up to 5 cm), whereas *S. attenuatum*, *S. meniscifolium* (Figure 5a), *S. sessilifolium*, and *S. triseriale*, exhibits dense, short roots.

Rhizomes. Rhizomes in *Serpocaulon* represents the type 1 (*Polypodium* type) described by Hovenkamp (1990) as they are dorsiventral and short to long-creeping. Where fronds are articulated to distinct phyllopodia, in two alternating dorsal rows, almost contiguous in short-creeping rhizomes to widely spaced in long-creeping rhizomes. Branching points are lateral, behind the phyllopodia, situated close to or directly on the phyllopodia (in short-creeping rhizomes) or at some distance from the phyllopodia (in long-creeping rhizomes).

In this contribution, the term long-creeping rhizome is delimited by the distance between two phyllopodia located in a mature portion of the rhizome (Figure 5e). If the distance of the phyllopodia is more than two times the rhizome diameter, it is considered long-creeping; otherwise, it is considered a short-creeping rhizome. Early-divergent species (Smith, et al. 2006; Kreier et al., 2008) like *S. attenuatum*, *S. meniscifolium* (Figure 5a), *S. sessilifolium*, and *S. triseriale* (Figure 5d) have short-creeping rhizomes.

Phyllopodia. This are dorsal extensions of the rhizome from which the fronds directly emerge. Phyllopodium emerge from the dorsal surface in two alternate rows (Figures 5e, f, 6) (Tejero-Díez, 2005). Because this structure can be confused with branching points, only scars of the leaves were considered as phyllopodium for the measurements.

Rhizome and laminar scales. Rhizome and laminar scales are flat pluricellular epidermal enantions (Lellinger, 2002). In *Serpocaulon*, rhizome scales are strictly clathrate (Figure 6, 7a-c, f-h, j), while laminar scales can be subclathrate (Figure 7e, i, k).

Rhizome scales can be concolorous in *S. attenuatum*, *S. concolorum*, *S. demissum*, *S. dissimile, S. eleuthrophlebium*, *S. glandulosissimum*, *S. rex, S. sessilifolium*, or as in *S. vacillans*, concolorous to rarely slightly bicolourous. The remaining species possess bicolorous rhizome scales. A contrary proportion is evident at compare with the laminar scales, where most of the species presents concolorous scales.

If the rhizome scales are strongly attached to the rhizome surface, they are considered appressed (Lellinger, 2002). This condition is usually related to the rounded, elliptic to ovate shape of the scales. This character is presented in *S. adnatum*, *S. antioquianum*, *S. appressum*, *S. dasypleuron*, *S. fraxinifolium*, *S. funckii*, *S. intricatum*, *S. latissimum*, *S. levigatum*, *S.*

loriceum, *S. maritimum*, and *S. ptilorhizon*. The appressed rhizome scales of *S. falcaria* are lanceolate with patent apices.

A rhizome scale is considered patent if they are directed strongly away from the surface of the structure on which it is borne (Lellinger, 2002). Patent scales may be difficult to distinguish from sub-appressed, sub-patent or reflexed, however, if the position of the apices of the scales along the rhizome are observed with especial attention, this character became evident.

Reflexed rhizome scales are those in which the apices are obliquely directed away from a surface and toward the base of the structure on which it is borne (Lellinger, 2002). This character is often related to the subulate scales commented below. Species with this feature are *S. catharinae*, *S. psychotrium*, and *S. richardii*.

Regarding the shape, there are five types of rhizome scales in *Serpocaulon*:

1. Subulate scales can be described as an awl-shaped structure that is very narrow and tapered from an expanded base to the apex (Figure 7a). They are present in *S. catharinae*, *S. psychotrium*, *S. richardii,* and *S. wagneri.* There is also considerable variation within some other species. *Serpocaulon eleutherophlebium* and *S. lasiopus*, for example, have ovate-lanceolate to slightly subulate rhizome scales. In *S. latipes*, the scales are lanceolate to lanceolate-subulate, whereas in *S. nanegalense* thay are lanceolate to subulate.

2. Lanceolate scales have a long-tapering apex and a short-tapering base, therefore they are widest well above the base. This shape is related to the patent and sub patent scales that are present on species like *S. articulatum*, *S. attenuatum*, *S. australe*, *S. concolorum*, *S. demissum*, *S. dissimile, S. falcaria*, *S. glandulosissimum* (Figure 7b), and *S. polystichum* (Figure 7j, f). Variation can be found in this character, for example, *S. lasiopus* has lanceolate to slightly subulate scales, whereas *S. sessilifolium* has acicular-lanceolate scales. In *S. triseriale* the scales can be ovate-lanceolate to lanceolate, whereas *S. vacillans* can have lanceolate, ovate-lanceolate, or rarely subulate scales.

3. Ovate-lanceolate scales have the outline of a longitudinal section of a hen's egg. They are similar to elliptical scales, except broadest toward the base, rather than at the middle (Figure 7c). This kind of scale is present in *S. crystalloneurum* and *S. rex,* as well as in *S. eleutherophlebium* (ovate-lanceolate to slightly subulate), *S. meniscifolium* (ovate-lanceolate

to lanceolate), *S. patentissimum* (ovate-lanceolate to triangular or deltate), and *S. subandinum* (ovate-lanceolate, lanceolate to triangular).

4. Rounded to elliptic scales are often also appresed, as already discussed above (Figure 7g-h).

5. Acicular scales are often present on the laminae, especially in pinnae/segments bases (Figure 7d, m-o) and are defined by the needle-shaped.

Fronds. Fronds are monomorphic, petiolate and articulated to the phyllopodia on the rhizome. They can be erect as in *S. adnatum*, *S. fraxinifolium*, and *S. triseriale*, or pendant, as in *S. dasypleuron* and *S. patentissimum.*

Petioles. They are subterete, with flat adaxial surface, often slightly sulcate in the margins of the adaxial flat surface. Light brown, black, reddish, greenish, lustrous to pale, often with different colors from the base to the apex. Some species have narrow wings distally, as occurs in *S. dasypleurum, S. patentissimum,* and *S. wagneri.*

Leaves. Three kinds of laminar dissections occur in the genus: pinnatisect, pinnate and simple. Following Lellinger (2002), they are described below.

1. Pinnatisect laminae are present in most of the species (24 of the 36 species) (Figure 8a, d). This shape characterizes the laminae by staying incised all the way to the axis, with the segments not contacted at their base. *Serpocaulon dissimile* is the only species that has laminae proximally pinnate and distally pinnatisect.

2. Pinnate: divided into entire to lobed pinnae that are contracted at the base (Figure 8b). The following 12 species present this morphology, *S. adnatum*, *S. antioquianum*, *S. articulatum*, *S. appressum*, *S. fraxinifolium*, *S. meniscifolium*, *S. polystichym*, *S. psychotrium*, *S. rex*, *S. richardii*, *S. sessilifolium* and *S. triseriale.*

3. Simple lamina: not divided; in laminae, without segments or pinnae. This morphology is presented only in *S. levigatum* (Figure 8c).

Regarding the hybrids, they can exhibit pinnae/pinnatisect in the base, segments or lobules can be presented in the center, and at the apex a simple portion as occurs in *S.* ×*semipinnatifidum*, and *S.* ×*manizalense*, or presents pinnate base and pinnatisect apex as show *S.* ×*rojasianum* and *S.* ×*tabuleirense.*

Segments are considered as decurrent if they are attached to the rachises and extending basiscopically on and adnate to an axis (Figure 9a). Therefore, the surcurrent shape is present if they are extending acroscopically on and adnate to an axis (Figure 9b).

Pinnae are sessile if they lack a free, basal portion of a stipe or costa (Figure 10e) (Lellinger, 2002). Or the pinnae are adnate if they are attached, laterally to the rachis (Figure 10f). This condition is an important feature to discriminate species as *S. adnatum* and *S. richardii*, both species with pinnate laminae and adnate apex.

The basal segments can be important to discriminate between some species, for example, *S. latissimum* and *S. loriceum* from *S. maritimum*, a similar one. First two presents a reflexed base (Figure 10a) while the later presents truncate base of the lamina, appearing as if cut off perpendicular to the axis (Figure 10b) (Lellinger, 2002).

Heteroblastic series from pinnatisect species are at initial stages similar to the pinnate and simple lamina, where leaves are simple (Figure 11a). Upon reaching bigger sizes they present lobes (Figure 11b) and then become pinnatisect (Figure 11c, d). For pinnate lamina, this series are similar to those described in the '*Lomariospsis japurensis* group' (Moran, 2000), presented simple and entire lamina at first, then producing a single lateral pinna, and as the successive leaves in the series become longer, they develop more pinna until, finally mature, 7–15 pinna pairs are presents.

The texture of laminae can also be useful in the taxonomy of the group. For example, papyraceous to membranaceous laminae are typical of *S. dasypleuron* and *S. patentissimum*, whereas chartaceous to coriaceous laminae are found in *S. adnatum* and *S. triseriale*.

Stomatal apparatus of *Serpocaulon falcaria* and *S. triseriale* from Mexico were studied by Tejero-Díez et al. (2010), who recorded anomocytic, polycystic, diacytic, copolocytic A and B in the first species, and anomocytic, polycystic, copolocytic A and B apparatus for the later. Where the most abundant were polycystic and copolocytic A and B in both cases.

Venation pattern. It has been called as 'goniophlebioid, which is derived from the Greek '*goni'*, meaning angle, and '*phleps'*, meaning vein (Rödl-Linder, 1990). The name refers to the veins which are forked and anastomosed to build a series of angular areolae, each with one included, excurrent, free veinlet (Rödl-Linder, 1990).

In the seminal work of Gisella Rödl-Linder (1990), four venation types are described for the genus *Goniophlebium*. Excluding the vulgare-type (number 4), and terrestre-type (number 3) the others fit *Serpocaulon* venation patterns.

1. Subauriculatum type: veins anastomose into one (rarely two) series of regular primary areolae. Simple or forked marginal free veins from irregularly empty areolae. It is verified in most of the pinnatisect species (Figure 12a-b).

2. Percussum type: veins anastomose into series of regular primary areolae from costa towards margin. This is exhibed by pinnate or simple laminae species that present more than two rows of sori (Figure 12c).

Here, the number of areolae or sori along and between the costa and the margin of the pinnae or segments represent a useful character to distinguish species, and it is described in Figure 6.

The prescence of notorious (impressed) veins and sori are also taxonomically useful. Veins or sori are impressed (Figure 10c) if at a level below the surface of lamina tissue, but not completely immersed in it, thus readily seen upon cursory examination. Or immersed (Figure 10d) within the laminae tissue, and then not readily seen upon cursory examination (Lellinger, 2002).

Laminar hairs. Despite Smith et al. (2006) described the laminae as glabrous, hairly, with scales absent, or scattered clathrate scales. The authors did not provide further information of the laminar hairs. Sanín (2018) stated that the hairs are fundamental to discriminate the species *S. dasypleuron*, *S. dissimile*, *S. lasiopus*, *S. patentissimum*, *S. richardii*, *S. subandinum*, and *S. wagneri.*

Hairs in *Serpocaulon* are catenate and terete. However, three types of hairs can be recognized following descriptions provided by Lellinger (2002).

1. Patent that constitutes a villous indument: conformed by weak, slender irregularly curled hairs (Figure 13).

2. Appressed to barely appressed short hairs that form a strigose-tomentose indument: usually fully appressed, straight, coarse and sharp-pointed hairs (Figure 14). A remarkable feature of these hairs is that they appear dispersed and are often difficult to record.

3. Glandular hairs, only present in *S. glandulosissimum* (Figure 15a-b), described as bearing glandular cells, but not itself a gland.

Sori. By definition, a sorus is a cluster of sporangia in ferns (Figure 12b). The sori of *Serpocaulon* are round or nearly so (Figure 12c, 15a). In *S. sessilifolium*, the sori could be unusual for being ovate. Sori are exindusiate and disposed of in 1–66 rows along and 1–10 rows between the costae and the margin. Each sorus is subsidized by a free included veinlet (Figure 12b). It can be impressed (Figure 10c) or immersed (Figure 10d) in the adaxial surfaces of the laminae.

Spores. The spores of *Serpocaulon* are monolete, ellipsoidal to sub-ellipsoidal, plane-convex to concave-convex, with irregular or regular, depressed or prominent verrucae (rarely with micro-ornamentation, or gemmulate), folded perinae, or as in *S. vacillans* with folded perinae producing linear folds. Previous descriptions of the spores can be consulted in Coelho & Esteves (2011), Ramírez-Valencia et al. (2013), and Ramírez-Valencia and Sanín (2016).

Ramírez-Valencia et al. (2013) studied the spores of *Serpocaulon* in Colombia, whereas Ramírez-Valencia and Sanín (2016), used the phylogenetic tree of Kreier et al. (2008) to examinate the evolution of spore characters in relation to the phylogeny. They presented SEM pictures for 25 species *Serpocaulon*, grouping the spores into four morphological types. Although some species concepts were not as clear as today, and despite their sampling being incomplete, the authors found an evolutionary pattern, from depressed irregularly verrucae to folded perispore, to regular depressed verrucae, to irregularly prominent verrucae (Ramírez-Valencia & Sanín, 2016). Here the morphological groups proposed by the authors were used to discriminate the species, including an additional type of morphology, named as gemmulate ornamentation and described by Lellinger (2002) as bearing bullae that are no higher than wide, slightly to greatly contracted at the base, and with a round apex. *Serpocaulon richardii*, and *S. rex* bear this morphology.

Group I. Irregularly depressed verrucae: presented in *S. appressum*, *S. australe*, *S. attenuatum*, *S. concolorum*, *S. demissum*, *S. intricatum*, *S. lasiopus*, *S. falcaria*, *S. fraxinifolium*, *S. funckii*, *S. levigatum*, *S. meniscifolium*, *S. nanegalense*, *S. polystichum, S. ptilorhizon*, *S. subandium* and *S. triseriale* (Figure 16, 17).

Group II. Folded perinae: *S. catharinae*, *S. dissimile*, *S. glandulosissimum*, *S. sessilifolium*, *S. vacillans*, and *S. wagneri* (Figure 18).

Group III. Depressed regular verrucae: *S. adnatum*, *S. eleutherophlebium*, *S. latipes*, and *S. patentissimum* (Figure 19).

Group IV. Prominent verrucae: *S. articulatum*, *S. dasypleuron*, *S. maritimum*, *S. latissimum*, *S. loriceum*, *S. psychotrium* (Figure 20a-g, m-n).

Group V. Gemmulate: *S. richardii*, and *S. rex* (Figure 20h-l).

INTERACTIONS WITH FUNGI AND ANIMALS

There are few studies regarding *Serpocaulon* ecological interactions. The only experimental study was presented by Silva et al. (2011), where a communal dormitory of male orchid bees, *Euglossa melanotricha* Moure, was monitored over a one-year period. The authors recorded that the bees passed the night on fronds of *S. triseriale.* They also observed that male bees used the same fronds continuously, moving to neighboring fronds as senescence set in. Interestingly, the authors commented that the bees exhibited an unexplained behavior with their hind legs. Because these legs are free, they were rubbed continuously over the surface of the body, as if the bees were spreading some kind of substance over their body. Sanín (2018) commented that *S. triseriale* has nectaries at the base of the pinnae or segments that produce a translucent substance, with sweet flavor and soft smell. The author argued that the bee's behavior could be related to these structures (Sanín, 2018). Nectaries are here recorded not only for *S. triseriale*, but also for *S. catharinae*, *S. latipes*, *S. meniscifolium* and *S. rex* (Figure 21, 22e).

Interactions with other arthropods are also recorded in *Serpocaulon adnatum, S. catharinae*, *S. demissum* and *S. ×tabuleirense*. The first two species have ovoid galls that are not inserted in the laminar tissue, being located near the sori (Figure 22 a-b). The third record is a spider nest of *Anyphaenoides* sp., Anyphaenidae, that protected the nest and eggs using the reflexed disposition of the segments (Figure 22c-d). And finally, in nectaries of *S. ×tabuleirense* were recorded ants of *Crematogaster* sp., Formicidae, harvesting the base of the pinnae where the nectaries are located (pers. obs., Figure 22e).

Interactions with fungi are also conspicuous in the genus. Black, hairs-like structures are often found at the base of the pinnae or on the adaxial laminar surfaces of *S. adnatum*, *S.*

fraxinifolium, and *S. polystichum.* These structures are usually confused with patent hairs (Figure 15c), but they are actually the fruiting bodies of the fungus *Tricharia*, Gomphillaceae (pers. obs., Figure 15e-f).

DISTRIBUTION AND ECOLOGY

Eighty one percent of the taxa of *Serpopocaulon* can be regarded as montane or submontane, with a distinct concentration of species in the northern part of the Andes (Table 3). Taking into account the lowland taxa that reach the eastern (*S. latipes*) or western (*S. patentissimum*) foothills of the Andes, as well as Central American species like *S. pthilorhizon*, or *S. australe* from southern South America, the Andes can be regarded as the center of species richness and also as the center of speciation with 12 species restricted to the region. This had been suggested in the literature for many groups of ferns (Tryon, 1972).

The second restricted species region is represented by the Atlantic rain forest of Brazil, named by Tryon (1972) as the Brazilian center. It harbors 29 percent of the species, from which five are restricted to it (Table 3).

In the Central America/Antilles region 15 species were recorded, where *S. loriceum* and *S. ptilorhizon* present most of the records restricted to this region, with few records in Ecuador and Colombia respectively (Table 3).

The Guayana/Amazon region recorded 13 species with no restricted species inhabiting this area (Table 3). However, species suchs as *S. psychotrium* and *S. richardii* are more common in this territory or foothills of the Andes that are in contact with the Amazon.

Lastly, the Mexican center listed three species with wider distribution: *S. triseriale*, *S. fraxinifolium*, and *S. dissimile*. *Serpocaulon falcaria* is also recorded there, but exhibited restricted distribution to Central America and Mexican centers (Table 3).

The range size of the distribution of some *Serpocaulon* species vary considerably, especially for lowland species such as *S. triseriale*, *S. dissimile*, *S. fraxinifolium*, *S. polystichum*, and *S. latipes* that occurs in at least three distinct regional centers of endemism. *Serpocaulon levigatum* and *S. lasiopus* are montane species with the broadest ranges, reaching the Andes, Antilles and Brazilian centers (Table 3), from 700−3700 m (Figure 23)

for the former; and the Andes, Brazilian, and Central American centers (Table 3), from 250−3200 m for the later (Figure 23).

Regarding the species with disjunct distributions, the more remarkable is *S. levigatum*, whose population are 1448 km apart, in the Andean and the Brazilian centers (Tryon, 1972). *Serpocaulon latipes* shows the same discontinuity of the latter from Atlantic rain forest to the Amazon and Andean foothills. *Serpocaulon loriceum* stretches 643 km from the Antilles to North of the Andes (Colombia and Ecuador) (Tryon, 1972). The same distance is recorded by *S. sessilifolium* which inhabits the Andes, Central America, and Guyana/Amazon; in addition, it also occurs in the Antilles and the Andes.

Serpocaulon patentissimum, *S. australe*, and *S. glandulosissimum* have a narrow geographic distribution. The first one inhabits the Chocó region of Colombia and Ecuador, but can reach the eastern side of the Andes in Ecuador. *Serpocaulon australe* is recorded from central north of Argentina to south of Bolivia, especially in Yungas montane ecosystems (Sanín et al., 2019a). *Serpocaulon glandulosissimum* is recorded only in Campos de Altitude ecosystems from Minas Gerais, Rio de Janeiro and São Paulo states, Brazil. Considering the size of this country, species that inhabits the Atlantic rain forest like *S. catharinae*, *S. meniscifolium*, and *S. vacillans* could be considered as restricted to this biome, although these species also occur near the border with Argentina, Paraguay, and Uruguay.

The case of *S. demissum* requires special attention. This species is restricted to the Brazilian region, but it is only recorded in Brazilian inselbergs from Rio de Janeiro to Bahia states, stretching a distance of 1050 km (Sanín & Salino, 2020).

Serpocaulon loriceum is in cultivation at the botanical garden of Chicago, United States and Meise, Belgium (Sanín pers. obs.), as well as, *S. fraxinifolium* is (or was) in Austria (Jacquin, 1789), and *S. polystichum*, and *S. vacillans* in Germany (Link, 1833).

Table 3. Distribution of *Serpocaulon* species in the regional centers of endemism in tropical America proposed by Tryon (1972). (*) endemic species.

Species	Regional centers of endemism in tropical America				
	Andean	Brazilian	Guayanan/ Amazonian	Central American/ Antilles	Mexican

1. *S. adnatum*	X (*)				
2. *S. antioquianum*	X (*)				
3. *S. appressum*	X (*)				
4. *S. articulatum*	X		X	X	
5. *S. attenuatum*	X		X	X	
6. *S. australe*	X (*)				
7. *S. catharinae*		X (*)			
8. *S. concolorum*	X (*)				
9. *S. crystalloneurum*	X (*)				
10. *S. dasypleuron*	X		X	X	
11. *S. demissum*		X (*)			
12. *S. dissimile*	X		X	X	X
13. *S. eleutherophlebium*	X			X	
14. *S. falcaria*				X	X
15. *S. fraxinifolium*	X		X	X	X
16. *S. funckii*	X (*)				
17. *S. glandulosissimum*		X (*)			
18. *S. intricatum*	X (*)				
19. *S. lasiopus*	X	X		X	
20. *S. latipes*	X	X	X		
21. *S. latissimum*	X (*)				
22. *S. levigatum*	X	X		X	
23. *S. loriceum*	X			X	
24. *S. maritimum*	X			X	
25. *S. meniscifolium*		X (*)			
26. *S. nanegalense*	X (*)				
27. *S. patentissimum*	X (*)				
28. *S. polystichum*	X	X	X	X	
29. *S. psychotrium*	X		X		
30. *S. ptilorhizon*	X			X	
31. *S. rex*		X	X		

32. *S. richardii*	X		X		
33. *S. sessilifolium*	X		X	X	
34. *S. subandinum*	X (*)				
35. *S. triseriale*	X	X	X	X	X
36. *S. vacillans*		X (*)			
37. *S. wagneri*	X		X	X	
Total	30/12	11/5	13	15	4

The species of *Serpocaulon* have been recorded from sea level (*S. attenuatum, S. catharinae*, *S. demissum*, *S. latissimum*, *S. maritimum*, *S. rex*, *S. triseriale*, and *S. vacillans*) up to 3500 m (–4200 m) as *S. crystalloneurum*, *S. eleutherophlebium*, *S. lasiopus*, *S. nanegalense, S. sessilifolium* and *S. subandinum* (Figure 23). The genus is distributed widely in tropical America, except in arid zones as deserts (Atacama-Chile, Tatacoa-Colombia, etc.) and the only record in the Caatinga of Brazil belongs to *S. triseriale* (Xavier et al. 2012). The species inhabit the tropical wet forest, montane forest and subparamo. Depending on the taxa, they can be found in disturbed forest zones (e.g. *Serpocaulon levigatum*, *S. triseriale*, and *S. vacillans*), as well as in preserved forests like occurs with *S. adnatum*, *S. articulatum* and *S. dasypleuron,* and *S. patentissimum*.

Serpocaulon triseriale is the species with the widest distribution. It was recorded in 24 countries, followed by *S. dissimile* (14), *S. sessilifolium* (13), *S. loriceum* (12), *S. attenuatum, S. lasiopus* and *S. falcaria* (11). On the other hand, *S. antioquianum* (1)*, S. demissum* (1), *S. patentissimum* (2)*, S. adnatum* (3), *S. latipes* (4), and *S. rex* (5) presented restricted country records.

Following the distribution of the species of *Serpocaulon*. The countries located at the north of the Andes (Ecuador, Colombia and Peru) present the higher species richness (Figure 24, Table 4).

Table 4. Distribution of *Serpocaulon* species by country, altitudinal range and growth habit. (*) New records for each country following Hensen (1990), Smith et al. (2006), Labiak and Prado (2008), Schwartsbund and Smith (2013), Sanín (2018) and Sanín et al. (2019a;

2019b). Exc. Means that the occurrence of the species is excluded of a given country or region.

Species	**Country**	**Altitudinal range (m)**	**Habit of growing**
1. *S. adnatum*	Colombia, Ecuador and Venezuela (excl. Bolivia)	350−3700	Hem, ep, ter or rarely rup
2. *S. antioquianum*	Colombia	400−900	Ep
3. *S. appressum*	Colombia* and Bolivia	1100−2200	Ep and ter
4. *S. articulatum*	Bolivia (Amazon), Brazil (Amazon), Costa Rica, Colombia, Ecuador, Guayana (Amazon), Panama, Peru and Venezuela (excl. South of Brazil)	5−2050	Ep, hem or ter
5. *S. attenuatum*	Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Guayana, Jamaica*, Nicaragua, Panama, Peru and Venezuela	0−2450	Ep, ter and rup
6. *S. australe*	Argentina and Bolivia	1500−3500	Rup or ep, rare ter
7. *S. catharinae*	Argentina, Brazil, Paraguay and Uruguay	0−2200	Ep, rup or, rarely ter
8. *S. concolorum*	Bolivia, Colombia*, Ecuador* and Peru	1820−3000	Ep or ter
9. *S. crystalloneurum*	Bolivia, Ecuador* and Peru	2300−4200	Ep, ter or rarely rup
10. *S. dasypleuron*	Brazil*(Amazon), Colombia, Costa Rica, Ecuador, Panama and Peru	40−2300	Ep
11. *S. demissum*	Brazil	200−1850	Rup

12. *S. dissimile*	Antillas (Cuba, Dominican Republic, Haiti, Jamaica, Martinique and Puerto Rico), Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Mexico and Panama	5−1950	Ep, ter or rup
13. *S. eleutherophlebium*	Colombia, Costa Rica, Ecuador, Panama and Venezuela	2430−3950	Ep, ter rarely rup
14. *S. falcaria*	Mexico, Costa Rica*, Guatemala, Honduras, Nicaragua*, Panama*, El Salvador and Antilles* (Cuba, Dominican Republic, Jamaica, and Monserrat)	20−2700	Ep, rarely ter
15. *S. fraxinifolium*	Belize, Costa Rica, Guatemala, Panama, Bolivia, Colombia, Ecuador, Peru and Venezuela (excl. Mexico, Brazil)	75−3696	Ep, ter, rup, rarely hem
16. *S. funckii*	Colombia, Ecuador, Peru and Venezuela	1240−3000	Ep, hem.
17. *S. glandulosissimum*	Brazil	1400−2350	Rup, ep, rarely ter
18. *S. intricatum*	Ecuador, Peru and Bolivia	1600−2850	Ep, ter
19. *S. lasiopus*	Argentina, Bolivia, Brazil*, Colombia, Ecuador, Honduras Paraguay*, Peru, and Venezuela, Antilles (Dominican Republic* and Haiti)	250−3210	Ep, rup, rarely ter
20. *S. latipes*	Brazil, Ecuador* and Peru*	40−2090	Hem, ter, rarely rup

21. *S. latissimum*	Bolivia, Colombia, Ecuador and Peru* (excl. Brazil)	0−2080	Hem, ep, ter, rarely rup
22. *S. levigatum*	Antilles (Dominican Republic*, Guadaloupe), Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Panama, Peru and Venezuela*	700−3700	Hem, ep, ter, rup
23. *S. loriceum*	Antilles (Cuba, Dominica*, Dominican Republic*, Grenada*, Guadaloupe, Jamaica, Puerto Rico, St. Kitts, and St. Vincent), Colombia, Costa Rica, Ecuador* and Venezuela (excl. Nicaragua and Guianas)	150−2000(−3020)	Ep, ter
24. *S. maritimum*	Colombia, Costa Rica, Ecuador, Nicaragua and Panama (excl. Peru)	50–1600	Ep, ter
25. *S. meniscifolium*	Brazil and Paraguay*	8–1415	Ep, rup, rarely ter
26. *S. nanegalense*	Colombia, Ecuador and Peru*	2170–3500	Ep or ter
27. *S. patentissimum*	Colombia and Ecuador	450–2400	Ep, hem, rarely ter
28. *S. polystichum*	Bolivia, Brazil*, Colombia*, Costa Rica*, Ecuador, Nicaragua*, Panama*, Peru* and Venezuela*	35–2620	Ep, hem, rarely ter, rup
29. *S. psychotrium*	Brazil (Amazon), Colombia, Ecuador, French Guiana, Peru and Venezuela	150–2000	Ep, occasionally ter

30. *S. ptilorhizon*	Colombia, Costa Rica, Nicaragua and Panama (excl. Peru and Bolivia)	650–2680	Ep, rarely rup
31. *S. rex*	Bolivia*, Brazil, Ecuador* and Paraguay*	0–705	Ter or rarely ep
32. *S. richardii*	Bolivia, Brazil (northeast*), Colombia, Ecuador, French Guiana, Guiana, Peru and Surinam	235–2225	Hem, ep, ter, rarely rup
33. *S. sessilifolium*	Antilles* (Cuba*, Dominican Republic*, Guadaloupe and Martinica*), Bolivia, Brazil*, Costa Rica*, Colombia, Ecuador, Guatemala*, Guiana, Peru and Venezuela	(125−)950–4000	Ep, rarely ter or rup
34. *S. subandinum*	Colombia, Bolivia, Ecuador, Peru and Venezuela*	1450–4150	Ep, hem, rarely rups or ter
35. *S. triseriale*	Antilles (Cuba, Dominican Republic*, Grenada, Guadaloupe and Trinidad & Tobago), South America: Argentina*, Bolivia, Brazil, British Guiana, Colombia, Costa Rica, Ecuador, Guiana, Paraguay, Peru and Surinam Central America: Belize, Guatemala, Honduras, Mexico, Nicaragua, Panama and Salvador	0–2497	Ep, ter, rarely sub or rup
36. *S. vacillans*	Argentina*, Bolivia, Brazil and Paraguay	0–2200(−3090)	Ter-Sub, rarely rup

37. *S. wagneri*	Bolivia*, Brazil*, Colombia, Costa Rica, Ecuador, Guiana, Panama and Venezuela	10–2550	Ep
Hybrids			
38. *S.* ×*manizalense*	Colombia	2070–2200	Ter
39. *S.* ×*rojasianum*	Costa Rica	938–1200	Ep
40. *S.* ×*semipinnatifidum*	Colombia, Peru, Venezuela	1610–3100	Ep, rarely ter
41. *S.* ×*sessilipinum*	Costa Rica	1447–1700	Not provided
42. *S.* ×*tabuleirense*	Brazil	681–739	Ter

Abreviations: Ep: Epiphyte, Hem: Secundary hemiepiphytic, Sub: Subterranean, Rup: Rupicolous, Ter: Terrestrial.

SYSTEMATIC

Based on morphological vegetative and reproductive characters we recognize here 37 species and five hybrids of *Serpocaulon*. From those, two species were described, *Serpocaulon australe* D. Sanín, J.C. Ospina, I.O. Moura & Salino (Sanín et al., 2019a), and *Serpocaulon psychotrium* Mostacero, D. Sanín & A.R. Sm. (Sanín et al. in prep. a), as well as one new hybrid, *Serpocaulon* ×*tabuleirense* D. Sanín & Salino (here described).

One new combination is proposed for *Goniophlebium demissum* Fée (*Serpocaulon demissum* (Fée) D. Sanín) based on morphological characters (Sanín & Salino, 2020).

A new taxonomic status for *Serpocaulon semipinnatifidum* (Fée) A.R. Sm. is proposed, recognizing it as a new hybrid, *Serpocaulon* ×*semipinnatifidum* (Fée) D. Sanín.

Serpocaulon appressum, *S. crystalloneurum*, *S. demissum*, and *S. falcaria* are illustrated for the first time. Some species and the hybrids were illustrated previously, nevertheless, all illustrations and photos represent the species concept established in this contribution.

NOMENCLATURE

As a result of the nomenclatural revision, 259 names (accepted or synonyms) were treated. Eighteen new synonyms were established, 47 lectotypes were designated, and 37 second-

steps lectotypifications were carried out when necessary. Two neotypes are designated. Four names and one species are excluded from the genus (Table 5).

Table 5. Nomenclatural summary.

Action	**Number of cases**
Total names revised	259
Accepted species names	37
Accepted hybrid names	5
Nomina dubia	24
Nomina nuda	5
New hybrids	1
New species	2
New combinations	1
New status	1
New synonyms	17
Lectotypes	34
Second-step lectotypes	24
Neotypes	2
Excluded species	5

CHOROLOGICAL NOVELTIES

An update of the records for each taxon recognized in here is presented. Twenty seven of the 37 species recorded a total of 44 chorological novelties in different countries of tropical America. Table 4 presents the new records for each country, or if any species is excluded.

Hereafter is discussed each chronological novelty in *Serpocaulon*.

Serpocaulon adnatum was cited by Smith et al. (2006) as growing in Brazil and Guianas to Bolivia, but later Smith et al. (2018) excluded it from Bolivia. Here its distribution is restricted to the Andes of Colombia and Venezuela to Peru.

Serpocaulon appressum is a species described from Bolivia (Copeland, 1941). Smith et al. (2018) suggested that inhabit from the northern Peru to northern Bolivia. Here is recorded as a chorological novelty for Colombia. The Colombian specimens were misidentified as *S. adnatum.* Nevertheless, both species can be distinguished by the comments hereafter presented.

Serpocaulon articulatum was described from an unknown locality and had been named as *S. giganteum* (Schwartsburd & Smith, 2013). This cause a wrong misconception of its distribution. For example, Smith et al. (2006) suggested that its range goes from Costa Rica to Bolivia and S. Brazil. Schwartsburd & Smith (2013) emended this at commented that 'in Brazil it probably occurs only in the northern region (the Amazon Forest). And later, in the Prodromus of a fern flora for Bolivia, Smith et al. (2018) pointed that its range encompasses Costa Rica to Bolivia, but it is possibly that a more widespread distribution can occurs. However, often it is lumped with *S. fraxinifolium* that, by the way, shares the long-creeping rhizomes with pinnate laminae, but contrast by the rounded appressed rhizome scales (vs. lanceolate with patent apex), 1 to 4 row of sori between the costa and the margin (vs. 3–10 rows), and notorious areolae (vs. immersed and inconspicuous). In this sense, and because the authors did not present collections, here is verified that inhabits the Amazon of Bolivia and Brazil, Guayana, and Venezuela.

Serpocaulon attenuatum was described from Venezuela. Smith et al. (2006), presented a distribution from Nicaragua to Panama, Venezuela, Guianas, Colombia to Bolivia and Brazil. Then in 2018, Smith et al. (2018), presents a narrow distribution, northern South America from Guianas to Venezuela and Bolivia. Here its confirmed with specimens its original distribution and including the Antilles (Jamaica).

Serpocaulon concolorum was described from Bolivia. Smith et al. (2018) commented that its range encompasses Colombia, Ecuador and Bolivia, without citing specimens. Here is verified its distribution in Colombia, Ecuador and Peru.

Serpocaulon crystalloneurum was described from Bolivia. Smith et al. (2006) pointed that its ranges goes from central Peru to Bolivia. Here is expanded to Ecuador.

Serpocaulon dasypleuron was described from Peru. Smith et al. (2006) proposed that was recorded from Colombia to Bolivia. After clarified its identity with *S. loriciforme*, here is expanded to Costa Rica and Panama and the Brazilian Amazon.

Serpocaulon demissum was described as *Goniophlebium demissum* Fée, from collections made in Brazil by A. Glaziou in 1872. However, it was not noticed that was part of *Serpocaulon*, reason why here is presented as a taxonomic combination novelty.

Polypodium falcaria (= *Serpocaulon falcaria*) was described from Mexico. Smith et al. (2006) suggested that its distribution is from south of Mexico to Honduras. Here it is expanded in Central America until Panama, and the Antilles.

Serpocaulon fraxinifolium was described from plants cultivated in Luxemburg, but native from Venezuela. Smith et al. (2006) suggested a distribution from Mexico to Bolivia, Guianas and south of Brazil. It has been confused with *S. polystichum* in Brazil (Labiak & Prado, 2008). Here is verified based on the specimens studied that its ranges do not reach Mexico or Brazil.

Serpocaulon lasiopus was described from Venezuela. Smith et al. (2018) suggested that inhabits from Nicaragua to Bolivia. Here it is expanded its range to the Antilles, Paraguay, and Brazil.

Serpocaulon latipes originally was described with plants from Brazil. Smith et al. (2006; 2018) proposed a distribution from Bolivia to South of Brazil. As chorological novelties, it is registered in the Amazon of Brazil, Ecuador and Peru.

Serpocaulon latissimum was originally described from Ecuador. Cited by Smith et al. (2006) in Ecuador and Bolivia. Despite the narrow distribution previously suggested by the authors, Smith et al. (2018) pointed that it also reaches the southeastern of Brazil. However, the authors did not cite specimens. Here the distribution range follows Sanín (2018), from Colombia to Bolivia.

Serpocaulon levigatum was described from Ecuador. Here is presented a new record in Dominican Republic, as well as Venezuela.

Serpocaulon loriceum was described originally from Martinique. Smith et al. (2006) commented that its ranges goes from Nicaragua to Panama, Antilles, Trinidad, Colombia, Venezuela and Guianas. Here is distinguished from *S. falcaria*, a similar species that also inhabits Central America and Antilles, derived in a narrow distribution of the former from Costa Rica to Colombia, Venezuela and north of Ecuador, and widely distributed in the Antilles.

Serpocaulon maritimum was described from Colombia. Its distribution was suggested by Smith et al. (2006) and Reyes-Chávez et al. (2019) from Honduras to Peru. However, here is presented a narrow distribution: from Honduras to Ecuador.

Serpocaulon meniscifolium was described from Brazil. Smith et al. (2006) as well as Labiak and Prado (2008) suggest that it is distributed in the Atlantic Rain Forest of Brazil. Here it is expanded to the neighbour country of Paraguay.

Serpocaulon nanegalense was described from Ecuador. Smith et al. (2006) suggested that it occurs from Colombia to Ecuador. Here it is expanded to North of Peru.

Type specimen of *Serpocaulon polystichum* originally comes from Brazil. Smith et al. (2006), suggested that its distribution expands from Ecuador to Bolivia. Later, Smith et al. (2018), increased its range from Brazil and Paraguay, Peru and Bolivia, and suggested that probably it is also further north in the Andes. Here, not just author's prediction is certified, but expanded from Nicaragua to Panama in Central America, from Colombia to Bolivia in the Andes, also in Andean and Amazonian ecosystems of Venezuela, and widely distributed in the Atlantic Rain Forest of Brazil.

Serpocaulon psychotrium was originally described from specimens collected in Venezuela. Because it had been named as *S. caceresii*, its taxonomy was blurred. After that the taxonomic relationships with *S. articulatum* were disentangles by Sanín et al. (in prep. a), it is possible to report its range from the foothill of the Andes from Colombia to Peru, as well as from Venezuela, Guiana, the Amazon of Brazil.

Serpocaulon ptilorhizon was described from a specimen collected in Costa Rica. Smith et al. (2006) stated that this species occurs from Nicaragua to Bolivia. The vouchers here examined, however, have shown that this species occurs predominantly in Central America, especially in Costa Rica, with a southern limit in Colombia. It was probably misidentified by Smith et al. (2018) as *S. funckii*, which ranges from Colombia and Venezuela to Bolivia.

Serpocaulon rex was described by Schwartsburd and Smith (2013) as narrowly endemic to a sub-formation of the Atlantic Rain Forest, the Seasonal semi-Deciduous Forest from Brazil. Here it is pointed that it occurs from Ecuador to Bolivia and from Brazil to Paraguay.

The type of *Serpocaulon richardii* is from the Guiana. Smith et al. (2006) commented that this species occurs in the Guianas, Venezuela, Colombia to Bolivia and Brazil. Later, Smith et al. (2018) excluded Colombia and expanded its occurrence in Brazil to the central and

southeast regions. Records presented in this contribution agree with Smith et al. (2006), specifying that the distribution in Brazil is restricted to the northeast region of the country.

Serpocaulon sessilifolium was described from Peru. Smith et al. (2006) commented that it occurs from Venezuela and Colombia to Bolivia. Later, its range was expanded to Costa Rica (Smith et al. 2018). Here are presented records that the species occurs from Guatemala to Bolivia, and from Venezuela to the Brazilian Amazon. It is also recorded in the West Indies (Cuba, Hispaniola, Jamaica, Haiti, Dominican Republic, Martinica, and Guadeloupe).

Serpocaulon subandinum was described based on specimens from Peru. Hensen (1990), suggested a distribution from Costa Rica to Peru. Tryon and Stolze (1993), in Pteridophyta of Peru recorded a similar range, and Smith et al. (2006, 2018) mentioned that its distribution is from Ecuador to Peru. Those records probably are derived from misidentifications with *Serpocaulon dasypleuron*, as was noticed in the sheets studied by the mentioned authors, and because *S. subandinum* inhabits preferentially Andean premontane, montane and subparamos ecosystems. In this sense, a narrow distribution, occurring from Colombia and Venezuela to Bolivia is here proposed.

Serpocaulon triseriale was described from the 'Oriental Indies'. This is the species with the widest geographic distribution in *Serpocaulon*. It was never expected to expand its range, but we did find new records from the Dominican Republic and north of Argentina.

Serpocaulon vacillans was described based on material from Brazil. It was recorded by Smith et al. (2018) for Bolivia, southeastern Brazil, and eastern Paraguay, but these records were not supported by specimens. Here those records are confirmed, and the distribution of *S. vacillans* is expanded to Argentina.

The type specimens of *Serpocaulon wagneri* were collected in Panama. Smith et al. (2006) commented that this species occurs from Costa Rica to Venezuela and Ecuador. Prado (2005) recorded it in Brazil with the name of *Polypodium panorense* C. Chr. for the Ducke reserve. Here, the records are expanded for Bolivia and Guiana, and confirmed for Brazil.

TAXONOMIC TREATMENT

Serpocaulon A.R. Sm. Taxon 55(4): 924–927, f. 3–4. 2006. TYPE SPECIES: *Serpocaulon loriceum* (L.) A.R. Sm.

Polypodium L. subg. *Polygoniophlebium* Lellinger, Amer. Fern. J. 83: 37. 1973. TYPE: *Polypodium fraxinifolium* Jacq. (= *Serpocaulon fraxinifolium* (Jacq.) A.R. Sm.).

Plants hemiepiphytic, terrestrial, epiphytic, or rupicolous. *Rhizomes* 0.8–17 mm diam., long to short-creeping, whitish to dark brown, reddish or yellowish, pruinose to scarcely pruinose; distance between phyllopodia 0.3–13 cm. *Scales* scattered to dense, especially located at the apex, 0.5–16.5 × 0.2–4 mm, rounded, ovate, elliptic, lanceolate to subulate, appressed, patent or with appressed base and patent apex, peltate, subpeltate or basifixed with notorious insertion, clathrate, bicolorous to softly bicolorous or concolorous, when bicolorouos light brown to dark, reddish, orange and/or goldish in the margin, and black, dark to light brown, reddish, orange and/or goldish in the center, when concolorous dark brown, reddish to yellowish, iridescent or dull; base rounded, truncate to acute, sometimes cordate with overlapping lobes, apex rounded, acute, obtuse, acuminate, attenuate, caudate to long-caudate, in the hybrids with constrictions, appressed or patent, when patent straight or reflexed, margin erose, dentate, ciliate or smooth. *Fronds* 5.3–176 cm long. *Petioles* 0.5–65 cm long, subterete and narrowly alate proximally, generally sulcate and distally winged or more frequently without wings, light brown, dark brown, reddish, greenish, lustrous to pale, often with different colour from the base to the apex. *Laminae* 4.8–111 × 0.9–54 cm, lanceolate, ovate-lanceolate, deltate, ovate-oblong, elliptic to linear, pinnatisect, pinnate to proximally pinnate and distally pinnatisect, simple (*S. levigatum*) or lobulate to slightly segmented or pinnate (in the hybrids), monomorphic, chartaceous, coriaceous, membranous to papyraceous, 2–61 pairs of segments, pinnae or lobes, sessile to adnate, base truncate, cuneate, obtuse, attenuate, acute, rounded to decurrent in a lobate wing, sinuate to smooth (in the hybrids), apex acute, cuneate, obtuse, acuminate to attenuate. *Medial pinnae or segments* 1.1–32 cm × 0.2–1.9 cm, base decurrent, adnate, acute, cuneate, inequilateral, obtuse to rounded, apex acuminate, acute, rounded, attenuate to wide cuspidate. *Areole* of the medial pinnae or segments 3–81 rows along and 1–8 rows between the costa and the margin, anastomosing venation or with irregular patterns in the hybrids, impressed, notoriously impressed, or covered by hairs to immersed and inconspicuous. *Laminar induments* scales absent to scattered, mainly on costae, rachises and at the base of pinnae or segments, 0.5–5.4 × 0.1–1.8 mm, acicular, lanceolate, triangular, orbicular to ovate, 2–20 cells wide, appressed,

subappressed to patent, concolorous or rarely bicolorous, then dark brown proximally and light brown distally, or light brown to yellowish to the margin and dark yellow, gold or brown to the center, base rounded, truncate, acute, basifixed, subpeltate to peltate, apex acuminate, acute, to long acuminate, margin dentate, erose to ciliate; hairs simple or rarely stellate, deciduous, persistent or absent, scarce to dense on the abaxial surfaces or in the whole laminae, especially on the rachises, catenate, patent or appressed, hyaline, brown to yellowish, 2–22 cells long, with obscure dissections between cells or not. *Sori* rounded, from the middle pinnae, segments or lobules in 1–66 rows along and 1–10 rows between costae and margins. *Spores* monolete, 33–86 × 20–55 µm, ellipsoidal to sub-ellipsoidal, plano-convex to concave-convex, with irregular or regular, depressed or prominent verrucae (rarely with micro-ornamentation, or gemmulate), folded perinae, or as in *S. vacillans* with folded perinae producing linear crests.

Etymology. The name alludes to the long-creeping rhizomes (present in most of the species) that resemble a snake (Smith et al., 2006).

Composition and distribution. Serpocaulon is composed by 37 species and five hybrids and occurs from south of Mexico to central Argentina, from sea level to 3500 (–4200 m) (Figure 23). The main diversity is recorded in the Andes of Ecuador, Colombia, Peru, Bolivia, and the Atlantic forest of Brazil (Figure 24).

KEY TO THE SPECIES OF *SERPOCAULON*

1. Laminae simple……22. *S. levigatum* (Kunze ex Klotzsch) A.R. Sm.
1'. Laminae pinnatisect to pinnate ….....2
2. Laminae pinnate..…….....3
2'. Laminae pinnatisect (at least at the apex)…..……..……....14
3. Rhizome scales rounded to ovate with the apex appressed to the rhizome…...…….....4
3'. Rhizome scales ovate-lanceolate, lanceolate to subulate with patent apex ….……....7
4. Laminae densely pubescent..…..……..……...3. *S. appressum* (Copel.) A.R. Sm.
4'. Laminae glabrous…….....5

5. Pinnae adnate in the distal ¾ part of the laminae……....1. *S. adnatum* (Kunze ex Klotzsch) A.R. Sm.

5'. Pinnae sessile in the distal ¾ part of the laminae…….....6

6. Rhizome scales with light brown margin; basal pinnae with the base notoriously equilateral, rounded at the basiscopic side, attenuate by the acroscopic; areolae 17–35 rows along the medial pinna; from Belize and Guatemala to the Andes reaching until Bolivia……....15. *S. fraxinifolium* (Jacq.) A.R. Sm.

6'. Rhizome scales with reddish colour margin; basal pinnae with the base slightly inequilaterous, cuneate at both side; areolae 36–57 rows along the medial pinna; from Middle Magdalena of Colombia……..2. *S. antioquianum* D. Sanín

7. Rhizomes long-creeping ….....….....….....8

7'. Rhizomes short-creeping.....….....….....12

8. Laminae densely pubescent..…….....….....32. *S. richardii* (Klotzsch) A.R. Sm.

8'. Laminae glabrous, or only pubescent in juvenile specimens (*S. meniscifolium*)….....9

9. Rhizome scales less than 3 mm long….....….....…..28. *S. polystichum* (Link) A.R. Sm.

9'. Rhizome scales more than 4 mm long….....….....….....10

10. Rhizome scales 1.8–7.2 mm wide, ovate-lanceolate, concolorous; areolae along the medial pinna 56–100 rows; hairs 1–3 cells and appressed……...…31. *S. rex* Schwartsb. & A.R. Sm.

10'. Rhizome scales 0.81–2.8 mm wide, lanceolate or subulate, bicolorous (at least basally in the case of *S. psychotrium*); areolae along the medial pinna 28–50 rows; hairs 3–17 cells and patent…….……..11

11. Rhizome scales subulate, reflexed apex, with the margin light brown; sori along the medial pinna in 30–40 rows.....29. *S. psychotrium* Mostacero, D. Sanín & A.R. Sm.

11'. Rhizome scales lanceolate, straight patent apex, margin salmon coloured; sori along the medial pinna in 15–29 rows..…..4. *S. articulatum* (C. Presl) Schwartsb. & A.R. Sm.

12. Rhizome scales concolorous, iridescent, dark brown, cell walls translucent (allowing the view across it); one row of sori between the costa and the margin of the medial pinna…....…….....33. *S. sessilifolium* (Desv.) A.R. Sm.

12'. Rhizome scales bicolorous, dull, dark brown, light brown to orange, cell walls dense (avoiding the view across it); more than one row of sori between the costa and the margin of the medial pinna…..….....13

13. Rhizome scales dark brown; base of the medial pinna basiscopically sessile and acroscopically slightly adnate to adnate; hydathodes in the adaxial surfaces…..….....25. *S. meniscifolium* (Langsd. & Fisch.) A.R. Sm.

13'. Rhizome scales light brown to orange; base of the medial pinna slightly adnate to sessile in both sides; hydathodes in the adaxial surfaces absent....35. *S. triseriale* (Sw.) A.R. Sm.

14. Rhizomes short-creeping.....….....….....….....….....…15

14'. Rhizomes long-creeping …...….....….....….....….....22

15. Laminae glabrous (with few scales at the base of the segments or scarce and dispersed hairs)…….....….....….....….....….....16

15'. Laminae densely pubescence…..….....….....….....19

16. Rhizome scales light orange; areoles of the medial segment 2−6 rows between the costae and the margin, impressed……...5. *S. attenuatum* (Humb. & Bonpl. ex. Willd.) A.R. Sm.

16'. Rhizomes scales dark brown to light brown; areoles of the medial segment 1 to rarely 2 rows between the costae and the margin, notorious but not impressed……....17

17. Rhizomes 5−12 mm in diameter; rhizome scales with apices long-acuminate-cirrose, with scattered pale marginal projections 1−2 mm long, especially at the base; endemic to Brazilian Inselbergs of the Atlantic Rainforest……...……...11. *S. demissum* (Fée) D. Sanín

17'. Rhizomes, 3−8 mm in diameter; rhizome scales with apices acute-acuminate to long-acuminate, with dentate to smooth margin; wide distributed in the South to Southeast of America…..….....…….....18

18. Rhizome scales dense, lanceolate, concolorous, light brown; segments ascending …….....6. *S. australe* D. Sanín, J.C. Ospina, I.O. Moura & Salino

18'. Rhizome scales scarce, subulate, bicolorous, light brown in the margin and dark brown in the center; segments parallel…….....7. *S. catharinae* (Langsd. & Fisch.) A.R. Sm.

19. Laminae linear, 35−49 pairs of segments….....37. *S. wagneri* (Mett.) A.R. Sm.

19'. Laminae ovate, oblong-lanceolate to narrowly lanceolate, 16−35 pairs of segments.....20

20. Rhizomes rugose; rhizome scales dispersed, specially disposed at the apex, and the base of phyllopodia; laminae densely covered by glandular dense hairs (1−2 cells) long….....17. *S. glandulosissimum* (Brade) Labiak & J. Prado

20'. Rhizome smooth; rhizome scales dense, distributed along the rhizome; laminae covered by strigose or villous dense hairs (3−22 cells)…….……..….21

21. Rhizomes 5−12 mm diam.; rhizome scales concolorous, iridescent, dark brown, 4−16 mm long.....….....….....….....12. *S. dissimile* (L.) A.R. Sm.

21'. Rhizomes less than 6 mm diam.; rhizome scales bicolorous, light brown to the margin and dark brown to the center, less than 5 mm long, ……...19. *S. lasiopus* (Klotzsch) A.R. Sm.

22. Rhizome scales rounded to ovate, totally appressed, dense cell walls opaque (except *S. intricatum*).....….....….....…23

22'. Rhizome scales ovate-lanceolate, lanceolate to long acuminate, patent at the apex, slim cell walls translucent…….....….....……29

23. Laminae linear, dense pubescent, base truncate or slightly reduced to a decurrent wing, membranaceous to papyraceous texture….....10. *S. dasypleuron* (Kunze) A.R. Sm.

23'. Laminae ovate-lanceolate, narrowly lanceolate to rarely linear-lanceolate, glabrous, with scarce reduced scales or/and scarce and dispersed hairs, base truncate and expanded, chartaceous to coriaceous texture.....24

24. Terminal segment widely attenuate (1/3 to 1/5 the size of the laminae); sori 3−9 rows along the medial segment....…….....30. *S. ptilorhizon* (H. Christ) A.R. Sm.

24'. Terminal segment shortly attenuate (1/7 the size of the laminae, similar size to the laterals); sori 6−48 rows along the medial segment…….....……...…25

25. Laminae 20−36 cm wide; sori 25–48 rows along and 2–3 rows between the costa and margin of the medial segments…...21. *S. latissimum* (R.C. Moran & B. Øllg.) A.R. Sm.

25'. Laminae 2.6−15(−23) cm wide; sori 6−21 rows along and 1−2 rows between the costa and the margin of the medial segments……...……..26

26. Rhizomes 1.4–2.5 cm diameter; sori 7–13 rows along and 1 rows between the costa and the margin of the medial segments……16. *S. funckii* (Mett.) A.R. Sm.

26'. Rhizomes 2.7–10 mm diameter; sori 10−26 rows along and 1−2 rows between the costa and the margin of the medial segments..……27

27. Petioles shortly winged to wings 1 mm wide; laminar scales 4−8 × 1.5−2.3 mm……..……23. *S. loriceum* (L.) A.R. Sm.

27'. Petioles not winged; laminar scales 0.7−2.3 × 0.5−1.3 mm……..28

28. Laminar scales 1.9−2.3 × 0.9−1.3 mm, peltate; laminae 26−60 cm long; medial segments 4−11 long; spores with irregular depressed verrucae; central Andes, Ecuador to Bolivia..……...…18. *S. intricatum* (M. Kessler & A.R. Sm.) A.R. Sm.

28'. Laminar scales 0.7−1.3 × 0.5−0.8 mm, basifixed; laminae 17–32 cm long; medial segments 2.7−5.5 cm long; spores with prominent verrucae; central America, Guatemala to rarely in Ecuador...……..……..…24. *S. maritimum* (Hieron.) A.R. Sm.

29. Rhizome scales appressed, strongly attached and overlapping, very difficult to remove…….....….....…….....….....……....30

29'. Rhizome scales patent, attached only in the insertion, and scarcely overlapping, if so, easy to remove…….....….....…….....….....…..32

30. Margins of the segments softly sinuate, with marginal hairs in the base of each sinus; S. Mexico to Panama and Antilles.....14. *S. falcaria* (Kunze) A.R. Sm.

30'. Margins of the segments entire, or if softly sinuate, without marginal hairs; Colombia to Bolivia and Brazil……..…….……31

31. Rhizomes diameter 0.9–2 mm; rhizome scales 0.2–0.6 mm wide, dark yellow to dark gold in the center; petioles 1.5–5 cm long, winged (1 mm wide); appressed and patent hairs; Chocó and Andes from Ecuador…….27. *S. patentissimum* (Mett. ex Kuhn) A.R. Sm.

31'. Rhizomes diameter 2.4–8.4 mm; rhizome scales 0.7–2.2 mm wide, dark brown in the center; petioles 8.7–36.5 cm long, not winged; appressed hairs; Atlantic Rain Forest, piemont of Andean-Amazon and Central Andes……..…20. *S. latipes* (Langsd. & Fisch.) A.R. Sm.

32. Rhizome scales concolorous, dark orange, dark brown to reddish, iridescent……33

32'. Rhizome scales bicolorous, dark brown to light brown, dull……...…….…35

33. Rhizome scales 1.6−2.3 mm wide; fertile veinlets inconspicuous…….....8. *S. concolorum* (M. Kessler & A.R. Sm.) A.R. Sm.

33'. Rhizome scales 0.5−1.7 mm wide, fertile veinlets conspicuous.……...…….34

34. Plants terrestrial with rhizomes strictly subterranean (at least 2 cm deep in the soil); laminae dense pubescence, with sweet smell when fresh and dry, widely distributed in the Atlantic Rainforest.…….....…...……....36. *S. vacillans* (Link) A.R. Sm.

34'. Plants epiphyte, terrestrial or rarely rupicolous with rhizome over the substrate; laminae glabrous, with few laminar scales in the base of the segments, sweet smell absent, widely distributed in the highlands of North Andes and Costa Rica……...13. *S. eleutherophlebium* (Fée) A.R. Sm.

35. Rhizomes 4−10 mm diameter; rhizome 2.2−3.4 mm wide, ovate to ovate-lanceolate…..….....…….....9. *S. crystalloneurum* (Rosenst.) A.R. Sm.

35'. Rhizomes 1−5 mm diameter; rhizome scales 0.4−2.2 mm wide, lanceolate to triangular or subulate-lanceolate, rarely ovate-lanceolate in *S. subandinum*……..……..36

36. Rhizome scales 1−4.5 mm long; laminae 11−48 × 3.2−15 cm, medial segments 1.5−7 × 0.4−1 cm, sori in 6−15 rows along and 1 rows between the costa and the margin…….....34. *S. subandinum* (Sodiro) A.R. Sm.

36'. Rhizome scales 3.6−7 mm long; laminae (11−)25−66 × 12−26 cm; medial segments 6−13.5 × 0.9−2.5 cm; sori in 15−31 rows along and 1−2(−3) rows between the costa and the margin……..……..……26. *S. nanegalense* (Sodiro) A.R. Sm.

DESCRIPTION OF SPECIES

1. Serpocaulon adnatum (Kunze ex Klotzsch) A.R. Sm., Taxon 55(4): 927. 2006. *Polypodium adnatum* Kunze ex. Klotzsch. Linnaea 20: 395. 1847. *Goniophlebium adnatum* (Kunze) T. Moore, Index fil. 385. 1862. TYPE: Venezuela. 'Merida Colombiae', 1846, *J.W.K. Moritz 353* (first step lectotype: B, designated by Hensen (1990: 290)); **second step lectotype** mounted on 4 sheets: B [bc] 200090109 image!, B [bc] 200090110 image!, B [bc] 200090111 image!, B [bc] 200090112 image! here designated; isolectotype BM). Figures 19a, 22a, 23a, 26, 27, 37a.

Plants hemiepiphytes, epiphytes, terrestrial or rarely rupicolous. *Rhizomes* 4–10 mm diameter, long-creeping, dark brown to reddish, pruinose; phyllopodia distance 1.7–7 cm. *Rhizome scales* dense, 1–3 × 1–2 mm, rounded, ovate to elliptic, appressed, peltate,

bicolorous, light brown to the margin and dark brown to the center, base rounded to obtuse, apex rounded and appressed, erose and overlapping margin. *Fronds* 37–153 cm long. *Petioles* 17–65 cm long, proximally subterete, distally slightly sulcate, light brown to dark brown. *Laminae* 20–88 × 13–46 cm, ovate-oblong to ovate-lanceolate, pinnate, truncate proximally and obtuse apex. *Pinnae* 4–10 pairs, chartaceous to coriaceous, adnate in 3/4 parts of the lamina, proximal sessile, medial slightly adnate and distal totally adnate, apical pinnae conform and adnate to the lateral. *Medial pinnae* 9–30 × 2.2–5.5 cm, base decurrent and apex acuminate, venation forming 26–61 rows along and 4–7 rows of areolae between the costae and the margin, notorious. *Laminar induments* pinnae scales scarce, 0.8–2.5 × 0.2–0.9 mm, acicular, patent, basifixed with a notorious insertion, concolorous, dark brown, base acute and apex acuminate, the margins dentate; hairs scarce, catenate with 3–16 cells, appressed, hyaline with dark brown dissections. *Sori* from the medial pinnae in 12–48 rows along and 2–6 rows between the costa and the margin. *Spores* 46.5–54 × 26–34 µm, ellipsoidal, plane-convex to concave-convex, and regular depressed verrucae.

Etymology. The specific epithet refers to the adnate condition of the medial and apical pinnae.

Distribution and habitat. Serpocaulon adnatum occurs from Colombia and Venezuela to Peru, mainly in Andean ecosystems, from 350 to 3700 m in humid forest.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon adnatum most resembles *S. antioquianum* and *S. fraxinifolium*, which also have long-creeping rhizomes, appressed rhizome scales and pinnate laminae. However, it differs from *S. antioquianum* by its medial to apical pinnae adnate (vs. petiolate to sessile pinnae and the apical pinnae cuneate, never adnate). From *S. fraxinifolium* it can be distinguished by its pinnae adnate in 3/4 part of the lamina (vs. sessile or petiolate in 3/4 part of the lamina, to slightly adnate or softly auriculate to the apex), and more rows of areolae between the costae and the margin (4–7 vs. 2–4 rows).

Serpocaulon adnatum also resembles *S. articulatum, S. psychotrium*, *S. richardii* and *S. triseriale* by its pinnate laminae and long-creeping rhizomes (except *S. triseriale*). However, it presents rounded, ovate to elliptic and appressed rhizome scales (vs. lanceolate to subulate rhizome scales with patent apices).

Taxonomic and nomenclatural notes. Hensen (1990) designated a lectotype for *S. adnatum*, based on *J.W.K. Moritz 353* from B, as a first-step of lectotypification. However, this collection was mounted on four sheets. Therefore, we designated B [bc] 200090109 image!, B [bc] 200090110 image!, B [bc] 200090111 image!, B [bc] 200090112 image! as a second-step of lectypification of *S. adnatum*, following Turland et al. (2018, Art. 8.3)

Representative specimens. COLOMBIA. **Antioquia:** Jardín, vereda Quebrada Bonita, sector Bocatoma, quebrada La Mendoza, 2110–2150 m, 5º35'4" N, 75º46'36" W, *W.D. Rodríguez 4907* (HUA); Rionegro, Santa Elena, Sajonia, quebrada El Yarumo, 6º13'00" N, 75º30'00" W, 9 May 1977, *L. Atehortúa 407* (HUA). **Boyacá**: entre Chiquinquirá y Pauna, Las Fuentes, 2000–2300 m, 12 Dec. 1970, *M.T. Murillo 1517* (COL); Sierra Nevada del Cocuy, 2200 m, 23 Aug. 1957, *Grubb 91* (COL). **Caldas:** Manizales, Neira, Alto del Guamo, hacienda San Juan, 2530 m, 5º9' N, 75º24' W, 9 Aug. 2004, *D. Sanín 1643* (FAUC). **Caquetá**: San Vicente del Caguán, cuenca del río Pato, 1500 m, 2°48'55" N, 74°50'31" W, 15 Nov. 1997, *H. Mendoza 4643* (FMB). **Cauca**: Bolívar, corregimiento del Carmen, 2300–2400 m, 1º49' N, 76º53' W, 10 Apr. 2003, *A. Aguilar 391* (CAUP); Popayán, a 2,5 km vía a Totoró, Río Blanco, 1850 m, 2º30' N, 76º23' W, 11 Apr. 1995, *B.R. Ramírez-P. 7131* (PSO). **Chocó**: San José del Palmar, vereda de Río Negro, Cerro Torrá, vertiente oriental río Negro, debajo del helipuerto, 1800 m, 12 Aug. 1988, *Ramos 1163* (CUVC). **Cundinamarca:** Albán, cercanías de San Bernardo hacia Sasaima, 1600–1800 m, 23 Jun. 1940, *J. Cuatrecasas 9607* (COL); arriba de la Vega, 2400 m, 15 Apr. 1964, *M.T. Murillo 736* (COL). **Huila**: Pitalito, vereda Charguayaco, reserva El Arroyuelo, 1925 m, 1º46' N, 76º1' W, 28 Jul. 2009, *D. Sanín 3214* (HUA). **Nariño:** Reserva La Planada, quebradas, El Mar-La Calladita 1500–1800 m, 1º10' N, 77º58' W, 13 Apr. 1988, *O. de Benavides 9702* (PSO). **Putumayo**: 59 km. Al W de El Pepino, puente de carretera encima del valle principal, 2280 m, 22 Nov. 1972, *O. Hagemann 1567* (COL, PSO). **Quindío:** Filandia, vereda Cruces, corredor biológico Los

Monos-sendero El Otobo, 1950 m, 19 Jul. 2009, *D. Sanín 3061* (FAUC). **Risaralda**: Pereira, reserva Otún Quimbaya, zona amortiguadora del Parque los Nevados, 1897 m, 4º43' N, 75º34' W, 7 Dec. 2009, *D. Sanín 2446* (FAUC); Mistrató, corregimiento de Jeguadas, Cordillera Occidental, vertiente occidental, 1500 m, 28 Mar. 1992, *J. Betancur 3172* (COL). **Santander:** Floridablanca, de La Corcova hacia El Cerro La Judía, 1800–2700 m, 22 Jun. 2004, *J. Murillo-A. 3648* (COL). **Tolima:** Ibagué, Corregimiento de Juntas, vía la escuela El Salto, 3696 m, 4º37' N, 75º16' W, 28 Jul. 2009, *D. Sanín 3178* (FAUC). **Valle del Cauca:** Argelia, vereda Las Brisas, 2140 m, 21 Feb. 1983, *P. Franco-Roselli 1654* (COL); San Antonio, west of Cali, near to summit of Cordillera Occidental, 1900–2350 m, 26 Mar. 1939, *E.P. Killip 33919* (COL); finca La Pradera ca 6 km SW of El Cairo on the trail to Río Blanco, between El Brillante and Boquerón, 2150–2200 m, 27 Mar. 1971, *D.B. Lellinger 813* (COL, LP).

ECUADOR**. Carchi:** Gualpi Chico, vicinity of Awá, 1330 m, 0º58' N, 78º16' W, 17 Jan. 1988, *W.S. Hoover et al. 2680* (QCA). **El Oro:** Hac. Buenaventura, 12 Km W Piñas on road to Machala, 1000 m, 3º48' S, 79º46' W, 1 Mar. 1991, *M. Kessler 2583* (QCA). **Esmeraldas:** Road Lita-Alto Tambo, km 17.5, entrance to Reserva Ecológica Cotacachi-Cayapa, 820 m, 00º53' N, 78º33' W, 4 Nov. 1994, *B. Øllgaard & H. Navarrete 105414* (AAU, QCA!). **Imbabura:** Road to Intag valley above Apuela, 0º21' N, 78º29' W, 1950 m, 7 May 1980, *L. Holm-Nielsen & J. Jaramillo 23409* (QCA!). **Morona-Santiago:** Cordillera del Cóndor, base camp overlooking Río Zamora at headwaters of Río Piuntza, 1850 m, 5 Jan. 1972, *B. MacBryde 987* (QCA). **Napo:** Road Baeza-Tena, 2 km N of Cosanga, 1900–2000 m, 0º34' S, 77º53' W, 17 Jan. 1992, *B. Øllgaard et al. 99548* (QCA); near Cosanga, Yanayacu biological Station: sendero principal and vicinity (along stream), 2106 m, -0.60036 S, -77.89070 W, 5 Dec. 2006, *E. Schuettpelz & M. Sundue 928B* (DUKE, QCA!, UC); Guacamayos, a 10 km pasando Cosanga con dirección al Tena, 2000 m, 00º38.5510 S, -77º50,02140 W, Jun. 2009, *L. Salazar 455* (3 sheets QCA); Quijos, ca 1.5 km NE of Cosanga, 2150–2400 m, 0º30' S, 77º52' W, 14 Feb. 1978, *J.H. Kirkbride & H. Chamba 4036* (Q). **Pichincha:** Saguangal, Had. Conquista, 770–820 m, 0º14' N, 78º47' W, 9 Mar. 1995, *B. Øllgaard et al. 1095* (AAU, QCA!); near Tandayapa: Bellavista Reserve, 2300 m, -0.00807 S, -78.68971 W, 8 Dec. 2006, *E. Schuettpelz & M. Sundue 970B* (QCA). **Tungurahua:** Road

Río Negro-Baños, km 8, wet forestead stream ravine N of the road, 1430 m, 1º24’ S, 78º15’ W, *B. Øllgaard & H. Navarrete 3004* (QCA).

PERU**. Junin:** Satipo, Granja Pajonal, east of Chequitavo on trail to Kotampaz, 1200 m, 10º45’ S, 74º23’ W, 4 Apr. 1984, *D.N. Smith 6748* (MO, USM).

VENEZUELA. **Merida:** Dto. Andrés Bello, Mun. Zerpa, La Carbonera, 2250 m, 3 Sep. 1975, *J. Bautista 3839* (LP).

2. Serpocaulon antioquianum D. Sanín, Flora de Colombia, 32. Pag. 43. 2018. TYPE: Colombia. Antioquia: municipio San Luis, autopista Medellín-Bogotá, vereda La Josefina, camino del caño La Mariola a Santa Bárbara, 800 m, 26 Dec. 1983, *S.E. Hoyos & J.J. Hernández 816* (holotype JAUM [bc] 42618!). Figures 23a, 28, 37b.

Plants epiphytes. *Rhizomes* 3.2–8 mm diameter, long-creeping, dark brown to reddish, not pruinose; phyllopodia distance 2–3 cm. *Rhizome scales* dense, 1.3–4 × 0.9–2.3 mm, ovate to rounded, appressed, peltate, bicolorous, salmon to the margin and dark brown to the center, base and apex rounded to obtuse and appressed, erose and overlapping margin. *Fronds* 34–107 cm long. *Petioles* 10–47 cm long, proximally subterete, distally slightly sulcate, basally light brown and distally dark. *Laminae* 24–60 × 15–30 cm, oblong, pinnate, truncate proximally and obtuse apex. *Pinnae* 2–7 pairs, proximal and medial sessile, apical pinna conform and widely attenuate; chartaceous to coriaceous. *Medial pinnae* 12–24 × 2.3–4.6 cm, sessile, base inequilateral, especially to the catadromic portion and apex largely acuminate, venation forming 36–57 rows along and 4–8 rows of areolae between the costae and the margin, wide and with square appearance, mainly those located at costae, notorious. *Laminar induments* pinnae scales scarce, 1.3–2 × 0.8–1.3 mm, triangular, 13–18 cell wide, appressed, peltate, concolorous, light brown, base rounded and apex acute, the margins erose; hairs scarce, 4–6 cells long, catenate, patent, hyaline with obscure dissections. *Sori* from the medial pinnae in 13–52 along and 3–8 rows between the costa and the margin.

Etymology. Its name is in honour to the Antioquia department of Colombia (Sanín, 2018).

Distribution and habitat. *Serpocaulon antioquianum* is restricted to Colombia, recorded in Antioquia and Caldas Departments, at the Oriental slope of the Central Andean Cordillera, in the Middle basin of the Magdalena river, from 400 to 900 m, in humid forest.

Phenology. Recorded fertile in January, March, April, July, October and December.

Notes. *Serpocaulon antioquianum* most resembles *S. adnatum* and *S. fraxinifolium*, that also have long-creeping rhizomes with appressed scales and pinnate laminae. However, it differs from *S. adnatum* by its medial to apical pinnae sessile (vs. medial to apical pinnae adnate), and terminal pinna conform and widely attenuate (vs. adnate to the lateral). From *S. fraxinifolium* can be distinguished by presents a greater number of areolae between the costae and the margin in the middle pinnae (4–8 vs. 2–4 rows) and the widely attenuate apical pinnae (vs. apical pinnae similar in size to the laterals).

Serpocaulon antioquianum also resembles *S. articulatum*, *S. psychotrium* and *S. richardii* that possess generally more than 4 rows of sori between the costae and the margin, pinnate laminae and long-creeping rhizomes. However, it presents appressed, rounded to ovate rhizome scales (vs. lanceolate to subulate rhizome scales, and patent apex).

Representative specimens. COLOMBIA. **Antioquia:** San Luis, Río Claro, reserva Río Claro, por el sendero turístico, 400 m, 13 Mar. 1983, *L. Albert de Escobar 3332* (HUA); Anorí, vereda Madre Seca, quebrada Pilones, 400–900 m, 13 Jul. 1975, *R. Fonnegra 374* (HUA); San Luis, autopista Medellín-Bogotá, vereda Josefina, camino del caño La Mariola, hacia Santa Bárbara, 800 m, 26 Dec. 1983, *S. Hoyos 816* (HUA); Anorí, sector Juanico, 610 m, 7º17’ N, 75º03’ W, 22 Jan. 2004, *W. Rodríguez 4526* (HUA); San Luis, Río Claro, reserva Río Claro, por el sendero turístico, 800 m, 5º53’ N, 74º51’ W, 21 Apr. 2007, *D. Sanín 1954* (FAUC, HUA). **Caldas**: Florencia, dirección este Quebrada Las Mercedes, 5º31’36” N, 75º02’26” W, 13 Oct. 1992, *C. Barbosa 7935 (165)* (FMB).

3. Serpocaulon appressum (Copel.) A.R. Sm., Taxon 55(4): 927. 2006. *Polypodium appressum* Copel. Univ. Calif. Publ. Bot. 19(9): 305, pl. 66. 1941. TYPE: Bolivia. La Paz: Prov. Sur Yungas, Colaya, alt. 1780 m, on tree trunk in virgin forest, 14 Dec. 1935, *Y.*

Mexia 7821 (first step lectotype: MICH, designated by Hensen (1990: 291), **second step lectotype**: UC [bc] 595046! here designated; isolectotypes F [bc] 0076008!, GB [bc] 0079099 image!, GH [bc] 00021810 image!, K [bc] 000642084 image!, LPB, MICH [bc] 1190827 image!, MO, S [bc] S-R-5036 image!, US [bc] 00065812 image! here designated). Figures 13a-b, 16a, 23a, 29, 30, 37c.

Polypodium rhizocaulon var. *hirsutula* Rosenst. Repert. Spec. Nov. Regni Veg. 12: 473. 1913. TYPE: Bolivia. La Paz: Polo-Polo bei Coroico, Nordyungas, 1100 m, 19 Dec. 1912, *O. Buchtien 3511* (**lectotype here designated**: S [bc] 05-9192 image!).

Plants epiphytic and terrestrial. *Rhizomes* 4−5.3 mm diameter, long creeping, green dark (when fresh) dark brown (when dry); phyllopodia distance 2.8−4 cm. *Rhizome scales* dense, 1.9−2.3 × 1.3−1.5 mm, rounded to ovate, appressed, peltate, bicolorous, light brown to the margin and dark brown to the center, base and apex rounded, erose and often overlapping margin. *Fronds* 60−81 cm long. *Petioles* 25−31 cm, proximally and distally subterete, light green (when fresh), light brown clear (when dry). *Laminae* 35−50 × 20−32 cm, ovate to ovate-lanceolate, pinnate, truncate proximally and obtuse apex. *Pinnae* 6−7 pairs, chartaceous, proximal and medial softly petiolate, distal sessile, apical pinna conform. *Medial pinnae* 10−15.6 × 3−3.5 cm, base rounded and apex acuminate, venation forming 39−42 rows along and 4−5 rows of areolae between the costae and the margin, notorious. *Laminar induments* pinnae scales scarce, 1.35−1.46 × 0.27−0.37 mm, elliptic to lanceolate, 10−13 cells wide, patent, peltate, concolorous, dark brown, base rounded and, apex acuminate, the margins dentate; hairs dense, catenate, patent, dark brown, darker in the union of cells, located on the abaxial surface and the rachis, 2−15 cells long, villose, and over the adaxial surface, 7−8 cells long, pilose. *Sori* from the medial pinnae in 40−57 rows along and 3−4 rows between the costa and the margin. *Spores* 48−50 × 25−30 µm, ellipsoidal to plane-convex, and irregular depressed verrucae that possess micro-ornamentation.

Etymology. Named for the strictly appressed scales of the rhizome (Copeland, 1941).

Distribution and habitat. Serpocaulon appressum occurs from South of Colombia, Peru and Bolivia, mainly in Andean ecosystems, from 1100 to 2210 m, in premontane cloud

forests. It is recorded here for first time in Colombia in primary forest at La Planada Reserve, western slope of the Western Andean Cordillera.

Phenology. It was recorded fertile from January to May, and from August to December.

Notes. Serpocaulon appressum most resembles *S. adnatum* and *S. fraxinifolium* by its long-creeping rhizomes with appressed rhizome scales and pinnate laminae. However, it differs from the named species by its dense hairs in the lamina (vs. glabrous or with scarce scattered hairs), and spores with micro-ornamentation at the verrucae (vs. smooth verrucae). It can be confused with *S. richardii* by its long-creeping rhizome and dense pubescent pinnate laminae, however, can be distinguished by its rounded appressed bicolorous scales (vs. patent concolorous scales with a long acuminate apex), conform apical pinna (vs. adnate), and the presence of lamina scales (vs. lamina scales absent).

Taxonomic and nomenclatural notes. Hensen (1990) commented that the holotype was hosted at MICH, although the protologue suggested that the type was hosted at UC but did not designate any herbaria (Copeland, 1941). For this reason, here is designated as lectotype the sheet *Y. Mexia 7821* housed in UC.

Despite Lellinger (1989) and Smith et al. (2006) suggested *Polypodium rhizocaulon* Willd. var. *hirsutula* Rosenst. as a synonym of *P. fraxinifolium* (= *S. fraxinifolium*), the name *Polypodium rhizocaulon* var. *hirsutula* is supported by a sheet that represents *S. appressum* as was suggested by Smith et al. (2018).

Rosenstock (1913: 473) used the name '*hirsutula*' to describe *Polypodium rhizocaulon* var. *hirsutula*. However, the name 'hirsutulum' has been used erroneously in previous taxonomic treatments (Smith et al., 2018) and database currently (www.tropicos.org, www.ipni.org, etc).

Representative specimens. BOLIVIA. **La Paz:** Prov. Nor Yungas, PNANMI Cotapata, Estación Biológica Tunquini, 1860 m, 16º11' S, 67º52' W, 6 Oct. 1998, *A. Portugal et al. 420* (LPB); Prov. Nor Yungas, 16.5 km al norte (debajo) de Chuspipata por el camino a Coroico (Yolosa), 1900 m, 16º13' S, 67º47' W, 28 May 1988, *J. Salomon 18494* (F!, LPB,

MO). **Franz Tamayo:** Parque Nacional Madidi, Piedra Blanca, 10.4 km en línea recta al S. de Pata, sobre el camino a Santa Cruz del Valle Ameno, 1900 m, 14º37'44" S, 68º40'19" W, 12 Nov. 2003, *A. Fuentes et al. 6008* (LPB).

COLOMBIA. **Nariño:** Reserva Natural La Planada, vda San Isidro, municipio Ricaurte, 1861 m., 1°09'25.7" N, 77°58'46.8" W, 18 Aug. 2017, *D. Sanín et al. 7040a* (HUA, BHCB); *D. Sanín et al. 7055* (HUA, COL, PSO); Reserva Natural La Planada, 1°10' N, 77°58' W, 19 Jan. 1990, *O. de Benavides 11410* (PSO); Ricaurte, Resguardo Pialapí, camino Pialapí-Las Cruces, 1300–1500 m, 1°7' N, 77°52' W, 3 Nov. 1995, *B.R., Ramírez-Padilla et al. 8621* (PSO); vicinity of Palmar, in valley of río Imbí, 3 km NW of Ricaurte (along road between Pasto and Tumaco), ca 1 km E of Texas Gulf Pipelin maintenance Station, along slopes above río Imbí, 1100 m, 1°8' N, 77°56' W, 14 Mar. 1990, *T.B. Croat 71427* (MO, PSO).

PERU. **Pasco:** Oxapampa, Distr. Chontabamba, Carretera a la Suiza, 10º39' S, 75º27' W, 2138–2210 m, 8 Mar. 2003, *A. Monteagudo et al. 4532* (F!, MO).

4. Serpocaulon articulatum (C. Presl) Schwartsb. & A.R. Sm., J. Bot. Res. Inst. Texas 7(1): 85. 2013. *Goniophlebium articulatum* C. Presl, Tent. Pterid. 186. 1836. *Polypodium articulatum* Desv., Mém. Soc. Linn. Paris 6: 236. 1827, nom. illeg. (non Juss. ex Poir. 1804, nec Vahl 1807).— TYPE: *Anon., s.n.* (lectotype designated by Schwartsburd & Smith (2013: 85): P [bc] 00624694 image!). Figures 5e, 10d, 20a, m, 23c, 31, 32, 37d.

Polypodium fraxinifolium Jacq. subsp. *articulatum* (C. Presl) Christ, Bull. Herb. Boissier, sér. 2, 6: 49. 1906. TYPE: Costa Rica. Cartago: Turrialba, 550 m, *H. Pittier 9061* (lectotype designated by Lellinger (1985: 387): US [bc] 00065825 image!, isolectotypes: CR, P).

Polypodium fraxinifolium Jacq. subsp. *luridum* Christ, Bull. Herb. Boissier, sér. 2, 6: 48. 1906. TYPE: Costa Rica. Navarro: 1400 m, 1901−1905, *L.C. Wercklé s.n.* (**lectotype here designated**: P [bc] 02142043 image!; isolectoypes: NY [bc] 144847 frag. image!, US [bc] 00065826 image!).

Serpocaulon caceresii (Sodiro) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium caceresii* Sodiro, Crypt. Vasc. Quit. 360. 1893. TYPE: Crece en los bosques de Oriente en la orilla del río Napo, *R.P.R. Caceres s.n*. (lectotype designated by Sanín et al. (in press a): P [bc] 00624700 image!; isolectotypes K [bc] 000642083 image!, P [bc] 00624701 image!, P

[bc] 00624703 image!, S [bc] 05-9725 image!, NHN-U [bc] 0007491!, US [bc] 00065813 frag. image!).

Polypodium fraxinifolium Jacq. subsp. *articulatum* (Desv.) Christ, Bull. Herb. Boissier, sér. 2, 6(1): 45–59. 1906. Costa Rica: Cartago, Turrialba, 550 m. *H. Pittier 9061* (lectotype designated by Lellinger (1985: 387): US [bc] 00065825; isolectotypes: CR, P).

Plants epiphytic, hemiepiphytic or terrestrial. *Rhizomes* 4.7–9.4 mm diam., long-creeping, dark brown, often pruinose; phyllopodia distance 1.3–12 cm. *Rhizome scales* dense, 3.6–11.35 × 0.81–2.8 mm, lanceolate, subappressed, basifixed, bicolorous, light brown to salmon to the margin with parallel cells, and dark brown to the center, base peltate, rounded, apex acuminate to caudate, patent and never reflexed, erose to smooth and overlapping margin. *Fronds* 32–102 cm long. *Petioles* 10–40 cm long, proximally subterete, distally sulcate, light brown. *Laminae* 22–62 × 14–50 cm, ovate to oblong, pinnate, truncate base and obtuse apex. *Pinnae* 2–11 pairs, chartaceous to coriaceous, proximal sessile, medial and apical sessile to slightly adnate, apical pinna conform, but with an excurrent side. *Medial pinnae* 9–28 × 2.3–5.6 cm, base decurrent and apex acuminate, venation forming 28–50 row along and 4–10 rows of areolae between the costae and the margin, secondary veins immersed and inconspicuous. *Laminar induments* pinnae scales scarce, 0.5–3 × 0.1–0.5 mm, acicular to long-acuminate, 2–4 cell wide, patent, basifixed with a notorious insertion, bicolorous, light margin and dark brown canter, base acute and long acuminate apex, the margins dentate; hairs scarce and deciduous, catenate with 3–14 cells, patent, hyaline with base dark brown. *Sori* from the medial pinnae in 15–50 rows along and 3–10 rows between costa and margins. *Spores* 46–55 × 24–28 µm, plane-convex to concave convex, conical, prominent and irregular depressed verrucae.

Distribution and habitat. Serpocaulon articulatum occurs from Costa Rica to Peru, southern Venezuela and Guiana to Amazonian Bolivia and Brazil, mainly in low to middle lands from the Chocó and Amazonian regions, from 5 to 2050 m, in humid forest.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon articulatum most resemble *S. psychotrium*, that also possess a similar size of the fronds, long-creeping rhizomes with patent scales, and pinnate laminae. However, differs from *S. psychotrium* by its lanceolate rhizome scales with long acute apex (vs. subulate rhizome scales with long acuminate and reflexed apex), salmon colour (vs. dark brown), distal pinnae sessile (vs. adnate), secondary veins immersed and inconspicuous (vs. impressed and conspicuous), and sori not impressed by the adaxial surface of the lamina (vs. sori impressed).

Serpocaulon articulatum also resembles *S. adnatum, S. antioquianum, S. appressum, S. fraxinifolium, S. polystichum, S. rex, S. richardii* and *S. triseriale*, that possess pinnate laminae with long-creeping rhizome (except *S. triseriale*). However, from the first fourt species can be distinguished by its lanceolate rhizome scales, with long acute and patent apex (vs. rounded to ovate, with rounded and appressed apex). From *S. polystichum*, could be distinguished by presenting rhizome scales light brown to salmon at the margin, and light brown to the center (vs. light brown at the margin and dark brown to the center), and more areolae between the costae and the margin (4–10 vs. 2–3(–4) rows), as well as, rows of sori (3–10 vs. 2–3 rows). From *S. rex* and *S. triseriale* differ by its secondary veins immersed and inconspicuous (vs. impressed and conspicuous), and more areolae between the costae and the margin (4–8 vs. 2–6 rows). Finally, from *S. richardii* can be distinguished by its glabre laminae (vs. dense pubescence) and conform apical pinna (vs. adnate).

In Brazil, Góes-Neto and Pietrobom (2012) recorded this species as *S. caceresii* for Pará state.

Taxonomic and nomenclatural notes. This species has been cited as *Polypodium giganteum* Desv. (Lellinger, 1985; 1989; Hensen, 1990; Tryon & Stolze, 1993; Moran, 1990; 1995; León & Jørgensen, 1999; Ramírez-P. & Macías-Pinto, 2007; Murillo et al., 2008), or *S. giganteum* (Desv.) A.R. Sm. (Smith et al., 2006; Kreier et al., 2008; Labiak & Prado, 2008; Murillo et al., 2008; Gómez & Arbeláez, 2009; Labiak & Hirai, 2010; Coelho & Esteves, 2011; Rodríguez-D. 2011; Ramírez-Valencia et al., 2013), but it is possible that represents a misidentification with *S. psychotrium.*

Lellinger (1985) pointed tha the name *Polypodium fraxinifolium* Jacq. subsp. *articulatum* (Desv.) Christ as variety, this mistake was emended by Sanín et al. (in press a).

The name *Polypodium fraxinifolium* Jacq. subsp. *luridum*, did not present a designation from its type. The specimen *L.C. Wercklé s.n.* based at P presents the handwriting of the collector and the stamp of Christ. It is constituted by a fertil apical portion of *S. articulatum*, reason why here is designated the named sheet as lectotype.

Hensen (1990) expressed doubt (?) in designating the specimen *R. Cáceres s.n*. from Q as the lectotype of *P. caceresii* (= *S. caceresii*). After visiting all the herbaria from Quito, it was not possible to find this collection. In this sense, Sanín et al. (in prep. a) designated the specimen from the same protologue locality and collection *R. Cáceres s.n.* based at P as the lectotype. Also, suggested that the type of *P. caceresii* = *S. caceresii* represents a specimen of *S. articulatum*, proposing it as a new synonym of the latter. This affirmation was based on the examination of Sodiro's specimens from P, Q, QLPS, and SI, which are the main collections where Sodiro deposited his series.

Indigenous name. Atoc-Zapato in Peru (*C. Orocollo et al. 151*, USM).

Traditional uses. Used in Peru for renal, liver and uterus infections (*C. Orocollo et al. 151*, USM).

Representative specimens. BOLIVIA. **Beni**: Prov. Ballivian, lower slopes of Serrania Pilon Lajas, 14.3 km N of the bridge over the Río Quiquibey, 700 m, 15º19' S, 67º3' W, 10 Jun. 1985, *J.C. Solomon 13895* (LP, LPB); Prov. Ballivian, 25 Km from Yucumo on Yucumo-Quiquibey road, in the Pilón Lajas, 950 m, 15º17' S, 67º4' W, 16 Jul. 1990, *A. Fay & L. Fay 2732* (LPB). **La Paz:** Prov. Caranavi, serranía de Bella Vista, 47 km de Caranavi hacia Sospecho, 1150 m, 15º29' S, 67º28' W, 13 Aug. 1997, *M. Kessler et al., 11656* (LPB); Prov. Larecaja, 7.1 km al SO de Tipuani por el camino a Unutuluni, 670 m, 15º36' S, 68º1' W, 24 Jan. 1988, *J.C. Solomon 17724* (LPB!, MO); Prov. Franz Tamayo, Parque Nacional Madidi, río Quendeque, campamento guardaparques, 300 m, 15º1'10" S, 67º44'31" W, 8 Feb. 2002, *A. Fuentes et al. 3826* (LPB). **San Martín:** Prov. Lamas, Alfonso de Alvarado,

Quebrada de Poloponta, 4 km de San Juán de Pacayzapa, 800–900 m, 30 Apr. 1973, *J. Schumke 6116* (LP).

BRAZIL. **Amazonas**: Camanaus, Basin of Rio Negro, [92 m], 31 Oct. 1971, *G.T. Prance et al. 15866* (F); Presidente Figueiredo, Terra-Firme adjacente ao Lago da Usina Hidrelétrica de Balbina, 29 Nov. 2006, *G. Zuquim & A.B. Junqueira 301* (SP). **Pará**: Oriximiná, Estação Ecológica Grão Pará, Trilha T2, 570 m, 1º15'56" N, 58º42'6" W, 29 Aug. 2008, *S. Maciel & M.R. Pietrobom 836* (SP); Oriximiná, Estação Ecológica Grão Pará, Serra do Acari, trilha 2. de 2800 m, 475 m, 1º16'17" N, 58º41'28" W, 30 Aug. 2008, *M.R. Pietrobom & S. Maciel 7852* (SP).

COLOMBIA. **Cauca:** Piamonte, corregimiento de Nápoles, vereda La Florida, Serranía de los Churumbelos, 800 m, 9 May 2006, *Muñoz 2018* (CAUP). **Caquetá:** Solano, 8 km SE, of Tres Esquinas on río Caquetá below mouth of río Orteguaza, 200 m, 6 Mar. 1945, *Little 9622* (COL); Florencia; corregimiento El Caraño, vereda El Caraño, finca Las Brisas, relictos en la cima de la montaña, 1285 m, 1º44'50" N, 75º40'42' W, 16 Oct. 2015 *D. Sanín 6151* (COL). **Chocó:** hoya del río San Juan, quebrada La Serpiente, afluente del río San Juan, 5 m, 1 Apr. 1979, *E. Forero 4451* (COL); San José del Palmar, vereda Damasco, escuela Santa Lucia, 641 m, 4º52'9" N, 76º15'2" W, 21 May 2009, *D. Sanín 2976* (FAUC); río Mutatá, ca 3 km above its junction with the río El Valle, NW of Alto del Buey, 800 m, not dat., *D.B. Lellinger 176* (COL). **Cundinamarca:** entre Albán y Sasaima, hacia Las Mercedes, not dat., 11 May 1961, *M.T. Murillo 84* (COL). **Huila**: Acevedo, carretera entre San Marcos y San Adolfo, 1300 m, 5 Apr. 1983, *Osorio 161* (COL). **Magdalena:** Sierra Nevada de Santa Marta, región el Campano, 1300 m, 11 Jan. 1948, *Barkley 1885* (COL, MEDEL). **Meta**: carretera Medina a San Pedro de Jagua, bosques sobre el río Gazuanta, sin dat., 18 Jun. 1986, *Murillo 2164* (COL). **Norte de Santander**: Sarare, Gibraltar, 700–900 m, 26 Mar. 1959, *Bischler 2049* (COL). **Valle del Cauca**: río Dagua valley, dense forest along río Engaña, 410–560 m, 27 Feb. 1988, *Killip 34844* (COL).

COSTA RICA. **Cartago:** Road to Moravia de Chirripó, near Finca los Quetzales, along Pacuare river, 1100–1300 m, 1 Oct. 1982, *D.L. Hazlett 5077* (F). **Heredia:** Braulio Carrillo National Park, 1865 m, 10º15' N, 84º10' W, 11 Nov. 1986, *E. Hennipman et al. 6838* (F!, CR, U). **Limón:** Cordillera de Talamanca, between headwaters of Rio Madre de Dios and Quebrada Barreal, 400–440 m, 10º 2' N, 83º27' W, 5 Sep. 1988, *M. Grayum et al. 8793* (F!,

CR). **Puntarenas:** Cantón de Golfito, P.N. Corcovado, Península de Osa, Estación Agujas, Quebrada Bonanza, Sendero Bonanza, 500 m, 8º31'40" N, 83º26'30" W, 12 Nov. 1997, *A. Azofeifa 530* (INB).

ECUADOR. 26 s.d. 1889, *L.M. Sodiro 1/905* (SI). **Napo**: Cuyuja-Baeza, 1888, *A. Sodiro 2/905* (QPLS); Canton Napo, trail from Zatzayacu to Las Palmas, 500 m, 17 Mar. 1935, *Y. Mexia 7103a* (F); Yasuni Scientific Research Station, ca 1km N of Río Tiputini, Bridge II (Road station Tivacuno oil well), 210 m, 00º40' S, 76º23' W, 22 Aug. 1995, *H. Baslev 6364* (QCA!, AAU). **Pastaza**: Finca Sta. Rosa, km 60 carretera Puyo Macas, 5 km antes de la comunidade Shuar de Chuwitayo y 10 km antes del puente sobre el río Pastaza, 850 m, 1º53'5" S, 77º48'7" W, 7 Apr. 1997, *H. Romero-Saltos & C. Kasent 498* (QCA). **Sucumbios**: Reserva Faunística Cuyabeno, N. of Laguna Grande, 265 m, 00º1' N, 76º11' W, 26 Mar. 1989, *H. Baslev et al. 84640* (QCA). **Tungurahua**: Cantón Baños, Parroquia de Río Negro, 1500 m, 1º24' S, 78º10' W, 16–17 Jun. 1987, *C.E. Cerón 1601* (QCA!, MO). **Zamora-Chinchipe**: Parque Nacional Podocarpus, Bombuscaro, along trail "Higuerones", 1050 m, 4º7' S, 78º58' W, 23 Nov. 2011, *M. Lehnert 2141* (QCA).

GUAYANA. **Potaro-Siparuni:** Kaieteur Plateau, [5º10'30" N, 59º28'49" W], 15 May 1944, *B. Maguire & D.B. Fanshawe 23478* (F).

PANAMA. **Darién**: Parque Nacional Darién, Serranía de Sapó, límite del Parque hasta la cima, 300–800 m, 4º43' N, 73º33' W, 26 Nov. 1990, *H. Herrera & J. Polanco 812* (F!, MO). **Veraguas**: NW of Santa Fé, 4.2 km from Escuela Agricola Alto de Piedra, 25 Feb. 1975, *S. Mori & J. Kallunki 4841* (RB).

PERU. **Amazonas**: Luya, Camporredondo, Localidad Jaipe, 2050 m, 6º9'7" S, 78º21'5" W, 26 Mar. 1997, *J. Campos et al. 3641* (MO, USM!); Bagua, Dist. Imaza, Comunidad de Kampaensa, borde del río Shimutaz, 450 m, 4º55'S, 78º19'W, 21 Oct. 1995, *E. Rodríguez 591* (USM). **Cajamarca:** San Ignacio, Huarango, San Martín-Quebrada Colorada, 860 m, 15º17' S, 78º42' W, 15 May 1996, *J. Campos et al. 2739* (F). **Cuzco**: La Convención, Distrito de Echarati, San Martín 3 site well, 400 m, 11º46' S, 72º42' W, 2 Nov. 1998, *H. Beltrán et al. 3282* (USM); Oxapampa, Palcazu, río alto Iscozacin, Ozuz to Río Pescado, 400–500 m, 10º19' S, 75º16' W, 12 May 1985, *R.B. Foster & B. d'Achille 10104* (F). **Huánuco**: Huánuco Chinchao, San Pedro de Carpish, cerca al río Lanmanio que divide al distrito de Churubamba de Carpish, a la localidad Óaupamarca de Carpish, 1800–2000 m, 19 Aug. 2002, *I. Salinas*

& M. Chocce 523 (USM); Distrito de Churubamba, Hacienda Éxito, bank of Río Isabel, river bottom, 1000 m, 8 Sep. 1936, *Y. Mexia 8161a* (F). **Junin**: Jauja, Perené, 1500 m, 1918, *N. Esposto s.n.* (USM). **Loreto**: Mariscal Ramón Castilla, Río Yavari, 130 km río abajo desde Angamos, 90–150 m, 4º30'53" S, 71º54'3" W, 9 Apr. 2003, *H. Beltán et al. 5687* (F); Maynas, from Iquitos, about 50 miles downriver on the Amazon at Peter Jensens's Explorama lodge, 26 Jun. 1984, *R.C. Moran 3658* (USM); Maynas, close to the village of 13 de Febrero, km 25 of the road Iquitos-Nauta, 100–200 m, 4º0' S, 73º27' W, 27 Dec. 1994, *H. Tuomisto et al. 6463* (USM). **Madre de Dios**: Manu, Cerro de Pantiacolla, Río Palotoa, 10–15 km NW of Shintuya, transec to ridgetop, 700–1300 m, 12º35' S, 71º18' W, 14 Dec. 1985, *R.B. Foster et al. 10820* (USM). **Pasco**: Oxapampa, Palcazu, Río Alto, Iscozacin, Ozuz to Río Pescado, 400–500 m, 10º19' S, 75º16' W, 12 May 1985, *R.B. Foster & B.d'Achille 10104* (USM). **Puno**: Sandia, Dist. Alto Inambari, sector Pacaysuizo, 1258 m, 14º1' S, 69º11'12" W, 21 Apr. 2003, *C. Orocollo et al. 151* (USM). **San Martín:** San Martín, Cataratas de Ahuashiyacu, Km 15 Tarapotó-Yurimaguas, 700 m, 6º29' S, 76º21' W, 19 Jun. 1986, *S. Knapp & P. Alcorn 7783* (USM!, MO). **Ucayali:** Padre Adad, Dist. San Miguel y Mapuya, 12 a 17 km de la Aguaytia, 350 m, 9º5' S, 75º26' W, 4 Oct. 2004, *J. Schunke Vigo & J. Graham 162*06 (F).

VENEZUELA**. Bolivar:** Ptari-Tepuí, base of the Cerro along Río Karauai, 1220 m, [5°46'1" N, 61º48'40" W], 27 Nov. 1944, *J.A. Steyermark 60656* (F).

5. Serpocaulon attenuatum (Humb. & Bonpl. ex. Willd.) A.R. Sm., Taxon 55(4): 927. 2006. *Polypodium attenuatum* Humb. & Bonpl. ex. Willd., Sp. Pl., ed. 4, 5: 191, 1810. *Goniophlebium attenuatum* C. Presl, Tent. Pterid. 186. 1836. *Polypodium brasiliense* var. *attenuatum* (Humb. & Bonpl. ex Willd.) Baker, Fl. Bras. 1(2): 524. 1870. TYPE: Venezuela. Caracas: Distrito Federal, *A. von Humboldt & A. Bonpland s.n*. (**lectotype here designated:** B [bc] B-W19683-010 image!). Figures 16c, 23e, 33, 34, 37e.

Polypodium kunhii E. Forum, Bull. Soc. Hot. Fr. 19: 251, 1872. TYPE: Nicaragua. Omotepe, *P. Lévy 1161* (lectotype designated by Hensen (1990: 310): P (not found).

Etymology. Its name referred to the attenuate condition of its distal pinnae.

Plants epiphytic, terrestrial and rupicolous. *Rhizomes* 8.6−20 mm diameter, short-creeping, dark brown to reddish, not pruinose to scarce pruinose; phyllopodia distance 0.5−1.5 cm. *Rhizome scales* dense, 3–6 × 1.2–3.9 mm, ovate-lanceolate to lanceolate, patent, subpeltate, concolorous, light brown to orange, base rounded to obtuse, apex acute to long acuminate, patent, erose and overlapping margin. *Fronds* 20−155 cm long. *Petioles* 7−45 cm long, proximally subterete, distally slightly sulcate, with a small wing, light brown to dark brown. *Laminae* 13–110 × 10−40 cm, ovate-lanceolate to lanceolate, truncate proximally and acute apex. *Segments* 3−34 pairs, chartaceous, proximal deeply dissected and adnate, medial and distal decurrent, rarely adnate (only in the state of Pará, Brazil), apical segment conform and adnate to the lateral. *Medial segments* 6–19 × 0.8–3 cm, base decurrent and apex acute to long acuminate, venation forming 27−64 rows along and 2–6 rows of areolae between the costae and the margin, impressed. *Laminar induments* segments scales scarce, 1.7−2.2 × 0.4−0.8 mm, widely ovate to lanceolate, 6–9 cell wide, appressed, peltate to basally attached with a notorious insertion, concolorous, dark brown, base rounded and apex rounded to acute, erose margin, hairs scarce, catenate with 2 cells, appressed, hyaline, dark brown. *Sori* from the medial segments in 24−62 rows along and 1–(2) rows between the costa and the margin. *Spores* 36–40 × 20–24 µm, plane-convex to concave-convex, and irregular depressed verrucae.

Distribution and habitat. Serpocaulon attenuatum occurs from Antilles (Jamaica); Nicaragua to the Amazon of Bolivia, Brazil, Venezuela and Guianas, mainly in exposed areas of lowlands, from the sea level to 2450 m, in humid to dry forest.

Phenology. It was recorded fertile all months of the year, except September.

Notes. Serpocaulon attenuatum most resembles *S. triseriale,* that also possess thick and short-creeping rhizomes with abundant and patent scales, impressed veins of the segments, and its main distribution in lowlands. However, differs from *S. triseriale* by its pinnatisect lamina (especially from the middle to the apex) (vs. pinnate laminae) and sori 1–2 rows between the costae and the margins (vs. sori 1–4 rows).

Taxonomic and nomenclatural notes. Hensen (1990) considered this species a synonym of *Serpocaulon triseriale*, commented that 'all possible intermediates can be found when ample material is at hand'. However, despite that both species present great variation, it is possible to recognize the type and protologue characterization of *S. attenuatum* like the pinnatisect laminae with one row of sori between the costa and the margin.

The protologue of *Polypodium attenuatum* Humb. & Bonpl. ex. Willd., mentioned that this species inhabits Venezuela and Brazil but did not mention any specimen. Hensen (1990), suggested that Venezuela and Brazil were the type locality of the two syntypes from B, and a photo of BM that the author mentioned respectively. However, he did not mention any collector series. Deriving in the present designation as lectotype of the specimen housted at B (B-W19683-010), following recommendation of the Article 9.3 (Turland et al., 2018).

Gómez and Arbeláez (2009) in TROPICOS (2020) suggested that the name *P. attenuatum* R. Br. was published earlier (April, 1810) than *P. attenuatum* Humb. & Bonpl. ex. Willd. (June 1810), but this information is not mentioned in any protologue because only the year of publication (1810) appears in this literature. In this order of ideas, the name *P. attenuatum* Humb. & Bonpl. ex Willd., is here supported by the fact that there is a protologue linked with the type, contrasting Gómez and Arbeláez (2009) proposition.

Hensen (1990) suggested the holotype of the name *Polypodium kunhii* E. Forum, the specimen *P. Lévy 1161* housted at P. However, the author included an interrogation (?) after the herbarium mentioned. This sheet was not traced at P, but at B, reason why here it is chosen as lectotype.

Local name. *Avento* in Brazil (*Fonseca 20343*, UFP), *Lengua de ciervo* in Peru (*N. Esposto n.d.,* USM).

Representative specimens. BOLIVIA. **La Paz:** Prov. Nor Yungas, Yolosa, 16.5 km hacia Unduavi, 2450 m, 27 Nov. 1980, *S.G. Beck 3743* (LPB). **Santa Cruz:** Velazco, Parque Nacional Noel Kempff Mercado, Campamento Huanchaca, 650 m, 13º54' S, 60º48' W, 14 May 1994, *L. Arroyo et al. 660* (LP).

BRAZIL**. Amapá:** Oyapock, Jul. 1924, *P. von Luetzelburg 20341* (R). **Amazonas:** Manaus, Reserva Florestal Ducke, Manaus-Itacoatiara, km 26, 2º53’ S, 59º58’ W, 18 Jan. 1996, *M.A.S. Costa et al. 708* (SP). **Bahia:** Miguel Calmon, 13 Jul. 1991, *A.M. Miranda & F. Esteves 302* (PEUFR). **Goiás:** Alto Paraíso de Goiás, Highway Brasília-Alto Paraíso de Goiás, (BR 010), ca 10 km S of Alto Paraíso de Goiás, 1060 m, 14,826 S, 47,569 W, 16 Jan. 2011, *P.H. Labiak & J.T. Mickel 5248* (NY, SP!, UFPR); Luziânia, Fazenda do Sr José Rodrigues, grota do Córrego Capão da Anta, 830 m, 16º18’39” S, 48º12’49” W, 10 Apr. 2003, *G. Pereira-Silva et al. 7556* (SP); Serra dos Pirineus, ca. 20 km N.W. of Corumbá de Goiás, near road to Niquelândia, 1400 m, 29 Jan. 1968, *H.S. Irwin et al. 19390* (F); Chapada dos Veadeiros, 1000 m, 14º S, 47º W, 13 Feb. 1966, *H.S. Irwin et al. 12779* (F, SP); Presidente Kennedy, road from highway BR 153 to to Itaporã, 12 km West of village of Presidente Kennedy, Fazenda Primavera along Ribeirão Feinho, 400–500 m, 8º25’ S, 48º37’ W, 31 Jan. 1980, *T. Plowman et al. 8181* (F). **Mato Grosso:** *H. Smith 44* (R); Chapada dos Guimarães, Parque Nacional Chapada dos Guimarães, Trilha para a Cachoeira Sete de Setembro, próximo à Pedra da Tartaruga, 613 m, 15º25’3” S, 55º50’23” W, 2 Mar. 2011, *T.E. Almeida et al. 2681* (BHCB). **Pará:** Bragança, Península de Ajuruteua, próximo ao canal de maré Furo Branco, 0º51’59.4” S, 46º39’23.6” W, *U. Mehlig 524* (UFP); Estrada Belém-Bragança, 4 Feb. 1960, *E. de la Sota 2428* (LP); Canaã dos Carajás, Floresta Nacional de Carajás, Serra do Tarzan, 540 m, 6º19’34” S, 50º7’13” W, 9 Feb. 2012, *A. Salino et al. 15149* (BHCB); Canaã dos Carajás, Serra Sul, Corpo C, 800 m, 6º23’ S, 50º22’ W, 13 Feb. 2010, *A.J. Arruda et al. 186* (BHCB); Capanema, Balneário Lagoa Azul, 59 m, 1º12’6.7” S, 47º7’40.1” W, 2 Jul. 2013, *M.R. Pietrobom 9331* (UFP); Serra dos Carajás, 5 km W of AMZA, camp 5, 750 m, 6º4’ S, 50º10’ W, 15 May 1982, *C.R. Sperling et al. 5707* (K); Vigia, 17 Km southeast of Vigia along road PA–140, to Belém, 50 m, 7º57’S, 48º05’ W, 30 Mar. 1980, *C. Davidse et al. 17618* (F); Parauapebas, Serra Sul, Corpo D, 6º23’8” S, 50º23’5” W, 16 Mar. 2009, *V.T. Giorni et al. 175* (BHCB); Rio Negro, Igarapé do Daará, Tapuruquara, 10 Oct. 1978, *M.T. Madison et al. 6243* (F). **Pernambuco:** Rio Formoso, Reserva Ecológica de Saltinho, 24 Nov. 1999, *R. Fonseca 20343* (UFP).

COLOMBIA**. Magdalena:** Sierra Nevada de Santa Marta, *H.H. Smith 1036* (F); Near Manaure, 700 m, 1 Sep. 1944, *O. Haught 4336* (COL). **Meta:** Reserva Natural La Macarena,

margen izquierdo del río Guayabero, primer raudal, 25–250 m, 9 Jul. 1970, *J.M. Echeverry-E. 2037* (COL, TOLI).

COSTA RICA. **Alajuela:** Vicinity of Los Chiles, Río Frío, 30–40 m, 11º2' N, 84º44' W, 1 Aug. 1949, *R. W. Holm & H. H. Iltis 711* (F). **Guanacaste:** Nandayure, 40–60 m, 9º51'28" N, 85º21'29" W, 13 Jul. 1994, *A. Estrada & A. Rodríguez 40* (INB, MO). **Limón:** Cantón de Pococí, Llanura de Tortuguero, San Juan de Pococí, Cuatro Esquinas, Finca de Hermanos Rojas Alvarado, 40 m, 10º34'00" N, 83º51'00" W, 13 Jun. 1995, *A. Rojas 1973* (INB). **Puntarenas:** Cantón de Osa, Faja costera de la Bahía de Coronado, Coronado, Coopemangle, 1–100 m, 9º15'20" N, 83º51'40" W, 23, Jun. 1995, *S. Avila 96* (INB, MO); Coto Brus. Z.P. Las Tablas, cuenca Térraba-Sierpe, en el sendero entre Sitio Coton y Sitio Coto Brus, 1500 m, 8: 54:27.7137 N, -82:46:19. 1180 W, 13 Feb. 1999, *A. Jiménez 60* (INB); Península de Osa, 2 km SE of Rincón de Osa, 0 m, 17 Jul. 1967, *J.T. Mickel 2760* (LP); Península de Osa, Puerto Jimenéz, 20 m, 8º32'14" N, 83º18'25" W, *W. Testo 1241* (VT). **San José:** Z.P. La Cangreja, Santa Rosa de Puriscal, cercanías de la casa de Célimo Jiménez, 1 km SE Santa Rosa, 450 m, 9º42'31" N, 84º23'58" W, *J.F. Morales 564* (INB).

ECUADOR. **Chimborazo**: Cañon of the río Chancha near Huigra, 1219–1370 m 7–14 May 1945, *W.H. Camp 2980* (F). **Guayaquil**: Quinta Rodriguez, *L. Mille 1024* (QLPS).

GUIANA. 1840. *Leprieur* s.n. (F).

JAMAICA. **Portland:** Vicinity of Thomsons, 1000 m, 5 Mar. 1920, *W. P. Maxon & E. P. Killip 829* (F).

NICARAGUA. **Río San Juan**: San Bartolo, 29 Jul. 1972, *F. C. Seymour 6179* (F).

PANAMA. **Panama:** Archipiélago de Las Perlas, San José Island, on the bluff beside coast N.W. of Pta. Crúz, 17 Jul. 1967, *W. R. Stimson 5309* (F).

PERU. **Cajamarca:** San Miguel, Dist. Niepos, La Florida, 30 Nov. 1978, *R. Vásquez n.n.* (USM); Santa Cruz, Catache, upper río Zaña valley, ca 1 km above Monte Seco on the road to El Chorro, 1200 m, 10 Mar. 1986, *M.O. Dillon et al. 4306* (F). **Cusco**: Camino a las ruinas de Machu Picchu, 25 Jan. 1983, *B. León 462* (USM). **Lambayeque**: Monte Seco, Quebrada del río Zuña, Dec. 1928, *N. Esposto n.n.* (USM). **Pasco**: Oxapampa, Dist. Palcazu, Comunidad Alto Lagarto, Reserva Comunal Yanesha, 500 m, 10.08.04 S, 75.22.06 W, 28 Mar. 2012, *R. Rojas & G. Ortíz 8209* (USM). **Junín:** Tarma, Quimirí, 1918, *N. Esposto*

10984 (USM). **Tumbes:** Zarumilla, Matapalo, Bosque Nacional de Tumbes, cerca de Campo Verde, 600–800 m, 17 Dec. 1967, *D.R. Simpson & J. Schunke 379* (F).

VENEZUELA. **Amazonas:** Samariapo, Fed. Terr. Amazonas, en la cumbre de la laja Carestía, bajo Sanariapo, 125 m, [5°14'38.0"N 67°47'42.0"W], 5 Jul. 1942, *L. Williams 16026* (F). **Bolívar:** Cerro Perro, alto río Paragua (Guayana), Jul. 1943, *F. Cardona 760* (F). **Mérida:** Aug. 1842, *J.J. Linden* 531 (BR); **Táchira:** 22 km above Pregonero, Boca de Monte, 2250 m, 13 Nov. 1980, *P.J.M. Maas & S.S. Tillett 5285* (L).

6. Serpocaulon australe D. Sanín, J.C. Ospina, I.O. Moura & Salino, Syst. Bot. 2019, 44(1): 95. TYPE: Argentina. Jujuy: Departamento Doctor Manuel Belgrano. Parque Prov. Potrero de Yala, 1200 m después de la entrada al sendero Miradores, 2500 m., 24°6'49" S, 65°28'17" W, 22 Feb. 2018, *C.M. Martín & J.C. Ospina 2234* (holotype: SI!; isotypes: BHCB!, HUA!, UC!). Figures 6, 16b, 23e, 35, 36, 37f.

Plants rupicolous or epiphytic, rare terrestrial. *Rhizomes* 3.2−6.7 mm diameter, short-creeping, blackish, pruinose; phyllopodia distance 0.5−1 cm. *Rhizome scales* dense, mainly in the apex of phyllopodia, 4.3−5.8 × 1.6−3 mm, lanceolate, patent, subpeltate, concolorous, light brown, with small pale margin, base auriculate to rounded, apex acute to rare long acuminate, smooth margin. *Fronds* 13−89 cm long. *Petioles* 6−27 cm long, proximally and distally subterete, light to dark brown. *Laminae* 7−62 × 3.5−12 cm, linear to linear-lanceolate, pinnatisect, truncate and reflexed proximally and abruptly reduced in an attenuate segment at the apex. *Segments* 9−42 pairs, chartaceous, proximal segments surcurrent, medial and distally decurrent. *Medial segments* 1.8−9 × 0.3−0.9 cm, base decurrent and apex acuminate, venation forming 9−21 rows along and 1 row of areoles between the costae and the margin, notorious. *Laminar induments* segment scales presence or absence, 1.1−4.5 × 0.3−0.7 mm, lanceolate to ovate-lanceolate, 20−28 cells wide, with patent apex, subpeltate, concolorous, with dark brown insertion, base rounded and acuminate apex, the margins smooth. *Hairs* absent. *Sori* from the medial segment 4−16 rows along and 1 row between the costa and the margin, distributed 3/4 the length of segments, absent at apices. *Spores* 50−55 × 38−40 µm, ellipsoidal to plano-convex, and irregular depressed verrucae.

Etymology. The specific epithet refers to the southern distribution of the species (Sanín et al., 2019a).

Distribution and habitat. Serpocaulon australe occurs from South Bolivia to northern and central Argentina (Catamarca, Córdoba, Jujuy, Salta, and Tucumán), in humid montane forests and grasslands of the Yungas, from 1500 to 3500 m. Only two specimens were found in the southern Córdoba province in forests of the Chaco Serrano (Sanín et al., 2019a).

Phenology. It was recorded fertile from November to April.

Notes. *Serpocaulon australe* most resembles *S. lasiopus*, that also possesses short-creeping rhizomes with patent scales and pinnatisect laminae and occurs sympatric in Bolivia and Argentina. However, differs from *S. lasiopus*, by its apex of the rhizome scale acute-acuminate to rarely long-acuminate (vs. cirrose), glabrous fronds with few axillary scales (vs. fronds with dense hairs and scarce or caducous scales), ascending segments (vs. parallel), and sori absent at the segment apices (vs. present).

Taxonomic and nomenclatural notes. This species was segregated from the re-interpretation of *S. gilliesii* (C.Chr.) A.R. Sm., resulting that this name was designated under the synonymy of *S. lasiopus*, and the description of *S. australe* (Sanín et al., 2019a). Following this, the collections that were determinated as *S. gilliesii* should be re-examined carefully because they could represent both: *S. australe* and *S. lasiopus.* It is frequently to find intermediaries between both mentioned species, which suggest the possibility of hybridization, especially in Argentina (i.e. *Venturi 4197*, SI, USM; *W. Lossen 243*, F).

Representative specimens. ARGENTINA. **Catamarca**: Ambato, El Rodeo, 1900 m, 19 January 1911, *L. Castillon s.n*. (K); Ambato, Los Mogotes, 2400 m, 7 Mar. 1960, *J.H. Hunziker 7214* (LP); Andalgalá, Yunka Suma, 2400 m, 21 Jan. 1949, *E. Peterson s.n*. (BM); El Rodeo, 15 Jan 1911, *L. Castillon 2026* (BM). **Córdoba**: al sur de la cuesta de Copinas, Sierra Achala, 29 Mar. 1881, *C. Galander s.n*. (BM); Sierras cerca a Copinas, Jan. 1942, *E.D. Gautier s.n*. (LP). **Jujuy**: Capital, Laguna de Yala, 1640 m, *E. Gomez Sosa 893* (SI); Capital,

Laguna de Yala, 10 Dec. 1962, *H.A. Fabris 3288* (LP); Capital, Laguna de Yala, 12 Feb. 1971, *A.L. Cabrera 21262* (LP); Capital, Laguna de Yala, 15 Nov. 1973, *A.L. Cabrera 24195* (LP, SI); Dr. Manuel Belgrano. Parque Prov. Lagunas de Yala, 2000 m, 17 Apr. 2008, *E.I. Meza Torres 798* (BHCB, RB); Manuel Belgrano, de lagunas de Yala a Termas de Reyes, 2100 m, 7º8" S, 65º29'16" W, 17 Feb. 2008, *F.O. Zuloaga 10153* (COR, SI); Quebrada de Yala, Laguna, 17 Apr. 1969, *A.L Cabrera 19971* (LP); Manuel Belgrano, Laguna Rodeo, Yala, 24 Mar. 1993, *N.B. Deginani 143* (SI); Santa Barbara, 2400 m, 13 Dec. 1962, *E. de la Sota 2910* (LP); Santa Barbara, Sierra del Centinela, 2300 m, 17 Dec. 1962, *E. de la Sota 2941* (LP); Tumbaya, volcán Chilcayo, 2200 m, 4 Mar. 1967, *A.L. Cabrera 16948* (LP); Tumbaya, Volcán, 20 Mar. 1973, *A.L. Cabrera 23490* (LP, SI); Yala, Feb. 1965, *U. Eskuche 119* (LP); Yala, Feb. 1965, *U. Eskuche 129* (LP). **Salta**: Jan. 1897, *C. Bettfreund 232* (SI); Jan. 1897, *S. Venturi 47* (SI); Orán, *Razy* (SI); Guachipas, Estancia Pampa Grande, western mountain range, path to Cerro Cristal, 2300–2400 m, 25º50' S, 65º33' W, 20 Mar. 1966, *J.G. Hawkes 3976* (K, LP); Guachipas, Pampa Grande, Jan. 1897, *C.L. Spegazzini s.n*. (SI); Santa Victoria, 31 Dec. 1972, *R. Kiesling 249* (LP); Santa Victoria, Huerta, camino a Sta. Victoria, 2500 m, 4 Apr. 1986, *J.A. Hurrell 60* (LP); Santa Victoria, cerca a Sta. Victoria, 2500 m, 26 Feb. 1966, *E. de la Sota 4111* (LP); sobre la Cuesta entre Yacone y Los Potreros, 17 Mar. 1873, *P.G. Lorentz 335* (BM, COR, SI). **Tucumán:** Burruyacu, Cerro del Campo, 1800 m, Mar. 1918, *E. Bailetti 247* (BM); Burruyacu, Los Pinos, La Mesada, 21 Jan. 1947, *O. Borsini s.n*. (LP); Chicligasta, Estancia Las Pavas, 9 Mar. 1949, *E. Peterson s.n*. (BM); Chicligasta, Estancia Santa Rosa, 3000 m, 20 Jan. 1927, *S. Venturi 4805* (LP, SI); Ciénaga en la Sierra de Tucumán, 25 Mar. 1872, *P.G. Lorentz 7901* (COR, SI); Cerca de la Ciénaga en la Sierra de Tucumán, 1 Jan. 1874, *P.G. Lorentz 5881* (COR); Mar. 1872, *P.G. Lorentz s.n.* (SI); Cerro de Medina, 2000 m, 24 Mar. 1914, *C.M. Hicken 16105* (SI); Chicligasta, Estancia Las Pavas, La Cascada, 2700 m, 13 Mar. 1924, *S. Venturi 3140* (BM, SI); Chicligasta, carretera Las Pavas-Pto. Del Satarillo, 1700 m, 09 Mar. 1924, *S. Venturi 2997* (BM, K); La Ventanita, 2100 m, 17 Nov. 1908, *M. Lillo 7682* (BM); El Pelado, Valle de Taji, Dec. 1911, *L. Castillón s.n*. (SI); Pié de la Cuesta, 1700 m, 20 Apr. 1926, *S. Venturi 4197* (LP, SI); San José, 27 Jan. 1933, *C.M. Hicken 5160* (SI); Valle del Tafi, Mar. 1908, *C. Bruch 20116* (SI); Valle de Tafí, Dec. 1911, *L. Castillón s.n*. (SI); Tafí, 3 km N de Tafí del Valle, 2400 m, 17 Feb. 1972, *V. Maruñak 301* (LP, MBM); Tafí, San José, 2400 m, 27 Jan. 1933, *A. Burkart 5160* (SI); Tafí,

La Ciénaga, 2500 m, 17 Apr. 1904, *M. Lillo 3717* (BM); Tafí, Quebrada de la Sosa, 1500–1600 m, 28 Dec. 1957, *E. de la Sota 1799* (SI); Tafí, Quebrada de la Sosa, 1700 m, Dec. 1958, *E. de la Sota 2040* (BR, COR, LP); Tafí, Quebrada de la Sosa, 2200 m, 7 Feb. 1959, *E. de la Sota 2075* (K); Trancas, Gualinchay a Mal Paso, 2000 m, Dec. 1917, *C.R. Schreiter 532* (BM); Trancas, ruta de Hualinchay a Tolombón, a 4 km de Hualinchay, 1800 m, 26º19'01" S, 65º7'16" W, 15 Feb. 2008, *F.O. Zuloaga 10023* (COR, LP, SI).

BOLIVIA. **Santa Cruz:** Prov. Caballero, Comarapa 32 km hacia Cochabamba, 2500 m, 24 Mar. 1981, *S. G. Beck 6826* (F). **Tarija:** Prov. Mendez, stelle and der die Straßevon Tarija nach Iscayachi erstmails, 3000 m, 2 Jan. 1980, *J. Krach & T. Feuerer 7603a* (F); Cercado, Abra del Condor, camino Tarija a Entre Ríos, 2800 m, 21º25' S, 64º30' W, 28 Apr. 1983, *A. Krapovickas & A. Schinini 38662* (LPB).

7. Serpocaulon catharinae (Langsd. & Fisch.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium catharinae* Langsd. & Fisch. Pl. Voy. Russes Monde 11, pl. 9. 1810. *Goniophlebium catharinae* (Langsd. & Fisch.) J. Sm. in Hook., 1840, Gen. Fil. Pl. 51. *Polypodium catharinae* Langsd. & Fisch. var. *latipes* Rosenst., Hedwigia 46: 142. 1907. TYPE: Brazil. Insulae Catharinae, *G.H. Langsdorff 12* (**lectotype here designated**: LE [bc] 00000033 image!). Figures 7a, m, 11, 18a, g, 21a 22b, 23e, 38, 39, 49a.

Polypodium laetum Raddi. Syn. Fil. Bras. 9 (no. 63), 1819. *Goniophlebium laetum* (Raddi) J. Sm. in Seemann, Bot. Voy. Herald, 6: 231. 1854, non Salisburi (1796). *Polypodium loriceum* L. var. *laetum* (Raddi) Baker, Mart. Fl. Bras. Enum 1(2: 49): 523. 1870. TYPE: Brazil, Serra da Estrela, *G. Raddi, s.n*. (lectotype designated by Hensen (1990: 299): FI (not seen); isolectotypes: P [bc] 00633216 image!, BR [bc] 697793!, P [bc] 00637554 image!). **New syn**.

Polypodium glaucum Raddi, Pl. Bras. Nov. Gen. 20, pl 29. 1825. *Goniophlebium glaucum* (Raddi) J. Sm. Cult. Ferns 3. *Chrysopteris raddiana* Fée, Cryp. Vasc. Brésil 1: 120. 1869. TYPE: Brazil. Rio de Janeiro: Serra de la Estrella, *G. Raddi* (lectotype designated by Hensen (1990: 292): FI (not seen)).

Goniophlebium pectinans Fée, Cryp. Vasc. Brésil 1: 109, pl: 34. 1869. TYPE: Brazil. Minas Gerais: Cachoeira, *P. Claussen* s.n. (lectotype designated by Windisch (1982: 58): RB).

Goniophlebium pictum Fée, Cryp. Vasc. Brésil 1: 244. 1869. *Polypodium pictum* (Fée) Brade, Arq. Ins. Biol. Veg. 1: 228, f. 5, pl. 6(1). 1935. *Polypodium limbatum* Brade, Arch. Jard. Bot. Rio de Janeiro 11: 30. 1951. (nom. nov. for *G. pictum*), non *P. limbatum* (Fée) Maxon, Bull. Torrey Bot. Club 42: 222. 1915. TYPE: Brazil. Rio de Janeiro: Serra dos Órgãos, June 1869, *A. Glaziou 3335* (first step lectotype: P, designated by Hensen (1990: 292); **second step lectotype**: P [bc] 00632823 image! here designated; isolectotypes: P [bc] 00624704, P [bc] 00632822, P [bc] 01375970).

Polypodium catharinae Langsd. & Fisch. f. *bipinnatifida* Rosenst., Hedwigia 46: 142. 1907. TYPE: Brazil. Rio Grande do Sul: Rio Pardo, Estação João Rodrigues, 70 m, 21 Dec. 1906, *I.C. Jürgens 376* (**lectotype here designated**: L [bc] 3591615!).

Polypodium rupicolum Brade, Arq. Inst. Biol. Veg. 3: 228, f. 5, pl. 6(1). 1935. TYPE: Brazil. Rio de Janeiro: Serra de Itatiaia, 2200 m, Jun. 1913, *F.T. de Toledo Jr. & A.C. Brade 766* (**lectotype here designated**: RB [bc] 00543394!; isolectotype: *A.C. Brade 6478* (HB not seen).

Plants epiphytic, rupicolous or, rarely terrestrial. *Rhizomes* 3.2−8 mm diameter, short-creeping, blackish, pruinose, rugose; phyllopodia distance (0.4−)1−3 cm. *Rhizome scales* dense, mainly in the base of phyllopodia, (2.1−)2.6−3.7(−7.9) × (0.4−)0.9−1.2(−1.9) mm, subulate, patent or reflexed, subpeltate, bicolorous, light brown to goldish to the margin and dark brown to the center, base rounded, apex long acuminate, dentate margin. *Fronds* 9−80 cm long. *Petioles* (2−)6.5−15(−46) cm long, proximally subterete, distally rounded, light brown to scarcely dark brown. *Laminae* 7−49 × 4−20 cm, lanceolate, pinnatisect, truncate and reflexed proximally, distally gradually tapering in an attenuate segment. *Segments* 17−37 pairs, chartaceous, proximal surcurrent, medial decurrent and apical gradually tapering. *Medial segments* 2−9 × 0.5−1.6 cm, base decurrent and apex acuminate to rounded, venation forming 7−28 rows along and 1 rows of areoles between the costae and the margin, notorious. *Laminar induments* segment scales present or absent, 0.4−4.5 × 0.1−0.5 mm, linear, aciculate, tangled up, 2−4 cells wide, patent, basifixed, concolorous, light brown, base rounded and patent and cirrose apex, the margins smooth. *Hairs* scarce or absence, catenate, 2–3 cells long, catenate, appressed, hyaline. *Sori* from the medial segment in 3−26 rows along

and 1 row between costae and the margins, slightly reaching the apices of the segments. *Spores* 47.5−51.5 × 27.7−32.3 µm, ellipsoidal to plano-convex, with folded perinae.

Etymology. Its name is in honour to the Santa Catarina State in Brazil, where the type was collected.

Distribution and habitat. Serpocaulon catharinae occurs from Pernambuco (Brazil) to Uruguay, restricted to the Atlantic Rain Forests, from the sea level to 2200 m, in humid, cloud forest, and *campos rupestres*. Mesa-Torres et al. (2010) documented it in Argentina and Uruguay.

Phenology. It was recorded fertile from November to April.

Notes. Serpocaulon catharinae most resembles *S. glandulosissimum*, *S. latipes* and *S. vacillans*, that also possess patent rhizomes scales, pinnatisect laminae, and also inhabit the Atlantic Rain Forest. However, differs from *S. glandulosissimum*, by its glabrous laminae, with few axillar aciculate, linear scales, tangled up, 2−4 cells wide at the base, with patent and cirrose apex (vs. dense glandular pubescence). From *S. latipes*, by its pruinose short-creeping rhizomes, that not presents oxidation (vs. not pruinose long creeping-rhizome, with black oxidation), and chartaceous to slightly coriaceous laminae with axillar linear laminar scales with patent and cirrose apex, and tangled up in the axes of the segment (vs. papyraceous laminae, pubescence with small dark hairs, and laminar scales short and lanceolate, individual in the axes of the segments). Finally, from *S. vacillans*, can be distinguished by its pruinose short-creeping rhizomes, that are exposed in the substrate (litter mater, trunk or rarely soil or rocks) (vs. not pruinose long-creeping rhizome which is strictly terrestrial and subterranean, at least 2 cm deep), strait petiole (vs. sinuate), and laminae glabrous (vs. dense pubescence). Additionally, *S. vacillans* usually presents a sweet smell that allow its discrimination from any *Serpocaulon*'s species. *Serpocaulon catharinae* is also similar to *S. demissum*, that also possess short-creeping rhizomes with patent scales and pinnatisect laminae. Could be distinguished by its bicolorous, subulate rhizome scales with dentate margin (vs. concolorous, lanceolate rhizome scales with prolongations at the margin),

strait petioles (vs. sinuate), and the epiphyte, terrestrial or rarely rupicolous habit (vs. strict rupicolous).

This species represents one of the most complex taxa of the genus. Its wide distribution, morphological variation, and the frequent hybridization detected in several specimens from the Atlantic Rain Forest support this. Sanín et al. (in prep. b) propose that it represent a model of reticulate hybridization that involves hybrids detected by its intermediary morphology with *S. latipes* (*Heringer et al. 240*, BHCB) and *S. vacillans* (*Salino & Morais 4526,* BHCB).

Specimens from Bahia to Pernambuco States present linear-lanceolate laminae with more that 30 segments (i.e. *A. Santiago 222*, PEUFR; *I.C.L. Barros 1988*, PEUFR; *L.S.B. Calazans et al. 467*, BHCB, RB; *Noblick 1758*, NY). Plants from Paraná, Santa Catarina and Rio Grande do Sul states (Brazil) tend to present pale green 'olive' colour, strongest consistency, biggest laminae, and often long aciculate scales tips.

Taxonomic and nomenclatural notes. Hensen (1990) mentioned that the lectotype of *Polypodium catharinae* Langsd. & Fisch. was hosted at LE, however, he did not designate any collection. Due that Langsdorff and Fischer (1810) include an illustration that matches the specimen *G.H. Langsdorff 12* based at LE (LE-00000045), this sheet is chosen as lectotype to represent this species following the recommendation of Turland et al. (2018, Article 9.3).

Raddi (1819) described *Polypodium laetum* Raddi. based on the bigger size of the plant, and the scarce pruinosity of the type's rhizome: *G. Raddi s.n*. Nevertheless, the author did not consider the types *Langsdorff 12* (LE 00000045) and *Langsdorff & Riedel 75* (LE 00000042) that represent respectively *S. catharinae* and *S. latipes* which were described nine years before (Langsdorff & Fischer, 1810). In addition, Raddi mixed specimens as duplicates of his collection *G. Raddi s.n.,* that represent both, *S. catharinae* and *S. latipes*. This is certified on the sheets from Paris: *G. Raddi s.n*. (P 00637554, P 00633216) (Picchi-Sermolli & Bizzarri, 2005), Meise: *G. Raddi s.n*. (BR 0000006977931) that represents *S. catharinae*, and from Pisa: *G. Raddi s.n*. (PI 010866) that represents *S. latipes*. The presence of short-creeping pruinose rhizome with subulate scales, as well as, the glabrous pinnatisect laminae of the two sheets from Paris (*G. Raddi s.n*., P 00637554, P 00633216) and the other from Meise (*G. Raddi s.n*., BR 0000006977931), probably represents polyploid individuals of *S.*

catharinae (Manton, 1950), that could be originated by interspecific hybridization (Barrington et al., 1989; Soltis & Soltis, 1993; Rieseberg & Wendel, 1993). Which is exemplified by the strikingly bigger lamina size of those specimens and the intermediary characters.

Raddi did not understand the complexity of this entity, probably because of the short time that he lived in Brazil and the difficulties that posteriorly achieved in Italy to work in his Brazilian collections (Picchi-Sermolli & Bizzarri, 2005). Situation that reflects the obscure designation of types and derived species concepts of his names.

Fée (1869), did not designate any sheet for the name *Goniophlebium pictum* Fée. Hensen (1990), mentioned as holotype the sheet *A. Glaziou 3335* without considering that in P exist four sheets with this series. Following Turland et al. (Article 9.3, 2018) here is designated by the second step lectotype the specimen P [bc] 00632823. Later Brade (1951: 30) published a new name *Polypodium limbatum* for *Goniophlebium pictum* presented a type (*A.C. Brade 16390* (RB), however, because *G. pictum* was published before, this specimen is not considered as the lectotype.

Polypodium catharinae Langsd. & Fisch. f. *bipinnatifida* Rosenst., was published based on plants from João Rodriguez Station at Rio Grande do Sul in Brazil (Rosenstock, 1907: 142). Despite that the German author suggested in parenthesis (J.-St. 294) as the type locality, no sheet was found at B. However, two sheets from the series *I.C. Jürgens 376* at L (3591615) and SI (077696) were traced. Stafleu et al. (2020) mentioned that in those herbaria the author deposited others sets of his collections. Intriguingly, both sheets present lobes projected from the basal segments, which can inform hybridization, but the former represents a specimen of *S. catharinae* and the later, *S. vacillans*. Apparently, Rosenstock did not realize the dense pubescence characteristic of *S. vacillans* and numbered both samples as the same series. Following Turland et al. (2018, Article 9.3), the sheet from L is designed as lectotype for *Polypodium catharinae* Langsd. & Fisch. f. *bipinnatifida*, because it presents the handwriting of Rosenstock, were recollected at the mentioned type locality and represents the species concept of *S. catharinae.*

Despite Hensen (1990), designated holotypes for the names *Goniophlebium pectinans*, *Polypodium limbatum* and *P. rupicolum*, the author omitted or did not choose the correct type

designated in the respective protologue, reason why they are designated here as recommended the Article 9.3, Turland et al. (2018).

Representative specimens. BRAZIL**. Alagoas:** Murici, Bananeiras, 572 m, 9º13’47” S, 35º52’78” W, 16 Mar. 2002, *A.M. de Carvalho et al. 7095* (NY). **Bahia:** Barro Preto, Serra da Pedra Lascada, 13.7 km de Barro Preto, na estrada que passa pela Faz. São Miguel em direção à Serra, 600−900 m, 14º46’13” S, 39º12’10” W, 8 Feb. 2005, *F.B. Matos et al 365* (NY); Itarantim, Pedra das três Pontas, Trilha ao topo da Pedra, 700−900 m, 15º38’41” S, 40º5’52” W, 29 Aug. 2009, *V.A.O. Dittrich et al. 1594* (CESJ); Jussari, R.P.P.N. Serra do Teimoso, 15º9’15” S, 39º31’24” W, 2 Nov. 2002, *A. Salino & J.G. Jardim 8154* (BHCB); Lençóis, 900−1000 m, 12º34’ S, 41º23’ W, 3 Apr. 1980, *L.R. Noblick 1758* (NY); Maracás, Fazenda juramento, a 6 km ao S. de Maracás, antiga rodovia para Jequié, 1000 m, 27 Apr. 1978, *S.A. Mori et al. 10027* (NY); Palmeiras, Morro do Pai Inácio, 1070 m, 12º27’20” S, 41º28’23” W, 20 Jul. 2006, *J. Paula-Souza et al. 6202* (BHCB, CESJ, SI); Porto Seguro, P.N. Monte Pascoal, trail to peak of Monte Pascoal, 250−560 m, 15º15’53” S, 40º34’29” W, 14 Nov. 1996, *W.W. Thomas et al., 11302* (NY). **Espírito Santo:** Cariacica, Reserva Biológica de Duas Bocas, Represa Velha, 170 m, 20º15’31” S, 40º29’51” W, 11 Jun. 2010, *A. Salino et al. 14859* (BHCB); Castelo, vertente conhecida como Balança, 1400 m, 20º31’51” S, 41º5’56” W, 28 Jun. 2008, *A. Salino 13710* (BHCB); Divino de São Lourenço, Parque Nacional do Caparaó/RPPN Águas do Caparaó, Cachoeira Alta, 1000 m, 20º35’49” S, 41º46’52” W, 12 Sep. 2008, *A. Salino et al.* (BHCB); Santa Teresa, Nova Lombardia, Reserva Biológica Augusto Ruschi, Trilha da Cachoeira, 750−850 m, 19º55’14” S, 40º33’37” W, 2 Dec. 2008, *A. Salino 13973* (BHCB). **Minas Gerais:** Aiuruoca, Parque Estadual do Pico do Papagaio, no topo do Pico, 2096 m, 22º2’32” S, 44º38’32” W, 2096 m, 11 May 2014, *V.A.O. Dittrich et al. 1877* (BHCB, CESJ); Alto Caparaó, Parque Nacional do Caparaó, Trilha entre Tronqueira e Terreirão, 2060 m, 20º24’44” S, 41º49’54” W, 3 Mar. 2010, *G. Heringer et al. 222* (BHBC); Belo Horizonte, near Serra da Piedade, Serra do Espinhaço, ca. 35 Km E of Belo Horizonte, near BR 31, 1800−2000 m, 13 Jan. 1971, *H.S. Irwin et al. 30255* (LP); Bocaiúvas, Parque Nacional Sempre Vivas, caminho entre Campos de São Domingos, e a Serra do Landi, passando pelo Córrego do Landi, 1282 m, 17º54’7” S, 43º46’22” W, 29 Apr. 2007, *T.E. Almeida et al. 895* (BHCB); Bom Jardim de Minas, Serra

da Bandeira, na trilha para o topo, face norte, 1650 m, 22º1’16” S, 44º00’5” W, 21 Jul. 2013, *V.A.O. Dittrich 1817* (CESJ); Bom Jardim, estrada Sta. Rita Jacutinga/Bom Jardim, 27 Jul. 1987, *M.H.M. Braga s.n.* (BHCB); Caeté, Serra da Piedade, 7 Jun. 1997, *A. Salino 3123* (BHCB); Camanducaia, Mata do Trevo de acesso à Camanducaia, 1180 m, 22º44’53” S, 46º9’16” W, 1 Apr. 2001, *A. Salino 6876* (CESJ); Carrancas, Serra de Carrancas, trecho conhecido como Serra das Broas, na Chapada dos Perdizes, 1270−1350 m, 21º36’2” S, 44º36’19” W, 19 Jun. 2007, *A. Salino 12298* (BHCB); Chácara, Fazenda Fortaleza de Santana, 750 m, 21º66’00” S, 43º18’27” W, 16 Jul. 2011, *D.E.F. Barbosa et al. 14* (CESJ); Cipó, Parque Nacional Serra do Cipó, 16 Nov. 1995, *A. Salino 2237* (BHCB); Delfim Moreira, Fazenda da Onça, trilha saindo da sede da fazenda para cachoeira, 1724 m, 22º36’33” S, 45º20’49” W, 15 Mar. 2011, *L.L. Giacomin et al. 1354* (BHCB, CESJ); Espera Feliz, Parque Nacional do Caparaó, trilha para o Mirante da Cachoeira, 1845 m, 20º28’51” S, 41º50’3” W, 5 Mar. 2010, *I.R. Martins da Costa et al. 262* (BHCB); Itamarandiba, Parque Estadual Serra Negra, 1570−1600, 18º00’55” S, 42º45’14” W, 4 Jul. 2006, *A. Salino et al. 11284, 11285* (BHCB); Itamonte, Hotel Casa Alpina, na floresta antes de chegar da área onde se avista o Pico das Agulhas Negras, 2128 m, 22º22’ S, 44º48’W, 30 Apr. 2011, *T.A. Batista & A.R. Naves 292* (CESJ); Jequitinhonha, Reserva Biológica Mata Escura, 1125 m, 16º21’3” S, 41º5’29” W, 25 Mar. 2008, *A. Salino 13137* (BHCB); Monte Verde, Mata do Pico do Bispo, 1890 m, 22º53’6” S, 46º1’32” W, 18 Jul. 2001, *L.C.N. Melo et al. 77* (BHCB); Nova Lima, RPPN Mata do Jambreiro, 920 m, 19º58’15” S, 43º53’15” W, 6 May 2004, *J.B. Figueiredo & A. Alves 433* (BHCB, CESJ); Olaria, são Francisco de Prata, Serra das Flores, km 162-km 163, 6 Sep. 1979, *Bacharelandos s.n.* (BHCB); Passa Vinte, Estrada que liga a sede do município a MG–457, 836 m, 22º11’8” S, 44º14’21” W, 14 Feb. 2009, *T.E. Almeida 1783* (BHCB); Ouro Preto, Parque Estadual Itacolomi, caminho ao pico, Lagoa Seca, 8 Mar. 2018, 1598 m, 20º25’53” S, 47º29’12” W, *D. Sanín 7154* (BHCB); Parque Nacional de Caparaó, V. Encantado, 2000 m, 27 Oct. 1988, *M. L. Andrade et al. 22659* (CESJ); Rio Pardo das Minas, Serra Nova, Parque Estadual de Serra Nova, Cadeia de Espinhaço, 1000–1230 m, 15º39’37” S, 42º45’53” W, 13 Mar. 2007, *A. Salino et al. 11730* (BHCB); Santana do Garambéu, trecho do Alto Rio Grande adjacente a zona urbana de Santana do Garambéu, 1100−1150 m, 21º36’5” S, 44º6’16” W, 11 May 2001, *A. Salino & P.O. Morais 6787* (CESJ); Santana do Riacho, RPPN Brumas, do Espinhaço e Ermo dos Gerais, Pico Ermo Açu, 1418

m, 86 635297, 7894786, 14 Apr. 2012, *C.A. Ferreira Junior 373* (BHCB); Santo Antônio de Itambé, Pico de Itambé, subida para o Pico, 18º23'45" S, 43º20'54" W, 8 Apr. 2010, *G.O. Romão et al. 2611* (CESJ); Santa Bárbara, Serra do Gandarela, 20º5'41" S, 43º41'12" W, 12 Dec. 2011, *C.V. Vidal & R.L. de Paula 1183* (BHCB); São Gonçalo de Rio Preto, Parque Estadual de Rio Preto, entre Lapa e o Pico dois Irmãos, 1600–1700 m, 18º12'53" S, 43º20'6" W, 7 Jul. 2003, *A. Salino et al. 9342* (BHCB); Teófilo Otoni, Pedra da Boca, 970 m, 17º55'45" S, 41º11'5" W, 18 Sep. 2016, *R.C. Forzza et al. 8853* (BHCB, RB). **Paraná:** Antonina, Serra Ibitiraquire, Subida ao Pico Paraná, 1300 m, *O.S. Rivas et al. 2159* (BHCB); Campina Grande do Sul, Parque Estadual Pico Paraná, Pico Itapiroca, 1750 m, 25º14' S, 48º50' W, 17 Feb. 2008, *J.B.S. Pereira & M. Meyer 178* (NY); Lapa, Pedra da Gruta do Monge, 800 m, 6 Nov. 2005, *R. Wasum et al. 3125* (BHCB); Paranaguá, Ilha do Mel, 18 Oct. 1992, *A. Salino s.n.* (BHCB); Pinhais, Fazenda Canguiri, 20 May 1999, *M. Petean et al. 34* (CESJ); Ponta Grossa, 1 Jan. 1986, *L. Krieger s.n.* (BHCB); Rio Iguaçu, próximo da ponte na Rod. PR-427 (Mun. Lapa), 4 Nov. 2001, *J.M. Silva et al. 3422* (SI); Sapopema, Salto das Orquídeas, Beira do Rio Lajeado Liso, 24 May 1997, *V.F. Kinupp et al. 541* (BHCB); Santa Catarina, São Bonifácio, 885 m, 27º53'54" S, 48º52'19" W, 10 Jun. 2009, *S. Dreveck & F.E. Carneiro 953* (BHCB); Tijucas do Sul, campina 46 km S de Curitiba, 14 Feb. 1978, *A. Krapovickas & C.L. Cristóbal 33633* (LP); Três Barras do Iguaçu, Cânion do Rio Iguaçu, [-25.427983, -53.175383], 26 Mar. 1993, *A. Salino s.n.* (BHCB); Tunas de Paraná, Serra do Cortador, 10 Apr. 1999, *E. Barbosa et al. 248* (BHCB). **Pernambuco:** Bonito, Mata da Reserva Biológica Municipal, 8º30'30" S, 35º43'18" W, 750–800 m, 11 Aug. 2000, *A. Santiago 222* (PEUFR); Caruaru, aprox. 450 m 10 Sep 1971, *Andrade-Lima 71–6724* (IPA); Caruaru, Mata do Brejo dos Cavalos, 16 Jul. 1988, *I.C.L. Barros 1988* (PEUFR); Caruaru, Brejo dos Cavalos, 1100 m, 8º18'36" S, 36º00'00" W, 3 Aug. 1995, *M.R.C. Sales de Melo 143* (PEUFR); Lagoa dos Gatos, Serra do Urubu, Trilha do Mosquito, 672 m, 8º42'2" S, 35º51'10" W, 3 Dec. 2014, *L.S.B. Calazans 467* (BHCB); Mata da Colônia, 800 m, 8º30'14" S, 35º42'56" W, 29 Nov. 2000, *A. Santiago & M. Pietrobom-Silva 343* (PEUFR); Maraial/Lagoa dos Gatos, Serra do Urubú, 19 Apr. 1994, *A.M. Miranda 1538* (PEUFR). **Rio de Janeiro:** Tijuca, Estação Biológica, Morro Frei Vellozo, 28 Aug. 1963, *C.M. Chaves 38* (LP); Serra dos Órgãos, 1800−2000 m, 2 Nov. 1959, *E. de la Sota 2358* (LP); Serra dos Órgãos, Pedra Chapadão, 1900 m, 15 Jul. 1940, *A.C. Brade 16390* (NY). **Rio Grande do**

Sul: Cambará do Sul, Cambará do Itaimbezinho, 986 m, 29º8’3” S, 50º7’58” W, 5 Dec. 2015, *F. Gonzatti 2257* (CESJ); Canoas, Capões, Instituto Geobiológico “La Salle” de Canoas, 8 Aug. 1949, *I.L. Afonso 20859* (CESJ); São Francisco de Paula, estrada para Serra do Umbu, 895 m, 29º30’3” S, 50º21’15” W, 9 Jul. 2016, *F. Gonzatti 2542* (BHCB); Porto Alegre, 800 m, 8 Sep. 1949, *I. Ligório Alfonso 6* (F). **Santa Catarina**: Blumenau, Parque Nacional da Serra do Itajaí, 28 Oct. 2007, *A.L. de Gasper 830* (BHCB); Campo Alegre, Serra do Quiriri, 29 Dec. 1998, *J.M. Silva et al. 2765* (BHCB); São Bento do Sul, Fazenda Sequóia, km 107, 26º11’54” S, 49º9’7” W, 28 Apr. 2008, *R.G. Koelher & G.C. Zickuhr s.n.* (BHCB); São Bonifácio, Parque Serra do Tabuleiro, 885 m, 27º53’54” S, 48º52’19” W, 10 Jun. 2009, *S. Dreveck & F.E. Carneiro 953* (BHCB). **São Paulo:** Águas da Prata, fragmento perto do Pico do Gavião, na estrada de acesso ao Pico, pela BR-146, 1350 m, 22º00’12” S, 46º37’54” W, 16 Jul. 2007, *A. Salino et al. 12721* (BHCB); Bananal, Estação Ecológica do Bananal, nas trilhas da Estação, e da Pedra Vermelha, 1130−1350 m, 22º49’10” S, 44º21’58” W, 8 Mar. 2001, *A. Salino et al. 6301* (BHCB); Campos de Jordão, Pico de Itapeva, 2000 m, 9 Jun. 1992, *A. Salino s.n.* (BHCB); Caraguatatuba, Parque Estadual da Serra do Mar, estrada intermediária, km 33,estação de Bombeamento da Petrobrás. 590 m, 23º40’58” S, 45º38’14” W, 18 Apr. 2000, *A. Salino et al. 5262* (BHCB); Eldorado, Parque Estadual do Jacupiranga, Núcleo Caverna do Diabo, trilha Araçá e trilha do Rolando, 400 m, 24º38’13” S, 48º28’1” W, 22 Mar. 2005, *A. Salino et al. 10129* (BHCB); Itanhaém, Floresta Ombrófila densa da Planície Litorânea, 25 m, 24º13’128” S, 46º55’51” W, 18 Apr. 2001, *A. Salino 6628* (BHCB, CESJ); Itapecerica da Serra, Estrada da Escola Maria Ward, 9 Dec. 1971, *P. G. Windisch 129* (LP); Jundiaí, Serra do Japi, 1233 m, 23º15’ S, 46º58’ W, 16 Oct. 2009, *R.Y. Hirai et al. 628* (NY); Miracatu, Reserva Votorantim, Complexo Juquiá, trilha do Chagas, UHE Fumaça, 429 m, 24º00’38” S, 47º17’41” W, 30 Mar. 2013, *A. Salino et al. 15654* (BHCB); Ribeirão Grande, Parque Estadual Intervales, trilha da Caçadinha, com início da estrada do Carmo, 780 m, 24º16’39” S, 48º25’9” W, 15 May 2003, *A. Salino et al. 8430* (BHCB); São Paulo, Parque Estadual da Serra do Mar, Núcleo de Curucutu, Trilha do Campo, 800 m, 23º59’7” S, 46º44’7” W, 10 May 2001, *A. Salino 6443* (BHCB, CESJ); São Lourenço da Serra, Reserva particular do Patrimônio Natural Paiol Maria, Trilha Ibirá-Mirim, 762−809 m, 23º49’27” S, 46º56’30” W, 9 Mar. 2011, *J.A. Lombardi 8037* (BHCB); São Luís do Paraitinga, Parque Estadual da Serra do Mar, Núcleo Santa Virgínia, Trilha da Pirapitinga,

900–950 m, 23º20’29” S, 45º8’48” W, 4 Feb. 2001, *A. Salino et al. 6139* (BHCB, CESJ); Sete Barras, Fazenda Intervales, Base de Saibadela, 20 Jul. 1993, *A. Salino 1991* (BHCB); Tapiraí, Fazenda São José, ao lado da Pousada Salve Floresta, 23 Feb. 2008, *J. Prado et al., 1955* (NY); Ubatuba, Parque Estadual da Ilha Anchieta, 4 Nov. 1993, *A. Salino 1647* (BHCB); Ubatuba, Parque Estadual da Serra do Mar, Núcleo Picinguaba, trilha do Picadão da Barra, 23º21’43” S, 44º50’2” W, 3 May 2001, *A. Salino et al. 6701* (BHCB).

PARAGUAY. *E. Hassler 3999* (NY). **Rocha:** Laguna Negra, Reserva de Don Bosco, 34º5’7” S, 53º45’20” W, *M. Bonifacino et al. 2170* (SI).

8. Serpocaulon concolorum (M. Kessler & A.R. Sm.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium concolorum* M. Kessler & A.R. Sm., Candollea 60(1): 277, f. 4A–E. 2005. TYPE: Bolivia. La Paz: Nor Yungas, 2 km de Chuspipata a Coroico, 2900 m, 16º22’ S, 67º49’ W, 19 Sep. 1997, *M. Kessler et al. 11922* (lectotype designated by Kessler & Smith (2005: 277): UC [bc] 1621195!; isolectotypes: GOET [bc] 009131 image!, LPB [bc] 0000106!). Figures 16d, 23b, 40, 41, 49b.

Serpocaulon obscurinervium D. Sanín, Plant Ecol. Evo. 147(1): 127−133. 2014. TYPE: Colombia. Nariño: Carretera La Victoria-Monopamba, 2500 m, 10 Jan. 1973, *O. Hagemann & H. Leist 1898* (holotype PSO [bc] 28225!, isotype COL!). **New syn.**

Polypodium loriceum var. *obscurum* Rosenst. Repert. Spec. Nov. Regni Veg. 6: 308. 1909. TYPE: Ecuador. Tungurahua, Mt. Abitagua [near Baños], Andes de Quito, Sep. 1856, *R. Spruce 5234* (**lectotype here designate**: P [bc] 00624574 image!). **New syn.**

Polypodium loriceum L. var. *squamuligera* Rosenst, Repert. Spec. Nov. Regni Veg. 7: 308–309. 1909. TYPE: Ecuador. Tungurahua, Mt. Tungurahua, 1857−1859, *R. Spruce 5233* (**lectotype here designate** P [bc] 00632980 image!, isolectotype P [bc] 632981 image!). **New syn.**

Plants epiphytic or terrestrial. *Rhizomes* 3.3−3.7 mm in diameter, long-creeping, colour orange to reddish at the apex, yellowish brown at the base, pruinose; phyllopodia distance 2.3−4 cm. *Rhizome scales* dense, 5.2−8.5 × 1.6−2.3 mm, lanceolate to narrowly-lanceolate, patent, subpeltate concolorous, dark orange, iridescent, base rounded, appressed and apex

acuminated, patent, ciliate margin. *Fronds* 54−61 cm long. *Petioles* 25−28 cm, proximally subterete, distally triangular, dark stramineous. *Laminae* 29−33 × 9−9.7 cm, narrowly lanceolate, pinnatisect, truncate and reflexed proximally and apex gradually tapering to a caudate attenuated segment. *Segments* 33−35 pairs, chartaceous to coriaceous, proximal and medial surcurrent, distally decurrent. *Medial segments* 4.7−5.2 × 0.7−0.8 cm, base decurrent and apex acute to rounded, venation forming 19−28 rows along and 1 row of areoles between the costae and the margin, fertile veinlets inconspicuous. *Laminar induments* segment scales scarce, 0.9−1.6 × 0.3−0.4 mm, lanceolate, 2−4 cells wide, patent, basifixed, concolorous, dark brown, base rounded with one stalk insertion, and apex acuminate to largely acicular the margins smooth. *Hairs* disperse and scarce, 2−4 cells long, catenate, appressed, dark brown, darker in the dissections of the cells and the apex. *Sori* from the medial segment 19−28 rows along and 1 row between the costa and margin. *Spore* 49−52 × 24−28 µm, ellipsoidal to sub-ellipsoidal, concave-convex to plane-convex, and irregular depressed verrucae with smooth perinae.

Etymology. The specific epithet refers to the concolorous rhizome scales.

Distribution and habitat. Serpocaulon concolorum occurs from Colombia to Bolivia, mainly in Andean ecosystems, from 1820 to 3000 m, in cloud forest.

Phenology. It was recorded fertile in January, March, May, July, August, September and November.

Notes. Serpocaulon concolorum most resembles *S. eleutherophlebium*, that also possess long-creeping rhizomes, scales with patent apex, concolorous, pinnatisect laminae and share distribution in Colombia and Ecuador. However, differs from *S. eleutherophlebium* by narrowly-lanceolate scales (vs. ovate-lanceolate to subulate), dark orange (vs. dark brown), larger size 5.2−8.5 × 1.6−2.3 mm (vs. 3.5−7.1 × 0.5−1.7 mm), longer petioles 24−28 cm (vs. 3.4−25 cm), more areolae along the medial segment (19−28 vs. 6−21 rows), and by presenting inconspicuous fertile veinlets (vs. conspicuous).

Taxonomic and nomenclatural notes. Kessler and Smith (2005) designated the sheet *Kessler et al. 11922* without designated the herbarium code, here is interpreted as a first step lectotype. Using the second step lectoypification, here is designated the sheet *Kessler et al. 11922* (UC [bc] 1621195), to designate the name *Polypodium concolorum* = *Serpocaulon concolorum*.

Rosenstock (1909) published the names *Polypodium loriceum* var. *obscura* Rosenst., and *Polypodium loriceum* L. var. *squamuligera* Rosenst., using two sheets that correspond to the series of Spruce (*R. Spruce 5234* and *R. Spruce 5233* respectively and hosted at P) without notice that they represent the same species, *S. concolorum*. For this reason, in this contribution are considered as synonyms of this species. This disagree Lellinger's (1989) designation of *Polypodium loriceum* L. var. *squamuligera* Rosenst., as synonym of *P. loriceum* = *S. loriceum*, nevertheless, Lellinger mentioned that he did not reviewed the type.

Posteriorly, Sanín (2014), supported by the variety status of the name *Polypodium loriceum* var. *obscura* Rosenst. that included the type collection *R. Spruce 5233* (P), and other specimens not cited before from Colombia (Sanín et al., 2017), published the name *S. obscurinervium*. However, the author did not notice the previous description of Kessler and Smith (2005), creating a new synonym of *S. concolorum*.

Due its distribution and scarce register in Colombia, Sanín (2014) suggested that this species fall under the Endangered (EN) category.

Representative specimens. BOLIVIA. **La Paz:** Franz Tamayo, Parque Nacional Madidi, senda Keara-Mojos, alrededores de Chunkani, 2900 m, 14º38'19" S, 68º57'33" W, 27 Feb. 2008, *I. Jiménez 4855* (LPB).

COLOMBIA. **Caquetá:** Florencia, Vía Neiva, vereda El Condor, a mano derecha de la vía, a 100 m del Puente Cerro Negro [1°45'19.62" N , 75°44'59.98" W], 2050 m, 27 Jul. 2015, *D. Sanín & J.L. Peña 6371* (CAUP, PSO, COL, HUA); Florencia, Vía Guadalupe, El Gabinete, a mano izquierda de la vía, a 100 m de la estación militar, 2700–2800 m, [1º52'44" N, 75º40'58" W], 20 Feb. 2016, *D. Sanín et al. 6396* (COAH, COL, FAUC, HUA). **Huila**: Suaza, vía Neiva, vereda Campo Hermoso, costado izquierdo de la vía, km 40, 2190 m, [1°46'11" N, 75°46'37.52" W], 1 Apr. 2016, *J.L. Peña 542* (COL). **Chocó**: San José del Palmar, Cerro Torrá, filo de cumbre, 2700−2800 m, [4º48' N, 76º29' W], 21 Aug. 1988, *P.*

Silverstone-Sopkin et al. 4633 (CHOCO, CUVC, F, MO, UC). **Nariño**: Reserva Natural La Planada, sendero entre El Hondon y Los Horquetas, bosque primario, 1820 m, 1º10' N, 78º00' W, 31 Jan. n.d., *H. Herrera 9302, 9193* (CUVC, UC).

ECUADOR. **Cotopaxi:** entre Quito y Sto. Domingo, cerca de San Francisco de las Palmas, 1990–2200 m, Nov. 1996, *C. Nowicki 531* (QCA); Km. 59 de la carretera antigua Quito-Sto. Domingo de los Colorados, a 3 ½ km, al NE de la carretera, estribaciones occidentales del Volcán Pichincha, 2200 m, 0º13'53" S, 78º48'10" W, 12 Feb. 1987, *E. Grijalva 174* (QCA). **Morona-Santiago:** Road Plan de Milagro-Gualaceo, km 10.8, 2200 m, 3º0' S, 78º32' W, 24 Nov. 1997, *B. Øllgaard & H. Navarrete 2768* (AAU, QCA!). **Pichincha:** Road Chillogallo-Alluriquin, 17.6 km W of Chiriboga, 1800 m, 0º14' S, 78º49' W, 17 Mar. 1992, *B. Øllgaard 99874* (AUU, QCA!); Sta. Rosa, 18 km al S. de Nanegalito, 1900−2000 m, 0º0'50" S, 78º39'10" W, Jan. 1995, *H. Navarrete 785* (QCA). **Zamora-Chinchipe:** Estación Científica San Francisco, around refuge, study plot A7, 2490 m, 3º59'23" S, 79º4'20" W, 22 Sep. 2003, *M. Lehnert 861* (UC); Reserva Tapichalaca, 2600−2650 m, 4º29' S, 79º7' W, 18 Sep. 2004, *M. Lehner & M. Kessler 1295* (QCA).

PERU. **Cajamarca:** Cutervo, El Suro, San Andrés, 2200 m, 16 Jul. 1990, *S. Llatas-Quiroz & H. Suarez 2810* (F); Cutervo, Fortaleza de Chontacruz, San Andrés, 2400 m, 17 Jul. 1990, *S. Llatas-Quiroz & H. Suarez 2883* (F). **San Martín:** Roja, Pardo Miguel Naranjos, Bosque de Protección Alto Mayo, Caserio Jorge Chávez, Sector Venceremos, 2364 m, 5º42'57" S, 77º14'43" W, 22 May 2017, *M. Acuña et al. 1946* (USM).

9. Serpocaulon crystalloneuron (Rosenst.) A.R. Sm., Taxon 55(4): 928. 2006. (20 Dec 2006). *Polypodium crystalloneuron* Rosenst. Repert. Spec. Nov. Regni Veg. 11: 57. 1912. TYPE: Bolivia. Nor Yungas: Unduavi, 3400 m, Nov. 1910, *O. Buchtien 2773* (**lectotype here designated**: S [bc] S-R−5059 image!; isosyntypes: *O. Buchtien 2774* (P [bc] 00624714 image!, P [bc] 00624715 image!, P [bc] 00624716 image!), *O. Buchtien 2775* (UC [bc] 477616 image!, US [bc] 00065818 image!). Figures 14a-b, 16e, 23b, 42, 49c.

Serpocaulon silvulae (M. Kessler & A.R. Sm.) A.R. Sm., Taxon 55(4): 929. 2006. *Polypodium silvulae* M. Kessler & A.R. Sm. Candollea 60(1): 280, f. 5. 2005. TYPE: Bolivia. La Paz: Franz Tamayo, P.N.-ANMI Madidi, senda Keara-Mojos, Tambo

Quemado, 3600 m, 14º41' S, 68º58' W, 15 Nov. 2001, *I. Jiménez 1093* (lectotype designated by Kessler & Smith (2005): LPB [bc] 0000108!; isotype: GOET here designated). **New syn.**

Plants epiphytic, terrestrial or rare rupicolous. *Rhizomes* 4−10 mm diameter, long or rarely short-creeping, blackish, pruinose, rugose; phyllopodia distance 1.5−2.5 cm. *Rhizome scales* disperse to abundant to the apex, 3.3−4.7 × 2.2−3.4 mm, ovate to ovate-lanceolate, subpatent, subpeltate, bicolorous, brown, with small pale margin, base auriculate to rounded, apex acute to rare acuminate, smooth margin. *Fronds* 15−64 cm long. *Petioles* 6−24 cm long, proximally and distally subterete, light brown to dark brown. *Laminae* 9−42 × 4−15 cm, lanceolate, pinnatisect, truncate and reflexed proximally and gradually tapering to a caudate apical segment. *Segments* 13−47 pairs, papyraceous, proximal surcurrent, medial and distal decurrent. *Medial segments* 4.8−8 × 0.7−1.5 cm, base decurrent and apex rounded, acute to acuminate, venation forming 11−21 rows along and 1 rows of areolae between the costae and the margin, notorious. *Laminar induments* segment scales scarce, 1.8−2.6 × 0.7−1.9 mm, triangular, lanceolate to deltate, 8−34 cells wide, basifixed with a notorious insertion, concolorous, light brown, base rounded to truncate and apex acuminate to long acuminate, cirrose, the margins smooth. *Hairs* along the rachis and costa, scarcely to rarely dense, 3−5 cells long, catenate, patent, dark brown. *Sori* from the medial segment in 6−20 rows along and 1 row between the costa and the margin, absent at the apices. *Spores* 45−55 × 36−42 µm, ellipsoidal, subellipsoidal to globular, plano-convex, and irregularly depressed verrucae.

Etymology. The specific epithet refers from the Greek *krystallos*: crystal, and *neuro*: nerve, by the crystalline perception of the rhizome scales.

Distribution and habitat. Serpocaulon crystalloneurum occurs from Ecuador to Bolivia, in Andean ecosystems, from 2300 to 4200 m, in cloud forest from middle to high montane forests. Only one collection was recorded in Ecuador, and curiously, it is the lowest register of the species and represents a new record for the country.

Phenology. It was recorded fertile all year, except June, September, and November.

Notes. *Serpocaulon crystalloneurum* most resembles *S. eleutherophlebium*, that also possess long-creeping rhizome, wide patent rhizomes scales, pinnatisect laminae and also inhabits middle to high lands of the Andes. However, differs from *S. eleutherophlebium*, by its short hairs from the rachis and the segments (vs. glabrous laminae), the rounded to ovate, wide, bicolorous rhizome scale, with acute apex (vs. ovate lanceolate, concolorous rhizome scale, with acicular apex).

Taxonomic and nomenclatural notes. Rosenstock (1912) described this species using the series of *O. Buchtien 2773−2775* as types. Hensen (1990) pointed this series, but suggested as lectotype one specimen without number hosted at B, and designated 'iso or syn' from BM, L, and P. Following this, the authors did not reference a holotype to represent this taxon. In this sense it is chosen the sheet *O. Buchtien 2773* (S-R−5059), because it is complete and represents the first specimen of the named series as is recommended in the Article 9.12 (Turland et al., 2018).

Kessler and Smith (2005), published *Polypodium silvulae* from Bolivia, supporting this species only with two collections. The authors mentioned that this species 'appeared to be genuinely rare'. Posteriorly, Smith et al. (2018) presented *S. silvulae* as endemic to Bolivia and mentioned that it is closely related to *S. eleutherophlebium*, the species that is compared here with *S. crystalloneurum*. After revising the type collection of this name, it was possible to realize that the pruinosity of the rhizome, the bicolorous rhizome scales and lamina indumenta are similar to the type collection of *S. crystalloneurum,* as well as, its distribution and altitudinal range that are overlapping (Smith et al., 2018). Concluding that those collections are a variation of the named species, characterizing by a narrow shape in the rhizome scales, recorded from the specimens studied in this study. In addition, previous phylogenies suggested that *S. crystalloneurum* and *S. silvulae* are part of the same polytomy (Smith et al., 2006; Kreier et al., 2008). This supports the present designation under the synonym *S. crystalloneurum.*

Indigenous name. Peti Chegana, *Piti Chchikana* in Bolivia (*W.E. Carter 133*, F).

Traditional uses. The rhizome is used in Bolivia to reduce inflammation of the matrix (*W.E. Carter 133*, F).

Representative specimens. BOLIVIA. **Cochabamba**: Ayopaya, above independencia, 3200–3400 m, 5 May 1990, *E. Hennipman & G. Rödl-Linder 8096* (LPB), Chapare, Cochabamba, 54 km hacia Villa Tunari, 2750 m, 30 Apr. 1979, *S.G. Beck 1427* (F); Cerros de Incachaca, 2800 m, 6 Oct. 1922, *J. Steinbach 6072* (F). **La Paz**: Bautista Saavedra, rechtes Seitental des Amarete-Tales gegenüber Amarete, Devonschiefer, 4200 m, 31 Jan. 1980, *T. Feuerer 8274a* (F); Ingenio de Oro, 3048 m, Mar. 1886, *H.H. Rusby 359* (F); Inquisivi, Pavionani fork of the río Chimu below the headwaters divide with the río Janko Kalani, 3700–3750 m, 16º48’ S, 67º18’ W, 9 Apr. 1991, *M. Lewis 38538* (LPB, MO); Inquisivi, comunidad Choquetanga-Wichupampa, serranías de Lulini 13 km al N de Choquetanga, 2–3 km al NW del cerro Lulini, 3290 m, 16º45’ S, 67º20’ W, 17 Mar. 1994, *N. Salinas 2807* (LPB); Murillo, 20.8 km al norte de la Cumbre del Valle del río Zongo, 3200 m, 16º9’ S, 68º7’ W, 20 Feb. 1987, *J.C. Solomon 16118* (MO, LPB); Nor-Yungas, Coroico, 39 km hacia La Paz, 3100 m, 13 Mar. 1979, *S.G. Beck 648* (LPB); Nor-Yungas, Unduaví, 3200 m, Feb. 1914, *O. Buchtien 421* (SI); Nor Yungas, 22 km NE (below) Unduaví on road to Yolosa Junction (Coroico), 3000 m, 16º18’ S, 67º48’ W, 29 Feb. 1980, *J.C. Solomon 5177* (LPB!, MO); Saavedra, Curva, above village of Charazani, 3900 m, 15º7’ S, 69º3’ W, 1978, *W.E. Carter 133* (F); Sud-Yungas, 19.8 km E of pass between Mururata and Illimani (ca. 0.5 km from Ikiko), 3500 m, 16º34’ S, 67º45’ W, 11 Dec. 1983, *J.C. Solomon 11363* (LPB, MO). **Santa Cruz:** Caballero, Comarapa 32 km, hacia Cochabamba, 2500 m, 24 Mar. 1981, *S.G. Beck 6826* (LPB); J.M. Caballero Vallegrande, Siberia, Carretera Jarahuasí, 2528 m, 17º49’ S, 64º45’ W, 26 Mar. 2004, *M. Mendoza & S. Acebo 929* (LPB).

ECUADOR. **Loja:** Trails ca 5 km ENE of San Pedro de Vilcabamba, loma Solamaco to upper Quebrada Romerillos, 2300–2400 m, 4º14’ S, 79º10’ W, 1 Dec. 1994, *B. Øllgaard & H. Navarrete 105976* (QCA).

PERU. **Ancash:** Yungay Prov. Huascarán National Park, Quebrada Ranincuray, 3850 m, 9º0’ S, 77º33’ W, 11 Jan. 1985, *D.N. Smith et al. 9051* (LPB, MO, USM). **Apurímac:** Abancay, Dist. Tamburco, Santuario nacional de Ampay, alrededores de Vervenasniyoc, 3159 m, 28 May 2015, *V. Zuñiga 390* (USM). **Ayacucho:** La Mar, alrededores de

Chiquintirca, Dist. Anco, 3120 m, 640461, 8555778, 27 Mar. 2005, *J. Roque 4524* (USM). **Cusco:** La Convención, Dist. Huayopata, Carrizales, 3250 m, 13.05.20 S, 72.23.03 W, 11 Aug. 2003, *E. Bonito et al. 1015* (USM); Oxapampa, Dist. Huancabamba, Sta. Barbara, above Lanturachi, 3300–3500 m, 10º20' S, 75º40' W, 2 Jul. 1985, *R.B. Foster et al. 10456* (USM); Paucartambo, km 130 hacia Kosñipata, incluye Acjanaco, Pillahuata, parte alta del Parque Nacional del Manu y ceja de selva hacia Kosñipata, 2600 m, 13º5' S, 71º30' W, 30 Oct. 1987, *P. Núñez et al. 8491* (F, MO); Urubamba, Dist. Ollantaytambo, Huaytampo, 3212 m, 12.11.39 S, 72.21.55 W, 24 Feb. 2006, *L. Valenzuela et al. 6317* (USM). **La Libertad:** Santiago de Chuco, Laguna El Tora 48 km from Huamachuco on Huamachuco-Shoreyo road, 3960 m, 7º59' S, 78º15' W, 25 Aug. 1982, *D. Smith 2298* (USM). **San Martín:** Mariscal Cáceres, Forest patch (C9) isolated above timberline, Chochos, NW corner of río Abiseo Nat. Park, 3350 m, 14 Jul. 1987, *K. Young & B. León 4572* (F).

10. Serpocaulon dasypleuron (Kunze) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium dasypleuron* Kunze, Linnaea 9: 43. 1834. *Marginaria dasypleura* (Kunze) C. Presl. Tent. Pterid. 188. 1836. *Goniophlebium dasypleuron* (Kunze) Moore, Index fil. 74. 1857. TYPE: Peru. Pampayacu: 1829, *Poeppig s.n*. (lectotype designated by Hensen (1990: 294): K [bc] 000642077 image!; isolectotypes K, fragm. US image!). Figures 5f, 20b, n, 23d, 43, 44, 49d.

Serpocaulon loriciforme (Rosenst.) A.R. Sm., Taxon 55(4): 927. 2006. *Polypodium loriciforme* Rosenst, Repert. Spec. Nov. Regni Veg. 22: 17. 1925. TYPE: Costa Rica. May 1910, *Brade & Brade 493* (lectotype designated by Lellinger (1989: 276 294): S [bc] S-5090 image!; isolectotypes NY [bc] 144866 image!, UC [bc] 405668 image!).

Polypodium subviride Lellinger, Proc. Biol. Soc. Wash. 98: 389, 1985. TYPE: Panama. La Eneida region near Cerro Jefe, 11 Aug. 1971, *Kennedy 1117* (lectotype designated by Lellinger (1985: 389): US [bc] 00048678 image!; isolectotype DUKE [bc]10000950 image!).

Polypodium subandinum Sodiro var. *biserialis* Rosents. Repert. Spec. Nov. Regni Veg. 7: 308. 1909. TYPE: Ecuador. Chimborazo: ad fluv. San Antonio, *R. Spruce 5729* (**lectotype here designated**: P [bc] 00709258 image!). **New syn.**

Plants epiphytic. *Rhizomes* 2–5 mm diameter, long-creeping, dark reddish, brown to light yellowish, pruinose; phyllopodia distance 2−14 cm, 2−5 mm long. *Rhizome scales* disperse, mainly located in the apex of the phyllopodia, 0.6−2 × 0.4–0.9 mm, rounded to elliptic, appressed, peltate, bicolorous, light brown to the margin and dark brown to the center, base and apex rounded, appressed, erose margin. *Fronds* 17–59 cm long. *Petioles* 2.5–9.5 cm long, proximally subterete, distally winged 3/4 or totally, wing to 1 mm wide, light to dark brown. *Laminae* 15–50 × 3.5–10 cm, linear to linear-lanceolate, pinnatisect, truncate proximally to slightly reduced, distally gradually reduced to a short-attenuate segment, acute to cuneate. *Segments* 20–43 pairs, membranaceous to papyraceous, proximally surcurrent, to decurrent in a winged lobe, sinuate or smooth, medial and distal decurrent, gradually tapering. *Medial segments* 2–4.5 × 0.5–1 cm, base decurrent and apex acute, venation forming 11–17 rows along and 1 rows of areolae between the costae and the margin, notorious. *Laminar iduments* segment scales scarce, 0.7–1.5 × 0.3–0.5 mm, lanceolate to triangular, 7–12 cells wide, patent, basifixed, concolorous, light brown, base rounded and acuminate apex, the margins erose. *Hairs* dense, catenate, patent, hyaline with dark brown dissections, villose, over the rachis 9–20 cells, and over the margin of the segments 6–8 cells. *Sori* from the medial segments in 10–16 rows along and 1 row between the costa and the margin. *Spores* 51–61 × 31–41 µm, ellipsoidal, plane-convex to concave convex, and irregular prominent verrucae.

Etymology. From the Greek *dasys*: thick with hair, and *pleuro*: side, describing the dense pubescence on the lamina.

Distribution and habitat. Serpocaulon dasypleuron occurs from Costa Rica to Peru, and Brazil, mainly in lowlands of the Amazon and Chocó regions, from 40 to 2300 m, in humid west and east foothills of the Andes.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon dasypleuron most resembles *S. subandinum* and *S. patentissimum*, that also possess long-creeping rhizomes, dense pubescence at the membranaceus to papyraceous pinnatisect laminae (except *S. patentissimum* that its pubescence but this is not

dense and is located mainly at the rachises). However, differs from *S. subandinum* by its linear laminae (vs. lanceolate), rhizome scales rounded to elliptic (vs. triangular to lanceolate), appressed (vs. patent at the apex) and spores with plane apex verrucae (vs. rounded apex). From *S. patentissimum* differs by its wider rhizome (2–5 mm vs. 0.9–2 mm diameter), rounded and totally appresed rhizome scales (vs. ovate-lanceolate to triangular or deltate), wider laminae (3.5–14 cm vs. 2.2–4 cm) and wider medial segments (0.5–1 cm vs. 0.2–0.5 cm).

Serpocaulon dasypleuron also can be confused with *S. wagneri* by its pinnatisect laminae with dense pubescence but differs from this species by its long-creeping rhizomes (vs. short-creeping), rounded to ovate rhizome scales (vs. subulate to lanceolate), and spores lacking folded perinae (vs. with folded perinae).

Serpocaulon dasypleuron differs from the others species with long-creeping rhizome, rounded to ovate appressed scales and pinnatisect laminae, as *Serpocaulon funckii*, *S. loriceum* and *S. ptilorhizon*, by its linear, dense pubescence laminae (vs. lanceolate to linear -lanceolate (*S. funckii*) laminae with scarce and dispersed hairs), membranaceous to papyraceous consistence at the laminae (vs. chartaceous to coriaceous laminae consistence, except by *S. funckii* that presents membranaceous laminae, but inhabits middle to highlands and subparamo).

Despite *S. dasypleuron* is predominanlty dense pubescence, specimens from the Amazon and Costa Rica tend to be glabrous (*Brade & Brade 493*, S), however, the indumenta from the rachises allow to recognize them. Due to its long-creeping rhizome, which represents the longest in the genus, this species was found at 5 m on the phorophyte (*D. Sanín & F. Criollo 6020*, COL). Another character that allows its determination is the frequent angle of 45º from the petioles in relation to the rhizome and the pronounced phyllopodia (2–4 mm long).

Taxonomic and nomenclatural notes. Contrasting Moran (1990) and Smith et al. (2006), Hensen (1990) and Sanín (2018) consider *S. loriciforme* a synonym of *S. dasypleuron*, which is also recognised here. In this respect, Moran (1990) mentioned that both species can be distinguished by the basal reduction of the lamina in *P. loriciforme*, as well as the contrasting southern distribution of *P. dasypleuron.* However, in the field trips made in Costa Rica and Colombia, where *S. dasypleuron* was collected, it was possible to verifying that this feature

is greatly variable, possible related with the age of the plant. Additionally, specimens from Peru exhibits this reduction (*Peralta Vargas 19*, USM).

Lellinger (1985) designated the type of the name *Polypodium subviride*, the sheet *Kennedy 1117* from US. Following recommendation of the Article 9.17 (Turland et al., 2018), here are designated by the second step lectotype the same sheet from the US, informing the barcode.

The name *Polypodium subandinum* Sodiro var. *biserialis* Rosenst., was traced as a new synonym of *S. dasypleuron*, and because no specimen was designated as lectotype, the derived lectotypification is presented.

Indigenous name. Kentawunki in Peru *D.N. Smith 6702* (USM, MO), *Achu boa tape* (Cayapa) in Ecuador (*L.P. Kvist & E. Asanza 40795*, QCA).

Traditional uses. The rhizome is macerate and used for a snake bite in Peru (*D.N. Smith 6702*, USM, MO), the leaves are macerated and mixed with water for hair washing to promote its growing in Ecuador (*L.P. Kvist & E. Asanza 40795*, QCA).

Representative specimens. BRAZIL. **Amazonas:** Coari, igarapé da Onça, arredores do Pólo Arara, Província Petrolífera de Urucu, 14 Feb. 2008, *M.R. Pietrobom et al. 7617* (HBRA); Coari, Província Petrolífera de Urucu, proximidades do alojamento Vitória Régia, 68 m, 4º52’55” S, 65º19’4” W, 11 Mar. 2007, *M.R. Pietrobom 7091* (UFP).

COLOMBIA. **Amazonas:** corregimiento de Puerto Santander, quebrada Metá, terraza alta, 0º 53’ N, 71º 36’ W, 05 Apr. 2001, *A. León 249* (COL); río Miriparaná, cerro de la Gente Chiquita in headwaters of quebrada Guacayá, 18 May 1952, *R.E. Schultes 16501* (COL). **Antioquia:** Anorí, vereda San Antonio, finca El Cielo, 725 m, 7º16’ N, 75º3’ W, 9 Nov. 2003, *W. Rodríguez 4221* (COL, HUA, MEDEL); Cáceres, 7 km noreste de Cáceres, sobre troncal de La Paz, 110–130 m, 7º34’ N, 75º20’ W, 5 Nov. 1987, *A.L. Arbeláez 190* (HUA); Jardín, vereda el Salado, bosque al margen del río Docató, 1500 m, 26 Jan. 1988, *A.L. Arbeláez 292* (HUA); San Carlos, corregimiento Alto de Samaná, vereda Miraflores, al interior de bosque, 820–900 m, 6º6’ N, 74º57’ W, 14 Jun. 1989, *R. Fonnegra 3030* (HUA); Zaragoza, corregimiento de Providencia, along río Anorí, vic. of the hydroelectric plant, 500

m, 8 Feb. 1971, *D. Soejarto 2638* (HUA). **Caquetá**: Solano, Araracuara, camino a la represa, plano sedimentario del Terciario, 16 Aug. 1998, *R. Alfonso 196* (COL), Florencia, vereda El Caraño, después del puente, bosques de galería atrás de la casa, 800−850 m, 24 Jul. 2015, *D. Sanín 6050* (COL). **Huila**: San Agustín, vereda Planares, relicto arriba de la escuela Platanares, 2147–2150 m, 1º59' N, 76º17' W, 1 Jul. 2009, *D. Sanín 3275* (FAUC). **Nariño**: corregimiento de Altaquer-La Ensillada, 1100 m, 2 Dec. 1981, *O. de Benavides 3099* (PSO). **Putumayo:** Mocoa, along S bank of río Mocoa, 700 m, 2 Dec. 1980, *T. Croat 51751* (COL); trayecto Puerto Asís a Orito, 240 m, 17 Feb. 1973, *H. Hagemann 2033* (PSO); Puerto Porvenir, arriba de Puerto Ospina hacia La Loma, selva higrófila del río Putumayo, 250 m, 19 Nov. 1940, *J. Cuatrecasas 10673* (COL, F). **Santander**: Puerto Berrío, between Carare and Magdalena rivers, 100–700 m, *O. Haught 1811* (COL).

COSTA RICA. **Alajuela:** Along road to Colonía Virgen del Socorro, barranca of río Sarapiquí, 700–800 m, 10º15' N, 84º10' W, 8 Aug. 1979, *W.D. Stevens 13534* (F). **Cartago:** La Esperanza, Río Atirno, 800 m, 8 Aug. 1974, *P.J.M. Maas 1182* (F); Turrialba, Tayutic, Vereh. Grano de Oro, 2 k al E, camino a Llanos de Quetzal, 1200 m, 9º48'50" N, 83º22'40" W, 28 Jul. 1995, *G. Herrera & A. Cascante 8165* (F). **Guanacaste**: Cantón de la Cruz, P.N. Guanacaste, Volcán, Orosí, Estación Pittilla, 680 m, 10º59'26" N, 85º25'39" W, 13 Aug. 1998, *A. Rojas et al. 4757* (INB). **Heredia:** Finca La Selva, OTS Field Station on the río Puerto Viejo just E of its junction with the río Sarapiquí, 100 m, 24 Jul. 1980, *M.H. Grayum 3057* (F); Near Tirimbina east of the río Sarapiqui, 150–250 m, 10º24' N, 84º7' W, 12 Aug. 1971, *W.C. Burger & M. Burger 8059* (F). **Limón:** Pococí, Llanura de Tortuguero, San Juan de Pococí, Cuatro Esquinas, Finca Hermanos Rojas Alvarado, 40 m, 10º34'00" N, 83º51'00" W, 16 Jun 1993, *A. Rojas & E. Lépiz 1970* (INB). **San José:** ca 10 km N of San Rafael de Heredia on Volcán Barba, 1950 m, 13 Jul. 1967, *J.T. Mickel 3678* (NY).

ECUADOR. **Bolívar:** Carretera Balsapamba-Guaranda, 2 km despues de Sta. Lucía, 1500 m, 1º48' S, 79º8' W, *H. Navarrete 520* (QCA). **Carchi:** Lita-San Lorenzo road, 5 km from Lita, 600 m, 0º50' N, 78º28' W, 17 Dec. 1982, *A. Barfod 41357* (QCA). **Esmeraldas:** Between Lita and Alto Tambo, roadside and trails from road, 450–500 m, 0º49' N, 78º27' W, 16 Dec. 2004, *M. Lehnert 1585* (QCA); Río Cayapa, Zapallo Grande, in front of the village, 100 m, 0º48' N, 78º55' W, 1 Aug. 1982, *L.P. Kvist & E. Asanza 40795* (QCA). **Imbabura:** Lita, 540 m, 26 May 1949, *M. Acosta Solís 12527* (F). **Loja:** Trails ca 5 km ENE

of San Pedro de Vilcabamba, upper part of Quebrada Romerillos, 2200–2300 m, 4º14’ S, 79º10’ W, 1 Dec. 1994, *B. Øllgaard et al. 106002* (QCA). **Morona-Santiago:** Misión Bomboiza, 800 m, 3º29’ S, 78º34’ W, 23 Apr. 1973, *L. Holm-Nielsen et al. 4291* (AAU, F!). **Napo-Pastaza:** Napo, Zatzayacu, 500 m, 22 Mar. 1935, *Y. Mexia 7057* (F); Río Aguarico, Island midway between Zancudo and Lagarto Cocha, 290 m, 0º37’ S, 75º22’ W, 30 Aug. 1979, *L. Holm-Nielsen et al. 20220* (QCA). **Pastaza:** Lorocachi, 2–4 km S-SE of the military camp, 200 m, 1º38’S, 75º58’W, 24 May 1980, *J. Brandbyge & E. Asanza 30836* (QCA). **Pichincha:** Maquipucuna Biological Field Station, ca 5 km, E. of Nanegalito, 34 km NW of Quito, trail Camino del Río, 1300 m, 0º8’ N, 78º37’ W, 4 Apr. 1996, *R.C. Moran et al. 6006* (QCA). **Santiago-Zamora:** Valley of the río Upano, from the río Paute nort ca. 17 km to the Chupiangas, 594 m, 9 Dec. 1944, *W.H. Camp 1435* (F). **Sucumbios:** Dureno, Territorio Cofan, E. of Lago Agrio, south side of río Aguarico, Headwaters of río Pisorié, 250 m, 0º2’30” N, 76º44’53” W, 26 May 2007, *C. Vriesendorp 191* (USM). **Zamora-Chinchipe:** Miazi, junction río Chumbiriatza to río Nangaritza, 950–1200 m, 4º19’ S, 78º40’ W, 21 Oct. 1991, *B. Øllgaard et al. 99238* (QCA); Parque Nacional Podocarpus, Bombuscaro, along trail Urraquita Verde, 1150 m, 9544917, 725575, 29 Nov. 2010, *M. Lehner 2233* (QCA).

PANAMA. **Cocle:** Area between Cano Blanco del Norte, Cano Sucio and Chorro del río Tife, 200–400 m, 8º42’19” N, 80º36’30” W, 3 Feb. 1983, *G. Davidse & W. Hamilton 23592* (F). **Darién:** vicinity of upper gold mining camp of Tyler Kittredge on headwaters of río Tuquesa ca 2 km air from Continental divide, 26 Aug. 1974, *T.B. Croat 27218* (RB). **Veraguas:** 6-7 km of Santa Fé on the road past agriculture school, 880 m, 16 Feb. 1974, *M. Nee 9727* (RB). **Panama:** La Eneida region near Cerro Jefe, 11 Aug. 1971, *H. Kennedy et al. 1117* (F).

PERU. **Amazonas:** Bagua, along road from Chiriaco towards Bagua, 800 m, 5º16’57” S, 78º23’10” W, 800 m, 20 Mar. 2001, *H. van der Werff et al. 16255* (USM!, MO); Condorcanqui, El Cenepa, Comunidad de mamayaque, 260 m, 4º3’35” S, 78º10’34” W, 21 Feb. 1997, *E. Rodríguez et al. 1597* (F!, USM!, MO); Imaza, camino Putuimi-Shimutaz, 520 m, 5º3’20” S, 78º20’23” W, 20 Jun. 1996, *R. Vásquez et al. 21295* (USM!, MO). **Cusco:** La Convención, Dist. Huayopata, Huyro, Calquiña, 1600 m, 12.52.01 S, 72.32.46 W, 26 Jun. 2003, *E. Bonito et al. 738* (USM); Paucartambo, arriba km 163 antes del Puente Quita Calzón, 1180–1250 m, 12 Sep. 1991, *B. León et al. 2994* (USM). **Huánuco:** Leoncio Prado,

Della (C. de las Lechuzas), 660 m, 25 May. 1997, *C.S. Arévalo Ramírez 232* (USM); Huánuco, Tingo María, 700 m, 7 Sep. 1956, *R.M. Tryon & A.F. Tryon 5284* (USM); Lima-Tingo Maria road km 454, 2600 m, 15 Sep. 1980, *P.J.M. Mass et al. 4633* (USM). **Junín:** Satipo, 3–5 km NW of Chequitavo, 1200 m, 10º45' S, 74º23' W, *D.N. Smith 6702* (USM, MO). **Loreto:** Above Pongo de Manseriche, left bank of río Santiago, 200 m, 23 Nov 1931, *Y. Mexia 6142* (F); Coronel Portillo, cerca a Boquerón del Padre Abad, entre Tingo María y Pucallpa, 7 Aug. 1948, *P. Aguilar s.n.* (USM). **Madre de Dios:** Manu, Cerro de Pantiacolla, rio Palotoa, 10–15 km NNW of Shintuya, 650–700 m, 12º35' S, 71º18' W, 12 Dec. 1985, *R.B. Foster et al. 10715* (F, USM). **Pasco:** Oxapampa, Chontabamba, Carretera a la Suiza, 2138−2210 m, 10º39' S, 75º27' W, 8 Mar. 2003, *A. Monteagudo et al. 4539* (USM, MO); Oxapampa, Palcazu, P. Nacional Yanachaga-Chemillén, Sector Paujil, quebrada Venado, Parcela Permanente 1 Ha. 414 m, 10.20.51 S, 75.15.34 W, 24 Apr. 2010, *M. Acuña et al. 610* (USM). **San Martín:** Mariscal , Tocache Nuevo, Puerto Pizana, río Huallaga, N.D., 15 Jan. 1971, *J. Schunke 4656* (USM).

11. Serpocaulon demissum (Fée) D. Sanín, Phytotaxa 449: 52–64. *Goniophlebium demissum* Fée, Cryp. Vasc. Brésil 2: 63. 1872. *Polypodium catharinae* var. *rotundatum* Christ, Bull. Herb. Boissier ser. 2, 2: 372. 1902. *Polypodium demissum* (Fée) C. Chr. Index Fil. 521. 1906. TYPE: Brazil. Rio de Janeiro: Jurujuba, Santa Cruz [Santa Cruz da Barra], 7 Apr. 1872, *A. Glaziou 5651* (lectotype designated by Sanín & Salino (2020): P [bc] 171187 image!; isolectotypes: P [bc] 171187 image!, P [bc] 00624706 image!, P [bc] 00624705 image! Figures 16f, 22c, d, 23e, 45, 46, 49e.

Plants rupicolous (growing in leaf litter over rocks). *Rhizomes* 5−12 mm diameter, short-creeping, light to dark brown, moderately pruinose; phyllopodia distance 1−1.8 cm, phyllopodia length 2−5 mm long. *Rhizome scales* dense, 4−9 × 2−3 mm, lanceolate, patent, subpeltate, concolorous, light brown, base rounded, insertion radially folding, apex long-acuminate, caudate, scattered pale marginal projections 1−2 mm long, dentate margin. *Fronds* 18−63 cm long. *Petioles* 6.5−29 cm long, proximally and distally subterete, light brown, sinuate at the base. *Laminae* 12−34 × 4−14 cm, lanceolate, pinnatisect, truncate proximally, distally gradually reduced to a short-attenuate segment. *Segments* 26−38 pairs,

chartaceous, proximal surcurrent and reflexed, medial decurrent, apical slightly decurrent, slightly revolute. *Medial segment* 2−6.5 × 0.4−0.9 cm, base decurrent and apex acuminate to rounded venation forming 13−25 rows along and 1−2 rows of areoles between the costae and the margin, fertile veinlets usually inconspicuous. *Laminar induments* segment scales scarce, 1−3.2 × 0.15−0.24 mm, acicular, sinuate, 10−26 × 2 cells, subpeltate, base rounded and appressed, apex long-acuminate and patent, bicolorous, dark brown at center, hyaline at margin, the margins dentate. *Hairs* absent or sparsely, catenate, 3−18 cells, strigose, light brown to hyaline, mainly in axils of segments and rachis. *Sori* from the medial segment in 6−23 rows along and 1–(2) rows between the costa and the margin, not reaching the apex of the segments. *Spores* 52−56 × 30−35 µm, ellipsoid to plano-convex, and irregular depressed verrucae.

Etymology. The epithet refers to Latin word *demissus* meaning hanging down, by its pendule laminae (Sanín & Salino, 2020).

Distribution and habitat. Serpocaulon demissum is occurring mainly in the Brazilian inselbergs rising from the Atlantic Rain Forest ecosystem, from [200] to 1850 m, known from Bahia, Espírito Santo, Minas Gerais, and Rio de Janeiro States.

Phenology. It was recorded fertile all year, though no fertile specimens were collected in May, October, and December.

Notes. *Serpocaulon demissum* most resembles *S. catharinae* and *S. vacillans*, that also possess short-creeping rhizomes (except *S. vacillans* that possess long-creeping rhizomes), and pinnatisect laminae with segments having predominantly one row of sori between the costae and the margin of the segment. However, *S. demissum* differs from *S. catharinae* by having larger ((2.1−)2.6−3.7(−7.9) × (0.4−)0.9−1.2(−1.9) vs. 4−9 × 2−3 mm), lanceolate, concolorous rhizome scales with insertion radially folding, apex long-acuminate, caudate, scattered pale marginal projections 1−2 mm long, specially at the base (vs. subulate, bicolorous rhizome scales, with dentate margin), petioles proximally sinuate (vs. straight), inconspicuous veinlets (vs. conspicuous veinlets) and spore ornamentation lacking folded

perine (vs. spore ornamentation with folded perine). From *S. vacillans*, *S. demissum* differs by the superficially rupicolous rhizomes (vs. subterranean), lanceolate rhizome scales (vs. deltate to ovate-lanceolate), laminae glabrous or with sparse hairs 3–18 cells long (vs. dense laminar pubescence with hairs 2–3 cells long), scales distributed mainly in the axils of the segments (vs. scarce scales, if any) and spore ornamentation lacking folded perine (vs. spore ornamentation with folded perine).

Taxonomic and nomenclatural notes. Hensen (1990) presented the name *Goniophlebium demissum* Fée, as a new synonym for *Polypodium catharinae = Serpocaulon catharinae.* Evidence presented by Sanín and Salino (2020), support the recognition of this taxa and presented a new combination and its respective lectotypyfication.

Conservation assessment. Following its distribution, scare specimens in the herbaria and in the field, it was considered as eligible for IUCN listing as Endangered (EN) (Sanín & Salino, 2020).

Representative specimens. BRAZIL. **Bahia**: Rio de Contas, Pico das Almas, vertente leste, vale acima da Fazenda Silvina, 1450–1500 m, 29 Nov. 1988, *R.M. Harley & B.L. Stannard 26677* (K); Rio de Contas, Pico das Almas, 25 km da cidade em direção ao Campo do Queiroz, 1850 m, 13º33’ S, 41º57’ W, 26 Feb. 2006, *F.B. Matos et al. 1049* (RB). **Espírito Santo**: Castelo, Parque Estadual do Forno Grande, Trilha para o Forninho, 1100 m, 20º30’58” S, 41º5’1” W, 12 Feb. 2008, *P.H. Labiak et al. 4566* (RB); Castelo, Parque Estadual do Forno Grande, 1300 m, 20º30’58” S, 41º5’20” W, 26 Jun. 2008, *A. Salino et al. 13607* (BHCB); Pancas, Pedra da Colina, 745 m, 19º13’52” S, 40º52’36” W, 11 Mar. 2016, *L.F.A. de Paula 894* (RB); Santa Maria do Jetibá, Garrafão, Pedra do Garrafão, 1081 m, 20º10’24” S, 40º55’6” W, 28 Aug. 2009, *A. Salino et al. 14539* (BHCB); Santa Maria do Jetibá, Pedra do Garrafão, depois da cultura do morango, 20º10’24” S, 40º55’6” W, 1079 m, 22 September 2018, *D. Sanín et al. 7229* (BHCB, CESJ, F, HUA); Santa Teresa, Pedra da Onça, 1 Feb. 2000, *V. Demuner et al. 688* (BHCB). **Minas Gerais**: Dores de Guanhães, Serra do Caraça, 700 m, 19º4’14” S, 42º52’23” W, 15 Aug. 2005, *T.E. Almeida et al. 82* (BHCB); near summit of Serra da Piedade, ca 35 km E of Belo Horizonte, near BR–31, 1800–2000 m,

13 Jan. 1971, *H.S. Irwin et al., 30255* (NY); Teófilo Otoni, afloramento rochoso lado esquerdo da MG 418, cerca de 30 km norte Teófilo Otoni, em ilha de vegetação de afloramento granítico, 560 m, 17º51'22" S, 41º15'39" W, 27 Jan. 2014, *L.F.A. de Paula et al. 686* (BHCB); Teófilo Otoni, afloramento rochoso lado esquerdo da MG 418, cerca de 30 km norte Teófilo Otoni, em ilha de vegetação de afloramento granítico, 560 m, 17º51'22" S, 41º15'39" W, 16 Apr. 2011, *L.F.A. de Paula et al. 334* (BHCB); Teófilo Otoni Afloramento rochoso lado esquerdo da MG 418, cerca de 30 km norte de Teófilo, 560 m, 17º51'22" S, 41º15'39" W, 16 Apr. 2011, *L.F.A. de Paula et al. 336* (RB). **Rio de Janeiro**: Niterói, Parque Estadual da Serra da Tiririca, Pedra de Itacoatiara, 3 Dec. 1994, *M.G. Santos & F.C. Pinheiro 62* (RB); Niterói, Parque Estadual da Serra da Tiririca, Pedra de Itacoatiara, 20 Mar. 1994, *M.G. Santos & F.C. Pinheiro 51* (RB); Niterói, Morro do Tucum, Itacoatiara, 07 Jul. 2012, *L.P. Mauad 306* (BHCB, RB).

12. Serpocaulon dissimile (L.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium dissimile* L., Syst. Nat. Ed. 10: 1325. 1759. *Goniophlebium dissimile* (L.) J. Sm., J. Bot. (Hooker) 4: 57. 1841. TYPE: Jamaica. *Anonymous s.n.* (lectotype designated by Proctor (1985: 530): LINN [bc] LINN-1251.24 image!). Figures 18b, 23f, 47, 48, 49f.

Polypodium retrofractum Desv., Mém. Soc. Linn. Paris 6(2): 237. 1827. *Goniophlebium retrofractum* (Desv.) Moore, Index Fil. 396 1862. TYPE: Peru. Habitat in America "Calidiori", *Anonymous. s.n.* (lectotype designated by Lellinger (1989): P [bc] 00624580 image!).

Polypodium chnoodes Spreng., Neues Entdeck. Pflanzenk. 3: 6. 1822. *Marginaria chnoodes* (Spreng.) C. Presl, Tent. Pterid.189. 1836. *Goniophlebium chnoodes* (Spreng.) Fée, Mém. Foug. 5: 255. 1852. TYPE: Martinique. *Kohaut (Sieber Exs.) s.n.* (LZ destroyed following Lellinger (1989: 270), and Hensen (1990: 295)).

Polypodium loriceum var. *umbricatum* Christ, Bull. Herb. Boissier, sér. 2. sér. 2, 5(1): 5. 1905. TYPE: Costa Rica. 1904, *C. Wercklé s.n*. (**lectotype here designated**: P [bc] 00624582 image!). N**ew syn.**

Polypodium chnoodes var. *minus* Christ, Bulletin de l' Herbier Boissier, sér. 2, 6(1): 49. 1906. TYPE: Costa Rica. Navarro, 1903, *C. Wercklé s.n.* (lectotype designated by Lellinger (1989: 270): P [bc] 00624708 image!).

Plants epiphytic, terrestrial or rupicolous. *Rhizomes* 5–14 mm diameter, short-creeping, dark brown to reddish, pruinose; phyllopodia distance 0.4–2.5 cm. *Rhizome scales* dense, 4–16 × 1–4 mm, lanceolate to acicular-lanceolate, patent, basifixed, concolorous, dark brown, iridescent, base rounded, generally auriculate, apex long acuminate, patent, dentate margin. *Fronds* 20–146 cm long. *Petioles* 4.5–35 cm long, subterete, light brown to dark brown. *Laminae* 16–111 × 6.3–31 cm, linear-lanceolate, lanceolate to narrowly oblong, truncate and pinnate proximally, reflexed, distally pinnatisect, with the apex gradually tapering in an attenuate segment. *Segments* 7–33 pairs, membranaceous to papyraceous, proximal generally auriculate, often overlapping the rachis, medial and apical adnate and pinnatisect, apical segment usually conform. *Medial segments* 3.5–15 × 0.8–3.2 cm, base decurrent to adnate, and apex acute to rounded, venation forming 11–35 rows along and 1–5 rows of areoles between the costae and the margin, inconspicuous. *Laminar induments* pinnae scales absents. *Hairs* dense, catenate, patent, hyaline, brown, over the laminae 12–15 cells, generally with dark brown septae, and over the rachis 4–8 cells long, with hyaline septae. *Sori* from the medial pinnae in 10–35 rows along and 1–4 rows between the costa and the margin. *Spores* 63–72 × 34–43 µm, ellipsoidal, plane-convex, with folded perinae.

Etymology. From the Latin: *dissimilis*, meaning different.

Distribution and habitat. Serpocaulon dissimile occurs from the south of Mexico to Ecuador and the Antilles, mainly as epiphyte in disturbed forest of lowlands, from 5 to 1950 m in humid forest.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon dissimile most resembles *S. lasiopus*, that also possesses laminae dense pubescent, short-creeping rhizomes, and rhizome scales with long acuminate and

patent apex. However, differs from *S. lasiopus* by its rhizome scales concolorous, dark brown and iridescent (vs. bicolorous, dark brown to the center and light brown to the margin), and by the number of areolae between the costa and the margin (1–5 rows vs. 1 row).

Taxonomic and nomenclatural notes. Proctor (1985) pointed out that the type of the name *Polypodium dissimile* L. was the sheet *P. Browne s.n.* (LINN-1251.24). However, after studying the images corresponding to the provided barcode for Proctor, it was possible to realize that the collector is anonymous. This is amended here.

Lellinger (1989), Hensen (1990), and Smith et al. (2006) suggested that the type of *Polypodium retrofractum* Desv., was hosted at P, however, no sheet was designated as type. In this respect, Hensen (1990) suggested that the collector was not stated.

The type of the name *Polypodium loriceum* var. *umbricatum* Christ was traced as a part of the synonymy of *S. dissimile*, lectotype and the present designation are provided as recommended Turland et al. (2018, Art. 9.17).

Hensen (1990) mentioned the possibility of finding hybrids in Guadeloupe between *S. dissimile* and *S. sessilifolium*. By his part, Chaves et al. (2015) published *S. ×rojasianum* as a new hybrid involving *S. dissimile* and *S. triseriale* from Costa Rica.

Despite Hensen (1990) and Smith et al. (2006) suggested *Goniophlebium elatum* Fée as a synonym of *S. dissimile*, it was verified that the type *J.J. Linden 1890* (BR-0000008261106) corresponds to *Polypodium sororium* Humb. & Bompl. ex Willd. In this order of ideas, it is excluded from *Serpocaulon* and the lectotype is designated.

Indigenous name. Kalahuala in Guatemala (*L.O. Williams et al. 40250,* F).

Traditional uses. The rhizome is used for headaches in Guatemala, putting on the forehead (*L.O. Williams et al. 40250*, F).

Chromosome number. n: 37 (Walker, 1985).

Representative specimens. COLOMBIA. **Antioquia:** Cocorná, vereda La Piñuela, vía San Francisco, 700–900 m, 14 Dec. 1991, *D. Giraldo-Cañas 749* (HUA); Frontino, Parque

Nacional Natural Las Orquídeas, vereda Venados Abajo, sector de Venados, sitio Arenales, 950–1000 m, 6º32'25" N, 76º18'38" W, 26 Jul. 2011, *D. Sanín 5068* (COL, NY); Parque Nacional Natural Las Orquídeas, vereda Venados Abajo, finca de Gabriel Montoya, margen derecha del río Venados, 860–910 m, 6º32'23" N, 76º19'9" W, 23 Jul. 2011, *D. Sanín 5162* (COL, NY); Porcesito: valle del río Medellín, 1100 m, 16 Apr. 1946, *H. Hodge 6779* (COL, MEDEL). **Boyacá:** valle del río Cusiana, carretera Sogamoso-Pajarito, Cordillera Oriental, vertiente oriental, 1100 m, 20 Oct. 1967, *R. Jaramillo-Mejía 3915* (COL). **Caldas:** Samaná, delante del puente La Linda, río Samaná, 1100 m, 19 Aug. 1974, *Acosta-Arteaga 768* (COL); Chinchiná, vereda La Esmeralda, bosques del embalse San Francisco, en la vía a los tubos, por el campo de entrenamiento militar, 900 m, 5º3' N, 75º44' W, 30 Apr. 2012, *D. Sanín 5656* (HUA). **Cauca:** El Tambo, Reserva Natural Tambito, 1600 m, 2º27'29" N, 76º48'31" W, 18 Apr. 2006, *Muñoz 1900* (CAUP, PSO); Santa Rosa, Serranía de los Churumbelos, Bota Caucana 1100 m, 4 Aug. 1998, *González 501* (COL). **Chocó**: San José del Palmar, vereda Damasco, escuela Santa Lucia, 641 m, 21 May. 2009, *D. Sanín 2879, 2901, 2957* (HUA, FAUC); Río San Juan, margen derecha: quebrada del Taparal, 5–20 m, 30 May. 1846, *J. Cuatrecasas 21498* (F). **Cundinamarca:** Sasaima, vereda Las Mercedes, granja Wisaca, 1620 m, 31 Oct. 1983, *Mejía 63, 64* (COL); carretera arriba de Sasaima, hacienda La Isabela, *R. Jaramillo-Mejía 4791* (COL); Ubalá, inspección de policía Manbita, campamento EMGESA, 880 m, 4º10'10" N, 73º19'26" W, 26 Jul. 1998, *J.L. Fernández-Alonso 15965* (COL). **Huila:** Acevedo, vía a San Adolfo, vereda San Marcos, 1200 m, 4 May 1983, *Osorio 159* (COL); Colombia, inspección Las Lajas, sitio Cara de Perro, 1400 m, 29 Sep. 1990, *F. Llanos 1846* (COL); Pitalito, vereda Mortiñal, 1400 m, 11 Sep. 1982, *Osorio 43* (COL). **Magdalena:** Sierra Nevada de Santa Marta, cuenca del río Buritaca, quebrada Honduras, 450 m, 25 Jun. 1991, *H. Dueñas 391* (COL). **Meta:** al W de Villavicencio, 700–800 m, 15 Oct. 1972, *O. Hagemann 1205* (COL). **Nariño:** Ricaurte, a un lado del río Imbi, a 2–3 km del campamento de Ecopetrol, 1150 m, 16 Mar. 1990, *T. Croat 71494* (PSO). **Quindío:** Salento, vereda Boquía, sector La Pata Sola, flanco sur oriental del río Boquía, 1950 m, 20 Jul. 2009, *D. Sanín 3086* (FAUC). **Valle del Cauca**: río Reposo, La Alegre, 18 Sep. 1967, *O. Hagemann 481* (COL).

COSTA RICA. **Cartago:** near Turrialba, slope of the río Reventazón behind the Instituto Interamericano de Ciencias Agrícolas, 600 m, 20 Aug. 1967, *J.T. Mickel 3365* (LP); El

Guarco, Cordillera de Talamanca, Estación Biológica Tropical Río Macho y alrededores Orosi, 1150–1730 m, 9º46'00" N, 83º52'00" W, 25 Nov. 1993, *A. Rojas 632* (INB). **Guanacaste:** 8 km from Tilarán on first road leaving the W side of the town, oxcart trail into banana plantation, 500 m, 26 Jul. 1967, *J.T. Mickel 2897* (LP). **Heredia:** Pto. Viejo, Finca La Selva, 125 m, 18 Jul. 1967, *E.R. de la Sota 5272* (LP); Sarapiqui, La Selva Biological Station, 50–150 m, 10º26' N, 84º1' W, 6 Jun. 2002, *M. Jones & P. Olivas 478* (QCA). **Limón:** Cantón Limón, R.B. Hitoy Cerere, cuenca del Estrella, sendero a la Cascada, orillas del río Cerere, 100–200 m, 9º39'35" N, 83º2'25" W, 12 May. 1998, *A. Rojas et al. 4540* (INB). **Puntarenas:** Monte Verde, 1430 m, 29 Jun. 1989, *J.R. Kirsch 46* (F); vicinity of biological field station at Finca Wilson, 5 km S of San Vito de Java, 1100–1200 m, 2 Aug. 1967, *J.T. Mickel 3142* (LP); P.N. Isla del Coco, Isla del Coco, 200–300 m, 5º31'55" N, 87º3'28" W, 31 Jul. 2001, *J. Trusty 136* (INB). **San José:** El General, 880 m, Dec. 1935, *A.F. Skutch 2151* (F); La Palma, NE of San Jeronimo, above the La Hondura valley, 1500 m, 10º2' N, 84º0' W, 27 May. 1968, *W.C. Burger & R.G. Stolze 5334* (F).

CUBA. Alrededores de la Patada, 26 Sep. 1857, *J. Linden* s.n. (BR), **Santiago de Cuba**: 1844, *J. Linden 2157* (BR).

DOMINICAN REPUBLIC. **San José de las Matas:** Santiago, Jucomé, 6–700 m, 27 Dec. 1929, *E.J. Valeur 323* (F).

ECUADOR. **Carchi:** surroundings of the village of Chical, 1250–1300 m, 1º4' N, 78º11' W, 1 Feb. 1985, *B. Øllgaard 57213* (QCA); trail from Rafael Quindí's Finca back toward Untal to stream, aprox. 0.5 km from finca, 1770 m, 0º53' N, 78º9' W, 25 Nov. 1987, *W.S. Hoover & S. Wormley 1575* (QCA, MO). **Napo:** new road between Loreto and Pangayacu, río Catapino, 1130 m, 6 Oct. 1989, *E. Zogg & H. Gassner 13159* (QCA). **Pichincha**: Sto. Domingo de los Colorados, 900 m, 0º15' S, 79º10' W, *X. Cornejo & S. Leagaard 2035* (GUAY, QCA!). **Quito:** Alluviquia y Lelia, 26 1881, *P.L. Sodiro 8.75* (SI). **Zamora-Chinchipe:** Parque Nacional Podocarpus, at Río Bombuscaro, 6 km SW of Zamora, 1100–1200 m, 4º7' S, 78º58' W, 26 Nov. 1994, *B. Øllgaard & H. Navarrete 105827* (QCA).

GUATEMALA. **Alta Verapaz:** 350 m, Jun. 1904, *H. von Türckheim 4049* (BR); Between Cobán city and Cobán airport, 1320 m, 28 Jun. 1969, *L.O. Williams et al. 40250* (F).

HAITI. **Petit Borgne:** to Mt. Casse, 609 m, 16 Aug. 1903, *G.V. Nash 492* (F).

HONDURAS. **Morazán:** Mt. Uyuca, 1600 m, 7 Aug. 1846, *L.O. Williams & A. Molina 10257* (F).

JAMAICA. **Cooks Bottom:** N of Ipswich, St. Elizabeth, 400–500 m, 31 Mar. 1920, *W.R. Maxon & E.P. Killip 1455* (F). **Crofts Mountain:** 800 m, 4 Dec. 1968, *G.R. Proctor 29245* (F). **St. Ann Parish:** Douglas Castle district ca 2 mi. NW of Mason River Savanna, 6 Jan. 1967, *A.M. Evans 2351* (LP). **Ewarton**: Upper slopes of Mount Diabolo, 500–800 m, 25 Feb. 1920, *W.R. Maxon & E.P. Killip 457* (F).

MARTINIQUE. **Morne-Rouge:** 1884, *J.M. Warlet 261* (BR); 1868, *T. Husnot 382* (F).

MEXICO. **Chiapas:** Ocosingo, adjacent to Laguna Ocotal Grande, 800 m, 6 Feb. 1973, *D.E. Breedlove 32906* (F).

PANAMA. **Chiriquí:** camino hacia Soledad, S.O. del campamento Fortuna (sitio de presa), hasta finca Pitti, 1100 m, 8 Jun. 1976, *M.D. Correa et al. 2096* (F).

PUERTO RICO. **Rio de Maricao:** 600–720 m, 14 Feb. 1915, *N.L. Britton & J.F. Cowell 4202* (F). 1899, *A.A. Heller 881* (F).

13. Serpocaulon eleutherophlebium (Fée) A.R. Sm., Taxon 55(4): 928. 2006. *Goniophlebium eleutherophlebium* Fée, Mém. Foug. 5: 255. 1850–1852. *Polypodium eleutherophlebium* (Fée) Mett., Farngatt. 1: 75. 1857. TYPE: Venezuela. Galipan, hautes Andes de Truxillo et de Mérida, 2500 m, *N. Funck & L.J. Schlim 1102* (first step lectotype: P, designated by Hensen (1990: 296); **second step lectotype**: P [bc] 00624577 image! here designated; isolectotypes: P [bc] 00624575 image!, P [bc] 00624576 image!, UC [bc] 477912 image!). Figures 4c, 5b, 19b, 23b, 50, 51, 62a.

Polypodium vagans Mett. Ann. Sci. Nat. (Paris) 5(2): 255. 1864. TYPE: Colombia. Nouvelle Grenade. Bogotá, province de Bogotá, 1851–1857, *A. Lindig 6* (**lectotype designated here**: P [bc] 00633218 image!; isolectotypes: B [bc] 200142589-1 image!).

Goniophlebium chondrocheilon Fée, Mém. Foug. 8: 92. 1857. TYPE: Nouvelle-Grenade [Colombia]. dans les Paramos, ou déserts des montagnes, province de Río de la Hacha, à 2600 m, *L.J. Schlim 1007* (lectotype designated by Windisch (1982: 58): RB [bc] 00700435!).

Polypodium mindense Sodiro, Crypt. Vasc. Quit. 348. 1893. TYPE: Ecuador. "bosques occidentales del monte Pichincha en el valle del Mindo cerca de Frutillas", Aug. 1889, *A. Sodiro 48/75* (**lectotype here designated**: Q [bc] 0000390!).

Plants epiphytic, terrestrial or rarely rupicolous. *Rhizomes* 1.3–4 mm diameter, long-creeping, light brown to dark, pruinose; phyllopodia distance 1–5.5 cm. *Rhizome scales* dense, mainly at the apex and phyllopodia, 3.5–7.1 × 0.5–1.7 mm, ovate-lanceolate to slightly subulate, patent, peltate, concolorous, dark brown to reddish, base rounded, acicular and patent apex, ciliate margin. *Fronds* 8–42 cm long. *Petioles* 3.4–25 cm long, proximally subterete, distally slightly sulcate, light brown to reddish or greenish. *Laminae* 4.8–38 × 3.5–13 cm, lanceolate, pinnatisect, truncate proximally and reflexed, and apex gradually tapering to a caudate attenuated segment. *Segments* 16–42 pairs, chartaceous to coriaceous, proximal surcurrent and reflexed, medial and distally decurrent. *Medial segments* 1.9–7 × 0.4–0.9 cm, base decurrent and apex acuminate, acute to rounded, generally with hydathodes in the adaxial surface, venation generally areolate, forming 6–21 rows along and 1 rows of areoles between the costae and the margin, sometimes free, especially to the margin and segments apices, notoriously impressed. *Laminar induments* segments scales scarce and dispersed, mainly in the base of the segments, 0.6–3.3 × 0.1–0.7 mm, lanceolate to linear, 4–6 cells wide, appressed, subpeltate, concave, concolorous, dark brown, base rounded and apex acuminate, marginal cells disposed horizontally and the centrals vertically, the margins dentate to ciliate. *Hairs* scares, catenate, dark brown, over the margin of the segments 3–4 cells, acute, and over the rachis 5–7 cells long, capitate. *Sori* from the medial segments in 4–19 rows along and 1 row between the costa and the margin. *Spores* 66−80 × 32−40 µm, ellipsoidal to subelipsoidal, concave-convex, and depressed regular verrucae.

Etymology. From the Greek words, *eleutheros*: free, and *phlebion*: dim, probably by the conspicuous dark venation.

Distribution and habitat. Serpocaulon eleutherophlebium occurs from Costa Rica to Ecuador and Venezuela, in high Montane forest and subparamo, from 2430 to 3950 m. It was recorded fertile all months of the year.

Notes. Serpocaulon eleutherophlebium most resembles *S. concolorum, S. crystalloneurum*, *S. nanegalense* and *S. subandinum*, which also have long-creeping rhizomes with patent scales and pinnatisect laminae. In addition, those species also can be found in the same habitat. However, differs from *S. concolorum* by its smaller rhizome scales (3.5–7.2 × 0.5–1.7 mm vs. 5.2–8.5 × 1.6–2.3 mm), smaller petiole (3.4–24 cm vs. 25–28 cm), less number of rows of areolae along the medial segment (6–21 vs. 19–28 rows), and conspicuous subsidiary veinlets of the sori (vs. inconspicuous). From *S. crystalloneurum* differs by its glabrous laminae with few axilar scales (vs. pubescent laminae with small hairs), and the subulate to lanceolate rhizome scales with long attenuate apex (vs. ovate to ovate-lanceolate rhizome scales with acute apex). From *S. nanegalense* can be distinguished by its smaller laminae (4.8–38 × 3.5–13 cm vs. (11–)25–66 × 12–26 cm), patent rhizome scales (vs. appressed) and scarce laminar scales (vs. abundant). Finally, form *S. subandinum* can be distinguished by its glabrous laminae or with scarce and dispersed hairs and scales (vs. dense pubescence), bigger rhizome scales (3.5–7.1 mm vs. 1.1–4.4 mm), ovate-lanceolate to slightly subulate (vs. triangular to lanceolate), the base rounded, and the apex acicular, patent and usually reflexed (vs. base and apex acute, slightly patent), concolorous, dark brown to reddish (vs. bicolorous, dark brown at the center and yellowish at the margin), and ciliate margin (vs. erose).

From the species with pinnatisect laminae and long-creeping rhizomes as *S. dasypleuron, S. funckii, S. loriceum*, and *S. ptilorhizon*, differs by its patent, subulate to lanceolate rhizome scales with patent apex (vs. appressed, rounded to ovate rhizome scales with rounded and appressed apex).

Serpocaulon eleutherophlebium is highly variable in the lamina size, number of segments and shape of the apex of the segment (rounded, acute to acuminate). This species hybridizes with other species that could be found in the same habitat (e.g. *S. concolorum*, *S. nanegalense* and *S. subandinum*). In Costa Rica there is a hybrid between this species and *S. lasiopus* (*K. Barringer et al. 3238a, 3267*, F; *C.A. Brawn 17361a*, F), characterized by the intermediary morphology as the presence of pubescence, a coriaceous lamina, short-creeping rhizomes and caudate apex of the rhizome scales.

Specimens from the Oriental Cordillera of Colombia exhibit rhizome scales wide ovate with decurrent apex, wide segments and rounded apex (*M. Murillo 788*, COL). Ramírez-Valencia and Sanín (2016) found that this species possesses the third biggest spore size of all *Serpocaulon*'s species, suggesting that this character is linked with the high montane forest and subparamo distribution.

Taxonomic and nomenclatural notes. Hensen (1990) suggested that the lectotype *Funck & Schlim 1102* that support the name *Goniophlebium eleutherophlebium* Fée was hosted at P. This sheet was traced, as well as other two specimens from the same herbaria. In this way, the specimen pointed here is designated as lectotype, following recommendations of Turland et al. (2018, Art. 9.17).

Mettenius (1864) designated the sheets: *A. Lindig 6* and *J.J. Triana s.n.*, as syntypes of the name *Polypodium vagans* Mett. Nevertheless, the author mixed two specimens representing the species *S. eleutherophlebium* and *S. subandinum*, respectively. Later, Hensen (1990) also omitted the presence of slender rhizomes with scarce appressed scales with patent apex, and hairs on the lamina and rachis, characters that allow recognition of *S. subandinum*. In this respect, when a type contains parts belonging to more than one taxon, the name must remain attached to the part that corresponds most nearly with the original description or diagnosis (Art. 9.11, Turland et al., 2018), which in this case is *S. eleutherophlebium*, deriving in the presented designation.

The name *Goniophlebium chondrocheilon* Fée is supported by the type *L.J. Schlim 1007* that following Hensen (1990) is based at P (?). This sheet was not traced in Paris, but in Rio de Janeiro (RB). Windisch (1982) inadvertently designated this lectotype.

The name *Polypodium mindense* Sodiro, was cited as synonym of *P. eleutherophlebium* by Hensen (1990), as well as by Smith et al. (2006). However, the first author doubed (?) at pointing the herbarium Q and did not designate any type for that collection. In this sense, the lectotype is here designated after revising the herbarium Q.

Polypodium wiesbaueri Sodiro, a name widely used in the literature (Lellinger, 1989; Hensen, 1990; Moran, 1990; Smith et al., 2006), as a synonym of *S. eleutherophlebium* is here presented as *nomina dubia* because no type was traced.

Representative specimens. COLOMBIA. **Antioquia:** Belmira, alrededores de la ciénaga El Morro, 3290 m, 6º41' N, 75º40' N, 28 May. 2002, *W.D. Rodríguez 3339* (COL, HUA); San José de la Montaña, vereda La Margarita, sector La Margarita, camino Alto El Cristo, 3110 m, 23 Jul. 2002, *W.D. Rodríguez 3529* (JAUM); Urrao, páramo de Frontino, 3540 m, 6º30' N, 76º7' W, 6 Sep. 2000, *J. Pérez-Zabala 1499* (MEDEL). **Caldas:** Salamina, corregimiento de San Félix, localidad El Recreo, bosques a la izquierda de la vía a Marulanda, 3083 m, 2 Feb. 2011, *D. Sanín 4350* (HUA); Villamaría, vía hostería Kumanday, bajando a Termales del Ruíz, 3580 m, 30 Aug. 2005, *D. Sanín 1308* (FAUC); carretera entre Manizales y el hotel Termales del Ruíz, 3000–3500 m, 8 Jun. 1966, *E. Forero 516* (COL). **Cauca:** Las Flautas, carretera, Toéz-Tacueyó, km 45–46, 3180 m, 10 Sep. 1980, *J.O. Rangel-Ch. 2493* (COL); Macizo Colombiano, valle de Las Papas, alrededores de Valencia, Los Andes, 3150 m, 1 Oct. 1950, *A.S. Barclay 5877* (COL); Puracé, trayecto entre el Crucero y el Km 28, vía a la laguna de San Rafael, 3000 m, 25 Jan 2000, *B.R. Ramírez-P. 12608* (CAUP). **Cundinamarca:** Bogotá, región de Monserrate, El Granizo, 3000 m, 15 Feb. 1980, *Zuluaga 84* (COL); Carmen de Carupa, camino a la peña de Sumangá, 3200 m, 1 Jul. 1947, *C.E. Acosta-Arteaga 558* (COL); Fómeque, km 10, carretera hacia Chingaza, 3000 m, 10 Jun. 1974, *C.E. Acosta-Arteaga 463* (COL); embalse del Neusa, entre los municipios de Tausa y Cogua, sin dat., 1 Jan. 1989, *Carrizosa 126* (FMB); Above Tausa (ca 22 km northeast of Zipaquirá), 2975 m, 25 Oct. 1961, *R.M. Tryon 6169* (COL). **Huila:** Entre Huila-Cauca, Macizo Colombiano, páramo de las Papas, cerros y alrededores de las Laguna del Magdalena y Santiago, 3530–3630 m, 5 Nov. 1958, *J.M. Idrobo 3382* (COL). **Nariño:** Pasto, serranía del Morasurco, Tacines, 3400–3500 m, 7 Dec. 1989, *B.R. Ramírez-P. 2002* (PSO); El Tábano, al E de Pasto, 3200 m, 29 Oct. 1972, *O. Hagemann 1367* (COL); San Francisco, entre San Francisco y Mocoa, 2700–2800 m, 26 Nov. 1967, *L.E. Mora-Osejo 4382* (COL). **Norte de Santander**: Cordillera Oriental, páramo de Tamá, alrededores de La Cueva, 3000–3200 m, 28 Oct. 1941, *J. Cuatrecasas 12680* (COL). **Putumayo:** Santiago, San Antonio de Bellavista, páramo del Bordoncillo, 3150–3250 m, 2º30' N, 76º23' W, 17 Apr. 1993, *B.R. Ramírez-P. 5280* (PSO). **Quindío:** Salento, sector entre Estrella de Agua y La Primavera, 2871–3502 m, 4º39' N, 75º29' W, 5 Jun. 2010, *D. Sanín 4009* (HUQ). **Risaralda:** Santa Rosa de Cabal, camino real entre termales de Santa Rosa y finca Berlín, 2740 m, 1 Jun. 1986, *J. Wolf 965* (COL); Santuario, Parque Nacional Natural Tatamá, Valle de los Frailejones,

3648 m, 20 Jul. 2011, *D. Sanín 4293* (HUA). **Santander:** páramo de Guatavita, lado occidental hacia Onzaga, 3460 m, 27 Nov. 1967, *R. Jaramillo-Mejía 4320* (COL). **Tolima**: Cajamarca, along Quindío highway, between Cajamarca and summit of divide, 3300 m, 27 Mar. 1939, *E.P. Killip 34630* (COL); Ibagué, corregimiento de Juntas, vía escuela El Salto, 3696 m, 4º 37' N, 75º16' W, 23 Jul. 2009, *D. Sanín 3166* (TOLI); Murillo, lugar Casas Viejas, 3140 m, 26 Jul. 2003, *Correa 70* (FAUC).

COSTA RICA. **Cartago:** Cantón de Pérez Zeledón, P.N. Chirripó, Cordillera de Talamanca, Valle Las Morrenas, 3500 m, 9º29'51" N, 83º29'25" W, 27 Jul. 1996, *E. Alfaro et al. 589* (INB!, MO). **Heredia:** Parque Nat. Braulio Carrillo, áreas alrededor de la Estación Barva, 2600 m, 10º17'33" N, 84º7'15" W, 16 May. 1992, *A. Fernández 234* (INB!, MO). **Limón:** Talamanca, P.N. La Amistad, cuenca del Sixaola, Cerro Kimuk, 3400 m, 9º16'15" N, 83º2'5" W, 22 Jul. 2000, *E. Alfaro 3312* (INB) **San José:** Cantón de Dota, Cordillera de Talamanca, camino a Provincia de Dota, entrando por Ojo de Agua, frente al restaurante Chespiritos, 2500–2950 m, 9º37'00" N, 83º49'10" W, 16 Jul. 1996, *A. Rojas & M. Coto 2721* (INB); Empalme along the International Highway between provinces San José and Cartago, 2200–2400 m, 9º43' N, 83º57' W, 9 Aug. 1971, *W.C. Burger & M. Burger 7953* (F). **Puntarenas:** Cantón de Coto Brus, P.I. La Amistad, Cordillera de Talamanca, Valle del Silencio, 2500 m, 9º7'15" N, 82º57'55" W, 14 Apr. 1996, *F. Quesada et al. 1442* (INB!, MO).

ECUADOR. *A. Sodiro 3/906* (SI). Atacazo, *A. Sodiro 7/907* (SI). **Cotopaxi:** km 80 Quevedo-Latacunga, 3100 m, 9 May 1981, *C.P. Dodson & W.P. Clendenin 10683* (Q); Quevedo-Latacunga road, above Pilaló, 3450–3500 m, 0º58' S, 78º56' W, 8 Apr. 1973, *L. Holm-Nielsen et al. 3350* (AAU, F!). **Napo:** Quijas, above Baeza near washout, 28 Jul. 1974, *T. Plowman et al. 3887* (F). **Pichincha:** Chaparro de Sebritana, sec. Oriental de las Hodas "Pedregal" y "Yanurcu", 3400–3500 m, 9 Jul. 1944, *M. Acosta Solis 8362* (F); Valle de Mindo, *A. Sodiro* 8/859 (SI); N. Slope of Vólcan Pichincha, at wáter catchment área Yanacocha, 3300 m, 24 Jan. 1981, *H. Baslev et al. 1757* (LPB); Road Quito-Baeza, 4100 m, 00º19' S, 78º13' W, 8 Jul 2002, *M. Lehnert 167* (LPB).

PANAMA. **Bocas de Toro:** Parque Nacional La Amistad, Cerro Fabrega, 3100 m, 9º5'96" S, 82º52'31" W, 14 Mar. 2003, *B.B. Klitgaard et al. 798* (INB).

VENEZUELA. **Mérida:** Rangel, Quebrada la Mucuchache, SE de la entrada, 3600–3700 m, 26 Jun. 1981, *B. Briceño & G.G. Adamo 294B* (F). **Miranda:** ascent of Pico de Naiguatá, above Los Chorros, 2200–2765 m, 16 Jun. 1945, *J.A. Steyermark 62969* (F).

14. Serpocaulon falcaria (Kunze) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium falcaria* Kunze, Linnaea 18: 316. 1844[1845]. (Feb (-May?) 1845). TYPE: México. Veracruz: Puente Nacional, Cordillera, 1000 m, 1840, *H. Galeotti 6336* (**lectotype here designated**: P [bc] 00624566 image!; isolectotypes: BR [bc] 0000006970345!, BR [bc] 0000006970673!, RB [bc] 216481!); Mexico: n.d., *F.E. Leibold 90b* (isosyntypes: B [bc] 200087742 image!, B [bc] 200091244 image!, P [bc] 00624565 image!). Figures 14c, 17i, 23b, 52, 53, 62b.

Goniophlebium calaguala Fée, Mém. Foug 9: 24. 1857. TYPE: México. Veracruz: Mt. Orizaba, Cordoba, Huatuzco, 1854, *W. Schaffner 184* (lectotype designated by Windisch (1982: 58): RB [bc] 00700426!; isolectotypes: K [bc] 000642116494 image!, K [bc] 000642116 image!).

Goniophlebium invertens Fée, Mém. Foug 9: 25. 1857. TYPE: México. Veracruz: Mt. Orizaba, May. 1856, *W. Schaffner 494* (lectotype designated by Windisch (1982: 58): RB [bc] 00700463!).

Polypodium loriceum fo. *duplisorum* Domin, Rozpr. Kral. Ceske Spolecn. Nauk, Tr. Mat.-Prir. 2: 130. 1929. TYPE: Trinidad. Heights of Aripo, 10 Jan 1922, *W.E. Broadway 9957* (first step lectotype: NY, designated by Lellinger (1977: 727); **second step lectotype**: NY [bc] 3981103 image!; isolectotype: US here designated). **New syn.**

Plants epiphytic or rare terrestrial. *Rhizomes* 2.4−5 mm diameter, long-creeping, green blackish, dark brown to reddish, fairly pruinose to not pruinose; phyllopodia distance 2.5−8 cm. *Rhizome scales* dense, 2.5−5.6 × 1−1.6 mm, narrowly lanceolate, appressed, peltate, bicolorous, light brown, with small pale margin and dark brown to the center, base acute, apex acuminate and patent, especially in the base of phyllopodia and apex, smoot and overlapping margin. *Frons* 31−110 cm long. *Petioles* 9−38 cm long, proximally subterete, distally slightly rounded, light brown to dark brown. *Laminae* 21−70 × 8−26 cm, lanceolate

to ovate-lanceolate, pinnatisect, truncate, reflexed proximally, distally gradually tapering in an attenuate segment. *Segments* 10−37 pairs, chartaceous, proximal surcurrent, medial surcurrent to slightly decurrent and distal decurrent, gradually tapering, slightly undulating margin. *Medial segment* 3−11 × 0.5−1.5 cm, base surcurrent to slightly decurrent and apex acuminate to long acuminate, venation forming 12−28 rows along and 1 rows of areoles between the costae and the margin, notorious. *Laminar induments* segments scales scarce, in the base of the segments, 2.5–3.2 × 0.4–1.3 mm, lanceolate to narrowly lanceolate, 10–16 cells wide, appressed, concave, basifixed, concolorous, dark brown, acute to rounded base and long acuminate apex, the margin dentate. *Hairs* scarce, catenate, hyaline, over the laminae, especially in the abaxial surface, 1−2 cells long, subappressed, 0.1 mm long, and over the sinus of the undulate margin, 2−10 cells long, patent, 0.3 mm long. *Sori* from the medial segment 7−26 rows along and 1 row between the costa and the margin, barely reaching the apices of the segments. *Spores* 40−47 × 32−37 µm, ellipsoidal to sub-ellipsoidal, plane-convex to concave-convex, with irregular depressed verrucae.

Distribution and habitat. Serpocaulon falcaria occurs from the South of Mexico to Panama and the Antilles, in humid montane forests, from 720 to 2700 m.

Phenology. It was recorded fertile all months of the year, except May.

Notes. Serpocaulon falcaria most resembles *S. latipes* and *S. loriceum*, that also possess long-creeping rhizomes and pinnatisect laminae, and as in the case of *S. loriceum* because both can share the same habitat (Central America and the Antilles). However, differs from *S. latipes*, by its surcurrent base of the medial segment (vs. decurrent), the absent of oxidation of the rhizome when fresh (vs. oxidation at cutting) and dark brown rhizomes scales (vs. light brown rhizomes scales). Also, because its northern distribution in Central America and the Antilles (vs. the southern distribution of *S. latipes*, in Ecuador, Peru, but mainly in Brazil). From *S. loriceum*, differs by its scare pubescent laminae, with small hairs (vs. glabrous laminae with scarce scales over the axis of the segments), the slightly undulate margin with patent hyaline hairs 2−4 cells long, 0.3 mm over margin (vs. smooth glabrous margin) and

lanceolate rhizome scales with patent apex and strongly overlapping (vs. disperse rounded, totally appressed and non-overlapping rhizome scales).

Moran (1990) recognized two different species from Mesoamerica, one identified as *Polypodium loriceum* (= *Serpocaulon loriceum*) and the other unidentified. Following his description of the rhizome scales dense with overlapping margins and lanceolate shape, it is possible to link the unknown species as *S. falcaria*.

Taxonomic and nomenclatural notes. Kunze (1844) in his protologue cited two collections '(Herb. Roemer., propr.) Coll. No. 90b. and (Galeotti coll. 6336!)*)', where he pointed with (*) the collection of the French-Belgian botanist. In contradiction of this, Hensen (1990) choose the collection from the German botanist (*Leibold 90b*) -which according to him- was destroyed at LZ. Consequently, Hensen designated as lectotype one duplicate of this series hosted at K, which was not possible to trace. Hensen probably assumed that because the author and the journal where the name was published were Germans, the type collection should also possesses this nationality. Therefore, supported on Kunze's designation of *Galeotti 6336* collection, it is designated as lectotype the sheet from P (P-00624566) which possesses a complete information of the locality and represents a trustable specimen of *S. falcaria*.

Lellinger (1989) commented that the types of the name *Goniophlebium calaguala* Fée are hosted at P or RB, without studying the specimens as he mentioned. The comparison of the type sheets cited here allow the recognition of the original labels in the specimen at RB (RB-00700426), This specimen was designated inadvertently by Windisch (1982). In the same way, Hensen (1990) designated the type *W. Schaffner 494* (P?) for the name *Goniophlebium invertens* Fée, including an interrogation in the P herbarium. After traced this sheet at P, it was not possible to found. However, Windisch (1982) inadvertently designated this lectotype.

Lellinger (1977) designated the sheet *Broadway 9957a* (NY) as lectotype of the name *Polypodium loriceum* fo. *duplisorum* Domin. Because there are several specimens from this series, here is designated by the second step lectotype the specimen mentioned from NY. In addition, he mentioned that this entity should be recognized as a synonym of *P. loriceum* L.

However, after the study of this sheet here is concluded that, indeed, the name represents a synonym, but from *S. falcaria*.

Indigenous name. Calaguala in México (*W. Schaffner 184*, RB).

Representative specimens. COSTA RICA. **Alajuela:** Alajuela, Cordillera Central, Cariblanco, camino a virgen del Socorro y orillas del Río Sarapiquí, 720–870 m, 22 Feb. 1995, *A. Rojas 1692* (INB!, MO); East and Southeast of Monteverde between Alajuela and Puntarenas, 1700 m, 10º18' N, 84º46' W, 17 Mar. 1973, *W.C. Burger & J.L. Gentry 8664* (F). **Cartago:** Cerro de la Muerte, Madre Selva, 24.5 km NW of la Asunción, near km 67 on Interamerican Highway, 2250 m, 11 Aug. 1967, *J.T. Mickel 3332* (LP); about 15 km S of Tapantí along the new road, on the east slope above the Río Grande de Orosi near the concrete bridge, 1500 m, 9º43' N, 83º47' W, 12 Dec. 1969, *W.C. Burger & D.L. Liesner 6858* (F). **Heredia:** Vara Blanca, 17 Aug. 1967, *E. de la Sota 5076* (LP); near Porrosati on Southern slope of Volcán Barba, 2200 m, 29º51' N, 84º7' W, *W.C. Burger & R.G. Stolze 6032* (F). **Limón:** Talamanca, P.N. La Amistad, Cuenca del Sixaola, río Lorí, 1900–2000 m, 0º21'22" N, 83º13'49" W, 18 Feb. 2007, *D. Santamaria et al. 5706* (INB). **Puntarenas:** Coto Brus, P.N. La Amistad, cuenca Térraba-Sierpe, sendero a Cerro Gemelo, 1900 m, 9º2'4" N, 82º57'39" W, 31 Jul. 2000, *L. Acosta & V. Ramírez 2367* (INB). **San José:** Aserrí, Z.P. Cerros de Escazú-La Carpintera, Cerro Cedral, camino a Londres, cabeceras del río Agres, 2300 m, 9º51'41" N, 84º8'37" W, 5 Aug. 1995, *J.F. Morales 4645* (INB); Along Interamerican Hwy ca. 8.5 km E of road to La Cima, 2600 m, 9º40' N, 83º51' W, 30 Jul. 1979, *W.D. Stevens 13376* (F).

CUBA. **Santiago de Cuba:** La Gran Piedra, 1525 m, 4 Mar. 1911, *J.A. Shafer 9013* (F).

DOMINICAN REPUBLIC. **Santo Domingo:** 1200 m, 14 Nov. 1910, *H. von Turckheim 3532* (F).

GUATEMALA. **Alta Verapaz:** 1–8 km NW of Cobán, 1200–1300 m, 4 Jan. 1973, *L.O. Williams et al. 42002* (F). **Baja Verapaz:** Purulha, along highway CA14 between El Progreso and Cobán, 3 mi S of Purulhá, 17 mi N of Junction with Hwy 17 to Salamá and San Jerónimo vic, 1620–1720 m, 15º13' N, 90º12' W, 26 Jan. 1987, *T.B. Croat et al. 63754* (F). **Chimaltenango:** Región of Los Positos, above Las Calderas, 2250–2400 m, 16 Dec. 1940,

P.C. Standley 80164 (F). **Jalapa:** Volcán Jalapa, 1300–2200 m, 1 Dec. 1939, *J. Steyermark 32476* (F). **Quetzaltenango:** along Quebrada San Gerónimo Quetzaltenango, along quebrada San Gerónimo, Finca Pirineos, lower south-facing slope of Volcán Santa María, between Santa María de Jesús and Calahuache, 1300–2000 m, 1 Jan. 1940, *J.A. Steyermark 33414* (F). **San Marcos:** barrancos 6 miles south and west of town of Tajumulco, NW slopes of Volcán Tajumulco, 2300–2800 m, 26 Feb. 1940, *J.A. Steyermark 36673* (F); Volcán Tajumulco, finca El Porvenir, 1500 m, 14º57' N, 91º56' W, 4 Sep. 1999, *J. Morales 536* (F); slopes of barrancos tributary to and bordering río Vega, between San Rafael at northeast portion of Volcán Tacaná and Guatemala-Mexico line, 2500–3000 m, 21 Feb. 1940, *J.A. Steyermark 36304* (F). **Sololá:** Cerro Iquitiu, San Lucas Tolimán, 1700 m, 14º37' N, 91º7' W, 7 Aug. 1999, *J. Morales 410* (F). **Zacapa:** Sierra de las Minas, vicinity of Finca Alejandrina, bordering Quebrada Alejandrina, 2500 m, 13 Oct. 1939, *J.A. Steyermark 29939* (F).

HONDURAS. **Comayagua:** El Achiote, above the plains of Siguatepeque, 1850 m, Jun. 1936, *T.G. Yuncker et al. 6258* (F). **Distrito Central:** Rancho Quemado, 1219 m, 3 Apr. 1970, *W.T. Gillis 9592* (F). **Lempira:** Montana de Celaque, Arriba de la Planta Eléctrica de Gracias, 18 Nov. 1974, *D. Hazlett 2349* (F). **Morazán:** Cerro de Uyuca, La Labranza and vicinity along trail to summit, 1600–1800 m, 2 Jul. 1949, *P.C. Standley 20621* (F). **Ocotepeque:** Mt. Cocal of Cordillera Merendón, 20 km NW. of Ocotepeque, 1800 m, 25 Aug. 1968, *A. Molinar 22115* (F).

JAMAICA. **St. Andrew Parish:** Mt. Horeb trail, Fairly Glade, 1210 m, 24 Jun. 1963, *M.R. Crosby et al. 305* (F). **Portland Parish:** Harward gap area along road bank near 23 mi. post betw., Green Hills and Section, 1097 m, 9 Jan. 1967, *A.M. Evans 2424* (LP). **St. Thomas Parish:** Between Blue Mountain Peak and Portland Gap, 1981 m, 24 Jul. 1963, *M.R. Crosby et al.* 865 (F, SP).

MEXICO. Aug. 1954, *W. Schaffner 184*, (RB). **Chiapas:** 11 Mar. 1945, *E. Matuda 5285* (F); Jitotol, about 12 k N of Jitotol, 2000 m, 28 Oct. 1971, *D.E. Breedlove & R.F. Thorne 21513* (F). **Guerrero:** Puerto Gallo, en la vertiente S. del Cerro Teotepec, municipio de Tlacotepec, 2450 m, 11 Aug. 1964, *Rzedowski 18599* (LP); El Gallo, sobre camino a Atoyac, estribaciones suroccidentales del Cerro Teotepec, 1900 m, 17º25' N, 100º14' W, 26 Jan. 1965, *Rzedowski & McVaugh 28* (LP). **Oaxaca:** Miahuatlán-Pochutla, 155 km S of Oaxaca

on Rte 175.5 km S of Suchixtepec, at Campamento río Molino, 2194 m, 29 Sep. 1970, *J.T. Mickel & S.W. Leonard 5029* (LP). **Veracruz:** Jalapa, Dec. 1894, *C.L. Smith 2113* (F); J. de Ferrer, El Cerro de Villa Rica, cerca de Plan de la Flor, 1250 m, 6 Jul. 1981, *G. Castillo et al. 1709* (F); Gorge at Puente Acaboloya, ca 1km SE of Xico Viejo and 5 km NW of Xico along trail between the two Mn. Xico, 1600 m, 19º27' N, 97º3' W, 31 Mar. 1983, *M. Nee & K. Taylor 26312* (F!, XAL).

MONTSERRAT. 850 m, 26 Jan. 1907, *J.A. Shafer 300* (F).

NICARAGUA. **Jinotega:** near Sta. Lastenia, Cordillera Central de Nicaragua above east of Jinotega, 1400–1600 m, 20 Feb. 1963, *L.O. Williams et al. 24754* (F); Macizos de Peñas Blancas, top and N slope of steep ridge SW of finca of Manuel Estrada, El Cielo, S. of río Gusaneras, 1200–1300 m, 13º15' N, 85º42' W, 16 Jan. 1979, *W.D. Stevens & B.A. Krukoff 11535* (F). **Matagalpá:** Cordillera Central, Sta. María de Ostuma, Disparate de Potter, 1600 m, 15 Jan. 1965, *L.O. Williams et al., 27679* (F).

PANAMA. **Chiriqui:** Bajo Chorro, Boquete, 1828 m, 15 Feb. 1938, *M.E. Davidson 292* (F); Along Boquete trail, Cerro Respinga, East of town of Cerro Punta, 2000–2500 m. 11 Sep. 1972, *A. Gentry 5959* (F).

SALVADOR. **Morazán:** Forest near El Sancudo, 1900 m, 10 Apr. 1979, *R. Seiler 1055* (F). **Santa Ana:** Bosque Montecristo, 2200 m, 1 Oct. 1977, *R. Seiler 123* (F); Volcán de Santa Ana, 1590–2340 m, 19 Feb. 1946, *M.C. Carlson 728* (F).

15. Serpocaulon fraxinifolium (Jacq.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium fraxinifolium* Jacq., Collectanea 3: 187. 1789. *Goniophlebium fraxinifolium* (Jacq.) T. Moore, Index fil. 74, 1857. TYPE: Cultivated plant from Hortus Schönbrunn (Austria/Wien), said to have originated from Venezuela, Caracas, *N.J. von Jacquin s.n.* (lectotype designated by Hensen (1990: 297): W [bc] W-0052621 image!). Figures 5c, 7g-i, 10e, 17j, 23a, 54, 55, 62c.

Polypodium rhizocaulon Willd. Sp. Pl. 5: 196. 1810. *Goniophlebium rhizocaulon* (Willd.) C. Presl, Tent. Pterid. 186. 1836. TYPE: Venezuela. Distr. Federal: Caracas, *W. Bredemeyer s.n.* (lectotype: B [bc] B-W 19690-01 0 image! designated by Lellinger (1989: 271).

Polypodium mutabile Kunze, Linnaea 9(1): 46−47. 1834. TYPE: Peru. Huánuco: Peruvia subandin. In sylva. humida "et Puquis" dicta. Cuchero, Nov. 1829, *E.F. Poeppig s.n.* (lectotype designated by Hensen (1990: 297): W [bc] W-0052622 image!).

Polypodium ornatum Klotzsch, Linnaea 20: 396. 1847. *Goniophlebium ornatum* (Klotzsch) Fée, Mém. Foug., 5. Gen. Filic. 255 (1852). *Polypodium fraxinifolium* subsp. *ornatum* (Klotzsch) Christ, Bull. Herb. Boissier, sér. 26(1): 49. 1906. TYPE: Venezuela. Mérida: Colonia Tovar, *J.W.K. Moritz 351* (lectotype designated by Hensen (1990: 297): B [bc] 200090114 image!; isolectotypes: B [bc] 200090105 image!, K, BM [bc] 000937443 image!).

Polypodium scutulatum Sodiro, Anales Univer. Centr. Ecuador 22(161): 1908. TYPE: Ecuador. Crescit in silv. subsand. vulc. Atacatzo-Cauzacoto, May 1882, *A. Sodiro 8/882* (**lectotype here designated**: P [bc] 00632903 image!; isolectotypes: P [bc] 00632902 image!, P [bc] 00632903 image!).

Plants epiphytic, terrestrial, rupicolous or rarely hemiepiphytes. *Rhizomes* 2.4–7 mm diameter, long-creeping, light brown to greenish, pruinose; phyllopodia distance 0.6–10 cm. *Rhizome scales* disperse to dense, 1–3 × 0.5–2.5 mm, rounded, ovate to elliptic (never long acuminate), appressed, peltate, bicolourous, light brown to the margin and dark brown to the center, base rounded to obtuse, apex obtuse to rounded to rarely acute and appressed, erose and often overlapping margin. *Fronds* 21–111 cm long. *Petioles* 4.2–29 cm long, proximally subterete, distally slightly sulcate, light brown to dark, often stramineous. *Laminae* 17–82 × 9–32 cm, ovate-oblong to ovate-lanceolate, pinnate, truncate proximally and acute apex. *Pinnae* 2–27 pairs, chartaceous to slightly coriaceous, proximal petiolate, base rounded at the basiscopic side and attenuate on the acroscopic, reflexed, medial and apical sessile to slightly adnate, especially at the apical pinna, apical pinna conform, often with a small auricule. *Medial pinnae* 9–32 × 1.5–1.9 cm, base rounded and apex acute to long caudate, venation forming 17–36 rows along and 2–4 rows of areolae between the costae and the margin, notorious. *Laminar induments* pinnae scales scarce, especially in the pinna base, 1.7–2 × 0.2–0.7 mm, lanceolate, 2–4 cells wide, appressed, basifixed with a notorious insertion, generally bicolorous, margin whitish and dark brown at the center, base rounded and apex acute, the margins erose. *Hairs* scarce and dispersed, catenate, 3–21 cells, patent, strigose,

hyaline with dark brown dissections. *Sori* from the medial pinnae in 11–26 rows along and 1–4 rows between the costa and the margin. *Spores* 46–54 × 27–34 μm, ellipsoid to sub-ellipsoid, plane-convex to concave-convex, and irregular depressed verrucae.

Distribution and habitat. Serpocaulon fraxinifolium occurs from Belize and Guatemala to Bolivia, and Andes of Venezuela, from lowlands to premontane forest, from 75 to 3696 m, in humid forest. Despite Smith (1981), Moran (1995), Mickel and Smith (2004) and Smith et al. (2006), cited this species from Chiapas in Mexico, the only specimen examined by Smith (1981) (*Breedlove 32151*, DS, MICH), and cited by the other authors was not traced, deriving in the suspicious distribution that is avoided here.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon fraxinifolium most resembles *S. adnatum* and *S. antioquianum*, *S. appressum* and *S. polystichum* that also possess long-creeping rhizomes with appressed scales, and pinnate laminae. However, differs from *S. adnatum* by its basal pinnae petiolate, the medial and apical sessile, to slightly adnate (vs. adnate 3/4 parts of the laminae, and the medial and apical complete adnate to the laterals). From *S. antioquianum* differs for its rhizome scales brown at the center and light brown to the margin (vs. salmon), the smaller number of areolae along and between the costa and the margin (17–35 × 2–4 vs. 13–52 × 3–8 rows), the narrow and ovate areolae (vs. wide square areolae), and its wide distribution (vs. know only from the Magdalena valley of Colombia). Could be distinguished from *S. appressum* by its glabrous laminae with scarce and dispersed hairs (vs. dense pubescence in the petiole, rachises and laminae). Finally, *S. fraxinifolium* could be differentiated from *S. polystichum* by its rounded and appressed rhizome scales and spores with rounded verrucae (vs. lanceolate rhizome scales with patent apex, and spores with flat apex).

It could be distinguished from *S. articulatum, S. psychotrium*, *S. richardii* and *S. triseriale*, species with long-creeping rhizomes (except *S. triseriale*) and pinnate laminae, by its rounded and appressed rhizome scales (vs. lanceolate, subulate to long acuminate rhizome scales with patent apex).

This taxon presents one of the wider distributions and morphological variation in the genus. The similarity of *S. fraxinifolium* with the species that share the same habitat: *S. adnatum* and *S. polystichum* (except in Brazil where *S. fraxinifolium* does not occur) is something that increases the complexity to identify it. Another situation that was recorded is hybridization, where a hybrid zone in Boyacá, Colombia was found with individuals presents intermediary morphology between *S. fraxinifolium* and *S. subandinum* (*D. Sanín et al. 6888*, BHCB, COL, F, HUA).

Taxonomic and nomenclatural notes. Although Hensen (1990) considered *Polypodium polystichum* (= *S. polystichum*) as a synonym of this species, he realized that specimens from southeastern Brazil and Paraguay have long, pointed rhizome scales (the main characters to identify it) (Figure 7). Here it is verified that *S. polystichum* exhibits verrucae with flat apices and predominantly more verrucae (Figure 17) and it is widely distributed in the Atlantic Rain Forest of Brazil (although it is possible to find this species in the Andes and Central America). Based on these dissimilarities, *S. polystichum* is here is recognized as distinct from *S. fraxinifolium*.

Specimens from Costa Rica have larger laminae, more pinnae with acute apex, and linear-lanceolate shape, as well as not impressed sori (*W.C. Burger & R.G. Stolze 5311*, F; *L.O. Williams et al. 29146*, F). In the same way, specimens from Bolivia recorded a notorious size in rhizome and lamina: *H. Huaya 1425* (LPB), *S.G. Beck 3749* (LPB), *J.C. Solomon et al. 12073* (LPB, MO), *D. Sanín et al. 5537* (HUA). In any case, the considerable variation that could be found in this species, especially recorded in size, shape and numbers of segments, as well as, the size of the laminae, are not consistent to recognize more entities.

Hensen (1990: 297) suggested that the holotype of *Polypodium fraxinifolium* was hosted at W without designated a sheet. A sheet was traced here and indicated for this name. Despite that the specimen did not present rhizome, it represents the species concept of *S. fraxinifolium* and bears Jacquin's handwriting.

The holotype from the name *Polypodium mutabile* Kuntze was pointed as destroyed at LZ by Hensen (1990: 297), deriving on the designation of a lectotype from W. However, the author did not mention a sheet from that herbarium. Here the specimen from W is informing.

Polypodium ornatum Klotzsch was described from the material of *J.W.K. Moritz 351*, from Venezuela. Hensen (1990: 297) designated as holotype a specimen hosted at B without notice that there was a duplicate of this collection and the isotype that the author also designated. This represents the first step lectotype designation. As a second step, it is here designated the lectotype from B [bc] 200090114, because this specimen is complete, fertile and bears the original handwriting of Moritz.

Hensen (1990), mentioned with an interrogation (?) that the holotype of *Polypodium scutulatum* Sodiro, was hosted at Q without mentioning a sheet. After the revision of all herbaria from Quito, it was not possible to find it. In consequence, here is designated as lectotype the specimen *A. Sodiro 8/882* (P-00632903) which is complete and represents the species in question.

Indigenous name. *^sinku^súk* in the Amazon from Peru (*B. Berlin 944*, USM). *Jé yei* remedio tape (Cayapa language) from Ecuador (*L.P. Kvist & E. Asanza 40798,* QCA).

Traditional uses. Cayapa culture used for removing mucus from the nose and throat, boiling the plant and drinking the decoction in Ecuador (*L.P. Kvist & E. Asanza 40798,* QCA).

Chromosome number. n: 37 from *R. Rodriguez s.n.* (F).

Representative specimens. BELIZE. **Toledo**: Bladen Nature Reserve, in the upper elevation of SE Maya Mountains, just south of the Maya Mountain divide, 930 m, 16º31’46” N, 88º56’1” W, 7 Mar. 2012, *S.W. Brewer 6547* (NY).

BOLIVIA. **Cochabamba:** Ayopaya, 50 m del subcampamento, quebrada com água permanente, ladera superior de la Serranía de Mosetenes, 1118 m, 16º2’ S, 66º39’ W, 24 Sep. 2004, *H. Huaya 1425* (LPB). **La Paz:** Nor Yungas, Yolosa, 16.5 km hacia Unduavi, 2450 m, 27 Nov. 1982, *S.G. Beck 3749* (LPB); Nor Yungas, 14.3 km SW (above) Yolosa on road to Chuspipata, 2000 m, 16º14’ S, 67º47’ W, 23 Mar. 1984, *J.C. Solomon et al. 12073* (LPB, MO); Inquisivi, río Jahuira Palca Uma, steep river flowing from Cerro Cachi Carani South-

westerly to the río Aguilani, 1 Km NE of Estancia Aguilani, 1650 m, 16º41’ S, 67º19’ W, 13 Sep. 1991, *M. Lewis 40238* (LPB!, MO).

COLOMBIA. **Antioquia:** Belmira, vereda La Salazar (parte baja), quebrada el Diablo, 2545 m, 6º35’ N, 75º39’ W, 20 May 2002, *W.D. Rodríguez 3454* (COL, HUA); Guatapé, vereda Santa Rita, finca Montepinar, bosque pluvial, 1850 m, 20 Mar. 1990, *N. Contreras 253* (HUA); Medellín, cerca a La Sierra, 2000 m, 26 Dec. 1930, *M. Archer 1099* (COL); San José de la Montaña, vereda El Caribe, sector El Calvario, arriba de la finca de la Fuente, 2980 m, 6º41’ N, 75º7’ W, 25 Jul. 2002, *W.D. Rodríguez 3556* (COL, HUA); Sonsón, Páramo de Sonsón, 2680 m, 6º35’ N, 75º39’ W, 7 Jul. 1987, *A.L. Arbeláez 86* (HUA). **Caldas**: Manizales, ecoparque Los Yarumos, 2150 m, 13 Feb. 2003, *D. Sanín 2695* (FAUC); Pensilvania, atrás de hospital de Pensilvania, 2300 m, 10 Jul. 1982, *L. Albert de Escobar 2073* (HUA); Salamina, corregimiento de San Félix, localidad El Recreo, bosques a la izquierda de la vía a Marulanda, entre el potrero y el bosque, 3070 m, 3 Mar. 2011, *D. Sanín 4382* (CUVC); San José de Risaralda, vereda Chavarquía, 1659 m, 15 Jul. 2007, *D. Sanín 2804* (FAUC); Villamaría, vereda Montaño, finca La Meza, vía Las Minas de California, Tolda Fría, 2680 m, 23 Ago. 2006, *D. Sanín 1955* (FAUC). **Cauca**: Cajibío, Raíces de Vida, 1700 m, 19 Nov. 2005, *Otálora 124* (CAUP); vía Popayán, río Orejas, Reserva El Guayabo, 1500 m, 12 Sep. 1967, *O. Hagemann 354* (CUVC); Santa Rosa, Serranía de los Churumbelos, Bota Caucana, La Piedra, 1100 m, 4 Aug. 1998, *González 557* (COL); El Tambo, Reserva Natural Tambito, 1621 m, 21 Mar. 2000, *O.L. Casañas-Suárez 217* (COL); Cordillera Occidental, vertiente oriental, cuchilla El Tambo, 1750 m, 23 Aug. 1949, *J.M. Idrobo 249* (COL). **Cesar**: Serranía del Perijá, Manaure, El Cinco, finca Vistahermosa, SE de la carretera, 2200 m, 10º26’ N, 72º57’ W, 13 Nov. 1993, *J.O. Rangel-Ch. 11388a* (COL). **Chocó**: El Carmen de Atrato, carretera a Urrao, ca 15 km al NO de la cabecera municipal, 2500 m, 7 Nov. 1985, *G. Galeano 787* (COL); Chocó, at both sides of the principal ridge of the Serranía de Los Paraguas, along the trail from El Cairo to Río Blanco, ca 8 km SW of El Cairo, 2200–2500 m, 28 Mar. 1971, *D.B. Lellinger 826* (COL); emisora La Sirena, 3 km W of La Mansa at top of Cordillera Occidental, 2300–2400 m, 16 Jan.1979, *A. Gentry 24193* (HUA); San José del Palmar, cerro al SO de la población, 1300 m, 25 Feb. 1977, *E. Forero 3408* (COL). **Cundinamarca**: km 60–61 de la carretera Guasca a Gachetá, 2730 m, 22 Jan. 1974, *C. Acosta-Arteaga 104* (COL); La Mesa, Laguna Pedro Pablo, 2000 m, 14 Dec. 1989,

C. Acosta-Arteaga 2253 (COL); sureste de Santandercito, cerros cercanos a El Ermitaño, 2150 m, 14 Aug. 1964, *L. Uribe-Uribe 4914* (COL); Silvania, km 36 de la carretera Sibaté a Fusagasugá cerca de la quebrada Agua Bonita, 2400 m, 2 Mar. 1974, *C. Acosta-Arteaga 145* (COL); Soacha, Salto del Tequendama, 2500 m, 27 Apr. 1959, *H. Bischler 2250* (COL). **Huila**: Algeciras, vereda el Paraíso, sector de Curubito, 2400 m, 9 Aug. 1984, *Mejía-P. 243* (COL); San Agustín, vereda Planares, relicto arriba de la escuela Platanares, estos se enmarcan en potreros que se comunica con otros bosques, 2147–2150 m, 1º59' N, 76º17' W, 28 Jul. 2009, *D. Sanín 3285* (FAUC); Pitalito, vereda Charguayaco, reserva de la comunidad El Arroyuelo, 1925 m, 1º46' N, 76º1' W, 28 Jul. 2009, *D. Sanín 3205* (FAUC); vía Popayán y La Plata, 2000–2300 m, 17 Jul. 1979, *I. Cabrera 5001* (CUVC); La Plata, vereda Agua Bonita, finca Meremberg, en bosque de robles, 1200–1300 m, 12 Jul. 1975, *S. Díaz-Piedrahita 425* (COL). **Magdalena**: Santa Marta, Cleveland in mts of Cincinnati, 2164 m, 4 Aug. 1981, *R. Foster 1379* (COL); Sierra Nevada de Santa Marta, in forest along quebrada N of house in finca Los Arroyitos, 1600–1700 m, 4 Oct. 1972, *J.H. Kirkbride* 2376 (COL); Sierra Nevada de Santa Marta, alto río Buritacá, cuchilla El Mirador, transecto Buritacá, 1800 m, 22 Jul. 1977, *R. Jaramillo-Mejía 5241* (COL); Santa Marta, base del cerro Quemado y cerro San Lorenzo, 2000–2300 m, 2 Apr. 1959, *R. Romero-Catañeda 7846* (COL). **Meta**: Acacías, colonia penal y agrícola de oriente, 1700 m, 6 Aug. 1981, *R. Jaramillo-Mejía 7313* (COL); Serranía de La Macarena, (extremo nordeste), macizo Rengifo, cumbre y alrededores, 1300–1900 m, 6 Jan. 1951, *J.M. Idrobo 1142* (COL). **Nariño**: Ipiales, Km 24, carretera Ipiales-La Victoria, 2960 m, 23 Nov. 1982, *O. de Benavides 3423* (PSO). **Putumayo**: vía Pasto-Mocoa, km 40, 3000 m, 9 Sep. 1972, *D. Barington 526* (PSO); alrededores de Mocoa, filo de Barniz, 1700 m, 8 Oct. 1959, *A. Barclay 9445* (COL); valle del río Sibundoy, camino de la hidráulica, 1 km Sibundoy, 2530 m, 21 Oct. 1962, *Bristol 307* (COL). **Quindío**: Filandia, carretera El Roble-Morro Azul, 2270 m, 3 Sep. 1985, *A.L. Arbeláez-S. 1038* (HUQ); Génova, vereda San Juan Alto, finca La Caucasia; 2500–2780 m, 19 May 1995, *M. Vélez 5027* (HUQ); Calarcá, vereda Planadas, 2900 m, 20 Sep. 1993, *M. Vélez 3429* (HUQ); Salento, vereda Cocora, vía a Estrella de Agua, camino con mosaicos sucesionales de aliso, 2430−3200 m, 4º38' N, 75º29' W, 23 Jul. 2009, *D. Sanín 3108* (FAUC). **Risaralda**: Apía, vereda La Cumbre, 2285 m, 24 Nov. 1983, *Torres 2205* (COL); Pereira, Santuario de Fauna y Flora Otún Quimbaya, senderos al interior del Santuario, 1783 m, 4º46' N, 75º37' W, 20

Apr. 2012, *D. Sanín 5122* (HUA); Santa Rosa de Cabal, reserva Central Hidroeléctrica de Caldas-CHEC, zona amortiguadora del Parque Los Nevados, 2612 m, 4º48' N, 75º31' W, 16 Jul. 2009, *D. Sanín 2499* (HUA); Santuario, vereda Las Colonias, 200 m arriba del campamento, 2740 m, 1 Feb. 1983, *Torres 1390* (COL); Santuario, Parque Nacional Natural Tatamá, descenso Monte Mosquito, 3000–3500 m, 15 Jan. 2011, *D. Sanín 4312* (FAUC). **Santander:** Charalá, vereda Santa Helena, predio La Sierra, margen izquierdo de aguas abajo del río La Rusia, Santuario de Fauna y Flora Guantená, alto río Fonce, 2400−2550 m, 6º1' N, 73º9' W, 13 Nov. 1997, *Cadena-M. 33* (COL); Charta, carretera hacia El Roble, 2750 m, 26 Mar. 1987, *Orozco 1571* (COL); Virolin, 1800 m, 6 May 1986, *J.L. Fernández-Alonso 6245* (COL). **Tolima**: Ibagué, corregimiento de Juntas, vía la escuela El Salto, 3696 m, 4º37' N, 75º45' W, 28 Jul. 2009, *D. Sanín 3176* (FAUC); Murillo, El Tambo, escuela El Tambo, 2220 m, 27 Mar. 2003, *Correa 42* (FAUC); Santa Isabel, vereda Purima, finca El Prado, Cordillera Central, vertiente oriental, 2340 m, 2 Aug. 1980, *J.M. Idrobo 10448* (COL). **Valle del Cauca**: Cali, Parque Nacional Natural Farallones de Cali, vereda Pance, Reserva Amor y Paz, vía a Balcones, Pico Pance, 2500–3000 m, 2 Jun. 2009, *D. Sanín 2705* (HUA); Peñas Blancas, cuenca del Río Pichindé, 1800 m, 5 May. 1978, *Belalcázar 229* (COL); carretera vieja Cali-Buenaventura, Km 91 ca, Sabaleta, 24 Jun. 1976, *E. de la Sota 6311* (COL).

COSTA RICA. **Alajuela:** Hacienda La Marina, río San Rafael, canton de Águas Zarcas, 450−500 m, 8 Feb. 1965, *L.O. Williams et al. 29146* (F); Reserva Forestal de San Ramón, 800−1200 m, 10°12'53" N, 84°36'28" W, 3 Dec. 1986, *G. Herrera et al. 305* (F). **Cartago:** Cantón de Jiménez, Selva Tausito, 1000–1100 m, 9°46'58" N, 83°45'20" W, 19 Jan. 1996, *A. Cascante et al. 939* (F); Volcán Turrialba, 1500 m, Jan. 1899, *H.F. Pittier 7493* (F). **Guanacaste:** Cantón de la Cruz, P.N. Guanacaste, Estación Pitilla, 9 km al S de Santa Cecilia, 700–1000 m, 10°59'26" N, 85°25'40" W, 10 Jul. 1992, *C. Moraga 482* (NY). **Heredia:** near río Pará Blanco, 1600 m, 10°3' N, 84°1' W, 10 Sep. 1972, *R.W. Lent 2857* (F). **Limón:** Talamanca, P.N. La Amistad, Cuenca del Sixaola, Talamanca, Bratsi, ca 1 km NW de Laguna Dabagri, 1046 m, 09.37.22 N, 83.16.38.5 W, 25 Jul. 2007, *A. Rodríguez et al. 11292* (NY). **Puntarenas:** La Pitahaya, Rincón, siguiendo la fila entre río Aranjuez y Quebrada Vueltas, a partir del sendero águas arriba, 1400 m, 10°15'30" N, 84°41'00" W, 30 May. 1996, *G. Herrera et al. 9102* (F). **San Jose:** near summit of La Carpentera, 25 Aug. 1965, cultivated at Berkeley Botanical Garden (57017-S1 accession number), *R. Rodríguez*

s.n. (F); La Palma area, northeast of San Jeronimo, above the La Hondura Valley, 1500 m, 10°2' N, 84°00' W, 27 May 1968, *W.C. Burger & R.G. Stolze 5311* (F).

ECUADOR. **Charchi:** Around encampment in Gualpi Chico, área Awá Reservation, NW and SE, 1330 m, 0'58' N, 78°16' W, 22 Jan. 1988, *W.S. Hoover et al. 3708* (QCA! MO). **Pichincha:** *A. Sodiro 2/907* (QLPS); Reserva Florística Ecológica Río Guajalito, via Quito-Sto. Domingo de los Colorados, a 3 ½ Km NE de la carretera, Estribaciones del Volcán Pichincha, 1800–2200 m, 0º13'53" S, 78º48'10" W, 10 Aug. 1985, *J. Jaramillo & V. Zak 7975* (QCA); **Esmeraldas:** Río Cayapa, Zapallo Grande, in front of the village a trail was followed into the forest, 100 m, 00º48' S, 78º55' W, 1 Aug. 1982, *L.P. Kvist & E. Asanza 40798* (AAU, QCA!). **Sucumbíos:** Río Bermejo to Cerro Sur Pax: Cofan community of Alto Bermejo, Access from Bermejo old field road to Pazo 2, NW between Lumbaqui and Cascales, Vicinity of Oso Ridge Camp. 1700–1920 m, 00°19'17" N, 77°25'10" W, 2 Aug. 2001, *R. Aguinda et al. 1247* (F). **Tunguragua:** Road Baños-Mera, 35 km from Baños, along río Cashuarco, 1450–1550 m, 1º25' S, 78º10' W, 4 Sep. 1976, *B. Øllgaard & H. Baslev 9283* (AAU, QCA!). **Zamora-Chinchipe:** Road Sabanilla-Zamora, 1300 m, 5 Feb. 1989, *B. Øllgaard 90407* (QCA).

GUATEMALA. **Alta Verapaz:** 1310 m, Jun 1885, *H. von Tuerckheim 642* (NY); near Chirriacté, on the Petén Highway, 900 m, 9 Apr. 1941, *P.C. Standley 91970* (F); Finca Socuyó, NE of Cahrchá, 1350 m, 2 Apr. 1939, *P.C. Standley 70216* (F); El Derrumbe, canyon of río Chixoy (or Negro), open slopes and mixed forest of Sierra de Chamá, about 10−15 km, west of San Cristóbal, 1200−1600 m, 15°25' N, 90°27' W, 2 Feb. 1969, *L.O. Williams et al. 40517* (F).

PANAMA. **Bocas del Toro:** Campamento La Pata del Cedro, 1521 m, 9º3' N, 82º 43' W, 8 Mar. 1525, *E. Alfaro & A.K. Monro 5415* (BM, INB!, MO, MEXU, PMA). **Chiriquí:** Palo Alto, just east of Boquete, 1524 m, 23 Jul. 1959, *W.L. Stern et al. 1024* (F); along road between Gualaca and Chirriquí Grande, 5.9 mi beyond Los Planes de Hornito, in direction of Lake, 4.8 mi. beyond turnoff to Caldera, 1225 m, 8°45' N, 82°14' W, 19 Sep. 1987, *T.B. Croat 67790* (MO, NY!). **Choclé:** foot of Cerro Pilón, above El Valle de Antón, 609 m, 27 Mar. 1969, *T.B. Croat et al. 4590* (F!, MO). **Veraguas:** Parque Nacional Cerro Hoya, 1455 m, 2 Mar. 1997, *M. Ruíz et al 204* (F, NY).

PERU. **Amazonas:** Aramago, trocha nueva Esperanza a la catarata, 1650 m, 5º 29'54" S, 78º20'00", 17 Dec. 2001, *R. Vásquez et al. 27458* (MO, USM!); Chachapoyas, Quebrada Molino 5 km below Chachapoyas, 2200 m, 30 May 1962, *J.J. Wurdack 629* (USM); Condorcanqui, Cordillera del Cóndor, Puesto de Vigilancia Alfonso Ugarte (PV 3), cabecera del río Comainas, tributário al oeste del río Cenepa, 1450–1650 m, 3º54' S, 78º26' W, 18 Jul. 1994, *H. Beltran & R. Foster 975* (USM); near Yuwi Inci Creek, 6 hours walk from the Pongo Mori, río Comaina, on trail to Kusu (río Numpatakai), 1700−2000 m, 11 Mar. 1973, *B. Berlin 944* (USM). **Cajamarca:** San Ignacio, San José de Lourdes, base del Cerro Picorana, 2010 m, 4°59'25" S, 78°54'5" W, 21 Jan. 1999, *C. Díaz et al. 10421* (MO, USM!). **Cusco:** La Convención, Echarati, east río Apurímac NE. Pueblo Libre, up mountain of Anchihuay and Bellavista, south Cordillera Vilcabamba, 2445 m, 12º51' S, 73º30' W, 3 Aug. 1998, *P. Núñes et al. 23499* (US, USM!). **Huánuco:** Tingo María-Huánuco, 1000 m, 9°40' S, 76°5' W, 26 Aug. 2002, *M. Lehnert 310* (USM). **Junín:** Satipo, cordillera de Vilcabamba, Northern Cordillera Vilcabamba, eastern slope, Upper river Poyeni, watershed, 2090 m, 11°33'35" S, 73°38'28" W, 26 Jun. 1997, *B. Boyle et al. 4770* (USM); Tarma, San Juan, cerca a Huacapistana, entre Tarma y San Ramón, 2200−2300 m, 22 Sep. 1955, *R. Ferreyra 11324* (USM). **Pasco:** Gran Pajonal, vicinity of Chequitavo, 1200 m, 10º45' S 74º23' W, 9 Apr. 1984, *D.N. Smith 6853* (USM). Oxapampa, Huancabamba, Parque Nacional Yanachaga Chemillen, caminho del Refugio al Abra La Esperanza, 2450−2610 m, 10º31' S, 75º20' W, 15 Mar. 2003, *A. Monteagudo & G. Ortíz 4651* (MO, USM!); Oxapampa, río San Alberto, camino a la estación hidroeléctrica, 2000 m, 12 Aug. 1985, *B. León 634* (USM). **San Martín:** Mariscal Cáceres, trail between La Playa camp and Papayas camp. río Abiseo National Park, 2650–2750 m, 25 Jul. 1987, *K. Young & B. León 4969* (USM); Rioja, km 399 of carretera Marginal, trail to Quebrada Venceremos and río Serranoyacu, 67 km E of Pomacochas, 8 km W of the bridge over río Serranoyacu, 1400–1500 m, 5°45' S, 77°29' W, 13 Jun. 1986, *S. Knap & P. Alcorn 7754* (MO, USM!).

VENEZUELA. **Aragua:** Colonia Tovar, 1700 m, [10°24'20'' N, 67°17'22'' W], 1921, *H. Pittier 9322* (MERF, NY!). **Bolivar:** Barinas, La Soledad, 22 Nov. 1980, *F. Ortega 1218* (NY!, PORT). **Distrito Capital:** El Libertador, borde SW del Parque Nacional Maracaibo, antes de la Colonia Tovar, 3 km al SE del Pico Geremba, 3 km al SW de alto Lagunazo, Quebrada La Fuente, afluente del río Petaquire, 2000–2200 m, 10º25' N, 67º14' W, 6 Aug.

1999, *A. Fernández & C. Reyes 15282* (NY). **Lara:** Distrito Jiménez, P.N. Yacumbú, 10−14 km by road SE of Sanare, ridges of Fila Potreritos, between Alto del Viento and El Volcán, 1800–2100 m, 9º41' N, 69º37' W, 25 Oct. 1982, *G. Davidse & A.C. Gonzáles 21148* (NY). **Mérida:** Campo Elías, Carbonera, 2400 m, 11 Sep. 1975, *E.R. de la Sota 6227* (LP). **Táchira:** along Quebrada Água Azul, S of El Reposo, 14 km SE of Delicias, 2150–2300 m, 7º31' N, 72º24'W, 22 Jul 1979, *J.A. Steyermark & R. Liesner 118208* (NY). **Trujillo:** entre el Batatal y Boca de Monte, Alrededores de la Laguna de Aguas Negras, 1750 m, 28 Sep. 1982, *F. Ortega & B. Stergios 1534* (NY!, PORT); Bocono, Páramo de Guaramacal, SE. Of television towers, 2000 m, 9º14' N, 70º11' W, 28 Apr. 1988, *L.J. Dorr et al., 4983* (NY).

16. Serpocaulon funckii (Mett.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium funckii* Mett., Abh. Senckenberg. Naturf. Ges. 2: 57. 1857. TYPE: Nueva Granada [Venezuela]. Mérida: 1846, *N. Funck & L.J. Schlim 963* (first step lectotype designated Hensen (1990: 302); **second step lectotype:** BM [bc] 000937441 image! Here designated; isolectoypes BM [bc] 000937440 image!, LE [bc] 00008718 image!). Figures 3b, 17k, s, 23d, 56, 57, 62d, 100b.

Plants epiphytic or hemiepiphytic. *Rhizomes* 1.4–2.5 mm diameter, long-creeping, dark brown to reddish, pruinose; phyllopodia distance 1.5–7 cm. *Rhizome scales* scattered, 0.5–1.3 × 0.5–1.2 mm, elliptic, appressed, peltate, bicolourous, light brown to the margin and dark brown to the center, base and apex obtuse to rounded, erose margin. *Fronds* 16–42 cm long. *Petioles* 2.5–14 cm long, proximally subterete, distally sulcate, light brown to dark. *Laminae* 14–28 × 2.6–11 cm, narrowly lanceolate, pinnatisect, proximally truncate and distally gradually tapering in an attenuate segment. *Segments* 15–42 pairs, papyraceous to rarely chartaceous, proximal surcurrent, slightly reflexed, medial and distal decurrent, gradually tapering, apical segment narrowly caudate and attenuate. *Medial segments* 2.2–6.6 × 0.5–1.2 cm, base decurrent and apex acuminate, venation forming 7–13 along and 1 rows of areoles between the costa and the margin of the segment, notorious, often free veins. *Laminar induments* segment scales scarce, 0.8–1.4 × 0.5–1.3 mm, ovate to ovate-lanceolate, 12–16 cells wide, appressed, subpeltate, concave, located at the base of the segments, concolorous, dark brown, base truncate and acute apex, the margins dentate. *Hairs* scarce,

catenate with 4–17 cells, patent, hyaline. *Sori* from the medial segment in 6–13 along and 1 row between the costa and the margin, not reaching the apex of the segments. *Spores* 74–84 × 42–53 µm, ellipsoidal to globular, plane-convex to concave-convex, and irregular depressed verrucae.

Etymology. Its name honored the botanist Nicholas Funck, from Luxembourg, who recollected the type specimens.

Distribution and habitat. Serpocaulon funckii occurs from Colombia and Venezuela to Bolivia, mainly in the Andean region, from 1240 to 3000 m, in cloud forest.

Phenology. It was recorded fertile all months, except in June and August.

Notes. Serpocaulon funckii most resembles *S. dasypleuron, S. loriceum* and *S. ptilorhizon,* that also possess long-creeping rhizomes with elliptic to rounded appressed scales, and pinnatisect laminae. However, differs from *S. dasypleuron* by its glabrous laminae with scarce scales in the base of the segment and dispersed to absents hairs (vs. dense pubescence with dimorphic hairs), and slimmer rhizome (1.4–2.5 mm vs. 2–5 mm diameter). From *S. loriceum*, can be distinguished by its papyraceous to rarely chartaceous texture (vs. coriaceous), the predominantly smaller petiole (2.5–17 cm vs. 7.5–38 cm) and laminae (14–28 cm vs. 14–51 cm). Finally, from *S. ptilorhizon* can be distinguished by the presence of more segments (15–42 vs. 11–24 pairs), the sori reaching the apex of the segments (vs. non reaching), and the terminal segment narrowly attenuate (vs. widely attenuate).

Taxonomic and nomenclatural notes. Hensen (1990) designated *Polypodium funckii* = *Serpocaulon funckii* to the synonymy of *P. loriceum* = *S. loriceum*, however, the type specimens support the morphological differences that were expressed before. In the same way, Ramírez-Valencia et al. (2013) suggested that the spores of those species can distinguish them by their size and ornamentation. Immature plants of this species can be confused easily with *S. loriceum* and *S. ptilorhizon*. On the other hand, it is not discarded the possibility of

hybridization between *S. funckii* and *S. ptilorhizon*, due the intermediary morphology and because those species share the same habitat, especially in Colombia.

Mettenius (1856) designated two numbers of the series *N. Funck & L.J. Schlim* (*963*, *964*) to describe the species *P. funckii*. Hensen (1990) pointed that those sheets were destroyed at LE, but suggest that there is a fragment at BM. After tracing those specimens at B, BM and LE, it was found a complete specimen at BM. Because Hensen did not designated any specimen as type, here is designated by the second step lectotype the specimen *N. Funck & L.J. Schlim 963* (BM [bc] 000937441) to represents Mettenius's species concept, due that it presents accurate labels and is complete as suggested by Turland et al. (2018, Article 9.3).

Serpocaulon semipinnatifidum (Fée) A.R. Sm, represents a putative hybrid between *S. funckii* and *S. levigatum* (Moran, 1990; 1995), described from Colombia and recorded frequently in that country (*D. Sanín et al. 5125*, NY; *J.L. Zarucchi et al. 5989*, MO, UC; *J.L. Zarucchi et al. 6290*, MO, UC, from Antioquia) (Sanín, 2018), but also found in Venezuela (*T.B. Croat 60675*, MO), and Peru (*L. Sanchez Veja & A. Miranda 6325*, F). For this reason, this taxon is here designated as a hybrid (see hybrid section).

Representative specimens. BOLIVIA. **La Paz:** Murillo, río Zongo valley, 22.5 km below a dam at Lago Zongo, 3000 m, 16º9' S, 68º7' W, 9 Oct. 1982, *J.C. Solomon 8391* (LPB!, MO); Murillo, valle del río Zongo, 23.6 km al N de la cumbre, 3000 m, 16º9' S, 68º7' W, 8 Jan. 1988, *J.C. Solomon 17463* (LPB!, MO). **Cochabamba:** Chapare, 54 km hacia Villa Tunari, 2750 m, 30 Apr. 1979, *S.G. Beck 1427*, *1428* (LPB); José Carrasco Torrico, 108 km, antigua carretera Cochabamba-Villa Tunari, 2950 m, 17º9' S, 65º38' W, 23 Jun. 1996, *M. Kessler et al. 6615* (LPB).

COLOMBIA. **Antioquia:** Amalfi, road between Amalfi and Fraguas, near Salazar, 17.5–19.8 km from centro of Amafi, bosque húmedo premontano, 1480–1560 m, 6º55' N, 75º5' W, 14 Feb. 1988, *J. MacDougal 3996* (HUA); Anorí, vereda Santa Gertrudis, finca La Estrella, quebrada que surte de agua la casa, 1420 m, 7º7' N, 75º9' W, 3 Oct. 2003, *W. Rodríguez 4133* (HUA); El Carmen de Viboral, vereda San Lorenzo, margen del río San José, 2300 m, 5.98377, -75.258764, 24 Nov. 2018, *J. Castro & D. Sanín 1359* (HUA); Fredonia, vereda Erbe, microcuenca la Chaparrala, bh-MB, bosque secundario, 2150–2250 m, 5º59' N, 75º38' W, 20 Dec. 2004, *W. Rodríguez 4840* (HUA); Frontino, Parque Nacional Natural Las

Orquídeas, vereda Venados Abajo, después de la finca Vista Hermosa, divisorias de aguas entre el río Venados y quebrada La Selva, 1240–1280 m, 6º33' N, 76º18' W, 25 Jul. 2011, *D. Sanín 5196* (COL, NY); Urrao, La Encarnación, vereda Calles Abajo, Parque Nacional Natural Las Orquídeas, vegetación al borde del camino entre la cabaña de Calles y La Raya, límite entre Urrao y Frontino, 1000–1280 m, 6º30' N, 76º15' W, 22 Jul. 2011, *D. Sanín 5127* (COL, NY). **Boyacá:** Arcabuco, vía que conduce a Bucaramanga, sitio La Cumbre, 2440 m, 10 May 1979, *Valencia 24* (COL); Samacá, inmediaciones de la represa Teatinos, 2 Oct. 1976, *C. Acosta-Arteaga 1098* (COL). **Cauca:** El Tambo, Reserva Natural Tambito, 1600 m, 18 Apr. 2006, *M. Muñoz 1918* (CAUP). **Chocó**: San José del Palmar, vereda Portachuelo, finca Barro Blanco, 1300 m, 15 Jan. 1983, *S. Díaz-Piedrahita 3568* (COL). **Cundinamarca**: San Bernardo, Cordillera Oriental, vereda Santa Rita, alto de Buenos Aires, 2300 m, 25 Jul. 1981, *R. Jaramillo-Mejía 7062* (COL).

ECUADOR. **Zamora-Chinchipe:** Estación Científica San Francisco, around refuge, 2470 m, 3º59' 21" S, 79º4'20" W, 23 Sep. 2003, *M. Lehnert 897* (QCA).

PERU. **Cajamarca:** San Ignacio, Huarango, Cordillera Huarango, El Romerillo, 2300 m, 5º16'12" S, 78º40'28" W, 14 Jul. 2005, *E. Rodríguez et al. 2786* (HUT, MO, USM!). **San Martín:** Rioja, Pardo Miguel Naranjos, Bosque de protección Alto Mayo, Caserio Jorge Chávez, Sector Venceremos, 2524 m, 5º43'7" S, 77º44'52" W, 13 Apr. 2017, *M. Acuña et al. 1802* (USM)

VENEZUELA. **Bolivar:** Ptari-tepuí, along base of east facing, 2410–2450 m, 7 Nov. 1944, *J.A. Steyermark 59921* (F). **Mérida:** Campo Elías, Carbonera, 2400 m, 11 Sep. 1975, *E.R. de la Sota 6233* (LP); Tabay, 2300–2400 m, 30 Aug. 1930, *M.R. Gehriger 374* (F). **Trujillo:** Boconó, Parque Nacional Guaramacal, trail from El Cafenol (E of Mosquey) to Fila Los Recostaderos, passing from "potrero" 1790–2200 m, 19–37258 E, 1026389 N, 12 Jun. 2001, *L.J. Dorr et al. 8932* (F).

17. Serpocaulon glandulosissimum (Brade) Labiak & J. Prado, Amer. Fern J. 98(3): 147. 2008. *Polypodium glandulosissimum* Brade. Arq. Inst. Biol. Veg. 1(3): 230. 1935. TYPE. Brazil. Rio de Janeiro: Serra do Itatiaia, Macieiras, 1900 m, 22 Jun. 1930, *A.C. Brade 10182* (lectotype designated by Labiak & Prado (2008): R [bc] 000021893!). Figures 4b, 7b, n, 15a, b, 18c, 23e, 58, 59, 62e.

Plants rupicolous or epiphytic, rarery terrestrial. *Rhizomes* 3−4.5 mm diameter, short-creeping, blackish pruinose, rugose; phyllopodia distance 0.5−1.5 cm. *Rhizome scales* disperse, mainly in the base of phyllopodia, 1.5−3.8 × 0.6−1.4 mm, lanceolate, patent, subpeltate, colorous, dark brown, base rounded, apex acuminate, wall of the cells dense, dentate margin. *Fronds* 17−65 cm long. *Petioles* 5−27 cm long, proximally subterete, distally rounded, light brown, dense pubescence to rarely glabrous. *Laminae* 12−39 × 5.5−16 cm, oblong-lanceolate, pinnatisect, truncate and reflexed proximally, distally gradually tapering in a short attenuate segment. *Segments* 19−37 pairs, chartaceous, proximal surcurrent, medial decurrent and distal gradually tapering. *Medial segments* 3−7 × 0.4−1.1 cm, base decurrent and apex acuminate to rounded, venation forming 5−20 rows along and 1 row of areoles between the costae and the margin of the segment, notorious. *Laminar induments* segments scales scarce, 1.1−2.9 × 0.1−0.2 mm, linear-cirrose, tangled up, 18−21 × 2−3 cells, basifixed, concolorous, light brown, base rounded and patent and cirrose apex, the margins smooth. *Hairs* dense, with short glandular apex, 0.1 mm long, with 2−3 cells, patent, light brown to yellowish similar at the petiole, rachises and lamina. *Sori* from the medial segment 7−18 rows along and 1 row between the costa and the margin, sorely reaching the apex of the segments. *Spores* 54−60 × 29−35 µm, ellipsoidal, concave-convex to plano-convex, with folded perinae that exhibts rounded proyections.

Etymology. Its name referred to the leaf indument composed of dense glandular hairs.

Distribution and habitat. Serpocaulon glandulosissimum is restricted to southeastern Brazil, occurring in the Atlantic Rain Forests, from 1100 to 2350 m, mainly in Campos de Altitude (called as Brazilian Páramos) and Campos Rupestres ecosystems.

Phenology. It was recorded fertile in January, February, April, May, June and August.

Notes. Serpocaulon glandulosissium most resembles *S. catharinae*, *S. lasiopus* and *S. vacillans*, that also possess pruinose rhizome (except in *S. vacillans*), dense pubescence in the pinnatisect laminae (except *S. catharinae* that is glabrous), and also inhabits the Atlantic

Rain Forest (except *S. lasiopus* that is widely distributed). However, differs from *S. catharinae* by its lanceolate and dark brown concolorous rhizome scales (vs. subulate and bicolorous rhizome scales, dark brown at the center and light brown at the margin), and laminae dense pubescent with glandular hairs (vs. glabrous laminae). From *S. lasiopus*, by its rugose and pruinose rhizomes (vs. not rugose and scarce pruinose rhizomes) with dispersed concolorous dark brown rhizome scales (vs. dense and bicolorous, tan at the margin and dark brown to light brown to the center), and the glandulose hairs (vs. hairs on margins of the segments, 3–5 cells long, hyaline, and over the surface of the segments, 13–22 cells long and brown). Finally, differs from *S. vacillans*, by the exposition of its rhizome on the substrate: litter matter, trunks, rarely soil or rocks (vs. subterranean, usually at least 2 cm deep), the rugose and pruinose short-creeping rhizome (vs. farely rugose and lacking pruinosty, long-creeping rhizome), dark brown concolorous lanceolate rhizome scales (vs. orange to light brown concolorous ovate to ovate-lanceolate), strait petiole (vs. sinuate) and by the glandular trichome (vs. hairs with absent glands).

Taxonomic and nomenclatural notes. Hensen (1990) considered it as a rare aberration of *Polypodium catharinae*, designated it as a synonym of it. Posteriorly, Labiak and Prado (2008) proposed a new combination for this species, stressing more specimens not just from Itatiaia in Rio de Janeiro as the protologue mentioned (Brade, 1935), but also from Minas Gerais and São Paulo States. However, it is necessary to take into account that some specimens cited by Hensen (1990) and Labiak and Prado (2008), represents *S. lasiopus* (i.e. *P.K.H. Dusén 1137,* P) and *S. vacillans* (i.e. *A.C. Brade 21158*, RB), respectively.

Representative specimens. BRAZIL. **Minas Gerais:** Nova Lima: Serra da Mutuca, beyond Barreiro, 1400 m, 15 Apr. 1945, *L.O. Willians & V. Assis 6652* (RB); Boa Esperaça, Serra da Boa Esperança, Parque Estadual da Boa Esperança, 1100 m, 20º58’38” S, 45º39’16” W, 14 Dec. 2007, *A. Salino et al. 13045* (BHCB). **Rio de Janeiro:** Itatiaia: Macieiras, Aug. 1933, *A.C. Brade 12623* (RB); Itatiaia: Km 11, 22−28 Jun. 1936, *Markgraf & Brade 3731* (RB); Itatiaia, Parque Nacional do Itatiaia, subida para o Pico das Agulhas Negras, 2350 m, 22º22’48” S, 44º39’47” W, 11 Jan. 2008, *P.H. Labiak et al. 4457* (NY!, SP!, UC, UPCB); Rio de Janeiro, P.N. do Itatiaia, abrigo de Rebouças, 2414 m, 20º22’38” S, 44º41’38” W, 24

May 2017, *D. Sanín et al. 6828* (BHCB). **São Paulo:** Campos do Jordão, 5−20 Feb. 1937, *C. Porto 3209* (BHCB!, NY!, RB!, UPCB); Serra da Bocaina, 1700 m, 16 May 1951, *A.C. Brade 21158* (RB).

18. Serpocaulon intricatum (M. Kessler & A.R. Sm.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium intricatum* M. Kessler & A.R. Sm., Candollea 60: 278. 2005. TYPE: Bolivia. Cochabamba: Ayopaya, 10 km Cocapata-Cottages, 2850 m, 16º38' S, 66º41' W, 10 May 1997, *M. Kessler et al. 9429* (holotype UC [bc] 1622414!; isotype LPB!). Figures 14d, e, 16g, 23b, 60, 61, 62f.

Plants hemiepiphytic or terrestrial. *Rhizomes* 3−10 mm diameter, long-creeping, orange to dark brown, not pruinose; phyllopodia distance 1−6 cm. *Rhizome scales* dense along the rhizome, 1−2.5 × 0.7−1.5 mm, ovate, appressed, peltate, bicolorous, light brown to the margin and the dark brown to the center, base appressed and rounded, acute and patent apex, smooth and overlapping margin. *Fronds* 34−82 cm long. *Petioles* 8−22 cm long, proximally subterete, slightly sulcate, distally triangular, brown to stramineous. *Laminae* 26−60 × 5−18 cm, narrowly deltate to linear-lanceolate, pinnatisect, truncate and reflexed proximally, distally gradually tapering in a caudate attenuated segment. *Segments* 21−49 pairs, proximal and medial surcurrent, distal decurrent, and gradually tapering, papyraceous to chartaceous. *Medial segment* 4−11 × 0.6−1.5 cm, base decurrent and apex attenuate to rarely rounded, venation forming 12−28 rows along and 1(−2) rows of areoles between the costae and margin, notorious. *Laminar induments* segment scales scarce, 1.9−2.3 × 0.9−1.3 mm, lanceolate, appressed, peltate, concolorous, light brown, base rounded and acute to acuminate apex, the margins smooth. *Hairs* in the blade and rachis disperse and scarce, 2−5(−10) cells long, catenate, 0.2−0.4 mm, appressed, hyaline to light brown. *Sori* from the medial segment in 7−21 rows along and 1 row between the costa and the margin, not reaching the apex of the segments. *Spores* 38−42 × 25−29 µm, ellipsoidal to sub-ellipsoidal, plane-convex to concave-convex, and irregular depressed verrucae.

Distribution and habitat. Serpocaulon intricatum occurs from Ecuador to Bolivia, mainly in Andean ecosystems, from 1600 to 2850 m, in cloud montane forest.

Phenology. It was recorded fertile in January, March, May, July, August, September and November.

Notes. Serpocaulon intricatum most resembles *S. falcaria* and *S. latipes* that also possess long-creeping rhizomes, appressed scales with patent apex and pinnatisect laminae. However, differs from *S. falcaria* by its narrowly deltate to linear-lanceolate laminae (vs. lanceolate), smooth margin and dispersed hairs along the segments (vs. undulate margin with patent hairs 2−4 cells and 0.3 mm long of the sinus), and by its distribution on the Andes (vs. Central America and the Antilles). From *S. latipes*, it could be distinguished by its smaller appressed rhizome scales (1−2.5 mm vs. 2.2–5.8 mm long, subappressed rhizome scales), and narrowly deltate to linear-lanceolate laminae (vs. lanceolate to deltate-lanceolate laminae), which is relatively narrow (5−18 cm vs. 6.5–41 cm). In addition, its Andean distribution (vs. Atlantic Rain Forest and scarcely in the Andean-Amazon piedmont, Peru and Ecuador), supports its distinction.

By his narrowly deltate to linear-lanceolate laminae with several segments and long-creeping rhizome, *S. intricatum* could be confused with *S. dasypleuron*. However, can be distinguished by its lanceolate rhizome scales with patent apex (vs. rounded to ovate rhizome scale with appressed apex), and by the scarce, appressed hairs of the laminae with 2−5(−10) cells long (vs. dense, patent hairs, over the rachis with 9–20 cells long, and over the margin of the segments 6–8 cells long).

Taxonomic and nomenclatural notes. *Serpocaulon intricatum* has been treated as *Polypodium loriceum* (Lellinger, 1989; Hensen, 1990; Tryon & Stolze, 1993), but morphological features like the absence of pruinosity on rhizomes (vs. rhizome pruinose), the lanceolate and spreading rhizome scales (vs. rounded and appressed), the scarce pubescence of the laminae composed by appressed small hairs (vs. glabrous laminae with few scales at the bases of segments) as well as, their distribution: Central Andes in the case of *S. intricatum*; and the Antilles, Central America and north of south America for *S. loriceum*, allow distinguished both species.

Despite Kessler and Smith (2005) suggested a distribution from 1400 to 3400 m for this species. Here is confirmed that the sheet *Feuerer 11528* (LPB) cited in the protologue to support the highest altitudinal range for the species, does not presented rhizome. Additionally, the size of the sori and indumenta seem more similar to those presented in *S. crystalloneurum*. Reason why here is suggesting a more restricted distribution for *S. intricatum*.

Representative specimens. BOLIVIA. **Cochabamba:** Carrasco, 28 km al noroeste de Comarapa por el camino entre Santa Cruz y Cochabamba (20 km en línea recta al noroeste de Comarapa), 2450 m, 17º49' S, 64º41' W, 10 Feb. 1987, *J.C. Solomon & M. Nee 15990* (MO, LP!); Cochabamba, km 130 Antígua carretera Cochabamba-Villa Tunari, 17º7' S, 65º36' W, 2000 m, *M. Kessler 7216* (GOET, LPB!, UC). **La Paz:** Murillo, río Zongo valley, 27 km below dam at Lago Zongo, 2600 m, 10 Oct. 1982, *J.C. Salomon 8481* (LP!, MO); Nor Yungas, Parque Nacional Cotapata, Estación Biológica de Tunquini, caminos alrededor de la Estación, 1600 m, 16°11' S, 67°52' W, 17 Jul. 2000, *T. Kromer & C. Acebey 1259* (LPB); Sud-Yungas, 2800 m, [16°24'12.6" S 67°43'35.6" W], 27 Nov. 1906, *O. Buchtien 486* (F, SI). **Santa Cruz:** Florida, 7 km NE of Crossing of río Paredones north of Achiras Camping Resort, on trail to Abra-Los Toros, 2075 m, 18°7' S, 63°47'30" W, 7 Jun. 1998, *M. Nee 49678* (NY).

ECUADOR. **Bolivar**: Balsapamba [1°45'6" S, 79°08'39" W], 1891, *A. Sodiro 26/80* (SI). Napo: SE. Slopes of Cordillera de Huacamayos, along the road between Tena and Baeza, 1828 m, 12 Jan. 1981, *G.R. Proctor 38716* (QCA). **Pichincha**: Quito, Río Guajalito Reserve, 10 km of Chiriboga, km 59 of old road Quito-Santo Domingo, 1900 m, 00°14' S, 78°48' W, 6 Jul. 1991, *A. Fay & L. Fay 3255* (QCA!, MO). **Santiago-Zamora**: along río Valladolid, around Tambo-Valladolid, 2000 m, 14 Oct. 1943, *J.A. Steyermark 54656* (F). **Zamora-Chinchipe**: New road Loja-Zamora, km13 E of the pass, 2000 m, 3°58' S, 79°6' W, 14 Feb. 1991, *B. Øllgaard et al. 98815* (AAU, QCA!).

PERU. **Amazonas**: Chachapoyas, Chachapoyas-Mendoza, km 52 ca 10 km behind Molinopampa, 2400 m, 6°14' S, 77°36' W, 4 Aug. 2002, *M. Lehnert 232* (USM). **Bolivar**: Huayopata, Chaullay Alto, 1990 m, 12.58.02 S, 72.37.32 W, 12 Jul. 2003, *E. Bonito et al. 1184* (CUZ, MO, USM!). **Cajamarca**: San Ignacio, San José de Lourdes, Santo Tomas, 2200

m, 4º55’ S, 78º50’ W, 31 Oct. 1995, *E. Rodríguez 688* (MO, USM!). **Cusco**: La Convención, Echarati, Llactahuaman, N. del río Apurimac, NE de Pueblo Libre, S. de la Cordillera de Vilcabamba, 1650 m, 12º51’55” S, 73º30’40” W, 14 Jul. 1998, *S. Baldeon et al. 3086* (USM!, US). **Huánuco**: Chinchao, San Pedro de Carpish, arriba del tunel, 2770−2820 m, 9º43’14” S, 76º6’53” W, 1 May 2005, *I. Salinas & H. Beltran 1007* (USM). **Junín**: Huacapistana, 1800−2400 m, 5 Jun. 1929, *E.P. Killip & A.C. Smith 24499* (F). **Pasco**: Oxapampa, Parque Nacional Yanachaca Chemillén, Sector San Alberto, 2600 m, 10º32’ S, 75º21’ W, 16 Mar. 2003, *R. Vasquez & R. Francis 28057* (MO, USM). **San Martín**: Mariscal Cáceres, P.N. Río Abiseo, Valle río Abiseo, 2420−2820 m, 7º55’12” S, 77º15’2” W, 8 Jul. 1999, *B. León & K. Young 4006* (USM).

19. Serpocaulon lasiopus (Klotzsch) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium lasiopus* Klotzsch, Linnaea 20: 393. 1847. *Goniophlebium lasiopus* (Klotzsch) T. Moore, Index Fil. 391, 1862. TYPE: Venezuela. Colonia Tovar, *J.W.K. Moritz 256* (lectotype designated by Hensen (1990: 298): B [bc] 200087597 image!; isolectotypes BM [bc] 000937447 image!, P [bc] 00633217 image!). Figures 13c, f, 16h, 23e, 63, 72a.

Polypodium argyrolepis Sodiro, Crypt. Vasc. Quit. 355. 1839. TYPE: Ecuador. Azuay: *A. Rimbach 43* (lectotype designated by Hensen (1990: 298): Q [bc] 0000384! here designated; isolectotype: P [bc] 00624693!).

Serpocaulon gilliesii (C. Chr.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium gilliesii* C. Chr. Ind. fil. 327. 1906. *Polypodium pubescens* Hook. & Grev. Icon. Filic. Pl. 182. 1831, ‘nom. illeg. hom.’ *Goniophlebium pubescens* (Hook. & Grev.) T. Moore, Ind. fil. 395. 1831. TYPE: Argentina. [Cerro del Morro, San Luis, Provincia Bonariae], *J. Gillies s.n.* (lectotype designated by Hensen (1990: 298): K [bc] 000642072!; isolectotype: E [bc] 00844430 image!).

Polypodium loriceum var. *hirto-pubescens* Hieron. Hedwigia 48: 263. 1909. TYPE: Colombia. Huila: Santo Domingo im Thal des Paez, *A. Stübel 153* (**lectoype here designate**: B [bc] 200141896 image!). **New syn.**

Serpocaulon mexiae (Copel.) A.R. Sm., Taxon 55: 928. 2006. *Polypodium mexiae* Copel., Univ. Calif. Pub. Bot. 17: 33, tab. 8. 1932. TYPE. Brazil. Minas Gerais: Diamantina, Serra do Rio Grande, 7 May 1931, *Y. Mexia 5776a* (first step lectotype: UC, designated by

Hensen (1990: 311), **second step lectotype**: UC [bc] 466101! here designated; isolectotype: US [bc] 00065831 image!). **New syn.**

Plants epiphytic, rupicolous or rarely terrestrial. *Rhizomes* 2.7−5.6 mm diameter, short-creeping, brown to dark reddish, pruinose or scarce; phyllopodia distance 1−2.5 cm. *Rhizome scales* dense, 3−7.5 × 0.9−2.5 mm, ovate-lanceolate, lanceolate to slightly subulate, patent, basifixed to subpeltate, bicolourous to rarely sligtly concolorous (specially in the southern distribution), light brown to the margin and dark brown to the center, base rounded, apex long-acuminate, cirrose, erose, dentate to ciliate margin. *Fronds* 6–56 cm long. *Petioles* 1–23 cm long, subterete, light brown. *Laminae* 5–53 × 2–12 cm, ovate-lanceolate to narrowly lanceolate, pinnatisect, truncate and reflexed proximally, distally gradually reduced to a short-attenuate segment. *Segments* 6–34 pairs, membranaceous to papyraceous, proximal surcurrent and reflexed, medial decurrent and apical attenuate. *Medial segment* 1.4–7.2 × 0.5–1.2 cm, base decurrent and apex acute to rounded, venation forming 10–23 rows along and 1 row of areolae between the costae and the margin, notorious. *Laminar induments* segments scales scarce, mainly in the axils of segments, 1.9–2.4 × 0.2–0.8 mm, acicular, 3–6 cells wide, patent, base truncate and acuminate apex, concolorous, dark brown. *Hairs* dense, catenate, patent, simple or rarely stellate, with brown dissections, on the margins of the segments, 3–5 cells long, hyaline and strigose, and over the surface of the segments, 9–22 cells long, hyaline to brown and villous. *Sori* from the medial segments in 6–21 rows along and 1 row between the costa and the margin, reaching the apex. *Spores* 68–83 × 42–44 µm, ellipsoidal to globular plano-convex to concave-convex, irregular depressed verrucae.

Etymology. The name proceeds from the Latin words: *lasio* and *pus*, meaning woolly-footed, in relation to its dense pubescence.

Distribution and habitat. Serpocaulon lasiopus occurs from Honduras (Batke & Hill, 2013), the Antilles (Dominican Republic and Haiti), to Paraguay and Brazil, mainly in middle elevation from the South of the Andes, from 250 to 3210 m.

Phenology. It was recorded fertile all months of the year.

Commentaries. Serpocaulon lasiopus most resembles *S. australe*, *S. crystalloneurum*, *S. dissimile,* that also possess short-creeping rhizomes (except *S. crystalloneurum* that is predominantly long-creeping) with patent scales, and pinnatisect laminae with dense hairs (except *S. australe* that is glabrous and *S. crystalloneurum* that present hairs only on the rachises and costae). However, differs from *S. australe* by its laminae dense pubescent (vs. glabrous with few laminar scales), segments parallel (vs. ascending), apex of the laminae gradually reduced in one apical segment (vs. abruptly reduced in one apical segment), sori reaching the apex of the segments (vs. absent in the apex of the segments), and apex of the rhizome scales cirrose (vs. acute to acuminate). From *S. crystalloneurum* could be distinguished by the short-creeping rhizomes (vs. often long-creeping), ovate-lanceolate, lanceolate to slightly subulate rhizome scales with cirrose apex (vs. ovate to ovate-lanceolate with acute apex) and dense, patent and hairs dense and patent, on the margins of the segments, strigose, and over the surface of the segments, villous (vs. scarcely along the rachis and costa and appressed). Finally, from *S. dissimile* by its pinnatisect laminae (vs. pinnate proximally and distally pinnatisect), bicolorous rhizome scales (vs. dark brown and iridiscents). Especially in Brazil, it can be confused with *S. vacillans* by the presence of pinnatisect lamina with dense hairs, but can be distinguished by its brown to dark reddish, pruinose or scarce, exposed short-creeping rhizomes (vs. yellow, light brown, or green to rarely dull black, no pruinose, subterranean long-creeping rhizome), and the presence of one row of sori between the costa and margin (vs. 1–2(−3) rows).

After *Serpocaulon triseriale*, *S. lasiopus* exhibits the wider distribution of the genus. This promotes the morphological variation registered. It could hybridize with *S. crystalloneurum* (*A. Cano & N. Valencia 21441,* USM), *S. sessilifolium* (*D.N. Smith & R. Vasquez 3343*, MO, USM) in Peru, *S. australe* in Argentina (*Lossen 243*, F) and *S. vacillans* (*C.M. Mynssen et al. 528*, RB; *532*, OUPR) in Brazil, a situation that increasses its taxonomic complexity.

Taxonomic and nomenclatural notes. Hensen (1990) mentioned that the sheet *A. Rimbach 43* was hosted at Q and included an interrogation (?) to designate the holotype of *Polypodium argyrolepis* Sodiro. This is here considered as the first step lectotypification. After studying

the collection from Q, here is applied the second-step lectotype for the sheet *Rimbach 43* traced at Q [bc] 0000384!

Sanín et al. (2019a) segregated *S. australe* and proposed *S. gilliesii* as a synonym of *S. lasiopus*. Additionally, clarified dates and geographical names wrongly attributed by the authors in the description of *P. lasiopus* and *P. pubescens*.

Polypodium loriceum var. *hirto-pubescens* Hieron., was published on the base of collections made in Colombia. Despite that the number 153 was mentioned in the protologue, no specimen was designated. After traced and studied the sheet *A. Stübel 153* from B [bc] 200141896, was possible to realize that this sheet matches the species concept of *S. lasiopus*, reason why here it is designated the lectotype and recognized as new synonym of this species.

Polypodium mexiae Copel. was described from Brazil, based on the type *Y. Mexia 5776a* (UC). Hensen (1990: 311) stressed the word holotype to designate the named collection. This is here considered as first step lectotype, because there is another specimen at US, and neither Copeland nor Hensen designated correctly that specimen as holotype or lectotype, the second step lectotype is applying to designate the collection *Y. Mexia 5776a* from UC ([bc] 466101). Hensen located *P. mexiae* = *P. mexiae* under the synonym of *P. vacillans* = *S. vacillans*. After revising the type from UC, we agree with the Dutch author that *S. mexiae* is indeed a synonym, but from *S. lasiopus*.

In Flora of Peru, Tryon and Stolze (1993) commented erroneously (see comments of *Serpocaulon* ×*semipinnatifidum*) that *P. lasiopus* = *S. lasiopus* is one of the parentals of *P. semipinnatifidum* = *S.* ×*semipinnatifidum* with *Polypodium levigatum* = *S. levigatum*.

Indigenous name. Calaguala by the Saraguro culture in Ecuador (*L. Ellemann 66815,* QCA).

Traditional use: The Saraguro-indian in Ecuador use as medicine for inflammation of the internal female sexual organs: the crushed plant is drunk with honey (*L. Ellemann 66815,* QCA).

Representative specimens. ARGENTINA. **Buenos Aires**: Balcarce, 22 Feb. 1938, *A. Burkart 8892* (SI); Balcarce, Cerro Bachicha, 23 Nov. 1975, *J. Frangi 652* (LP); Balcarce,

Partido de Balcarce, 3 Jan. 1943, *A.T. Hunziker 2240* (LP); Mar del Plata, 6 Jan. 1933, *C.M. Hicken s.n.* (SI); Pto. Saavedra, Sierra Curá Malal, cordón Lehmann, estancia "La Malvina", 550 m, 12 Mar. 1980, *Proyecto Ventania 995* (LP); Toraquist, Sierra de la Ventana: Cerro Tres Picos, 1075–1160 m, 15 Mar. 1979, *Proyecto Ventania 711* (LP). **Cordoba:** Capilla del Monte, Cerro Uritorco, Feb. 1933, *E.G. Nicora 124* (SI); Colón, Unquillo, 1 Dec. 1918, *C.C. Hosseus 126* (SI); Copina, 29 Dec. 1935, *A. Burkart 7132* (SI); Feb. 1905, *Tessi s.n.* (SI); Huerta Grande, 19 Feb. 1906, *T. Stuckert 2040* (SI); Mina Clavero, 12 Dec. 1901, *T. Stuckert 10544* (SI); La Cumbrecita, 1500–1600 m, 18 Sep. 1955, *F.A. Roig 982* (SI); Pampa de Achala, Potrero de Guzmán, 2120 m, 10 Feb. 1941, *C.C. Housseus 239* (SI); Punilla, camino Tanti a los Gigantes, *G. Dawson 1107* (LP); Punilla, Copina, primer puente colgante al borde de la cascada, 27 Mar. 2006, *E. Filippa 60* (SI); Punilla, La Falda, 1928, *C.C. Hosseus 176* (SI); Punilla, Copina, en las Cascadas, 1450 m, 27 Feb. 1942, *C.C. Hosseus 451* (SI); Punilla, antes de llegar al Parque Nacional Quebrada del Condorito, zona Noreste (desde Va. Icho Cruz), 26 May 2001, *R.E. Moreno 4* (SI); Punilla, El Nipur, Los Gigantes, 31º24'42" S, 64º48'25" W, 19 Feb. 2005, *R.E. Moreno 82* (SI); Punilla, alrededores de Capilla del Monte, 20 Jan. 1917, *C.C. Hosseus 119* (SI); Punilla, Sierra Grande más arriba de Copina, 24 Nov. 1932, *C.C. Hosseus 58* (SI); San Alberto, subida W de la Pampa de Achala, 23 Feb. 1965, *A.L. Cabrera 16642* (LP); San Alberto, La Ensenada, Pampa de Achala, 2115 m, 31º36'00" S, 64º45'38" W, 6 Mar. 2004, *R.E. Moreno 18* (SI); San Alberto, Ruta Nacional No. 20, antes del Parque Nacional Quebrada del Condorcito, desde Va. Icho Cruz, 16 May 2004, *R.E. Moreno 29* (SI); Sierra de Achala, entre Tauti y río de Juepe, 12 Feb. 1876, *G. Hieronymus 844* (SI); Sierras Grandes, Cerca de los Gigantes, 5 Dec. 1958, *E.D. Gautier 745* (LP); Valle de Punilla, alrededores de Capilla Dolores, 19 Nov. 1917, *C.C. Hosseus 960* (SI); Valle de Punilla, Capilla del Monte, al pié el Cerro Uritorco, 17 Mar. 1917, *C.C. Hosseus 713* (SI); Valle de Punilla, alrededores de Capilla del Monte, 14 Apr. 1915, *C.C. Hosseus 75* (SI); Valle de Punilla, Capilla del Norte, Cerro Uritorco, 23 Nov. 1917, *C.C. Hosseus 1091* (SI); alrededores de Capilla del Morte, Cerro Uritorco, 10 Mar. 1917, *C.C. Hosseus 487* (SI); Punilla, Copina, 28 Apr. 1962, *L. Ariza Espinar 1415* (SI); Punilla, Camino del Cóndor a Copina, cuarto puente, 11 Feb. 1999, *G. Seijo 1904* (SI); Punilla, Camino a Cerro Los Gigantes, 25 Mar. 1886, *F. Kurtz 3894* (SI); Punilla, vertiente del río Malambo, al pie de los Gigantes, 2000 m, 3 May 1936, *C.C. Hosseus 66* (SI); Punilla, Sierra Achala, 1908, *F. Kurtz*

15605 (SI); Punilla, Sierra Achala, Cuesta de Tránsito, 1700 m, 6 Jan. 1895, *F. Kurtz 8345* (COR, LP. SI); Punilla, Sierra Achala, Los Gigantes, 1910, *O. Doering 15827* (SI); Punilla, Sierra Córdoba, Sierra de la Barranquita, arriba del río Zeballos, 22 Dec. 1875, *G. Hieronymus 33* (SI); Punilla, Sierra Córdoba, entre Tanti (Cuchi) y el río Yuspe, 12 Feb. 1876, *G. Hieronymus 363* (SI); Punilla, Sierra Córdoba al pié de los Tres Gigantes, 1880, *P.G. Lorentz 1784* (SI); Punilla, Sierra Achala, al norte de la Cuesta de Copina, 18 Feb. 1880, *C. Galander s.n.* (SI); Punilla, Sierra Achala, Quebrada al Pié de los Gigantes, 23 Jan. 1880, *C. Galander s.n.* (SI); Punilla, Sierra Chica, Cumbre del Cerro Uritorco, 1949 m, Feb. 1902, *F. Alvarez Sarmiento 11902* (SI); Sierra Alta, 1700 m, Mar 1825, *W. Lossen 243* (SI); Sierra Grande, Cerro de la Ventana, 5 Mar. 1933, *C.C. Hosseus 25a* (SI); Sierra Grande, EL Mirador entre río Yuspe y Cuchilla Nevada, 1700 m, 2 Feb. 1951, *J.H. Hunziker 2707* (SI); San Alberto, Las Higueras, Dec. 1885, *F. Kurtz 2845* (SI); San Alberto, Sierra Grande, Pampa de Achala, por Ruta Nacional no. 20, Garganta de Batán, entre Estancia La Higuerita y El Cóndor, 7 Feb. 1992, *M. Duran 87* (SI); San Alberto, Sierra Grande, Pampa de Achala, por Ruta Nacional no. 20, El Cóndor, 7 Feb. 1992, *M. Duran 89* (SI); San Alberto, Sierra Achala, Cuesta de Tránsito, Región del Tabaquillo, 1700 m, 13 Jun. 1895, *F. Kurtz 8345b* (SI); San Alberto, Pampa de Achala, Posta de Piedra, 31º38’ S, 64º49’ W, 10 May 2008, *R.E. Moreno 82* (COR). **Jujuy:** Capital, 24 Jan. 1944, *A.L. Cabrera 8179* (LP); Chijra, 4 Dic. 1905, *C.M. Hicken s.n*. (SI); Ledesma, Abra de la Cañas, 1700 m, *E.R. de la Sota 4458* (LP). **Salta**: Guachipas, Cuesta de Lajar, ruta 9, 23 Km al SE de Guachipas, 1900–2000 m, 16 Jan. 1990, *L. Novara 9394* (COR, SI); Santa Victoria, arroyo cerca camino desvio a Baritú, 15 Jul. 1999, *M.A. Ganem 172* (LP); Santa Victoria, Los Toldos, 1700 m, 9 Mar. 1986, *C. Paloú 532* (LP); Santa Victoria, Los Toldos, Finca el Nogalar, terraza alta del río Huaico, 1650 m, 11 Nov. 1997, *L.A. Cassa 231* (LP); Santa Victoria, Los Toldos, Finca el Nogalar, terraza alta del río Huaico, 1700 m, 11 Nov. 1997, *L.A. Cassa 232* (LP); Santa Victoria, Los Toldos, 1700 m, 15 Mar. 1986, *C. Palaú 473* (LP); Santa Victoria, Parque Nacional Baritú, río Lipeo, 1160 m, 22º25’ S, 64º44’ W, 16 Nov. 2002, *F.O. Zuloaga 7745* (SI); Orán, *Razy s.n*. (SI); Santa Victoria, Los Toldos, Finca el Nogalar, terraza alta del río Huaico, 1700 m, 11 Nov. 1997, *L.A. Cassa 247* (LP); Santa Victoria, Lipeo, Parque Nacional Baritú, Escuela No. 250, 850 m, 5 Jul. 1998, *O.G. Martínez 619* (LP); Santa Victoria, Los Toldos, 1600 m, 6 Jul. 1998, *O.G. Martínez 648* (LP); Santa Victoria, Los Toldos, Finca el Nogalar, terraza alta del río

Huaico, 1600 m, 2 Jul. 1998, *O.G. Martínez 595* (LP); Santa Victoria, camino a Los Toldos, 1000–1100 m, 5 Jul. 1998, *O.G. Martínez 641* (LP). **San Luis**: Provincia Bonariae, Cerro del Morro, *J. Gillies s.n*. (K); 27 Feb. 1811, *F. Pastore 16* (SI); La Cienaga, 11 Feb. 1936, *M.A. Vignati 17* (LP, SI)**.**

BOLIVIA. **Cochabamba:** Mizque, about 3 km southwest of Vilavila, 2700 m, 24 Mar. 1939, *W.J. Eyerdam 25042* (F); a unos 109 km de la capital en dirección Santa Cruz, 3210 m, 25 Dec. 1982, *J. Fernández Casas 7750* (F). **La Paz**: Inquisivi, Loma Linda Turculi, along the road between Loma Linda y Turculi, this road runs north from Cajuata off of existing maps, 1850 m, 16º38' S, 67º10' W, 26 Dec. 1989, *M. Lewis 36883* (MEDEL); **Tarija:** Arce, entre Emborozú y río Negro, 24 Feb. 1960, *T. Meyer 20989* (LP); Pinos bei Tarija, 2200 m, 11 Mar. 1904, *K. Fiebrig s.n.* (K); Arce, ca 2 hours by trail N of Sidras (trail to Tariquia) 900–1000 m, 22º12' S, 64º32' W, 25 Apr. 1983, *J.C. Solomon 10106* (LPB!, MO); Rincón de la Victoria, 17 km W de Tarija, 18 May 1971, *A. Krapovickas 18909* (LP); Quebrada Erquis Seibal, camino de Tomatitas, 7 Km al NW, 10 Km de Tarija, 2150 m, 15 Nov. 1997, *E.R. de la Sota 7102* (LP).

BRAZIL. **Minas Gerais:** Alto Caparaó, Parque Nacional do Caparaó, trilha entre Tronquiera e base do Pico da Bandeira, na região das Três Lagoas, na trilha para o Pico do Cristal, 1800–2560 m, 20º25'5" S, 41º48'56" W, 23 Nov. 2006 *A. Salino et al. 11454, 11455* (BHCB); São Gonçalo de Rio Preto, Parque Estadual do Rio Preto, Chapada, 1367 m, 18º12'9" S, 43º20'25" W, 21 Apr. 2007, *T.E. Almeida et al. 800* (BHCB); São Thomé das Letras, Baependi, 1250 m, 13 Jul. 1950, *C.A. Brade & Apparicio 20463* (RB).

COLOMBIA. **Antioquia:** Guarne, vereda La Quiebra, sítio La Embajada, 2480 m, 6º 12' N, 75º27' W, 29 Jun. 2001, *W. Rodríguez 3268* (HUA, JAUM, MEDEL, MO). **Cauca**: Cajibio, vereda El Cofre, orillas del río Cofre, 1800 m, 2 May 2002, *E.L. Muñoz 636* (CAUP); Cajibío, Raíces de Vida, 1700 m, 2º38' N, 76º38' W, 19 Nov. 2005, *N. Otálora 119* (CAUP); Popayán, 1100 m, 21 May 1969, *S. Espinal 3592* (COL, CUVC); Popayán, camino enre la vía Totoró y la Vereda Clarete, 1830, 2º27' N, 76º29' W, 5 Feb. 2000, *B. Ramírez-P. 12768* (CAUP); Popayán, km 2 vía al Huila, cruce por la Cabaña de don Luis. Quebrada Quitacalzón, 1920 m, 2º26'39" N, 76º35'24" W, 10 Nov. 2000, *B. Ramírez-P. 13653* (COL); Popayán, río Palacé, km 25 vía Totoró, 1850 m, 2º30' N, 76º35' W, 1 Dec. 2000, *B. Ramírez-P. 13719* (COL); Popayán, vereda las Guacas, carretera que conduce a la vereda El Cabuyo,

fragmento de Bosque ubicado frente a la Finca Las Guacas, 1740 m, 2º27’ N, 76º37’ W, 8 Mar. 2001, *A. Alcázar Caicedo 297* (CAUP). **Cundinamarca**: Cachetá, en el cementerio, 1750 m, 18 May 1974, *P. Acosta-Arteaga 405* (COL); San Cayetano, vía Villa Gómez, vereda Chingatubi, 2130 m, 8 Jun. 1993, *A. Chaparro 89* (COL); Ubaque, laguna de Ubaque, 2000 m, 11 Jul. 1974, *P. Acosta-Arteaga 595* (COL); La Mesa, laguna de Pedro Palo, 2000 m, 14 Dec. 1989, *P. Acosta-Arteaga 2244* (COL); Suesca, hacienda Susatá, 2621 m, 9 Oct. 1946, *M.B. Foster 1810* (COL); Suesca, Hacienda Susatá, 2580 m, 8 Nov. 1999, *J.P. Groenendijk 1317* (COL); Suesca, 2600 m, 2 Jun. 1974, *P. Acosta-Arteaga 423* (MEDEL); Mosquera, laguna La Herrera, 2680 m, 14 Dec. 1943, *H. García-Barriga 10919* (COL). **Magdalena**: Sierra Nevada de Santa Marta, 1828 m, Aug. 1898–1901, *H.H. Smith 2440* (K).

DOMINICAN REPUBLIC. **Baoruco:** Sierra de Neiba, Sabana del Silencio, 2201 m, 18º39’7” N, 71º33’26” W, 19 Jun. 2003, *P. Acevedo et al. 13026* (NY). **San Juan:** entre San Juan y Azua, Parque Nacional Ramírez, en el sendero entre Los Fríos (de los Montes Fríos), 1400−2100 m, 18º53’ N, 70º58’ W, 22 Jun. 1988, *T. Zanoni & R. García 41538* (NY).

ECUADOR. **Chimborazo:** Pallatanga, Riobamba, Parroquia Maria de Lourdes, 1500 m, 5 Jan. 2010, *D. Romero 1* (CHEP, QCA!). **Cotopaxi:** Quevedo-Latacunga, road, Steep rocks and áreas along río Pilaló, 950–1100 m, 00º53’ S, 79º10’ W, 6 Apr. 1973, *L. Holm-Nielsen et al. 3181* (F). **Loja:** road Veracruz-Olmedo, c. km 2, 2030 m, 3º57’ S, 79º35’ W, 11 Mar. 1989, *B. Øllgaard et al. 90036* (AAU, QCA!); Lugma Huycu 12 km north of Saraguro, the root tasty, Vernacular name: Calaguala, Use: medicine for inflammation of the internal female sexual organs: the crushed plant is drunk with honey, from Marie Christine Bermeo a Saraguro-indian, 2100 m, 3º34’ S, 79º15’ W, 19 Jan. 1989, *L. Ellemann 66815* (AAU, QCA!). **Trujillo:** Cerro Campana, 700–996 m, 4 Sep. 1978, *J. Jaramillo et al. 755* (QCA).

HAITI. Morne de Commissaires, 1600 m, 24 Jul. 1942, *L.R. Holdrige 1357* (F).

PARAGUAY. Feb. 1901, *E. Hassler 4812* (NY).

PERU. **Amazonas:** Bagua, 12 km E of La Peca (by trail), 1700 m, 23 Jun. 1978, *P. Barbour 2508* (F!, MO). **Ancash:** Lauta, Lomas de Lupin, 4 Aug. 1954, *O. Velarde 9388* (LP). **Cajamarca:** between Llacamora and Namora, 2900 m, 26 Mar. 1960, *D.S. Correll P882* (K); Contumazá, La Pampa de Guzmange, 2000 m, 21 Apr. 1984, *A. Sagástegui 11440* (F). **Chiclayo:** Lambayeque, Cerro Reque, 580 m, 27 Oct. 1991, *S. Llatas Quiroz 3043* (F). **Cuzco:** Urubamba, Jan. 1936, *J. Soukup s.n*. (K); Putina, Dec. 1938, *J. Soukup 972* (F).

Lima: Atocongo, 250–500 m, 28 Jun. 1925, *F.W. Pennell 14765* (F); Chancay, Lomas of Granados, 12 Km north of Huaral. 3 Oct. 1938, *H.E. Stork 9338* (K); Chancay, Loma de Lachay, ca 80 km of Lima, 600 m, 21 Oct. 1956, *R.M. Tryon & A.F. Tryon 5418* (F). **Junín:** Mito, 1828 m, 8 Apr. 1923, *J.F. Macbride 3340* (F). **Piura:** Ayabaca, entre Yanchalá y Ayabaca la Vieja, 2200–2250 m, 4º39' S, 79º35' W, 18 May 1996, *V. Quipuscoa et al. 469* (F). **Trujillo:** La Libertad, Cerro Campana, 800 m, 25 Oct. 1983, *A. Sagástegui et al. 10981* (F).

VENEZUELA. **Aragua**: Colonia Tovar, May 1865, *J.W.K. Moritz 256* (BM); prope Coloniam Tovar, May 1954, *A. Fendler 244* (BR). **Distrito Federal:** Boca del Tigre, 1800 m, 16 Dec. 1938, *A.H.G. Alston 5559* (BM). Rangel, entre Santo Domingo y Las Piedras, 2200 m, 5 Sep. 1975, *E.R. de la Sota 6218* (LP). **Bolivar:** Ptari-tepuí, along base of South-facing high sand-stone bluff, 2410 m, 6 Nov. 1944, *J.A. Steyermark 59907* (F).

20. Serpocaulon latipes (Langsd. & Fisch.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium latipes* Langsd. & Fisch. Pl. Voy. Russes Monde 1: 10, pl. 10. 1810. *Marginaria latipes* (Langsd. & Fisch.) C. Presl. Tent. Pterid. 188. 1836. *Goniophlebium latipes* (Langsd. & Fisch.) J. Sm. Curtis's bot. Mag. 72, Comp. 12, 1846. TYPE. Brazil. "Insula St. Catharinae", *G.H. Langsdorff & L. Riedel 75* (**lectotype designate here**: LE [bc] 00000042 image!). Figures 12a, b, 19c, 21b, 23b, 64, 65, 72b.

Serpocaulon laetum (C. Presl) Schwartsb. & A.R. Sm. J. Bot. Res. Inst. Tex. 7(1): 91. 2013. *Marginaria laeta* C. Presl. Tent. Pter. 188. 1836. *Polypodium laetum* Raddi. Opusc. Sci. 3: 287. 1819. (Not *P. laetum* Salisb.) nom. ille. *Goniophlebium laetum* (Raddi) J. Sm. Bot. voy. Herald 231. 1854. *Serpocaulon sehnemii* (Pic.Serm.) Labiak & J. Prado. Amer. Fern J. 98(3): 153. 2008. *Goniophlebium sehnemii* Pic.Serm. Webbia 60(1): 108. 2005. nom. superf. TYPE: Brazil. Brazilia: *G. Raddi s.n.* (first step lectotype: PI, designated by Pichi-Sermolli & Bizzarri (2005), **second step**: PI [bc] 10866 image! here designated). **New syn.**

Plants hemiepiphytic, terrestrial or rarely rupicolous. *Rhizomes* 2.4–8.4 mm diameter, long-creeping, dark brown to blackish, non-pruinose, rugose, dark oxidation when fresh;

phyllopodia distance 1–3.8 cm. *Rhizome scales* dense, 2.2–5.8 × 0.7–2.13 mm, lanceolate to lanceolate-subulate, subappressed, subpeltate, bicolourous, light brown to the margin and dark brown to the center, base acute to rounded, apex acuminate (rarely long acuminate only found in Peru: *A. Gentry et al. 23060,* F, UC), patent, erose and strongly overlapping margin. *Fronds* 24–100 cm long. *Petioles* 8.7–36 cm long, proximally subterete, dark brown to rarely light brown. *Laminae* 15–65 × 6.5–41 cm, lanceolate to deltate-lanceolate, pinnatisect, truncate and reflexed proximally, distally gradually tapering in a short-caudate segment. *Segments* 12–21(−40) pairs, papyraceous to membranaceus, proximal surcurrent, medial and distally decurrent, apical segment widely caudate, undulate margin. *Medial segments* 3.6–13 × 0.9–1.9 cm, base decurrent and apex acute to long acuminate, venation forming 9–33 rows along and 1–2 rows of areolae between the costae and the margin, conspicuous. *Laminar induments* segment scales scarce and deciduous, 0.9–4.2 × 0.3–1.2 mm, linear-lanceolate to aciculate, strigose, 5–15 cells wide, patent, basifixed with a notorious insertion, concolorous, dark brown, base rounded and acute to long acute and cirrose apex, the margins dentate. *Hairs* scarce, 2–5 cells long, catenate, 0.1 mm long, appressed and dark brown, with darker insertions. *Sori* from the medial segments in 6–33 rows along and 1–2 rows between the costa and the margin, non-reaching the apex of the segments. *Spores* 33–36 × 23–28 µm, ellipsoidal, plane-convex to concave-convex, and regular depressed verrucae.

Distribution and habitat. Serpocaulon latipes occurs scarcely on the foothills of the Andean-Amazonian of Ecuador to Peru, the Brazilian border, and in the Atlantic Rain Forest of Brazil where it is more frequent, from 40 to 2090 m, in humid forest.

Phenology. It was recorded fertile all months of the year.

Notes. *Serpocaulon latipes* most resembles *S. intricatum*, *S. falcaria*, and *S. latissimum*, that also possess long-creeping rhizomes, appressed scales with patent apex (except *S. latissimum* that are appressed), and pinnatisect laminae. However, differs from *S. intricatum* by its lanceolate to deltate-lanceolate laminae (vs. narrowly deltate to linear-lanceolate laminae), truncate laminae (vs. fairly truncate with narrow reduced base laminae), segments (12–21(–40) vs. 21–45 pairs), and by its distribution in the Atlantic Rain Forest and scarcely

in the Andean-Amazon piedmont of Peru and Ecuador (vs. cloud montane forest of the Andes from Ecuador to Bolivia). From *S. falcaria* can be distinguished by its decurrent base of the medial segment (vs. surcurrent), the presence of oxidation of the rhizome when fresh (vs. absence of oxidation at cutting), light brown rhizomes scales (vs. dark brown), and glabrous margin of segments (vs. margin with patent hyaline hairs 2−10 cells long, 0.3 mm over the sinus of the segments). Finally, from *S. latissimum* differs by its lanceolate rhizome scales with patent apex (vs. rounded rhizome scales with appressed apex), membranaceous to papyraceous consistence (vs. chartaceous to coriaceous), and predominantly less rows of sori between the costa and margin (6–33 × 1–2 rows vs. 25–48 × 1–3 rows).

Taxonomic and nomenclatural notes. *Polypodium latipes* Langsd. & Fisch. (Pl. Voy. Russes Monde 1: 10, pl. 10. 1810) was published without the designation of any specimen. Posteriorly, Hensen (1990) mentioned that the holotype was based at LE, but still not pointed any sheet. After tracing digital collections, a specimen (*Langsdorff & Riedel 75*) that match line drawings from the protologue was found and it possesses the original handwriting of the authors. For this reason, and following sugestions of Turland et al. (2018, Art. 9.3) here is designate this specimen as the lectotype.

Raddi (1819) proposed *P. laetum* Raddi., without considering the names: *S. catharinae* and, specially in this case, *S. latipes*. The latter is represented by the type *Langsdorff & Riedel 75* (LE) (discussed before). Which represents a proper species different to *S. catharinae*, and because it was validly published deserves recognition. Raddi (1819) presented five sheets for supporting the name *P. laetum*. Intriguingly, the first three sheets represent *S. catharinae* (*G. Raddi, s.n*., P [bc] 00637554, P [bc] 00633216, and BR [bc] 0000006977931, see commentaries for this species), and from the two that remain deposited in Pisa (following Pichi-Sermolli & Bizzarri, 2005), only *G. Raddi, s.n*. (PI [bc] 010866) represents a trustable *P. latipes* = *S. latipes.* In this sense, Raddi created one synonym for two species.

Apparently, Raddi not only misinterpreted Langsdorff and Fischer species concept, but also did not review the history of the name *P. laetum* Salisb. published previously (Salisbury, 1796), creating a synonym, as well as the described *Marginaria laeta* C. Presl. (Presl, 1836) and the posteriorly combination *Goniophlebium laetum* (C. Presl) J. Sm. (Smith, 1854) made in order to maintain the name.

By his part, Pichi-Sermolli and Bizzarri (2005) based on Raddi's misconception, combined this name under a new binomial *G. sehnemii* Pic.Serm. This situation promoted that Labiak and Prado (2008) recombined this name as *Serpocaulon sehnemii* (Pic.Serm) Labiak & J. Prado. The authors cited as lectotype the collection from FI, contrary to Pichi-Sermolli and Bizzarri (2005) suggestion of being PI the herbarium where Raddi deposited this sheet.

Finally, Schwartsburd and Smith (2013) recombined the name *Marginaria laeta* C. Presl to *Serpocaulon laetum* (C. Presl) Schwartsb & A.R. Sm., under the premise that this name was the earliest basionym available for the illegitimate name *Polypodium laetum* Raddi, created a new synonym, as well as the other authors, because apparently, they did not review the type collection and previous name *P. latipes* Langs & Fisch. (*Langsdorff & Riedel 75*, LE [bc] 00000042).

Hensen (1990) recognised *Polypodium laetum* Raddi, as a synonym of *P. latipes* Langsd. & Fisch., like Tryon and Stolze (1993). Additionally, Pichi-Sermolli and Bizzarri (2005) suggest that *Goniophlebium laetum* Raddi is allied to *P. latipes* Langsd. & Fisch., and Smith et al. (2018) mentioned an uncertain distribution due its unsolved taxonomy, suggesting that this species is part of a 'taxonomically difficult group, involving *S. concolorum*, *S. intricatum*, and *S. silvulae*'. This revision disagree with the last perception, not just because the distribution of those species (montane forest and subparamo of North of the Andes vs. mainly in Atlantic Rain Forest in the case of *S. latipes*), but also because *S. concolorum* and *S. silvulae* (synonym of *S. crystalloneurum*), present patent rhizome scales and laminae chartaceous to coriaceous. Futhermore, it is easily distinguished from *S. intricatum* for the characters presented previously.

Serpocaulon latipes represent a complex taxon that could hybridize with *S. catharinae* and *S. vacillans* in the Atlantic Rain Forest (Sanín et al. in prep b). The records suggest that this species expand its distribution to piedmont Andes from Ecuador to Bolivia, representing a chorological novelty for those countries.

Representative specimens. BRAZIL: **Acre:** Mâncio Lima, P.N. da Serra do Divisor, Serra do Môa, Trilha do Igarapé do Amor até a Cachoeira da Estátua, 218 m, 7º26'51" S, 73º40'1" W, 13 Dec. 2010, *T.E. Almeida & A. Salino 2576* (BHCB). **Espírito Santo:** Castelo, Parque

Estadual do Forno Grande, Localidade de Bateias, 1250 m, 20º31’37” S, 41º6’6” W, 13 Feb. 2008, *P.H. Labiak et al. 4597* (BHCB!, RB!, UPCB); Domingos Martins, São Paulo do Aracê, Entorno P.E. da Pedra Azul, 1085 m, 20º26’7” S, 41º1’20” W, 6 Dec. 2008, *A. Salino et al. 14161* (BHCB); Espera Feliz, P.N. do Caparaó, Pedra Menina, estrada da porteira de Pedra Menina para Casa Queimada, 1554 m, 20º29’36” S, 41º49’20” W, *A. Salino et al. 16149* (BHCB); Ibitirama, Parque Nacional de Caparaó, Córrego do Calçado, Tecnotruta, 1117 m, 20º28’3” S, 41º44’1” W, 9 Feb. 2011, *F.S. Souza et al. 1439* (BHCB); Santa Teresa, Nova Lombardia, Reserva Biológica Augusto Ruschi, Tracomal, linha da Divisa, 7 May 2003, *R.R. Vervloet & W. Pizziolo 2365* (BHCB); Sooretama, Reserva Biológica de Sooretama, Floresta de Tabuleiro, 40 m, 19º4’16” S, 40º7’33” W, *A. Salino 13313* (BHCB). **Minas Gerais:** Alto Caparaó, Parque Nacional do Caparaó, Vale Verde, 20 Nov. 1988, *Brügger et al. 523* (CESJ); Alto Caparaó, Mata na Base da Mata do Coração, 1316 m, 20º25’56” S, 41º50’52” W, 9 Mar. 2010, *I.R. Martins da Costa et al. 374* (BHCB); Arapongas, Parque Estadual da Serra do Brigadeiro, nas proximidades da Sede, 1400 m, 10 Jul. 1999, *A. Salino 4905* (BHCB, CESJ); Araponga, Serra do Araponga, PESB, trilha da Mina, 1300 m, 20º43’ S, 42º19’ W, 13 Mar. 1994, *L.S. Leoni 2482* (BHCB); Bom Jardim de Minas, Serra da Bandeira, na trilha para o topo, face norte, 1650 m, 22º1’16” S, 44º00’5” W, 21 Jul. 2013, *V.A.O. Dittrich 1813* (BHCB!, CESJ!, FURB); Caldas, Pocinhos do Rio Verde, Serra da Pedra Branca, 1700 m, 21º58’40” S, 46º22’16” W, 15 Jul. 2007, *A. Salino et al. 12600* (BHCB); Caldas, Pocinhos do Rio Verde, Serra da Pedra Branca, 14 Sep. 2008, *F.S. Souza et al. 566* (CESJ); Camanducaia, Mirante para distrito costas, segundo pela Estrada da Mata do sr. Édio, 1680 m, 22º40’34” S, 45º55’32” W, 19 Oct. 2001, *L.C.N. Melo et al. 165* (BHCB, CESJ); Carandaí, Pedra do Sino Hotel Fazenda, BR 040 Km 6: trilha da Matinha, 1000–1200 m, 13 Jul. 2005, *N.F.O. Mota & P.L. Viana 315* (BHCB); Carrancas, Serra das Carrancas, Serra das Broas, na Chapada das Perdizes, 1270 m, 21º36’17” S, 44º36’19” W, 19 Apr. 2007, *A. Salino et al. 12339* (BHCB); Catas Altas, R.P.P.N. Santuário do Caraça, caminho para a Bocaina, 1364 m, 20.12482 S, 43.46842 W, 27 Aug. 2008, *R.S. Viveros & A. Salino 27* (BHCB); Conceição de Mato Dentro, Parque Municipal Natural do Ribeirão do Campo, 19º6’12” S, 43º34’28” W, 13 Sep. 2002, *R.C. Mota et al. 1776* (BHCB); Delfim Moreira, Fazenda Boa Esperança, trilha do Marlon, 1317 m, 22º34’27” S, 45º19’20” W, 16 Mar. 2011, *T.E. Almeida et al. 2847* (BHCB, RB); Felício dos Santos, APA Felício, região

da Mata do Isidoro, entorno P.E. do Rio Preto, nas proximidades do Pico Dois Irmãos, 1150−1350 m, 18º11'48" S, 43º17'13" W, 30 Oct. 2004, *A. Salino et al. 9959* (BHCB); Ibitipoca, Parque Estadual de Ibitipoca, 1220 m, 9 Oct. 1993, *J.E.Z. Oliveira 378* (BHCB!, CESJ!, HUEFS); Jequitinhonha, Reserva Biológica da Mata Escura, 1000 m, 16º 20'31" S, 4º5'13" W, 29 Mar. 2008, *A. Salino et al. 13249* (BHCB); Marmelópolis, Picada para o Pico dos Marins Olaria, 1600 m, 22º29'45" S, 45º8'00" W, 3 Apr. 2002, *V.A.O. Dittrich 1141* (BHCB); Nova Lima, Estação Ecológica de Fechos, 20º3'57" S, 43º57'32" W, 11 Jul. 2001, *A. Salino et al. 7144* (BHCB); Olaria, Serra do Cruz, 1400 m, 21º53'26" S, 44º4'58" W, 2011, *F.E. Alves & E. Menini Neto 212* (BHCB, CESJ); Olaria, Serra do Cruz, 1360 m, 21º53'24" S, 44º4'26" W, 23 Jun. 2013, *V.A.O. Dittrich et al. 1803* (BHCB, CESJ); Ouro Preto, Camarinhas, Jun 1973, *M.A. Lisboa et al. 20* (OUPR); Paraisópolis, Parque Ecológico do Brejo Grande, 1265 m, 22º34'47" S, 45º48'52" W, 31 Oct. 2008, *T.E. Almeida et al 1584* (BHCB); Passa Vinte, Estrada que liga a sede do município à MG–457, 836 m, 22º11'8" S, 44º14'21" W, 14 Fev. 2009, *T.E. Almeida & D.T. Souza 1776* (BHCB, CESJ); Rio Preto, Serra do Funil, Ninho da Égua, Apr. 2006, *N.L. Abreu & P.L. Viana 117* (BHCB, CESJ); Santo Antônio do Itambé, P.E. Pico do Itambé, trilha do Capivari e Grotas perto do Pico, 1932 m, 18º23'52" S, 43º20'39" W, 6 Oct. 2006, *T.E. Almeida et al. 565* (BHCB); São Gonçalo de Rio Preto, Parque Estadual de Rio Preto, Chapada, próximo a Morro Redondo, 1595 m, 18º14'11" S, 43º19'57" W, 10 Jul. 2008, *T.E. Almeida et al. 1455* (BHCB); Sapucaí, Mirim, Propriedade de Sr. Germano, 1430 m, 22º44'31" S, 45º57'42" W, 19 Jul. 2007, *A. Salino et al. 12810* (BHCB); Simonésia, RPPN Mata do Sossego, 1150−1600 m, 20º4'2" S, 42º4'40" W, 20 May 2006, *A. Salino et al. 11038* (BHCB, CESJ); Simonésia, Mata do Sossego, trilha da areia branca e trilha para o mirante, 1625 m, 20º4'9" S, 42º5'19" W, 13 Jun 2012, *J.F. Souza & A. Salino 186* (BHCB). **Paraná:** Adrianópolis, P.E. das Lauráceas, 750 m, 9 Jan, 2000, *V.A.O. Dittrich 666* (BHCB); Ponta Grossa, Parque Estadual de Vila Velha-Capão da Fortaleza, 1000 m, 25º14' S, 50º00' W, 21 Apr. 2005, *P.B. Schwartsburd et al. 719* (SP!, UPCB). **Rio de Janeiro:** *Glaziou 1726* (RB); 30 Jan. 1952, *A.C. Brade 10173a* (RB); Itatiaia, Parque Nacional do Itatiaia, Parte baixa, Trilha para os Três Picos, início no antigo Hotel Simon, 1200 m, 22º25'48" S, 44º36'20" W, 13 Jan. 2012, *A. Lobão et al. 1841* (BHCB!, SPF, NY!); Itatiaia, Parque Nacional do Itatiaia, Trilha para a cachoeira Itaporani, 1150 m, 22º25'42" S, 44º37'10" W, 9 Jan. 2008, *P.H. Labiak et al. 4400* (SP); Itatiaia, Parque

Nacional do Itatiaia, Trilha para Três Picos, 20 Jun. 2000, *J. Prado et al. 1115* (SP); Itatiaia, P.N. Itatiaia, cachoeira Véu da Noiva, 22º27'7" S, 44º36'43" W, 23 May 2017, *D. Sanín et al. 6824* (BHCB); Serra da Magdalena, Ribeirão Vermelho, 12 Jul. 1935, *Santos Lima 296* RB); Teresópolis, Quebra Frasco, 1000 m, 14 Oct. 1929, *A.C. Brade 9688* (R); Teresópolis Parque Nacional Serra dos Órgãos, Trilha da Pedra do Sino, 1700 m, 22º27'9" S, 43º00'54" W, 22 Aug. 2010, *R.A. Engelmann et al. 953* (NY); Teresópolis, Parque Nacional Serra dos Órgãos, 1300 m, 22º26'56" S, 42º59'6" W, 13 Jan. 2008, *P.H. Labiak et al. 4492* (SI, SP); Teresópolis, Parque Nacional Serra dos Órgãos, Trilha da Pedra do Sino, 2000 m, 22º27' S, 43º00' W, 13 Jul. 2006, *J. Paula-Souza et al. 5938* (ESA, RB!). **Rio Grande do Sul:** São Leopoldo, *J. Dutra 56* (LP). **Santa Catarina:** Araranguá-Sombrio, 14 Apr. 1944, *R. Reitz 496* (RB); Sombrio, 20 Aug. 1945, *R. Reitz 1185* (RB). **São Paulo:** Bananal, Estação Ecológica do Bananal, nas trilhas da estação, e da Pedra Vermelha, 1130−1350 m, 22º49'10" S, 44º21'58" W, 8 Mar. 2001, *A. Salino et al. 6276* (BHCB); Cananéia, Parque Estadual da Ilha do Cardoso, 10 Dec. 1992, *M. Sugiyama 1133* (SP); Cunha, P.E. da Serra do Mar, Núcleo Cunha, trilha da casa de Pedra de Indaiá, 1070 m, 23º14'45" S, 44º59'36" W, 16 Dec. 1996, *A. Salino 2929* (BHCB); Eldorado, Parque Estadual do Jacupiranga, Núcleo Caverna do Diabo, trilha do Bugio, 400 m, 24º38'48" S, 48º23'38" W, 23 Mar. 2005, *A. Salino et al. 10170b* (BHCB); Estrada Alto da Serra, Jun. 1912, *H. Luederwaldt s.n.* (SP); Estrada Rio Grande, 1905, *M. Warlket s.n.* (SP); Iporanga/Apiaí, Parque Estadual Turístico do Alto Ribeira (PETAR), 24º32'22" S, 48º4º'36" W, 7 Jul. 2012, *F.F. Mazziero & A. Albeiro 1114* (SP); Jaraguá, Jun. 1912, *H. Luederwaldt s.n.* (SP); Ribeirão Grande, Parque Estadual Intervales, trilha da Caçadinha, com início na estrada do Carmo, 780 m, 24º16'39" S, 48º25'9" W, 15 Apr. 2003, *A. Salino et al. 8422* (BHCB); Serra da Bocaina, 1700 m, 5 May 1957, *A.C. Brade 20854* (RB); São Paulo, about 10 km. due north of center of São Paulo (Praça da Sé), Serra da Cantareira, near top, 1200 m, 18 Jul. 1960, *G. Eiten et al. 2174* (SP); São Paulo, Água Funda, Jardim Botânico, 4 Jan. 1975, *O. Handro 2268* (SP); São Paulo, Parque Estadual do Jacupiranga, Núcleo Caverna do Diabo, Trilha do Bugio, 400 m, 24º38'48" S, 48º23'38" W, 23 Mar. 2005, *A. Salino et al. 10170b* (BHCB, CESJ); São Luís do Paraitinga, Parque Estadual da Serra do Mar, Núcleo Santa Virgínia, Trilha da Pirapitinga, 900 m, 23º20'29" S, 45º8'48" W, 4 Mar. 2001, *A. Salino et al. 6140* (BHCB, CESJ); Tapiraí,

Reserva Votorantim, Complexo Juquiá, trilha Boatudo, 425 m , 24º2'14" S, 47º22'53" W, 29 Mar. 2013, *T.E. Almeida et al. 3221* (BHCB).

ECUADOR. **Morona-Santiago:** trail along río Inimkis, ca 3km. NE of village of Inimkis (San Luis) toward foothills of Cor. Cutucú, 900–1000 m, 2º23' S, 78º6' W, 14 Nov. 1995, *B. Øllgaard & H. Navarrete 1439* (AAU, QCA!); Mutinza, eastern foothills of Cord. Cutucú, trail to Tunantza, 660–680 m, 2º11' S, 77º44' W, 17 Nov. 1995, *B. Øllgaard & H. Navarrete 1477* (AAU, QCA!); Misión Bomboiza, 800 m, 3º29' S, 78º34' W, 24 Apr. 1973, *L. Holm-Nielsen et al. 4299* (AAU, NY!, UC!). **Santiago-Zamora**: Macuma, on the Macuma river, S. of Chiquaza, 700 m, 19 Oct 1971, *H.H. van der Werff 686* (L).

PERU: **Amazonas:** Near O'neall base camp, ca. 12 trail km E of La Peca in Serranía de Bagua, 1650–1800 m, 13 Jun. 1978, *A. Gentry et al. 23060* (F, UC). **Cusco:** Paucartambo, Kosñipata Valley, río Tono first foothill ridge on road N. of Pátria, 800 m, 13º7' S, 71º12' W, 3 Dec. 1985, *S. Wachter et al. 188* (F, USM). **Huánuco:** Along road between Tingo Maria airport and Huayna Capac, 1294 m, 9º14'56" S, 76º2'16" W, 6 Jun. 1998, *T.B. Croat & M. Sizemore 81882* (MO, UC!, USM!). **Junín**: La Merced, Chanchamayo, Sep. 1939, *J. Soukup 1086* (F); Satipo, Cordillera de Vilcabamba, Northern Cordillera Vilcabamba, eastern slope, upper river Poyeni watershed, 2090 m, 11º33'35" S, 73º38'28" W, 26 Jun. 1997, *B. Boyle et al. 4787* (USM). **Leoncio Prado:** Tingo Maria (Brunas), 17 Jun. 1997, *C.S. Arévalo Ramírez 256* (USM). **Loreto:** Requena, Divisor, Montañas de la Sierra del Divisor, al este del alto río Tapiche, 255 m, 7º12'16" S, 73º52'58" W, 21 Aug. 2005, *V.L. Uliana 1493* (AMAZ, F!). **Madre de Dios:** Manu, Cerro de Pantiacolla, río Palatoa 10–15 km NNW of Shintuya, 650–700 m, 12º35' S. 71º18' W, 11 Dec. 1985, *R.B. Foster et al. 10685* (F, USM!), *10753* (F). **Pasco:** Oxapampa, 19 km W of Oxapampa, 2080 m, 10º36' S, 75º33' W, 19 Nov. 1982, *D.N. Smith 2695* (F!, MO). **San Martín:** Rioja, Prov. Pedro Euíz-Moyobamba road, 390 km Venceremos, 1800 m, 5º50' S, 77º45' W, 27 Jul. 1983, *D.N. Smith 4414* (MO, UC!).

21. Serpocaulon latissimum (R.C. Moran & B. Øllg.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium latissimum* R.C. Moran & B. Øllg., Nordic. J. Bot. 15: 184. 1995. TYPE: Ecuador. Zamora-Chinchipe: road Zamora-Gualaquiza, 10 km N of Los Encuentros, 1000−1050 m, 3º42' S, 78º36' N, 3 Mar. 1992, *B. Øllgaard 99806* (first step lectotype: AAU, designated by Moran & Øllgaard (1995) **second step lectotype:** AAU [bc-image]

3717 image! here designated; isolectotypes AAU [bc-image] 3718 image!, QCA!, QCNE!). Figures 20 d-e, 23d, 66, 72c.

Etymology. The specific epithet is derived from the great width of the laminae (Moran & Øllgaard, 1995).

Plants hemiepiphytic, epiphytic, terrestrial or rarely rupicolous. *Rhizomes* 3–8 mm diameter, long-creeping, dark brown, non-pruinose; phyllopodia distance 3.5−8 cm. *Rhizome scales* dense to disperse, 1.3−1.5 × 0.6−1.5 mm, rounded, appressed, peltate, bicolourous, light brown to the margin and dark brown to the center, base rounded to obtuse, apex rounded to rarely acute, appressed, erose and overlapping margin mainly at the rhizome apex. *Fronds* 49−110 cm long. *Petioles* 14−41 cm long, proximally subterete, distally slightly sulcate, basally light brown and distally often become dark. *Laminae* 35−69 × 20−36 cm, narrowly deltate to lanceolate, pinnatisect, truncate and reflexed proximally, distally gradually tapering to a short-caudate segment. *Segments* 21–38 pairs, chartaceous to coriaceous, proximally surcurrent, medial and distally decurrent, apical segment widely caudate to 2–5.5 cm long. *Medial segments* 7.5–19 × 1.5–2.2 cm, base decurrent and apex acute to long acuminate, venation forming 26–48 rows along and 2– 4 rows of areolae between the costae and the margin, impressed. *Laminar induments* segment scales scarce, 1–2.2 × 0.6– 1.1 mm, triangular to lanceolate, 10–16 cells wide, patents, basifixed with a notorious insertion, concolorous, dark brown to reddish, base rounded and acute to long acute apex, margins dentate. *Hairs* scarce, 0.1 mm long, 3 cells long, catenate, appressed and hyaline. *Sori* from the medial segments in 25–48 rows along and 2–3 rows between the costa and the margin, reaching the apex of the segments or near so. *Spores* 46–50 × 28–32 µm, ellipsoidal, plane-convex, and prominent verrucae.

Distribution and habitat. Serpocaulon latissimum occurs from Colombia to Bolivia, in the east piedmont of the Andes (Bolivia, Ecuador and Peru), and the Biogeographic Chocó region of Colombia and Ecuador, from 0 to 2080 m, mainly in humid forest. Despite Smith et al. (2018) suggested that this species occurs in south-eastern of Brazil, we did not find specimens

to support it, and due that the authors did not present specimens examined, it is not possible to link those records with its distribution.

Phenology. It was recorded fertile all months of the year, except March and December.

Notes. Serpocaulon latissimum most resembles *S. latipes* and *S. maritimum* that also possess long-creeping rhizomes with appressed to subappressed (*S. latipes*) scales and pinnatisect laminae. However, it differs from *S. latipes* by its rounded rhizome scales with appressed apex (vs. lanceolate with patent apex), laminae chartaceous to coriaceous consistence (vs. membranaceus to papyraceous), more rows of sori between the costa and margin reaching the apex (2–3 rows vs. 1 row that not reaching). Additionally, *S. latipes* is predominantly distributed in the Atlantic Rain Forest of Brazil, with few records in Amazon of Ecuador, Peru and Brazil (see *S. latipes* for comparison). From *S. maritimum* could be distinguished by its relative bigger size, represented by the laminae (35–69 cm × 20–36 cm vs. 10–32 cm × 5.5–15 cm), and number of areolae along the segments (26–48 vs. 14–23 rows). Moran and Øllgaard (1993) suggested that the endemic distribution in Ecuador allows to distinguish it. However, Sanín (2018), as well as this revision, presented a wider range, including Colombia and Bolivia as the northern and southern limit range respectively.

Often the size is not a suitable feature to recognize *Serpocaulon*'s species. This applies in this case and it is critical in countries where *S. latissimum* and *S. maritimum* coexist (i.e. Colombia and Ecuador), as well as, *S. latipes* and *S. latissimum* (i.e. Peru and Ecuador), where a morphological continuity between the named species can be register.

Taxonomic and nomenclatural notes. Moran and Øllgaard (1993) designated the sheet *B. Øllgaard 99806* (AAU) as holotype. Due to the fact that in the named herbarium exist two sheets of the same collection, here is interpreted as the first step lectotypification. Following Turland et al. (2018, Art. 9.17), the sheet *B. Øllgaard 99806* AAU [bc-image] 3717 is designated as lectotype, using the second step lectotypification.

Representative specimens. BOLIVIA. **Cochabamba:** Prov. Chapare, territorio Indigena Parque Nacional Isiboro-Secure, cordillera de Mosetenez, laguna Carachupa, 1300 m, 16º14'

S, 66º25’ W, 29 Aug. 2003, *M. Kessler et al. 12938* (GOET, LPB, UC). **La Paz:** Prov. J. Bautista Saavedra Pauji-Yuyo, entre Apolo y Charazani, 1350 m, 15º3’ S, 68º29’ W, 14 Jun. 1997, *M. Kessler et al. 10134* (LPB).

COLOMBIA. **Antioquia:** Frontino, Parque Natural Nacional Las Orquídeas, sector Venados, vereda Venados Abajo, sítio La Esperanza, cuenca de la quebrada Arenales, 880–920 m, 6º32’ N, 76º18’ W, 29 Jul. 2011, *D. Sanín 5109* (COL, NY). **Cauca**: delta del río Guapi, Isla de los Obregones, 28 Aug. 1978, *I. Cabrera 3869* (CUVC); **Chocó:** Guayabal, río Serrano, afluente del río Atrato, 4–6 km arriba de Guayabal, 50 m, 30 Apr. 1975, *E. Forero 1381* (COL); Primavera, hoya del río San Juan, río Tamaná, afluente del San Juan, entre Primavera y Santa Rosa, 10 Apr. 1979, *E. Forero 4881* (COL); Bahía Solano, río Miniquía, E. of Puerto Mutis (Bahía Solano), 0–20 m, 26 Jan. 1971, *D.B. Lellinger 58* (COL); San José del Palmar, vereda Damasco, escuela Santa Lucía, 641 m, 4º52’ N, 76º15’ W, 21 May 2009, *D. Sanín 2977* (FAUC); Parque Nacional Natural Los Katíos, Alto el Limón, 600 m, 15 Oct. 1982, *Zuluaga-R. 1331* (COL). **Nariño**: Tumaco, Llorente, vereda El Pinde, km 71 Tumaco-Pasto, finca La Cabaña, 350 m, 2 Jun. 1999, *B.R. Ramírez-P. 12199* (PSO). **Valle del Cauca**: Valle-El Calima, 17 Sep. 1967, *O. Hagemann 461* (COL); Buenaventura, Vista Hermosa, Piangüita, 3 m, 3º50’ N, 77º11’ W, 14 Jul. 2010, *D. Sanín 4205* (FAUC).

ECUADOR. **Guayas:** Junction of the Provinces of Guayas, Cañar, Chimborazo and Bolivar, foothills of the western cordillera near the village of Bucay, 100–1250 m, 8 Jun 1945, *W.H. Camp 3682* (COL). **Morona-Santiago:** trail along río Inimkis, ca 3 km NE of village of Inimkis (San Luis), toward foothills of Cord. Cutucú, 900–1000 m, 2º23’ S, 78º6’ W, 14 Nov. 1995, *B. Øllgaard & H. Navarrete 1439* (AAU, QCA!). **Pichincha:** Loma Bomboli, just NW of Sto. Domingo de los Colorados, 650 m, 00º15’ S, 79º12’ W, 6 Mar. 1991, *B. Øllgaard & M. Larrea 98841* (AAU, QCA!). **Zamora-Chinchipe:** Pachicutza, Sendero hacia el Hito, 900 m, 00º33’ S, 76º10’ W, 17 Oct. 1991, *J. Jaramillo 13982* (QCA); Parque Nacional Podocarpus, Quebrada San Francisco (Road Loja-Zamora, E of the pass), 2000–2200 m, 3º59’ S, 79º6’ W, 23 Nov. 1994, *B. Øllgaard & H. Navarrete 105762* (AAU, QCA!).

PERU. **Cusco:** La Convención, Echarate, Km 62–66 del Derecho de vía del Gaseoducto Camisea, margen derecha del río Poyentimari, 1350–1450 m, 2 Apr. 2007, *S.M. Baldeón et al. 6612* (USM). **Junín:** Tarma, Chanchamayo, 1000 m, 1918, *N. Esposito s.n.* (USM).

Loreto: Coronel Portillo, divisória cumbre entre Tingo María y Pucallpa, 1600–1700 m, 28 Feb. 1947, *R. Ferreyra 1687* (USM). **Pasco:** Oxapampa, Palcazú, Comunidad nativa Alto Lagarto, Villa Progreso, Reserva Comunal Yanesha, 500 m, 10.08.04 S, 75.22.06 W, 5 May 2009, *R. Rojas & G. Ortíz 6632* (HOXA, USM!, MO); Villa Rica, Bosque San Matías, Sector Yunculmas, 25 Jun. 2007, *R. Vásquez et al. 32470* (HOXA, MO, USM!). **San Martín:** Rioja, Pedro Ruíz-Moyobamba road, km 390 Venceremos, 1800 m, 5º50' S, 77º45' W, 27 Jul. 1983, *D.N. Smith 4414* (MO, USM!)

22. Serpocaulon levigatum (Cav.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium levigatum* Cav., Descr. Pl. 244. 1802. TYPE: Ecuador. Quito: Montaña de San Antonio, *L. Née s.n.* (lectotype designated by Hensen (1990: 301): MA [bc] 476117 image!; isolectotype fragment BM). Figures 8c, 12c, 17l, 23d, 67, 68, 72d, 100b.

Polypodium glaucophyllum Kunze ex Klotzsch, Linnaea 20: 393. 1847. *Goniophlebium glaucophyllum* (Kunze.) Fée, Mém. Foug. 5: 256. 1850–1852. TYPE: Venezuela. Mérida: *J.W.K. Moriz 305* (first step lectotype: designated by Tryon & Stolze (1993: 134)**; second step lectotype**: B [bc] 200141919 image! here designated; isolectotypes: B [bc] 200141918 image!, BM [bc] 000937444 image!, BM [bc] 000937445 image!, BM [bc] 000937446 image!, BR [bc] 0000006977504 image!, HAL [bc] 0137789 image!, K [bc] 000642071 image!); Venezuela Columbiae, *E. Otto 570* (syntype designated by Hensen (1990): B [bc] 200141922 image!).

Etymology. The specific epithet is derived from the Latin words *levis* (*laevis*) = smooth, and *atus* = make, in reference to the white wax that often covers the abaxial surface of the fronds.

Plants hemiepiphytic, epiphytic, terrestrial or rupicolous. *Rhizomes* 1.6–5 mm diameter, long-creeping, whitish brown to dark or reddish, becoming whitish to the apex, pruinose; phyllopodia distance 0.5–9 cm. *Rhizome scales* disperse, 0.6–1.8 × 0.7–1.8 mm, rounded, elliptic to ovate, appressed, peltate, bicolourous, light brown to the margin and dark brown to the center, base and apex rounded to scarcely acute, appressed, erose margin. *Fronds* 6–

50 cm long. *Petioles* 1–23 cm long, proximally subterete, distally slightly sulcate, light brown to dark. *Laminae* 5–27 × 0.9–7.5 cm, narrowly elliptic to ovate-lanceolate, simple, truncate, rounded to attenuate proximally and attenuate, acute to long acuminate apex, membranaceous to coriaceous, venation forming 30–70 rows along and 3–7 rows of areolae between the costae and the margin, notoriously impressed. *Laminar induments* scales in the rachis and lamina, scarce, 1.2–2 × 0.7–1.8 mm, orbicular, triangular, lanceolate or rarely square, appressed, concave, bicolorous, dark brown proximally, light brown distally, rounded to concave base and acute to acuminate apex, the margins erose. *Hairs* absent. *Sori* in 9–49 rows along and (1–)3–7 rows between the costa and the margin. *Spores* 50–56 × 29–42 µm, ellipsoidal, plane-convex to concave-convex, and irregular depressed verrucae.

Distribution and habitat. Serpocaulon levigatum occurs from Costa Rica to Panama, and from Colombia, Venezuela to Bolivia, the Atlantic Rain Forets of Brazil, (only in Bahia and Espírito Santo States) and Antilles (Dominican Republic and Guadalupe), mainly in Andean ecosystems, from 700 to 3690 m, in cloud forest.

Phenology. It was recorded fertile all months of the year.

Despite that Hensen (1990), Smith et al. (2006) and Labiak and Prado (2008) mentioned its presence at the Guianas, any sheet was found to support it. Because the authors did not cite specimens, those records are omitted.

Notes. Serpocaulon levigatum is the unique species with simple laminae in the genus. It could be confused with some species of *Campyloneurum*, however, differed by presents one row of sori between the secondary veins (vs. two rows).

Serpocaulon levigatum hybridize frequently with species that presents pinnatisect laminae (v.g. *S. funckii*) originating *S.* ×*semipinnatifidum* (Moran, 1990; 1995; Sanín 2018). Smith et al. (2006) recognized this entity like species, a situation that is amended here with the hybrid designation presented in the corresponding section. In the same line, it was registered as a hybrid between *S. subandinum* originating a non described hybrid (*D. Sanín et al. 6896*,

BHCB, HUA). There is only one register of hybridization between this species and one with pinnate laminae (*S. adnatum*) originating *S.* ×*manizalense* (Sanín & Torrez, 2014).

Serpocaulon levigatum presents the third wider distribution of the genus, this promotes considerable morphological variation, represented by specimens with laminae base truncate and notoriously pruinose. Regarding its disjunct distribution with the Andes and Brazil, no significant distinguishing features were found among the specimens to propose taxonomic novelties.

Taxonomic and nomenclatural notes. Despite Tryon and Stolze (1993), and Lellinger (1989) mentioned as '*laevigatum*', the original description of Cavanilles was '*levigatum'* reason why this is amended.

Polypodium glaucophyllum Kunze ex Klotzsch, was described by Kunze in Klotzsch (1847) cited two collections: *E. Otto 570* and *J.W.K. Moriz 305*, that presents one and eight sheets respectively. Hensen (1990) did not designate any holotype from those sheets. Tryon and Stolze (1993) designated the sheet *J.W.K. Moriz 305* from B, however, due that in the German herbarium exist more duplicates of this series, the specimen *J.W.K. Moriz 305* (B [bc] 200141919), is designated here as lectotype because it is fertile and presents the handwriting of the mentioned collector, following Turland et al. (2018, Art. 9.17).

Indigenous name. In Quechua from Peru: *Jala wala* (*Morales Huamán 7*, Herbarium of University of San Cristóbal de Huamanga, Ayacucho). In Quechua from Ecuador: *Catchi panga* (*M. Shemluck & F. Ness* 203, F); Calaguala (*Acosta Solis 14385*, F).

Traditional use. In Peru it is used to cure kidney sickness (*Morales Huamán 7*, Herbarium of University of San Cristóbal de Huamanga, Ayacucho). Used in antiquity in Ecuador when was not salt, the leaves are very sweet; flavouring for monkey meat; use when sick so blood does not dry up (*M. Shemluck & F. Ness* 203, F). In Bolivia is chewed by the natives, has a sweet flavour like coconut and may contain an alkaloid (*A. Quesada 7,* F).

Representative specimens. BOLIVIA**. Cochabamba:** Chapare, 2000 m, 21 Jan. 1929, *J. Steinbach 8868* (F); Incachaca, 914 m, 14 Aug. 1950, *W.M.A. Brooke 6687* (F). **La Paz:**

Larecaja, Copacabana (about 10 km S of Mapiri), 850–950 m, 8 Oct. 1936, *B.A. Krukoff 11162* (F); Tajlini, 1400 m, 15 Jan. 1963, *A. Quesada 7* (F); Nor Yungas, Coroico, track Coroico-Mt. Uchumachi, 2300 m, 29 Apr 1990, *H. Hennipman & G. Röd-Linder 8043* (LPB); Nor Yungas, al NW de caranavi, carretera hacia Carrasco entrando por la derecha, Cooperativa Alto Sajama, 1800 m, 15º40' S, 67º30' W, 30 Apr. 1989, *R. Seidel 3007* (F). **Santa Cruz:** Manuel Maria Caballero, 50 km al norte de Mataral (Carretera Santa Cruz-Comarapa) pasando por San Juan del Potrero y bajando a la Cuenca del río Ichilo, 2000–2100 m, 26 May 1989, *D.N. Smith et al. 13425* (F!, LPB!, MO).

BRAZIL. **Bahia:** Camacan, Trilha do mirante, na estrada para Jacarecí, daí 6 km SW na estrada para RPPN Serra Bonita e Torre da Embratel, 9,7 km W de Camacan, Reserva Serra Bonita, Fazenda Serra Bonita, 900 m, 15º23'25" S, 39º33'58" W, 28 Jul. 2008, *F.B Matos et al. 1530* (UPCB); trilha para a serra Arataca, RPPN Caminho das Pedras, ca. 22.4 km de Arataca, estrada Arataca-Una, entrada no assentamento Santo Antônio, Serra do Peito de Moça, 1000 m, 21 Jul. 2005, *F.B Matos et al.* 741 (UPCB). **Espírito Santo:** Santa Teresa, Santo Anselmo, 24 Mar. 2006, *L. Kollmann et al. 8814* (BHCB!, MBML).

COLOMBIA. **Antioquia:** Belmira, vereda El Golfo, quebrada El Mogote, 2690 m, 6º36' N, 75º39' W, 17 Jul. 2002, *W. Rodríguez 3387* (MEDEL); Caldas, vereda la Corrala, bosque húmedo, finca La Zarza, 2440 m, 31 May 1984, *L. Albert de Escobar 4517* (HUA); Medellín, corregimiento de Santa Elena, sector Piedras Blancas, 2400 m, 6º15' N, 75º35' W, 1 Mar. 1998, *F. Álzate 492* (HUA); Sonsón, vereda Chaverras, quebrada El Padre Sánchez, 4 km SE de Sonsón, en la vía al municipio de Nariño, 2500 m, 5º39' N, 75º18' W, 16 Aug. 1992, *R. Callejas 10493* (HUA); La Unión, vereda Pantaleón, finca Sta. Teresita, 2490 m, 22 Apr. 1987, *Escobar 76* (HUA). **Boyacá:** bosques de Arcabuco, 2700 m, 7 Feb. 1959, *Bischler 1896* (COL); carretera en construcción entre Soatá-Onzaga, 2600 m, 24 Nov. 1967, *R. Jaramillo-Mejía 4199* (COL); carretera entre Uvita y Cusagui, alto de las Borregas, 2975 m, 24 Nov. 1967, *R. Jaramillo-Mejía 4248* (COL); Villa de Leyva, vereda La Capilla, cerca de la Antena de radio aficionados, 2483 m, 5º41' N, 73º29' W, 11 Jul. 1996, *H. Mendoza 1938* (COL). **Caldas**: Aránzazu, vereda El Diamante, finca El Porvenir, 2649 m, 5º15' N, 75º25' W, 22 Jul. 2009, *L.F. Coca 66* (FAUC); Manizales, Cerro Sancancio, base izquierda de la vía, 2200 m, 5º2' N, 75º29' W, 2 Aug. 2012, *D. Sanín 5700* (FAUC); Neira, vereda Manga Bonita, finca San Juan, 2530 m, 5º9' N, 75º24' W, 9 Sep. 2004, *D. Sanín 768* (FAUC);

Pensilvania, vereda Líbano, 2400 m, 5º23’ N, 75º9’ W, 11 Jul. 1982, *L. Albert de Escobar 2098* (HUA); Riosucio, vereda El Claren, corregimiento de Bonafón, finca El Mirador, 1500–1800 m, 29 Jan. 2007, *D. Sanín 2805* (HUA). **Caquetá**: Cordillera Oriental, vertiente oriental, orillas del río Hacha, 1000 m, 3 Apr. 1940, *J. Cuatrecasas 9035* (COL). **Cauca:** Argelia, cuch. Naranjal, cuenca Guitara (Micay), robledal Andino, 2600 m, 2º15’ N, 77º14’ W, 5 Aug. 1994, *Becking 1542* (COL); Bolívar, corregimiento de Los Milagros en límites con Nariño, ascenso al páramo de Granadillos, 2500–3000 m, 1º45’ N, 76º54’ W, 1 Sep. 2003, *Aguilar 723* (CAUP); Inzá, vereda El Carmen, entre la vía Popayán-Inzá, en inmediaciones entre las torres 162 y 164, 2425 m, 24 Nov. 1998, *O. Ribera-Díaz 970* (COL); Popayán, La Capilla, 25 km al norte de Popayán, 1740 m, 24 May. 1944, *E.P. Killip 38464* (COL); Tambo, Parque Nacional Natural Munchique, La Romelia, 2100 m, 2º27’ N, 76º48’ W, 27 Sep. 2000, *Casañas-Suárez 563* (CAUP). **Cesar**: Codazzi, Cordillera Oriental, camino a Codazzi-Machiques, antes de la frontera, 2400 m, 11 Mar. 1959, *R. Romero-Castañeda 7545* (COL); Serranía del Perijá, Sabana Rubia, 2470 m, 5 Mar. 1959, *R. Romero-Castañeda 7399* (COL). **Chocó**: carretera Ansermanuevo-San José del Palmar, límite con el Valle del Cauca, alto del Galápago, 2100 m, 28 Aug. 1976, *E. Forero 2256* (COL); La Mansa, carretera Medellín-Quibdó, km 105–500, en bosque que circunda la antena de Telecom, 2300 m, 2 Jul. 1983, *Mejía 112a* (COL); San José del Palmar, vereda Corcovados, La Esperanza, 1950 m, 19 Jan. 1983, *S. Díaz-Piedrahita 3708* (COL). **Cundinamarca**: Sasaima, vereda de Guane, entre los ríos Gualibá y Guane, 11 Jan. 1974, *H. García-Barriga 20472* (COL); San Bernardo, vereda Santa Rita, 2300 m, 25 Jul. 1981, *S. Díaz-Piedrahita 3145* (COL); San Cayetano, hacienda Portugal, laguna de La Béssia, 2800 m, 18 Nov. 1972, *A. Cleef 6551* (COL); Subachoque, vereda El Tobal, finca El Cerro, 2960 m, 3 Nov. 1989, *Hernández-Schmidt 362* (COL); Usaquén, camino de La Calera, 2700 m, 8 Jun. 1974, *C.E. Acosta-Arteaga 449* (MEDEL). **Huila**: Acevedo, carretera a San Adolfo-La Victoria, 1300 m, 4 Apr. 1983, *Osorio 156* (COL); La Argentina, arriba de la finca Palmira, 2100–2300 m, 28 Sep. 1984, *G. Lozano 4236* (COL); Nátaga, Serranía de las Nieves, vereda El Orozco, finca Miraflores, 2050 m, 2º32’ N, 75º48’ W, 20 Sep. 2006, *Ótalora 262* (CAUP); vía Popayán y La Plata, 27 Jul. 1979, *I. Cabrera 5081* (CUVC); San Agustín, vereda Planares, relicto arriba de la escuela Planares, 2147–2150 m, 1º59’ N, 76º17’ W, 1 Jul. 2009, *D. Sanín 3262* (FAUC). **Magdalena**: Manaure, mountains just east of Manaure, 1900 m, 16 Apr. 1944, *O. Haught*

4097 (COL); Sierra Nevada de Santa Marta, NE end of Serranía San Javier, 1900–2200 m, 5 Aug. 1972, *J.H. Kirkbride 1902* (COL); Sierra Nevada de Santa Marta, on trail from finca Reflejo to finca Cecilia in quebrada E of quebrada Indiana, 1700 m, 1 Sep. 1972, *J.H. Kirkbride 2036* (COL); Sierra Nevada de Santa Marta, transecto del alto río Buritaca, 2100 m, 27 Jul. 1977, *R. Jaramillo-Mejía 5284* (COL). **Meta**: Acacías, colonia penal y agrícola de oriente, cuchilla de la meseta del Mirador, arriba del campamento de la Argentina, 1700 m, 6 Aug. 1981, *R. Jaramillo-Mejía 7287* (COL); Cordillera La Macarena (extremo nordeste), macizo Rengifo, cumbre y alrededores, 1300–1900 m, 6 Jan. 1951, *J.M. Idrobo 1135* (COL); al w de Villavicencio, ridge betwen río Negro and río Manzanares, 20 km west of Villavicencio, 890 m, 26 Aug. 1944, *A. Grant 9932* (COL). **Nariño**: La Cruz, corregimiento de Alto Mayo, vereda Escandoy, cerro Negro, 2900 m, 11 Jul. 1999, *Díaz-Ibarra 282* (CAUP); La Unión, cerro La Jacoba, 2000–2400 m, 12 Apr. 991, *B.R. Ramírez-P. 3464* (PSO), Pasto, isla La Corota, 2700 m, 8 Nov. 1979, *O. de Benavides 1952* (PSO); road betwen Pasto and río Bobo, bosque and pasture, 19 Jul. 1957, *A. Barclay 4673* (COL); San Francisco, carretera Pasto-Mocoa, entre el Mirador y San Francisco, 1500–2200 m, 27 Nov. 1967, *L.E. Mora-Osejo 4461* (COL). **Norte de Santander**: La Playa de Belén, Parque Nacional Natural los Estoraques, bosques de Piritama, 1900 m, 17 May 2001, *R. Galindo 450* (COL); Pamplona, along road between Pamplona and Chorro Colorado, vía Chiquinquirá, at km 128 marker, 2580 m, 7º22’ N, 72º38’ W, 4 May 1983, *T.B. Croat 56406* (COL); Sararé, Santa Librada, 1300–1600 m, 24 May 1959, *H. Bischler 1943* (COL); Chitagá, montes aledaños al río Chitagá, 2000–2550 m, 10 Aug. 1968, *L.E. Mora-Osejo 4564* (COL). **Putumayo**: San Francisco-páramo de San Francisco, 3200 m, 22 Nov. 1979, *O. de Benavides 2101* (PSO); Valle del Sibundoy, 2200 m, 5 Dec. 1962, *Bristol 404* (COL); Valle del Sibundoy, alta cuenca del río Putumayo, lado sur, 2200 m, 3 Jan. 1941, *J. Cuatrecasas 11654* (COL); 50 km de El Pepino en dirección occidental, 2050 m, 20 Nov. 1972, *O. Hagemann 1503* (COL). **Quindío:** Calarcá, vereda Planadas, 2900 m, 4º32’ N, 75º37’ W, 20 Sep. 1993, *C. Vélez 3425* (COL); Córdoba, finca Palma Hermosa, vereda Las Auras, 2800 m, 4º25’ N, 75º40’ W, 14 Dec. 1993, *C. Vélez 3670* (HUQ); Filandia, carretera El Roble-Morro Azul, 2270 m, 6º10’ N, 75º38’ W, 3 Sep. 1985, *Arbeláez G. 1057* (HUQ); Génova, vereda Río Gris Alto, reserva Natural El Jardín, 3000 m, 12 Nov. 1995, *C. Vélez 5826* (COL); Salento, vereda Boquía, sector Pata Sola, flanco sur-oriental del río Boquía, al frente del departamento del Quindío y detrás la

Reserva Natural Otún Quimbaya, 1980 m, 4º38’ N, 75º32’ W, 22 Jul. 2009, *D. Sanín 3103* (HUQ). **Risaralda**: Pereira, vereda Yarumal, finca Sinaí, 1400–1600 m, 5º2’ N, 75º7’ W, 17 Feb. 1997, *L.M. Álvarez-Mejía 2171* (FAUC); Santa Rosa de Cabal, finca El Cortijo, 2300 m, 4º51’ N, 75º32’ W, 17 Jan. 1988, *A. de Wilde 2542* (COL); Santuario, Parque Nacional Natural Tatamá, Monte Zancudo, 2840 m, 20 Jul. 2011, *D. Sanín 4240* (HUA). **Santander**: carretera entre Bucaramanga y Pamplona, arriba de Corcova, 2500 m, 5 Nov. 1969, *M.T. Murillo 1127* (COL); Los Santos, Mesa de Los Santos, 1500 m, 11 Dec. 1926, *E.P. Killip 15147* (COL). **Tolima**: Água Bonita, 3077 m, 20 Apr. 1946 *J.M. Duque-Jaramillo 3339* (FAUC); Ibagué, corregimiento de Juntas, vía escuela El Salto, 3696 m, 4º37’ N, 75º16’ W, 28 Jul. 2009, *D. Sanín 3177* (FAUC); Murillo, 9 km de Murillo hacia el Líbano, 2320 m, 4º52’ N, 75º10’ W, 8 Apr. 1984, *L. Albert de Escobar 4162* (HUA); Santa Isabel, vereda Purima, finca El Prado, Cordillera Central, vertiente Oriental, 2300 m, 2 Aug. 1980, *J.M. Idrobo 10452* (COL). **Valle del Cauca**: Buga, Carretera Buga-El Placer a 33 km al este de hotel Guadalajara, finca El Diluvio, Cordillera Central, vertiente occidental, 2425 m, 4º12’ N, 76º9’ W, 9 Nov. 1991, *P. Silverstone-Sopkin 6414* (CUVC); Cali, Parque Nacional Natural Farallones de Cali, vereda Pance, Reserva Amor y Paz, vía a Balcones, Pico Pance, 2500–3000 m, 21 Jan. 2009, *D. Sanín 2704* (CUVC); Cali, hoya del río Cali, El Recuerdo, 2000 m, 24 May. 1944, *J.M. Duque-Jaramillo 1892* (COL); Florida, corregimiento de Pueblo Nuevo, de Las Dantas a la vereda Cajones, margen derecha del río Desbaratado, 2500 m, 1 Aug. 1990, *Sarria 740* (COL); Palmira, Potrerillo, La Nevera, finca EL Orisol, carretera Potrerillo-Ataco, 2550 m, 25 May. 1990, *Ruíz 934* (CAUP).

COSTA RICA. **Cartago:** Turrialba, along Quebrada Platanillo near confluence of Quebrada Sipiri, Platanillo de Chirripó, 1135 m, 9º49’00” N, 83º24’30” W, 2 Mar. 1990, *M. Grayum & D. Hodel 9737* (F). **Limón:** Limón, Chirripó, Fila de Matama, Admirante, 1060-1330 m, 9º46’15” N, 83º20’15” W, 10 Aug. 1993, *A. Rojas et al. 2289* (INB).

DOMINICAN REPUBLIC. **Morne Colla Anglais:** 610–732 m, 16 Feb. 1940, *W.H. Hodge 1181* (NY).

ECUADOR. **Azuay:** the eastern Cordillera, 1–8 km north of the village of Sevilla de Oro, 2400–2700 m, 27 Jul. 1945, *W.H. Camp 4588* (F). **Cotopaxi:** Km 78, Quevedo-Latacunga, 2750 m, 9 May 1981, *C. & P. Dodson & W. & P. Clendenin 10661* (Q). **Charchi:** Valle de Maldonado, km 71 on road Tulcán-Maldonado, 2100–2200 m, 00º54’ N, 78º6’ W, 20 May

1973, *L. Holm-Nielsen et al. 6096* (AAU, F!). **Esmeraldas:** *A. Sodiro* 8/904 (SI). **Imbabura:** Shanshipamba, La Esperanza, 2950 m, 16 Nov. 1949, *M. Acosta Solis 14385* (F). **Morona-Santiago:** Parque Nacional Sangay, Lagunas de Sardinayacu, Sendero desde el refugio 3 a las orillas del río Volcán, 1600–1700 m, 2º4'27" S, 78º13'13" W, 21 Jan. 2015, *A.J. Pérez et al. 8014* (QCA). **Napo:** caminho Santa Barbara-La Bonita km 20–22, 2100 m, 00º25' N, 77º30' W, 17 May 1982, *E. Baslev et al. 2612* (F!, QCA); Napo, Quijos, 2.5 km N of Cosanga, 2150 m, 00º30' S, 77º52' W, 18 Feb. 1978, *J.H. Kirkbride & H. Chamba 4152* (Q). **Pastaza:** Río Chicó, afluente of río Pastaza, village of Río Chicó, approx. 10 km S of Puyo, 5 km. S of Tarqui, 1000 m, 1º30' N, 77º55' W, Aug. 1979, *M. Shemluck & F. Ness* 203 (F); Mera, 1100 m, 25 May 1968, *G. Harling et al. 10126* (F). **Pichincha:** Reserva Florística-Ecológica Río Guajalito, km 59 de la carretera antigua Quito-Sto. Domingo de los Colorados, 3.5 Km al NE de la carretera, estribaciones occidentales del Volcán Pichincha, 1800–2200 m, 00º12'53" S, 78º48'10" W, 30 Jun. 1985, *J. Jaramillo & V. Zac 7914* (F!, MO). **Sucumbíos:** Alto Río Chingual, Canyon above Chingual Bridge, on new road to Bonito-Tulcán, above Puerto Libre, 1000 m, 00º19' N, 77º3'' W, 8 Jul. 2000, *R. Aguinda et al. 903* (F). **Tungurahua:** *A. Sodiro 12/904* (QLPS); Caserío Runtún, in the vicinity of Baños, 1 m, 28 Apr. 1969, *H. Lugo 1206* (F, Q); Baños, W of Baños, up the valley South, W side of río Bascun, 2200 m, 1º24' S, 78º26' W, 3 Jul. 1992, *A. Fay & L. Fay 3522* (F). **Zamora-Chinchipe:** Reserva Tapichalaca, study plot B6, on N slope of Cerro Tapichalaca, 2660 m, 4º29' S, 79º7' W, 29 Oct. 2003, *M. Lehnert 1011* (QCA).

GUADELOUPE. 1862, *M. l'Herminier* (F); 1895, *P. Duss 4070* (F).

PANAMA. **Coclé:** El Valle de Antón, 600 m, 21 Mar. 1945, *H. Trapido & G.B. Fairchild B1011* (F).

PERU. **Amazonas:** Bongara, 4 km N of Pomacochas on road to Rioja, trail down gorge to W of road, 2150–2200 m, 5º40' S, 77º22' W, 2 Jun. 1986, *S. Knapp et al. 7525* (F). ca. 12–18 km E trail of La Peca in Serranía de Bagua, 1800–1950 m, 14 Jun. 1978, *A. Gentry et al. 22906* (F). **Ayacucho:** Aina, between Huanta and río Apurimac, 750−1000 m, 7 May 1929, *E.P. Killip & A.C. Smith 23140* (F). **Cajamarca:** Cutervo, entre San Andrés y El Suro, ruta a Santo Tomas, 2400 m, 4 Nov. 1991, *L. Sanchez Veja et al. 6011* (F); Bosque Cutervo, Parque Nacional de Cutervo, NW corner of Cordillera Tarros, Chorro Blanco ca. 10 km W of San Andres de Cutervo, 2550 m, 6º12' S, 78º46' W, 5 Nov. 1990, *M.O. Dillon et al. 6179*

(F). **Huánuco**: Pachitea, Chaglla, Yanano, 1828 m, 13 May 1923, *J.F. Macbride 3817* (F). **Junín:** Chanchamayo, río Rondayacu, 45 km from San Ramón, 1880–1950 m, 11º20' S, 72º20' W, 15 Oct. 1982, *D. Smith et al. 2619* (F!, MO); Schunke Hacienda, above San Ramón, 1400–1700 m, 8 Jun. 1929, *E.P. Killip & A.C. Smith 24592* (F). **Pasco:** Oxapampa, km 53 on road between Oxapampa and Paucartambo, 1950 m, 10º37' S, 75º33' W, 10 May 1982, *D. Smith & A. Pretel 1486* (F). **Piura:** Ayabaca, Ruinas de Aypate, comunidade campesina Tacalpo, anexo Yanchalá, 2700–2800 m, 4º42' S, 79º34' W, 21 May 1996, *V. Quipuscoa et al. 502* (F). **San Martín:** Rioja, 100 km from Rioja on road to Pomacocha (Florida) km 384 of carretera marginal, 1900 m, 5º45' S, 77º35' W, 16 Feb. 1985, *B. Stein & C. Todzia 2190* (F).

VENEZUELA. **Amazonas:** Río Negro, Cerro Aracamuni, summit. Proa Camp., 1400 m, 1°32' N 65°49' W, 31 Oct. 1987, *R.L. Liesner & G. Carnevali 22691* (MO). **Falcón:** Sierra de San Luis, vecindad del hotel Parador, al sur de La Tabla, 1450 m, 16 Jul. 1967, *J.A. Steyermark 98901* (F). **Lara:** Distrito Jiménez: hills along road between Alto del Viento to Cerro Pando, 1000–1700 m, 9°39' N 69°34' W, 26 Oct. 1982, *G. Davidse & A.C. González 21185* (MO). **Mérida:** between Mucuchachí and Canaguá, 1065–1820 m, 6 May 1944, *J.A. Steyermark 56352* (F). **Portugueza:** Laderas selvaticas, 13 kms al Este de Chabasquén, 1325 m, 9°26'27" N 69°54'55" W, 29 Oct. 1982, *J.A. Steyermark et al. 126625* (MO). **Táchira:** Distr. Lobatera; La Cazadora, 1600 m, 7°55'N, 72°18'W, 24 Jul. 1983, *H. van der Werff & R.E. Ortíz 5624* (MO).

23. Serpocaulon loriceum (L.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium loriceum* L., Sp. Pl. 2: 1086. 1756. *Marginaria loricea* (L.) C. Presl, Tent. Pterid. 188. 1836. *Goniophlebium loriceum* (L.) J. Sm. ex Hook., Gen. Fil. 51. 1840. TYPE: Martinique. Morne de la Calebasse, *Plumier s.n. in Herbarium Tournefort 5301* (P-TRF) (lectotype designated by Proctor (1977: 331): Petiver (1712, Pter. Amer. Pl. 7, fig. 10), which is a redraw from Plumier (1705, Trac. Fil. Amer. Pl. 78); epitype designated by Cremers & Aupic, 2008): P [bc] 00322168 image! and spores!). Figures 20f, 23d, 69, 72e.

Goniophlebium arcuatum Feé, Mém. Foug., 5. Gen. Filic. 255 (1852). TYPE: Martinique. *M. Rivoire s.n.* ((lectotype designated by Windisch (1982: 58): RB [bc] 216378!).

Polypodium chartaceum Baker, J. Bot. 15: 166. 1877. TYPE: Ecuador. Pichincha: near [San José de Nieblí], Dec. 1871, *A. Sodiro 48/43* (**lectotype here designated**: K [bc] 000642065 image!).

Plants hemiepiphytic or terrestrial. *Rhizomes* 2.7–5 mm diameter, long-creeping, dark brown, pruinose; phyllopodia distance 1.2–8.5 cm. *Rhizome scales* disperse, 0.7–1 × 0.5–0.8 mm, rounded to elliptic, appressed, peltate, bicolourous, light brown to the margin and dark brown to the center, base rounded, apex rounded to widely acute and appressed, erose margin. *Fronds* 22–89 cm long. *Petioles* 7.5–38 cm long, proximally subterete, distally sulcate 1/3 part and softly winged to 1 mm wide, dark brown, distally become light brown. *Laminae* 14–51 × 5–23 cm, lanceolate, narrowly deltate to linear-lanceolate, pinnatisect, truncate, rarely slightly reduced and reflexed proximally, distally gradually tapering in an attenuate segment. *Segments* 17−39 pairs, chartaceous to coriaceous, proximal surcurrent, medial and apical decurrent, gradually tapering. *Medial segment* 2.3−11 × 0.6−1.5 cm, base decurrent and apex acuminate, venation forming 10−21 rows along and 1−2 rows of areoles between the costae and the margin, impressed. *Laminar induments* segments scales scarce, in the base of the segments, 4−8 × 1.5−2.5 mm, ovate-lanceolate, 19–25 cells wide, appressed, concave, basifixed, concolorous, dark brown, rounded base and acuminate apex, the margins slightly dentate-ciliate. *Hairs* scarce, 7−9 cells long, catenate, hyaline, patent, light brown with dark insertion. *Sori* from the medial segment 7−20 rows along and 1−2 rows between the costa and the margin, barely reaching the apices of the segments, the terminal segment is frequently fertile. *Spores* 47−53 × 30−34 µm, ellipsoidal plane-convex to concave-convex, with prominent verrucae.

Distribution and habitat. Serpocaulon loriceum occurs from Costa Rica, Antilles (Cuba, Dominica, Dominican Republic, Granada, Guadeloupe, Haiti, Jamaica, Martinique, Puerto Rico, St. Vincent) to Colombia, Venezuela, and rarely in Ecuador, in humid forest from 150 to 2000(−3020) m. Smith et al. (2006) suggested that occurs in Nicaragua, Trinidad and Guianas without citing specimens. In this respect, no sheet from those countries were traced, suggesting that those records probably are misidentifications with *S. falcaria*, following its morphological similarities and sympatric distribution in Central America.

Phenology. It was recorded fertile in January, March, April to December.

Notes. Serpocaulon loriceum could be distinguished by the combination of long-creeping, pruinose rhizome with rounded scales, conspicuous laminar scales, located at the base of the segments, 3 to 6 times bigger that the rhizomes scales, first row of sori often growing next to the rachis, and in the apical segment distributed until the tip of it. *S. loriceum* most resembles *S. funckii*, *S. maritimum* and *S. ptilorhizon*, that also possess long-creeping rhizomes, appressed scales with appressed apex and pinnatisect laminae. However, differs from *S. funckii* by its longer petioles (7.5–38 cm vs. 2.5–14 cm long), bigger laminae (14–51 cm vs. 4–28 cm long), and lanceolate, narrowly deltate to linear-lanceolate laminae (vs. linear-lanceolate), in addition, its predominantly distribution in low to middle lands (150 m to 2000(−3020) vs. 1240 to 3000 m) can be important to discriminate them (Figure 17d). From *S. maritimum* differs by the hairs with more cells long (7–9 vs. 2–5 cells), and the acuminate apex of the segments (vs. widely cuspidate). Finally, differs from *S. ptilorhizon* by bigger petiole (7.5–38 cm vs. 1.5–17 cm), bigger laminae (21–42 cm vs. 9.5–21 cm long), more number of segments (20–36 vs. 11–24 pairs), more number of areolar along the medial segments (10–21 vs. 5–9 rows) and the apical segments slightly attenuate (vs. long attenuate).

Taxonomic and nomenclatural notes. Although *Serpocaulon loriceum* represents the type species of the genus, Smith et al. (2006) did not designated a type. This was probably due to the nomenclatural complexity of this name: Linnaeus (1753) described *Polypodium loriceum* based on a re-drawing of Petiver (1712, in fig. 10), which was in fact was a line drawing made by Plumier (1705, in pag. 78) that supported the original polyname. Later, Proctor (1977) designated Petiver's drawing as lectotype. After tracing the type at P, Cremers and Aupic (2008) epitypified the specimen used by Plumier to prepare the original drawing (*Plumier s.n. in Herbarium Tournefort 5301,* P-TRF, P [bc] 0032216, from Martinique). This sheet does not have rhizome. Because rhizome scales, as well as the pruinosity of the rhizome and the distance between the phyllopodia are important features to discriminate it from *S. falcaria*, the other sympatric species, its taxonomy has been obscure. Nevertheless, the spores of both types were studied here, finding remarkable differences in the ornamentation, named

as the presence of irregular depressed verrucae in *S. falcaria* and prominent verrucae in the case of *S. loriceum.*

Apparently, the complexity, tradition and antiquity of this name promoted that many names were described as varieties or forms of *P. loriceum* (i.e. *P. loriceum* var. *nanegalense* syn. of *S. nanegalense*, *P. loriceum* var. *squamuligera* syn. of *S. nanegalense*, *P. loriceum* fo. *duplisorum* syn. of *S. falcaria*, *P. loriceum* var. *obscurum* syn. of *S. concolorum*, etc.). Hensen (1990) included in its synonymy the species recognized later by Moran (1990; 1995) and Smith et al. (2006), as well as in the present contribution: *S. funckii* and *S. ptilorhizon*. However, Hensen (1990) mentioned that this is a complex taxon mainly distributed in Central America and the Caribbean, but also widespreading to Peru. The author suggested that *P. loriceum* is very similar to *P. latipes*, probably because he included *S. falcaria* as a synonym of the latter. Moran (1990; 1995) suggested that more research is necessary to clarify the species that were lumped by Hensen (1990). By his part, Lellinger (1985; 1989) and Proctor (1977; 1989) proposed several names as a synonym of this taxa, where most of them were indeed, synonyms, but from *S. falcaria*, *S. maritimum*, *S. nanegalense* and *S. concolorum*, or were considered here as *nomina dubia*.

Goniophlebium arcuatum Feé was described by Fée (1852), based on *M. Rivoire s.n.* from Martinique, without indicating any herbaria. Because most of Fée's collections are at P, it was expected that the type of this species was also there. However, this sheet was not foundat P, being found at RB instead. Windisch (1982: 58) inadvertently lectotypified this name when listed it in his article. Smith et al. (2006) cited this name as synonym of *P. loriceum* = *S. loriceum*, mentioned that they follow Hensen's recommendation. However, Hensen (1990) cited *Goniophlebium arcuatum* Feé as a synonym of *S. latipes*. After reviewing the types of this name, it was possible to confirm the former affirmation.

Polypodium chartaceum Baker, was described by Baker (1877) based on Sodiro's collection. Nevertheless, the author did not designate the type. Following the recommendation of Turland et al. (2018, Art. 9.3) it is here designated the sheet *A. Sodiro 48/43* housted at K (K [bc] 000642065) because it represents the protologue, the collection date of 1871 is earlier than the publication date, and it is fertile and complete. The specimens of this species, v.g. (*A. Barfod et al. 48753,* AAU, QCA!; *L. Sodiro 9/73*, Q), exhibits small laminae (17−21 cm long), with lanceolate shape, 22−28 segments, and straight, wide and

pruinose rhizome. Here those specimens are included and considered as a synonym of *S. loriceum*. However, they may represent another taxon with restricted distribution in Ecuador, but more evidence is necessary to confirm this.

Chromosome number. n: 37 Walker (1985).

Representative specimens. COLOMBIA. **Antioquia:** Frontino, Parque Natural Nacional Las Orquídeas, sector Venados, vereda Venados Abajo, sitio La Esperanza, cuenca de la Quebrada Arenales, 1000−1300 m, 6º32' N, 76º17' W, 27 Jul. 2011, *D. Sanín 5087* (COL, NY); Medellín, corregimiento de Altavista, vereda Manzanares, cabecera de la quebrada La Colástica (La Peña) y La Perla, 2000 m, 7 Jul. 1996, *D. Giraldo 888* (JAUM). **Chocó:** San José del Palmar, Cerro Torrá, vertiente nororiental, arriba del helipuerto, 1875−1905 m, 6 Jan. 1984, *P. Silverstone-Sopkin 1572* (CUVC). **Huila**: Pitalito, vereda Charguayaco, reserva de la comunidad El Arroyuelo, 1925 m, 28 Jul. 2009, *D. Sanín 3221* (FAUC). **Norte de Santander:** Herrán, Parque Nacional Tamá, sector Orocue, hacia el alto del Pesebre, 2650−3020 m, 2 Apr. 1987, *G. Lozano 5491* (COL).

COSTA RICA. **Alajuela:** around summit and old crater lake of Volcán Poás, 2500– 2650 m, 6 Jul. 1967, *J.T. Mickel 2447* (LP). **Guanacaste:** 8 km from Tilarán on first road leaving the W side of the town, Oxcart trail into banana plantation, 500 m, 26 Jul. 1967, *J.T. Mickel 2899* (LP!, NY).

CUBA. Have Christiania, *F.A. von Eggers 4976* (F). Prope villam Monte Verde dictam, Cuba Orientali, Jan-Jul 1859, *C. Wright 827* (NY). **Santiago de Cuba:** Sierra Maestra, Loma de Gato, 150 m, [19°59'22'' N 76°50'9'' W], 11 Jul.–14 Aug. 1921, *León et al. 9842* (NY); Loma de Gato, 150 m, 1923, *A. Féurier 642* (SP).; Upper slopes and summit of Gran Piedra, Oriente, 900−1200 m, 14 Apr. 1907, *W.R. Maxon 4042* (NY). **Holguín:** Sierra Nipe, near Woodfred, Oriente, near Bandera Trail, 450−550 m, [20°32'56'' N 75°30'16'' W], 20 Jan. 1910, *J.A. Shafer 3514* (NY).

DOMINICA. **Saint George:** Laudat, 365 m, [15°18' N, 61°23' W], 1903, *F.E. Lloud 189* (NY). Shanford Estate, Roseau Valley, 1903, [15°18' N, 61°23' W], *F.E. Lloyd 392* (NY). **Saint Joseph:** near end of passable road below Mt. Joy, S of the Layou Valley, 243 m, 29 Sep. 1965, *D.B. Lellinger 407* (LP).

DOMINICAN REPUBLIC. **Sabaneta:** Monte Cristy, Las Cidras, 5−600 m, 8 Nov. 1938, *E.J. Valeur 530* (F). **Santo Domingo:** Santiago, Cordillera Central, Las Lagunas de Cenoví, aprox. 3.5 hr por mulo al Sur de El Aguacate, (de Monción), en laderas del arroyo Caña, 1050−1100 m, 20 Nov. 1989, *T. Zanoni et al. 43736* (NY). **Silvania:** 457 m, 31 Jan. 1933, *G. Proctor Cooper III 99* (F).

ECUADOR. **Carchi:** San Marcos Valley, 600 m, 1º7' N, 78º22' W, 20–24 Nov. 1983, *A. Barfod et al. 48753* (AAU, QCA!). **Pichincha:** Niebly, *L. Sodiro 9/73* (Q).

GRENADA. **Grand Erang:** 4 Oct. 1945, *P. Beard 1261* (F). 22 Mar. 1905, *W.E. Degadway s.n.* (NY).

GUADELOUPE. **La Grande Soufrière**: *Blanchon 52* (F).

HAITI. **Massif de la Hotte:** Grand'Anse, 41 km Sur de Roseaux donde la Carretera a Camp Perrin cruce el Riviére Glacé, 720 m, 18º25' N, 73º54' W, 13 Nov. 1982, *T. Zanoni et al. 24101* (NY). **Port Margot:** to Correil, 518 m, 8 Aug. 1903, *G.V. Nash 280* (F).

JAMAICA. 1874−1879, *Jenman s.n.* (NY). **St. Andrew:** Blue Mountains, Catherine's Peak, 1371 m, 25 Jan. 1888, *F.A. von Eggers 3642* (F).

MARTINIQUE. 1883, *P. Duss 1661* (F). Font de l'Alma, 450 m, 6 Sep. 1937, *H. Stehlé 2104* (F). 1968, *T. Husnot 383* (F). **Gros-Morne:** Ruelle Bagatelle, Camp. Jacal, route de la cascada de la Cascade de Yaucheles, 1894, *P. Duss 4072* (F).

PUERTO RICO. 1990, *A.A. Steller s.n.* (F); Adjuntas, Ad arbores sylvae in Mte Capaes., [18.2005737 -66.740797], 29 Mar. 1886, *P.E.E. Sintenis 4093* (F!, NY).

St. KITTS. 1889, *J. H. Berkeley s.n*. (NY)

ST. VINCENT. Along Chateaubelair river, 300−400 m, [13°10' N 61°14' W], 16−25 Apr. 1947, *C.V. Morton 5178* (LP).

VENEZUELA. **Aragua:** Parque Nacional Aragua, Rancho Grande, 1000 m, 12 Feb. 1938, *L. Williams & A.H. Alston 10760* (F), Parque Nacional Aragua, Rancho Grande, 1000 m, 2 Dec. 1931, *L. Williams & A.H. Alston 157* (RB). **Bolivar:** Chimantá Massif, between Bluff Camp and low promontory north of Bluff Camp, along the west-facing portion of Chimantá-tepuí (Torono-Tepuí), 1600−1700 m, 5 Jun. 1953, *J.A. Steyermark 75647* (F). **Caracas:** El Avila, 1600−1800 m, 31 Sep. 1937, *C. Vogl 120* (F). **Maracay:** 1939, *P.C. Vagl s.n.* (F). **Miranda**: Parque Nacional Guatopo, boundary between Estado Miranda and Estado Guárico, NE of highway, 18 km (by air) NW of Altagracia de Orituco, 800−950 m, 10º2' N

66º26’ W, 28 Aug. 1979, *M. Nee 17861* (F). **Nueva Esparta:** Isla Margarita, río Reunción, 500 m, 12 Aug. 1903, *J.R. Johnston 169* (F).

24. Serpocaulon maritimum (Hieron.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium maritimum* Hieron., Bot. Jahrb. Syst. 34: 527. 1904. TYPE: Colombia. Valle del Cauca: Buenaventura, río Dagua, 0−300 m, *E. Lehmann 5035* (first step lectotype designated by Hensen (1990: 303): B; **second step lectotype**: B [bc] 200121047 image! here designated; isolectotypes F [bc] C0655813F!, K [bc] 000642063 image!, K [bc] 000642064 image!, US-00065829 image!); Colombia, Cauca, río Micay, 4 Oct. 1900, *E. Lehmann 8922* (syntype designated by Lellinger (1989: 276): B [bc] 200121048 image!; isosyntype P [bc] 00624563 image!). Figures 10b, 20c, 23d, 70, 71, 72f.

Polypodium beyerianum Rosenst., Repert. Spec. Nov. Regni Veg. 22 (606−608): 17. 1925. TYPE: Costa Rica. Cartago: Turrialba, 650 m, Aug. 1909, *A. Brade & C. Brade 21* (lectotype designated by Lellinger (1985: 387): S [bc] S-R-5045 image!; isolectotypes: B [bc] 200087535 image!, NY [bc] 00144828 image!, UC [bc] 405667 image!). **New syn.**

Plants epiphytic or terrestrial. *Rhizomes* 2.8–5 mm diameter, long-creeping, notoriously curved, light to dark brown or reddish, pruinose to scarce pruinose; phyllopodia distance 2.2–13 cm. *Rhizome scales* disperse when mature, dense at the apex, 0.9–1.5 × 0.5–0.9 mm, rounded to ovate, appressed, peltate, bicolorous, light brown to the margin and dark brown to the center, base rounded, apex acute to rounded to widely acute, appressed, erose margin. *Fronds* 19–59 cm long. *Petioles* 2.5–27 cm long, proximally subterete, distally sulcate 1/3 part, dark brown to light brown. *Laminae* 17–32 × 5–15 cm, lanceolate, pinnatisect, truncate base and apex gradually tapering. *Segments* 16–38 pairs, coriaceous, proximal reflexed and surcurrent, medial and distal decurrent, gradually tapering to a caudate segment, 1.4−6 cm. *Medial segment* 2.7−5.5 × 0.6−1.5 cm, base decurrent and apex acute, attenuate to widely cuspidate, venation forming 14−26 rows along and 1−2 rows of areoles between the costae and the margin, notoriously impressed. *Laminar induments* segments scales scarce, 0.7−1.3 × 0.5−0.8 mm, triangular to lanceolate, to 3 cells wide, appressed, basifixed with notorious

insertion, concolorous, dark brown, base rounded and acuminate apex, the margin dentate. *Hairs* scarce, 2−5 cells long, catenate, patent, hyaline, light brown with dark insertion. *Sori* from the medial segment in 12−19 rows along and 1−2 rows between the costa and the margin. *Spores* 48−58 × 30−42 µm, ellipsoidal plane-convex to concave-convex, with prominent verrucae.

Etymology. Its name referred to its distribution, generally from the sea level to lowlands from foothills of mountain ranges.

Distribution and habitat. Serpocaulon maritimum occurs from Honduras (Reyes-Chávez et al., 2018) to Ecuador, mainly in lowlands, from 50 to 1600 m, in humid forest. Despite Smith et al. (2006) and Reyes-Chávez et al. (2019) suggested its distribution to Peru, no exemplar was found in this country. In this respect, this contribution agree with the distribution previously suggested by Hensen (1990).

Phenology. It was recorded fertile all months of the year, except September.

Notes. Serpocaulon maritimum most resembles *S. funckii, S. latissimum*, *S. loriceum* and *S. ptilorhizon* that also possess long-creeping rhizomes with scales appressed and pinnatisect laminae with notoriously impressed venation. However, differs from *S. latissimum* by its smaller laminae (17−32 × 5.5−15 cm vs. 35−69 × 20−36 cm long) and a smaller number of areolae along the medial segments (14−23 vs. 26−48 rows). Both species are sympatric in Ecuador and Colombia, nevertheless, *S. maritimum* contrast by its northern distribution, due that *S. latissimum* inhabits from Colombia to Bolivia. From *S. funckii* and *S. ptilorhizon*, could be distinguished by its curved rhizome with dense scales (vs. rhizome strait with scale dispersed), and predominantly two rows of sori between the costa and margin (vs. 1 row of sori between the costa and margin). Finally, from *S. loriceum* could be distinguished by the curved rhizome with dense scales (vs. rhizome strait with scale dispersed), and the laminar scales smaller than the rhizome scales (vs. laminar scales 3 to 6 times bigger that the rhizomes scales).

Taxonomic and nomenclatural notes. Hieronymus (1904), designated two collections named: *Lehmann 5035* and *Lehmann 8922* to represents the name *Polypodium maritimum* Hieron. Hensen (1990) commented that those series represent syntypes and pointed that they were located at B (first step lectotypification). Follow recommendations of Turland et al. (2018, Art. 9.3) the sheet from *Lehmann 5035* (B [bc] 200121047) is chosen by the second step lectotype because it is complete, fertile and presents the handwriting of the collector.

Despite that in the protologue of *Polypodium bayerianum* Rosenst., two collections were designate as syntypes: *A. Brade & C. Brade 21* (B), and *L. Beyer 44* (not assigned or traced), Lellinger (1985) designated the former as lectotype, probably by the absent of the latter in collections. The specimens that support the name *P. beyerianum* are considered here as part of the synonymy of *S. maritimum*, as was suggested by Hensen (1990) in contrast to Lellinger's and Smith et al. (2006) affirmations of being synonym of *P. loriceum* = *S. loriceum*.

Representative specimens. COLOMBIA. **Antioquia:** Urrao, corregimiento de Encarnación, vereda Calles Abajo, Parque Nacional Natural Las Orquídeas, vegetación al margen del camino entre la cabaña de Calles y La Raya, límite entre Frontino y Urrao, 1000−1280 m, 6º30' N, 76º15' W, 22 Jul. 2011, *D. Sanín 5134* (COL, NY); Valdivia, 6 Oct. 1977, *L. Atehortúa 304* (HUA). **Chocó**: Andagoya, 70−100 m, 20 Apr. 1939, *E.P. Killip 35490* (COL); hoya del río San Juan, carretera Andagoya-Condoto, cerca de Andagoya, 14 Apr. 1979, *E. Forero 5259* (COL, MO); Nóvita, inspección de Curundó, margen derecha del río Ingará, 400−550 m, 12 Jan. 1983, *S. Díaz-Piedrahita 3424* (COL); San José del Palmar, vereda La Badea, 900 m, 24 Jan. 1983, *S. Díaz-Piedrahita 3928* (COL). **Guajira**: Serranía del Macuira, 600 m, 3 Aug. 1975, *A. Sudgen 32* (COL). **Magdalena**: cerro Las Bóvedas, 700 m, 29 Jun. 1983, *C. Barbosa 1907* (COL). **Nariño**: Altaquér, 1066 m, 10 Nov. 1946, *R. Foster 2086* (COL); Barbacoas, vecindad El Diviso, 350 m, 3 May 1973, *H. Leist 2149* (COL); La Planada Reserve, 7 km from Chucunes, cloud forest, 7 Jan. 1988, *A. Gentry 60548* (PSO, MO); 5 km de Junín en dirección a Barbacoas, 1000 m, 20 Dec. 1972, *O. Hagemann 1750* (COL). **Valle del Cauca**: Buenaventura-El Queremal, old road from Cali, about km 32,5, plants by roadside, 1300 m, 6 Feb. 1984, *A. Juncosa 2004* (CUVC, MO); hoya del río Anchicayá, 400 m, 5 Nov. 1972, *O. Hagemann 1448* (COL).

COSTA RICA. **Alajuela:** Upala, Dos Rios, Estación San Ramón, Sendero Níspero, 550 m, 10º52'50" N, 85º24'5" W, 16 Aug. 1996, *F. Quesada 356* (INB!, MO); below the Methodist Rural Center, Quebrada Marín, about 7 km east of Ciudad Quesada, 500 m, 10º22' N, 84º24' W, 17 May 1968, *W.C. Burger & R.G. Stolze 4925* (F). **Cartago:** on the road from San José to Turrialba, 7 km E of Juan Viñas, roadbank, 850 m, 11 Jul. 1967, *J.T. Mickel 2605* (LP); South of Tapantí, along the new road on the east slope above the río Grande de Orosi, 1400–1600 m, m, 9º42' N, 83º47' W, 10 Jun. 1968, *W.C. Burger & R.G. Stolze 5631-A* (F). **Guanacaste:** 9 km of Tilarán, 450 m, 25 Jul. 1967, *J.T. Mickel 2884* (LP). **Heredia:** Sarapiquí, La Selva biological station, nearest grid post 2300, 50–150 m, 10º26' N, 84º1' W, 3 Jul. 2002, *M. Jones & P. Olivas 507* (INB); Sarapiquí, OET La Selva casa de Rafael, 100 m, 13 Jun. 2007, *O. Vargas 1832* (INB); Sarapiquí, on road between Cariblanco and San Miguel, 700 m, 10º16' N, 84º10' W, 12 Jul. 1983, *K. Barringer 3723* (F). **Limón:** Suerre, Llanuras de Santa Clara, 300 m, Feb. 1896, *J.D. Smith 6912* (F).

ECUADOR. **Charchi:** Surroundings of the village of Chical, 1250–1300 m, 1º4' N, 78º11' W, 1 Feb. 1985, *B. Øllgaard 57219* (AAU, F!); Chical, farmland, 1200 m, 1º5' N, 78º17' W, 16 Nov. 1983, *A. Barfod et al. 48651* (AAU, QCA!); **Pichincha:** forest at confluence of Rios Toachi and Pilaton, 919 m, 4 Apr. 1951, *P.R. Bell 290* (RB); Carretera Quito-Puerto Quito, Km 113, 800 m, 00º5' N, 79º2' W, 28 Apr. 1984, *A. Arguello & L. Ayala 481* (QCA); Santo Domingo de los Colorados, Loma, Bombolí, just NW of the town, 65 m, 00º15' S, 79º12' W, 6 Mar. 1991, *B. Øllgaard & M. Larrea 98844* (AAU, QCA!).

NICARAGUA. Castillo el Viejo: along the La Juana river, 1893, *B. Shimek 43* (F).

PANAMA. **Panama:** Cerro Campana, along trail to summit, Jun. 22 1972, *T.B. Croat 17197* (F!, MO). **Veraguas:** Río Segundo Braso, 8 km, beyond Escuela Agrícola, alto Piedra beyond Santa Fé, 750 m, 24 Jul. 1974, *T.B. Croat 25550* (MO, RB!).

25. Serpocaulon meniscifolium (Langsd. & Fisch.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium menisciifolium* Langsd. & Fisch., Pl. Voy. Russes Monde monde 11, pl. 12. 1810. *Marginaria meniscifolia* (Langsd. & Fisch.) C. Presl, 1836, Tent. Pterid. 189. *Goniophlebium meniscifolium* (Langsd. & Fisch.) J. Sm. ex Hooker, 1840, Gen. Fil. Pl. 51. TYPE: Brazil. "Insula St. Catharina", *G.H. Langsdorff 15* (**lectotype designate here**: LE [bc] 00000045 image!). Figures 5a, 7l, o, 17m, 21c, 23f, 73, 74, 84a.

Polypodium albo-punctatum Raddi, 9. Opusc. Sci. 3: 287. 1819. *Goniophlebium albo-punctatum* (Raddi) J. Sm. Companion Bot. Mag. 72: 12. 1846. TYPE: Brazil. *G. Raddi s.n.* (first step lectotype: PI, designated by Pichi-Sermolli & Bizzarri (2005), **second step lectotype**: PI [bc] 010886 image! here designated). **New syn.**

Polypodium elatius Schrad. Geott. Gel. Anz. 1824: 868. 1824. *Goniophlebium elatius* (Schirad.) Moore, Index fil. 389, 1862. TYPE: Brazil. Serra do Mar, *M. von Neuwided s.n.* (**lectotype designated here**: BR [bc] 0000006970611!).

Goniophlebium gauthieri Fée, Crypt. Vasc. Brésil 1: 112, pl. 34. 1869. *Polypodium gauthieri* (Fée) C.Chr., Index Filic. 326, 1905. TYPE: Brazil. "fluminensii", Rio de Janeiro, 1868, *A. Glaziou 2406* (first step lectotype: P, designate by Hensen (1990: 304), **second step lectotype**: P [bc] 00624555 image! here designated; isolectotypes: P [bc] 01581956 image!, P [bc] 00624556 image!); Brazil, Sta. Catharina, *Gauthier s.n.* (syntype designated here: RB [bc] 00543287!).

Goniophlebium excelsior Fée, Cryp. Vasc. Brésil 1: 204, pl: 34. 1869. TYPE: Brazil. Rio De Janeiro: St. Louis, Serra dos Orgues, Jun. 1869 *A. Glaziou 3334* (first step lectotype: B, designated by Hensen (1990: 304); **second step lectotype** mounted on 2 sheets: P [bc] 00624559 image!, P [bc] 00637493 image! here designated); isolectotypes: P [bc] 00624558 image!, P [bc] 00632826 image!, P [bc] 00632827 image!).

Polypodium mosenii C. Chr. Bot. Tiddskr 25: 78. 1902. *Goniophlebium mosenii* (C. Chr.) Pic. Serm. Webbia 31(1): 248. 1977. TYPE: Brazil. Minas Gerais: Vallée du Bomfim, *A. Glaziou 4422* (**lectotype designate here**: P [bc] 00624554 image!; isolectotypes P [bc] 00632997 image!, P [bc] 00632996 image!, B [bc] B 20 0142470 image!); Brazil, Minas Gerais, Caldas, *Mosén 2208* (syntype designated by Hensen (1990): C (not finded); isosyntype P [bc] 00632995 image!).

Serpocaulon hirsutulum (T. Moore.) Schwartsb. & A.R. Sm. Bot. Res. Ins. Texas 7(1): 90. 2013. *Polypodium hirsutulum* T. Moore. Index. Fil. (T. Moore) 390. 1862, *nom. nov.* for *Polypodium hirsutulum* Raddi, Pl. Bras. Nov. Gen. 21, t 29, fig 2. 1825, *nom. ileg.* (non G. Forst 1786). TYPE: [Brazil]. Super palmarum annosarum truncus inviciniis Urbis Rio-Janeiro, Nov. 1817–May 1818, *G. Raddi* s.n. (lectotype designate by Schwartsburd & Smith, 2013): PI [bc] 010870 image!). **New syn**.

Serpocaulon ×*pubescens* (Rosenst.) Schwartsb. & A.R. Sm., J. Bot. Res. Ins. Texas 7(1): 90. 2013. *Polypodium menisciifolium* Langsd. & Fisch. var. *pubescens* Rosenst. Repert. Spec. Nov. Regni Veg. 21(21–25): 348. 1925. TYPE: Brazil. São Paulo: Morro Jaraguá, 8 Dec. 1912, *A.C. Brade 5384* (lectotype designated by Schwartsburd & Smith, 2013): HB [bc] 39800 image!). **New syn**.

Plants epiphytic, rupicolous or rarely terrestrial. *Rhizomes* 0.6–1.5 cm diameter, short-creeping, brown to reddish, no pruinose, when fresh, with dark orange oxidation after cutting; phyllopodia distance 0.5–2.5 cm. *Rhizome scales* dense, 3–7 × 2–4 mm, ovate-lanceolate to lanceolate, patent, sub-peltate, bicolourous, brown to the center, and dark brown to the margin, base rounded to obtuse, apex acute to acuminate and patent, erose margin. *Fronds* 26–135 cm long. *Petioles* 8–41 cm long, proximally subterete, distally slightly sulcate, basally dark brown and distally light brown. *Laminae* 18–95 × 15–30 cm, ovate-lanceolate to narrowly lanceolate, pinnate, truncate and reflexed proximally and obtuse, acute to acuminate apex. *Pinnae* 6–36 pairs, chartaceous to coriaceous, in any case, basiscopically sessile and acroscopically slightly adnate to adnate, gradually tapering to a conform pinna, hydathodes in the adaxial surface placed at the end of the subsidiary sori free veinlets. *Medial pinna* 8–22 × 1–3 cm, base inequilaterous and apex acute to acuminate, venation forming 28–54 rows along and 2–4 rows of areolae between the costae and the margin, notoriously impressed. *Laminar induments* pinnae scales scarce, 1.6–2.4 × 0.6–1 mm, lanceolate, 11–29 cells wide, appressed, subpeltate with a notorious insertion, concolorous, dark brown, base rounded to auriculate and apex acuminate to long attenuate, the margins ciliate. *Hairs* scarce in the rachise, to dense (when juvenile) in the laminar tissue, 4–6(–9) cells long, catenate, patent, hyaline with dark brown dissections. *Sori* from the medial pinnae in 10–41 rows along and 1–2(–3) rows between the costa and the margin. *Spores* 37–42 × 20–25 µm, ellipsoidal, plane-convex to concave-convex, and irregular depressed verrucae.

Etymology. The specific epithet refers from the Latin *meniscifolium* meaning with crescent-shaped leaves (Stearn, 1996).

Distribution and habitat. Serpocaulon meniscifolium occurs restricted to the Atlantic Rain Forest from Brazil to Paraguay, from 8 to 1415 m, in humid forest.

Phenology. It was recorded fertile all months of the year.

Notes. *Serpocaulon meniscifolium* most resembles *S. attenuatum* and *S. triseriale* that also possess short-creeping rhizomes with patent scales and pinnate laminae (except *S. attenuatum* which exhibits laminae proximally pinnate and distally pinnatisect), with venation notoriously impressed. However, differs from *S. attenuatum* by the dark rhizome scales (vs. light orange), lamina apex conform (vs. pinnatisect) and their distribution, restricted in the Atlantic Rain Forest in the case of *S. meniscifolium* (vs. wide northern distribution, from Nicaragua to Pará state in Brazil). From *S. triseriale* differs by its dark rhizome scales (vs. light brown to orange), the inequilaterous base of the pinnae where the basiscopical side is sessile and the acroscopical slightly adnate to adnate (vs. equilaterous sessile, decurrent to slightly adnate).

When juveniles, specimens of *S. meniscifolium* also could be confused with *S. dissimile* by the dense pubescence and the short-creeping rhizomes with dark patent scales. However, could be distinguished by its dull, bicolorous, ovate-lanceolate to lanceolate rhizome scales with dense cell walls, making not possible to see across the scale (vs. iridescent, concolorous, linear-lanceolate scales with slim cell walls, possible to see across the scale).

Taxonomic and nomenclatural notes. Hensen (1990) mentioned that the lectotype of *Polypodium meniscifolium* Langsd. & Fisch. = *S. meniscifolium* was hosted at LE, however, he did not designate any collection. Due that Langsdorff and Fischer (1810) include an illustration that matches the specimen *G.H. Langsdorff 15* based at LE (LE [bc] 00000045), this sheet is chosen as lectotype following recommendation of Turland et al. (2018, Article 9.3).

Polypodium albo-punctatum Raddi was described by Raddi (1819) only mentioned the precedence from Brazil ‘Brasilia: “lnvenitur in opacissimis sylvis montium Estrella’. Pichi-Sermolli and Bizzarri (2005) designated as holotype a single sheet based at PI (*Raddi s.n.*). Although the holotype was chosen by Pichi-Sermolli and Bizzarri (2005) (first step

lectotype), the correct designation should be as lectotype (second step designation here) as suggested Turland et al. (2018, Art. 9.3). Lellinger (1989) proposed *Polypodium albo-punctatum* Raddi as a synonym of *P. triseriale* = *S. triseriale*. After revised the type image at PI (PI [bc] 010886), it was possible to verify the presence of white dots (hydathodes) in the adaxial surface of the lamina, as well as, inequilaterous base of the pinna. This agrees with Sehnem (1970) and Labiak and Prado (2008) that stressed this name as s synonym of *S. meniscifolium*.

The lectotype of *Polypodium elatius* Schrad was designated with an interrogation (?) based at LE by Hensen (1990). That sheet was not traced, reason why after studying the specimen *M. von Neuwided s.n.* (BR [bc] 0000006970611) here is designated as lectotype like suggested the Art. 9.3 (Turland et al. 2018).

Fée (1869) designated two collections in the protologue of *Goniophlebium gauthieri* Fée: *A. Glaziou 2406*, and *Gauthier s.n.*, without pointed any herbaria, situation that identified the named collections as syntypes (Article 9.6, Turland et al. 2018). Hensen (1990) designate as a lectotype the specimen *A. Glaziou 2406* (P), and as a syntype the collection *Glaziou s.n*. (P). After searching at P both specimens mentioned by Fée, it was only possible to find the sheet that Hensen (1990) designated to be as lectotype (*A. Glaziou 2406*, P [bc] 00624555), which is considered here as the first step lectotype. However, due that exist two sheets of this series at P, using the second step lectotypification (Art. 9.17, Turland et al. 2018), this gathering is chosen as lectotype. In addition, the specimen *Gauthier s.n.* was found at RB (RB [bc] 00543287), reason why it was chosen as syntype (Article 9.6, Turland et al. 2018).

Fée (1869) designated the series *A. Glaziou 3334* for the name *Goniophlebium excelsior* Fée, without mentioned any herbaria. Hensen (1990) designated the type at P without chosen any specimen and pointed that this name is a new synonym of *P. meniscifolium.* However, this series possess six sheets, two of them represents a complete individual (P [bc] P00624559, P [bc] 00637493), the apex of the lamina and the rhizome with the base of the lamina respectively and mentioned June as the data of collection. In some duplicates is consigned another data: 26 may (i.e. P [bc] 00624558, P [bc] 00632826, P [bc] 00632827), which disagree with the protologue. For this reason, and following Turland et al. (2018, Art. 8.3) are designated the former sheets as lectotype.

Polypodium mosenii C. Chr., was described based on the series *A. Glaziou 4422* and *Mosén 2208* and a specimen distributed to K and marked: *P. neriifolium* Schkunr, collected in Brazil (Christensen, 1902). Posteriorly, Hensen (1990) designated the first two series as syntypes. Follow Turland et al. (2018 Art. 9.6) here is designated the sheet *A. Glaziou 4422* (P [bc] 00624554) because it is complete, fertile and presents original handwriting of the collector. Further specimens were designated as syntypes by Hensen (1990).

After visiting the locality of Serra de São José in Tiradentes, Minas Gerais, Brazil, recommended by Schwartsburd and Smith (2013) as reservoir of *Serpocaulon hirsutulum* (T. Moore.) Schwartsb. & A.R. Sm., and *S.* ×*pubescens* (Rosenst.) Schwartsb. & A.R. Sm., it was possible to verify that in the same spot, specimens with (*D. Sanín 7138,* BHCB, F), and without dense hairs (*D. Sanín 7137,* BHCB, F) inhabit together. Features suggested by the authors as the main characters to discriminate *S. hirsutulum* from *S. meniscifolium*, both parentals of the hybrid: *S.* ×*pubescens*. In order to verify this, those specimens were cultivated from rhizomes for three years at controlled conditions in Belo Horizonte, Minas Gerais, Brazil, founding that both, the glabrous and pubescence specimens presents hairs when they produce juvenile fronds, and posteriorly they became glabrous, coriaceous and with more pinnae and bigger laminae. In addition, the laminar scales did not present differences in those specimens and are described and illustrated here (Figures 7l, o). Which was also suggested by Brade (1951) to considered *Polypodium hirsutulum*, as a juvenile form of *P. meniscifolium*. Hensen (1990) also commented 'I studied juvenile specimens of the species occurring in Brazil and discovered that the specimen illustrated by Raddi agrees perfectly with juvenile *P. meniscifolium*'.

The continuous in features described by Schwartsburd and Smith (2013) to support the differences between *Serpocaulon hirsutulum* and *S. meniscifolium*, as well as in its putative hybrid *S.* ×*pubescence*, like the number of pinnae: *S. hirsutulum* (9–13), *S.* ×*pubescens* (9–20(–25)) and *S. meniscifolium* ((20–)25–35) pairs, and the laminae size, 45–55 cm for the former species and 50–140 cm for *S. meniscifolium*. As well as, the revision of the types of *S. hirsutulum* and *S.* ×*pubescens*, here are considered both names as synonyms of *S. meniscifolium*, as were pointed by Sehnem (1970), Hensen (1990) and Pichi-Sermolli and Bizzarri (2005).

Langsdorff and Fischer (1810) published the epithet name '*menisciifolium*' with an additional 'i'. Smith et al. (2006), in the protologue of the genus, made the combination of this species as *S. meniscifolium*. Following Stearn (1996), the correct spelling is "meniscifolium", reason why here is recommended to conserv this orthography.

Representative specimens. BRAZIL. **Bahia:** Piatã, Serra de Santana, 2 Apr. 2010, 1260 m, 13º9'19" S, 41º45'55" W, *V.A.O. Dittrich et al. 1610* (CESJ). **Espírito Santo:** Castelo, 20º30'12" S, 41º4'51" W, 25 Jun 2008, *A. Salino et al. 13583* (BHCB); Castelo, Parque Estadual do Forno Grande, Trilha para o Forninho, 1100–1400 m, 20º30'58" S, 41º5'1" W, 17 Jul. 2008, *P.H. Labiak et al. 4807* (RB); Vargem Alta, ES–164 no km 332, entre Castelinho e Vargem Alta, a ca 1 km N do perímetro urbano de Vargem Alta, 663 m, 20º39'26" S, 41º0'20" W, 23 Jan. 2011, *P. Fiaschi et al. 3557* (SP). **Mato Grosso:** Aripuanã, Cachoeira Dardanelos, 200 m, -9º10' S, -60º37' W, 9 Oct. 1996, *P.G. Windisch 8551* (BHCB). **Minas Gerais:** Bicas, Faz. da Florestinha, 29 Nov. 1984, *L. Krieger & R.F. Velino-Camargo 20644* (BHCB!, CESJ!, UFJF); Bom Jardim de Minas, Serra da Bandeira, 1415 m, 22º00'45" S, 44º00'31" W, 28 Jan. 2017, *V.A.O. Dittrich et al. 2162* (CESJ); Caldas, 18 Dec. 1873, *Mosén 203* (R); 1854, *G. Lindberg 568a* (K); Carangola, Serra do Papagaio, 600 m, 20º38' S, 42º1' W, 7 Feb. 1995, *L.S. Leoni 2781* (BHCB); Chácara, Fazenda Fortaleza de Santana, 750 m, 21º66'00" S, 43º18'27" W, 13 Jun. 2012, *D.E.F. Barbosa et al. 101* (BHCB, CESJ); Delfim Moreira, Fazenda Boa Esperança, trilha do Marlon, 1313 m, 22º34'32" S, 45º19'20" W, 16 Mar. 2011, *T.E. Almeida et al. 2877* (BHCB); Mariana, Serra do Frazao, Mar. 1907, *L. Damazio 1487* (BHCB, R, RB); Muriaé, área de inundação da Usina Hidrelétrica de Cachoeira Encoberta, às margens do Rio Glória, 18 Apr. 1998, *A. Salino & P.O. Morais 4189* (BHCB, CESJ); Passa Vinte, Estrada que liga a sede do município à MG–457, 836 m, 22º11'8" S, 44º14'21" W, 14 Feb. 2009, *T.E. Almeida & D.T. Souza 1786* (BHCB); Rio Preto, Ninho de Égua, 9 Nov. 2005, *F.S. Sousa et al. 67* (BHCB, CESJ); Rio Preto, Serra do Funil, descida do Ninho de Égua, até o vilarejo do Funil, 21º58'59" S, 43º53'12" W, 11 Apr. 2007, *T.E. Almeida et al. 770* (BHCB, CESJ, SP); Santa Rita de Jacutinga, Usina Hidrelétrica Henrique Portugal, Rio Bananal, 14 Nov. 2000, *A. Salino & L.C.N. Melo 5884* (BHCB); Tiradentes, Serra de São José, campos rupestres e matas de galeria, 1002 m, 21º6'6" S, 44º12'4" W, 20 Jun. 2007, *T.E. Almeida et al. 1135* (BHCB);

Tiradentes, Serra de São José, descida do caminho Refúgio de Vida Silvestre Libélulas Serra São José, perto de uma casa não habitada, 1125 m, 21º5'7" S, 44º9'55" W, *D. Sanín 7137* (BHCB, F); Tiradentes, Serra de São José, descida do caminho Refúgio de Vida Silvestre Libelulas Serra São José, perto de una casa não habitada, 1125 m, 21º5'7" S, 44º9'55" W, *D. Sanín 7138* (BHCB, F). **Paraná:** Campo Largo, Serra São Luiz, 48 km a oeste de Curitiba, 28 Feb. 1951, *A. Frenzel s.n*. (BHCB, RB); Jacaré 5 Apr. 1914, *P. Dusén 14705* (F); Ponta Grossa, Vila Velha, 800–900 m, 25º13' S, 50º2' W, 20 Jan. 1965, *L.B. Smith & R.M. Klein 14908* (LP, R); Serra do Mar, Porto de Cima, 170 m, 2 Jan. 1914, *P. Dusén 14290* (F); Terra do Lar, Porto de Cima, 200 m, 24 Jul. 1914, *Jôrman 718a* (F); Tibagi, Canyon Guartelá, 13 Dec. 1996, *J.M. Silva et al. 1804* (BHCB). **Pernambuco:** Bonito, Mata da Colônia, 800 m, 8º30'14" S, 35º42'56" W, 19 Jun 1998, *I.C.L. Barros s.n. et al.* (PEUFR); Jaqueira, Usina Colônia, Mata do Ageró, 415 m, 18 Oct. 2001, *M.S. Lopes & M.R.S. Pietrobom 404* (RB); Mata da Chuva, 750 m, 8º32'20" S, 35º43'22" W, 7 May 1999, *I.C.L. Barros s.n. et al.* (PEUFR); Maraial, Lagoa dos Gatos, Serra do Urubu, 22 May 1998, *I.C.L. Barros 36 et al.* (PEUFR). **Rio de Janeiro:** Cachoeiras do Macacu, Reserva Ecológica de Guapiaçu, trilha Preta, 185 m, 22º24'59" S, 42º44'11" W, 12 Sep. 2010, *K. Baber & J. Wesenberg 525* (RB); Cachoeiras do Macacu, Estrada para a Reserva Ecológica Guapiaçu (REGUA), 50 m, 23 Apr. 2009, *A. Bonnet 5029* (RB); Itatiaia, Parque Nacional do Itatiaia, no final da rua, no desvio para a Cachoeira Véu da Noiva, 815 m, 22º27'3" S, 44º36'51" W, 25 May 2017, *D. Sanín et al. 6838, 6839, 6840* (BHCB); Itatiaia, Donati, 29 Nov. 1964, *R.E. Strang 635* (LP); Serro de Itatiaia, Mont Serrat, 800 m, 4 Jul. 1930, *A.C. Brade 10387* (R); Jacarepaguá, entre Jacarepaguá e Recreio dos Bandeirantes, 10 Aug. 1972, *Gomes* (BHCB, RB); Miguel Pereira, 18 Apr. 1980, *A. Sehnem 16694* (CESJ); Santa Maria Madalena, Fazenda Dubois (Propriedade do Sr. Portugal), base da pedra Dubois, 756–785 m, 21º56'53" S, 41º59'29" W, 28 Oct. 2014, *J.M.A. Braga 7526* (BHCB, RB); Teresópolis, Quebra Frasco, 17 Oct. 1929, *A.C. Brade 9717* (RB). **Rio Grande do Sul:** Osório, Santa Luzia, Fazenda do Arroio, 8 m, 29º58'37" S, 50º12'46" W, 21 Apr. 2015, *F. Gonzatti 1848* (CESJ); Porto Alegre, Morro Teresópolis, 17 Jun. 1980, *O. Bueno et al.* 2655 (F); Porto Alegre, 1906, *L.A. Lrièr 312* (SI); Porto Alegre, 7 Feb. 1952, *A.C. Brade 10192* (RB); São Leopoldo, Itapuã, *J. Dutra 177* (SI); Tapes, Faz. São Miguel, Área de Manejo, 30º32'3" S, 51º21'9" W, 30 Apr. 2014, *V. Klein 2* (ECT, RB!); Torres, 30 Jan. 1952, *G.F.J. Pabst 10167* (BHCB, RB). **Santa Catarina:**

Araranguá, 17 Nov. 1944, *R. Ruitz C860* (RB); Garopaba, 20 Dec. 1979, *A. Tosta Silva 173* (SP); Isla de Santa Catarina, Morro do Antão, 100 m, 10 Jul. 1948, *A. Sehnem 3146* (RB); 23 Jan. 1982, *A. Krapovickas & C.L. Cristóbal 37741* (F, LP); Vista Alegre, 50 m, 1 Dec. 1944, *R. Ruitz C867* (RB). **São Paulo:** Analandia, Serra do Cuscuzeiro, 940 m, 24 Apr. 1991, *A. Salino 88* (BHCB); Bananal, Estação Ecológica do Bananal, nas trilhas da Estação e da Pedra Vermelha, 1130–1350 m, 22º49'10" S, 44º21'58" W, 8 Mar. 2001, *A. Salino et al. 6296* (BHCB); Bragança Paulista, Estrada entre a cidade e a rodoviária Fernão Dias, 4 Jan. 1990, *A. Salino 883* (BHCB); Eldorado, Parque Estadual do Jacupiranga, Núcleo Caverna do Diabo, trilha da Agua Grande ou trilha da Ressurgência, 400 m, 24º37'39" S, 48º23'47" W, 25 Mar. 2005, *A. Salino et al. 10217* (BHCB); Itanhaém, Parque Estadual Serra do Mar, Núcleo Curucutu, 100–120 m, 24º9'59" S, 46º49'43" W, 17 May 2001, *A. Salino 6611* (BHCB); Planalto, entre unknown e div. com Paraná, 12 Jan. 1964, *E. Pereira & G. Pabst 7487* (LP); Salesópolis, Bacia do Paraitinga, próximo ao eixo da Barragem, 25 Apr. 2001, *S.A. Nicolau et al. 2827* (SP); São Luís de Paraitinga, Parque Estadual da Serra do Mar, Núcleo Santa Virgínia, trilha da Parapitinga, 950 m, 23º20'29" S, 45º8'48" W, 4 Mar. 2001, *A. Salino et al. 6118* (BHCB, CESJ); São Sebastião, Parque Estadual da Serra do Mar, sítio Urucurana, trilha do Escorrega às margens do Rio Una, 130 m, 23º42'42" S, 45º42'29" W, *A. Salino et al. 5359* (BHCB); São Paulo, Parque Estadual Serra do Mar, Núcleo Cunha, 15 Dec. 1996, *A. Salino et al. 2867* (BHCB); Ypiranga (Horto Bot.), May 1910, *H. Luerderwald s.n.* (SP).

PARAGUAY. **Canindeyú:** Salto del Guairá, 1921, *T. Rojas 3960* (SI).

26. Serpocaulon nanegalense (Sodiro) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium nanegalense* Sodiro, Recens. Crypt. Vasc. Quit. Species no. 49, pag. 65. 1883. *Polypodium loriceum* var. *nanegalense* Sodiro, Crypt. Vasc. Quit. 80: pag. 351. 1893. TYPE: Ecuador. Pichincha: Valle de Nanegal, *A.L. Sodiro 10.06* (**Neotype here designated**: S [bc] S-05−9729 image!). Figures 17n, 23b, 75, 76, 84b.

Plants epiphytic or terrestrial. *Rhizomes* 2.8−4.9 mm in diameter, long creeping, dark brown to reddish, generally no pruinose; phyllopodia distance 2.5−8 cm. *Rhizome scales* dense or scarcely dispersed along the rhizome, 3.6−7 × 0.8−2.2 mm, lanceolate to subulate,

appressed, subpeltate, bicolorous, light brown to the margin and dark brown to reddish to the center, base rounded, apex long-acuminated and patent, dentate margin. *Fronds* 20−100 cm long. *Petiole* 10−35 cm long, proximally subterete, distally sulcate, dark brown and lustrose. *Lamina* (11−)25−66 × 12−26 cm, lanceolate, pinnatisect, truncate and reflexed base and gradually tapering to a caudate attenuated apex. *Segments* (10−)21−39 pairs, chartaceous, proximal surcurrent and reflexed, medial and apical decurrents, apical segment caudate 2−6 cm long. *Medial segment* 6−13.5 × 0.9−2.5 cm, base decurrent and apex acuminate, venation forming 15−31 rows along and 1−2(−3) rows of areoles between the costae and the margin, notorious. *Laminar induments* segment scales abundant, 1.2−5.3 × 0.2−0.7 mm, acicular, 5−9 cells wide, patent, basifixed, concolorous, dark brown, base acute with one stalk insertion and apex largely acuminate, the margins dentate. *Hairs* scarce, 2−6 cells long, catenate, appressed, brown, with dark brown dissections. *Sori* from the medial segment in 5−27 rows along and 1−2 row between the costa and margin. *Spore* 53−65 × 29−36 m, ellipsoidal to sub-ellipsoidal, concave-convex to plane-convex, and irregular depressed verrucae.

Distribution and habitat. Serpocaulon nanegalense occurs from Colombia to North of Peru, mainly in Andean ecosystems, from 2170 to 3500 m, in cloud forest from highlands to subparamo.

Phenology. It was recorded fertile all months of the year, except November.

Commentaries. Serpocaulon nanegalense most resembles *S. concolorum*, *S. eleutherophlebium* and *S. subandinum*, that also possess long-creeping rhizomes with a series of lanceolate to lanceolate-subulate scales with patent apices, pinnatisect laminae, and also, because they can be found in sympatry. However, *S. nanegalense* differs from *S. concolorum* by its rhizome scales bicolorous, light brown to the margin and dark brown to the center (vs. concolorous, dark orange and iridescent), appressed rhizome scales with patent apex (vs patent), and fertile veinlets conspicuous (vs. inconspicuous). From *S. eleutherophlebium* by presenting bicolorous rhizome scales, light brown to the margin and dark brown to the center (vs. concolorous, dark brown to reddish), more areolae between the costa and the margin (1−2(−3) vs. 1 row), and bigger laminae ((11−)25−66 × 12−26 cm vs. 4.8–38 × 3.5–13 cm).

Finally, from *S. subandinum* can be distinguished by the laminae with monomorphic scarce hairs 2−6 cells long, and abundant scales (vs. dense pubescent laminae, with long hairs 7−19 cells long, and scarce and disperse scales), bigger laminae ((11−)25−66 cm vs. 11−29 cm long), and more areolae along the medial segments (15−31 vs. 6−15 rows).

Taxonomic and nomenclatural notes. Sodiro described the names *Polypodium nanegalense* (Sodiro, 1883) and *P. loriceum* var. *nanegalense* (Sodiro, 1893), without designated any sheet. Hensen (1990) mentioned that the holotype was at Q, without pointed any collection. After revising Q, QLPS, P, and SI herbaria, the main collections where Sodiro deposited his samples, it was not possible to trace any sheet that match the type locality (Valle del Nanegal, Ecuador). However, the specimen *A.L. Sodiro 10.06* based at S ([bc] S-05−9729) presents features that characterize the Sodiro's species concept of *P. nanegalense* = *S. nanegalense*, and because it was collected in Ecuador by the Italian pteridologist. Here it is designated as a neotype of both names, follow recommendations of Turland et al. (2018, Art. 9.8).

Representative specimens. COLOMBIA. **Antioquia:** Belmira, páramo de Belmira, localidad Montañita, 3126 m, 6º37' N, 75º38' W, 9 Feb. 2012, *D. Sanín 5105* (HUA); Caldas, vereda la Corrala, bosque húmedo, finca "La Zarza" 2440 m, 1 Jun. 1988, *L. Albert de Escobar 8538* (HUA); Jardín, vereda La Mesenía, sector Paramillo, 2280−2560 m, 5º29' N, 75º53' W, 9 Jan. 2005, *W.D. Rodríguez 4940* (HUA); Medellín, along to road to cerro del padre Amaya, 2,3 km from main Medellín-Santa Fé de Antioquia, road, 2560 m, 22 May 1988, *J. Zarucchi 6847* (HUA, MO); Sonsón, páramo de Sonsón, 2680 m, 5º41' N, 75º14' W, 7 Jul. 1987, *A.L. Arbeláez 92* (HUA). **Boyacá:** bosques de Arcabuco, 2700−2900 m, 1 Feb. 1959, *H. Bischler 1905* (COL); Cordillera Oriental, vertiente oriental, valle del río Cusiana, bosque en el cañón del río, 2700 m, 22 Jun. 1967, *R. Jaramillo-Mejía 2739* (COL); paramó de Sogamoso, 2500 m, 12 Oct. 1967, *O. Hagemann 678* (COL); Villa de Leyva, Santuario de Fauna y Flora de Iguaque, quebrada Carrizal, 2700 m, 9 Jun. 2001, *J. Murillo-A. 2932* (COL). **Cauca**: Inzá, vereda río Sucio, Jardín Botánico Las Delicias, km 62, 2700−2800 m, 5 Aug. 2003, *Muñoz 1409* (CAUP); carretera Toez-Irlanda, 1 km delante de Inderena, 3000 m, 14 Sep. 1980, *O. Rangel-Ch. 2554* (COL). **Cundinamarca**: San Miguel,

extremo SW de la Sabana de Bogotá, 2800 m, 21 Sep. 1967, *R. Jaramillo-Mejía 3438* (COL); Sibaté, bosques de San Miguel, 2700 m, 19 Oct. 1961, *M.T. Murillo 430* (COL); vereda La Concepción, 3000 m, 17 Aug. 1989, *E. Linares 2892* (COL). **Nariño:** Ipiales, carretera La Victoria-Monopamba, km. 32, Motilón, 2500 m, 10 Jan. 1973, *O. Hagemann 1827* (COL, PSO). **Norte de Santander**: Herrán, Parque Nacional Natural Tamá, camino al alto de la Piñuela, 2650 m, 13 Jul. 1991, *M. Harker 226* (COL); Herrán, Parque Nacional Natural Tamá, sector Orocue, 2600 m, 1 Apr. 1987, *C. Orozco 1719* (COL); road from Pamplona to Toledo, crossings the divide between río La Teja (Maracaibo drainage) and río Mesme (Orinoco drainage), 2800−3000 m, 27 Feb. 1927, *E.P. Killip 19985* (COL). **Putumayo**: Valle del Sibundoy, 3km, Sibundoy, 2475 m, 10 Mar. 1963, *Bristol 608* (COL). **Quindío**: Génova, vereda San Juan Alto, finca Caucasia, bosque intervenido, borde de camino, 2500−2780 m, 19 Mar. 1995, *M.C. Vélez 5031* (HUQ). **Risaralda**: Santuario, Parque Nacional Natural Tatamá, Monte Zancudo, 2824 m, 20 Jul. 2011, *D. Sanín 4262* (HUA); Santuario, Parque Nacional Natural Tatamá, descenso Valle de las Mirlas, 3000−3500 m, 20 Jul. 2011, *D. Sanín 4303* (FAUC). **Valle del Cauca:** Cali, Parque Natural Los Farallones de Cali, Vereda Pance, Reserva Amor y Paz, vía a Balcones, zona de transición de bosque alto andino-páramo, 3000−3500 m, 2 Jan. 2009, *D. Sanín 2732* (FAUC).

ECUADOR. **Cañar:** above Rivera on road to Pindilig, 2800 m, 9 Mar. 1985, *G. Harling & L. Andersson 23033* (QCA). **Cotopaxi:** Sigchos, Triunfo Grande, bosque al N de la carretera, ca 2 horas de casa de Galo Roballo, loma La Delicia, 2731 m, 00.31.15 S, 78.58.9 W, 5 Aug. 2003, *J. Ramos et al. 6982* (UC). **Imbabura:** road Cotacachi-Apuela, 22.5 km from Cuicocha entrance, 3000 m, 00º20’ N, 78º23’ W, 27 Feb. 1993, *B. Øllgaard 100665* (AUU, QCA!). **Loja:** Parque Nacional Podocarpus, E. of Nudo de Cajanuma, trail E of Centro de Información, to crest on trail to Lagunas de Compadre, 2850−3050 m, 4º5’ S, 79º10’ W, 7 Jun. 1988, *B. Øllgaard 74636* (AUU, QCA!). **Napo:** Road Papallacta-Cuyuja, 2700 m, 00º23’ S, 78º4’ W, 29 Jan. 1989, *B. Øllgaard et al. 90303* (AUU, QCA!). **Pichincha:** *A. Sodiro* 10/906 (L); Quito, Parroquia Nanegal, Reserva Maquipucuna, trail along ridge east of Cerro Montecristi, 2720 m, 0º4’ N, 78º34’ W, 26 Jun. 1996, *K.A. Wilson et al. 2776* (UC); Saloya, 2800 m, 1918, *L. Mille s.n.* (QLPS); near Tandayapa: Bellavista Cloud Forest Reserve, along near research station (heading toward trail H), 2264 m, -0.00807, -78.68971, 8 Dec. 2006, *E. Schuettpelz & M. Sundue 963b* (QCA); km 6 en la Carretera Pela Gallo,

Monte Cristi, 2500 m, 0º3’ N, 78º31’, 26 Jul. 1997, *H. Navarrete 1946* (QCA, 4 sheets). **Tungurahua:** Tunguragua, 12/91 *A. Sodiro No. 26/80* (QLPS).

PERU. **Amazonas:** Bagua, third camp, Cordillera Colán, SE of La Peca, 1866−2175 m, 10 Oct. 1978, *P. Barbour 3978* (USM); remnants of foresta round Laguna Pomacochas, 2250 m, 5º50’11” S, 77º57’47” W, 20 Mar. 1998, *H. van der Werff et al. 15233* (F!, MO, USM!); Camporedondo, Tullanya, Pascana, La Palma, 2710 m, 6º4’35” S, 78º21’45” W, 9 Dec. 1996, *R. Vásquez et al. 22033* (MO, UC!, USM!); Luya, Huaylla Belen, 2926 m, 17 m 0827088, 9301438, 16 Aug. 2007, *M. Epiquién 267* (USM). **Cajamarca:** Cutervo, Madre Mia, entre el Suro y La Flor, al NO del parque, 2400 m, 25 Jul. 1992, *I. Sanchez Vega & A. Miranda 6322* (F). **San Martín:** Mariscal Cáceres, near Pajaten ruins, 2700 m, 22 Jul. 1985, *K. Young 1248* (USM).

27. Serpocaulon patentissimum (Mett. ex Kuhn) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium patentissimum* Mett. ex Kuhn, Linnaea 36: 134. 1869. TYPE: Ecuador. Chimborazo: Bolívar, 1000 m, May 1869, *R. Spruce 5713* (lectotype designated by Sanín (2018): K [bc] 000006925 image!; isolectotypes: BM [bc] 000776972 image!, LE [bc] 00008775 image!, P [bc] 00632974 image!). Figures 8a, 10a, 19d, 23b, 77, 78, 84c.

Polypodium manabyanum Baker, J. Bot. 15: 165. 1877. TYPE: Ecuador. Near Manaby, 1875, *A.L. Sodiro s.n.* (**lectotype here designated**: K [bc] 000642055 image!; isolectotypes: Q [bc] 0000391!). **New syn**.

Plants hemiepiphytic, rarely terrestrial (only finded in initial stages of growing). *Rhizomes* 0.9–2 mm diameter, long-creeping, light to dark brown, scarcely pruinose; phyllopodia distance 1–6 cm long. *Rhizome scales* disperse and scarce, 0.6–1.7 × 0.2–0.6 mm, ovate-lanceolate to triangular or deltate, base appressed and apex patent, peltate, fairly bicolorous, light brown to yellowish to the margin and dark yellow to dark gold to the center, base rounded to truncate, apressed and apex acute and patent, erose margin. *Fronds* 16–39 cm long. *Petioles* 1.5–5 cm long, proximally subterete, distally winged 1/3 to 2/3 parts, wings to 1 mm wide, reaching the laminar tissue, light, dark brown to reddish proximally and light brown distally. *Laminae* 15–34 × 2.2–4 cm, linear-lanceolate, pinnatisect, truncate to slightly

reduced to a decurrent, lobate, sinuate or smooth wing proximally, disally atenuate-cuneate and pinnatifid. *Segments* 36–61 pairs, membranaceous to papyraceous, proximally surcurrent and reflexed, medial and distal decurrent, slightly attenuate and gradually tapering. *Medial segments* 1.1–2.6 × 0.2–0.5 cm, base decurrent and apex acute to rounded, venation forming 5–12 rows along and 1 row of areolae between the costae and the margin, slightly notorious, often open (not forming areolae). *Segment scales* scarce, 0.9–1.1 × 0.5–0.7 mm, ovate to ovate-lanceolate, 10–13 cells wide with mazed patterns in the cells, patent, peltate, concolorous, light brown, base rounded to truncate and acute apex, the margins slightly dentate. *Hairs* mainly in the abaxial surface, catenate, hyaline, disperse over the laminae, 3–9 cells long, appressed, base dark brown and apex dark; and dense over the rachis, 7–12 cells long, patent, light brown with dark brown dissections. *Sori* from the medial segments in 4–12 rows along and 1 row between the costa and the margin. *Spores* 48–58 × 29–35 µm, ellipsoidal to globular, plane-convex to concave-convex, and regular depressed verrucae.

Etymology. Its name referred to the patent condition of its fronds.

Distribution and habitat. Serpocaulon patentissimum occurs mainly at the Biogeographic Chocó region of Colombia and Ecuador, and the Ecuadorian Andes, from 450 to 2400 m, in low to middle humid forest.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon patentissimum is the smaller and delicated species of the genus and could be distinguished by the long-creeping slim rhizome, the light brown petiole and rachise with several segments and the predominantly absence of areolae at the margin of the segments. It resembles *S. dasypleuron* and *S. subandinum*, that also possess long-creeping rhizomes with appressed scales and linear (more than 20 segments), pinnatisect and pubescent laminae. However, differs from *S. dasypleuron* by the scales, ovate-lanceolate to triangular or deltate with patent apex (vs. rounded to elliptic and appressed), thin rhizome (0.9–2 mm vs. 2–5 mm diameter), and less number of areolae along the medial segments (5–12 vs. 11–17 rows), that can be open (vs. areolate). From *S. subandinum* can be distinguished

by the presence of more pairs of segments (36−61 vs. 16−44 pairs), two types of hairs (vs. one type), thin rhizome scales (0.2–0.6 mm vs. 0.4−2 mm wide), and mazed patterns in laminar scales (vs. conventionally clathrate). Additionally, *S. patentissimum* is narrowly restricted to the Chocó region and the Ecuadorian Andes, distributed in low and middle lands (vs. wide distribution from Colombia to Bolivia, in highland to subparamo).

Taxonomic and nomenclatural notes. *Polypodium manabyanum* Baker was described without mentioned any sheet or herbaria. Despite Hensen (1990) did not cited this species as part of *Polypodium loriceum* complex = current *Serpocaulon*, the Duch author labeled as *P. patentissimum* and stressed as isotype a sheet from Sodiro based at P (00632975) that was recollected in the type locality Quito-Manaby in Ecuador. Nevertheless, here were traced two sheets, one at Q and the other in K, that belongs to Sodiro's series *Sodiro 9.74*, and bear the original handwriting of the Italian author. In this respect, it is chosen the sheet from K ([bc] 000642055) as lectotype as recommended Turland et al. (2018, Art. 9.6).

Indigenous name. Yashpilla in Ecuador (*Steyermark 52684*, F).

Representative specimens. COLOMBIA. **Antioquia:** Frontino, corregimiento La Blanquita, 14.6 km al oeste de Nutibara, colecciones hechas 4–7 km del alto de Cuevas a la Blanquita, 1350–1450 m, 6º40' N, 76º15' W, 10 Jul. 1988, *A.L. Arbeláez 325* (HUA, MO); Frontino, corregimiento Nutibara, región Murrí, vía hacia la Blanquita, área de pastoreo, 1510 m, 14 Jul. 1986, *Acevedo 1318* (HUA). **Chocó:** principal ridge and slope 2 km E of San José del Palmar, 1550–1650 m, 26 Mar 1971, *D.B. Lellinger & E.R. de la Sota 781* (LP). **Nariño:** Barbacoas, km 1, El Mirador-Junín, 1500 m, 4 Apr. 1991, *B.R. Ramírez-P. 3379* (PSO); Ricaurte, Reserva Natural la Planada, sendero entre El Hondón y Los Horquetas, 1820 m, 29 Jan. 1997, *H. Herrera 9272* (PSO); Ricaurte, vicinity Ricaurte, along río Imbí, ca 2–3 km above Ecopetrol campamento Palmar, located 3 km of Ricaurte, along trail to Ramos (indigenous settlement), 1150 m, 16 Mar. 1990, *T.B. Croat 71573* (MO, PSO); Ricaurte, trayecto San Isidro-La Planada, 1500–1800 m, 1º8' N, 77º56' W, 13 Feb. 1988, *O. de Benavides 9294* (PSO). **Valle del Cauca**: Along road to Dapa from main Cali-Buenaventura

highway, 1945 m, 3º32’ N, 76º36’ W, 32 Jul. 1997, *T.B. Croat 80188* (CUVC, MO); vía Cali-Buenaventura, río Danubio, 1500 m, 15 Sep. 1967, *O. Hagemann 415* (COL).

ECUADOR. *J. Verleysen s.n.* (QLPS); Cabitoña, *A. Sodiro 20/93* (QLPS). **Azuay:** Loma de la Plata, slopes bordering río Putucay, at Chacanceo, 1430–1465 m, 22 May 1943, *J.A. Steyermark 52684* (F). **Azuay/Cañar:** Manta Real, río Patul, sur de la Carretera La Troncal-Zhud, camino entre Zhucay y Río Patul base de los Andes, trocha subiendo el piedemonte hasta (1200 m), atrás (este) del pueblo de Manta Real, 2º33’ S, 79º20’ W, 450–800 m, 13–14 Jul. 1991, *R. Foster & B. Mitsui 13550* (F, QCA). **Carchi:** Valle de Maldonado, km 67 on the road Tulcán-Maldonado, 2400 m, 00º53’ N, 78º4’ W, 20 May 1973, *L. Holm-Nielsen et al. 6160* (F); embankments along río Verde, from point at which trail from Rafael’s Mountain Finca crosses river, 1.5 km, 1890 m, 00º52’ N, 78º8’ W, 29 Nov. 1987, *W.S. Hoover 1941* (QCA!, MO). **Loja:** Hac. Buenaventura, 12 km W Piñas on road to Machala, 1000 m, 3º48’ S, 79º46’ W, 26 Feb. 1991, *M. Kessler 2631* (QCA). **Los Ríos:** summit of Cerro Samama (Had. Clementina), S of road Caluma-Catarama, 700–730 m, 1º40’ S, 79º19’ W, 14 Nov. 1996, *B. Øllgaard & H. Navarrete 2067* (QCA). **Morona-Santiago:** road Macas-Guamote, km 23, 1800 m, 2º13’ S, 78º13’ W, 16 Mar. 1997, *B. Øllgaard & H. Navarrete 2463* (QCA); Parque Nacional Sangay, Lagunas de Sardinayacu, alrededores de la laguna Chimerella, 1660 m, 2º4’45” S, 78º12’14” W, 21 Jan. 2015, *A.J. Pérez et al. 8033* (QCA). **Napo:** road Baeza-Lago Agrio, 23 km from Baeza at río Oyacachi, 1500 m, 00º18’ S, 77º48’ W, 29 Oct. 1976, *H. Baslev & E. Madsen 10448* (AAU, QCA!, L!); Campamento de Inecel, cascada de San Rafael, 1400 m, 00º6’ S, 78º35’ W, 17 Jun. 1996, *H. Navarrete & P. Asimbaya 1817* (QCA); El Chaco, Hostería Los Yumbos, a lo largo del camino hacia Las Cascadas, 1600 m, 00º20’ S, 77º45’ W, 8 May 1996, *H. Navarrete & P. Asimbaya 1583* (QCA). **Pastaza:** Mera, road and muletracks to aprox. 4 km N of the village (along río San Jorge and río Tigre, 1200 m, 1º35’ S, 77º 53’ W, 1–2 Sep. 1976, *B. Øllgaard & H. Baslev 9160* (AAU, F!); 2 km W of Shell-Mera road, 1100 m, 1º27’ S, 78º4’ W, 21 Jan. 1992, *R.G. Stolze & S.H. Stolze 1679* (F); road N of Mera, toward río Anzu, km 6.7, 1480 m, 1º27’ S, 78º4’ W, 12 Nov. 1994, *B. Øllgaard & H. Navarrete 105608* (QCA). **Pichincha:** km 36 along road to the SE from La Aurora (km 7 on Sto. Domingo-Quevedo road), passing through La Reforma, 1450 m, 00º28’ S, 79º8’ W, 24 Jul. 1990, *B. Øllgaard 98066* (QCA); road Chillogallo-Santo Domingo, below Chiriboga, 2000 m, 00º15’ S, 78º47’ W, 13 Aug. 1980,

L. Holm-Nielsen et al. 24759 (USM); Las Palmeras, Reserva Florística Río Guajalito, 1800–2100 m, 00º14'00" S, 78º49'00" W, May 1997, *C. Nowicki & J. Mutke 897* (QCA); Quito, Estación Biológica Río Guajalito, km 59 of old road from Quito to Sto. Domingo, 1800 m, 00º14' S, 78º48' W, 13 Feb. 2004, *R.C. Moran et al. 6824* (QCA); reserve Florística-Ecológica "Río Guajalito", km 59 de la Carretera Antigua Quito-Sto. Domingo de los Colorados, a 3 ½ km al NE de la Carretera, estribaciones occidentales del Volcán Pichincha, 2200 m, 00º13'53" S, 70º48'10" W, 17 Jan. 1992, *J. Jaramillo & E. Grijalva 14566* (QCA).

28. Serpocaulon polystichum (Link) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium polystichum* Link, Hort. Berol. 2: 101. 1833. TYPE: Brazil. (Cult. in bot. gard. at Berlin), *J.H.F. Link s.n.* (**lectotype here designated**: B [bc] 200163713 image!). Figures 2a, 7f, j-k, 8b, 17o, 23c, 79, 80, 84d.

Polypodium fraxinifolium var. *rhizocaulon* (Willd.) Christ, Bull. Herb. Boissier, sér. 2, 6(1): 49. 1906. TYPE: Brazil. Minas Gerais: Itatiaia, Mont Serrat, 900 m, 16 Jul. 1902, *P.K.H. Dusén 711* (**lectotype here designated**: P [bc] 01371433 image!).

Plants hemiepiphytic, rarely terrestrial or rupicolous. *Rhizomes* 1.5–6 mm diameter, long-creeping, dark brown to dark reddish, not pruinose to scarce pruinose, rugose; phyllopodia distance 1–6 cm. *Rhizome scales* dense to slightly disperse, 2–5 × 0.9–1.8 mm, lanceolate, subappressed, subpeltate, bicolourous, light brown to the margin and dark brown to the center, base rounded to acute, apex acuminate to long acuminate and patent to rarely reflexed, erose and frequently overlapping margin, covering the rhizome. *Fronds* 22–70 cm long. *Petioles* 8–26 cm long, subterete, light brown to dark. *Laminae* 14–44 × 11–25 cm, lanceolate to ovate-lanceolate, pinnate, truncate proximally and acute to long acuminate apex. *Pinnae* 2–10 pairs, slightly coriaceous, in some point of the laminae opposite to subopposite, especially at the base, proximal sessile, inequilaterous base, rounded at the basiscopic side and attenuate on the acroscopic, reflexed, medial sessile, apical pinna conform, often adnate to a small auricule, when dry, dark green at adaxial surface and light green in the abaxial surface. *Medial pinna* 8–23 × 1.5–3.5 cm, base rounded and apex acuminate to long acuminate, venation forming 16–33 rows along and 2–3(–4) rows of areolae between the

costae and the margin, immersed, especially the fertile veinlets that are inconspicuous, often slightly contrasting in color with the laminar tissue when dry. *Laminar induments* pinnae scales scarce, especially in the pinna base, 0.9–3.3 × 0.3–0.9 mm, lanceolate to acicular-lanceolate, (3–)5–12 cells wide appressed, subpeltate with a notorious insertion, bicolorous, margin light-brown to goldish and dark brown at the center, base rounded and long acuminate cirrose apex, the margins erose, non-clatrate. *Hairs* scarce and dispersed, 2–3 cells long, catenate, appressed, strigose, hyaline with dark brown pronunciated apex. *Sori* from the medial pinnae in 11–31 rows along and 2–3(–4) rows between the costa and the margin. *Spores* 40–48 × 27–33 µm, ellipsoidal to sub-ellipsoidal, concave-convex to plane-convex, and irregular depressed verrucae, with flat apex in the verrucae.

Distribution and habitat. Serpocaulon polystichum occurs scarce from Nicaragua to Panama in Central America, and from Colombia to Bolivia in the Andes, also in Andean and Amazonian ecosystems of Venezuela. However, it is widely distributed in the Atlantic Rain Forest of Brazil, in lowlands to premontane forest, from 35 to 2620 m, in humid forest.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon polystichum most resembles *S. adnatum*, *S. antioquianum*, *S. appressum* and *S. fraxinifolium* that also possess long-creeping rhizomes with appressed scales and pinnate laminae. However, differs from *S. adnatum* by its medial pinnae sessile (vs. adnate 3/4 parts of the laminae), the apical pinna conform (vs. adnate to the lateral), and the rhizome scales lanceolate with patent to reflexed apex (vs. rounded, ovate to elliptic with appressed apex). From *S. antioquianum* differs for its rhizome scales lanceolate, light brown to the margin and dark brown at the center (vs. ovate to rounded, light brown to salmon at the margin and dark brown at the center), the patent to reflexed apex (vs. appressed), and the inconspicuous fertile veinlets (vs. conspicuous). Could be distinguished from *S. appressum* by its glabrous laminae with scarce and dispersed hairs (vs. dense pubescence in the petioles, rachises and laminae), and its lanceolate rhizome scales with patent to reflexed apex (vs. rounded to ovate with appressed apex). Finally, *S. polystichum* could be differentiated from *S. fraxinifolium*, the most similar one, by its lanceolate rhizome scales with patent apex (vs.

rounded with appressed apex), the fertile veinlets inconspicuous (vs. conspicuous), the laminar scales narrowly lanceolate to acicular-lanceolate, (3–)5–12 cells wide, with long acuminate cirrose apex (vs. lanceolate, 2 to 4 cells wide, and acute apex), and by shorter hairs 2–3 cells long, with dark brown protuberant apex (vs. hairs 3–21 cells long, hyaline with dark brown dissections and absent protuberant apex).

Serpocaulon polystichum, also have been confused with *S. articulatum*, because both species present long-creeping rhizomes, with appressed to subappressed rhizomes scales with patent apex and pinnate laminae with inconspicuous areolae or fertile veinlets. However, differs from *S. articulatum* by its thin rhizome (1.5–6 mm vs. 4.7–9.4 mm diameter), smaller number of areolae between the costae and margin (2–3(–4) rows vs. 4–10 rows), and laminae scales lanceolate to acicular-lanceolate, appressed, (3–)5–12 cells wide (vs. acicular to long-acuminate, patent, 2–4 cell wide).

Taxonomic and nomenclatural notes. Link (1833) described *Polypodium polystichum* Link = *Serpocaulon polystichum* without designating a type or herbaria. Because the origin of the author and the publication were from Germany, the sheet *Link s.n.* (B [bc] 200163713), a cultivated plant that was originally collected in Brazil (as suggested in the sheet label), is designated here as a lectotype following recommendations of Turland et al. (2018). This sheet does not present rhizomes and present two fronds: one fertile and the other sterile. Nevertheless, the specimens show confom apical pinna, with few opposites to subopposite pinnae and two rows of sori. In addition, because in Brazil is not recorded *S. fraxinifolium*, it is possible to suggest the identity of the type as *S. polystichum*. Hensen (1990) designated *Polypodium polystichum* = *Serpocaulon polystichum* under the synonymy of *P. fraxinifolium* = *S. fraxinifolium*, commented that 'shape of the rhizome scales is generally constant, but long, pointed scales occur throughout the range of this species, only sporadically in most region, but dominantly in the southeastern parts of the range: Brazil and Paraguay'. This describes our records along the distribution of this species and supports that Hensen lumped both entities. Posteriorly, Smith et al. (2006) combined the former as species in the genus description, a situation that is confirmed here.

Polypodium fraxinifolium var. *rhizocaulon* (Willd.) Christ was described by Christ (1906) included nine series made by different collectors in Brazil (Minas Gerais, São Paulo, and

Paraná states). The author did not mention any herbaria for those collections. After traced the series provided by the protologue (*Casaretto 1133*; *Dusen 711*, *3462*; *Gomez 711*; *Schenck 2740*; *Schwache 13242*; *Schwacke 12430*; *Wettstein et Schiffner s.n.*) and taking into account the French nationality of the author, the sheet *P.K.H. Dusén 711* was found at P [bc] 01371433, justifying its designation as lectotype (Turland et al., 2018).

Smith et al. (2006) initially suggested that the distribution of this species was from Ecuador to Bolivia. Posteriorly, Smith et al. (2018) presented a wider range for this species: Brazil and Paraguay, Peru and Bolivia, commented that probably occurs also further north in the Andes. In this sense, this distribution partially matches our records, excluding Paraguay. In the same line, Cacharani et al. (2014; 2016), Labiak et al. (2008), and Flora de Argentina (2018) misidentified this species with *S. triseriale* in the Argentine Flora (Sanín et al., 2019b).

In Brazil, this species was widely confused with *S. fraxinifolium* (Hensen, 1990; Labiak & Prado, 2008; Coelho & Esteves, 2011; Schwartsburd & Smith, 2013). The records here suggest that the latter do not inhabit the country.

The sheet *J. Teran et al. 3702* (UC) presents most of the characteristics of this species, but with a pinnatisect apex. This probably represents an interbreeding with one pinnatisect species from Bolivia.

Representative specimens. BOLIVIA. **Cochabamba**: Ayopaya, en dirección al subcampamento, 1118 m, 16º20 S, 66º39’ W, 24 Sep. 2004, *H. Huaylla 1408* (LPB); Antahuacama, Espiritu Santo, etur 160 km montibus von Cochabamba, 750 m, Jun. 1909, *O. Buchtien 2152* (SI); Chapare, Villa Tunari, terreno de El Puente, 400 m, 16º59’ S, 66º35’ W, 25 Jul. 1993, *P & C. Ibisch 931161* (LPB); Chapare, Tablasmonte, a unos 110 km de la ciudad de Cochabamba, 2300 m, 17.5.5 S, 65.56.33 W, 19 Apr. 2009, *J. Teran et al. 3702* (UC). **La Paz:** Canavari, Serranía Bella Vista, 44 km de Canavari hacia Sapecho, 1300 m, 15º40’ S, 67º29’ W, 29. Aug. 1997, *M. Kessler et al. 11581* (LPB); Nor Yungas, 1 Km al O de Yolosa por el camino a Unduavi, Vado del río Cedro, 1400 m, 16º13’ S, 67º45’ W, 12 Nov. 1987, *J.C. Solomon 17394* (LPB, MO); B. Saavedra, Área Natural de Manejo Integrado Apolobamba, Pauje Yuyo, 1.8 km NE de la Comunidad, 1020 m, 15º2’19” S, 68º26’54” W, 8 Sep. 2004, *L. Cayola et al. 1204* (LPB). **Santa Cruz:** Florida, 4 km NE of Bermejo, in on

near bottom of valley of Refugio los Volcánes, 1100 m, 18º6' S, 63º36' W, 28 Jul. 2003, *M.A. Sundue 753* (SP).

BRAZIL. **Acre:** Mâncio Lima, Parque Nacional da Serra do Divisor, Serra Môa, trilha do Igapare do Amor até a Cachoeira da Estátua, 218 m, 7º26'51" S, 73º40'1" W, *T.E. Almeida & A. Salino 2569* (BHCB). **Bahia**: 1865, *Martius s.n.* (L); Boa Nova, recanto dos Pássaros, na trilha ao topo da serra, 915 m, 14º24'29" S, 40º7'34" W, 3 May 2015, *V.A.O. Dittrich & A.M. Souza 2116* (CESJ two sheets); Camacã, mountain peak with TeleBahia tower, 10.6 km SW of Camacã on road to Jacareçi, then right at bridge for 6.2 km to tower, 700–800 m, 15º22'52" S, 39º34'11" W, 24 May 1994, *W.W. Thomas et al. 10454* (SP). **Distrito Federal:** Taguatinga, Córrego Vicente Pires, near Taguatinga, 1100 m, 8 Sep. 1965, *H.S. Irwin et al. 8103* (RB two sheets). **Espírito Santo:** Castelo, Parque Estadual do Forno Grande, trilha para o Forninho, 1100 m, 20º30'58" S, 41º5'1" W, 12 Feb. 2008, *P.H. Labiak et al. 4551* (CEPEC, MBML, RB!, UPCB); Castelo, arredores da sede do Parque Estadual do Forno Grande, 1100 m, 20º30'39" S, 40º45'52" W, 6 Aug. 2013, *R.C. Forzza et al. 7648* (RB, SP); Castelo, Parque Estadual do Forno Grande, 1105 m, 20º30'39" S, 41º4'53" W, 25 Jul. 2008, *A. Salino et al. 5261* (BHCB); Divino de São Lourenço, Parque Nacional do Caparaó, RPPN Águas do Caparaó-Cachoeira Alta, 1000–1050 m, 20º35'49" S, 41º46'52", 12 Sep. 2008, *A. Salino et al. 13846* (BHCB); Ibitirama, P.N. do Caparaó, Córrego Santa Marta, Sede Sta. Marta, 1399 m, 20º29'41" S, 41º44' W, 8 Fev. 2011, *F.S. Souza et al. 1399* (BHCB); Iúna, Serra do Valentim, 1370 m, 20º21'54" S, 41º28'22" W, 6 Aug. 2011, *J.P. Zorzanelli 41* (BHCB); Santa Teresa, Nova Lombardia, Terreno do Furlani, 900 m, 19º48'19" S, 40º32'18" W, 13 Jul. 2007, *P.H. Labiak et al. 4064* (RB!, SP!, UFPR); Santa Teresa, Reserva Biológica Augusto Ruschi, trilha da Cachoeira, 750–850 m, 19º55'14" S, 40º33'37" W, 2 Dec. 2008, *A. Salino et al. 14019* (BHCB); São Paulo de Aracê, em torno do Parque Estadual da Pedra Azul, 1115 m, 20º26'2" S, 41º8'16" W, 29 Sep. 2016, *I.O. Moura & A. Salino* 162 (BHCB). **Goiás:** Córrego Itaquera, ca 30 km N of Formosa, 850 m, *H.S. Irwin et al. 15592* (SP); Aporé, Rodoviaria Aporé-Serranópolis, ca 72 Km de Aporé (4 km até a estrada), Rio Corrientes, 650 m, 21 Aug. 1995, *M.R. Pietrobom et al. 2402* (SP). **Minas Gerais:** Almenara, Fazenda Limoeiro, Mata da Mamoneira, 250 m, 16º2' S, 40º51' W, 22 Fev. 2003, *A. Salino et al. 8305* (BHCB); Almenara, Fazenda Limoeiro, 741 m, 16º3'26" S, 40º51'19" W, 28 Fev. 2004, *A. Salino et al. 9379* (BHCB); Alto Caparaó, Mata na Base da Mata do Coração, 1398 m,

20º25’54” S, 41º50’44” W, 9 Mar. 2010, *I.R. Martins da Costa et al. 387* (BHCB); Araponga, Parque estadual da Serra do Brigadeiro, nas proximidades da Sede, 1400 m, 20º43’12.2” S, 42º28’46.8” W, 10 Jul. 1999, *A. Salino 4927* (BHCB, CESJ); Caldas, 11 Feb. 1905, *A. Regnell 473* (BR); Caldas, Distrito de Pocinhos do Rio Verde, propriedade do sr. Antônio Geraldo Módolo Cardia, Fazendinha Selma, 1083 m, 21º55’45” S, 46º25’58” W, 12 May 2012, *T.E. Almeida & L.L. Giacomin 3173* (BHCB); Carrancas, serra de Carrancas, próximo a rampa de Paraglide, 1160 m, 21º26’58” S, 44º40’15” W, 18 Jun. 2007, *A. Salino et al. 12233* (BHCB); Carandaí, Pedra do Sino Hotel Fazenda, BR 040 km 6, trilha da Matinha, 1000–1200 m, 4 Apr. 2005, *N.F. Mota & J.R. Stehmann 253* (BHCB); Catas Altas, Parque Natural do Caraça, 1300 m, 20º5’46” S, 43º28’45” W, 30 Aug. 1997, *A. Salino 3378* (BHCB, CESJ); Chácara, Fazenda de Santana, 750 m, 21º6’00” S, 43º18’27” W, 31 Mar 2012, *D.E.F. Barbosa & F. R. Silva 59* (CESJ); Conceição de Mato Dentro, Parque Natural Municipal do Ribeirão do Campo, 1 Aug. 2002, *R.C. Mota et al. 1544* (BHCB); Congonhas, RPPN, Poço Fundo, RPPN próxima à Mina de Fábrica, 1260 m, 20º26’45” S, 43º54’21” W, 6 May 2015, *J.A. Paiva et al. 274* (BHCB); Delfim Moreira, Fazenda Boa Esperança, trilha do Marlon, 1317 m, 22º34’27” S, 45º19’2” W, 16 Mar. 2011, *T.E. Almeida et al 2880* (BHCB); Ervália, Serra do Brigadeiro, fazenda Pedro Dutra, córrego de Ouro, 18 Jun. 1945, *O. Drummond et al. 4230* (BHCB); Felício dos Santos, APA Felicio, região da Mata do Isidoro, entorno Parque Estadual do Rio Preto, nas proximidades do Pico Dois Irmãos, 1150–1350 m, 18º11’48” S, 43º17’13” W, 30 Oct. 2004, *A. Salino et al. 9926* (BHCB); Ibitirama, Parque Nacional do Caparaó, Braço Norte, 1183 m, 20º44’60” S, 41º73’66” W, 30 Nov. 2010, *F.S. Souza et al. 1194* (BHCB); Lambari, Parque Estadual de Nova Baden, trilha das Sete Quedas, 890–1000 m, 21º56’15” S, 45º19’23” W, 13 Jul. 2007, *A. Salino et al. 12547* (BHCB); Lavras, Parque Florestal Quedas do Rio Bonito, trilha do Sauá, 1000 m, 21º19’47” S, 44º58’5” W, 17 Jun. 2007, *A. Salino et al. 12198* (BHCB); Mariana, 851 m, 20º10’38” S, 43º26’14” W, 15 Mar. 2016, *F.D. Gontijo 990* (BHCB); Nova Lima, Estação Ecológica de Fechos, 20º3’57” S, 43º57’32” W, 11 Jul. 2001, *A. Salino et al. 7161* (BHCB); Olaria, Serra do Cruz, 1440 m, 21º53’57” S, 44º4’38 W, 28 Jul. 2011, *F.E. Alves et al. 132* (CESJ); Ouro Branco, Serra de Ouro Branco, 1000 m, *A. Salino & P.O Morais 4356* (BHCB); Ouro Preto, Próximo a Mina da Fábrica, 1075 m, 20º25’18” S, 43º50’41” W, 11 Jul. 2008, *S.G. Rezende 3046* (BHCB); Passa Vinte, Estrada que liga a sede do município à MG-457, 836 m, 22º11’8”

S, 44º14’21” W, 14 Fev. 2009, *T.E. Almeida & D.T. Souza 1770* (BHCB); Poços de Caldas, complexo da Serra da Mantiqueira, Serra dos Poços, Cachoeira das Antas (Usina Hidroelétrica das Antas), 4 km da cidade, 1200–1250 m, 21º47’ S, 46º34’ W, 15 Jun. 1995, *M.R. Pietrobom 1836* (SP); Rio Acima, Rio de Peixe, Bacia do Córrego Fazenda Velha, 825–1050 m, 20º9’23” S, 43º49’37” W, 25 Mar. 2010, *S.G. Rezende et al. 4378* (BHCB); Rio Preto, Serra Negra, Mata da Dona Lúcia, 12 Oct. 2007, *S.A. Roman et al. 14* (BHCB, CESJ); Sabará, Mina de Cuiabá da Anglogold Ashanti, base da Serra da Piedade, 776 m, 19º51’10” S, 43º44’00” W, 26 Apr. 2006, *D.T. Souza 15* (BHCB); São Roque de Minas, Parque Nacional da Serra da Canastra, 20º10’17” S, 46º39’52” W, 13 Jul. 1997, *A. Salino 3151* (BHCB, CESJ); Santa Bárbara, RPPN Capivari, Porção oeste da RPPN, entrada na divisa da Fazenda do Zé Maria, 900 m, 20º7’45” S, 43º35’99” W, 1 May 2009, *A.J. Arruda et al. 119* (BHCB); Santa Maria do Salto, divisa entre Bahia e Minas Gerais, Fazenda Duas Barras, Reserva do Alto Cariri, trilha da Divisa Bahia-Minas Gerais, 950 m, 16º24’23” S, 40º3’16” W, 9 Feb. 2006, *F.B. Matos et al. 934* (SP); Santa Maria do Salto, distrito de Talismã, fazenda Duas Barras, próximo divisa com o estado da Bahia, 750–850 m, 16º24’16” S, 40º3’27” W, 9 Oct. 2003, *A. Salino et al. 9191* (BHCB); Santo Antônio do Itambé, Cachoeira do Neném e trilha entre a Cachoeira e Capivari, 1089 m, 18º25’27” S, 43º18’56” W, 4 Oct. 2006, *T.E. Almeida et al. 496* (BHCB); São Gonçalo de Rio Preto, Parque Estadual do Rio Preto, Chapada, 1348 m 18º11’42” S, 43º19’54” W, 21 Apr. 2007, *T.E. Almeida et al. 793* (BHCB); São Lourenço das Águas até a clareira-base, 707 m, 23º39’32” S, 46º56’22” W, 13 Jul. 2010, *M.N. Saka & B. Franco 130* (BHCB); Sapucaí Mirim, Bairro Santa Luzia, Serra de Campestre, 30 Jul. 1988, *A. Salino 498* (BHCB); Serra do Espinhaço, trailing in woods near stream, valley ca. 5 km SE of Pico do Itambé, 1140 m, 14 Feb. 1972, *W.R. Anderson et al. 36020* (SP); Simonésia, Mata do Sossego, trilha das Hortências e trilha 2, 1298 m, 20º4’11” S, 42º43” W, 12 Jun. 2012, *F.S. Souza & A. Salino 116* (BHCB); Viçosa, Fazenda de Aguada, 695 m, 31 Jul. 1930, *Y. Mexia 4929* (L); Viçosa, Fazenda de Aguada, 700 m, 14 Oct. 1930, *Y. Mexia 5170* (RB). **Paraná:** Antonina, Usina Hidrelétrica Parigot de Souza, 120 m, 7 Mar. 2013, *J. Cordeiro 4750* (MBM); Antonina, Reserva Natural Rio Cachoeira (SPVS), trilha do Gervásio, 50 m, 25º15’ S, 48º41’ W, 21 Dec. 2004, *F.B. Matos & P.H. Labiak 134* (SP!, UFPR); Guaraqueçaba, Tagaçaba, arredores, 100–150 m, 25 Sep. 2002, *G. Hatschbach et al. 73838* (SI); Serra do Mar, Ponta Grossa, 6 Aug. 1911, *P. Dusén*

12014 (SI); Guaratuba, Colônia Limeira, 170 m, 25º38'29" S, 48º44'2" W, 21 Feb. 2013, *J. Cordeiro et al. 4721* (MBM); Morretes, Entrada de la Vía Graciosa, Estaredo y mirador a lado derecho del ascenso hacia Curitiba, Campina Grande do Sul, 800 m, 1 Jul. 2010, *D. Sanín & P. Labiak 4203* (HUA); Morretes, Serra da Graciosa, 800 m, 25º19'56" S, 48º53'54" W, 30 Jul. 2005, *P.H. Labiak & M.L.B. Paciência 3542* (SP!, UFPR). **Pernambuco:** Jaqueira, Usina Colônia, Serra do Quengo, 713 m, 8º42'50" S, 35º50'25" W, 3 Apr 2002, *M.S. Lopes & M.R.S. Pietrobom 529* (RB, UFP); Taquaritinga do Norte, Sítio Cafundó, 10 Jan. 1977, *I. Pontal 77–1438* (PEUFR); Taquaritinga do Norte, alto da serra ou engenho Brejinho, 21 Nov 1977, *Andrade-Lima 77–8321* (IPA). **Rio de Janeiro:** 1867, *A. Glaziou 2411* (BR); *G.G. Langsdorff 1820* (BR); 12 Jan. 1905, *Pohl 110* (BR); Cachoeiras de Macacu, street between Funchal and Guapiaçu, near Régua, 35 m, 22º28'69" S, 42º45'33" W, 17 Nov. 2009, *K. Baber & J. Wesenberg 450* (LZ, RB!); Guapimirim, Granja Monte Olivete, margem de rio Bananal, 400–500 m, 17 Nov. 1993, *J.M.A. Braga et al. 888* (RB); Itatiaia, parte baixa, trilha Véu da Noiva, 28 Oct. 2011, *A. Lobâo & G.C. Lopes Paes 1739* (BHCB, RB); Itatiaia, Parque Nacional do Itatiaia, trilha do lote 21, próximo ao rio, 800 m, 22º27'23" S, 44º36'45" W, 30 May 2009, *E.R. Damasceno & T.V. Costa 279* (BHCB, RB); Itatiaia, P.N. de Itatiaia perto da casa de visitantes, depois do ponte, 773 m, 22º27'07.1" S, 44º36'43.4" W, 25 May 2027, *D. Sanín et al. 6836* (BHCB); Paraty, Área de Proteção Ambiental de Cairuçu, APA Cairuaçu, Ponta Negra, caminho para a Pedra da Jamantha, 90 m, *L. Sylvestre et al. 508* (BHCB, RB); Paraty, Parque Nacional da Serra da Bocaina, estrada para a cachoeira das Sete Quedas, 23º11'9" S, 44º46'48" W, 28 Nov. 2014, *M.G. Bovini et al. 4956* (BHCB, RB); Parque Nacional da S. dos Órgãos, 1080 m, 30 Nov. 1999, *E.R. de la Sota 2342* (LP 2 sheets); Parque Nacional da S. dos Órgãos, abricó 13 de maio, 20 Jun. 1965, *G.F.J. Pabst 8710* (LP); Rio de Janeiro, P.E. Cunhambebe, trilha da Serra Grande, atrás da sede da Fazenda Rio da Prata, 22º51'34" S, 44º1'31" W, 6 Aug. 2013, *M.G. Bovini et al. 3862* (NY, RB!); Santa Maria Madalena, Parque Estadual do Desengano, Poço do Padre, 21º52'23" S, 41º55'35" W, 25 Jul. 2012, *P.H. Labiak et al. 5370* (RB!, UPCB); Teresópolis, estrada para Posse, 12 Feb. 1968, *D. Sucre & P.I.S. Braga 261* (BHCB, RB); Teresópolis, Parque Estadual dos Três Picos, Jacarandá, trilha do Alto da Boa Vista, 1200 m, 22º26'48" S, 42º55'55" W, 19 Apr. 2011, *R.A. Engelmann et al. 1711* (RB, SP!). **São Paulo:** 18 Aug. 1873, *Leverin 41* (BR); Bananal, Estação Ecológica do Bananal, nas trilhas da Estação e da Pedra Vermelha,

1130–1350 m, 22º49’10” S, 44º21’58” W, 8 Mar. 2001, *A. Salino et al. 6255* (BHCB); Boracéia, Estação experimental Boracéia, 19 Dec. 1940, *A.S. Lima & L. da Silva 5985* (BHCB, RB); Campinas, Barão Geraldo, Mata da Santa Genebra, 11 Mar. 1992, *A. Salino 1316* (BHCB); Caraguatatuba, Parque Estadual Serra do Mar, estrada intermediária km 33, Estação de Bombeamento da Petrobrás, 590 m, 23º40’58” S, 45º38’14” W, 18 Apr. 2000, *A. Salino et al. 5261* (BHCB); Cunha, Parque Estadual Serra do Mar, Núcleo de Cunha, trilha da Casa de Pedra ao Indaiá, 1070 m, 23º14’45” S, 44º59’36” W, 16 Dec. 1996, *A. Salino 2912* (BHCB); Eldorado, Parque Estadual do Jacupiranga, Núcleo Caverna do Diabo, trilha do Rio das Ostras, 24º37’7” S, 48º23’3” W, 28 Mar. 2005, *A. Salino et al. 10275* (BHCB, CESJ); Guarulhos, Parque Estadual da Cantareira, Núcleo Cabuçu, trilha da Cachoeira, 1373 m, 7.413.184 N, 343.976 E, 11 Aug. 2005, *F.A.R.D.P. Arzolla et al. 925* (SP); Iporanga/Apiaí, Parque Estadual Turístico do Alto Ribeira (PETAR), 24º32’22” S, 48º32’22” W, 8 Jul. 2012, *F.F.F. Mazziero & A. Albiero Jr. 1136* (SP); Parque Estadual do Jacupiranga, Núcleo Caverna do Diabo, trilha do Rio das Ostras, 24º37’7” S, 48º23’3” W, 28 Mar. 2005, *A. Salino et al. 10275* (BHCB, CESJ); Ribeirão Grande, Parque Estadual Intervales, trilha da Caçadinha, com início na estrada do Carmo, 780 m, 24º16’39” S, 48º25’9” W, 15 Apr. 2003, *A. Salino et al. 8451* (BHCB, CESJ); Salesópolis, Estrada de Boracéia, Picada do Castelinho, ao Observatório, 4 Mar. 1962, *O.P. Travassos 334* (BHCB, RB); Salesópolis, Estação Biológica de Boracéia, antes do alojamento, 880 m, 23º39’14.3” S, 45º53’45.4” W, 30 Mar. 2012, *J. Prado & R.Y. Hirai 2259* (SP); Santo André, Estação Biológica do Alto da Serra, 800 m, 15 Jul. 1963, *C.P. Lima & L. Zimmermann 5* (SP); Santo André, Paranapiacaba, 16 Jun. 1966, *T.M. Pederson 7783* (LP); Santo André, Reserva Biológica de Paranapiacaba, trilha 8, 850 m, 23º46’28” S, 46º18’46” W, 12 Dec. 2014, *R.Y. Hirai et al. 755* (NY, SP!, US); São Lourenço da Serra, Reserva Particular do Patrimônio Natural Paiol Maria, trilha próxima à base, 757 m, 23º49’28” S, 46º56’30” W, 12 Jul. 2010, *M.N. Saka & B. Franco 110* (BHCB); São Luís de Paraitinga, Parque Estadual da Serra do Mar, Núcleo Santa Virgínia, trilha Pirapitinga, 900–950 m, 23º20’29” S, 45º8’48” W, 4 Mar. 2001, *A. Salino et al. 6113* (BHCB); São Paulo, Parque Estadual da Serra do Mar, Núcleo de Curucutu, trilha para o Rio Branco, 800 m, 23º59’7” S, 46º44’7” W, 12 May 2001, *A. Salino et al. 6506* (BHCB); Sete Barras, Parque Estadual Intervales, base de Saibadela, Rio Saibadela, 110 m, 24º15’ S, 48º03’ W, 13 Nov. 2001, *V.A. Dittrich 1012* (BHCB); Ubatuba, P.E. Serra do Mar,

Núcleo Picinguaba, trilha do Jatobá, 40 m, 23º20’25” S, 44º50’13” W, 2 May. 2001, *A. Salino et al. 6670* (BHCB). **Santa Catarina:** Apiúna, Faxinalzinho, 793 m, 27º10’49” S, 49º23’37” W, 17 Mar 2010, *A. Korte & A. Kniess 2154* (RB); Blumenau, Parque Nacional da Serra do Itajaí, 22 Mar. 2007, *A.L. de Gasper s.n.* (SP); Doutor Pedrinho, Véu-da-Noiva, near Dr. Pedrinho, Ecological trail to the waterfall, 600–700 m, 26º39’ S, 49º31’ W, 20 Mar. 2008, *M.J.M. Christenhusz et al. 4998* (SP); Jaraguá, [26°29’10’’S 49°04’00’’W], Sep. 1897, *Schwacke 13242* (RB); Joinville, Dec. 1904, *I.O. Müller 107* (SI).

COLOMBIA. **Antioquia:** Angelopolis: Sector Bocatoma acueducto, Quebrada Las Animas, 1950 m, 6º6’55” N, 75º41’16” W, 6 Feb. 2005, *W. Rodríguez et al. 5089* (HUA); Frontino, corregimiento de Nutibara, cuenca alta del río Cuevas, 1560 m, 10 Jul. 1986, *D. Sánchez et al. 250* (HUA); Guatapé, ca 8 km NNE of Guatapé, ver. Santá Rita, Finca Montepinar, 1850 m, 6º17’ N, 75º8’ W, 20 Nov. 1986, *J.L. Zaruchi 4162* (HUA); La Ceja, Camino de la Ceja, 1 Jul. 1934, *Ho. Daniel 655* (MEDEL); Mesopotamia, carretera entre San Miguel y Mesopotamia, 2440 m, 5º52’ N, 75º18’ W, 7 Jul. 1987, *A.L. Arbelaéz et al. 75* (HUA); Urrao, PNN Las Orquídeas, sector Calles, quebrada Agudelo, 1300–1400 m, 1988, *A. Cogollo & J.G. Ramírez 3493* (FMB); Urrao, camino hacia La Vereda La Encarnación, vereda Calles, sector La Quiebra-San Pedro, 1880 m, 6º29’42” N, 76º14’4” W, Jun 2014, *J. Castro & J. Serna 599* (HUA); Valdivia, Ver. San Fermín, finca propiedad de Javier Torres, 2079 m, 7.0799 N, -75.475917, 12 Sep. 2013, *M.J. Carmona et al. 479* (HUA); Valdivia, 3 km sobre la vía de Ventanas (Mun. Yarumal)-Briceño, quebrada El Oro, ver. San Fermín, 1700 m, 7º5’ N, 75º30’ W, 21 Mar. 1988, *A.L. Arbeláez et al. 305, 306* (HUA); Unión, Cerro San Miguel, 2620 m, 5º55’ N, 75º17’ W, 6 Jul. 1987, *A.L. Arbeláez et al. 70* (HUA). **Caldas**: Samaná, cruce camino a Florencia con Carretera a Pueblo Nuevo, con 24 de Pensilvania, 5º30’8” N, 75º7’33” W, 5 Nov. 1994, *C. Barbosa 10033 (28)* (FMB). **Chocó-El Valle del Cauca:** at both sides of the principal ridge of the Serrania de los Paraguas, along trail from El Cairo to río Blanco, ca 8 km SW of El Cairo, 2200–2250 m, 28 Mar. 1971, *D.B. Lellinger & E.R. de la Sota 856* (COL, LP). **Chocó:** San José del Palmar, vereda El Corcovado, Finca Ayaconas, 2140 m, 20 Jan. 1983, *P. Franco et al. 1628* (COL); San José del Palmar, Cerro Torrá, vertiente oriental, Río Negro, Abajo del Helipuerto, vereda Río Negro, 1800 m, 12 Aug. 1988, *J.E. Ramos & P.A. Silverstone et al. 1164* (CUVC). **Santander:** Sarare, Alto el Mirador, Santander, 1800–2100 m, 7°8’21” N, 72°15’46” W, 28 Mar. 1959, *H. Bischler 2144*

(COL). **Valle del Cauca:** Cali, vereda Pico de Águila, 1600 m, 1 Feb. 1992, *Montero H. & M. Gamboa 22* (COL).

COSTA RICA. **Puntarenas:** Vicinity of biological field station at Finca Wilson, 5 km S of San Vito de Java, 1–4 km SW of station, 1200–1400 m, 4 Aug. 1967, *J.T. Mickel 3105* (NY).

ECUADOR. **Loja-Zamora:** road aprox. 7.5 km from Loja (by our reckoning, Sabanillo was 34 km from Loja), on the west side of the pass, 2494 m, 3.98474 S, 79.16565, 27 Feb. 2010, *C.J. Rothfels et al. 3615* (DUKE, QCA!, UC). **Pichincha:** Road Chiriboga-Santo Domingo, just below Chiriboga, 1900 m, 00º17’ S, 78º46’ W, 2 Jun. 1979, *L. Holm-Nielsen 18150* (QCA). **Quito:** Reserva Florística-Ecológica Río Guajalito, km 59 de la Carretera Antigua Quito-Sto. Domingo de los Colorados, a 3 ½ km al NE de la carretera, estribaciones occidentales del Volcán Pichincha, 2200 m, 00º13’53” S, 78º48’ W, 12 Feb. 1987, *E. Grijalba 158* (QCA). **Zamora-Chinchipe:** Northern side of río Palanda at crossing with Zumba road, 1200 m, 30 Jan. 1983, *G. Harling & L. Andersson 21283* (QCA); Quebrada León, affluent of río Bombuscara S of Zamora, limit of Parque Nacional Podocarpus, vicinity of House owned by Predesur, 1100–1150 m, 4º7’ S, 78º58’ W, 13 Feb. 1990, *J.E. Madsen & J. Jnudsen 86807* (QCA).

NICARAGUA. **Bluefields:** Base Camp 3.6 km S.E. Cerro San Isidro, río Kama, río Escudero, 65 m, 12º5’–12º15’ N, 83º45’–84º20’ W, 4 Mar. 1966, *G.R. Proctor 26941* (NY).

PANAMA. **Coclé:** foot of Cerro Pilón, above El Valle de Antón, 600 m, 23 Mar. 1969, *D.M. Porter et al. 4606* (NY).

PERU. **Amazonas:** Bagua, ca 40–43 km (by road) NE of Chiriaco, 320 m, 7 Nov. 1978, *P. Barbour 4521* (USM!, MO). **Huánuco:** región A. Cáceres, Leoncio Prado, Bella (C. de las Lechuzas), 660 m, 11 May 1997, *C.S. Arévalo Ramírez 125* (USM).

VENEZUELA. **Amazonas:** Atabapo, cabecera del río Yudi, frente a trabajo no. 17, 1600 m, 5º29’ N, 65º18’ W, Mar. 1992, *L. Delgado 1696* (NY!, PORT); Río Negro, Cerro de la Neblina, 5.1 km NE Pico Phelps (= Neblina) (21.5 km, E Neblina Base Camp), 1850 m, 00º50’40” N, 65º58’10” W, 2 Dec. 1984, *D. Bell 399* (NY); Cerro Neblina, camp 7, South slopes of Cañon Grande, 1800 m, 00º55’ N, 66º00’ W, 29 Nov. 1984, *T.B. Croat 59464* (MO, NY!). **Aragua:** Parque Nacional Henry Pittier, on summit of knife-edge above Rancho Grande Biological Station, towards Pico Guacamayo, 1500–1700 m, 20 Oct. 1961, *J.A.*

Steyermark 89786 (NY). **Caracas:** on the old road from Caracas to La Guayra, 1100–1700 m, 28 Feb. 1913, *H. Pittier 5911* (NY). **Trujillo:** Between Trujillo and Bocono, 2450 m, 21 Jan. 1939, *A.H. Alston 6486* (NY)

29. Serpocaulon psychotrium Mostacero, D. Sanín & A.R. Sm. sp. ined. (Sanín et al., in prep. a). TYPE. Venezuela. Táchira: Distr. Uribante, Potosí at mouth of the Río Puya (formerly Río Puyita) at W end of Embalse La Honda, 1140 m, 7°57' N, 71°42' W, 20 Jun. 1990, *L.J. Dorr et al. 7102* (holotype: NY image!; isotypes: COL [bc] 336478!, MER [bc] 046202 image, MO [bc] 4381972, 4895044, 4895151!, image, MY [bc] 109654 image, PORT [bc] 23036 image!, VEN [bc] 296654 image!). Figures 10c, 20g, 23c, 81, 82, 84e.

Plants epiphytic, hemiepiphytic, occasionally terrestrial. *Rhizomes* 5–10 mm diameter, long-creeping, dark brown and dull, greenish gray when fresh, not pruinose, oxidizing at cutting; phyllopodia distance 1–4.5 cm. *Rhizome scales* dense, (3–)7–12 × 1–2 mm, subulate, patent, basally bicolorous, light brown to the margin and dark brown to the center, base ovate to rounded, appressed and peltate, apex abruptly reducing to a long narrow tip, patent and reflexed, erose margins. *Fronds* 28–150 cm long. *Petioles* (8–)17–50(–70) cm long, proximally subterete, distally slightly sulcate, usually stramineous to rarely strawy. *Laminae* 20–80 × (15–)20–50 cm, ovate-oblong to oblong-lanceolate, pinnate, truncate proximally and obtuse to acuminate apex. *Pinnae* (3–)6–12(–13) pairs, chartaceous to coriaceous, proximal and medial sessile, distal adnate, apical pinna conform. *Medial pinnae* (7–)9–20(–23) cm × (1.5–)2.0–4.0(–4.5) cm, base obtuse and apex acuminate-caudate, venation forming 42–46 rows along and 4–5 rows of areolae between the costae and the margin, notorious. *Laminar induments* pinnae scales scarce, especially in the pinna base, 1.5–4 × 0.3–0.5 mm, ovate-lanceolate, 3–4 cells wide, patent, peltate, bicolourous, light brown to the margin and dark brown at the center, base rounded to acute and apex acuminate, patent, the margins dentate. *Tricomes* scarce, 14–17 cells long, catenate, patent, hyaline to reddish. *Sori* from the medial pinnae in 30–42 rows along and (1–)3–4 rows between the costae and the margins. *Spores* 42–50 × 24–30 µm, ellipsoidal to sub-ellipsoidal, concave-convex to plane-convex and prominent verrucae.

Etymology. The epithet derived combining Latin words *psycho* = mind, and *aíthrion*, or *atrium* = hall lit from above, refers metaphorically to the confused taxonomy of the species (Sanín et al., in prep. a).

Distribution and habitat. Serpocaulon psychotrium occurs from Colombia to Peru, and Venezuela, mainly in Andean Amazon foothill, from 150–2000 m, in humid premontane forest.

Phenology. It was recorded fertile all months of the year.

Notes. *Serpocaulon psychotrium* most resembles *S. articulatum* and *S. richardii*, that also possess long-creeping rhizomes with subappressed to patent, lanceolate (in *S. articulatum*) or subulate (in *S. richardii*) rhizomes scales, and pinnate laminae. In addition, all species possess spores with prominent verrucae or papillae. However, *S. psychotrium* differs from *S. articulatum* by the subulate rhizome scales (vs. lanceolate), prominent sori in the adaxial surface (vs. immersed or inconspicuous), and lateral pinnae adnate to the apical (vs. sessile or pedicellate). From *S. richardii,* differs by its dark brown rhizome scales (vs. whitish to reddish rhizome scales), lamina nearly glabrous (vs. lamina dense pubescent), and spores with flat apex of the verrucae (vs. papillate ornamentation of the spores).

Taxonomic and nomenclatural notes. This species was segregated from a re-interpretation of *S. caceresii* (Sodiro) A.R. Sm., deriving in the consideration of it as a synonym of *S. articulatum*, and supporting the description of *S. psychotrium* (Sanín et al., in prep. a). In this sense, the collections that were determined as *S. caceresii* should be re-examined carefully because they could represent both, *S. articulatum* or *S. psychotrium*.

Indigenous name. Uap-hia in Venezuela (*Matos & Arias 1270*, CAR).

Representative specimens. COLOMBIA. **Antioquia:** Anorí, vereda Santa Gertrudis, finca La Estrella, quebrada que surte de agua la casa (bocatoma), 1420 m, 10 Mar. 2003, *W.D.*

Rodríguez 4138 (HUA); Barbosa, vereda La Pradera, 1500 m, 5 Jul. 1991, *D.L. Echeverry 504* (HUA); Cocorná, vereda La Piñuela, carretera a San Francisco, 1000–1500 m, 13 Apr. 1991, *D. Giraldo-Cañas 71* (HUA); Guatapé, vereda Santa Rita, finca Montepinar, 1850 m, 22 Aug. 1990, *Contreras 330* (HUA); San Rafael, vereda Bizcocho, finca La Selva, 8 Oct. 1981, *Orozco 369* (COL). **Boyacá**: Pauna, carretera Pauna-Borbur, 1300 m, 20 Oct. 1967, *R. Jaramillo-Mejía 3602* (COL); Sogamoso, Cordillera Oriental, vertiente oriental, carretera Sogamoso-Pajarito, valle del río Cusiana, 1500 m, 20 Oct. 1967, *R. Jaramillo-Mejía* 3894 (COL). **Caquetá**: Cordillera Oriental, vertiente oriental, Sucre, orillas de río Hacha, 1000 m, 3 Apr. 1950, *J. Cuatrecasas 9031* (COL); Sierra de Chiribiquete, cerca del Campamento Base, 600 m, 20 Nov. 1992, *Palacios 2737* (COL). **Cesar**: Agustín Codazzi, Serranía del Perijá, vereda El Milagro, finca de Miguel San Juan, 1870 m, 10º3' N, 73º3' W, 28 May 1994, *O. Rangel-Ch. 12551* (COL). **Cundinamarca**: Sasaima, km 66, 1500 m, 31 Mar. 1974, *C.A. Acosta-Arteaga 218* (COL); Viotá, cerro La Vieja, finca La Turena, 1200–1500 m, 21 Feb. 1978, *Torres 753* (COL); Yacopí, vereda La Laguna, inspección de policía de Guadualito, 1450 m, 31 Oct. 1995, *G. Lozano 7695* (COL). **Guaviare**: San José del Guaviare, confluencia Caño Perdido-río Losada, sin dat., 2º11' N, 74º3' N, 30 Jan. 1990, *Marulanda 1865* (HUA). **Huila:** Rivera, vereda Honda Alta, 1370–1550 m, 22 Aug. 1992, *F. Llanos et al. 2375* (COL); Palestina, Vereda Santa Bárbara, finca La Esperanza, bajando 10 m por la ladera de la montaña hacia el río Guarapas, 1550 m, 1°43'42" N, 76°6'54" W, 25 Oct. 2005, *G.A. Silva et al. 375* (FMB); Pitalito, Vereda El Triunfo, finca El Pedregal, a 300 m arriba de la casa de doña Isabel Chaus, entrando 10 m desde el borde donde colinda con un cafetal, 1550 m, 1°48'32" N, 76°0'59" W, 1 Nov. 2005, *G.A. Silva et al. 557* (FMB). **Magdalena**: Vereda La Tagua, sitio Filo Cartagena, 900–1545 m, 19 Jul. 1992, *A.L. Arbeláez et al. 534* (UC); región del Campano, Sierra Nevada de Santa Marta, ca. 1300 m, 11 Jan.1948, *F.A. Barkley & G. Gutiérrez V. 1885* (COL, MEDEL); in damp forest of camp, 10 km E of Codazzi, 1000 m, 10 Nov. 1943, *O. Haught 3826* (COL); Sierra Nevada de Santa Marta, transecto Buritaca, Alto Río Buritaca, Cuchilla, 1300 m, 3 Sep. 1977, *R. Jaramillo & T. van der Hammen et al. 5574* (COL); San Pedro de La Sierra, 16 Dec. 1966, *R. Romero-Castañeda 10728* (COL); Parque Natural Nacional Sierra Nevada de Santa Marta, Apr. -May 1992, *N. Pinilla & F.L.N. 8* (FMB), same general locality, *N. Pinilla & F.L.N. 73* (FMB). **Meta**: Municipio de la Macarena, vereda El Tapir, Parque Nacional Natural La Macarena, río Guayabero, bocas del

río Duda, Caño Cabaña (parte alta), sector Cielo Roto, 2°31' N, 73°54' W, 29 Jun. 1996, *D. Cárdenas et al. 7226* (COAH, COL); Sierra de la Macarena, Vereda El Tablazo, Morro Bello, 1000–1200 m, 27 May 1973, *M.C. García et al. 414* (COL, F); Municipio de Acacías, Colonia Penal y Agrícola de Oriente, cerca del Campamento Las Blancas, 930 m, 14 Aug. 1981, *R. Jaramillo 7737* (COL); Mesetas, Vereda Villa Lucía, hacia la Serranía de la Macarena, comunidad Páez, entre la Escuela del resguardo indígena de Villa Lucía y la casa de Hipólito Yandi, microcuenca de la Quebrada La Cristalina, 1000–1200 m, 3°28'4" N, 74°8'58" W, 7 Oct. 2002, *O. Rivera et al. 1133* (COAH, COL); Villavicencio, El Carmen, caño Maizano, 9 Mar. 1971, *C. Sastre & P. Pinto 1078* (COL). **Santander**: Piedecuesta, Mesa de los Santos, Guayabal, 2000 m, 5 May 1984, *G. Díaz et al. 123* (HUA).

ECUADOR. **Napo**: Carretera Pompeya Sur-Iro-Parque Nacional Yasuní, Km 30 al margen del río Tiputini, Transecta B, a 100 m de la carretera en dirección N 140°, 200–230 m, 4 Aug. 1994, *J. Jaramillo & X. Buitrón 16717* (QCA).

PERU. **Huánuco:** Huánuco, Dist. Churubamba, Hacienda Éxito, bank of río Isabel, 1100 m, 9 Sep. 1936, *Y. Mexia 8163* (F). **Loreto:** Maynas, Iquitos, río Nanay, carretera de Picuruyacu, 160 m, 22 Jan. 1981, *M. Rimachi 5455* (USM); Iquitos, 120 m, 1977, *J. Revilla 4311* (F); Maynas, Medio Putumayo, 150–170 m, 2°1'54" S, 73°15'26" W, 23 Oct. 2012, *M. Ríos* 2681 (F, USM); Maynas, Rio Mazan, quebrada Salinas, 110 m, 15 Mar. 1935, *J.M. Schunke 376* (USM). **Madre de Dios**: Tambopata, Dist. Tambopata, Tambopata Reserve, jct. of río La Torre and río Tambopata, 250 m, 22 Mar. 1981, *K. Young 160* (F, MO). **Pasco-Oxapampa:** Gran Pajonal, vicinity of Chequitavo, 1250 m, 10°45' S, 74°23' W, 23 Sep. 1983, *D.N. Smith* 5161 (MO, USM). **Moyobamba:** Corazón de Jesus, 1324 m, 5°49' S, 77°32' W, *L. Suominen et al. 388* (USM).

VENEZUELA. **Aragua**: carretera Maracay-Choroní, Alto de Choroní, 1400 m, 26 Dec. 1965, *V. M. Badillo 4324* (MY); a few mi. S of Colonia Tovar, 1800 m, 19 Dec. 1854, *A. Fendler 237* (YU); seaside of mountains between Maracay and Choroní, 2000 m, 29 Jan. 1857, *A. Fendler 414* (YU); Serranía del Interior, San Casimiro, sobre la fila extendida 2 km al O del Topo Golfo Triste, 1200–1300 m, 10°00'23" N, 66°56'31" W, 26 Jun. 2007, *J. Mostacero et al. 885* (VEN); near Campamento Rafael Rangel, Sierra Maestra, 1260 m, 1950, *E. Schwarz & P.J. Anduze 38* (US); Cerro El Paují, Topo El Paují, al sur de El Consejo, alrededores de la torre, 1450 m, 10°11' N, 67°15' W, 14 Jul. 1979, *J. A. Steyermark & A.*

Stoddart 118014 (MY, VEN); Parque Nacional Henri Pittier, bosque de Rancho Grande, Oct.-Nov. 1965, *R.H. Tschudy 59* (VEN). **Barinas**: Bolívar, vía de acceso al acueducto de Barinitas, río Paguey, Sector Moreno, 800 m, 8°46' N, 70°30' W, 18 Dec. 1991, *J. Farreras et al. 20* (PORT); Bolívar, ladera Este al pie de la Peña del Gobernador, sedimentos Eocenos de la Formación Paguey, 1500 m, 8°54' N, 70°29' W, 15 Dec. 1985, *A. Fernandez 1468* (PORT); Bolívar, ladera Este al pie de la Peña del Gobernador, cerca de Altamira, sedimentos Eocenos de la Formación Pagüey, 1500 m, Dec. 1985, *A. Fernández 1528* (PORT); Periférica del Municipio de Calderas en orilla del brazo del río Sto. Domingo, 8 Oct. 1983, *B. Stergios et al. 6453* (MO); Brazo del río Sto. Domingo, saliendo de Calderas para Masparrito, 8 Oct. 1983, *B. Stergios 6485* (F, PORT). **Distrito Capital**: Los Flores, Sierra de El Ávila, 1600 m, 15 Dec. 1938, *A.H.G. Alston 5526* (BM, NY, L!, U!, US!, VEN!); Selvas del Ávila, Mar. 1937, *E. Delgado 23* (VEN); quebrada arriba de Maripérez, 1100 m, 11 Jun. 1940, *L. Schnee 619* (MY). **Falcón**: Bolívar y Petit, Sierra de San Luis, 3 km NNE del Hotel Parador Turístico, 1500 m, 9 May 1979, *C. Burandt & R. Wingfield V0654* (UCOB); Sierra de San Luis, Fila Norte, Hoya de Curimagua, along road between Curimagua and La Chapa, 1.8 km NE of Uria, 1200 m, 11°9' N, 69°38' W, 6 Mar. 1993, *T.B. Croat 74475* (UC, VEN); Sierra de San Luis, bajando de la Finca Piña hacia la antena, sector El Chorro, 1269–1369 m, 11°14'2" N, 69°36'46" W, 28 Apr. 2007, *H. Ferrer-Pereira et al. 246* (VEN); Carretera Coro-Curimagua, cerca de torre de relevo, 1700 m, 27 Aug. 1962, *T. Lasser 4420* (VEN); Sierra de San Luis, vecindad del Hotel Parador, al sur de La Tabla, 1450 m, 16 Jul. 1967, *J.A. Steyermark 98926* (VEN); Sierra de San Luis, vecindad del Hotel Parador, al sur de La Tabla, 1400–1500 m, 17 Jul. 1967, *J.A. Steyermark 99042* (VEN); top of Parador at TV relay post, *W. van Cotthem 1353* (UC); Sierra de San Luis, cerca del Hotel Parador, 1300 m, 3 Sep. 1978, *H. van der Werff & R. Wingfield 3033* (MO, UC); Sierra de San Luis, cerca del Hotel Parador, 1400–1500 m, 25 Aug. 1978, *R. Wingfield & H. van der Werff 6566* (MO, UC, VEN). **Lara**: Jiménez, Parque Nacional Yacambú, 3 km E of Park headquarters, Quebrada El Blanco, 1300–1400 m, 9°43' N, 69°34' W, 24 Oct. 1982, *G. Davidse & A.C. González 21090* (PORT, VEN), same locality, *21091* (MO); Torres, Quebrada Los Caballos, 1 km de El Jabón, 1400 m, 12 Feb. 1983, *E. Escalona 11* (PORT); Yacambú Park area, 1500 m, 16 Dec. 1986, *A. Fay 1409* (MO, UC); Iribarren, Fila Sana Esteban, Quebrada Las Dantas con Quebrada río Claro, Parque Terepaima, Sector V, 1300–1400 m, 17 Jan. 1981, *L. Iriarte 69*

(PORT); Iribarren, trocha Camino Real, margen derecho, zona Palo El Tigre, Parque Terepaima, 1200–1300 m, Aug. 1983, *L. Iriarte & G. Morillo 167* (PORT, MER); Palavecino, Fila de Terepaima, entre el Alto de Chaparral y la Loma Redonda, 21–23 kms al sur de Cabudare, 1300–1460 m, 4 Aug. 1970, *J.A. Steyermark et al. 103419* (VEN). **Lara**/**Falcón**: Cerro Cerrón (western part), 1800–2000 m, 17 Jun. 1979, *R. Liesner et al. 8242* (MO, VEN); Cerro Socopo, 1200–1560 m, 10°29' N, 70°48' W, 9 Jun. 1979, *R. Liesner et al. 8355* (VEN). **Mérida**: Páramo de Chacantá, 1800 m, 22 Jan. 1921–1922, *A. Jahn 905* (US, VEN); Libertador, Mérida, Campo de Oro, bosquete residual en la margen derecha del río Chama, entre el pie de la Cuesta de los Chucos y la quebrada Campo de Oro, 1370 m, 16 Jul. 1977, *L. Ruíz-Terán & J.A. Dugarte 14003* (MERF, UC); camino entre La Azulita y Olinda, 2 Apr. 1950, *R. Velasco & M. Ramia 575* (MY). **Miranda**: Paz Castillo, Reyes Cueta, Los Guayabitos, bosque húmedo de la Vírgen, 1300–1490 m, 10°21'16" N, 66°38'36" W, 15 Aug. 1988, *A. Castillo & F. Bocaranda 2943* (VEN); Macizo del Golfo Triste, al suroeste de Ocumare del Tuy, Topo Onza, 1100–1130 m, 10°3'30" N, 66°53'30" W, 22 Jul. 2001, *W. Meier & S. Nehlin 8555* (B, MY, UC, VEN); Guaicaipuro, al sureste de Las Tejerías, al sureste de la mina de Nickel (Loma de Hierro), Fila El Amparo, 750–1000 m, 10°8' N, 67°7' W, 7 Jul. 2002, *W. Meier et al. 9023* (UC, VEN); Zamora, Cordillera de la Costa, Macizo del Ávila, vertiente sur, al noroeste de Guatire, al noroeste de El Bautismo: alrededores de El Oso, 1100–1300 m, 10º31'N, 66º28' W, 15 Jun. 2003, *W. Meier et al. 9266* (F, UC); Macizo del Golfo Triste, subida al macizo entre la Quebrada La Providencia y la Fila Las Yaguas, 1000–1100 m, 10°3'N, 66°53'W, 21 Mar. 2004, *W. Meier et al. 10196* (UC, VEN); Zamora, Parque Nacional El Ávila, El Bautismo, al noroeste de Guatire, 1250–1500 m, 10°31' N, 66°29' W, 4 Jan. 2006, *W. Meier & J.L. Hernández-Bretón 12543* (VEN); límite Municipio Baruta/Municipio El Hatillo, al sureste de Caracas, sureste de Baruta, El Volcán, vertiente sur, 1250–1350 m, 10°25' N, 66°51'30" W, 30 Mar. 2006, *W. Meier & H. N. Cordido 13621* (MY, UC); límite Municipio Baruta/Municipio El Hatillo, sureste de Caracas, entre Baruta y El Hatillo, Cerro El Volcán, vertiente norte, 1300–1450 m, 10°26' N, 66°51' W, 10 Dec. 2006, *W. Meier 14025* (MY, UC); Serranía del Interior, Urdaneta, vertiente N de la altiplanicie, Fila 1–3 km al S del Palacio de El Guayabal-pueblo de La Providencia, 1050–1100 m, 10°2'29" N, 66°55'11" W, 11 Oct. 2005, *J. Mostacero & W. Meier 640* (UC, VEN); Baruta, fila montañosa al Oeste del sector El Naranjal y el túnel de Los Ocumitos, arriba de

la Urb. Hacienda La Soledad, alrededores de torre repetidora de telefonía, 1375 m, 10°20’22” N, 66°53’3” W, 10 Aug. 2008, *J. Mostacero et al. 1529* (VEN); Baruta, sector montañoso al Oeste del Valle de Sartenejas (detrás de la represa), Reserva Ecológica Universidad Simón Bolívar, 1300 m, 10°24’55” N, 66°53’48” W, 4 Apr. 2014, *J. Mostacero* & *D. Petit 1884* (VEN); Baruta, carretera Hoyo de la Puerta, sector El Laurel, Estación Experimental de Agronomía “Dr. Jaime Henao Jaramillo” de la Universidad Central de Venezuela, 1400 m, 10°22’38” N, 66°53’51” W, 16 Oct. 2014, *J. Mostacero et al. 1897* (VEN); Parque Nacional Guatopo, along ridgetop, boundary between estado Miranda and estado Guárico, NE of highway, 18 km (by air) NNW of Altagracia de Orituco, 800–950 m, 10°2’ N, 66°26’ W, 28 Aug. 1979, *M. Nee 17871* (F, VEN). **Miranda**/**Aragua** (border): bosque nublado de Loma de Hierro, 1350 m, 10°11’ N, 67°7’ W, 10 Jun. 1984, *M. Colella & V. Morales 599* (PORT, VEN); límites distritos Urdaneta-San Casimiro, fila al sur del Topo Santo Domingo, 20 km distancia aérea al suroeste de Ocumare del Tuy, al oeste de Las Quebraditas, 1000–1150 m, 10°4’30” N, 66°58’ W, 21 Jan. 2002, *W. Meier & S. Nehlin 8876* (VEN). **Portuguesa**: Guanare, Caserío “La Montaña”, 4 km al NW de Córdoba, a lo largo de la quebrada “El Silencio”, 1000 m, 10°24’ N, 69°52’ W, 11 Dec. 1986, *G. Aymard 5167* (PORT, MO); Sucre, Villa Rosa, 15 km al SE de Biscucuy, bosques nublados a lo largo de la Quebrada El Potrero, 1400–600 m, 9°19’ N, 69°54’ W, 16 Jun. 1985, *G. Aymard et al. 3712* (PORT, UC); Unda, Caserío Santa Clara, sector El Plan, 1000 m, 9°29’27” N, 69°52’10” W, 26 Oct. 2002, *M. Gaydos & Y. Piñero 4* (PORT); Ospino, dentro de y alrededor de la Qda. Mazamorra, vía rural la Esperanza-Sta. Ana, 900 m, 9°28’40” N, 69°30’30” W, 22 Nov. 1990, *N. Gonzalez et al 10* (PORT); Guanare, entre Chabasquen y Córdoba, 1150 m, 20 Feb. 1982, *F. Ortega & B. Stergios 1452* (PORT lacking rhizome, UC); Ospino, 20 km W of La Estación, Laguna de San Bartolo and vicinity (turnoff from road to Palma Sola), 1400 m, 9°26’ N, 69°38’ W, 10 Nov. 1982, *A.R. Smith et al. 1155* (MO, PORT, UC); 13 kms al Este de Chabasquén, 1325 m, 9°26–27’ N, 69°54–55’ W, 29 Oct. 1982, *J.A. Steyermark et al. 126734* (MO, UC, VEN); laguna natural en la fila de la cumbre, 17.8 kms (por carretera) de La Estación, 30 kms (por carretera) al Norte de Ospino, 1170 m, 1 Nov. 1982, *J.A. Steyermark et al. 127033* (PORT, UC, VEN). **Táchira**: carretera Rubio-Las Delicias, 1 km arriba de Diamante, al lado de carretera, 1310 m, 4 Oct. 1967, G. S. *Bunting 2417* (MY); Independencia, El Ron, 26 Dec. 1968, *L. Cardenas de Guevara 759* (MERF, MY!); along highway between San Cristóbal

and Delicias, 45 km SW of Bus Terminal in San Cristóbal, 21 km S of Delicias turn-off in Rubio, 19 km N of Delicias, 1300 m, 9°42’ N, 72°25’ W, 10 Aug. 1982, *T.B. Croat 55020* (VEN); along highway between San Cristóbal and Páez, vía Rubio and Las Delicias, 13.8 km SW of plaza in Brammon, 1600 m, 7°39’ N, 72°22’ W, 12 Mar. 1993, *T.B. Croat 74663* (MO, UC, VEN); Uribante, Quebrada between Cerro La Escalera and Cerro El Morro, 1150–1250 m, 7°57’ N, 71°42’ W, 23 Jun. 1990, *L.J. Dorr & L.C. Barnett 7148* (MY, NY, PORT, VEN); Jáuregui, Seboruco, pasando el Alto del Niño, 1700 m, 7 Nov. 1982, *A. Fernandez 139* (PORT); Jáuregui, Seboruco, Alto del Niño, 1800 m, 7 Nov. 1982, *A. Fernandez 148* (PORT); Jáuregui, Seboruco, creciendo más arriba del sector Torcoroma, 800 m, Nov. 1982, *A. Fernández & J. Fernández 1059* (PORT, UC); en riberas del río Uraca, carretera la Fría-Colón, 5 May 1978, *B. Stergios 1106* (PORT); vicinity of Las Minas, north of La Laguna, 16 km SE of Santa Ana, 7°36’ N, 72°13’ W, 1150–1250 m, 28 Jul. 1979, *J.A. Steyermark & R. Liesner 118886* (UC, VEN); along steep slopes leading to Cerro Azul, at Cerro Las Minas, 18 km southeast of Santa Ana, 7°36’ N, 72°13’ W, 1200–1380 m, 11 Nov. 1979, *J.A. Steyermark et al. 120017* (MO, VEN); Uribante, Represa Las Cuevas near La Fundación, 8°50’ N, 71°47’ W, 900 m, 6 Jul. 1983, *H. van der Werff 4937* (VEN); Uribante, Represa Las Cuevas near La Fundación, 8°50’ N, 71°47’ W, 900 m, 7 Jul. 1983, *H. van der Werff & A. González 5030* (MO); Uribante, along road from La Siberia to entrance to Las Cuevas Represa, 9 Jul. 1983, *H. van der Werff & A. González 5208* (MO, VEN). **Trujillo**: Cerro vía Las Carmelitas (desde Las Pavas), 8 Feb. 2007, *C. Berlingeri et al. 181* (MY). **Vargas**: on the old road from Caracas to La Guaira, 1100–1700 m, 28 Feb. 1913, *H. Pittier 5911* (US). **Zulia**: Machiques de Perijá, Kunana (Perijá), 1175 m, 26 Dec. 1949, *F. Matos & S. Arias 1270* (CAR).

30. **Serpocaulon ptilorhizon** (Christ) A.R. Sm., Taxon 55(4): 929. 2006. *Polypodium ptilorhizon* Christ, Bull. Herb. Boissier, sér. 2, 5(1): 6. 1905. TYPE: Costa Rica. 1903, *L.C. Wercklé s.n.* (first step lectotype: P, designated by Hensen (1990: 302), **second step lectotype**: P [bc] 00632921 image! here designated; isolectotype: P [bc] 00632922 image!, P [bc] 00632923 image!). Figures 17p, 23d, 83, 84f.

Plants hemiepiphytic, epiphytic to rarely rupicolous. *Rhizomes* 0.5–4 mm diameter, long-creeping, dark brown to yellowish, pruinose; phyllopodia distance 0.8–5.5 cm. *Rhizome scales* disperse, 0.7–1.5 × 0.6–0.9 mm, rounded to elliptic, appressed, peltate, bicolorous, light brown to the margin and dark brown to the center, base and apex rounded to wide acute and appressed, erose margin. *Fronds* 6.5–38 cm long. *Petioles* 1.5–17 cm long, proximally subterete, distally slightly winged, light to rarely dark brown, dull. *Laminae* 5–21 × 2–8 cm, lanceolate, pinnatisect, truncate proximally and distally gradually tapering. *Segments* 8–24 pairs, chartaceous to slightly coriaceous, proximal surcurrent to slightly decurrent and slightly reflexed, medial and distal decurrents, apical segment widely attenuate (1/4–1/5 part of the laminae). *Medial segments* 1.2–3.4 × 0.3–0.8 cm, base decurrent and apex acute to rounded, venation forming 5–12 rows along and 1 row of areolae between the costae and the margin, impressed. *Laminar induments* segment scales scarce, mainly in the base of segments, 1.1–1.7 × 0.5–1.5 mm, lanceolate, 3 times bigger the rhizome scales, 16–20 cells wide, appressed, basifixed, concave, concolorous, dark brown, base rounded and acuminate apex, the margins dentate. *Hairs* scarce, 12–22 cells long, catenate, appressed or patent, hyaline. *Sori* from the medial segment in 3–10 rows along and 1 row between the costa and the margin, reaching the apices of the segments. *Spores* 56–72 × 43–55 µm, ellipsoidal, plane-convex to concave-convex, and irregular depressed verrucae.

Distribution and habitat. Serpocaulon ptilorhizon occurs from Nicaragua to Colombia, mainly in the mountain range of Costa Rica, from 650 to 2680 m, in cloud montane forest.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon ptilorhizon could be distinguished by the combination of pruinose long-creeping rhizome with rounded appressed scales, petiole 1/3 part of the laminae or bigger, triangular to deltate-lanceolate lamina, wide segments with apex rounded to acute, apical segment widely attenuate, and sori reaching the apex of the segments.

It most resembles *S. dasypleuron, S. funckii* and *S. loriceum,* that also possess long-creeping rhizomes with elliptic to rounded appressed scales, and pinnatisect laminae. Additionally, all of them can be sympatric (especially in Colombia). However, differs from

S. dasypleuron by its glabrous laminae with scarce scales in the segment base and dispersed to absent hairs (vs. dense pubescent), laminae chartaceous to slightly coriaceous (vs. membranaceus to papyraceous), and minor number of segments (8–24 vs. 20–43 pairs). From *S. funckii* could be distinguished by the presence of a minor number of segments (11–24 vs. 15–42 pairs), the sori reaching the apex of the segments (vs. non-reaching), and the apical segment widely attenuate (vs. narrowly attenuate). Finally, from *S. loriceum* by smaller petiole (1.5–17 cm vs. 7.5–38 cm long), smaller laminae (5–21 cm vs. 21–42.5 cm long), minor number of segments (11–24 vs. 20–36 pairs), the apical segments long attenuate (vs. slightly attenuate), and minor number of areolae along the medial segments (5–9 vs. 10–21 rows).

Taxonomic and nomenclatural notes. Polypodium ptilorhizon Christ was described from specimens recollected by L.C. Wercklé in Costa Rica. Hensen (1990) designated as isotype the sheet from P but labeled other sheets also from P as holotype (firs step lectotypification). Here were traced three sheets of the named collection, designating the specimen P [bc] 00632921 as lectotype (second step lectotypification). As pointed the Art. 9.17 from Turland et al. (2018).

Smith et al. (2006) suggested that this species is distributed from Nicaragua to Bolivia. Later, in the Prodromus of a fern flora for Bolivia, Smith et al. (2018) mentioned that 'the Bolivian specimens may not be conspecific with specimens from Costa Rica, the type locality'. Following the specimens studied, *S. ptilorhizon* is not recorded neither Ecuador nor Peru. Sanín (2018), in the Flora of Colombia, only found this species in Antioquia Department, border with Panama. And Moran (1995), pointed that its distribution goes from Mesoamerica to Colombia. In the same line, after studied the most important collections from Ecuador (QCA), Peru (USM) and Bolivia (LPB), it was possible to verify that only *S. funckii*, a species that is frequently misidentified with *S. ptilorhizon*, inhabits those countries.

Both species are very similar, and because they grow sympatric in Colombia, it is possible to find specimens that suggest hybridization between *S. ptilorhizon* with *S. funckii*, as well as, with the former and *S. levigatum* (Sanín, 2018). Rojas and Chaves-Fallas (2013) documented in Costa Rica a hybrid, *S.* ×*sessilipinnum*, between this species and *S. fraxinifolium.*

Smith et al. (2006), published the combination of *Polypodium ptilorhizon* Christ as *S. ptilorhizon* (H. Christ) A.R. Sm., however, the acronym of the author is Christ, as was verified in the protologue.

Chromosome number. n: 37 from *C.K. Horich s.n.* (F).

Representative specimens. COLOMBIA. **Antioquia:** Amalfí, Vereda El Oso, 13–16 kms de Amalfí a Medellín, 1590 m, 6º54' N, 75º8' W, 30 Sep. 1988, *J. Betancur et al. 880* (HUA); Anorí, Reserva La Forzosa, 1815 m, 27 Sep. 2003, *W.D. Rodríguez 4008* (HUA); Guatapé, vereda Santa Rita, 1850 m, 29 Apr. 1987, *D.L. Echeverry 70* (HUA); Medellín-Guarne, Parque Ecológico Piedras Blancas, sector Lajas, 2350 m, 6º18' N, 75º29' W, 10 Dec. 1994, *R. Fonnegra et al. 5329* (HUA); Medellín, corregimiento de Santa Elena, Reserva Natural Montevivo, sector Casapalo, 2500 m, 15 Feb. 2003, *H. David 485* (HUA); Sonsón, páramo de Sonsón, 2680 m, 7 Jul. 1987, *A.L. Arbeláez 113* (HUA); Rionegro, vereda Llano Grande, en el bosque de Corpoica La Selva, 2100 m, 15 Apr. 2008, *D. Sanín 2211* (HUA).

COSTA RICA. **Alajuela:** Alajuela, Cordillera Central, Cariblanco, caminho a Colonia Virgen del Socorro, 720–870 m, 10º15'24" N, 84º10'20" W, 11 Sep. 1994, *A. Rojas 1425* (INB); San Carlos, NE de Ciudad Quesada, 1250 m, 22 Jul.1963, *A. Jiménez 955* (F); Cordillera de Tilarán, Monteverde, 1520–1560 m, 22 Jun. 1976, *V.J. Dryer 350* (F); 5 min. N of San Ramón, 975 m, 27 Jul. 1967, *A.M. Evans & F. Bowers 2911* (NY); Upala, Z.P. Miravalles, Cuenca del Zapote, 3 km W of Bijagua, ridges above río Zapote, 650–700 m, 10º44'27" N, -85º05'39" W, 22 Aug. 1995, *W.H. Penneys 713* (INB). **Cartago:** Paraíso, valle del Reventazón, Estación Biológica Tropical Río Macho y alrededores, 1580–1630 m, 9º46'00" N, 83º52'00" W, 4 Mar. 1993, *A. Rojas 106* (INB); about 10 km S of Tapatiní along the new road on the east slope above the río Grande de Orosi, 1400 m, 9º42' N, 83º47' W, 10–24 Jun. 1968, *W.C. Burger & R.G. Stolze 5688* (F); SE. of Orosi, ca 2.2 km SSE of Purisil, above Finca La Concordia, at the head of the Valley, 1800–2300 m, 9−11 Aug. 1970, *D.B. Lellinger & J.J. White 1547* (F); Tapaní, ca 15 k, S of Paraíso, trail through wet forest along steep bank of the river, 1150 m, 3 Jul. 1967, *J.T. Mickel 2338* (NY, LP). **Guanacaste:** Las Nubes, 1 km N Las Nubes vilage, 8 km NW Monteverde, 1200 m, 10º22' N, 84º51' W, 31 Aug. 1989, *W. Haber & W. Zuchowski 9500* (CR, INB); 5 km N Santa Elena on road to Las

Nubes, Finca San Bosco road, río Negro, 1400 m, 10º22’ N, 84º49’ W, 10 Nov. 1988, *W. Haber & W. Zuchowski 8744* (F). **Heredia:** Cantón de Heredia, ca 5.5 km S of Vara Blanca, on ruta 9, 0.5 km before intersection with Ruta 120, 1980 m, 10º9’31” N, 84º9’10” W, 8 Aug. 1990, *G. Crow 7512* (INB); San Rafael, Cuenca del Tárcoles, Faldas del Cerro Zarquí, ca 4 km N de San Pedro de Heredia, 1700 m, 10:03:03.0000 N, -84º:03:26.0000 W, 26 Apr. 2008, *B. Hammel & I. Pérez 24742* (INB). **Limón:** R.I. Chirripó, Pila de Matama, orilla del río Bolley, 1300–1400 m, 9º45’15” N, 83º18’50” W, 16 Aug. 1993, *A. Rojas et al. 2327* (INB). **Puntarenas:** Buenos Aires, Cuenca Térraba-Sierpe, Estación Tres Colinas, 1940 m, 9º7’44” N, 83º3’58” W, 9 Dec. 1996, *E. Alfaro 710* (INB); Coto Brus, P.I. La Amistad, 1680 m, 9º1’30” N, 82º57’49” W, 8 Jun. 1995, *L. Angulo 338* (INB); Coto Brus, Z.P. Las Tablas, cuenca Terraba-Sierpe, sitio Coto Brus, 1960 m, 8º58’30” N, 82º46’15” W, 18 Feb. 1998, *A. Rojas & E. Navarro 4339* (INB); Monteverde, 20 Jun. 1967, *E.R. de la Sota 5020* (LP); Monteverde, 1475 m, 19 May 1980 m, *C. Lumer 1194* (NY); Monteverde Reserve, 1 km SW Station 1500–1550 m, 10º18’ N, 84º48’ W, 7 Feb. 1992, *S. Ingram & K. Ferrell-Ingram 1280* (NY). **San José:** La Palma, 1400–1550 m, *C.K. Horich s.n.* (F, NY); La Palma área, NE of San Jerónimo, above the La Hondura valley, 1500 m, 10º2’ N, 84º00’ W, 27 May–1 Jun. 1968, *W.C. Burger & R.G. Stolze 5331* (F); between Bajo La Hondura and Alto La Palma, 1400–1500 m, 10º2’ N, 83º59’ W, 19 Jul. 1983, *K. Barringer et al. 3991* (F); Tarbaca (1km S and 2 km N), 1600–1750 m, 5 Jul. 1967, *J.T. Mickel 2396* (NY, LP); Turrubares, Z.P. Cerros de Turrubares, faldas del Cerro Bares, 1600 m, 9º47’30” N, 84º28’30” W, 6 Nov. 1990, *R. Zuñiga et al. 357* (INB).

NICARAGUA. **Jinoteca:** along road from Hwy 3 to La Fundadora, 1200–1400 m, ca 13º2’4” N, 85º54-55’ W, 31 Oct. 1979, *W.D. Stevens & A. Grijalva 15452* (NY).

PANAMA. N.E. del Campamento Fortuna (Hornito), sitio de presa, después de excavaciones geológicas hasta la finca Santa María, 1000–1200 m, 15 Aug. 1976, *M.D. Correa et al. 2480* (F, NY).

31. Serpocaulon rex Schwartsb. & A.R. Sm., J. Bot. Res. Inst. Texas 7(1): 86–88, f. 1. 2013.

TYPE: Brazil. Minas Gerais: Frutal, Reserva Floresta Escola, Floresta Estacional Semi-Decídua, próxima ao Rio Grande, 460 m, 20°13’58” S, 48°53’3” W, 10 Aug. 2012, *P.B. Schwartsburd & L.M. Alves 2596* (holotype SP!; isotypes K [bc] 001089710 image!, K

[bc] 001089711 image!, K [bc] 001089712 image!, P [bc] 02142594 image!, UC, VIC [bc] 37085!). Figures 20h, j-l, 21d, 23c, 85, 86, 97a.

Polypodium brasiliense var. *pleiosorum* Rosenst. ex Hassl., Trab. Inst. Bot. Farm. Buenos Aires 45: 71, 1928. TYPE: Paraguay. Serra de Amambay, 1907–1908, **lectotype here designated**: *E. Hassler 10139a* (S [bc] S-05–9182 image!); isolectotype: *E. Hassler 10139* (S [bc] S-05–9181 image!). **New syn.**

Etymology. The specific epithet is an allusion to the size of the fronds, which are among the largest in *Serpocaulon* (Schwartsburd & Smith, 2013).

Plants terrestrial or rarely epiphytic. *Rhizomes* 5–11 mm diameter, long-creeping, subterranean, light brown to yellowish, dark dots persistent where the scales were attached, not pruinose; phyllopodia distance 2.4–7 cm. *Rhizome scales* dense, 4–8 × 1.8–7.2 mm, ovate-lanceolate, subappressed, subpeltate, concolorous, light to dark brown, base ovate to rounded, auriculate and overlapping, appressed, apex acuminate, patent, erose margins. *Fronds* 70–230 cm long. *Petioles* 28–82 cm long, proximally subterete, distally slightly sulcate, light brown, dull to dark brown. *Laminae* 41–150 × 34–47 cm, oblong-lanceolate to lanceolate, pinnate, truncate proximally and acute to acuminate distally. *Pinnae* 7–15 pairs, cartaceous, proximal and medial sessile, ascending, distal slightly adnate, apical pinna conform. *Medial pinnae* 13–28 cm × 1.5–3 cm, linear, base inequilateral, cuneate, basiscopically petiolulate, acroscopically sessile, and apex acute to acuminate, margin cartilaginous, crenate, venation forming 56–100 rows along and 5–7 rows of areolae between costae and the margin, notoriously impressed. *Laminar induments* pinnae scales absent; hairs scarce, 1–3 cells long, catenate, appressed, hyaline with dark brown apex. *Sori* from the medial pinnae in 30–42 rows along and 3–6(7) rows between the costae and margins, often non attaching the apex. *Spores* 60–69 × 38–45 μm, ellipsoidal to globular, plane-convex to cancave-convex and regular depressed verrucae or gemmulate.

Distribution and habitat. Serpocaulon rex occurs from Ecuador to Bolivia, and from Brazil to Paraguay, mainly in lowland swamps ecosystems, from 0–705 m, along the margins

of streams of Seasonal forest, knowing as "veredas" and "matas ciliares", vegetation of Cerrado domain or Amazon transitional forest.

Schwartsburd and Smith (2013) described this species as narrowly endemic to the sub-formation of the Atlantic Rain Forest, Seasonal semi-Deciduous Forest from Brazil. Sanín et al. (2019b) expanded its distribution in Brazil to Goias and Mato Grosso do Sul states, as was prognosticate by Schwartsburd and Smith (2013). Here, its range is expanded even more in Brazil (Espírito Santo, Mato Grosso and Rio de Janeiro States), as well as, to the named neighboring countries.

Remarkably, this species inhabits black water swamps (*B. Øllgaard et al. 35065*, F, QCA, U; *M.R. Pietrobom-Silva* 3917, IPA), and its rhizomes could be found just above the water level (*B. Øllgaard et al. 35065*, F, QCA, U), as well as terrestrial and hemiepiphyte (*D. Sanín & M.O. Duarte 7111*, BHCB). *D. Flores et al. 121* (CESJ), perceived a good strong odor in the plants, and it was confirmed the presence of nectaries in the base of the pinnae of juveniles (Sanín pers.obs. 2020, Fig. 21 d).

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon rex most resembles *S. attenuatum* and *S. triseriale*, that also possess thick rhizomes (5.7–20 mm) with abundant pubescent roots, lanceolate rhizomes scales with patent apex, and pinnate laminae (except *S. attenuatum*) with impressed venation. However, *S. rex* differs from *S. attenuatum* by the long-creeping rhizome (vs. short-creeping), pinnate laminae (vs. proximally pinnate and distally pinnatisect), and more row of sori between the costae and margins (3–6(–7) vs. 1(–2) rows). From *S. triseriale*, differs by the long-creeping, subterranean rhizome (vs. short-creeping and exposed), rhizome scales with clear lumen in the center of the cells (vs. colored lumen in the center of the cells), margin of the pinnae cartilaginous and crenate (vs. margin cartilaginous absent and smoot), and more row of sori between the costa and the margin (3–6(–7) vs. 1–4 rows).

Taxonomic and nomenclatural notes. Hassler (1928) described *Polypodium brasiliense* var. *pleiosorum* Rosenst. ex Hassl., based on three sheets 'syntypes' *E. Hassler 10139, 10139a* (NE), and *Rojas 3960* (NE). Despite that those specimens were designated, they were

not found, and it was necessary to choose one lectotype as suggested the Art. 9.3 (Turland et al. 2018). In this order of ideas, the sheet *E. Hassler 10139a* (S-05–9182) is designated here as lectotype. Additionally, this name here is presented as a new synonym of *S. rex*.

Representative specimens. BOLIVIA. **Pando:** Manuripi, selva a lo largo de la trocha entre Altagracia y Los Gomales, margen izquierdo del río Monte Alto, 1.51 m, 22 Oct. 1989, *S.G. Beck 19637* (Q); Manuripi, ca 20 km south of Río Manuripi on the road to Chivé, 11º58' S, 68º35' W, 12 Aug. 1982, *C.R. Sperling & S. King 6595* (F). **Santa Cruz:** Nuflo de Chavez, 5 km al N de Perseverancia, trocha del cafetal, 257 m, 14º38' S, 62º37" W, 11 Jun. 1990, *I.G. Vargas 586* (F).

BRAZIL. **Espírito Santo:** Cariacica, Reserva Biológica Duas Bocas, localidade Duas Bocas, trilha do Pescador, 135 m, 20º16'44" S, 40º28'42" W, 20 Oct. 2008, *P.H. Labiak et al. 5002* (CEPEC, MBML, RB!, UPCB); Linhares, Reserva da Companhia Vale do Rio Doce, Estrada do Roxinho, próximo ao aceiro Catelâ, 78 m, 19.1630 S, 40.0660 W, 8 Apr. 2006, *M.B. Paciência et al. 2396* (SP). **Goiás:** Caldas Novas, at headwaters of the creek, Rio Quente, at the hotel Pousada do Rio Quente, at foot of west side of the Serra de Caldas (a flat-topped batholiths dome), 13 km due WSW of city of Caldas Novas, 17º48' S, 48º45' W, 17 Dec. 1974, *E.P. Heringer & G. Eiten 14061* (F, LP, SP); Jataí, Queixada, 9 Feb. 1950, *A. Macedo 2142* (SP). **Mato Grosso:** Xavantina–São Félix road, 8 km NE of the Base Camp, 12°54' S, 51°52' W, 23 Apr. 1968, *J.A. Ratter et al. 1020* (K); Xavantina-São Félix road, 8 12 km da estrada Alto Araguaia-Alto Garcas, próximo a Serra do Touro, 12 Nov. 1988, *A. Salino 620* (BHCB). **Mato Grosso do Sul:** Aquidauana, Fazenda Feliz entre Terenos e Aquidauana, *S.N. Moreira et al. 966* (BHCB); Campo Grande, local Embrapa, 480 m, 20°26'54" S, 54°43'40" W, 19 Dec. 2003, *V.J. Pott et al. 6534* (BHCB); Maracajú, Faz. Jaboticaba, 60 km de Maracajú, rumbo a Jardim, 558 m, 21º33'22" S, 55º32'10" W, 8 Mar. 2013, *S.N. Moreira et al. 1400* (BHCB); Ponta Porã, Faz. Curupi, 19 Aug. 1999, *I.A. Carneiro 70* (BHCB); Ponta Porã, Faz. Curupi, 13 Nov. 2000, *I.A. Carneiro 5* (SP); Sonora, Local CASE (Companhia Agrícola de Sonora), ao longo da descida para foz do Cabecera Alta, 17°37'12" S, 54°53'30" W, 17 Aug. 2002, *V.J. Pott et al. 5669* (BHCB). **Minas Gerais:** Frutal, Reserva Floresta Escola, Floresta Estacional Semi-Decídua, próxima ao Rio Grande, 460 m, 20°13'58" S, 48°53'3" W, 2013, *P.B. Schwartsburd & L. Benevides 2853* (VIC);

Frutal, Reserva Floresta Escola, Floresta Estacional Semi-Decídua, próxima ao Rio Grande, 460 m, 20°13'58" S, 48°53'3" W, 22 Jan. 2018, *D. Sanín & M.O. Duarte 7111* (BHCB). **Rio de Janeiro:** Baixada de Jacarepaguá, Pedra de Itaúna, 19 Aug. 1988, *D. Flores et al. 121* (CESJ). **São Paulo:** Bauru, Jardim Botânico Municipal de Bauru, lado direito do Córrego Vargem Limpa, 22 Dec. 2005, *G.A. Nóbrega & M. Andrade 121* (BHCB); Borborema, ca 500 m do cruzamento da SP–302 com SP–333, 500 m, 21º35' S, 49º7' W, 21 Dec. 1996, *M.R. Pietrobom-Silva 3917* (IPA); Brotas, viveiro municipal, 470 m, 11 Aug. 1991, *A. Salino 1017* (BHCB, CESJ); Itirapina, mata de brejo junto ao Cerrado da Estrela, 21 Jul. 1991, *A. Salino 965* (BHCB, CESJ); Itirapina, Estação Ecológica de Itirapina, 705 m, 22°10' S, 47°51' W, 12 Mar. 2002, *V.A.O. Dittrich 1097* (BHCB); Moji-Guaçu, campos das Sete Lagoas, Faz. Campininha, just north of Rio Moji-Guaçu, 4 km NNW of Padua Sales, about 27 km NW of city of Moji-Mirim, 575–625 m, 22º11–18" S, 47º7–10' W, *G. Eiten and L.T. Eiten 5681* (SP); Planalto, Chácara nas proximidades da cidade, 21º20' S, 49º55'W, 15 Aug. 1996, *M.R. Pietrobom-Silva 3423* (IPA); Presidente Epitácio, região do Pontal do Paranapanema, estrada Viscinal Teodoro Sampaio-Presidente Epitácio, entre km 1718, margem esquerdo do Ribeirão Xavantes, 250–300 m, 22º5' S, 52º7' W, 23 Sep. 1996, *M.R. Pietrobom-Silva & C.T. de Lucca 3476* (SP).

ECUADOR. **Pastaza:** Río Capihuari, tributary of río Pastaza, 285 m, 2º30' S, 76º50' W, 23 Jul. 1980, *B. Øllgaard et al. 35065* (F, QCA, L).

PARAGUAY. **Zwischen Río Apa and Río Aquidaban:** 1908–1909, *K. Fiebrig 5736* (SI).

32. Serpocaulon richardii (Klotzsch) A.R. Sm., Taxon 55(4): 929. 2006. *Polypodium richardii* Klotzsch, Linnaea 20: 394. 1847. TYPE: Guiana. 1844, *R. Schomburgk 1651* (first step lectotype: B, designated by Hensen (1990: 306), **second step lectotype** mounted on 2 sheets: B [bc] 200090107 image! and B [bc] 200090108 image! here designated; isolectotypes: B [bc] 200090106 image!, frag. NY [bc] 00144899 image!). Figures 10f, 15c, 20i, 23c, 87, 88, 97b.

Etymology. Its name honoured the german botanist Richard Schomburgk, collector of the types.

Plants hemiepiphytic, epiphytic, terrestrial or rarely rupicolous. *Rhizomes* 4.5–10 mm diameter, long-creeping, dark brown to reddish, not pruinose; phyllopodia distance 2–5 cm. *Rhizome scales* dense, 6–8.3 × 1.2–1.6 mm, subulate, peltate base, patent to reflexed apex, bicolorous, light brown to the margin and dark brown to reddish to the center, base rounded to obtuse, apex long caudate-acuminate, reflexed, erose to slightly dentate margin. *Fronds* 45–120 cm long. *Petioles* 15–58 cm long, proximally subterete, distally slightly sulcate, light brown to dark, dull. *Laminae* 30–63 × 9–40 cm, ovate-oblong to ovate-lanceolate, pinnate, truncate proximally and acute to acuminate apex. *Pinnae* 4–13 pairs, papyraceous to slightly chartaceous, adnate 1/4 parts of the lamina, proximal sessile, medial slightly adnate and distal totally adnate, apical pinna conform and adnate to the laterals. *Medial pinna* 12–24 × 2.5–5.5(7) cm, base acute to cuneate and apex acuminate, venation forming 35–59 rows along and 4–7 rows of areolae between the costae and the margin, inconspicuous. *Laminar induments* pinnae scales absent; hairs in both surfaces, dense, catenate, patent, light brown with dark dissections, over the laminae and rachises, 5–13 cells long, villose, and over the laminae, 3–7 cells long, strigose. *Sori* from the medial pinnae in 27–47 rows along and (3)4–5(8) rows between the costa and the margin. *Spores* 44–52 × 24–28 µm, ellipsoidal to subellipsoidal, concave-convex to plane-convex, and prominent verrucae or gemmulate.

Distribution and habitat. Serpocaulon richardii occurs from Colombia to Bolivia, and Amazonian Brazil and Guianas, mainly in premountain forest of Amazon-Andes transition, and 'Brejos de Altitude' in Brazilian Northeast, from 235–2225 m, in humid forest.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon richardii most resembles *S. psychotrium*, that also possess long-creeping rhizomes with rhizome scales subulate, with base peltate, and apex patent, reflexed, and pinnate laminae with distally adnate pinnae. However, differs from *S. psychotrium* by its laminae dense pubescent (vs. glabrous or with disperse and scarce hairs), papyraceous consistence (vs. chartaceous to coriaceous), and the absence of laminar scales (vs. ovate-lanceolate laminar scales).

Taxonomic and nomenclatural notes. Hensen (1990) designated a specimen hosted at B as the holotype, however the collection is composed by two sheets that represent the apex and the rhizome. Following Turland et al. (2018, Art. 8.3) are designated the mentioned sheets as lectotype.

The presence of *S. richardii* in Brazil was confirmed by Sanín et al. (in prep. c). It was commonly misidentified as *S. adnatum* (Zuquim et al., 2008; 2009; Góes-Neto & Pietrobom, 2012), which is a North Andean species (see commentaries of this species). Nevertheless, Smith et al. (2018) mentioned its presence in the central and southeastern of Brazil without citing specimens. In this respect, Sanín et al. (in prep. c) recorded that the southern distribution of this species is Pernambuco and Bahia, which are part of the northeast area of the named country.

Representative specimens. BOLIVIA. **Cochabamba:** Carrasco, 235 m, 17º00’ S, 64º46’ W, 27 Apr. 1989, *D.N. Smith et al. 13041* (LPB, MO); Cochabamba, Carrasco, Proyecto Valle del Sacta, 241 km w of Santa Cruz, 219 km E of Cochabamba off new road between Cochabamba and Santa Cruz, 290 m, 17º12’ S, 64º43’ W, 10 Jul. 1989, *A. Fay & L. Fay 2336* (F!, LPB, MO, UPCB!. USM!); Cochabamba, Carrasco, de Villa Tunari 62 km hacia Puerto Villarroel “Parque Litoral”, cerca de Ivirgarzama, 400 m, 2 May 1979, *S.G. Beck 1539* (F).

BRAZIL. **Acre:** Mâncio Lima, Parque Nacional da Serra do Divisor, Serra do Môa, trilha para a Cachoeira Formosa, 260 m, 7º26’10” S, 73º39’36” W, 14 Dec. 2010, *T.E. Almeida & A. Salino 2611* (BHCB). **Bahia:** Camacan, Fazenda Serra Bonita, 9.7 km W de Camacan na estrada para Jacareí, 9 Jul. 2005, *F.B. Matos et al. 634* (UFPR). **Mato Grosso:** Itaúba: Floresta do Planalto dos Parecis, 278 m, 5 Feb. 2015, *M.E. Engels et al. 2824* (RB, HERBAM, MBM, TANG, CNMT); Vila Bela da Santíssima Trindade, Faz. Cabixi, junto ao Rio Cabixi, ca 12 km divisa com Rondônia, 13º S, 60º10’ W, 11–14 Jan. 1987, *J. Prado & A. Salino 17* (BHCB). **Pará:** Canaã dos Carajás, Floresta Nacional dos Carajás, Serra Sul, Corpo S11, 575 m, 6º20’36” S, 50º24’30” W, 24 May 2012, *A. Salino et al. 15297* (BHCB); Canaã dos Carajás, Floresta Nacional dos Carajás, Serra Sul, Corpo A, 584 m, 6º18’33” S, 50º27’19” W, 29 Jun. 2010, *T.E. Almeida et al. 2437* (BHCB); Parauapebas, N1, 677 m, 6º2’19” S, 50º17’32” W, 8 Feb. 2012, *A.J. Arruda et al. 545* (BHCB); Parauapebas, Ponto

T, 383 m, 6º16’21” S, 50º18’42” W, 28 Aug. 2012, *A.J. Arruda et al. 1294* (BHCB). **Pernambuco:** Bonito, margem estrada para Camocim, 21 Jan. 1970, *Andrade-Lima 70–5657* (IPA); Bonito, Mata da Azuada, relitos a mão direita descendo, 709 m, 8º30’8” S, 75º41’49” W, 16 Mar. 2019, *D. Sanín & A. Santiago 7267* (BHCB); Mata da Reserva Biológica municipal de Bonito, 750–800 m, 8º30’30” S, 35º43’18” W, 19 May 2000, *A. Santiago et al. 149* (PEUFR); Reserva Biológica, 21 Nov. 1994, *L.P. Felix 7003* (PEUFR); Mata da Colônia, 800 m, 8º30’14” S, 35º42’56” W, 14 Jul. 2000, *A. Santiago 218* (PEUFR); Mata da Chuva, 750 m, 8º32’20” S, 35º43’22” W, 8 May 2001, *A. Santiago & M.R. Pietrobom-Silva 453* (PEUFR); São Vicente Ferrer, Complexo do Maciço Serra do Mascarenhas, Mata do Estado, 640 m, 7º35’00” S, 35º30’00” W, 20 Apr. 1998, *M.R. Pietrobom-Silva 4229* (BHCB, PEUFR); Vicência, 8 Jul. 1974, *I. Pontual s.n.* (PEUFR).

COLOMBIA. **Boyacá:** carretera a Pauna-Otro Mundo, 1350 m, 16 Oct. 1967, *R. Jaramillo-Mejía 3650* (COL). **Cundinamarca:** carretera arriba de Sasaima, hacienda La Isabela, 1540 m, 22 Dec. 1967, *R. Jaramillo-Mejía 4784* (COL). **Putumayo:** Mocoa, Valle del Sibundoy, Mocoa and vicinity, 2225 m, 16 Mar. 1953, *R.E. Schultes 19049* (COL).

ECUADOR. **Morrona-Santiago:** Mutintza, SE of Makuma, trail to río Kiritin, ca 3 km SW of village, 675–750 m, 2º13’ S, 77º45’ W, 4 Nov. 1996, *B. Øllgaard & H. Navarrete 1981* (AAU, QCA!); Road Santa Susana de Chiviasa-Panecillo, km 3–4, 1300 m, 2º55’ S, 78º4’ W, 18 Nov. 1997, *B. Øllgaard & H. Navarrete 2621* (AAU, QCA!). **Napo:** Parque Nacional Yasumí, km 41.5 on an oil road starting at Pompeya, transect 22, 00º41’ S, 76º27’ W, 21 Apr. 1996, *R.C. Moran et al. 6258* (QCA). **Pastaza:** Mera-Shell Mera, ca 2 km E of Mera, at bridge over río Alpayacu, 1100 m, 1º28’ S, 78º6’ W, 21 Jan. 1992, *B. Øllgaard 99570* (AAU, QCA!); Road-Puyo-Palora, 6 km of San Jacinto, 1000 m, 1º38’ S, 78º00’ W, 22 Jan. 1992, *B. Øllgaard 99611* (AAU, QCA!). **Sucumbios:** Parque Nacional Yasuní, km 100 de la carretera construida por MAXUS, 380 m, 4º40’ S, 76º24’ W, Apr. 1994, *H. Navarrete 703* (QCA).

FRENCH GUIANA. Montagnes de la Trinité, Bassin de la Mana, 600 m, 4º35’ W, 53º21’ W, 13 Mar. 1997, *J.J. de Granville 13322* (NY).

GUIANA. Sur les bords d’une crique et d’ un ilet, au niveau d’un saut à environ 17 km au sud de Saü, 4 Apr. 1983, *J.J. de Granville 5501* (BR); *Richard* (F). **Kaw**: Montagne situe a 2km environ au sud du vilage, 6 Apr. 1984, *J.J. de Granville 6898* (BR).

PERU. **Amazonas:** Rodríguez de Mendoza, Mariscal Benavides, Izcuchaca, 1880 m, 6º19'40" S, 77º31'5" W, 30 Aug. 1998, *R. Vásquez & J. Campos 25355* (F!, MO). **Cajamarca:** San Ignacio, La Coipa, localidad La Lima, 1800 m, 5º26'0" S, 78º55'00" W, 16 Jun. 1997, *J. Campos & Z. Garzia 4004* (F). **Cusco:** La Convención, Distrito de Echarati, Meronkiari, 477 m, 18L 0724395, 8699214, 9 Jul. 2008, *S. Castillo & H. Beltran 573* (USM); Paucartambo, Kosñipata Valley, río Tono, First foothill ridge on road N. of Pátria, 800 m, 13º7' S, 71º12' W, 3 Dec. 1985, *T.S. Wachter et al. 159* (F, USM). **Huánuco:** Huánuco, Tingo María, 700 m, 30 Aug. 1956, *R.M. Tryon & A.F. Tryon 5222* (F); A. Cáceres, Leoncio Prado, Tingo María (Brunas), 680 m, 17 Jun. 1997, *S. Arévalo Ramírez 265* (USM). **Madre de Dios:** Tambopata, Dist. Tambopata, Tambopata Reserve, jct. of río La Torre and río Tambopata, 250 m, 22 Mar. 1981, *K. Young 160* (F). **Napo:** Tena, 670 m, 27 Apr. *E. Heinrichs 389* (F). **San Martín:** Moyobamba, Calzada, alrededores del Fundo Ganadera, 822 m, 18M 0268302/9335282, 7 Sep. 2012, *L. Tonder 4202* (USM).

SURINAM. Inselberg Talouakem-Masiff des Tumuc-Humac, 500 m, 2º29' S, 54º45' W, 9 Aug. 1993, *J.J. de Granville et al. 12175* (NY).

33. Serpocaulon sessilifolium (Desv.) A.R. Sm., Taxon 55(4): 929. 2006. *Polypodium sessilifolium* Desv., Mém. Soc. Linn. Paris 6: 238. 1827. TYPE: Peru. In montosis Peruvianis, *Anonymous s.n.* (lectotype designated by Hensen (1990: 307): P [bc] 01818732 image!; isolectotype B [bc] 200087688 fragm. image!). Figures 18d, h, j, 23f, 89, 90, 97c.

Polypodium surucuchense Hook. Icon. Pl. 1: 69. 1837. *Goniophlebium surucuchense* (Hook.) T. Moore, Index Fil. 74. 1857. TYPE. Ecuador. Azuay: Surucucho, near Cuenca, 1830, *W. Jameson s.n.* (lectotype designated by Hensen (1990: 307): K [bc] 000642048 image!).

Polypodium andinum H. Karst. Fl. Columb. (H. Karst.) 1 (5): 171–172; tab. 85. 1861. TYPE. Colombia. Cundinamarca: near Bogotá, 2200 m, *H. Karsten s.n.* (**Neotype here designated**: W [bc] 0061338 image!).

Serpocaulon chacapoyense (Hook.) A.R. Sm., Taxon 55(4): 929. 2006. *Polypodium chacapoyense* Hook. Sp. Fil. 5: 29, pl. 281. 1863. TYPE. Peru. Sesuja, Chachapoyas, *Mathews 3278* (lectotype designated by Hensen (1990: 307): K [bc] 000642046 image!).

Serpocaulon acuminatum (Fée) Christenh. Bot. J. Linn. Soc. 16(3): 270. 2009. *Goniophlebium acuminatum* Fée, Mem. Foug., Hist. Foug. Ant. 11: 68, pl. 19. 1866. TYPE. Guadeloupe, Rivière St. Louis au Matouba, *l'Herminier s.n.* (first step lectotype: P, designated by Hensen (1990: 307); **second step lectotype:** P [bc] 00632831 image! here designated; isolectotypes P [bc] 00632830 image!, B, RB [bc] 216379!, BM [bc] 000937454 image!, K).

Polypodium remotum Baker, Ann. Bot. 5: 470. 1891. Invalid homonym of *Polypodium remotum* Desv. = *Pleopeltis remota* (Desv.) A.R. Sm. *Polypodium uniseriale* C. Chr. Index Filic. 572. 1906. TYPE. Colombia. Norte de Santander: Salazar, *W. Kalbreyer 843* (lectotype designated by Hensen (1990: 307): K [bc] 000642050 image!; isolectotype: photo: US); syntypes: Guyana, Demerara, *G.S. Jenman 1434* (K [bc] 000642086 image!, K [bc] 000642085 image!).

Serpocaulon antillense (Maxon) A.R. Sm., Taxon 55(4): 927. 2006. *Polypodium antillense* Maxon, Proc. Biol. Soc. Washington 43: 83. 1930. TYPE. Guadeloupe, *l'Herminier s.n.* (first step lectotype: RB, designated Sanín & Salino (2018)): RB; **second step lectotype:** RB [bc] 216378! here designated; isolectotype P [bc] 00624734 image!).

Polypodium pseudofraternum A.C. Sm., Bull. Torrey Bot. Club 58: 307. 1931. TYPE. Venezuela. Amazonas: Summit of Mount Duida: summit of Peak No 7, 2164 m, 1929, *Tate 645* (lectotype designated by Hensen (1990: 307): NY [bc] 00144897 image!).

Plants epiphytic, rarely terrestrial or rupicolous. *Rhizomes* 4.7–20 mm diameter, short-creeping, dark brown distally, light brown to the apex, pruinose; phyllopodia distance 0.8–2.6 cm. *Rhizome scales* dense, 5–16 × 2.1–3.6 mm, acicular lanceolate, patent, basifixed, concolorous, dark brown, iridescent, base truncate to rounded and appressed, auriculate often overlapping, apex long acuminate and patent, erose and overlapping margin. *Fronds* 9–135 cm long. *Petioles* 1.8–53 cm long, proximally subterete, distally slightly sulcate, dark to light brown. *Laminae* 7–81 × 3–50 cm, ovate-oblong to ovate-lanceolate, pinnate, truncate proximally and acute apex. *Pinnae* 3–27 pairs, coriaceous, proximal petiolate, reflexed,

medial sessile and distally slightly adnate, apical pinna conform, generally adnate or with a basal auricule. *Medial pinna* 5.7–28 × 0.5–2.3 cm, base decurrent, inequilaterous and apex acute to long acuminte, with hydathodes over the adaxial surface, venation forming 15– 42 rows along and 1 row of areolae between the costae and the margin, impressed. *Laminar induments* pinnae scales scarce, mainly in the base of the pinna, 1.8–5.4 × 0.2–0.5 mm, acicular-lanceolate, to 8 cells wide, appressed, basifixed, concolorous, dark brown, base peltate and apex rounded and long acuminate, cirrose, the margins dentate; hairs scarce, 2–9 cells long, catenate, patent, strigose, brown with dark brown dissections. *Sori* from the medial pinnae in 6–66 rows along and 1 row between the costa and the margin. *Spores* 57–67 × 34–42 μm, ellipsoidal to globular, concave-convex to plane-convex, with thick folded perinae.

Etymology. The epithet refers to the sessile condition of pinnae.

Distribution and habitat. Serpocaulon sessilifolium occurs from Guatemala to Bolivia and from Venezuela to Brazilian Amazon. It is also found in the West Indies (Cuba, Hispaniola, Jamaica, Haiti, Dominican Republic, Martinica, and Guadeloupe). Mainly in high montane cloud forest and subparamo to rarely in oceanic islands, from (125–)950 to 4000 m. Despite that there were no find specimens from Salvador, Honduras or Nicaragua, it is expected to be recorded in those countries.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon sessilifolium could be distinguished by its thick short-creeping rhizome, with iridescent rhizome scales, pinnate and coriaceous laminae, apical pinnae conform, one row of sori between the costae and margin, and spores with thick folded perinae. Has been confused with *Polypodium kunzeanum* C. Chr., by its thick short-creeping rhizome, pinnate laminae with one row of sori. However, differs by its pruinose rhizome (vs. non-pruinose), with clathrate rhizome scales (vs. non-clathrate), not articulate pinnae (vs. articulate), coriaceous consistence (vs. membranaceus consistency), and pinna base decurrent (vs. cordate and overlapping the rachis) (Smith et al., 2006; Salino et al., 2019).

Serpocaulon sessilifolium is one of the widely distributed species in the genus. This could be related to the morphological variation recorded, as well as, the synonymy stressed by the literature (Lellinger, 1989; Hensen, 1990; Smith et al., 2006; Sanín & Salino, 2018).

Most of the specimens present loriform pinnae, however, some samples from Colombia, show rhizome scales dark reddish with elongated cells, pinnae notoriously narrow and sori that cover the wide of the pinnae hiden the veins (*Idrobo 3551*, COL) (Sanín, 2018). Also, from Colombia, it was recorded dichotomies in the pinnae apex (*Callejas 13364*, HUA), as well as, the presence of one exemplar with two laminae for petiole (*Duque-Quintero 15*, FAUC) (Sanín, 2018).

In La Libertad department of Peru are recorded specimens that suggest hybridization between *S. lasiopus* and *S. sessilifolium* (sympatric species in Peru), diagnosticated by the presence of thick, short-creeping rhizome, with concolorous iridescent rhizome scales (characters of *S. sessilifolium*), with auriculate base and non-well formed scales (intermediary feature), fronds dense pubescent and pinnatisect, gradually tapering apex (feature to *S. lasiopus*) (*Roque 5939*, USM; *Smith & Vasquez 3343*, USM).

Taxonomic and nomenclatural notes. Polypodium andinum H. Karst., was described based on collections made by the author in Bogotá, Colombia (Karsten, 1861). Nevertheless, Karsten did not designate any sheet or herbaria. Hensen (1990) commented that the type is at LE without mentioning any collection. Sanín and Salino (2018) suggested that the lectotype designated by Hensen (1990) was hosted at LE, but did not provide its respective barcode. Stafleu et al. (2020) cited Leningrad as the location of Karsten's types. However, they also mentioned that another important set of Colombian plants collected by Karsten is at W. Following the Article 9.16 of Turland et al. (1018) is designated as neotype the sheet *H. Karsten s.n.* (W [bc] 0061338) because the specimens from LE was not traced, and additionally, because the specimen from W is complete and bears the original handwriting of the collector.

Hensen (1990) designated as holotype of the name *Goniophlebium acuminatum* Fée = *Serpocaulon acuminatum* (Fée) Christenh., the sheet *l'Herminier s.n.* from P (first step lectotype). The author did not notice that in Paris exist two sheets from the same collection, reason why here is designated by the second step lectotype the specimen P [bc] 00632831 as

suggested Turland et al. (2018, Art. 9.17). Sanín and Salino (2018) supported that this name is part of the synonymy of *S. sessilifolium*, affirmation that is also stated here.

Polypodium antillense Maxon, was proposed by Maxon (1930), to replace the name *Goniophlebium acuminatum* Fée arguing that this species name would be invalid under *Polypodium* due the existence of *P. acuminatum* Houtt. (Houttyuyn, 1761–1785), *P. acuminatum* Roxb. ex D. Don (Don, 1735) and *P. acuminatum* (Fée) Sodiro (Sodiro, 1893). Sanín and Salino (2018) designated as lectotype of this species the sheet from *l'Herminier* based at RB without mentioning the barcode (first step lectotype). After traced at RB, it was possible to localize two sheets from *l'Herminier* that represents *Serpocaulon sessilifolium*, one was chosen here (RB [bc] 216378) to designated by the second step lectotype the name *S. antillense* (Maxon) A.R. Sm.

After revising macro and micro-morphology of types specimes of *Serpocaulon acuminatum, S. antillense* and *S. chacapoyense*, Sanín and Salino (2018), proposed those names as synonyms of *S. sessilifolium*.

Representative specimens. BOLIVIA. **Cochabamba:** Province of Chapare, the ridge descending from Cerro Pajcha Ukhu towards the north (the area between Laguna Corani and Corani Pampa), 3100–3250 m, 12 May 1996, *N. Ritter 3177* (NY); Sacaba, Incachaca, 2500 m, 14 Oct. 1921, *J. Steinbach 5859* (SI). **La Paz:** Franz Tamayo, Parque Nacional Madidi, quebrada Jatun Chiriuno, 31 km en línea recta al este de Apolo por el camino a San José de Uchupiamonas, trayecto de 1.5 km hacia el oeste, 1850–2020 m, 14°30'00" S, 68°13'58" W, 27 Jun. 2002, *A. Fuentes 4625* (MO). **Santa Cruz:** Manuel María Caballero, Bosque Hiperhúmedo de Ceja de Monte, colecta en El Locotal sobre el camino a San Mateo a 9.5 km del cruce El Empalme, 2200 m, 17°47'41" S, 64°43'1" W, 18 Jun. 2003, *R. Nuñez 214* (MO).

BRAZIL. **Amazonas:** Parque Nacional do Pico da Neblina, Trilha para a cachoeira da Anta, Alto da Serra da Neblina, Acampamento do Marco 5 da fronteira do Brasil com a Venezuela, São Gabriel da Cachoeira, 2343 m, 31 Dec. 2004, *F. Carvalho* 377 (INPA).

COLOMBIA. **Antioquia:** Angostura, finca El Cordal, quebrada El Pajarito, bosques de robles plantados, 2 km NE del peaje de Santa Rosa de Osos, sobre la vía a Medellín-Costa Atlántica, Bmh-P, 1800 m, 6º53' N, 75º21 W, 6 Nov. 2003, *R. Callejas 13364* (HUA); Belmira, páramo de Belmira, localidad Montañita, 2839 m, 6º37' N, 75º38' W, 9 Feb. 2012,

D. Sanín 5002 (HUA); La Unión, carretera de la Unión-San Miguel, 2340–2430 m, 5º58’ N, 75º21’ W, 5 Jul. 1987, *A.L. Arbeláez 50* (HUA); Medellín, corregimiento de San Antonio de Prado, vereda Astilleros, divisoria de aguas entre las quebradas Doña María-Ana Díaz, sector Piedra Galana, 2580–2650 m, 6º15’ N, 75º40’ W, 5 Dec. 2005, *W.D. Rodríguez 5674* (HUA); Urrao, 2350 m, 28 May 1976, *L. Atehortúa 265* (HUA). **Boyacá**: Santa María, vereda Caño Negro, camino a Palo Negro, entre las fincas Santa Rosita, El Recuerdo y El Tesoro, hacia cuchilla Negra, 1810 m, 5 Nov. 2003, *J. Murillo-A. 3479* (COL). **Caldas:** Manizales, Reserva Torre IV, parte alta, al borde del potrero de la finca aledaña, 3200 m, 24 Jul. 2009, *D. Sanín 2362* (FAUC); Salámina, corregimiento de San Félix, sector La Samaria, relictos detrás de la escuela, 2945 m, 4º59’ N, 75º10’ W, 28 Aug. 2009, *D. Sanín & B. Gonzalez 3459* (FAUC, HUA). **Cauca**: Bolívar, corregimiento de Los Milagros, vereda Aguas Regadas, alrededor de la Laguna, 3000–3200 m, 1º49’ N, 76º53’ W, 6 Jul. 2006, *Ramírez-Ch. 359* (CAUP); Macizo Colombiano, páramo de las Papas, entre El Boquerón y La Hoyola, 3200–3510 m, 7 aug. 1958, *J.M. Idrobo 3551* (COL); Popayán, Parque Nacional Natural Puracé, sector anexo a las bases militares, 3887 m, 26 Jul. 2009, *D. Sanín 3294* (FAUC); Silvia, páramo El Abejorro, vía al páramo Cresta de Gallo, vereda La Marquesa, 2900 m, 8 Apr. 2006, *Muñoz 1853* (CAUP). **Cundinamarca**: Fómeque, páramo de Chingaza, La Laja y alrededores, 2700–3250 m, 11 Dic. 1963, *H. Huertas 5802* (COL). **Huila**: La Argentina, arriba de la finca Palmira, 2100–2320 m, 28 Sep. 1984, *G. Lozano 4256* (F, COL); Pitalito, carretera a Mocoa, km 25, 1700 m, 11 Nov. 1982, *G. Osorio 34* (COL); Pitalito, vereda Charguayaco, reserva de la comunidad El Arroyuelo, 1925 m, 1º46’ N, 76º1’ W, 28 Jul. 2009, *D. Sanín 3204* (FAUC); Neiva-San Vicente del Caguán, valle de Balsillas, bosques colinados que rodean el valle, Cordillera Oriental, Bp-MB, 2070 m, 2º55’ N, 75º16’ W, 24 Nov. 1990, *J. Betancur 2064* (COL). **Nariño**: Pasto, Pasto-Bosque Daza, 2700 m, 20 Nov. 1980, *O. de Benavides 2565* (PSO); Pasto, corregimiento El Encanto, isla La Corota, 2700 m, 8 Nov. 1979, *O. de Benavides 1980* (PSO). **Quindío:** Salento, cuchilla de Morro Azul, 2140 m, 6 Feb. 2002, *C. Vélez 7309* (HUQ); Salento, vereda Boquia, sector La Patasola, flanco sur-oriental del río Boquia, frente al Quindío y detrás del Santuario Otún Quimbaya, 1950 m, 4º41’ N, 75º41’ W, 20 Jul. 2009, *D. Sanín 3084* (FAUC). **Risaralda**: Pereira, Santuario Otún Quimbaya, 2000 m, 24 Oct. 2004, *J.M. Duque-Quintero 15* (FAUC); Pereira, Santuario de Fauna y Flora Otún Quimbaya, senderos al interior del Santuario, 1783 m, 4º46’ N, 75º37’ W, 20 Apr. 2012,

D. Sanín 5124 (HUA); Santuario, vereda Baja Esmeralda, cerro Churumbelo, zona amortiguadora P.N.N. Tatamá, 2446 m, 9 Jul. 2002, *D. Sanín 939* (FAUC). **Santander**: carretera del páramo de Guantiva a Onzaga, 2970 m, 1 Dec. 1967, *R. Jaramillo-Mejía 4442* (COL); Piedecuesta, vereda Cristales, trocha que conduce al nor-este de la estación, 2780 m, 7 Nov. 1997, *G. Bustos-P. 181* (COL). **Tolima**: Ibagué, El Vergel, vía Termales de Cañón, escuela rural, bosques a mano derecha, sur este, 3500 m, 23 Jul. 2009, *D. Sanín 3147* (TOLI). **Valle del Cauca**: Barragan, Páramo de Bavaya, Corrales, hoya del río Bugalagrande, 3550–3400 m, 9–24 Apr. 1964, *J. Cuatrecasas 20555* (F two sheets); Cali, vereda Pance, P.N.N. Farallones de Cali, Reserva Amor y Paz, vía Balcones, transición entre bosque alto andino y páramo, 3000–3500 m, 2 Jan. 2009, *D. Sanín 2731* (CUVC).

COSTA RICA. **Cartago:** Oreamuno, Pastures along road to the top of Volcán Irazú, 9°55'12" N, 83°52'12" W, 2600–2900 m, 23 Jun. 1983, *R.C. Moran 3031* (F, MO); Cerro de la Muerte, Madre Selva, 24.5 km NW of La Asunción, near km 67 on Inter American Highway, 2550 m, 11 Aug. 1967, *J.T. Mickel 3329* (LP). **Heredia:** Cantón de Barva, P.N. Braulio Carrillo, Cuenca del Tárcoles, Estación Barva, 2700–2900 m, 10º7'20" N, 84º6'00" W, 30 May 1997, *A. Rojas 3555* (INB).

CUBA. Lomas de la Emita, 16 Aug. 1918, *Bro. Hioram 2095* (NY); Jun. 1941, *R.A. Howard 5355* (MO); Jun. 1941, *R.A. Howard 5395* (MO). **Matanzas:** 10 Oct. 1950, *A.H. Liogier 1651* (MO); 20º52' N, 76º54' W, *C. Wright 804* (MO).

DOMINICAN REPUBLIC. **La Vega:** between Constanza and Valle Nuevo, 22 Dec. 1964, *Jones 1053* (NY); 1889 m, 18º51' N, 70º43' W, 16 April 1981, *T.A. Zanoni 12656* (MO, NY). **Peravia:** Cordillera Central, 20 km NW of Rancho Arriba, 1300 m, 1 Mar. 1983, *J.T. Mickel 9122* (NY). **Caña Brava:** Barahona, 1300 m, 24 Apr. 1976, *A.H. Liogier 25139* (NY).

ECUADOR. **Azuay:** Cuenca, Parroquia Baños, Hacienda Yanasacha, 3000–3200 m, 20 Jul. 1978, *J.D. Boeke 2451* (NY); km 91 on Pan American highway N of Loja, 2900 m, 3º25' S, 79º10' W, 5 May 1973, *L. Holm-Nielsen et al. 5122* (F). **Carchi:** Carretera Julio Andrade-El Carmen km 18, 3200 m, 00º38' N, 77º40' W, 16 May 1982, *H. Baslev et al. 2539* (QCA); Estación Biológica La Guandera, 3310 m, 00°35' N, 77°42' W, 18 Feb. 2004, *R.C. Moran et al. 6878* (MO, QCA). **Chimborazo:** Riobamba, 1887, *A. Sodiro s.n.* (Q). **Imbabura:** Shanshipamba, Macheloma, 2900 m, 14 Nov. 1949, *M. Acosta Solís 14304* (F); Ibarra,

Hacienda la Victoria, 2345 m, 3 Jul. 1935, *Y. Mexia 7421* (F); Páramos de Zuleta, 3598 m, 00º13’ N, 78º3’ W, 3 Jul. 2010, *D. Cárate & L. Bremer 1315* (QCA). **Loja:** Parque Nacional Podocarpus, S of Loja, wet montane forest at the Centro de Información E of Nudo de Cajanuma, 2850–2950 m, 4°5’ S, 79°10’ W, 21 Feb. 1985, *B. Øllgaard 57904* (MO); Parque Nacional Podocarpus, cajanuma, 2818 m, 9545630, 702367, 2 Dec. 2010, *M. Lehnert 2263* (QCA). **Morona:** Morona-Santiago, near city of Macas, 1100 m, 2°20’ S, 78°8’ W, 7 Oct. 1993, *A. Fay 4037* (MO). **Napo:** El Cacho, on the Baeza-Lago Agrio rd., turn east to the bridge over río Quijos to Sala Honda, near the bridge, 1560 m, 00°24’ S, 77°49’ W, 9 Aug., 1992, *A. Fay 3904* (MO). **Pastaza:** Pastaza, north of city of Puyo, in city park by the river, 950 m, 1°29’00” S, 77°59’30” W, 14 Jul. 1992, *A. Fay 3610* (MO); 1 km al E de Topo por carretera entre Baños y Mera, 1300 m, 1º27’ S, 78º10’ W, 18 Mar. 1985, *W. Palacios et al. 189* (QCA). **Tungurahua:** vale Tungurahua, *A. Sodiro 8/901* (SI); in silvis or vulcani Tungurahua, *A. Sodiro 12/904* (SI); 1300 m, 1°24’ S, 78°10’ W, 18 Mar. 1985, *W.A. Palacios 189* (MO). **Zamora-Chinchipe:** along road from Quime Ferry Crossing into Cordillera del Condor, 22 km above río Zamora, in a southward direction, along creek at old military camouflage shed, 1489 m, 3°37’46” S, 78°26’17” W, 14 Jul. 2004, *T.B. Croat 91048* (MO).

GUADELOUPE. Without locality, 1864, *l’Herminier s.n.* (RB).

GUATEMALA. **Baja Verapaz:** Purulhá, Centro de visitantes en Biotopo Universitario para la conservación del Quetzal, 29 Feb. 2009, *J. Jiménez Barrios 879* (MO).

GUYANA. **Pakaraima:** Mts Aymatoi, 1150 m, 5º55’ N, 61º00’ W, 17 Oct. 1981, *P.J.M. Maas et al. 5804* (L).

MARTINICA. 125–680 m, 1883, *P. Duss 1652* (F).

PERU. **Amazonas:** Chachapoyas, eastern Calla-Calla slopes, 3–5 km southeast of km 422, Leymebamba-Balsas road, 3000–3200 m, 22 Aug. 1963, *J.J. Wurdack 1755* (USM); close to the border with Depto. San Martín, along the road from Pedro Ruíz, past Laguna de Pomacocha to Rioja, the border between the departments is the watershed dividing the río Mayo (the San Martín side) and the río Chiriaco (the Amazonas side), 1950 m, 5°41’ S, 77°48’ W, 4 Mar. 2001, *H. van der Werff 16738* (MO). **Ancash:** Huaylas, Huascarán National Park, Paro Valley, 3500–4000 m, 9°1’ S, 77°42’ W, 29 Sep. 1985, *D.N. Smith 11553* (MO); Llanganuco, 3505 m, 30 Jul. 1960, *S.G.E. Sanders 530* (F). **Apurimac:** Andahuaylas, Pacobamba, Cerabamba, bosque de Chinchay, 3719 m, 18L 704316, 8502391, 6 Jul. 2015,

V. Zuñiga 675 (USM). **Ayacucho:** La Mar, Camino de Chinquintirca a Toccate, altura de los kp 206–207 del gasoducto, distr. Anco, 2300–2400 m, 642423, 8587772, 24 Feb. 2005, *J. Roque 4467* (USM). **Cajamarca:** Contumaza, La Pampa de Guzmango, 2000 m, 21 Apr. 1984, *A. Sagástegui 11440A* (F, MO); San José de Lourdes, Base del Cerro Picorana, 2010 m, 4º59'25" S, 78º54'5" W, 21 Jan. 1999, *C. Díaz et al. 10414* (MO, USM). **Chuquisaca**: Chorro, 3048 m, 24 Jan. 1950, *W.M.A. Brooke 6032* (F). **Cusco:** Calca, Road Quebrada-Alto Lacco, 2800 m, 12°37'22" S, 72°14'40" W, 30 Apr. 2006, *H. van der Werff 21208* (MO). **Huánuco:** Muna, 11 Mar. 1959, *F. Woytkowski 5180* (MO); Pachitea, Fist. Umari, Comunidad Campesina de San Marcos, 2800 m, 379989 E, 8905774 N, 3 Mar. 2010, *H. Beltran 6663* (USM); San Pedro del Cani, pueblo 7 miles NE: of Mito, 1981 m, 16–28 Apr. 1923, *J.F. Macbride 3405* (F). **La Libertad:** Otuzco, Cerro Ragache (Salpo), 3400 m, 8°00' S, 78°37' W, 23 May 1984, *A. Sagástegui 11609* (MO); **Pachitea:** Chaglla, 2743 m, 12 May 1923, *G.S. Bryan 423* (F). **Pasco:** Oxapampa, Laguna San Daniel, 2400 m, 10°25'58" S, 75°27'23" W, 8 Nov. 2009, *H. van der Werff 23383* (MO). **Piura:** Huancabamba, Subiendo al Cerro La Viuda (Distrito Sondor), 2300 m, 5°15'18" S, 79°41'34" W, 21 Jul. 1975, *A. Sagástegui 8208 et al.* (F, MO). **Puno:** Carabaya, Ollachea Alsojo Rocas, 1500 m, *C. Vargas 6910* (MO). **San Martín:** Mcal. Cáceres, P.N. Río Abiseo, valle río Abiseo, 2840–2880 m, 7º58'27" S, 77º18'45" W, 28 Jun. 1999, *B. León & K. Young 3817* (USM).

VENEZUELA. **Amazonas:** Atabapo: Cerro Marahuaca, riverine forest upstream from "Sima Camp" along branch of Caño Negro, 1140 m, 3°43' N, 65°31' W, 28 Feb. 1985, *J.A. Steyermark 130903* (MO). **Bolivar:** PIAR: Auyan-tepui, summit, in south central region, headwaters of río Churun, 1700–1800 m, 5°51' N, 62°32' W, 31 Mar. 1987, *B.K Holst 3829* (MO). **Distrito Federal:** Libertador, selva nublada con *Ceroxylon interruptum*, a lo largo del camino Costa de Maya, noroeste de la Colonia Tovar, 3–5 kms desde la carretera principal La Vitoria-Colonia Tovar, 2100–2240 m, 10°25' N, 67°20' W, 9 Dec. 1982, *J.A. Steyermark 127905* (MO). **Lara:** Morán, Carretera desde Humacaro Alto hacia Guaito, 2200 m, 9°28' N, 70°1' W, 14 Nov. 1984, *H. van der Werff 7868* (MO). **Mérida:** Andres Bello, Zerpa, La Carbonera, Bosque San Eusebio, 2400–2800 m, 4 Nov. 1981, *R. Rico et al. 114* (F). **Tachira:** Lobatera, La Cazadora, 2000 m, 7°56'00" N, 72°14'48" W, 22 Jul. 1983, *H. van der Werff 5492* (MO). **Trujillo:** Carache, via Páramo Cende, margenes del río Cende, 3000 m, 9°32'N, 70°8'W, 15 Apr. 1988, *R. Rivero & N. Rondón1641* (MO).

34. Serpocaulon subandinum (Sodiro) A.R. Sm., Taxon 55(4): 929. 2006. *Polypodium subandinum* Sodiro, Crypt. Vasc. Quit. 348. 1893. TYPE: Ecuador. Pichincha: Crece en la región arbórea superior del Corazón, Pasochoa, entre 3000–3500 m, 1892, *A. Sodiro s.n.* (first step lectotype: Q, designated by Hensen (1990: 308), **second step lectotype**: Q [bc] 0060380! here designated; isolectotypes P [bc] 01525813 image!, P [bc] 01525814 image!, S [bc] S-R-5162 image!). Figures 8d, 17q, 23b, 91, 92, 97d.

Plants hemiepiphytic to rarely rupicolous or terrestrial. *Rhizomes* 1−3.5 mm diameter, long-creeping, light brown to yellowish or rarely dark brown to reddish, pruinose; phyllopodia distance 0.3−11 cm. *Rhizome scales* disperse, dense to the apex, 1−4.5 × 0.4−2 mm, ovate-lanceolate, lanceolate to triangular, appressed, subpeltate, bicolorous, light brown to yellowish to the margin, and dark brown to dark yellowish to the center, base truncate to rounded, apex acute to long acuminate and patent or reflexed, ciliate margin. *Fronds* 13−76 cm long. *Petiole* 2−28 cm long, proximally subterete, distally sulcate, dark brown to light. *Lamina* 11−48 × 3.2−15 cm, lanceolate to linear-lanceolate, pinnatisect, truncate, reflexed, often slightly reduced proximally and distally gradually tapering in an attenuate segment. *Segments* 16−44 pairs, papyraceous to slightly chartaceous, proximal surcurrent and reflexed, medial and apicals decurrents, apical segment caudate, 1.2−3.4 cm long. *Medial segment* 1.5−7 × 0.4−1 cm, base decurrent and apex acuminate to rounded, venation forming 6−15 rows along and 1 rows of areolae between the costae and the margin, notorious, often with free veinlets to the margin or the apex of segments. *Laminar induments* segments scales scarce, 0.5−3 × 0.4−1 mm, triangular to widely lanceolate, 13−17 cells wide, patent, concave, base truncate to acute and acute to acuminate apex, concolorous, light brown, ciliate margin; hairs dense or rarely scarce, 7−19 cells long, catenate, patent, light brown with dark insertion. *Sori* from the medial segment in 3−13 rows along and 1 row between the costa and the margin. *Spores* 66−86 × 36−50 µm, ellipsoidal, concave-convex to plane convex, and irregular depressed verrucae.

Distribution and habitat. Serpocaulon subandinum occurs from Colombia and Venezuela to Bolivia, in Andean premontane, montane and subparamos ecosystems, from 1450 to 4150 m.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon subandinum most resembles *S. dasypleuron* that also possess long-creeping rhizomes and pinnatisect laminae with dense pubescence. However, differs from *S. dasypleuron* by its thin rhizome (1−3.5 mm vs. 2–5 mm diameter), scales ovate-lanceolate, lanceolate to triangular with patent apex (vs. rounded to elliptic with appressed apex), minor number of row of sori along the medial segments (3−13 vs. 10−16 rows), narrow laminar scales (0.4−10 mm vs. 0.3–0.5 mm wide) and spores with irregular depressed verrucae with rounded apex (vs. prominent irregular verrucae with plane apex).

Serpocaulon subandinum also can be confused with *S. eleutherophlebium*, *S. funckii, S. ptilorhizon*, and *S. patentissimum* that also presents long-creeping rhizomes with pinnatisect laminae, additionally, the size and shape of their laminae could be very similar. However, *S. subandinum* differs from the first three named species by its laminae dense pubescent (vs. glabrous or with scarce hairs or scales). From *S. patentissimum* can be distinguished by its minor number of segments (16−44 vs. 36–61 pairs), wider laminae (3.2−15 cm vs. 2.2–4 cm), wider segments (0.4−1 cm vs. 0.2–0.5 cm), and laminae with only one type of hairs (vs. two types).

Specimens from Peru present hairs disperse at the rachises, and the rhizome scales are ovate-lanceolate with acute and subappressed apex (*Huamantupa et al. 9268,* BHCB), or coriaceous laminae, dark brown and thicker rhizome (*B. León et al. 2120*, USM), in those cases, the wide of the segments (0.4−1 cm) and the presence of few hairs 7−19 cells long allows its determination.

Hensen (1990) suggested a range between 200 to 3400 m, distributed from Costa Rica to Peru. Tryon and Stolze (1993) in Pteridophyta of Peru recorded a similar range, 200−3000 m, and Smith et al. (2006; 2018) mentioned that its distribution is from Ecuador to Peru. Those records probably are derived from misidentifications with *Serpocaulon dasypleuron*, as was noticed in the sheets studied by the mentioned authors, and also because *S. subandinum* inhabits preferentially Andean premontane, montane and subparamos ecosystems. In this sense, the distribution pointed here is more restricted.

Taxonomic and nomenclatural notes. Polypodium subandinum Sodiro was described based on collections made in Corazón, Pasochoa, Pichincha in Ecuador (Sodiro, 1983). Nevertheless, the author did not designate any series. Hensen (1990) suggested that the holotype was hosted at Q without mentionig any sheet (first step lectotypification). Here the second step lectotype is designated after traced the collection *Sodiro s.n.* housted at Q (Q 0060380), and three more isolectotypes at P (01525813, 01525814) and S (S-R-5162).

Representative specimens. BOLIVIA. **Cochabamba:** Chapare, 54 km Cochabamba-Villa Tunari, 2750 m, 30 Apr. 1979, *S.G. Beck 1424a* (F); José Carrasco Torrico, 108 m, antigua carretera Cochabamba-Villa Tunari, 2950 m, 17º9’ S, 65º38’ W, 23 Jun. 1996, *M. Kessler et al. 6615* (LPB); Jacába, bosque de Incachaca, 2500 m, 5 Sep. 1921, *J. Steinbach 5777* (SI). **La Paz:** Murillo, valle del río Zongo, 23.8 km al norte de la cumbre, 2900 m, 16º8’ S, 68º7’ W, 18 Mar. 1987, *J.C. Solomon 16380* (F!, MO). **Santa Cruz:** Caballero, Comarapa, Serranía Siberia, entre Torrecillas e Pojo, 36 km de Torrecillas, 2800 m, 17º49’43” S, 64º43’5” W, 14 Dec. 2002, *P. Labiak et al. 2870* (RB).

COLOMBIA. **Antioquia:** Belmira, vereda La Amoladora, sector Montefrío, límites con los municipios de San Pedro de los Milagros y San Jerónimo, 2920 m, 6º30’ N, 75º39’ W, 10 Oct. 2002, *W.D. Rodríguez 3722* (COL, JAUM); Urrao, páramo de Frontino, El Río, 3040 m, 1 Aug. 1984, *Londoño 126A* (MEDEL). **Boyacá**: Cabugon, Sierra Nevada del Cocuy, in forest around Cobugon, 2900 m, 16 Aug. 1957, *J.P. Grubb 60* (COL); Duitama, vereda El Carmen, bosque arriba de la casa de don Aniceto, 3150 m, 15 Mar. 1994, *J.O. Rangel-Ch. 11543* (COL); Samacá, inmediaciones de la represa Teatinos, 2 Oct. 1976, *C.E. Acosta-Arteaga 1098AC* (COL); arriba de la carretera Tunja-Arcabuco, en la vertiente del río Pómeca, 3100 m, 27 Aug. 1969, *R. Jaramillo-Mejía 2869* (COL); Villa de Leyva, Santuario de Fauna y Flora de Iguaque, alrededor de la cabaña Mama Ramos, 2750 m, 9 Jun. 2001, *J. Murillo-A. 2964* (COL). **Caldas:** Manizales, finca La Línea, entre Reserva Torre IV y Río Blanco, vía por camino que conduce a las minas de Maltería, 3808 m, 22 May 2009, *D. Sanín 2759* (FAUC); Salamina, corregimiento de San Félix, finca Samaria, vía Monte Loro-Valle Alto, relictos a mano derecha del bosque El Retiro, 2800 m, 3 Aug. 2008, *D. Sanín 2355* (HUA); Nevado del Ruíz, Los Chorros, cerca de la estación termal, 3000 m, 5 Aug. 1958, *H. Bischler 1464* (COL); Villamaría, de Termales hacia abajo, 22 Oct. 1961, *M.T. Murillo 491*

(COL). **Cauca:** Bolívar, corregimiento Los Milagros, en los límites con el departamento de Nariño, ascenso al páramo de Granadillos, 2500−3000 m, 1º45' N, 76º54' W, 1 Sep. 2003, *Aguilar 748* (CAUP); Inzá, vereda Río Sucio, Jardín Botánico Las Delicias, km 62, 2700−2800 m, 17 Sep. 2003, *Muñoz 1721* (CAUP); Popayán, corregimiento de Quintana, bajando hasta el Cedral, 2600−3000 m, 9 Mar. 2003, *Sandoval 123* (CAUP); Silvia, páramo El Abejorro, vía páramo Cresta de Gallo, vereda La Marquesa, 2900 m, 8 Apr. 2006, *Muñoz 1851* (CAUP); Totoro, finca Potrero del Río, 3100 m, 29 Sep. 2007, *Cortes 23* (CAUP). **Cesar**: 32 km SE de Manaure, arriba de la Laguna, 2950 m, 5 Nov. 1993, *J.O. Rangel-Ch. 11111* (COL). **Chocó-Valle del Cauca:** Serranía de Los Paraguas, along the trail from El Cairo to Río Blanco, ca 8 km Sw of El Cairo, 2200−2250 m, 28 Mar. 1971, *D.B. Lellinger & E.R. de la Sota 854* (LP). **Cundinamarca**: Bogotá, Monserrate, bosque El Granizo, 3200 m, 16 Aug. 1990, *Serna-Isaza 216* (COL); extremo sudeste de la Sabana de Bogotá, en San Miguel, 2800 m, 10 Sep. 1941, *J. Cuatrecasas 12018* (COL); Subachoque, vereda Tobar, finca El Cerro, 2950 m, 27 Jul. 2002, *M. Hernández-Schmidt 768* (COL); Suesca, hacienda Susatá, 2600 m, 18 Nov. 1999, *J.P. Groenendijk 1287* (COL); páramo de Usaquén, carretera al Boquerón, 3000 m, 23 Apr. 1974, *C.E. Acosta-Arteaga 339* (COL, L). **Huila**: Pitalito, vereda Charguayaco, reserva de la comunidad El Arroyuelo, 1925 m, 1º46' N, 76º1' W, 28 Jul. 2009, *D. Sanín 3222* (FAUC). **Magdalena**: Sierra Nevada de Santa Marta, transecto del Alto Río Buritaca, 3100 m, 7 Aug. 1977, *R. Jaramillo-Mejía 5419* (COL). **Nariño:** Pasto, a 3 km al E. de la población de Dolores, 3000 m, 3 Aug. 1991, *B.R. Ramírez-P. 3960* (COL, PSO); páramo del Tábano, alto de la Cordillera, entre Pasto y El Encano, vertiente occidental, 3300 m, 11 Jan. 1941, *J. Cuatrecasas 11928* (COL); carretera La Victoria-Monopampa, 2500 m, 10 Jan. 1973, *O. Hagemann 1854* (COL). **Norte de Santander**: Herrán, Parque Nacional Natural Tamá, sector Orocue, 2600 m, 1 Apr. 1987, *Orozco 1692* (COL). **Quindío:** Salento, Reserva Biológica Estrella de Agua, 3317 m, 26 Mar. 1996, *López 134* (HUQ); Salento, vereda Cocora, Estrella de Agua, vía a Romerales, 3400 m, 24 Jul. 2009, *D. Sanín 3142* (HUQ). **Risaralda:** Santuario, Parque Nacional Natural Tatamá, Monte Zancudo, 2824 m, 20 Jul. 2011, *D. Sanín 4265* (HUA). **Tolima**: Ibagué, El Vergel, vía Termales del Cañón, escuela rural, bosques a mano derecha al SE, 3500 m, 23 Jul. 2009, *D. Sanín 3151* (FAUC); along Quindío highway, between Cajamarca and summit of divide, 3200 m, 27 Mar 1939, *E.P. Killip 34576* (COL).

ECUADOR. **Carchi:** Cordillera Oriental, 1400 m, Nov. 1906, *A. Rimbach 1112* (SI); Estación Biológica La Guandera, 3310 m, 00º35' N, 77º42' W, 18 Feb. 2004, *R.C. Moran et al. 6858* (QCA); Road Tulcán-Maldonado, 53 km from Tulcán, 3200 m, 00º50'N, 78º3' W, 31 Jul. 1976, *B. Øllgaard & H. Balslev 8293* (F). **Chimborazo:** Chimborazo-Cañar border (western escarpment), E 4014−4052, between Sta. Rosa (2529 m) and Joyagshi (2746 m), 6−9 Jul. 1945 *W.H. Camp 4077* (F, L). **Cotopaxi:** Road Angamarca El Corazón, 2950 m, 1º8' S, 78º59' W, 7 Jul. 1979, *L. Holm-Nielsen & R. Andrade 18522* (QCA). **Imbabura:** road Cotacachi-Apuela, 22.5 km from Cuicocha entrance, 3000 m, 00º20' N, 78º23' W, 27 Feb. 1993, *B. Øllgaard 100666* (QCA); vía La Joya-Laguna de Mojanda Cajas, al sur de la población de Otavalo, 3109−3659 m, 26 Jan. 1980, *J. Jaramillo & F. Coello 2064* (QCA). **Loja:** Parque Nacional Podocarpus, Cerro Toledo, 3350 m, 4º23' S, 79º7' W, 1 Dec. 1988, *J.E. Madsen et al. 75718* (QCA); Parque Nacional Podocarpus, Cajuna, Matrix plot M6, 2875 m, 9544970, 702562, 27 Nov. 2010, *M. Lehnert 2205* (QCA). **Morrona-Santiago:** trail Alao-Huamboya, around and above El Placer, 2850−3400 m, 1º47' S, 78º23' W, 8 May 1982, *B. Øllgaard et al. 38436* (AAU, QCA!). **Napo:** Baeza, Papallaeta, *A. Mille s.n.* (QLPS); Oyacachi, ca 2 km below the village, opposite abandoned village, 3150 m, 00º13' S, 78º3' W, 26 Oct. 1995, *B. Øllgaard & H. Navarrete 1215* (AAU, QCA!); Oyacachi, 5 km al E del pueblo, camino a Puerto Viejo, 3000 m, 00º12' S, 78º6' W, 4 Jun. 1996, *H. Navarrete 1722* (QCA). **Pastaza:** Road N of Mera, toward Río Anzu, km 8.2, 1450 m, 1º27' S, 78º4' W, 11 Nov. 1994, *B. Øllgaard & H. Navarrete 105513* (AAU, QCA!). **Pichincha:** *A. Sodiro 10/905* (L, QLPS); Camino Tabacundo-Lagunas de Mojada, 3960 m, 00º13'15" N, 78º14'50" W, 5 Feb. 1999, *J. Jaramillo et al. 20916* (QCA); Cerro Pasochoa, W slope, 2700−3300 m, 27 Apr. 1985, 00º28' S, 78º29' W, *B. Eriksen 59210* (QCA); Pasochoa, 1890, *A. Sodiro s.n.* (SI); Quito-Sto. Domingo via Chiriboga, (old road), 2400 m, 15 May 1981, *C. Dodson et al. 10890* (Q), Quito**,** Atacazo, *A. Sodiro 7/907* (SI); in regione subandina, 3500 m, *A. Babet s.n.* (QLPS). **Sucumbios:** Forest below páramo El Mirador, 8 km E of the Pan American Hwy on rd to la Bonita, S at Cocha Seca 1.2 km trail through forest, 3300 m, 00º38' N, 77º41' W, 8 Mar. 1992, *V.A. Funk 11098* (QCA). **Tungurahua:** Above El Triunfo, trail from El Playón up along río Rancho Grande, 3000−3200 m, 30 Mar. 1989, *H.B. Pedersen 60* (QCA). **Zamora-Chinchipe:** Parque Nacional Podocarpus, Quebrada San Francisco (road Loja-

Zamora, E of the pass), 2000−2200 m, 3º59’ S, 79º6’ W, 23 Nov. 1994, *B. Øllgaard & H. Navarrete 105791* (AAU, QCA!).

PERU. **Amazonas:** Bagua, Cordillera Colán SE of La Peca, 2365 m, 16 Oct. 1978, *P. Barbour 4110* (USM); Chachapoyas, Cerros Calla Calla, east side, 18 km above Leymebamba on road to Balsas, 3100 m, 1 Apr. 1964, *P.C. Hutchison & J.K. Wright 4872* (F, USM). **Cusco:** Calca, Yanatile, Colca, Huaca Huiscana, 2800−2700 m, 5 Jun. 2007, *I. Huamantupa et al. 9268* (BHCB!, MO); Paucartambo, Camino Eriksson, P.N. Manu, 31 Aug. 1990, *B. León & N. Huapalla 2378* (USM); Urubamba, camino a Intipata, Santuario Histórico de Machu Picchu, 2850−2875 m, 9 Feb. 1990, *B. León et al. 2120* (USM); Urubamba, Machu Picchu, a 88 km y 112 km de Cusco, Santuario Histórico de Machupicchu y en Camino Inca, en Qorihuayrachina Llaulluchayoc, Ronkurakay, Phuqupatamarca, Wiñaynhayna e Intipunco, 4150 m, 13º9’10” S, 72º31’00” W, 14−22 Oct. 1987, *P. Nuñez & J. Arque 8371* (MO, NY, UC, USM). **Pasco:** Oxapampa, Chontabamba, alrededores Abra Suiza, 2200−2500 m, 23 Jun. 1986, *B. León 969* (USM); Oxapampa, Huancabamba, Parque Nacional Yanachaga Chemillén, sector Quebrada Yanachaga, parcela Permanente 1 ha, 3170 m, 10.22.33 S, 75.28.03 W, 13 Nov. 2009, *M. Acuña et al. 201* (USM); Oxapampa, Huancabamba, Milpo, 2950−3100 m, 10.23.01 S, 75.37.46 W, 2 Nov. 2009, *H. van der Werff et al. 23086* (USM); Oxapampa, Parque Nacional Yanachaga Chemillén, camino del Refugio al Abra La Esperanza, 2610−2800 m, 10º31’ S, 75º20’ W, 17 Mar. 2003, *A. Monteagudo et al. 4686* (MO, USM!). **Piura:** Huancabamba, El Carmen de la Frontera, Rosarios Bajo, trocha entre campamento minero Río Blanco y El Tambo, 2190−2550 m, 0692671, 9460736, 24 Apr. 2006, *A. Cano et al. 16296* (USM). **San Martín:** Mariscal Cáceres, 3200 m, 24 Jul. 1987, *K. Young & B. León 4930* (USM); Mariscal Cáceres, P.N. Río Abiseo, Valle río Abiseo, 2830 m, 7º58’27” S, 77º18’45.1” W, 28 Jun. 1999, *B. León & K. Young 3832* (USM).

VENEZUELA. **Amazonas:** Atabapo, Cerro Marahuaca, Summit on NE corner, 2700 m, 3º37’ N, 65º21’ W, 13−14 Oct. 1988, *R. Liesner 24774* (L!, MO). **Anzoátegui:** Cero Peonía (Cerro los Pajaritos), above Santa Cruz, headwaters of río Manantiales, east of Bergantín, 2000−2300 m, 21 Mar. 1945, *J. Steyermark 61660* (F). **Bolívar:** Chimantá Massif, east-central portion of Summit of Apácara-tepuí, 2450−2500 m, 21−22 Jun. 1953, *J.A. Steyermark* 75908 (F). **Caracas:** entre Boca de Tigre y El Avila, 1900 m, 16 Dec. 1938, *L. Williams 10910* (F). **Mérida:** Páramo de la Negra above Bailadores, 2900 m, 13 Feb. 1939, *A.H.G.*

Alston 7038 (L); Rangel, entre Apartaderos y Santo Domingo, 2700 m, 6 Sep. 1975, *E.R. de la Sota 6195* (LP). **Sucre:** Cerro Turumuquire, 2500 m, 6 May. 1945, *J.A. Steyermark 62617* (F). **Táchira:** Jáuregui, Portachuelo, 2800 m, 1 Oct. 1975, *E.R. de la Sota 6279* (LP).

35. Serpocaulon triseriale (Sw.) A.R. Sm., Taxon 55(4): 929. 2006. *Polypodium triseriale* Sw. J. Bot. (Schrader) 2: 26. 1800 [1801]. *Goniophlebium triseriale* (Sw.) Wherry. Amer. Fern. J. 54(3): 144. 1964. TYPE**:** Oriental Indies, *Anonymous s.n.* (**lectotype here designated** UPS [bc] 24589 image!; isolectotype BM [bc] 000937455 image!). Figures 5d, 15d, 17r, 23f, 93, 94, 97e, 104b, 105c.

Polypodium brasiliense Poir. In Lam. & Poir. Encycl. 5: 525, 1804. TYPE. Brazil. *Anonymous s.n*. (**lectotype here designated**: B [bc] B-Willdenow-Herbarium-19687 image!).

Polypodium preslianum Spreng. Syst. 4: 556, index. 1827. New name designated for *Polypodium longifolium* C. Presl. Delic. Prag. 1: 167. 1822. (non *Polypodium longifolium* Cav. 1802). TYPE: Brazil. Rio de Janeiro: *W.D. Brackenridge s.n.* (**lectotype here designated**: PH [bc] 00021063 image!).

Polypodium gladiatum Kunze, Linnaea 9: 45. 1834. Illegitim homonym of *Polypodium gladiatum* Vell. Fl. Flumin. 11, pl. 59. 1831. *Marginaria gladiata* (Kunze) C. Presl, Tent. Pterid. 189. 1836. *Goniophlebium gladiatum* (Kunze) Fée, Mém. Foug., 5. Gen. Filic. 256. 1852. *Polypodium triseriale* var. *gladiatum* (Kunze) Proctor. Amer. Fern J. 72(4): 114. 1982. TYPE: Cuba. Sep. 1822, *Poeppig s.n.* (**lectotype here designated**: BM [bc] 000937455 image!).

Polypodium subalatum Klotzsch, Linnaea 20(4): 394. 1847. TYPE. Guiana. *M.R. Schomburgk 1210* (lectotype designated by Hensen (1990: 309): B [bc] 200090558 image!).

Polypodium campylopodium Klotzsch, Linnaea 20(4): 395. 1847. TYPE: Venezuela. Mérida: Nov. 1865, *J.W.K. Moritz 352* (**lectotype here designated**: BM [bc] 000937451 image!; isolectotypes: K [bc] 000642038 image! and K [bc] 000642039 image! in the same sheet).

Polypodium xiphophoron Kunze ex Mett. Abh. Senckenberg. Naturf. Ges. 2: 73. 1856. *Goniophlebium xiphophoron* (Kunze ex Mett.) Fée, Cr. vasc. Br. 1: 108. 1869. TYPE. Brazil. *J.E. Pohl s.n.* (**lectotype here designated**: P [bc] 01525629 image!).

Goniophlebium intermedium Fée. Mém. Foug. Antil. 11: 69, pl 18, 1866. TYPE: La Guadaloupe. 1861, *l'Herminier s.n.* (lectotype designated by Windisch (1982: 58): RB [bc] 216394 image!; isolectotype P [bc] 00632886 image!.

Polypodium neriifolium var. *acuminatissimum* Kuntze, Revis. Gen. Pl. 2: 819. 1891. TYPE: Costa Rica. Pcia. Cartago: between Turrialba and Cartago, 21 Jun. 1874, *C.E.O. Kuntze 2256* (**lectotype here designated**: NY [bc] 144880 image!).

Polypodium neriifolium var. *heterophyllum* Kuntze, Revis. Gen. Pl. 2: 819. 1891. TYPE: Trinidad and Tobago. bei Arima, 20 Apr. 1874, *C.E.O. Kuntze 1115* (**lectotype here designated**: NY [bc] 00144879 image!).

Goniophlebium ampliatum Maxon, Contr. U.S. Natl. Herb. 10: 492. 1908. Name asignated by Maxon to *Polypodium gladiatum* Kunze. *P. ampliatum* (Maxon) Proctor, Bull. Inst. Jamaica Sc. Ser. 5: 45. 1953. *Polypodium brasiliense* var. *gladiatum* Kuhn, Bot. Jahrb. Syst. 24: 130. 1897. TYPE. Cuba. Pinar del Río, 22 Feb. 1900, *W. Palmer & J.H. Riley 41* (**lectotype here designated**: NY [bc] 1849259 image!); Cuba. Pinar del Río, 17 Apr. 1900, *W. Palmer & J.H. Riley 571* (syntype: NY [bc] 1849260 image!); Cuba. Pinar del Río, 24 Abr. 1903, *J.A. Shafer 388* (syntype: NY [bc] 1849243 image!); Cuba. Isla de la Juventud, at top of Sierra de los Caballos Isle of Pines, 25 Jun 1901−20 Jul 1901, *A.A. Taylor 9,* (syntype: NY [bc] 1849262 image!); Cuba. Oriente: in Cuba Orientali, 1859−1860, *C. Wright 804* (NY [bc] 1849269 image!); Cuba. in Cuba Orientali 1856−1857, *C. Wright 804* (NY [bc] 814570 image!, NY [bc] 1849256, NY [bc] 1849261 image!, NY [bc] 1862605 image!, NY [bc] 1862864 image!); Cuba. La Habana, Madruga, 26 Mar. 1903 *N.L. Britton 695* (NY [bc] 1849242 image!).

Polypodium preslianum var. *immersum* Rosenst., Repert. Spec. Nov. Regni Veg. 6: 314. 1909. TYPE: Bolivia: Depto. La Paz: S. Antonio near Mapiri, 850 m, Dec. 1907, *O. Buchtien 1062* (**lectotype here designated**: P [bc] 00632887 image!; isolectotype: US [bc] 00065835 image!, US [bc] 00065836 image!).

Plants epiphytic, terrestrial (rarely subterranean, only recorded at Bahia, Brazil) or rupicolous. *Rhizomes* 5.6–17 mm diameter, short-creeping (rarely intermediary with long-creeping in specimens from Bahia), dark brown, often pruinose; phyllopodia distance 1–12 cm long. *Rhizome scales* dense, 3–10 × 1–4 mm, ovate-lanceolate to lanceolate, patent, subpeltate, with notorious insertion, bicolorous, light brown or orange to the margin and orange to dark brown to the center, base rounded to obtuse, apex acuminate to long decurrent and patent, erose to dentate or rarely with projections at the margin. *Fronds* 15–126 cm long. *Petioles* 5.5–49 cm long, proximally subterete, distally slightly sulcate, light brown to dark. *Laminae* 9.4–77 × 6–54 cm, ovate-lanceolate, ovate elliptic to deltate, pinnate, truncate proximally and acute apex. *Pinnae* 2–27 pairs, chartaceous to coriaceous, pinnate to slightly adnate 1/3–1/4 distally, proximal sessile to slightly adnate in the anandromic side, medial and distal sessile to slightly adnate, apical pinna conform to adnate to the laterals. *Medial pinna* 6.2–29 × 1–4.5 cm, base decurrent and apex acuminate, acute, to rarely rounded, venation forming 28–81 rows along and 2–6 rows of areolae between the costae and the margin, notoriously impressed, decreasing in size gradually from the costae to the margin. *Laminar induments* pinnae scales scarce, 0.8–2.7 × 0.2–0.6 mm, triangular to lanceolate, 4–8 cells wide, patents, basifix with a notorious insertion, concolorous, dark brown, attenuate base to acute (in any case with a constriction), long acuminate apex, the margins ciliate to dentate, hairs scarce, 2–17 cells long, catenate, appressed, dark brown with dark dissections. *Sori* from the medial pinnae in 13–66 along and (1)3–4(5) rows between the costa and the margin. *Spores* 57–67 × 34–42 μm, ellipsoidal, concave-convex, to plane-convex, and irregularly depressed verrucae.

Etymology. Its name references the three rows of sori often presented between the costa and the margin of pinnae.

Distribution and habitat. Serpocaulon triseriale occurs from south of Mexico to north of Argentina, in Brazil and the Antilles. Widely distributed in lowlands to premontane ecosystems, from 0 to 2500 m, in dry to humid forest with alteration or not.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon triseriale most resembles *S. attenuatum*, *S. meniscifolium* and *S. rex*, that also possess thick, short-creeping rhizomes (except for *S. rex*, which posseses long-creeping rhizomes) with ovate-lanceolate to lanceolate, dense, patent scales, pinnate laminae (except *S. attenuatum* that is pinnatisect at the apex) and laminae with notoriously impressed veins. However, it differs from *S. attenuatum* by its pinnate laminae (vs. pinnatisect in the apices), and more than 2 rows of sori (vs. 1–2 rows). From *S. meniscifolium*, by its light brown to orange rhizome scales (vs. dark rhizome scales), equilaterous, sessile, decurrent to slightly adnate base of pinnae (vs. inequilaterous, with the basiscopical side sessile and acroscopical slightly adnate to adnate), and by its wide distribution, where, only in the Atlantic Rain Forest of Brazil, they can be sympatric. Finally, from *S. rex* differs by its short-creeping and exposed or rarely subterranean rhizome (vs. long-creeping, and often subterranean rhizome), rhizome scales with colored lumen in the center of cells (vs. with clear lumen in the center of cells), margin of the pinnae not cartilaginous absent and smooth (vs. cartilaginous and crenate), and lower number of sori rows between the costa and the margin ((1–)3–4(–5) vs. 4–6(–7) rows).

Taxonomic and nomenclatural notes. Swartz (1800–1801) published the name *Polypodium triseriale* but did not mentioned a sheet or herbarium. Hensen (1990), stated that the holotype specimen could be hosted at W. After tracing a sheet that matches Swart's protologue in UPS (24589), here it is designated as lectotype.

Polypodium brasiliense Poir. is based on material cited by Poiret in 'Herb. Lam. & Desfontaines'. Nevertheless, Proctor (1985) designated as lectoype the sheet *Sloane*, Nat. Hyst. Jamaica 1: t. 40, commented that 'there is now no specimen of this in the Lamarck Herbarium in Paris'. By his part, Hensen (1990) designated as holotype one sheet from the Lamarck & Desfontaine Herbarium based at P, however, this sheet was not traced. In F was found a picture of a sheet based at B, that belongs to Lamarck but that is referenced as Willdenow Herbarium with the number catalogue 19687. This specimen represents *Serpocaulon triseriale*, reason why it is designated as lectotype of the name *P. brasiliense* Poir.

Hensen (1990) suggested as a synonym of *Polypodium triseriale* = *S. triseiriale* the name *P. preslianum* Spreng., without cited a type. Due that the sheet *W.D. Brackenridge s.n.* (PH-00021063), is cited and represents the protologue description, here is designated as lectotype.

The name *Polypodium gladiatum* Kunze represents an illegitime homonym of *P. gladiatum* Vell., which is an older name. In spite of that, it was combined as part of *Goniophlebium* (*G. gladiatum* (Kunze) Fée), as well as a variety of *P. triseriale* (var. *gladiatum* (Kunze) Proctor) without a type designation. Following recommendations of the Article 9.6 (Turland et al., 2018) here it is designated the sheet *Poeppig s.n.*, from BM (000937455), as lectotype.

Hensen (1990) stated that the type of the name *Polypodium campylopodium* Klotzsch was housed at B. However it was not found there, so we designated specimen at BM (also cited in the protologue) as lectotype.

Althought Mettenius (1856) designated three syntypes named: *Kegel s.n.* (Surinam), *Pohl s.n.* (Brazil), and *Leprieur s.n.* (French Guiana) when he published *Polypodium xiphophoron* Kunze ex Mett., it was only possible to find the sheet from P (*J.E. Pohl s.n,* P [bc] 01525629) reason why it is designated here as a lectotype (Art. 9.6, Turland et al., 2018).

The names *Polypodium neriifolium* var. *acuminatissimum* Kuntze, and *P. neriifolium* var. *heterophyllum* Kuntze, were published in the same journal and volume. Nevertheless, no type was designated for these names, in this sense, here are chosen two sheets from NY as the respective lectotypes.

Maxon (1908) designated the sheet *C. Wright 804* (NY) as part of the syntypes that represent *Goniophlebium ampliatum* Maxon. Kuhn previously designated for the name *Polypodium brasiliense* var. *gladiatum* Kuhn two sheets, the former, and *Rawson s.n.* However, the last specimen was not traced, derived in the designation of the specimens *C. Wright 804* (NY-814570) as syntype. It is important to take in mind that Wright designated different specimens with the same number. In this case, the number 804 was designated to *P. sessilifolium* = *S. sessilifolium*, *P. triseriale* = *S. triseriale* and a grass (*Elionurus barbiculmis* Hack.), reason why the barcode is here provided. *Goniophlebium ampliatum* Maxon was proposed by Maxon to replace *Polypodium gladiatum* Kunze that was in use. When Proctor recombined the name under *Polypodium*, he designated several syntypes housed at NY. Here

it is choose the sheet *W. Palmer & J.H. Riley 41* (NY [bc] 1849259) as lectotype following recommendations of Turland et al. (2018).

Rosenstock (1909) did not designate a type when he published *Polypodium preslianum* var. *immersum* Rosenst., in this sense and following recommendation of Turland et al. (2018, Art. 9.6), here it is designated as lectotype the sheet from P.

The specimens that support the name *Goniophlebium ampliatum* Maxon represents an interesting variation of *S. triseriale* in Cuba, features that support this are the presence of pinnatisect apex of the proximal pinna farely adnate, as well as, one to two rows of sori between the costa and the margin. Also, it is remarkably the sunken sori at the pinnae tissue and the pruinosity of the fronds. Hensen (1990) commented that 'all kind of intermediates between this and the typical form occur', which was verified in Proctor's syntypes designation for the name *Polypodium ampliatum* (Maxon) Proctor. It is necessary more research to state its taxonomic status.

In the same way, specimens from Bahia, Brazil, have subterranean intermediary short to long-creeping rhizomes, small (to 30 cm) and erect laminae, with few ascendent pinnae (3 to 6). After revising the spores, rhizomes scales, and laminar indumentum, it was not possible to find differences with the treated specimens.

Local name. Calaguala in Honduras (*J. Gomez 55,* F).

Chromosome number. n: 37 (Walker, 1985), n: 74 (Walker, 1966).

Representative specimens. ANTIGUA. **St. Mary:** Near Wallings Reservoir, 100 m, 24 Oct. 1974, *C. Holland 17* (F).

ARGENTINA. Salta. Dpto. La Caldera: camino de cornisa, quebrada húmeda al costado de la RN 9, 1450 m, 24°30'25" S, 65°19'26" W, 5 Apr. 2014, *M. Ramos s.n.* (MCNS).

BELIZE. **Cayo:** Upper 200 m of Baldy Beacon, 1000 m, 17°00' N, 88°47' W, 10 Jul 1970, *D.L. Spellman 1628* (MO). **Stann Creek:** Sittee River Forest Reserve, Watershed of the Cocoa Branch of the Sittee River, upper reaches of the Cocoa Branch, on a N-S ridge, 600 m, 16°49'49" N, 88°37'51" W, 19 Mar. 2016, *S.W. Brewer & M. Paredes 7743* (MO).

Toledo: Central Golden Stream Corridor Preserve in the 'Marsh' area, 21 m, 16°19'26" N, 88°46'15" W, 29 Jan. 2015, *S.W. Brewer 7402* (MO).

BOLIVIA. **Beni:** Gra. Ballivian, 25 km from Yucumo on Yucumo-Quiquibey road, in the Pilón Lajas, 950 m, 15°17' S, 67°4' W, 16 Jul. 1990, *A. Fay & L. Fay 2731* (MO). **La Paz:** Franz Tamayo, Parque Nacional Madidi, Sector Tanhuara Pata, por el antiguo camino Pelechuco-Apolo, 2259 m, 14°45'17" S, 68°57'24" W, 14 Jun. 2009, *A.F. Fuentes & D. Alanes 14192* (MO); Madidi, Apolo, Naranjal, Parque Nacional-ANMI Madidi, Senda Apolo-San Jose de Uchupiamonas, cerca de Naranjal, entrando una quebrada, 20 Apr. 2003, 14°34'00" S, 68°20'15" W, *T.B. Miranda et al. 786* (MO). **Nord Yungas:** Milluguaya, 1300 m, Dec. 1917, *O. Buchtien 4232* (F). **Pando:** Manuripi, Ca. 20 km. south of río Manuripi on the road to Chivé**,** 11°58' S, 68°35' W, 12 Aug. 1982, *C.R. Sperling 6595* (MO). **Santa Cruz:** 5 km al N de Perseverancia, 257 m, 14°38' S, 62°37' W, 11 Jun. 1990, *I.G. Vargas 568* (MO). **Süd Yungas:** Sirapaya bei Yanacachi, 2100 m, 17 Nov. 1906, *O. Buchtien s.n.* (SI).

BRAZIL. **Acre:** Mâncio Lima, bacia do Alto de Juruá, rio Moa, Parque Nacional da Serra do Divisor, entre río Azul e Igarapé Novo Recreio, 7º27'00" S, 73º23'00" W, 4 May 1996, *M. Silveira et al. 1229* (MO, QCA). **Alagoas:** Campo Grande, Adutora de água rio São Francisco-Arapiraca, 9º57'32" S, 36º47'31" W, 5 Jun. 2008, *D.T. Souza 411* (BHCB); Igreja Nova, Linha de Energia Vale Verde, 10º7'23" S, 36º39'40" W, 10 Jun. 2008, *D.T. Souza 418* (BHCB). **Amazonas:** Barcelos, Parque Estadual da Serra do Aracá, trilha da Cachoeira do Eldorado para o cume, 1000–1150 m, 00º52'29" S, 63º20'27" W, 22 May 2014, *P.H. Labiak et al. 5717* (RB); Santa Isabel do Rio Negro, Igarapé de Daará, 14 Oct. 1978, *M. Madison et al. 243* (BHCB!, INPA). **Ceará:** Maranguape, 4 km of Maranguape, 400 m, 9 Mar. 1945, *H.C. Cutler 8298* (F). **Bahia:** Barro Preto, Fazenda Bela Vista, Pedra Lascada, pela trilha para a Pedra Lascada, 373 m, 13°36'25" S, 39°42'29" W, 20 Sep. 2018, *D. Sanín et al. 7217* (BHCB); Boa Nova, Recanto dos Pássaros, na trilha ao topo da serra, 815 m, 14º24'53" S, 40º75'8" W, 4 Apr. 2015, *V.A.O. Dittrich & A.M. Souza 2138* (CESJ); Camacan, Estrada Camacan-Jacareci, Serra Bonita, 860 m, 15º23'6" S, 39º34'17" W, 3 Feb. 2017, *I.O. Moura & A. Salino 185* (BHCB); Itarantim, Pedra das Três Pontas, trilha ao topo da Pedra, 700–900 m, 15º38'41" S, 40º5'52" W, 29 Aug. 2009, *V.A.O. Dittrich et al. 1600* (CESJ); Jacobina, Oeste de Jacobina, Serra do Tombador, estrada para Lagoa Grande, 23 Dec. 1984, *G.P. Lewis et al. s.n.* (F); Macarani, rod. Para Vila das Graças, 27.2 km E ca. 4.4. km de Vila das Graças,

560–600 m, 15º46’19” S, 40º24’50” W, 17 Aug. 2001, *A.M. Carvalho et al. 7017* (BHCB, CEPEC); Morro do Chapéu, arredores da cidade, em afloramento quartzíticoàs margens da rodoviária que liga Morro do Chapéu a Bonito, 1063 m, 11º34’14” S, 41º9’50” W, 7 Oct. 2016, *T.E. Almeida et al. 4429* (BHCB); Mucugê-Igatu, Chapada Diamantina, 714 m, 12º53’46” S, 41º18’50” W, 29 Jan 2017, *I.O. Moura & A. Salino 173* (BHCB); Mucugê, Estrada que liga Mucugê ao município de Andaraí a 8 km da cidade, 1162 m, 12º57’34” S, 41º19’12” W, 8 Oct. 2016, *T.E. Almeida et al. 4432* (BHCB); Porto Seguro, km 5 da BR5, 19 Jun. 1962, *A.P. Duarte 6795* (F); Prado, Parque Nacional do Descobrimento, 70 m, 17º8’12” S, 39º19’57” W, 31 Oct. 2002, *A. Salino et al. 8141* (BHCB); Rio de Contas, Serra das Almas, trilha para o Pico das Almas, 1464 m, 13º31’10” S, 41º56’25” W, 5 Oct. 2026, *T.E. Almeida et al. 4413* (BHCB); Rui Barbosa, Serra do Orobó, Encosta da Serra, 700 m, 12º18’52” S, 40º28’32” W, 28 Jul. 2004, *L.P. de Queiroz et al. 9338* (SP); Uruçuca, Distrito de Serra Grande, Estrada Serra Grande-Itacaré, 7.3 km a partir de Serra Grande, Faz. Lagoa do Conjunto Faz. Santa Cruz, 13 May 1999, *A.M. Amorim et al. 3072* (SP). **Espírito Santo:** Anchieta, Praia de Iriri, 10 Sep. 1987, *L. Behar et al. 45* (CESJ); Cachoeira de Itapemirim, Virgem Alta Morro de Jal, 4 Aug. 1948, *A.C. Brade 19316* (RB); Cachoeira do Itapemirim, 65 m, 20º45’13” S, 41º17’46” W, 28 Oct. 2009, *A. Salino et al. 14608* (BHCB); Cariacica, Reserva Biológica Duas Bocas, Pau Amarelo, ex-condominio Rural Cantinho do Céu, 619 m, 20º26’00” S, 40º32’00” W, 6 May 2008, *A.P. Fontana et al. 5195* (RB); Guarapari, Setiba, km 32, 1 Apr. 1987, *D.J. Pereira 1016* (CESJ); Conceição da Barra, Parque Estadual de Itaúnas, restinga próxima ao Lixão da Vila, 16 Mar. 1999, *A. Salino & P.O. Morais 4477* (BHCB, CESJ); Linhares, Reserva Natural da Vale, 10 m, 19º9’43” S, 40º4’00” W, 17 Apr. 2011, *A. Salino et al. 15065* (BHCB); Pinheiros, Reserva Biológica do Córrego do Veado, 50 m, 18º22’13” S, 40º9’25” W, 9 Jun 2009, *A. Salino et al. 14290* (BHCB); Santa Leopoldina, Chaves, na ES080 (estrada não pavimentada ligando a ES–261 à cidade de Santa Leopoldina), ca 8 km S da ES 261, num ramal de 1 km de extensão à Cachoeira do Recanto, no Rio da Prata (Afluente do Rio Santa Maria) 580 m, 20º00’ S, 40º32’ W, 22 Jan. 2011, *J.R. Pirani 6161* (SP); Santa Maria do Jetibá, Rio das Farinhas, Propriedade do Kuzzanski, 861 m, 20º4’17” S, 40º43’18” W, *F.S. Souza et al. 1319* (BHCB); São Mateus, estrada entre Guriri e a praia de Barra Nova, 0–10 m, 18º48’33” S, 39º45’49” W, 11 Feb. 2007, *T.E. Almeida et al. 700* (BHCB). **Goiás:** Alto Paraíso de Goiás, Parque Nacional da Chapada dos

Veadeiros, entre a Guarita de Mutuca e Cruzeiro, 13º58’69” S, 47º30’6” W, 18 Apr. 2009, *G. Martinelli et al. 16571* (RB); Alto Paraíso de Goiás, highway Brasilia-alto Paraíso de Goiás (BR 010), ca 10 k S of Alto Paraíso de Goiás, 16 Jan. 2011, *P.H. Labiak & J.T. Mickel 5248* (SP). **Mato Grosso:** Xavantina, Cachimbo road, km 260, expedition Base Camp, 12º49’ S, 51º46’ W, 19 Dec. 1967, *D. Philcox et al. 3587* (RB). **Minas Gerais:** Bandeira, área a ca. 14 km da sede de Bandeira, na divisa com a Bahia, 500–550 m, 15º49’30” S, 40º31’16” W, 6 Oct. 2003, *A. Salino et al. 9089* (BHCB); Conselheiro Pena, Parque Estadual de Sete Salões, 430 m, 19º15’9” S, 41º23’37” W, 7 May 2006, *A. Salino et al. 10897* (BHCB, CESJ); Descoberto, Reserva Biológica da Represa do Grama, 1 Jul. 2001, *R.M. Castro et al. 243* (CESJ); Felício dos Santos, Cachoeira do sumidouro, 1200 m, 18º13’ S, 43º15’ W, 15 Nov. 2006, *P.L. Viana et al. 2849* (BHCB); Itamarandiba, Parque Estadual da Serra Negra, Bucarão, 1020 m, 18º1’5” S, 42º56’55” W, 5 Jul. 2006, *A. Salino et al. 11320* (BHCB); Paracatu, Reserva do Acangaú, 675 m, 17º11’27” S, 47º5’42” W, 2 Nov. 2006, *A. Salino et al. 10698* (BHCB, CESJ); Rio Pardo de Minas, Parque Estadual Serra Nova, trilha para o Poço de Jacaré, 829 m, 15º38’56” S, 42º44’29” W, 23 Mar. 2012, *L.A.A. Góes-Neto 725* (BHCB); Santa Maria do Salto, Talismã, faz. Duas Barras, próxima a divisa com Bahia, 750–850 m, 16º24’16” S, 40º3’27” W, 9 Oct. 2003, *A. Salino et al. 9184* (BHCB); Santa Rita do Itueto, Parque Estadual de Sete Salões, trilha para a Gruta de Sete Salões e Pico do Garrafão a partir da fazenda dos Correa, área com Floresta Estacional Semidecidual e Campo Rupestre, 770 m, 19º16’42” S, 41º22’26” W, 8 May 2006, *A. Salino et al. 11007* (BHCB, CESJ); São Gonçalo de Rio Preto, Parque Estadual do Rio Preto, Entre Lapa e Pico dois Irmãos, 1600–1700 m, 18º12’25” S, 43º18’35” W, 7 Aug. 2003, *A. Salino et al. 9348* (BHCB); São Roque de Minas, Parque Nacional da Serra da Canastra, 1450 m, 20º13’1” S, 46º28’42” W, 5 Apr. 2017, *I.O. Moura et al. 192* (BHCB). **Paraná:** Jacareí, 5 Apr. 1914, *P. Dusén 14702* (SI). **Pernambuco:** Amaragi, Matas do Engenho Animoso, 2 Dec. 1999, *C.P.L. Luna et al. 21* (UFP); Bezerros, Parque Municipal de Serra Negra, 2 Jun. 1995, *M.R.C. Sales de Melo 63* (PEUFR); Bonito, Mata da Chuva, 750 m, 8º32’20” S, 35º43’22” W, 19 May 2000, *A. Santiago et al. 166* (PEUFR); Bonito, Mata da Reserva Biológica Municipal de Bonito, 750–800 m, 8º30’30” S, 35º43’18” W, 10 May 2000, *A. Santiago et al. 149* (PEUFR); Bonito, Mata da Colônia, 800 m, 8º30’14” S, 35º42’56” W, 19 May 2000, *A. Santiago et al. 148* (PEUFR); Bonito, Mata da Azuada, 709 m, 8º30’8” S, 75º41’49” W, 16 Mar. 2019, *D.*

Sanín & A. Santiago 7267 (BHCB); Cabo, Reserva de Gurjaú, s.d. Aug. 1991, *K.* Duarte *s.n.* (UFP); Cortez, 10 Nov. 1974, *Andrade-Lima s.n.* (IPA); Goiana, Eng. Itapirema do Meio, 12 Oct. 1966, *Andrade-Lima 66–4728* (IPA); Gravatá, Fazenda Harmonia, 10 Oct. 1970, *Andrade-Lima 70–6043* (IPA); Jaqueira, Usina, Colônia (Ageró), 415 m, 8º44'27" S, 35º50'37" W, 20 May 2002, *M.S. Lopes & M.R.S. Pietrobom 613* (UFP); Joaquim Pessoa, Mata do Buraquinho, IBDF descendo à esquerda do Estritório, 25 Jul. 1985, *E.S. Santana 87* (PEUFR); Jaqueira, R.P.P.N. Frei Caneca, Serra do Espelho, 716 m, 8º43'58" S, 35º50'41" W, 1 Apr. 2012, *L.L. Giacomin et al. 1786* (BHCB); Madre de Deus, Biruti Grande, Mata do Biturizinho, 1000 m, 15 Sep. 1992, *K.M.R. Santos s.n*. (PEUFR); Maraial/Lagoa dos Gatos, Serra do Urubú, 22 May 1998, *I.C.L. Barros 34* (PEUFR); Pedra Pintada, Serra Negra de Bezerros, 800 m, 8º10' S, 35º47' W, 13 Aug. 1999, *L. Krause & A. Liebig 33* (PEUFR); Recife, Várzea, mata de São João, 11 May 2001, *M.D. Santos et al, 5* (PEUFR); Vicência, Engenho Jundiá, Mata do Engenho Jundiá, 487 m, 7º37'20" S, 35º19'40" W, 5 Mar. 2002, *A.M.R. Carvalho et al. 55* (UFP). **Rio de Janeiro:** Araruama, Restinga entre a Lagoa de Araruama, e á Praia de Maçambaba, 0–10 m, 11 Jul. 1979, *M. Leitman et al. 4* (RB); Cabo Frio, Restinga, 9 Oct. 1968, *D. Sucre et al. 3877* (BHCB, RB); Gávea, 1868, *A. Glaziou 1655* (BR); Itaipuaçu (Maricá), 8 Apr. 1977, *P.L. Krieger 14788* (CESJ); Miguel Pereira, Reserva Biológica do Tinguá, Orbel 2, trilha com acesso pelo km 31, margens do Rio São Pedro, 789 m, 22º32'39" S, 43º26'1" W, 11 Jul. 2007, *L.S. Silvestre et al. 2076* (RB); Rio das Ostras, 4 Apr. 1971, *P.L. Krieger 10362* (CESJ); Rio de Janeiro, Pão de Açúcar, na base, perto do Paredão Universal, 7 Jun. 1981, *J.P.P. Garauta et al. 3805* (CESJ); Rio de Janeiro, Monumento Natural das Ilhas Cagarras, Ilha de Palmas 23º1'60" S, 43º12'20" W, *M.G. Bovini & M. Faria 3586* (BHCB, RB); Saquarema, Reserva Ecológica de Jacarepiá, 9 Jun. 1995, *A.Q. Lobão et al. 4* (BHCB, RB); Silva Jardim, Poço d' Anta, 25 Aug. 1977, *J.P.P. Carauta 2549* (CESJ). **Santa Catarina:** Joinville, 10 m, 16 Nov. 1901, *J.P. Schmalz 105* (F). **São Paulo:** Altinópolis, Morro do Forno, 5 Jan. 2004, *R.B. Oliveira et al. 397* (SP); Altinópolis, Morro do Forno, Faz. Morro do Forno, estrada Altinópolis-Cajuru (SP-388), 4 km da rodovia Altino Arantes (SP-351), 750 m, 21º5'42" S, 47º20" W, 25 Nov. 2003, *R. Mello Silva et al. 2187* (BHCB, RB); Cananéia, Parque Estadual do Jacupiranga, Itapitangui, trilha do Rio Das Minas, Sitio Paraiso das Minas, 50 m, 24º59'31" S, 48º7'38" W, 26 Mar. 2005, *A. Salino et al. 10240* (BHCB); Caraguatatuba, Martim de Sá, 3 Jul. 1953, *O. Scavone*

20858 (CESJ); Iguape, Ilha Comprida, 31 May 1985, *E.J.M. Catharino s.n.* (CESJ); Itanhaém, Ilha da Queimada Grande, 11–12 Apr. 1996, *V.C. Souza et al. 11054* (RB); Ñhundú, Boqueirão, Oct. 1898, *H. Luederwaldt 1922* (SP); São Sebastião, Praia da Baleia, Rua Olavo Pazzanese, ca 10 m, 23º46'27" S, 45º39'54" W, *A. Salino et al. 5379* BHCB); Parque Estadual do Jacupiranga, Distrito de Itapitangui, trilha do Rio das Minas, sitio Paraiso das Minas, 50 m, 24º59'31" S, 48º7'38" W, 26 Mar. 2005, *A. Salino et al. 10240* (BHCB, CESJ); Ubatuba, Parque Estadual da Serra do Mar, região do Poruba, Nov. 1993, *R.C. de Oliveira s.n.* (BHCB); Ubatuba, Parque Estadual da Serra do Mar, Núcleo Picinguaba, trilha do Jatobá, 40 m, 23º20'25" S, 44º50'13" W, 4 May 2001, *A. Salino et al. 6740* (BHCB).

BRITISH GUIANA. Iamakusa, 16 Nov. 1922, *H. Lang & A.C. Persaud 144* (F).

COLOMBIA. **Amazonas:** río Caquetá, alrededores de Araracuara, 120 m, 10 Nov. 1982, *J.M. Idrobo 11497* (COL); corregimiento La Araracuara, trocha al río Yarí, al NE del corregimiento, 200–300 m, 18 Apr. 1986, *G. Galeano 912* (COL); Río Caquetá, La Pedrera and vicinity, cerro de la Pedrera, 2 May 1952, *R.E. Schultes 16299* (COL); Leticia, Parque Nacional Amacayacu, resguardo indígena El Vergel, isla Mocagua, restinga alta de Pachaco, 22 Mar. 2002, *D. Higuera 284* (COL); Villa Azul, isla Morrocoy, llanura aluvial del río Caquetá, 3 Sep. 1998, *R. Alfonso 477* (COL). **Antioquia:** Anorí, corregimiento de Providencia, 400–700 m, 6 Jun. 1971, *D.D. Soejarto 2902b* (HUA); Caldas, finca El Ranchito, a 25 Km de Medellín, 1750 m, 6º5' N, 75º38' W, 4 Jun. 1978, *R. Callejas 675* (HUA); Cocorná, vereda La Piñuela, carretera a San Francisco, 700 m, 07 Jun. 1991, *D. Giraldo-Cañas 391* (HUA); Medellín, quebrada El Guamal, entre la vía Las Palmas-av. El Poblado, 1600–1700 m, 18 Apr. 1997, *W.D. Rodríguez 528* (HUA); San Luis, vereda La Josefina, camino hacia el Tulipán, 700–925 m, 12 Apr. 1990, *D. Cardenas 2724* (JAUM). **Boyacá**: desierto de la Candelaria, 2250 m, 10 Apr. 1974, *C.E. Acosta-Arteaga 278* (COL); entre Pauna y Chiquinquirá, 1000–1900 m, 13 Dec. 1970, *M.T. Murillo 1538* (COL); Villa de Leyva, cerro del Espíritu Santo, alrededores de la cabecera municipal, 2200 m, 12 Jul. 2001, *H. Dueñas 3095* (COL). **Caldas**: Chinchiná, vereda La Esmeralda, bosques del Embalse San Francisco, en la vía a los tubos, por el camino de entrenamiento militar, 900 m, 5º3' N, 75º44' W, 30 Apr. 2012, *D. Sanín 5658* (HUA); Chinchiná, vereda La Colina, localidad El Alto Español, al borde de la carretera fronteriza entre los municipios de Santa Rosa y Chinchiná, relicto a mano derecha vía Chinchiná, 1728 m, 4º56'34" N, 75º41'46" W,

6 Mar. 2006, *D. Sanín 1892* (FAUC); Villamaría, vía Potosí, cascada del río Nereidas, 2497 m, 4º54’ N, 75º26’ W, 13 Sep. 2009, *D. Sanín 3470* (FAUC); Manizales-Palestina, Empresa ESTEPAN-Colombiana de Químicos, vía Medellín, Tres Puertas, regeneración hacia el margen de la empresa, 1000 m, 3 Aug. 2008, *D. Sanín 2542* (FAUC); Neira, vía Aránzazu, 4 km del casco urbano, 1350 m, 5º12’ N, 75º35’ W, 3 Mar. 2008, *D. Sanín 2602* (FAUC). **Caquetá**: km 17 entre Belén de los Andaquíes y la inspección de policía ‘La Mono’, 400 m, 12 Mar. 1981, *R. Bernal 512* (COL); Solano, Parque Nacional Natural Serranía Chiribiquete (región SE), estación Puerto Abeja, margen derecho del río Mesay, costado oriental de la quebrada Puerto Abeja, 500 m, 00º4’ N, 72º26’ W, 23 Apr. 2002, *R. Arévalo 333* (COL); Solano, 200 m, 00º16’ N, 72º30’ W, 23 Sep. 2001, *A. Vasco-Gutiérrez 421* (HUA). **Cauca**: Bolívar, alrededores de la zona urbana de la cabecera del corregimiento, El Morro, 1700–1800 m, 10 Jun. 2003, *Aguilar 697* (CAUP); Margen izquierda del río Guapi, estación del Incora, zona de potreros, 0 m, 6 Jan. 1976, *I. Cabrera* 3837 (CUVC); El Tambo, Reserva Natural Tambito, 1600 m, 5 Mar. 2000, *O.L. Casañas-Suárez 147* (COL); Popayán, Universidad del Cauca, detrás de la biblioteca de la Facultad de Educación, 1713 m, 27 Nov. 1999, *B.E. Salgado-N. 36* (COL); Rosas, camino de Márquez, 1800 m, 27 Jun. 1975, *C.E. Acosta-Arteaga 949* (COL). **Chocó**: Altagracia, río Munguidó, afluente del río Atrato, alrededores de Altagracia, 40 m, 3 May 1975, *E. Forero 1478* (COL); Bahía Solano, Parque Natural Utría, margen izquierda de la ensenada, sin dat., 17 Nov. 1989, *Espinal 3569* (CHOCO); Baudó, 11 Feb–29 Mar. 1967, *H.P. Fuchs & L. Zanella 21874* (F); San José del Palmar, vereda Damasco, escuela Santa Lucia, 641 m, 21 May 2009, *D. Sanín 2897* (FAUC); Unión Panamericana, corregimiento de Raspadura, 16 Aug. 2004, *Ledezma 269* (CHOCO). **Cundinamarca**: Albán, a lo largo del ferrocarril entre el casco urbano y el peaje de Jalisco, vertiente occidental de la Cordillera Oriental 1900–2100 m, 4º52’ N, 74º26’ W, 14 Feb. 2004, *L.A. Triana-Moreno 196* (COL); Tibacuy, carretera hacia Silvania, 1300 m, 13 Jun. 1975, *C.E. Acosta-Arteaga 870* (COL); Yacopí, inspección de policía de Guadualito, vereda La Laguna, 1245 m, 28 Oct. 1995, *G. Lozano 7199* (COL). **Guainía:** caserío del Sejal, río Guainía, 100 m, 18 Oct. 1977, *Pabón 398* (COL). **Guaviare**: al Este de El Retorno, cerca del caño Mico, cerca a la escuela La Morichera, sin dat., 1 May 1994, *P. Stevenson 1223* (COL); San José del Guaviare, en inmediaciones de Ciudad de Piedra, serranía La Lindosa, carretera San José-El Capricho, 290 m, 2º28’ N, 72º41’ W, 19 Nov. 1995, *López 813* (COL). **Huila**:

Colombia, inspección de Santa Ana, camino hacia El Cerro de La Cruz, zona con vegetación poco alterada, 1400 m, 15 Sep. 1990, *F. Llanos 1648a* (COL); Neiva, carretera La Vega, Quebrada El Mico, 720 m, 23 Mar. 1996, *F. Llanos 2684* (COL); Pitalito, vereda Charguayaco, reserva de la comunidad El Arroyo, 1925 m, 1º46' N, 76º1' W, 28 Jul. 2009, *D. Sanín 3213* (FAUC). **Magdalena**: San Andrés, 1300 m, 20 Jan. 1959, *R. Romero-Castañeda 7003* (COL); Sierra Nevada de Santa Marta, en trochas de finca Los Arroyitos, 1800 m, 8 Oct. 1972, *J.H. Kirkbride 2459* (COL). **Meta**: Llanos de San Martín, La Serranía, hoya del río Ariari, laguna inundable en la laguna de Aguasucia, 300 m, 11 Sep. 1956, *R. Jaramillo-Mejía 1038* (COL); primeros cerros al sur de La Macarena, frente al río Guayabero, 480 m, 10 Jun. 1970, *R. Echeverry 2075* (COL); carretera entre Villavicencio-Acacias, a 7 km, finca La Reforma, 800 m, 5 Jul. 1970, *R. Echeverry 2133* (COL); Serranía La Macarena (extremo nordeste), macizo Rengifo, faldas orientales, 600–1300 m, 30 Dic. 1950, *J.M. Idrobo 876* (COL); carretera entre Villavicencio, Cumaral y La Medina, 1500 m, 17 Jun. 1986, *M.T. Murillo 2144* (COL). **Norte de Santander**: Toledo, de Toledo a Samore, 1500–2500 m, 30 Mar. 1987, *G. Lozano 5464* (COL); **Putumayo**: Mocoa, El Pepino, 700 m, 18 Feb. 1973, *O. Hagemann 2047* (COL, PSO). **Quindío:** Circasia, vereda Buenavista, finca Calamar, 1550 m, 23 Feb. 1995, *M.C. Vélez 4936* (HUQ); Filandia, condominio Lusitania, cañón del río Barbas, 1880 m, 4º42' N, 75º38' W, 17 Jul. 2009, *D. Sanín 3053* (FAUC); La Tebaida, vereda La Argentina, finca Santa Fé, margen izquierda de la quebrada La Argentina, 1090 m, 31 Oct. 1985, *G. Arbeláez 1188* (HUA, HUQ); Montenegro, vereda El Castillo, bosque relictual, 1200 m, 18 Apr. 1997, *M.C. Vélez 6679* (HUQ); vereda San Rafael, bosque intervenido a la orilla de río Santo Domingo, 1560 m, 7 Sep. 1996, *M.C. Vélez 6246* (HUQ). **Risaralda**: Pereira, Santuario de Fauna y Flora Otún Quimbaya, senderos al interior del Santuario, 1783 m, 4º46' N, 75º37' W, 20 Apr. 2012, *D. Sanín 5120* (HUA). **Santander**: Charalá, corregimiento de Virolín, camino El Reloj, en vallecito y alrededores de la quebrada La Lanosa, 1900 m, 20 Oct. 1983, *J.H. Torres 2676* (COL); 5 km S of Zapatoca, 1900 m, 26 Jul. 1975, *A.H. Gentry 15444* (COL, MO). **Tolima:** Ibagué, Universidad del Tolima, 1150 m, 23 Oct. 2006, *Forero A*. 17 (TOLI); Villarica, 2000 m, 6 Apr. 1966, *Aguilar 79* (TOLI). **Valle del Cauca**: Alcalá, carretera a Filandia, 14 Apr. 1976, *C.E. Acosta-Arteaga 1048* (COL); hoya del río Anchicayá, 400 m, 5 Nov. 1972, *O. Hagemann 1446* (COL); Bajo Calima, 4 Apr. 1961, *I. Cabrera 471* (COL); Buenaventura, Vista Hermosa-Piangüita, 3 m,

14 Jul. 2010, *D. Sanín 4207* (CUVC); Calima, valle del río Bravo, cerca de Playa Rica, Cordillera Occidental, 1110 m, 24 Jan. 1982, *P. Silverstone-Sopkin 1108* (CUVC). **Vaupés**: río Kuduyarí (tributary of río Vaupés): middle and lower course, 700–800 m, 16 Oct. 1952, *R.E. Schultes 17904* (COL); río Pira Paraná, (tributary of río Apaporis), caño Teemeeña, 6 Sep. 1952, *R.E. Schultes 17252* (COL). **Vichada**: hato Canáima, límites entre Vichada y Meta, carretera a Puerto Carreño, entre El Porvenir y Sta. Rosalía, cerca a Carijén, 14 Mar. 1971, *P. Pinto 1216* (COL).

COSTA RICA. **Alajuela:** Cantón de Los Chiles, R.N.V.S. Caño Negro, Llanura de Guatuso, Caño Negro, 40 m, 10º57'25" N, 85º8'15" W, 3 Mar. 1996, *A. Rojas et al. 1496* (INB). **Cartago:** Cordillera de Talamanca, Estación de Biología Tropical Río Macho y alrededores, Orosí, 1550–1580 m, 9º46'00" N, 83º52'00" W, 30 Sep. 1991, *A. Rojas 479* (INB); 2 km N of Orosi, near bridge over río Navarro, 1000 m, 3 Jul 1967, *J.T. Mickel 2285* (LP). **Guanacaste:** Tilaran, Cordillera de Tilarán, Cerro Frio, 2.5 km NE of EL Dos, 1200 m, 10º24'00" W, 84º53'00", 16 Aug. 1994, *W. Haber 11890* (INB). **Limón:** P.N. Tortuguero, Pococi, Llanura de Tortuguero, Estación Cuatro Esquinas, 10 m, 10º32'2" N, 83º30'26" W, 12 Sep. 1990, *J. Solano et al. 102* (INB). **Puntarenas:** Buenos Aires, Cuenca Térraba-Sierpe, Potrero Grande, Tres Colinas, Finca del señor Kennethe Esponoza, c.c. Matamoros, 1350 m, 9º5'23.7000 N, -83.03.56.4000 W, 14 Jun. 2006, *D. Santamaria et al. 4522* (INB); Puntarenas, Buen Amigo (galeón y casa de Zobeida Fuentes), 1100 m, 10º16'20" N, 84º49'30" W, 4 Jun. 1993, *Z. Fuentes 348* (INB); San Vito, 1500 m, 28 Jun 1967, *E.R. de la Sota 5219* (LP). **San José:** San José, City Park, Parque Nacional, 1000 m, 9º55' N, 84º50' W, 29 Oct. 1986, *E. Hennipman et al. 6549* (L).

CUBA. **Santiago de Cuba:** vicinity of Barbacoa, 24–29 Jan. 1902, *C.L. Pollard et al. 64* (F); Cuba Orientali, Jul. 1856, *C. Wright 824* (BR); in Cuba Orientali 1860, *C. Wright 804* (F).

ECUADOR. **Esmeraldas:** *A. Sodiro 8/90* (QLPS); Along rails W of Lita Railway station, 510 m, 00º53' S, 78º27' W, 2 Nov. 1994, *B. Øllgaard & H. Navarrete 105309* (QCA); Ibabura, along road from Lita to train station, 450–550 m, 5 Oct. 1980, *P.J.M. Maas & L. Cobb 4729* (QCA). **Imbabura:** along road from Lita to train station, 450–550 m, 5 Oct. 1981, *P.J.M. Maas & L. Cobb 4729* (L). **Loreto:** Maynas, Pebas, río Ampiyacú, 4 km de la desembocadura entre Pucaurquillo (Comunidad Bora y Estirón del Cuzco) (Comunidad

Huitota y Bora), 12 Apr. 1987, *P. Pinto et al. 6355* (QCA). **Manabi:** P.N. Machalilla, Pueblo Nuevo, cerro El Guasmo hasta el cerro Cacho de Toro, salida por Salaite, 200–580 m, 1º25' S, 80º44' W, 4 Sep. 1991, *C. Josse 606* (QCA). **Morona-Santiago:** road from Plan del Milagro to 10–15 km past San Juan Bosco, 1470 m, 3º10' S, 78º50' W, 1 Jun. 1989, *J.F. Smith 2080* (QCA). **Napo:** At and near Laguna Grande de Cuyabeno, 250 m, 00º00' S, 76º12' W, 12–15 Jul 1984, *S. Laegaard 52569* (QCA); Laguna de Canangueno, 00º25'30" S, 76º13'30" W, 23 Apr. 1986, *J. Jaramillo 8393* (QCA). **Pastaza:** Montalvo, on the río Bonanza, along the trail to Chiriboga, 300–350 m, 2º5' S, 76º58' W, 28 Jul. 1980, *B. Øllgaard et al. 35465* (QCA). **Pichincha:** Pululahua, *A. Mille s.n.* (Q). **Sucumbios:** Reserva Faunistica Cuyabeno, Laguna Grande, 265 m, 00º1' N, 76º11' W, 25 Mar. 1989, *H. Balslev et al. 84592* (QCA). **Zamora-Chinchipe:** Parque Nacional Podocarpus, at río Bombuscaro, 6 km SW of Zamora, 1100–1200 m, 4º7' S, 78º58' W, 26 Nov. 1994, *B. Øllgaard & H. Navarrete 105829* (QCA); Parque Nacional Podocarpus, Bombuscaro, along trail Urraquita Verde, Matrix Plot M1, 1150 m, 9544917, 725575, 29 Nov. 2010, *M. Lehnert 2219* (QCA).

GRENADA. **Parish St. John:** Belvedere, 457 m, 30 Oct–11 Dec. 1957, *G.R. Proctor 16967* (F); Soulier Mts, 30 Oct. 1905, *W.E. Broadway s.n.* (F).

GUADELOUPE. *P. Martens 1931* (BR); 1868, *T. Husnot 381* (BR); Dugommier, 650 m, 21 Nov. 1936, *H. Stehlé 1877* (F); Matouba, 80−800 m, 1894, *P. Duss 4076* (NY); Matouba, 1868, *T. Husnot 381* (F); route de Tour de France, Camp Balete, 35−308 m, 1884, *P. Duss 1653* (F).

GUATEMALA. **Alta Verapaz:** 350 m, Nov. 1904, *H. von Türckheim 4046* (BR); hills about 5 km N of San Pedro Carchá, 1200 m, 15º32' N, 90º15' W, 28 Jan. 1969, *L.O. Williams et al. 40209* (F). **Chiquimula:** Thickets of Quebrada Resimiento, 4 km N of Esquipulas, 1100 m, 27 Sep. 1971, *A. Molina & A.R. Molina 26768* (F). **Escuintla:** 2 km E of Santa Lucía, 14°20'6" N, 91°00'16" W, 30 Jul. 1970, *W.E. Harmon & J.D. Dwyer 3380* (MO). **Izabal:** along trail beginning from mile 33.23 between Dartmouth and Morales towards Lago Izabal, Montaña del Mico, 35−150 m, 7 Apr. 1940, *J.A. Steyermark 39009* (F); South shore of Lake Izabal, east of Izabal, 600 m, 15º15' N, 89º00' W, 2 May 1966, *G.C. Jones & L. Facey 3230* (F). **Petén:** Puerto Chimino, Laguna Petexbatún, 20 km S. of Sayaxché, 16º34' N, 90º14' W, 12 Oct. 1989, *H. Zomer 36* (L); Río Chocop, San Andres, 100 m, 17º36' N, 90º24' W, 17 Aug. 1998, *J. Morales et al. 16* (F). **San Marcos:** Volcán Tajumulco, Finca El Porvenir,

1500 m, 14º57’ N, 91º56’ W, 4 Sep. 1999, *J. Morales 542* (F). **Sololá:** bordering río Bravo, in vicinity of Finca Mocá, south facing slopes of Volcán Atitlán, 1000–1100 m, 21 Jun. 1942, *J.A. Steyermark 47956* (F). **Zacapa:** along río Lima, Sierra de las Minas, between río Hondo and Summit of mountains at Finca Alejandrina, 1500–1700 m, 11 Oct. 1939, *J.A. Steyermark 29635* (F).

GUYANA. **Cayenne:** Montagne de la Trinité, sommet NE, 450 m, 23 Jan. 1984, *J.J. de Granville et al.* 6234 (RB). **Cuyuni-Mazaruni:** Along Mazaruni R, confluence with Kamarang R to ± 3 km upstream, 490 m, 5º53’ N, 60º37’ W, 12 May 1990, *T. McDowell & D. Gopaul 2572* (F).

HONDURAS. **Comayagua:** Siguatepeque, in school forest of La Escuela Nacional de Ciencias Forestales, 1100 m, 13 Sep. 1974, *A. Horwath 95* (F). **Cortés:** Lago de Yojoa, 60 km SO de San Pedro Sula, 600 m, 3 Oct. 1985, *L. Argueta 84* (F); Villanueva, Ocote Arrancado, 50 km N Lago de Yojoa. Pinares, 600 m, 15°23’ N. 88°1’ W, 1 Nov. 1980, *C.H. Nelson et al. 5912* (MO). **El Paraíso**: Danlí, Los Arcos, 12 km SO de Danlí. Pinares, 1000 m, 14°01’23” N, 86°33’7” W, 21 Oct. 1987, *S. Flores 83* (MO). **Francisco Morazán**: El Hatillo-Tegucigalpa, 1200 m, 3 Aug 1978, *L. Zelaya 68* (LP); La Tigra, 20 km al NE de Tegucigalpa, 2000 m, 17 Aug. 1984, *J. Gomez 55* (F); Distrito Central, Tegucigalpa, cerro El Picacho, 1300 m, 14°6’56” N, 87°11’41” W, 8 Aug. 1976, *C.H. Nelson 3827* (MO). **Gracias A Dios:** Puerto Lempira, La Mosquitia: Caserío de Rus-Rus; vaguada del río Rus-Rus, 0 m, 14°42’ N, 84°57’ W, 17 Jun. 1977, *C.H. Nelson 4091* (MO). **Intibucá:** La Esperanza, camino que conduce a los baños públicos, 14°18’28” N, 88°10’57” W, 12 Sep. 1981, *I. Cambar 1* (MO). **Morazán,** along and near río Agua Amarilla, above EL Zamorano 1000−1200 m, Oct.-Nov. 1948, *P.C. Standley 13790* (F). **Ocotepeque:** Along Agua Caliente river, vicinity of Guatemala border, 900 m, 3 Sep. 1975, *A. Molina 31029* (F); Belén Gualcho, Aldea de Belén Gualcho y alrededores; 40 km al E de Nueva Ocotepeque, 1500–2000 m, 14°29’ N, 88°48’ W, 29 Jun. 1976, *C.H. Nelson et al. 3819* (MO). **Olancho:** 6 mi E of La Unión along road to Olanchito, 950 m, 15°3’ N, 86°35’ W, 1 Jul. 1994, *G. Davidse et al. 35425* (MO). **Santa Bárbara:** Orillas del Lago de Yojoa, 60 km SO de San Pedro Sula, 600 m, 20 Sep. 1987, *R. Well 33* (F); Llama, Montaña de La Nieve, lado SO del Caserío El Tapiquilar, 20 km S de San Antonio de Cortés, 1200–1500 m, 15°4’53” N, 88°5’32” W, 23 Feb. 1982, *C. Nelson et al. 7943* (MO).

MEXICO. **Chiapas:** Ocozocoautla de Espinosa, 18–20 km N of Ocozocoautla along road to Mal Paso, 800 m, 4 Nov. 1971, *D.E. Breedlove & A.R. Smith 21847* (F); 2 miles N of Ocozocoautla, on gravel road to Apitpac, 900 m, 16°47'24" N, 93°22'12" W, 8 Jul. 1977, *T.B. Croat 40519* (MO). **Oaxaca:** Deep ravine along stream near Hwy 185, ca 5 km N of the junction with the road to Matias Romero, 200–300 m, 20 Aug. 1974, *J. Conrad & R. Conrad 3002* (MO, RB); Ixtlan, Mpio. de Comaltepec. Puerto Eligi, 700 m, 17°41' N, 96°17' W, 8 Aug. 1987, *E. López Garcia & G.J. Martin 10* (MO). **Veracruz**: cerca de Carrueco, 600 m, 12 Jul 1964, *E.R. de la Sota 4014* (LP); 12 km al E de Córdoba, cerca de Atoyaquillo, 650 m, 12 Oct. 1964, *Rzedowski 19080* (LP); Huatusco, 2 km N of Huatusco, 1280 m, 19°9'36" N, 96°56'24" W, 28 Jun. 1977, *T.B. Croat 39636* (MO); Playa San Vicente, 100 m, 16 Oct. 1969, *G. Martínez 2084* (F).

NICARAGUA. **Atlántico Norte:** orillas del río Lucus, La Tronquera Sur Oeste de Waspan, 60 m, [14°44' N 83°58' W], 18 Aug. 1965, *A. Molinar 14911* (F). **Atlántico sur:** Barra de Punta Gorda, S side; protected beach, 2 m, 11°30'55" N, 83°46'25" W, 30 Sep. 1981, *W.D. Stevens 20720* (MO). **Boaco:** Upper SW slope of Cerro Mombachito, S of road between Boaco and Camoapa, roadside, 900−1000 m, 12°24' N, 85°33' W, 3 Oct. 1979, *W.D. Stevens et al. 14607* (MO). **Chontales:** 2.0 km N of road to Betulia along road to Cerro Margarita, 500 m, 12°15'34" N, 85°16'33" W, 20 Jan. 2015, *W.D. Stevens & O.M. Montiel 35837* (MO). **Estelí:** North slope of Cerro El Fraile, 1160−1200 m, 13°25' N, 86°15' W – 13°25' N, 86°16' W, 28 Sep. 1980, *W.D. Stevens & O.M. Montiel 18096* (MO). **Jinotega:** Salto Acatulu, río Bocay, 130 m, 14°13' N, 85°10' W, 12 Mar. 1980, *W.D. Stevens et al. 16734* (MO). **Managua:** ca 2.3 km from Hwy 12 on road along ridge of Sierra de Managua from Hwy 12 (Carretera vieja a León) at km 17 to Hwy 2 (Carretera sur), ca. 450−550 m, 12º4' N, 86º22' W, 20 Aug. 1977, *W.D. Stevens et al. 3451* (MO, QCA). **Matagalpa:** El Ocotal, 4 km al S de la ciudad de Matagalpa, 900−1000 m, 12°52' N, 85°55' W, 5 Oct. 1982, *P.P. Moreno 17674* (MO). **Río San Juan:** Municipio El Castillo, vicinity of Comunidad Che Guevara, 2 Km al Oeste, 60 m, 11°03'33" N, 84°22'33" W, 10 Nov. 2004, *L. López 520* (MO).

PANAMA. **Bocas del Toro:** Isla San Cristobal. E side of island just S of Pigeon Creek, 0 m, 9°16'42" N, 82°15'20" W, 12 Feb. 1989, *P.M. Peterson & C.R. Annable 6808* (MO). **Canal Area:** Summit Garden, 75 m, 9°3'52" N, 79°38'58" W, 22 Jun 1972, *T.B. Croat*

17152 (MO). **Chiriquí:** Along road from Gualaca to Chiriquí Grande, 1.2 miles beyond Los Planes de Hornito, 1 mile beyond turnoff to left to Caldera 1120 m, 8°39' N, 82°12' W, 19 Sep. 1987, *T.B. Croat 67751* (MO). **Coclé:** Trail from Cano Blanco del Norte to continental divide N of El Copé, 250 m, 8°41'23" N, 80°36'9" W, *G. Davidse & C.W. Hamilton 23685* (MO). **Colón:** Santa Rita Ridge, southeast of Colon. Along ridge road, 10–12 miles from Transisthmian Highway, 550 m, 9°24' N, 79°39' W, 21 May 1986, *G. McPherson 9203* (MO). **Daríen:** South of El Real, region called Alturas de Nique, near Cana mine, along trail following old Camino Real towards Colombia, 900−1250 m, 7°45'N, 77°40' W, 26 Aug. 1987, *G. MacPerson 11604* (MO). **Panama:** Capira, Cerro Campana, 900 m, 8°41' N, 79°54' W, 21 Jan. 1985, *H. van der Werff 6166* (MO). **Veraguas:** Slopes of Cerro Tute, above Santa Fé, 1200−1400 m, 8°31' N, 81°5' W, 28 Sep. 1972, *A.H. Gentry 6255* (MO).

PARAGUAY. Canindeyú, Mbaracayú Natural Reserve, administered by Fundación Moisés Bertoni: around Jejuí-Mí, 24°7'59" S, 55°31'40" W, 29 May, 1999, *E.M. Zardini & I. Chaparro 50971* (MO).

PERU. **Amazonas:** Chachapoyas, Jalca zone 3−6 km W of Molinopampa, 2200−2450 m, 19 Jul 1962, *J.J. Wurdack 1407* (F, USM); Chachapoyas, road from Chachapoyas to Molinobamba, 2200 m, 6º12'26" S, 77º42'32" W, 15 May 2001, *T. Henning & C. Schneider 217* (USM); Condorcanqui, Distrito El Cenepa, Comunidad de Mamayaque, Cerro Sakeegaig, 1010 m, 4°34'58" S, 78°14'1" W, 14 Feb. 1997, *R. Vásquez 22532* (MO). **Cajamarca:** Jaén, Dist. Santa Rosa. Alrededores del Cerro San Cristóbal, 1625−1745 m, 5°25'21" S, 78°35'10" W, 26 Mar 2006, *E.M. Ortíz 1288* (MO); San Miguel, Monteseco, 7 km después del monte, 24 Mar. 1982, *L. Vasque & J. Loos s.n.* (USM); Sta. Cruz, abajo del campamento, 1350 m, 28 Jan. 1989, *S. Leiva 26* (F, USM). **Cusco:** La Convención, Huayopata, Huyro, 1910 m, 12.59.02 S, 72.32.52 W, 22 Nov. 2003, *E. Bonito et al. 1094* (USM); La Convención, Echarati, 678 m, 0712418, 8663168, 21 Apr. 2007, *H. Beltran & I. Salinas 6194* (USM). **Huánuco**: Tingo María, 650 m, 26 Jul. 1947, *P.G. Aguilar 310* (USM). **Junín:** La Merced-Chanchamayo, Sep. 1939, *J. Soukup 1094* (F); Tarma, Huacapistana, 1800 m, 28 Oct. 1956, *E. Cerrate 2893* (USM); 2 km S of Satipo, 700 m, 11°16'4" S, 74°39'34" W, 24 Jun. 1977, *J.C. Solomon 3277* (MO). **Loreto:** río Tacsha Curaray, 19 Sep. 1972, *T.B. Croat 20458* (USM); Maynas, Iquitos, carretera Quisto Cocha-Nauta, km 10, 160–170 m, 10 Jan. 1984, *S. MacDaniel et al. 27601* (USM); Ucayali, Cerros de Canchahuaya, 18 km al NE de

Contamana, 700 m, 7º11'46" S, 74º55'38" W, 24 Nov. 2000, *J. Roque 2171* (USM). **Pasco:** Oxapampa, Palcazu valley, Cabeza de Mono, 5–6 km W of Iscozacin 325 m, 10º12' S, 75º14' W, 13/19 Apr. 1983, *D.N. Smith 3723* (MO, USM). **San Martín:** Lamas, Alonso de Alvarado, San Juan de Pacayzapa, km 72 carretera Tarapoto-Moyobamba, 1000–1050 m, 29 May 1977, *J. Schunke 9543* (MO, USM); Mariscal Cáceres, Tocache Nuevo, 17 Jan. 1970, *J. Schunke 3718* (F).

SALVADOR. **Chalatenango:** La Palma, Caballero, 900–1500 m, 14º18' N, 89º8' W, 11 Oct. 2001, *D. Sloot et al. 41* (L).

SURINAME. **Sipaliwini:** South Rim Burned Cliff (Tafelberg), South Rim of the Tafelberg in a zone of dry tropical forest created by a 3 km long forest fire 20–40 m wide running along the edge of the cliff, 800 m, 3°53'5" N, 56°10'30" W, 6 Jul. 2001, *T. Hawkins 2180* (MO).

TRINIDAD & TOBAGO. **Guanapo:** 1832, *A. Fendler 1389* (F). 4 Sep. 1925, *W.E. Broadway 5764* (F); Mason Hall, near the river in the ground, 4 Aug. 1913, *W.E. Broadway 4593* (F); Neora Forest, via Sangre Grande, 12 Sep. 1924, *W.E. Broadway 5374* (F).

VENEZUELA. **Amazonas:** Atabapo, Riverine forest upstream from ''Sima Camp'' along branch of Caño Negro, south-central portion of meseta, 1140 m, 3°43' N, 65°31' W, 28 Feb. 1985, *J.A. Steyermark 130858* (MO); Río Negro, Neblina Massif, Canyon Grande, along the río Mawarinuma between the mouth of the canyon and the first major fork of the river, ca. 7 airline km ENE of Puerto Chimo, 150−700 m, 00°50' N, 66°5' W – 00°53' N, 66°2' W, 9 Jul. 1984, *G. Davidse & J.S. Miller 27288* (MO). **Bolívar:** Chimantá Massif, Along southwest-facing sandstone bluffs of Chimantá-tepui (Torono-tepuí), near southern corner, 1700 m, 19−20 May 1953, *J.A. Steyermark 75478* (F); 17 km E of El Pauji by road and 64 km W of Santa Elena by road, 4 km N of highway, río Las Ahallas, 850 m 4°30' N, 61°30' W, 1 Nov. 1985, *R.L. Liesner 19252* (MO); Mount Roraima, in meadow, vicinity of Rondón Camp, on southwest-facing slopes, 2040 m, 30 Sep. 1944, *J.A. Steyermark 58938* (F). **Falcón:** Sierra San Luis, 2 km E. de Cucaide, 1300 m, 14 Sep. 1978, *H. van der Werff & R. Wingfield 3136* (L). **Lara:** Portuguesa, Araure del Edo. En los rios Bocoy y Riecito, 800−1200 m, 9°37' N, 69°25' W, 27 Aug. 1983, *F.J. Ortega & G. Aymard 1799* (MO). **Merida:** 1400 m, 28 Jan. 1939, *H.G. Alston 6661* (L); 2500 m, 1893−1984, *A. Mocquerys 1213* (F); Tovar, La Llorona, on roat to Amparo, 1200 m, 8°22' N, 71°45' W, 27 Jul. 1983,

H.van der Werff & R.E. Ortíz 5765 (MO). **Portuguesa:** 15kms al Este de Chabasquén, 67 kms al NNO de Guanare, 1450−1520 m, 9°26'27" N, 69°54'55" W, 29 Oct. 1982, *J.A. Steyermark et al. 126810* (MO). **Tachira:** Uribante. La Idea, below Campamento Siberia (CADAFE), 1300−1400 m, 7°50' N, 71°45' W, 26 Jun. 1990, *L.J. Dorr & L.C. Barnett 7198* (MO). **Yaracuy:** Nirgua: 5 km N of Nirgua by road, 1200 m, 10°12' N, 68°34' W, 21 Oct. 1982, *G. Davidse et al. 20884* (MO).

36. Serpocaulon vacillans (Link) A.R. Sm., Taxon 55(4): 929. 2006. *Polypodium vacillans* Link. Hort. Berol. 2: 97. 1833. *Goniophlebium vacillans* (Link) Fée, Mémoires sur les Familles des Fougères, Gen. Filic. 255. 1850. TYPE: Brazil. Herb. Link, *Anonymous s.n.* (first step lectotype: B, designated by Hensen (1990), **second step lectotype** mounted on 2 sheets: B [bc] 200090562 image! and B [bc] 200090563 image! here designated; isolectotype: B [bc] 20090566 image!). Figures 3c, 4a, 7c-e, 18e, 23b, 95, 96, 97f, 104d, 105a.

Polypodium harpeodes Link, Hort. Berol. 2: 97. 1833. *Marginaria harpeodes* (Link) C. Presl, Tent. Pterid. 188. 1836. *Goniophlebium harpeodes* (Link) J. Sm. Bot. Mag. 72, Comp. 11. 1846. TYPE: Brazil. Herb. Link, *Anonymous s.n.* (first step lectotype, designated by Hensen (1990: 311): B, **second step lectotype**: B [bc] 200090560 image! here designated).

Goniophlebium gramatioides Fée, Cryp. Vasc. Brésil 1: 110, pl 34, 1869. TYPE: Brazil. Rio de Janeiro: 18 Jun. 1867, *A. Glaziou 1222* (first step lectotype: P, designated by Hensen (1990: 311), **second step lectotype**: P [bc] 00632825 image! here designated; isolectotype: P [bc] 00633219 image!).

Polypodium hassleri Christ, Bull. Herb. Boiss. II, 7: 923. 1907. *Polypodium latipes* var. *hassleri* Hassl. TYPE. Paraguay. Santo Tomas, 1885–1895, *E. Hassler 649* (first step lectotype: G, designated by Hensen (1990: 311), **second step lectotype**: G [bc] 00349443 image! here designated; isolectoype: S [bc] S-05-9195 frag. & linedrawings image!).

Plants terrestrial or rare rupicolous, forming big populations (more than 10 individuals). *Rhizomes* 3.2−10 mm diameter, long-creeping, subterranean, yellow, light brown, or green to rarely dull black, no pruinose, slightly rugose; phyllopodia distance 0.7−3 cm. *Rhizome scales* dense, 2−5.2 × 0.9−2.6 mm, lanceolate, ovate-lanceolate, to rarely subulate, patent, basifixed to subpeltate, concolorous to rarely slightly bicolourous, orange at the margin and light brown to dark brown to the center, base rounded, apex acuminate to long acuminate, erose margin. *Fronds* 26–160 cm long. *Petioles* 7.5–60 cm long, subterete, light brown to rare dark brown, base slightly sinuate, and slightly alate distally. *Laminae* 19–100 × 8.5–25 cm, linear-lanceolate, lanceolate to narrowly deltate, pinnatisect, truncate and reflexed proximally, distally gradually reduced to a short-attenuate segment. *Segments* 19–44 pairs, papyraceous to cartaceous, proximal reflexed and surcurrent, medial decurrent and apical attenuate. *Medial segment* 3.6–12.5 × 0.6–1.5 cm, base decurrent and apex acute to rounded, venation forming 12–29 rows along and 1–2(–3) rows of areolae between the costae and the margin, notorious. *Laminar induments* segments scales scarce, mainly in the abaxial base of segments, 1.3–3.5 × 0.1–0.43 mm, acicular, 2–3(–12) cells wide, appressed, base truncate and acuminate apex, concolorous, dark brown. *Hairs* dense or scarce to glabrous, when glabrous with protuberant scarce of the base of the trichome, catenate, hyaline, over the lamina and rachises, 2–3 cells long, patent, villose, brown yellow with dark insertions and over the rachises and veins, scarce, 11–23(–31) cells long, appressed, strigose, dark brown with dark dissections. *Sori* from the medial segments in (4–)8–17(–28) rows along and 1(–2) rows between the costa and the margin, reaching or not the apex. *Spores* 41–48 × 33–38 µm, ellipsoidal to plano-convex to concave-convex, irregular depressed verrucae with thin folded perinae, producing linear creases.

Etymology. From the Latin word *vacillātum*, meaning vacillant.

Distribution and habitat. Serpocaulon vacillans occurs from Bolivia, Brazil, Paraguay and Argentina, mainly in exposed ecosystems, from 0 to 2200(–3090) m, in the Atlantic Rain Forest.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon vacillans most resembles *S. catharinae, S. demissum*, *S. glandulosissimum*, *S. lasiopus*, and *S. latipes* that also possess lanceolate rhizome scales with patent apex, and pinnatisect laminae with dense hairs (except *S. catharinae* and *S. demissum* that are glabrous). However, differs from *S. catharinae* by its non-pruinose long-creeping rhizome that is strictly terrestrial and subterranean (at least 2 cm deep) (vs. pruinose short-creeping rhizomes, that are exposed in the substrate, litter mater, trunk or rarely soil or rocks), sinuate petiole (vs. straight), and laminae dense pubescent (vs. glabrous). From *S. demissum* differs by the subterranean rhizomes (vs. superficially rupicolous rhizomes), deltate to ovate-lanceolate rhizome scales with erose margin (vs. lanceolate rhizome scales with scattered pale marginal prolongations of the margin cells 1−2 mm long, especially at the bases), fertile veinlets conspicuous (vs. inconspicuous), dense laminar pubescence with hairs 2–3 cells long (laminae glabrous or with sparse hairs 3–18 cells long), and spore ornamentation with folded perinae, producing linear creases (vs. lacking folded perine). Differs from *S. glandulosissimum*, by its non-pruinose (vs. pruinose), long-creeping rhizome (short-creeping), rhizome scales orange at the margin and light brown to dark brown to the center (vs. dark brown concolorous rhizome scales), sinuate petiole (vs. straight), and vilose and strigose hairs (vs. glandular). By its pubescence, *S. vacillans* has been confused in Brazil with *S. lasiopus*, which also inhabits the country. However, can be distinguished by its long-creeping rhizome, that is subterranean (vs. short-creeping and exposed), bigger size represented by the petiole (7.5–60 cm vs. 1–23 cm long), as well as, the longitude of the medial segment (3.6–12.5 cm vs. 1.4–7.2 cm) and verrucae with thin folded perinae, producing linear creases (vs. verrucae lacking perinae). Finally, from *S. latipes*, differs by the yellow, light brown, or green to very rarely black rhizome (vs. dark brown to blackish), subterranean (vs. exposed), and lacking dark oxidation when the rhizome is fresh (vs. dark oxidation). Also, the indumentum allows their recognition, due that *S. vacillans* presents dense hairs (vs. scarce and disperse).

Serpocaulon vacillans usually present big populations with more that 10 individuals (a rare characteristic in the genus), the sori are mainly disposed at the apex of the fronds and a sweet smell is often presented in the field that persists in dry collections. Those features also allow it discriminate from any *Serpocaulon*'s species.

Serpocaulon vacillans presents interesting features not commons for the genus: 1) the subterranean growing of the rhizome suggest that the spores are filtered into the substrate by the water and then germinate underground, or the spore germinating over the substrate and then, the rhizome continue its growing at underground direction, 2) the species presents often dense populations in altered or exposed areas, a feature that is rarely recorded (i.e. *S. maritimum*), and 3) in the field, and even in dry material, it is possible to perceive a sweet smell that probably proceeds from the linear nectarium located in the laminar tissue along to the rachises. This observation is effective for many other species (i.e. *S. catharinae*, *S. demissum*, *S. fraxinifolium*, *S. latipes*, *S. rex* and *S. triseriale* (Figure 14) however, apparently just in few of them the smell persists after drying as in *S. triseriale* and *S. vacillans*.

Some specimens suggest hybridization between *Serpocaulon catharinae* with *S. vacillans* (*Salino & Morais 4526,* BHCB). This probably promotes the confusion in Brazil that involves synonyms here treated under *S. catharinae* (i.e. *Polypodium laetum* Raddi). Additionally, it is possible to find hybrids that involve *S. catharinae*, as well as, *S. triseriale* with *S. vacillans*. This was found in the hybrid's zones recorded in the Caparaó National Park (*D. Sanín et al. 6767*, BHCB) and in the Serra do Intendente State Park, Tabuleiro National Park both located in Minas Gerais state of Brazil (*D. Sanín & M.O. Duarte 6801*, BHCB) (see the hybrid chapter).

Taxonomic and nomenclatural notes. Polypodium vacillans Link was described from cultivated plants at the Hortus Regius Botanicus Berolinensis by Link (1833), the author mentioned that the possible (?) origins were Brasilia [Brazil], but any sheet or herbaria was pointed. Hensen (1990) suggested that the holotype was hosted at B. But still, he did not mention any specimen. After revised the digital images, it was verified that at B there are three sheets, all parts of two individuals. Because, Hensen labeled the sheets from B (200090562 and 200090563) as holotype, here it is considered as the first step lectotype. Using the second step lectotype, those sheets are designated as lectotypes (Turland et al*.,* 2018, Art. 8.3).

Polypodium harpeodes Link, was described in the same contribution that was *P. vacilans*, and in fact, it was described before: numbers 23 and 24 respectively (Link, 1836). As was expected, the author did not designate any specimen or herbaria to represent this name.

Hensen (1990) mentioned that the holotype was hosted at B without mention any sheet (first step lectotype). Using the second step lectotypification here is designated the sheet *Anonymous s.n.* from B (200090560) as lectotype (Turland et al., 2018, Art. 8.3). The other sheets named by Hensen (1990) are excluding because as he suggested the 'possible' isotype was gathering at P and K, stressed with (!) the fact that he studied those specimens. This was verified by Hensen's handwriting labels of determination in 1989, where he doubt in designated the isotype for *P. harpeodes* Link '?' from K (001044285). In the same way, the isotype labelled as *P. vacillans* by Hensen at B (20090566). In this respect, the isotype of *P. harpeodes* from K (001044285) designated by Hensen do not presents pubescence and the margins are revolute and smooth, characters of *S. catharinae*, reason why it must be disregarded as type. The aforementioned illustrate that despite Hensen (1990) realize that *P. harpeodes*, as well as, *P. vacillans* = *S. vacillans* were described in the same publication (Link, 1833) neither has priority. Despite that Hensen designated properly the type specimens of *P. vacillans* = *S. vacillans* as he mentioned 'I prefer to use the name *vacillans* because the type of this name is a better representative of the species as here constructed', he was in doubt at recognize *P. vacillans* = *S. vacillans* from *P. catharinae* = *S. catharinae.* Which can be verified by his commentaries: 'it remains doubtful whether is really represents *P. vacillans* or should be referred to *P. catharinae*' (Hensen, 1990).

Goniophlebium gramatioides Fée was published supported on the series *Glaziou 1222*. Hensen (1990) designated the holotype of the mentioned series based at P (first step lectotype). However, due the presence of two sheets from this series, and additionally because the Dutch author misidentified the series of *Glaziou 1222* (P) named as *P. latipes* = *S. latipes* (P-00633219) and *P. vacillans* = *S. vacillans* (P-00632825), here is using the second step to designated the sheet from P (00632825) as lectotype.

Hensen (1990) proposed *S. mexiae* as a synonym of *S. vacillans*. However, the long-creeping rhizome with ovate-lanceolate, concolorous rhizome scales with acute apex, and the thin folded perinae producing linear creases, allow its differentiation from the type specimen of *S. vacillans*. The evidence presented here supports that *S. mexiae* is indeed a synonym, but of *S. lasiopus*.

Local name. In Brazil, Amambai in Mato Grosso do Sul (*J.O.O. Carauta et al. 3080,* RB) and Samambaia-do-brejo in São Paulo (*W. Hoehne 626,* CESJ).

Representative specimens. ARGENTINA. **Corrientes:** Ituzaingó, Isla Apipé Grande, Panco-Cué, 6 Oct. 1978, *A. Schinini & R. Vanni 15833* (LP). **Jujuy:** Termas de Reyes, cerros, 2200 m, 17 Feb. 1940, *A. Burkart & N.S. Troncoso 11170* (SI). **Misiones:** Candelaria, Loreto, 40–60 m, 16 Nov. 1951, *J.E. Montes 11251* (LP); San Ignacio, Peñón del Teyú-Cuaré, 150 m, 27º16' S, 55º35' W, 20 Sep. 2000, *M. Múlgura de Romero et al. 2153* (SI); San Ignacio, P.P. Teyú Cuaré, 28 Apr 2007, *G. Márquez et al. 225* (LP); San Ignacio, Camino hacia el paraje El Payal, 128 m, 27º16'37" S, 55º33'44" W, 15 Dec. 2008, *S.S. Denham & N.D. Deginani 220* (SI); San Ignacio, Parque Provincial Teyú Cuaré, 3 Jun. 2006, *M.A. Link-Perez 209* (CESJ); San Ignacio, Parque Provincial Teyú Cuaré, 200 m, 37º16' S, 55º33' W, 21 Apr. 1996, *F.O. Zuloaga et al. 5709* (NY).

BOLIVIA. **La Paz:** Bautista Saavedra, Charazani-Tal, oberhalb der Brücke des Wages von Charazani nach Khata, 3090 m, 25 May 1980, *T. Feuerer 4251a* (F); Franz Tamayo, Parque Nacional Madidi, Virgen del Rosario, 890 m, 14º36' S, 68º41'20" W, 8 Nov 2003, *A. Fuentes 5811* (LPB); Nor Yungas, Yolosilla, 1050 m, 16º11' S, 67º44' W, 21 May 1995, *M. Kessler et al. 4260* (LPB). **Nord Yungas:** trail Coroico to río Yolasa, 1650 m, 5 Dec. 1935, *Y. Mexia 7797* (F, USM, NY); Polo-Polo, Coroico, 1100 m, Oct-Nov. 1912, *O. Buchtien s.n.* (F, NY). **Santa Cruz**: Chiquitos, Serrania de Santiago de Chiquitos, E of pass on road to Sunsas, 800 m, 18º19' S, 59º34' W, 25 Jan. 2001, *J.R.I. Wood & D.J. Goyder 16973* (LPB). **Sud Yungas:** Yanacachi, senda entre Yanacachi (2010 m) y la carretera pr. La Florida, 1620 m, 21 Sep. 1996, *I.F. Muñoz Garmendia & J.P. Pivel Rainieri 3130* (NY).

BRAZIL. **Espírito Santo:** Guarapari, Sep. 1980, *L. Krieger 2674* (CESJ). **Mato Grosso do Sul:** Amambai, Serra de Amambai, estrada para Sapucaia, 28 Jan. 1979, *J.O.O. Carauta et al. 3080* (RB); Corumbá, Local MCR (Mineração Corumbaense Reunidas), Rio Tinto, Mina da Escarpa, Maciço do Urucum, 140 m, 19º11'35" S, 75º34'14" W, 15 Feb. 2005, *V.J. Pott et al. 7436* (BHCB); Glória de Dourados, Fazenda Nossa Sr. Aparecida, 15 May 2001, *D.S.L. Silva et al. 6* (SP); Ponta Porã, Fazenda Gurupi, 13 Jan. 2000, *I.A. Carneiro 3* (SP); Ponta Porã, Campanário, Cia Mate Laranjeira, 6 Feb. 1952, *E. Kuhlmann s.n.* (SP). **Minas Gerais:** Andradas, Serra de Poços, na estrada de Poços de Caldas-Andradas, 1320 m,

22º1’17” S, 46º33’50” W, 16 Jul. 2007, *A. Salino et al. 12683* (BHCB); Baependi, Toca dos Urubus, 29 Dec. 2004, *F.N. Ferreira 811* (BHCB); Baependi, Parque Estadual da Serra do Papagaio, Estrada de acesso à sede (Fazenda Santa Rita), 1720 m, 22º9’52” S, 44º43’56” W, 23 Mar. 2015, *V.A.O. Dittrich & L.V. Lima 2036* (CESJ); Belo Horizonte, Serra da Piedade, near BR 31, 1850 m, 15 Jan. 1971, *H.S. Irwin et al. 30422* (F, NY); Brazópolis, Área do Laboratório Nacional de Astrofísica, Pico dos Dias, margens da estrada que leva até o Pico, 1668 m, 22º31’53” S, 45º34’23” W, 24 Mar. 2009, *L.L. Giacomin et al. 808* (BHCB); Brumadinho, Inhotim, Transição de Cerrado com Mata, 870 m, 20º8’21” S, 44º14’13” W, 22 Jan. 2008, *J.G. Oliveira & F.M. Rodrigues 134* (BHCB, CESJ); Caeté, Serra da Piedade, 28 Apr. 1985, *J.C. Gadinho Guimarães 1779* (F); Caldas, Pocinhos do Rio Verde, Serra da Pedra Branca, 6 Dec. 2008, *M.G. Rezende & R.C.L. Elias 260* (CESJ); Camanducaia, estrada do entorno da mata dos Mota, trevo de acesso à Camanducaia, 1180 m, 22º44’53” S, 46º9’16” W, 20 Aug. 2001, *L.C.N. Melo et al. 163* (CESJ); Catas Altas, Cadeia do Espinhaço, Serra do Caraça, R.P.P.N. Caraça, Banho do Imperador, 1300 m, 29 May 2008, *P.B. Schwartsburd et al. 1678* (SP); Conceiçao de Mato Dentro, 19º30’11” S, 43º23’4” W, 11 Dec. 2012, *C.V. Vidal & R.L. de Paula 1081* (RB); Congonhas do Norte-Santana do Riacho, Serra da Carapina (Serra Talhada segundo folha do IBGE), 1200 m, 18º52’ S, 43º14’ W, 3 Mar. 1998, *R.C. Forzza et al. 733* (SP); Diamantina, Rio Jequití, ca 25 km E of Diamantina, 790 m, 21 Mar. 1970, *H.S. Irwin et al. 28005* (F); Diamantina, Escola a margem da Rocha “Chapada”, 1185 m, 18°14’28” S, 43° 35’ 23” W, 11 Mar. 2018, *D. Sanín et al. 7071* (BHCB); Igarapé, próximo a Serra do Itatiaiuçu, 20 Dec. 1999, *A. Salino 500* (BHCB); Itabirito, Mata da Encosta, 9 Sep. 2003, *F.A. Carvalho et al. 139* (BHCB); Itutinga, a 3 km da cidade na rodovia Lavras-São João del Rei, 15 Dec. 1982, *J.R. Pivari et al. 295* (SP); Lambari, Parque Estadual de Nova Baden, trilha das Sete Quedas, 890–1000 m, 21º56’15” S, 45º19’23” W, 13 Jul. 2007, *A. Salino et al. 12556* (BHCB); Lima Duarte, Parque Estadual Ibitipoca, Gruta é Pico do Pião, 1664 m, 21º42’20” S, 43º52’15” W, 21 Jun. 2007, *T.E. Almeida et al. 1155* (BHCB); Mariana, Mina de Fábrica Nova, ampliação da Mina de Fábrica Nova, 20º11’59” S, 43º26’9” W, 28 Jun. 2011, *R. Mota s.n.* (BHCB); Moeda, Marinho da Serra/C1, 1544 m, 20º20’54” S, 43º56’17”, 2 Feb. 2010, *F.F. Carmo 4231* (BHCB); Nova Lima, R.P.P.N. Mata do Jambreiro, 19º58’15” S, 43º53’15” W, 13 Apr. 2004, *J.B. Figueiredo 372* (BHCB); Nova Lima, Mina Capitão do Mato, 1376 m, 20º6’38” S, 43º54’7” W, 26 Feb. 2013, *E. Miranda et al. 748*

(BHCB); Ouro Preto, Serra de Capanema/C2, 1807 m, 20º13'7" S, 43º34'52" W, 28 Feb. 2008, *F.F. Carmo et al. 2498* (BHCB); Ouro Preto, P.E. do Itacolomi, 1340 m, 20º25'47" S, 43º27'15" W, *L.B. Rolim 221* (BHCB); Ouro Preto, saindo da estrada principal para Belo Horizonte, 1242 m, 22º25'52" S, 44º36'5" W, 24 Jun 2017, *D. Sanín et al. 6852* (BHCB); Paraisópolis, 16 Apr. 1927, *F.C. Hoene s.n.* (SP); Passa Vinte, estrada que liga a sede do município à MG-457, 836 m, 22º11'8" S, 44º14'21" W, 14 Feb. 2009, *T.E. Almeida & D.T. Souza 1789* (BHCB with a rhizome not belonging to *Serpocaulon*); Rio Preto, Fazenda da Tiririca, entre Rio Preto e Olaria, 21º58'83" S, 43º56'8" W, 23 Feb. 2004, *F.R. Salimena et al. 1216* (CESJ); Santa Bárbara, RPPN Capivari, Porcão, oeste da RPPN, entrada na divisa da Fazenda do Zé Maria, 850 m, 20º7'21" S, 43º36'30" W, 1 Apr. 2009, *A.J. Arruda et al. 92* (BHCB); Santa Rita do Jacutinga, estrada que liga a MG–457 ao município de Passa Vinte, 852 m, 22º6'26" S, 44º10'5" W, 13 Feb. 2009, *T.E. Almeida & D.T. Souza 1761* (BHCB); Santo Antônio do Itambé, P.E. do Pico do Itambé, Cachoeira do Neném e trilha entre a cachoeira e Capivari, 1089 m, 18º25'27" S, 43º18'56" W, 4 Oct. 2006, *T.E. Almeida et al. 516* (BHCB); Santos Dumont, Serra da Mantiqueira, Sep. 1979, *L. Krieger 2676* (CESJ); São Gonçalo de Rio Abaixo, Estação de Pesquisa Ambiental de PETI, 19º53'33" S, 43º21'55" W, 20 Jun. 2002, *A. Salino 8032* (BHCB); São João da Chapada, road to Campo do Sampaio, 1150 m, 29 Mar. 1970, *H.S. Irwin et al. 28576* (F, SP); São Sebastião do Paraíso, Faz. Cachoeira, 17 Apr. 1945, *A.C. Brade et al. 17967* (RB); São Tomé das Letras, encosta leste da Serra do São Tomé, 20 Jun. 1962, *J. Mattos & H. Bicalho 10358* (SP); Tiradentes, Serra de São José, 1125 m, 21º5'7" S, 44º9'55" W, 4 Mar. 2018, *D. Sanín 7130* (BHCB); Tiradentes, Serra de São José, 1002 m, 21º6'35" S, 44º11'56" W, 29 Jun. 2007, *T.E. Almeida et al. 1106* (BHCB); Três Pontas-Campos Gerais, 27 Feb. 1970, *P.G. Windisch 68* (SP). **Paraná**: Antonina, Reserva Natural Rio Cachoeira (SPVS), trilha do Taquaral, 30 m, 25º18' S, 48º41' W, 11 Jul. 2006, *F.B. Matos et al. 1219* (SP); Balsa Nova, São Luiz do Purunã, 16 Feb. 2013, *C. Michelon & M. Selusniaki 1669* (BHCB); Guarapuava, Estrada Municipal Benedito de Paula Louro, próximo da Cachoeira São Francisco, N-NE, 1080 m, 25º3' S, 51º12' W, 15 Oct. 2011, *J. Prado & R.Y. Hirai 2191* (SP); Jacare´, 5 Apr. 1914, *P. Dusén 14703* (F); Jaguariaíva, Alto do Canyon, ca 5 km da Sede da Prefeitura de Jaquariaíva (antiga Estação de Trem), 925 m, 3 Jan. 2008, *J. Prado et al. 1786* (SP); Jaguariaíva, km 168, 27 Mar. 1974, *R. Kummrow 444* (LP); Jaguariaíva, Fazenda Barros, 9 Feb. 1997, *O.S. Ribas &*

L.B.S. Pereira 1664 (SI); Lindoeste, Borda do Parque Nacional de Iguaçu, Margem do rio Goncalves, Dias, 12 Feb. 2013, *M Laurert & V.G. Krepschi 152* (BHCB); Palmeira, Rio Tibagi, 3 Feb. 1999, *J.M. Cruz et al. 89* (BHCB); Ponta Grossa, Parque Estadual de Vila Velha, 1000 m, 25º14' S, 50º50' W, 1 Jun. 2004, *P.B. Schwartsburd & F.B. Matos 212* (RB). **Rio de Janeiro:** Guanabara, Restinga de Jacarepaguá, Pedra de Itaúna, 13 Mar. 1975, *D. Araújo & A.L. Peixoto 656* (RB); Itatiaia, P.N. de Itatiaia, trilha conhecida como dos três picos, depois do hotel Simon, m, 1242 m, 22º25'52" S, 44º36'5" W, 25 May 2017, *D. Sanín et al. 6853* (BHCB); Serra de Itatiaia, Mont Serrat, 30 Jun. 1930, *A.C. Brade 10280* (R); Macaé, restinga aberta com ilhas de gravatás, entre Macaé e Rio das Ostras, 15 May 1993, *R. Melo-Silva & J.R. Pirani 867* (NY, SP); Rio de Janeiro, Recreio dos Bandeirantes, 0 m, 15 Mar 1931, *B. Lutz 538* (F). **Rio Grande do Sul:** Rio Pardo, Estação João Rodrigues, 70 m, 21 Dec. 1906, *I.C. Jürgens 376* (SI); 1940–1941, *J. Éugenio 1884* (F). **Santa Catarina:** Dionísio Cerqueira, Pinheiral, 2 km W of Rio Capetinga on the road to Dionísio Cerqueira, 900–1000 m, 29 Dec. 1956, *L.B. Smith et al. 9612* (SI); Imbituba, 18 Oct. 1979, *A. Tosta Silva 156* (SP); São Francisco do Sul, Ilha dos Barcos, 29 Sep. 2008, *J. Meirelles 231* (SP). **São Paulo**: Analândia, Serra do Cuscuzeiro, 22º8'S, 47º40' W, 26 Oct. 1986, *A. Salino 24* (BHCB); Analândia, Morro do Camelo, 650 m, 22º6' S, 47º41' W, 8 May 2011, *J. Prado & R.Y. Hirai 2163* (SP); Analândia, Fazenda Pedra Vermelha, 760–770 m, 22º7'50" S, 46º40'53" W, 29 May 2012, *N.L. Souza & L. Birai 239* (BHCB); Anhembi, Fazenda Santa Rita (Agropave), 22º43'52" S, 48º1'13.8" W, 23 Mar. 1994, *K.D. Barreto et al 2218* (CESJ, RB); Bauru, Jardim Botânico Municipal de Bauru, mata de brejo junto ao Córrego Vargam Limpa (Paliteiro), 303 m, 22º20'29" S, 49º00'90" W, 30 Mar. 2006, *J. Prado et al. 1632* (SP); Bofete e Guareí, Fazenda Cachoeira, 25 Jan. 1945, *M. Kuhlmann 3465* (SP); Cabreúva, Jacaré, 23º13'41" S, 47º2'23.7" W, 15 Mar. 1994, *K.D. Barreto et al. 2152* (CESJ); Campinas, Faz. Campo Grande, 4 Dec. 1938, *O. Zagatto & A. Vetorato s.n.* (RB); Campos do Jordão, Parque Estadual de Campos do Jordão, 1300–1400 m, 22º42' S, 45º28' W, 28 Nov. 2001, *V.A. de O. Dittrich & A. Mantovani 1078* (BHCB); Cascata, 29 Nov. 1938, *J. Kiehl s.n.* (RB); Cantareira, Mar. 1905, *A. Usteri s.n.* (SP); Corumbataí, 6 Oct. 1976, *A. Tosta Silva 3* (SP); Guarulhos, Bairro das Pimentas, sítio Kida, km 268 da Dutra, 1 Mar. 1981, *O. Yano 3197* (SP); Itapetininga, Fazenda Santa Luzia do Campo Largo, 21 Sep. 1999, *M.P. de U. Jolkerky s.n.* (SP); Itirapina, Fazenda Santa Décima, Rodovia Washington Luiz (Lado

direito, sentido São Carlos), 4 Jan. 1995, *K.D. Barreto et al. 3443* (BHCB); Jundiaí, Reserva Biológica municipal da Serra do Japi, trilha base/Biquinha/Rocinha/Base, 1000 m, 23º13' S, 46º56' W, *J.A. Lombardi et al. 6659* (BHCB); Jundiaí, Serra do Japi, 1233 m, 23º15' S, 46º58' W, 16 Oct. 2009, *R.Y. Hirai et al. 633* (SP); Moji-Guaçu, Campos das Sete Lagòas, Fazenda Campininha, just north of Rio Moji-Guaçu, 6.6 km NW of Padua Sales, about 27 km NW of city of Moji-Mirim, 576–625 m, 22º11–18' S, 47º7–10' W, 10 Jul. 1961, *G. Eiten & L.T. Eiten 3244* (F, SP); Pirassununga, Emas, 1950, *A.B. Joly 1207* (RB); Pirassununga, Morro da Senzala, 750 m, 31 Dec. 1987, *A. Salino 264* (BHCB); Pirassununga, cerrado de Emas, 22º2' S, 47º30' W, 13 Apr. 1994, *M. Batalha & W. Mantovani 41* (SP); Piraju, Monte Alegre, sítio Alves, Rodovia Raposo Tavares, km 305, vegetação que circunda o Sítio Arqueológico, 23 Aug. 1969, *G. Felippe 216* (SP); Porto Ferreira, P.E. Do Porto Ferreira, trilha da Pesquisa, 520–660 m, 21º49' S, 47º25' W, 8 Apr. 2010, *J.A. Lombardi 7770* (BHCB); Rezende, 27 Apr. 1926, *F.C. Hoehne & A. Gehrt s.n.* (SP); Santo Amaro, 1 Apr. 1941, *W. Hoehne 626* (CESJ); São Bento do Sapucaí, topo do morro "Pedra do Bauzinho", 1831 m, 22º41'9" S, 45º39'25" W, 24 Jan. 2010, *P.B. Schwartsburd et al. 2303* (SP); São Carlos, rodovia Washington Luiz, km 222, entrada para Analândia, 28 Mar. 1962, *M. Labouriau 25* (RB); São José dos Campos, parte superior da encosta leste do vale do Córrego da Ressaca, 6–6 ½ km ao SW (ao longo da Rodoviar Pres. Dutra), da saída para São José dos Campos, 100–500 m ao lado SE da Rodovia, 600 m, 21 Mar. 1962, *I. Mimura 324* (SP 2 sheets); São Paulo, Parque Municipal Ecológico de Campo-Cerrado Dr. Alfred Usteri, 19 Dec. 2011, *F.G. Pereira 400* (SP); São Paulo, Cantareira, Mar. 1905, *A. Usteri s.n.* (SP); São Paulo, Ypiranga (Horto Bot.), May 1910, *H. Luederwaldt s.n.* (SP); São Pedro do Turvo, Fazenda São Sebastião, 31 Jun. 1962, *I.M. Válio 276* (SP); Serra do Cruzeiro, Analandia, 22º8' S, 47º40' W, 26 Oct. 1986, *A. Salino 24* (BHCB); Silveiras, Estrada do Parque Nacional da Serra da Bocaina para Campos Novos, 1200 m, 7 Jan. 2008, *P.H. Labiak et al. 4338* (SP); Vicentinópolis, Fazenda Canadá, Fragmento P–01, 380 m, 20º56'S, 50º20' W, 28 Nov. 2007, *J. Prado et al. 1732* (RB; SP); Ypiranga (Horto Bot.), May 1910, *H. Luederwaldt s.n.* (SP).

PARAGUAY. **Caaguazú:** 22 km S de Caaguazú, Est. Itá Carú, 29 Dec 1972, *A. Schinini 5830* (LP). **Cordillera Central-Paraguarí:** May 1916, *Rojas 1708* (LP); 1888–1890, *T. Morong 828* (F, NY); orillas montes entre piedras, 0.6–0.8 m, May 1916, *Rojas 1708* (LP); desvio de la Ruta 2 para el Ramal Piribebuy-Paraguari, ca 3 km sobre la ruta, 21 Jul. 1995,

M.R. Pietrobom-Silva et al. 2111 (SP); Tobati, 30 Dec. 1950, *B. Sparre & F.B. Vervoorst 1383* (LP); Valenzuela, Meoyacá Guazú Ty, 26 Mar. 1950, *G.J. Schwarz 11330* (LP). **Corrientes:** Ituzaingó, Isla Apipé Grande, Panco-cué, 6 Oct. 1978, *A. Schinini & R. Vanni 15833* (LP). **Cunendiyu:** 3 km N of Itambú, 24º40' S, 54º30' W, 16 Feb. 1984, *W. Hann 2124* (NY); **Guairá**: Independencia**:** 1967*, A. Schinini 18DA* (LP). **Pirayú**: 11 Jul. 1874, *B. Balasa 387a* (BR); San Pedro, Alto Paraguay, Primavera, 26 Dec. 1960, *A.L. Woolston 1230* (NY).

37. Serpocaulon wagneri (Mett.) A.R. Sm., Taxon 55(4): 929. 2006. *Polypodium wagneri* Mett., Ann. Sci. Nat., Bot., sér. 2, (5)2: 255. 1864. TYPE: Panama. Chiriquí, *H. Wagner s.n.* (first step lectotype: B, designated by Hensen (1990), **second step lectotype**: B [bc] 20 0087731 image! here designated). Colombia. Ocaña, *L. Schlim 636* (syntypes: B [bc] 20 0087732 image!, BR [bc] 0000006970819!, P [bc] 00632877 image!, RB [bc] 216389/00700399!). Figures 18f, i, 23e, 98, 99,101a.

Goniophlebium pectinatum J. Sm., Bot. Voy. Herald. 230. 1854. TYPE: Panama. Pcia. Panama: new city of Panama, *Seemann 14* (lectotype designed by Hensen (1990: 312), not seen). Invalid homonym of *Goniophlebium pectinatum* (L.) J. Sm. = *Pecluma pectinata* (L.) M.G. Price.

Polypodium costaricense Christ., Bull. Herb. Boissier 4(10): 660. 1896. TYPE: Costa Rica. Plaine de Surubres au S. de Puntarenas, côte du Pacifique, 18 Jul. 1890, *P. Biolley ex Pittier 2677* (first step lectotype: BR, designed by Hensen (1990: 312), **second step lectotype**: BR [bc] 0000006970406! here designated); isolectotype BR [bc] 0000006980511!, NY [bc] 00144837 frag. image!, US [bc] 00065816 image!).

Polypodium kuhlmanni A. Samp. Relat. Commiss. Linhas Telegr. Estratég. Mato Grosso Amazonas 5, Bot. pt. 7: 27, pl. 5. 1916. TYPE: Brazil. Mato Grosso: Salto Augusto, flum. Tapajóz, Jan. 1915, *J.G. Kuhlmann 1* (lectotype designated by Sanín & Salino (2018): R [bc] 000213407!).

Serpocaulon panorense (C. Chr.) A.R. Sm., Taxon 55(4): 928. 2006. *Polypodium panorense* C. Chr. Dansk Bot. Ark. 6(3): 97. 1928. TYPE: Brazil. Amazonas: Rio Waupés, Panoré,

R. Spruce 2324 (lectotype designated by Hensen (1990: 306): B [bc] 200087731 image!; isolectotype: RB [bc] 471672/0053651!).

Plants epiphytic. *Rhizomes* 3.4–6.4 mm diameter, long-creeping, dark brown to reddish, scarce pruinose; phyllopodia distance 3.6–6.5 cm. *Rhizome scales* dense, 1.3–4.3 × 0.6–1.2 mm, subulate, subappresed, peltate, bicolorous, light brown to the margin and dark reddish to the center, base rounded, apex caudate to acuminate, patent, erose margin. *Fronds* 29–66 cm long. *Petioles* 3.8–5.5 cm long, proximally subterete, distally slightly winged, mainly in the conection with the lamina, light brown to dull. *Laminae* 26–61 × 4.8–9 cm, linear; pinnatisect, truncate to slightly reduced proximally, distally gradually tapering in a short-attenuate segment. *Segments* 35–75 pairs, membranaceous to papyraceous, proximal reflexed and surcurrent, medial and distally decurrent, terminal segment slightly attenuate. *Medial segments* 2.5–4.5 × 0.4–0.7 cm, base decurrent and apex acute to rounded, venation forming 15–16 rows along and 1 rows of areolae between the costae and the margin, inconspicuous covered by hairs. *Laminar induments* segment scales absent. *Hairs* dense, 2–4 cells long, catenate, subterete, with flat aspect, patent, hyaline with dark brown dissections. *Sori* from the medial segments in 14–15 rows along and 1 row between the costa and the margin. *Spores* 49–62 × 27–35 µm, ellipsoidal, subellipsoidal to globular, plane-convex, and folded perine.

Etymology. The name honoured the German botanist H. Wagner, collector of the type.

Distribution and habitat. Serpocaulon wagneri occurs from Costa Rica to Bolivia, and Brazil and Guiana, mainly in the Chocó and Amazon regions, from 10 to 2550 m, in lowlands of humid forest.

Phenology. It was recorded fertile all months of the year.

Notes. Serpocaulon wagneri most resembles *S. dasypleuron* and *S. patentissimum*, which also have linear to linear-lanceolate laminae that resemble a pectinate appearance with more than 30 pairs of segments, and the presence of dense to rarely scare pubescence. However, it differs from those species by its short-creeping rhizome (vs. long-creeping), and rhizome

scales subulate with apices caudate to acuminate (vs. triangular to rounded). Furthermore, *S. wagneri* exhibits spores with thin perine (Ramírez-Valencia et al., 2013; Ramírez-Valencia & Sanín, 2016; Sanín & Salino, 2018) (vs. lacking perine).

Often specimens present a dark green lamina when dry. Despite that a trustable feature to recognize the species is its pubescence, in the Amazon basin there are specimens glabrous or nearly so, with hairs only on the rachises (*M.A.S. Costa & P.A.C.L. Assunçâo 546,* INPA, SP!). This situation probably promoted the description of the synonym *Polypodium panorense* C. Chr., as is suggested in Christensen's (1928) discussion.

Taxonomic and nomenclatural notes. Polypodium wagneri Mett. was described based on two series named: *L. Schlim 636* from Colombia and *H. Wagner s.n.* from Panama (Mettenius, 1864). However, the author did not designate the collection. For this reason, Hensen (1990), designate *Wagner s.n.* from B, following comments of Christensen (1928), here it is considered as the first step lectotype because it is possible to find more types of this species at B. Using the second step is designating the sheet *H. Wagner s.n.* from B [bc] 20 0087731 as lectotype.

Polypodium costaricense Christ was described based on collections made in Costa Rica by *P. Biolley ex Pittier 2677* (Bommer & Christ, 1896). Hensen (1990) designated as isotype a sheet from BR (first step lectotype). However, in BR are hosted two sheets from this series, reason why using the second step lectotype, here is designated as lectotype the sheet BR [bc] 0000006970406.

Prado (2005) cited the specimen *M.A.S. Costa & P.A.C.L. Assunção546* (INPA, SP!) for the flora of Ducke reserve in Brazil as *P. panorense*, here recognized as synonym of *S. wagneri.* In this sense, it is confirmed the record of this species for the country.

Indigenous name. The Chacobo from Bolivia called as *Xëqui Jahëhua* (*B.M. Boom 4380*, LPB, NY), or *Mitaisa* (*B.M. Boom 5050*, LPB, NY).

Representative specimens. BOLIVIA. **Beni:** Vaca Díez, vicinity of the Chácobo village Alto Ivon, 200 m, 11º45' S, 66º2' W, 7 Feb. 1984, *B.M. Boom 4380* (LPB, NY); Vaca Díez,

vicinity of the Chácobo village Alto Ivon, 200 m, 11º45’ S, 66º2’ W, 18 Apr. 1984, *B.M. Boom 5050* (LPB, NY).

BRAZIL. **Amazonas:** Manaus-Itacoatiara, Km 26, Reserva Florestal Duke, Acará, Floresta de Campinarana, 2º53’ S, 59º58’ W, 24 May 1996, *M.A.S. Costa & P.A.C.L. Assunção 546* (INPA, SP!); Basin of rio Purus, rio Cunhuá at Deni Indian village, 6º43’ S, 66º47’ W, *G.T. Prance 16421* (NY). **Rondônia:** Guajará-Mirim-Abuna, 6º linha do Yata, km 25, 26 Jan. 1983, *L. Carreira et al. 265* (MG); Margem esquerdo do rio Pacaás Novos, entre 1ª e 2ª cachoeira, 22 Mar. 1978, *J. Ubiratan et al. 240* (F). **Mato Grosso:** Alta Floresta, R.P.P.N. Cristalino, local conhecido como Inferno, margem direita do rio Cristalino na direção do rio Teles Pires, 248–274 m, 9º38’11” S, 54º57’ W, 9 Dec. 2014, *J. Lombardi 10563* (BHCB); Colíder, Fazenda Geo-Acu, 15 Feb. 1988, *A. Salino 313* (BHCB); Itaúba, área de inundação da Usina Hidrolétrica Colíder, rio Teles Pires, desde o ancoradouro até corredeiras, 225–254 m, 10º59’35” S, 55º31’50” W, *J. Lombardi 10525* (BHCB); Juína: beira do rio Perdido, 20 Apr. 1985, *J.A.F. da Costa 710* (R); Salto Augusto, flum. Tapajóz, Jan. 1915, *J.G. Kuhlmann 2* (R).

COLOMBIA. **Antioquia:** Cáceres, corregimiento de Manizales, 6 Jun. 1978, *J. Mercado 21* (HUA); Mutatá, vereda Cauchera, 66 m, 6 Jun. 1987, *R. Giraldo et al. 112* (HUA); Mutatá, Finca El Darién, 200 m, 18 May 1976, *L. Athehortúa & H.J. Hoyos 199* (HUA). **Chocó:** Upper río Tigre near base of Serranía del Darién, E of Unguía, 250–300 m, 8°7’12” N, 77°8’1” W, 18 Jul. 1976, *A.H. Gentry 16759* (MO). **Cundinamarca**: Ubalá, vereda San Roque, camino a Campo Hermoso, 1150 m, 30 Jun. 1998, *J.L. Fernández-Alonso 16217* (COL); Ubalá, inspección de policía Mambita, campamento Emgesa, 880 m, 4º46’ N, 73º 19’ W, 26 Jun. 1998, *J.L. Fernández-Alonso 15960* (COL). **Meta:** Mesetas, Inspección de Policía “La Uribe”, Vereda “La Lagartija”, 500 m, 7°7’4” N, 74°16’6” W, 13 Aug. 1989, *J. Betancur 1388* (MO); P.N.N. Tinigua, río Duda, Serranía Chamusa, centro de Investigaciones Ecológicas La Macarena, trocha H 150 m, 350 m, Jul. 1996, *P. Stevenson 1860* (FMB). **Norte de Santander:** Ocaña, San Pedro, May 1846–52, *L. Schlim 636* (BR).

COSTA RICA. **Arejuela:** San Ramón, bosque demostrativo de la Universidad de Costa Rica, sede occidente, 1070 m, 10º5’25” N, 84º29’10” W, 11 Aug. 1999, *P. Pérez & P. Arguedas s.n.* (INB). **Cartago:** Turrialba, Cordillera de Talamanca, Tayutic, Jicotea, 1100–1600 m, 9°46’48” N, 83°32’24” W, 22 Jun. 1995, *A. Rojas 2022* (MO). **Coclé:** La

Mesa-El Valle de Antón, 8 Jul. 1973, *M. Troetsch 26* (F). **Guanacaste:** La Cruz, Western part of Cerros Santa Elena, along main ridge just W of second-highest peak (at head of Quebrada Los Chanchos), Península de Santa Elena, 600–620 m, 10°53'30" N, 85°52'00" W, 31 Aug. 2003, *M. Grayum 11925* (MO). **Limón:** Limón, R.I. Chirripó, Fila de Matama, Admirante, 1060–1330 m, 9°46'12" N, 83°19'48" W, 10 Aug. 1995, *A. Rojas 2188* (MO). **Puntarenas:** Osa, Vicinity of Boscosa at Quebrada Aguabuena, 8°42'1" N, 83°30'48" W, 11 Sep. 1996, *T.B. Croat 79295a* (MO); Cantón de Golfito, Península de Osa, Puerto R.B. Monteverde, Cordillera de Tilarán, Finca Buen Amigo, 1100–1200 m, 10º16'41" N, 84º47'43" W, 22 Apr. 1995, *A. Azofeifa 133* (INB); Brujo, along río Platanares, 73 km from San Isidro, 260 m, 9º6' N, 83º17' W, 19 Nov. 1086, *E. Hennipman 7033* (F, L); Cantón de Golfito, Península de Osa, Puerto Jiménez, río Nuevo, 0 m, 8º32'19" N, 83º18'21" W, 9 Sep. 1997, *A. Azofeifa 408* (INB); Reserva biológica Carara, Sector Quebrada Bonita, Sitio Quebrada Bonita, 50 m, 9º46'50" N, 84º35'40" W, 30 Oct. 1990, *R. Zuñiga 313* (INB); along Inter American Higway, crossing with Río General, 400 m, 9º10' N, 83º15' W, 22 Nov. 1986, *E. Hennipman et al. 7115* (U). **San José:** Cantón de Pérez Zeledón, Cordillera de Talamanca, San Isidro de El General, 700 m, 9º17'50" N, 83º38'55" W, 1 Sep. 1993, *R. Aguilar 2086* (INB); Puriscal, Zona Protectora La Cangreja, along río Negro, east of Santa Rosa de Puriscal, 315 m, 9°42'00" N, 84°23'30" W, 21 Jul. 1988, *M. Grayum 8611* (MO).

ECUADOR. **Chimborazo**: Sibambe, Canyon of río Sibambe, affl. of río Chanchan, Cordillera Occidental, 2460–2550 m, 28 Jan. 1945, *F.R. Fosberg & M.A. Giler 22580* (LP).

GUAYANA. **Cuyuni-Mazaruni:** Pakaraima Mts; 8.6 km NE of Imbaimadai, 900–925 m 5º46' N, 60º15' W, 27 May 1992, *B. Hoffman et al. 1921* (U). **Mazaruni:** Mount Latipu, ca. 8 km N of Kamarang, 600 m, 5º57' N, 60º38' W, 24 Feb. 1985, *J. Renz 14305* (U).

PANAMA. **Canal Area:** Edge of lake near Madden Dam, 50 m, 9°12'32" N, 79°37'00" W, 18 Sep. 1974, *S. Mori 1995* (MO); Barro Colorado Island, 19 Oct. 1931, *O. Shattuck 284* (F). **Chiriquí:** Along road between Concepción and El Hato del Volcán, 16 km above Concepción, 800 m, 8°39' N, 82°38' W, 6 Aug. 1974, *T.B. Croat 26249* (MO). **Coclé:** El Valle, 100–800 m, 8°36' N 80°8' W, 5 Sep. 1938, *Allen 740* (MO); El Valle de Antón, 500–700 m, 23–27 Jul. 1935, *R.J. Seibert 413* (F). **Colón:** Cerro Jefe, Parque Nacional Chagres, 1010 m, 4 Jul. 2012, *A. Salino 15333* (BHCB). **Darién:** Parque Nacional del Darién, along S branch of río Pucuro, forest and ridge S of river and up river from old village of

Tacarcuna, ca. 18 km E of Pucuro, 600–800 m, 8°5' N, 77°16' W, 25 Oct. 1987, *B. Hammel 16515* (MO); trail between Cana and Boca de Cupe, Cana, río San Jose below former goldmine headquarters, 22 Jun. 1959, *D. Burch et al. 1967/642* (F). **Herrera:** Las Minas, 18 km W of Las Minas, N slope of Alto Higo, 731–914 m, 7°43'48" N, 80°52'25" W–7°43'24" N, 80°51'47" W, 8 Aug. 1978, *B. Hammel 4358* (MO); Near summit of Cerro Jefe, 900–1000 m, 9°14'2" N, 79°22'30" W, 21 Jul. 1972, *A.H. Gentry 5533* (MO); Lago Maden, 24 Sep. 1960, *D. Sucre 92* (RB); Lago Maden, 24 Sep. 1960, *D. Sucre 95* (RB). **Panama:** 11 miles up road from Panama Highway to Cerro Jefe, 14 Jul. 1970, *P. Armond 448* (F). **Salamanca:** Hydrographic Station, río Pequení, 80 m, 28–29 Jul. 1938, *R.E. Woodson et al. 1598* (L). **Santos:** Tonsí, dry forest área near town of Guanaquito, 17 Jul. 1970, *P. Armond 469* (F). **Veraguas:** Along río Grande, Arenas del Quebro, Península de Azuero, 10 m, 7°22' N, 80°52' W, 21 Jul. 1990, *M. Grayum & R. Evans 9917* (F, MO).

VENEZUELA. **Amazonas:** Río Negro, 2 km E and SE of San Carlos de Río Negro, 120 m, 1°51' N, 67°3' W, 12 Nov. 1987, *R.L. Liesner & G. Carnevali 23019* (MO). **Barinas:** Between la Esmeralda and El Curito, 4 km southwest of río Capitanejo, 175 m, 25–26 Aug. 1966, *J.A. Steyermark & M. Rabe 96530* (U). **Bolívar:** Municipio Sucre, alrededores de Santa María de Erebato, alto río Erebato, 340 m, 4°59' N, 64°49' W, Feb. 1989, *A. Fernández 5021* (MO); Ptari-tepuí, dry sandy and rocky sandstone exposures on level ground adjacent to swamp on plateau-portion of southeast-facing slopes, 1600 m, 1 Nov. 1944, *J.A. Steyermark 59656* (F). **Portuguesa:** La Laguna, vecindad de una lagunita, a 10 kms NNO (en línea recta) de La Estación, 18.5 kms (en línea recta) NNO de Ospino, 900 m, 9°28' N, 69°33' W, 1 Nov. 1982, *J.A. Steyermark 126907* (MO). **Táchira:** Montaña de Guafitas, just west and north of El Piñal, 0 m, 7°32'30" N, 71°58'20" W, 7 Nov. 1979, *J.A. Steyermark 119527* (MO).

HYBRIDS

Hybridization is also a recurrent fact that have been recorded since the description of *Goniophlebium semipinnatifidum* Fée (Fée, 1852), this taxon is here considered as a hybrid between *S. levigatum* and *S. funckii* that occurs in Colombia, Peru and Venezuela (*Serpocaulon ×semipinnatifidum*). Later Rojas and Chaves (2013), described the hybrid *Serpocaulon ×sessilipinum* interbreeding between *S. fraxinifolium* and *S. ptilorhizon* in Costa

Rica. Sanín and Torrez (2014), described *S.* ×*manizalense* as a hybrid between *S. adnatum* and *S. levigatum* in Colombia. Chaves-Fallas et al. (2015), presented *S.* ×*rojasianum* a hybrid between *S. dissimile* and *S. triseriale* also from Costa Rica. And finally, here is presented *S.* ×*tabuleirense* a hybrid between *S. triseriale* and *S. vacillans* from Brazil. Nevertheless, as far as is known, no records of hybridization experiments or molecular research exist to test those or other hybrids zones, as were found in Colombia, Bolivia, Brazil and Peru.

38. Serpocaulon ×manizalense D. Sanín & Torrez, Blumea 59(2): 123–130. 2014. TYPE: Colombia, flanco occidental de la Cordillera Central de Colombia, Manizales-Caldas, en zona aledaña a la ciudad por la vía a Neira, 2070–2200 m, 5º5’ N, 75º30’ W, 3 Nov. 2008, *D. Sanín et al. 2646* (holotype FAUC!; isotypes COL!, HUA!).

This is a hybrid between *S. adnatum* and *S. levigatum*, only recorded in the city of Manizales, Caldas, Colombia (Sanín & Torrez, 2014). The authors suggested that this noto taxon is critically endangered (CR) presented its description and comments suggesting that the spores are well-formed.

39. Serpocaulon ×rojasianum J.M. Chaves, R.C. Moran & F. Oviedo, Brittonia 7: 185–19. TYPE. Costa Rica. Puntarenas: Cantón de Coto Brus, San Vito, Las Cruces, cerca viva del Jardín Botánico Wilson, 1200 m, 8º47’7” N, 82º57’32” W, 25 Jul. 2014, *J.M. Chaves & F. Oviedo-Brenes 562* (holotype CR; isotypes: HLDG, NY).

This is a hybrid between *S. dissimile* (a pinnate-pinnatisect lamina species) and *S. triseriale* (a pinnate lamina species), only recorded in the type locality in Costa Rica. Chaves-Fallas et al. (2015) described the hybrid, recording the presence of collapsed spores.

40. Serpocaulon ×semipinnatifidum (Fée) D. Sanín, **hybr**. **stat. nov.** *Serpocaulon semipinnatifidum* (Fée) A.R. Sm. Taxon 55(4): 929. 2006. *Goniophlebium semipinnatifidum* Fée, Mém. Foug. 5: 256. 1852. *Polypodium semipinnatifidum* (Fée) Mett., Abh. Senckenberg. Naturf. Ges., 2: 80. 1856. TYPE: Colombia. Pamplona, *N. Funck & L.J. Schlim 1363* (first step lectotype: P, designated by Hensen (1990: 301), **second step lectotype**: P [bc] 00632819 image! here designated; isolectotype: P [bc] 00632818 image!, LD [bc] 1774884 image!). Figures 100, 101b.

Plants hemiepiphytic or rarely terrestrial. *Rhizomes* 1.7–2.9 mm diameter, long-creeping, light to dark brown, yellowish or reddish, pruinose; phyllopodia distance 0.5–8.5 cm. *Rhizome scales* disperse, 0.8–1.8 × 0.3–1.4 mm, ovate to scarce lanceolate, appressed, peltate, bicolorous, light brown to the margin and dark brown to the center, base and apex rounded to acute, appressed, erose margin. *Fronds* 16–44 cm long. *Petioles* 1.6–12 cm long, proximally subterete, distally slightly sulcate, winged 1/2 to 3/4 its length, light brown to dark. *Laminae* 15–32 × 1.2–9 cm, linear to ovate-deltate, lobulate to slightly pinnatisect, cuneate, obtuse to truncate proximally, distally caudate apex. *Lobes* 11–24 pairs, chartaceous to rare coriaceous, proximally lobate to slightly pinnatisect or with basal segments inequelaterous, medial and distal lobate to scarcely lobate, apical segment long attenuate. *Medial lobes* or segments with decurrent base and rounded to acute apex, with irregular patterns, venation forming 3–38 rows along and 1–3 rows of areolae between the costae and the margin of the biggest lobe or segment, generally not well formed, with irregular patterns, free veins or anastomosing to the margin, impressed. *Laminar induments* lobe or segment scales scarce, mainly in the base of lobes or segments, 0.8–1.8 × 0.5–1.4 mm, triangular, ovate to lanceolate, appressed, peltate with a notorious insertion, concave, concolorous, dark brown, base and apex rounded, erose margin; hairs scarce, 2–3 cell long, over the lobes or segments, catenate, with glandular appearance, appressed, hyaline, with dark brown apex. *Sori* from the more pronounced lobe or segment in 5–10 row along and 1–2 rows between the costa and the margin. *Spores* 55–65 × 34–42 μm, ellipsoidal, sub-ellipsoidal to globular, irregular depressed verrucae.

Etymology. The name refers to the shape of the dissection in the laminae, that often is pinnate or pinnatisect proximally.

Distribution and habitat. Serpocaulon ×*semipinnatifidum* occurs in Colombia, Venezuela and Peru, in montane forest from 1610 to 3100 m.

Phenology. It was recorded fertile all months of the year, except January and March.

Notes. Serpocaulon ×*semipinnatifidum* most resembles *S.* ×*manizalense* that also possesses a variable morphology with undifferentiated patterns of cell organization of the rhizome scales and shape and dissection of the laminae. However, differs from *S.* ×*manizalense* by the less diameter of the rhizome (1.7–2.9 mm vs. to 5 mm), smaller laminae (15–32.5 cm. vs. > 33 cm long), laminae distally lobulate or segmented (vs. pinnate), and minor number of areolae between the costae and margins in the basal segments (1–3 vs. to 5 rows).

Taxonomic and nomenclatural notes. Goniophlebium semipinnatifidum Fée, was described from plants recollected in Pamplona, Colombia by *Funck & Schlim 1363* (Fée, 1852). The French author did not designate any herbaria for his collections, deriving in Hensen (1990)'s designation (first step lectotype). However, in P are hosted two sheets of this series that, despite they informing different data collections, belong to *Funck & Schlim 1363*'s series. Using the second step lectotype here is designated the sheet from P (00632819).

Serpocaulon ×*semipinnatifidum* (Fée) D. Sanín was originally described by Fée in 1852 as *Goniophlebium semipinnatifidum* Fée. Posteriorly, Mettenius (1856) combined it as *Polypodium semipinnatifidum* (Fée) Mett. Tryon and Tryon (1982) suggested that it could have a hybrid origin, undoubtedly involving *P. glaucophyllum* = *Serpocaulon levigatum*. However, Hensen (1990) designated it as synonym of *P. levigatum* (= *S. levigatum*) arguing that it represents part of its variation, and because the author did not find aborted spores. Moran (1990) disagreed with Hensen, commented that 'although a rare phenomenon in ferns, it is possible to have primary hybrids with well-formed spores'. Tryon and Stolze (1993) in Flora of Peru, commented that probably *P. levigatum* and *P. lasiopus* = *S. lasiopus* are the parentals of this taxon, but suggested that for the epoch the epithet '*semipinnatifidum'* was used to designate all noto taxa. This affirmation is probably mistaken due that *S.* ×*semipinnatifidum* is glabrous and presents a long-creeping rhizome, contrary to *S. lasiopus* that is characterized by short-creeping rhizome and dense pubescence. In this respect, Moran (1995) proposed that it is a hybrid between *P. levigatum* = *S. levigatum* and probably *P. funckii* = *S. funckii*. Posteriorly Smith et al. (2006) combined under a species category, without considering the intermediary morphology represented by the lobulate, segmented to

simple laminae that could be present all forms in one lamina. In addition, the distribution of the hybrid along the parental range (Figure 101b), and the finding of three hybrids zones (see representative specimens) further supports the recognition of *S.* ×*semipinnatifidum* as a hybrid.

Representative specimens. COLOMBIA. **Antioquia:** Belmira, vereda El Yugal, nacimiento de la quebrada La Aldaña, parte alta, bhMB, rastrojo alto, 2600 m, 6º35' N, 75º41' W, 8 Oct. 2002, *W.D. Rodríguez 3667* (HUA); Guarne, Piedras Blancas submontane *Quercus* forest, 2200 m, 8 Jul. 1971, *D.D. Soejarto 3040* (HUA); Medellín, corregimiento de Santa Elena, vereda del Plan-Piedras Blancas, finca El Naranjal, 2300 m, 7 Jul. 1995, *R. Callejas 11513* (HUA); Río Negro, Jul. 1934, *Bro. Daniel 639* (F); San Antonio del Prado, al sur de Medellín, vereda la Cabaña, finca Loma Linda, 2200 m, 6 Nov. 1989, *L. Albert de Escobar 8809* (HUA); Sonsón, 2575 m, 20 Aug. 1948, *W.J. Johnson 18 c 792* (COL); Urrao, Corregimiento La Encarnación, camino entre el Páramo El Almorzadero y poco antes de la cabaña de Calles, 31 Jul. 2011, *D. Sanín et al. 5125* (COL, NY). **Boyacá**: entre Chiquinquirá y Pauna, en Las Fuentes, 2000–2300 m, 12 Dic. 1970, *M.T. Murillo 1500* (COL). **Antioquia/Chocó:** Salgar, at the border, km 15 of road Salgar-El Dauro (Chocó), 2280 m, 5º59' N, 76º7' W, 29 Sep. 1987, *J.L. Zarucchi et al. 5989* (MO). **Cesar:** Sierra del Perijá, 11 km east-N. of Manaure, 47 km east of Valledupar, 2 km from the Venezuelan boarder, 2700 m, 5 Feb. 1945, *M.A. Grant 10833* (COL). **Chocó**: La Mansa, carretera Medellín-Quibdó a lado y lado de la carretera desde La Mansa, en el km 106, 2000–2100 m, 2 Jul. 1983, *F. Mejía 121* (COL). **Cundinamarca:** Subachoque, La Pradera cerca del río, 2800 m, 14 Sep. 2003, *M. Hernández-Schmidt 1309* (COL). **Huila:** 15 km SE of Garzón, 2850 m, 1 Feb. 1945, *E.L. Little 9353* (COL); Nátaga, Serranía de las Nieves, vereda El Socorro, La Torre, 1950 m, 1 Nov. 2006, *N. Otálora 278* (CAUP); Pitalito, vereda Charguayaco, reserva de la comunidad El Arroyuelo, 1925 m, 28 Jul. 2009, *D. Sanín 3208* (FAUC); San Agustín, vereda Platanares, relicto arriba de la escuela Platanares, 2147 m, 1 Jul. 2009, *D. Sanín 3282* (FAUC). **Norte de Santander:** al oriente de Pamplona, páramo de Fontibón, 2800 m, 9 Nov. 1969, *M.T. Murillo 1324* (COL). **Putumayo:** San Francisco, vereda Siberia, 2800 m, 1 Feb. 1999, *B.R. Ramírez-P. 12013* (CAUP). **Tolima:** 9 km de Murillo, hacia Líbano, en Bosque perturbado dominado por *Quercus*, 2320 m, 8 Apr. 1984, *L. Albert de Escobar 4179* (HUA).

PERU. **Cajamarca:** Cutervo, Madre Mía, entre Suro y la Flor, al nor oeste del Parque, 2400 m, 25 Jun. 1992, *L. Sánchez Vega & A. Miranda 6325* (F). **Huánuco:** Mariscal Cáceres, Leoncio Prado, 1610 m, 11 May 1997, *C.S. Arévalo Ramírez 147* (USM). **Pasco:** Oxapampa, Huancabamba, Milpo, 2950–3100 m, 1 Nov. 2009, *H. van der Werff et al. 23062* (MO, USM!).

VENEZUELA. **Tachirá:** Vicinity of Betania at base of Volcan Tamá, 2300 m, 7º28' N, 72º27' W, 22 Mar. 1985, *T.B. Croat 60675* (MO).

41. Serpocaulon ×sessilipinum A. Rojas & J.M. Chaves, Amer. Fern J. 2013. 103 (3): 175–181. TYPE: Costa Rica. Puntarenas: Coto Brus, San Vito, Cerro Paraguas, orillas de la Laguna Los Gamboa, 1447 m, 8º47'16" N, 82º59'20" W, 3 Nov. 2012, *J.M. Chaves et al. 299* (holotype: CR, isotypes: HLDG, MO).

This is a hybrid between *S. fraxinifolium* (a pinnate lamina species) and *S. ptilorhizon* (a pinnatisect lamina species), only recorded from the type locality in Costa Rica. Rojas and Chaves-Fallas (2013) described the hybrid and commented that it presents well-formed spores.

42. **Serpocaulon ×tabuleirense** D. Sanín & Salino, **hybrid. nov.** TYPE. Brazil. Minas Gerais: Conceição de Mato Dentro, Tabuleiro, Parque Natural Municipal do Tabuleiro, via para a Cachoeira de Tabuleiro, 739 m, 19º5'18" S, 43º33'7" W, *D. Sanín & V. Torres 6782* (holotype: BHCB!, isotypes: COL!, RB!, UC!). Figures 22e, 102–104c, e, 105b, d.

Serpocaulon ×tabuleirense is intermediate between *S. triseriale* and *S. vacillans* based on the present of the rhizome scales 2.9–7.8 mm long, laminae proximally pinnate, sessile, becoming pinnatisect and gradually tapering to abruptly reduced in an attenuate, caudate apical segment. The spores are malformed.

Plants terrestrial or rupiculous. *Rhizomes* 4.7–5 mm diameter, short-creeping, whitish brown to green, pruinose to scarcely; phyllopodia distance 0.8–1 cm, phyllopodia length 4–5 mm. *Rhizome scales* dense, 2.9–7.8 × 1.3–2.4 mm, lanceolate, patent, subpeltate, bicolorous, light brown to the margin and dark brown to the center, base rounded or cordate,

apex cirrose, patent, erose margin. *Fronds* 30–40 cm long. *Petioles* 12–16 cm long, proximally subterete, distally slightly sulcate, light brown. *Laminae* 18–24 × 13–15 cm, lanceolate, pinnate, truncate and reflexed proximally, gradually tapering to abruptly reduced in an attenuate, caudate apical segment. *Pinnae or segments* **(**especially to the apex) 9–15 pairs, chartaceous, proximal pinnate, sessile, medial and distal pinnatisect to scarcely lobate (mainly in the apex), apical segment long attenuate. *Medial segment or pinnae* 5.7–7.5 × 1.2–1.4 cm, base decurret and apex acute to attenuate, irregular pattern of appearance of the segments or lobes, venation forming 16–26 rows along and 1–2 rows of areolae between the costae and the margin, with irregular patterns, anastomosing to free veins at the margin, impressed. *Laminar induments* lobe/segment or pinna scales scarce, mainly in the base of the structure, 1.56–2.17 × 0.2–0.3 mm, aciculate, long attenuate, 18 × 2 cells long, patent, basal insertion notorious, concolorous, brown to yellow, base rounded and apex long attenuate, erose margin. *Hairs* scarce, in the base of the segments or lobes, catenate, strigose, patent, hyaline, over the rachises and base of veins 9–24 cell long, and over the laminar tissue, 2–3 cells long, hyaline. *Sori* from the bigger lobe or segment in 5–10 rows along and 1 row between the costa and the margin. *Spores* 38–42 × 25–29 µm, collapsed on one side, ellipsoidal, concave-convex to plane-convex, irregular depressed verrucae.

Etymology. The name honours the Tabuleiro waterfall in Minas Gerais where the type was found.

Distribution and habitat. Serpocaulon ×tabuleirense occurs in Brazil, Minas Gerais State, Parque Natural Municipal do Tabuleiro, in the trail to the Tabuleiro waterfall, the type location is a remnant of the Atlantic Rain Forest that is rounded by Campo Rupestre ecosystem, from 650 to 740 m.

Phenology. It was recorded fertile in April.

Notes. Serpocaulon ×tabuleirense was found only in one spot located along the trail of the Tabuleiro waterfall, where it was growing with *S. vacillans* (Link) A.R. Sm, and *S. catharinae* (Lansd. & Fisch.) A.R. Sm. (Figure 104). Despite that the other putative parental,

S. triseriale was not found in the Tabuleiro waterfall canyon, one population was found 3–4 km distant from the hybrid. *Serpocaulon vacillans* is abundant in the region, it was recorded in three different locations. The hybrid was detected by the intermediate shape and dissection of the laminae. The frond of *S. vacillans* are pinnatisect, and the apex is gradually tapering with a terminal attenuate segment, whereas that of *S. triseriale* possess a pinnate lamina with apical conform pinna, often adnate to the lateral pinnae. On the other hand, *Serpocaulon* ×*tabuleirense* presents proximally pinnate laminae, that are sessile, becoming pinnatisect and gradually tapering to abruptly reduced in an attenuate, caudate apical segment. The size of the rhizome scales is also an intermediary feature (Table 6). Interestingly, there are characters that are proper of each parental that are also present in *S.* ×*tabuleirense*, as the presence of short-creeping rhizome and spores with irregular depressed verrucae (from *S. triseriale*), or one row of sori, and two types of hairs (from *S. vacillans*). However, there are characters that are only recorded in the hybrid as the combination of frond dissection (pinnate proximally and pinnatisect distally), and the cirroze rhizome scale apex.

Collapsed spore of hybrid is a feature described in those taxa (Chaves-Fallas et al., 2015). In this case, both parental present a contrasting morphology, in one hand, *S. triseriale*, presents spores without perinae, and on the other hand, *S. vacillans* presents thin folded perinae, producing linear creases. The hybrid has clearly a scarce perinae, and the ornamentation morphology is similar to *S. triseriale* (Figure 105).

This is the second hybrid between a pinnate and pinnatisect species. Following the cladogram of Kreier et al. (2008), *S. triseriale* (the most widespread species of the genus) and *S. vacillans* (a restricted species in the Atlantic Rain Forest), belongs to clades II and III respectively. This situation suggest the week barriers of interbreeding in *Serpocaulon*, because it is possible to find hybrids between pinnate lamina species crossing with simple lamina species (*S.* ×*manizalense*) (Sanín & Torrez, 2014), pinnatisect with simple lamina species (*S.* ×*semipinnatifidum*) (this contribution), and pinnate with pinnatisect species (*S.* ×*sessilipinnum* (Rojas & Chaves (2013), *S.* × *rojasianum* (Chaves et al., 2015) and *S.* ×*tabuleirense*).

Table 6. Comparison of two species of *Serpocaulon* and their hybrid in Brazil.

Character/taxa	*S. triseriale*	*Serpocaulon ×tabuleirense*	*S. vacillans*
Rhizome	Short-creeping	Short-creeping	Long-creeping
Rhizome scale length (mm)	3–10	2.9–7.8	2−5
Rhizome scale shape	Ovate-lanceolate to lanceolate	Lanceolate	Lanceolate, ovate-lanceolate, to rarely subulate
Rhizome scale base	Base rounded	Base rounded or cordate	Base rounded
Rhizome scale apex	Acuminate to long decurrent	Cirroze	Acuminate to long acuminate
Lamina base	Pinnate	Pinnate	Pinnatisect
Lamina apex	Conform	Pinnatisect, gradually tapering	Pinnatisect, gradually tapering
Pinnae/segments pairs	2–27	9–15	19–44
Number of rows of sori along the medial pinnae/segment	13–66 × (1–)3–4(–5)	5–10 × 1	(4–)8–17(–28) × 1(–2)
Spore ornamentation	Irregular depressed verrucae	Folded perinae	Irregular depressed verucae

Additional specimens or paratypes. Brazil, Minas Gerais, Parque Natural Municipal do Tabuleiro, Parque Estadual da Serra Geral do Intendente, a 200 m da Cachoeira do Tabuleiro, 681 m, 19º5’16” S, 43º33’3”, 23 Apr. 2017, *D. Sanín & M.O. Duarte 6801* (NY, SP).

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NAMES TREATED

In **bold** the names here recognized and the respective page where are described.

166. *Polypodium chacapoyense* Hook.
167. *Serpocaulon acuminatum* (Fée) Christenh.
168. *Goniophlebium acuminatum* Fée
169. *Polypodium remotum* Baker
170. *Polypodium remotum* Desv.
171. *Polypodium uniseriale* C. Chr.
172. *Serpocaulon antillense* (Maxon) A.R. Sm.
173. *Polypodium antillense* Maxon
174. *Polypodium pseudofraternum* A.C. Sm.
175. **Serpocaulon subandinum** (Sodiro) A.R. Sm..……...……229
176. *Polypodium subandinum* Sodiro
177. **Serpocaulon triseriale** (Sw.) A.R. Sm..…….....…235
178. *Polypodium brasiliense* Poir.
179. *Polypodium preslianum* Spreng.
180. *Polypodium longifolium* C. Presl.
181. *Polypodium longifolium* Cav.
182. *Polypodium gladiatum* Kunze
183. *Polypodium gladiatum* Vell.
184. *Marginaria gladiata* (Kunze) C. Presl.
185. *Goniophlebium gladiatum* (Kunze) Fée
186. *Polypodium triseriale* var. *gladiatum* (Kunze) Proctor
187. *Polypodium subalatum* Klotzsch
188. *Polypodium campylopodium* Klotzsch
189. *Polypodium xiphophoron* Kunze ex Mett.
190. *Goniophlebium xiphophoron* (Kunze ex Mett.) Fée
191. *Goniophlebium intermedium* Fée
192. *Polypodium neriifolium* var. *acuminatissimum* Kuntze
193. *Polypodium neriifolium* var. *heterophyllum* Kuntze
194. *Polypodium brasiliense* var. *gladiatum* Kuhn
195. *Goniophlebium ampliatum* Maxon
196. *Polypodium ampliatum* (Maxon) Proctor

ANIMALS

1. *Anyphaenoides* sp., Anyphaenidae
2. *Crematogaster* sp., Formicidae
3. *Euglossa melanotricha* Moure, Euglossidae

NEW SYNONYMS

1. *Polypodium laetum* Raddi. New synonym of *Serpocaulon catharinae* (Langsd. & Fisch.) A.R. Sm.
2. *Polypodium loriceum* var. *obscurum* Rosenst. New synonym of *Serpocaulon concolorum* (M. Kessler & A.R. Sm.) A.R. Sm.
3. *Polypodium subandinum* Sodiro var. *biserialis* Rosents. New synonym of *Serpocaulon dasypleuron* (Kunze) A.R. Sm.
4. *Polypodium loriceum* var. *umbricatum* Christ, New synonym of *Serpocaulon dissimile* (L.) A.R. Sm.
5. *Polypodium loriceum* fo. *duplisorum* Domin. New synonym of *Serpocaulon falcaria* (Kunze) A.R. Sm.
6. *Polypodium loriceum* var. *hirto-pubescens* Hieron. New synonym of *Serpocaulon lasiopus* (Klotzsch) A.R. Sm.
7. *Polypodium loriceum* L. var. *squamuligera* Rosenst. New synonym of *Serpocaulon concolorum* (M. Kessler & A.R. Sm.) A.R. Sm.
8. *Polypodium beyerianum* Rosenst. New synonym of *Serpocaulon maritimum* (Hieron.) A.R. Sm.
9. *Polypodium albo-punctatum* Raddi. New synonym of *Serpocaulon meniscifolium* (Langsd. & Fisch.) A.R. Sm.
10. *Polypodium manabyanum* Baker. New synonym of *Serpocaulon patentissimum* (Mett. ex Kuhn) A.R. Sm.
11. *Polypodium distans* Raddi. New synonym of *Serpocaulon polystichum* (Link) A.R. Sm.
12. *Polypodium brasiliense* var. *pleiosorum* Rosenst. ex Hassl. New synonym of *Serpocaulon rex* Schwartsb. & A.R. Sm.

13. *Serpocaulon obscurinervium* D. Sanín, New synonym of *Serpocaulon concolorum* (M. Kessler & A.R. Sm.) A.R. Sm.
14. *Serpocaulon silvulae* (M. Kessler & A.R. Sm.) A.R. Sm. New synonym of *Serpocaulon crystalloneuron* (Rosenst.) A.R. Sm.
15. *Serpocaulon mexiae* (Copel.) A.R. Sm. New synonym of *Serpocaulon lasiopus* (Klotzsch) A.R. Sm.
16. *Serpocaulon laetum* (C. Presl) Schwartsb. & A.R. Sm. New synonym of *Serpocaulon latipes* (Langsd. & Fisch.) A.R. Sm.
17. *Serpocaulon hirsutulum* (T. Moore.) Schwartsb. & A.R. Sm. New synonym of *Serpocaulon meniscifolium* (Langsd. & Fisch.) A.R. Sm.
18. *Serpocaulon* ×*pubescens* (Rosenst.) Schwartsb. & A.R. Sm. New synonym of *Serpocaulon meniscifolium* (Langsd. & Fisch.) A.R. Sm.

NEW STATUS

Serpocaulon ×**semipinnatifidum** (Fée) D. Sanín, hybr. stat. nov.

NEW TAXA DERIVED OF THIS THESIS

1. **Serpocaulon australe** D. Sanín, J.C. Ospina, I.O. Moura & Salino
2. **Serpocaulon psychotrium** Mostacero, D. Sanín & A.R. Sm. sp. nov. (unpublished)
3. **Serpocaulon** ×**tabuleirense** D. Sanín & Salino, hybrid. nov.

NEW COMBINATION DERIVED FROM THIS THESIS

1. **Serpocaulon demissum** (Fée) D. Sanín

EXCLUDED SPECIES

1. *Goniophlebium elatum* Fée, Mém. Foug. 5: 256. 1852. TYPE. CUBA. *J.J. Linden 1890* (**lectotype here designated**, BR [bc] 0000008261106 image!). Despite Hensen (1990)

and Smith et al. (2006), suggested *Goniophlebium elatum* Fée as a synonym of *S. dissimile*, it was verified that the type *J.J. Linden 1890* (BR) corresponds to *Polypodium sororium* Humb. & Bompl. ex Willd. Due that the type was not designated by Fée, the sheet (BR0000008261106) is chosen as lectotype, and it is excluded from *Serpocaulon.*

2. *Polypodium loriceum* var. *oligomerum* Christ. Bull. Soc. Roy. Bot. Belgique 35(1): 221. 1896. TYPE. COSTA RICA. sur les trones des caféiers à la Verbena, 1000 m, Aug. 1894, *Tonduz 8804* (P [bc] 00624567 image!). Despite Lellinger (1989), suggested this species as synonym of *P. loriceum* (= *S. loriceum*), it was combined by Tejero-Díez and Pacheco (2004) as *Polypodium colpodes* Kunze var. *oligomerum* (H. Christ.) Tejero, reason why it is excluded from *Serpocaulon*.
3. *Polypodium cordatum* Kunze, Linnaea 9: 44. 1834. Illegitimate name. TYPE. PERU. Huánuco: ad Casapi, Jul 1829, *E.F. Poeppig 1148* (**lectotype here designated**: W [bc] 0052623 image!). Lellinger (1989) mentioned that the type was destroyed from LZ, here is designated as lectotype the sheet (W0052623) suggested by the original protologue. Tryon and Stolze (1993), pointed that this is a synonym of *P. sessilifolium* = *S. sessilifolium*, as well as *P. kunzeanum* C. Chr. However, the non-pruinose rhizome with non-clathrate scales and cordate base of the articulate pinnae of the types, allow it to recognize as a different species like suggested Smith et al. (2006) and Salino et al. (2019). For this reason, it is excluded from *Serpocaulon* and located as a new synonym of *Polypodium kunzeanum* C. Chr. **New syn.**
4. *Polypodium salicifolium* Vahl, Eclog. Amer. 3: 51. 1807. TYPE. Montserrat. *Ryan s.n.* (C [bc] 10014112 image!). Cited by Hensen (1990) as a synonym of *P. triseriale* Sw. However, this specimen represents *Meniscium angustifolium* Will., reason why it is excluded from *Serpocaulon*.
5. *Serpocaulon tayronae* D. Sanín, Phytotaxa 213(3): 243–252. 2015. TYPE: Colombia, Magdalena: Santa Marta, Sierra Nevada de Santa Marta, Las Nubes, 1524 m, 1898–1901, *H. H. Smith 1025* (holotype BR!, isotypes BP!, CM!, DAO!, E!, ISC!, MICH!, MPU!, NY!, TEX [bc] 00208812!). Molecular analyses performed by the authors (Chapter two), reveals that this species should be placed in *Campyloneurum*. The iconography and description can be found in Sanín (2015).

NOMINA DUBIA

1. *Goniophlebium haenkei* C. Presl, Tent. Pterid. 186, pl. 7. 1836. *Polypodium haenkei* (C. Presl) Liebm. Vid. Selsk. Skr. V (1): 204. 1849). TYPE: Mexico, *Haenke s.n.* (PRC). Despite that this name was cited by Hensen (1990) and Smith et al. (2006), no type was traced. The authors mentioned as part of *Serpocaulon triseriale*'s synonymy.
2. *Goniophlebium neriifolium* (Sw.) Hook. J. Bot. (Hooker) 4: 57. 1841. Despitethe fact that there is a protologue for this combination, the original name was *Polypodium neriifolium* Schkuhr, and no type was traced. It was suggested as a synonym of *P. triseriale = S. triseriale* (Lellinger, 1989; Hensen, 1990; Smith et al., 2006).
3. *Polypodium brasiliense* f. *subcordatum* C. Chr. Kuhn, Bot. Jahrb. Syst. 24: 130. 1897. TYPE. Guadeloupe, *Mazé 1074* (not traced).
4. *Polypodium brasiliense* var. *neriifolium* (Schkuhr) Baker, Fl. Bras. (Martius) 1(2): 524 1870. TYPE: not found, as well as the protologue. Cited by Lellinger (1989), Hensen (1990), Smith et al. (2006), and Schwartsburd and Smith (2013), as a synonym of *P. triseriale = S. triseriale*.
5. *Polypodium catharinae* Langsd. & Fisch. f. *aurita* Rosenst., Hedwigia 46: 142. 1907. TYPE: Brazil. *Lages 82*. Type not traced.
6. *Polypodium cymatodes* Kunze, Linnaea 23: 277, 317. 1850. TYPE: Venezuela. (Cult in bot. gard. at Leipzig and Berlin), *Kunze s.n.* (LZ destroyed)). This name probably represents a synonym of *S. fraxinifolium* following Lellinger (1989), Hensen (1990) and Smith et al. (2006), also the distribution could support this. Therefore, neither the protologue that was not traced, nor the type destroyed allow to confirm this.
7. *Polypodium dissimile* Schkuhr. Deutschl. Krypt. Gew. 1: 14, t. 14. 1806. inv. hom. of *Polypodium dissimile* L. 1753. Nor type or protologue was traced.
8. *Polypodium elegans* Cav. Ex Sw. Syn fil. 35. 1806 (nom. illeg. hom. of Poir. 1804. Encycl. 5: 519. 1804.). Cited by Lellinger (1989) and Smith et al. (2006) as synonym of *S. loriceum*. However, the type was not traced.
9. *Polypodium fraxinifolium* var. *elegans* Sodiro, Recens. Crypt. Vasc. Quit. 67. 1883. TYPE: Ecuador. Pichincha: En los declives del volcán Atacazo entre Cansacoto y S. Florencio, *A. Sodiro s.n.* The type was not found at Q, QLPS, SI, or P, Sodiro's main collections.

However, the protologue mentioned that the specimen presents 8–10 areolae and 7–9 rows of sori, features presented in *S. articulatum*. Also, the distribution and the pinnate laminae probably match with this species.

10. *Polypodium fraxinifolium* var. *fraxinellum* Christ. Bull. Herb. Boissier, sér. 2, 5(1): 5. 1905. TYPE: Costa Rica. *Werckle* & *Brune* s.n. (lectotype following Lellinger (1989): P, not found). The recommendation of Lellinger (1989) is to designate it under the synonymy of *S. fraxinifolium*. Despite the fact that a protologue exists in a French journal, the type specimen was not found at P, reason why it is included here as *nomen dubium*.
11. *Polypodium fraxinifolium* var. *oligophyllum* Sodiro, Recens. Crypt. Vasc. Quit. 67. 1883. TYPE: Ecuador. Pichincha: Crece en los bosques de los Colorados, *A. Sodiro s.n.* (lectotype following Hensen (1990): QLPS). Due to the fact that the type was not found at QLPS, this name is included as *nomen dubium* because it was not possible to link the type with the protologue. The characteristic described in the protologue: coriaceus laminae with 1–5 pinnae, a conform apical pinnae, 7–9 rows of areolae, and 6–8 rows of sori, probably represents a juvenile specimen of *S. articulatum*.
12. *Polypodium laetum* Raddi var. *boliviana* Rosenst. TYPE: Bolivia. Antahuacana Quebrada del Espíritu Santo, 116 1/2 º ß. etna (?) 160 km nordosten Cochabamba, 750 m, Jun. 1909, *A. Otto 2151* (S S12-19619). Despite that there is a label with this name that belong to Rosenstock, the protologue was not traced. The sheet belongs to *S. latissimum.*
13. *Polypodium loriceum* var. *heterolepis* Sodiro. Crypt. Vasc. Quit. 352. 1893. TYPE: Ecuador. Crece en la región tropícal y subtropical de las provincias de Guayaquil, Riobamba y Quito, *A. Sodiro s.n.* (not found). Following Lellinger (1989) this name is linked with *S. loriceum*. However, *S. loriceum* presents a predominantly northern distribution. After revising the herbaria Q, QLPS, P and SI, the type was not traced, reason why this name is treated as *nomen dubium*.
14. *Polypodium lucens* Schrad., Gott. gel. Anz. 868. 1824. TYPE. Brazil. Espírito Santo. Brasilia, Barra de Jucú [= Jucu], 1805, *A.P.M. Wied-Neuwied s.n.* (BR [bc] 697025, isolectotypes: MEL [bc] 2424289, MEL [bc] 2353815). Althought there are types, the protologue was not traced. Nevertheless, it was cited by Lellinger (1989), Hensen (1990), Smith et al. (2006), and Schwartsburd and Smith (2013) as synonym of *P. triseriale* = *S. triseriale*.

15. *Polypodium martii* Colla, Herb. Pedem. 6: 230. 1836. TYPE. Brazil, Mart. In Sched. (not traced). Hensen (1990), designated this name under the synonymy of *P. vacillans* = *S. vacillans*, however, he did not reference it to any specimen. Even though the protologue described a Brazilian specimen that have pinnatisect laminae with 5–7 segments and short hairs (features possible found in juvenile specimens of *S. vacillans*), the type was not found.
16. *Polypodium neriifolium* Schkuhr, Cited by Hensen (1990) as published in Kl. Linn. Pfl.-Syst. 1: 14, t. 15, 1806., as well as, by Lellinger (1989) like Vier Zwanzigste Kl. Linn. Pfl.-Syst. 1: 14, t. 15, 1804. *Marginaria neriifolia* (Schkuhr) C. Presl. Tent. Pterid. 189. 1836. TYPE. Loc. Not stated, "ex. Herb Breyne" (holo HAL?). Nor the protologue or the type was found for the name *Polypodium neriifolium* Schkuhr. It was suggested as a synonym of *P. triseriale* = *S. triseriale* (Lellinger, 1989; Hensen, 1990; Smith et al., 2006).
17. *Polypodium palma* Vell., Fl. Flumin. Icon. 11: 447, t.69. 1831. TYPE: Brazil. Rio de Janeiro: around Rio de Janeiro, *A. Vellozo s.n.* Plate 69 (designated by Hensen (1990)). Not found at R, neither RB. It was cyted by Lellinger (1989) as a synonym of *S. triseriale*, however, Hensen (1990) and Smith et al. (2006) suggested as synonym of *S. meniscifolium.*
18. *Polypodium palmatum* Vell. Fl. flum. 11: t. 63. 1827, as well as Arch. Mus. Nac. Rio Jan. 5: 447. 1881. The original text named *P. palma* Vell. Apparently, Hassler and Schmit (2020) mistaken the name. Hensen (1990) and Smith et al. (2006) suggested the latter as a synonym of *S. meniscifolium.*
19. *Polypodium pycnosorum* Link, Fil. Sp. 128 (1841). TYPE: America Tropical, cultivated, (B 20 0090564), Despite it is cited in IPNI (2020), and there is a type that supports it, the protologue was not traced. The sheet represents a specimen of *S. attenuatum.*
20. *Polypodium punctulatum* Hook. Hooker's Icon. Pl. I-XXX, p. 60: 1919. Illegitim homonym of *Polypodium punctulatum* Poir. TYPE. Peru. *Jameson, s.n*. (K [bc] 000642041, K [bc] 000642042). Excluded from the synonymy of *S. subandinum* because, despite the index where it was published was found, the protolog was not. Additionally, the type specimen could be *S. eleutherophlebium* or *S. subandinum* because Hensen (1990) designated as isotype of *P. punctulatum* the sheet *Jameson* 127 (K [bc] 000642076), but this specimen belongs to *S. eleutherophlebium*. In the same way, his

handwriting designated the specimen at K (K000642042) as the holotype but, this specimen belongs to *Matews 1805* (K) and the sheet is composed by two individuals of *S. subandinum*.

21. *Polypodium ramosum* Lodd. ex Link., Hort. Berol. 2: 97. 1833. *Goniophlebium ramosum* (Link) Fée, Mém. Foug. 5: 255. 1850–2. TYPE. Unknown, cultivated in London from unknown origin (following Lellinger (1989): K, not found, duplicate: B B200090565). The type at B (B200090565) did not present rhizome, the reason why it is not possible to link with certainty its identity. However, by the texture and the decurrent base of the segments seems to be a specimen of *S. vacillans*. In the database and collection of K, it was not traced any specimen linked with this name, a reason why it is treated as *nomen dubium*.
22. *Polypodium triseriale* var. *gladiatum* (Kuhn) Proctor, Amer. Fern J. 72. P 114, 1982. *P. brasiliense* var. *gladiatum* Kuhn, Engl. Bot. Jahrb. 24: 130. 1897. TYPE. "Interior" of Cuba, Sep. 1822, *Poeppig s.n.* (following Proctor, 1982): LZ, destroyed; isotype BR, photo US). No specimen was found. It was cited as a synonym of *S. triseriale*.
23. *Polypodium variolatum* Willd. Sp. Pl. 5: 192. 1810. TYPE. Brazil. In Brasilia, *J.C. Hoffmannsegg s.n.* Despite the fact that the protologue exists, the type was not traced. It was cited by Lellinger (1989), Hensen (1990), and Smith et al. (2006) as a synonym of *P. triseriale* = *S. triseriale*.
24. *Polypodium wiesbaueri* Sodiro, Rec. Cryp. Vasc. Quit. 65. 1883. TYPE: Ecuador. Pichincha: Eastern slopes of Pichincha, above 3000 m, *A. Sodiro s.n.* (lectotype designated by Hensen (1990): QPLS). In spite of that the protologue exist, any specimen was traced. Following Lellinger (1989), Hensen (1990), Moran (1990), and Smith et al. (2006), this name represents a synonym of *S. eleutherophlebium*.

NOMINA NUDA

1. *Goniophlebium deflexum* Hort. Gard. Mag. Bot. 3: 61. 1851. This name is not supported by a type. Additionally, the protologue is from a horticultural magazine where the author dessigned differed to T. Moore & Houlston. The original precedence is referred from Brazil, and since it was cited as a synonym of *P. fraxinifolium* = *S. fraxinifolium* by Hensen

(1990) and Smith et al. (2006), the most probable identity is *S. polystichum*, the only 1-pinnate species with long-creeping rhizomes and subappresed rhizome scales that inhabit the country.

2. *Polypodium acuminatum* (Fée) Sodiro, Crypt. Vasc. Quit. 354. 1893. Despite it appears in TROPICOS (2020) and citing at IPNI (2020) as *Polypodium acuminatum* Sodiro, Crypt. Vasc. Quit. 354. 1893, apparently this name represents a misunderstanding of Sodiro's designation at named *P. acuminatum* Fée = *S. sessilifolium.*
3. *Polypodium latipes* Langsd. & Fisch. var. *pubescens* Rosenst. TYPE: Brazil, Rio Grande do Sul: Rio Gr. do Sul, Arroio Joao Rodriguez, Mar. 1903, *C. Jürgens 55* (S, S05–9228). Protologue not traced. This sheet is hosted at S, representing a specimen of *S. vacillans*.
4. *Polypodium rhoifolium* Will. Combined as *Marginaria rhoifolia* (Will.) C. Presl, Tent. Pterid. 189 (1836). Neither the protologue nor type was traced for the former name.
5. *Polypodium oleandrifolium* Kunze, Tent. Pterid. 188. 1836. *Marginaria oleandrifolia* (Kunze) C. Presl. Tent. Pterid. 188. 1836. *Goniophlebium oleandrifolium* (Kunze) T. Moore, Index Fil. (T. Moore) 20: 394 (1862). Type not designated nor traced. Cyted as synonym of *P. attenuatum = attenuatum* by Hassler and Schmit (2020) as well as, *nomen nudum* of *P. P. triseriale = S. triseriale* by Hensen (1990).

NUMERIC LIST OF TAXA

1. *S. adnatum*
2. *S. antioquianum*
3. *S. appressum*
4. *S. articulatum*
5. *S. attenuatum*
6. *S. australe*
7. *S. catharinae*
8. *S. concolorum*
9. *S. crystalloneurum*
10. *S. dasypleuron*
11. *S. demissum*

12. *S. dissimile*
13. *S. eleutherophlebium*
14. *S. falcaria*
15. *S. fraxinifolium*
16. *S. funckii*
17. *S. glandulosissium*
18. *S. intricatum*
19. *S. lasiopus*
20. *S. latipes*
21. *S. latissium*
22. *S. levigatum*
23. *S. loriceum*
24. *S. maritimum*
25. *S. meniscifolium*
26. *S. nanegalense*
27. *S. patentissimum*
28. *S. polystichum*
29. *S. psychotrium*
30. *S. ptilorhizon*
31. *S. rex*
32. *S. richardii*
33. *S. sessilifolium*
34. *S. subandinum*
35. *S. triseriale*
36. *S. vacillans*
37. *S. wagneri*

Hybrids

38. *S. ×manizalense*
39. *S. ×rojasianum*
40. *S. ×semipinnatifidum*

41. *S.* ×*sessilipinum*

42. *S.* ×*tabuleirense*

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SPECIMEN EXAMINED

The specimens are arranged by collector (with initial name if known) in alphabetic order, followed by collector's number (s.n. without number), followed by species number in parentheses and in bold the types. Hybrids are denoted by (H), following by the hybrid's number.

Abreu, N.L. & P.L. Viana 117 (20)

Acevedo, P. et al. 13026 (19)

Acevedo, ? 1318 (27)

Acosta-Arteaga, C.E. 104 (15), 145 (15), 278 (35), 339 (34), 449 (22), 463 (13), 558 (13), 768 (12), 870 (35), 949 (35), 1048 (35), 1098 (16), 1098AC (34), 2253 (15)

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Figure 1. Ornamental use in Belo Horizonte, Minas Gerais, Brazil. A. Entrance of a flower shop. B. Detail of the hemiepiphytic plant in a palm tree.

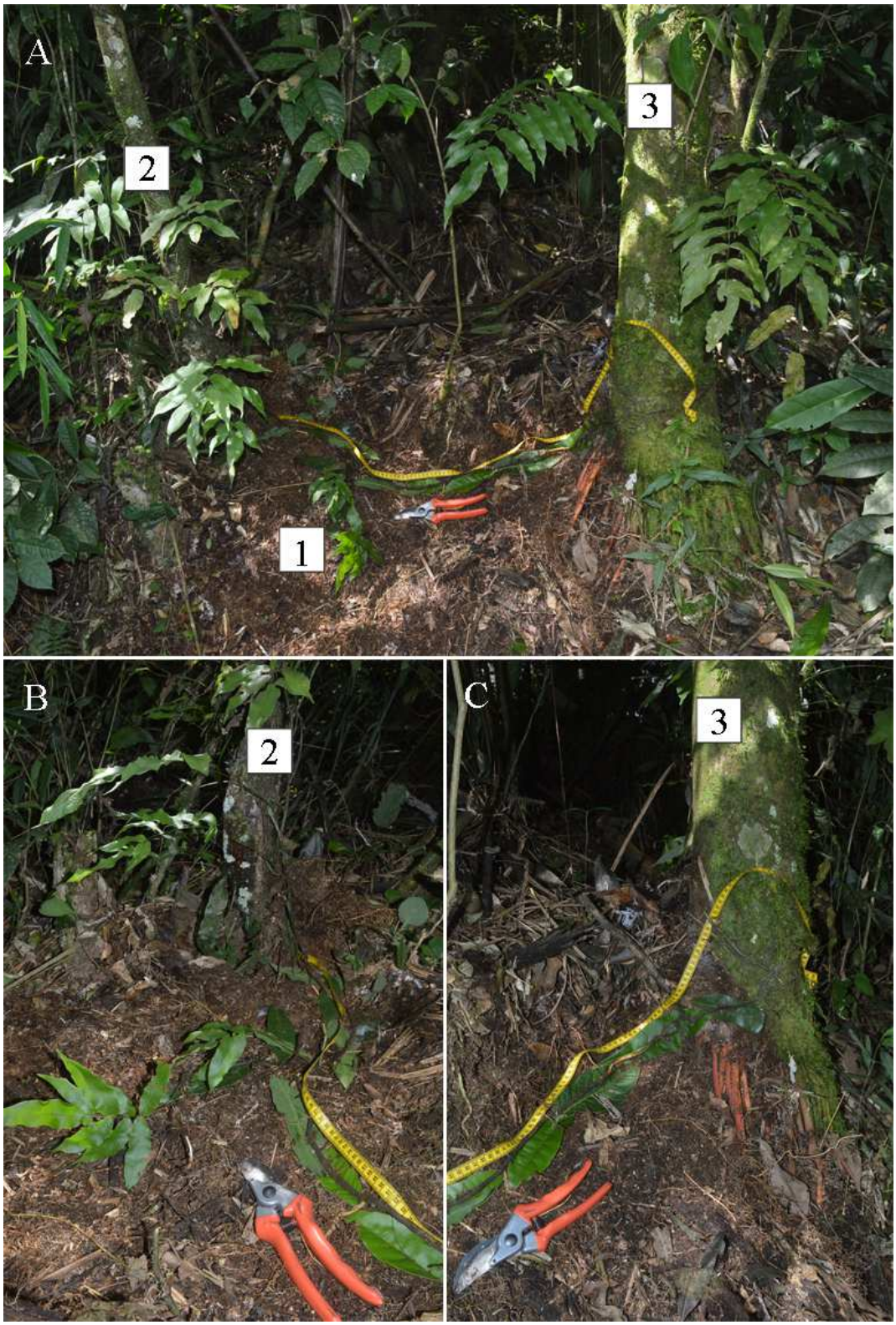


Figure 2. Secondary hemiepiphytic habit in *Serpocaulon*. —A. *S. polystichum* showing two ramifications. —B. First ramification that became secondary hemiepiphytic after 1m long (number 2). —C. Second ramification that became secondary hemiepiphytic after 2m long (number 3). All from *Sanín et al. 6824* (BHCB).

Figure 3. Different states of growing in *Serpocaulon*. —A. Young sporophyte of *S. patentissimum.* —B. Secondary hemiepiphytic plant of *S. funckii* showing juveniles in the soil and mature plant in a trunk. —C. Pinnatific leaves development of *S. vacillans*. A, from *Sanín & Duarte 6860* (HUA). B, from *Castro & Sanín 1359* (HUA). C, from *Sanín et al. 7071* (BHCB).

Figure 4. Habits of growing in *Serpocaulon*. —A. Terrestrial habit of *S. vacillans*. —B. Rupicolous habit of *S. glandulossisimum*. —C. Epiphytic habit of *S. eleutherophlebium*. A, from *Sanín et al. 7071* (BHCB). B, from *Sanín et al. 6828* (BHCB). C, from *Sanín 4350* (HUA).

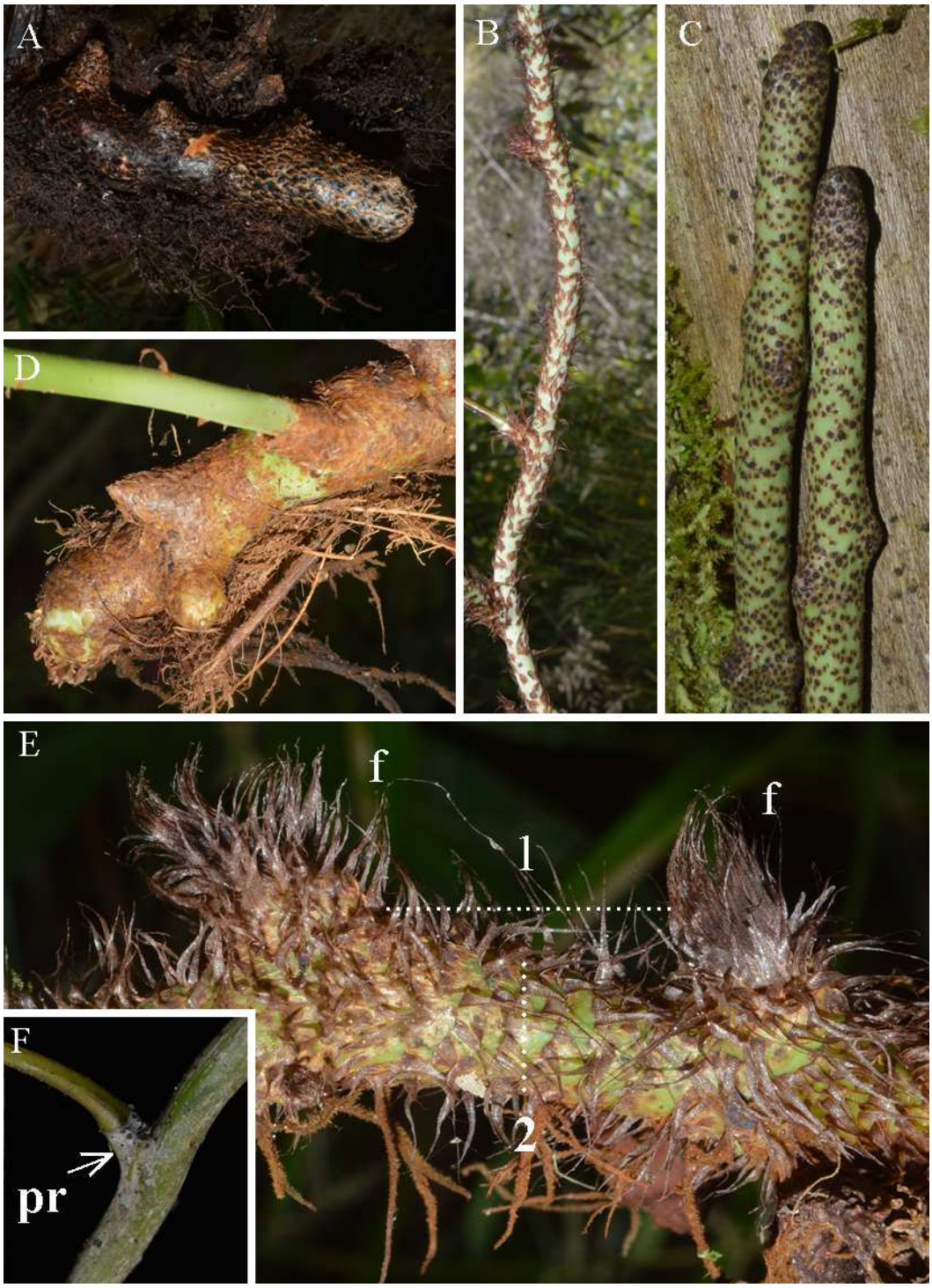


Figure 5. Rhizomes in *Serpocaulon*. Short-creeping rhizome with patent rhizome scales, —A. *S. meniscifolium* (from *Sanín 7138* (BHCB). —D. *S. triseriale* (from *Sanín et al. 7202* (BHCB). Long-creeping rhizome with patent rhizome scales, —B. *S. eleutherophlebium* (from *Sanín et al. 4350*), —E. *S. articulatum* (from *Sanín 6151* COL). Long-creeping rhizome with appressed rhizome scales, —C. *S. fraxinifolium* (from *Sanín et al. 6887*, COL), —F. *S. dasypleuron* (from *Sanín et al. 6050*, BHCB). Abbreviations, 1= phyllopodia distance, 2= rhizome diameter, f= phyllopodia, pr= pruinosity.

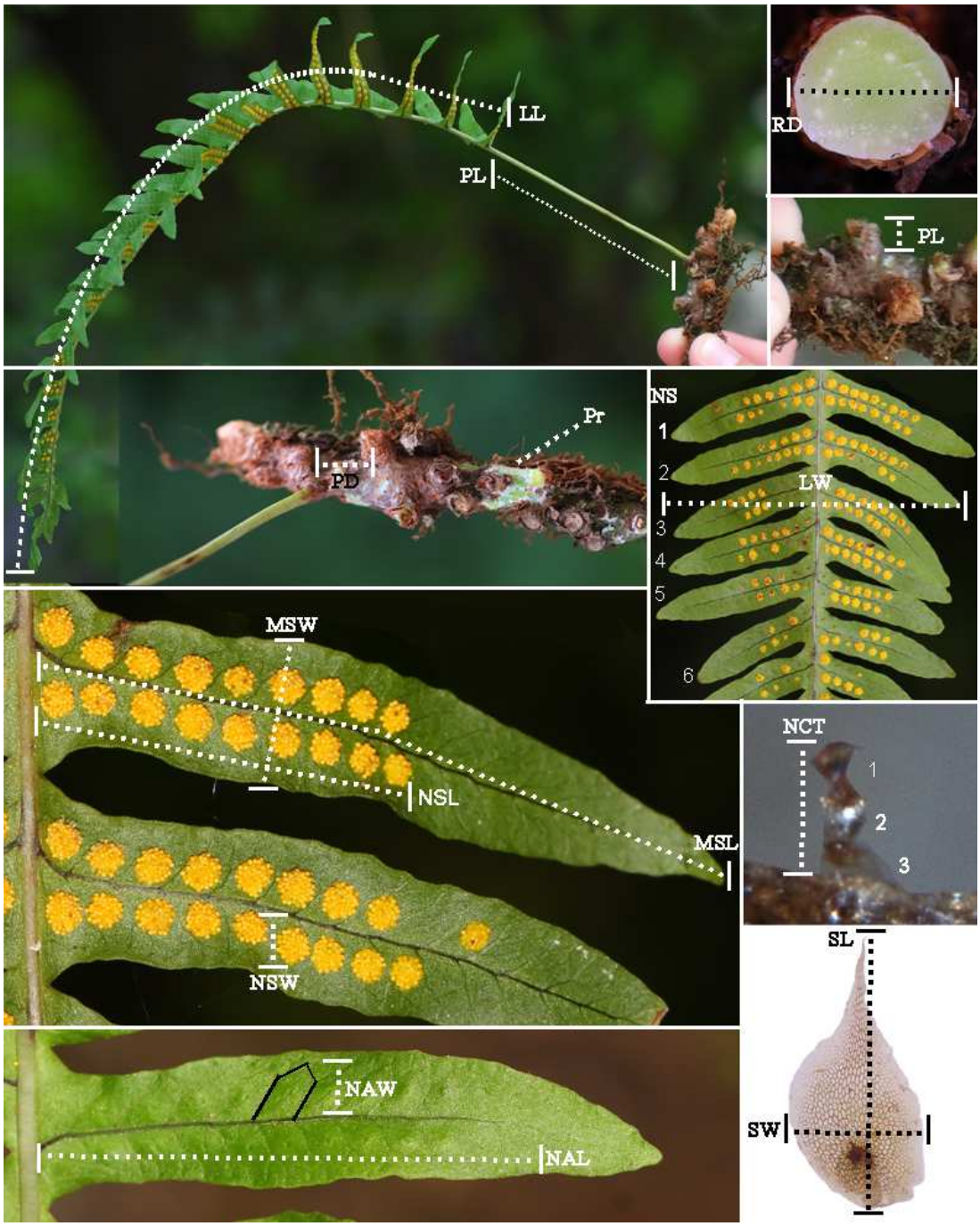


Figure 6. Some features evaluated in *Serpocaulon*. Pinnatisect laminae from *S. australe*, from *Martín & Ospina 2234* (SI*). Abbreviations, LL= lamina length, LW= lamina width, MSL= middle segment length, MSW= middle segment wide, NAL= number of areole along the costa and the margin, NAW= number of areolae between the costa and the margin, NS= number of segments, NSL= number of sori along laminae or segments, NSW= number of sori between the costa and the margin, NCT= number of cell of the trichome, PD= phyllopodia, pi= pinna, PL= petiole length, pr= pruinosity, ra= rachis, RD= Rhizome diameter, se= segment, SL= scale length and SW= scale wide.

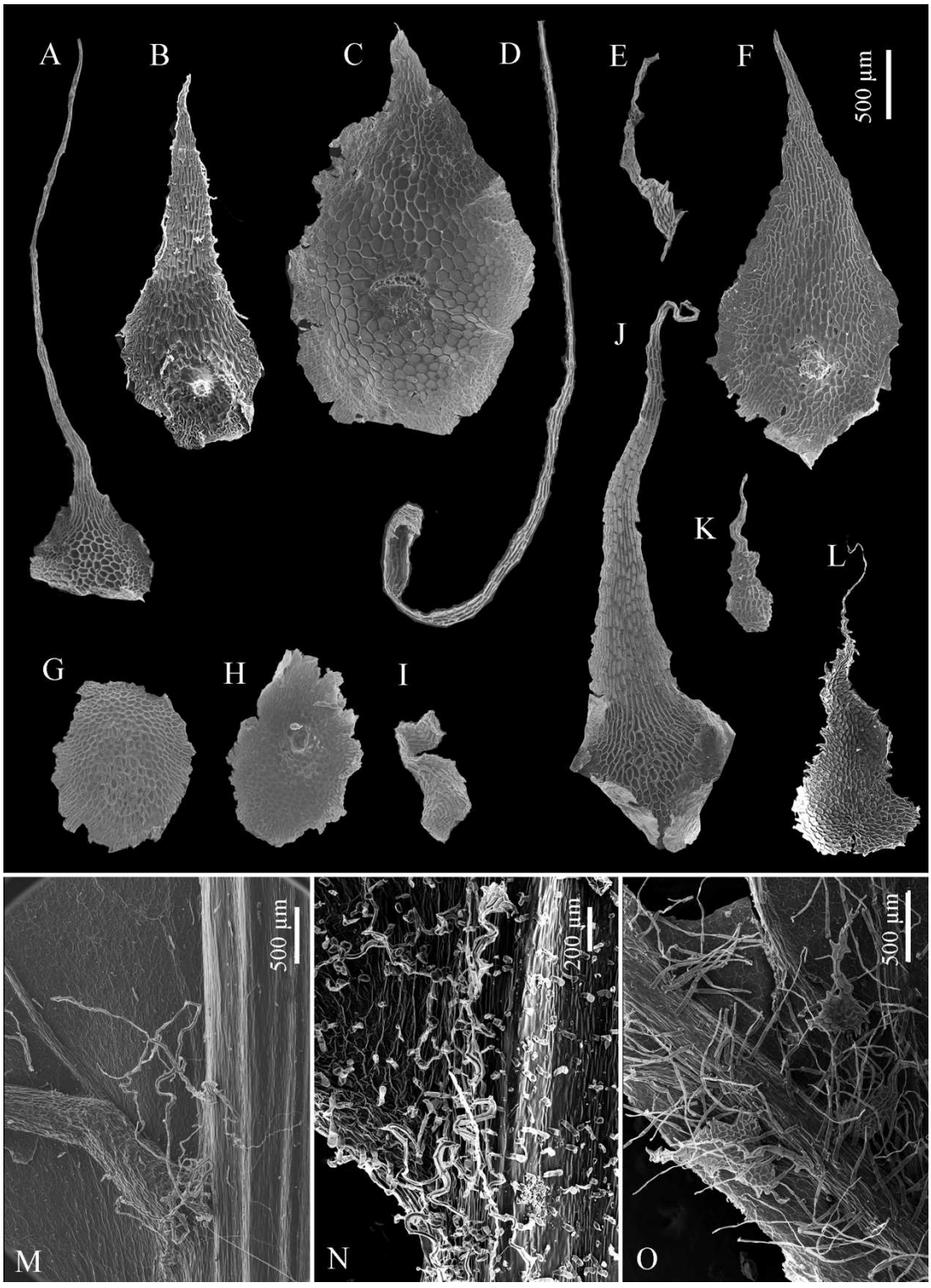


Figure 7. Rhizome and laminar scales in *Serpocaulon*. *S. catharinae*, —A. Rhizome scale, —M. Lamina scales, from *Salino 5848* (BHCB). *S. glandulosissimum*, —B. Rhizome scale, —N. Lamina scales and trichomes, from *Salino 14378* (BHCB). *S. vacillans*, —C. Rhizome scale, —D–E. Laminar scales, from *Almeida et al. 1106* (BHCB). *S. polystichum*, —F, J. Rhizome scales, —K. Lamina scales, from *Salino 5261* (BHCB). *S. fraxinifolium*, —G–H. Rhizome scales, I. Lamina scales, from *Sanín & Duarte 6859* (COL). *S. meniscifolium,* —L. Laminar scale of a mature plant, from *Sanín 7137* (BHCB); —O. Laminar scales and trichomes of a younger plant, from *Sanín 7138* (BHCB).

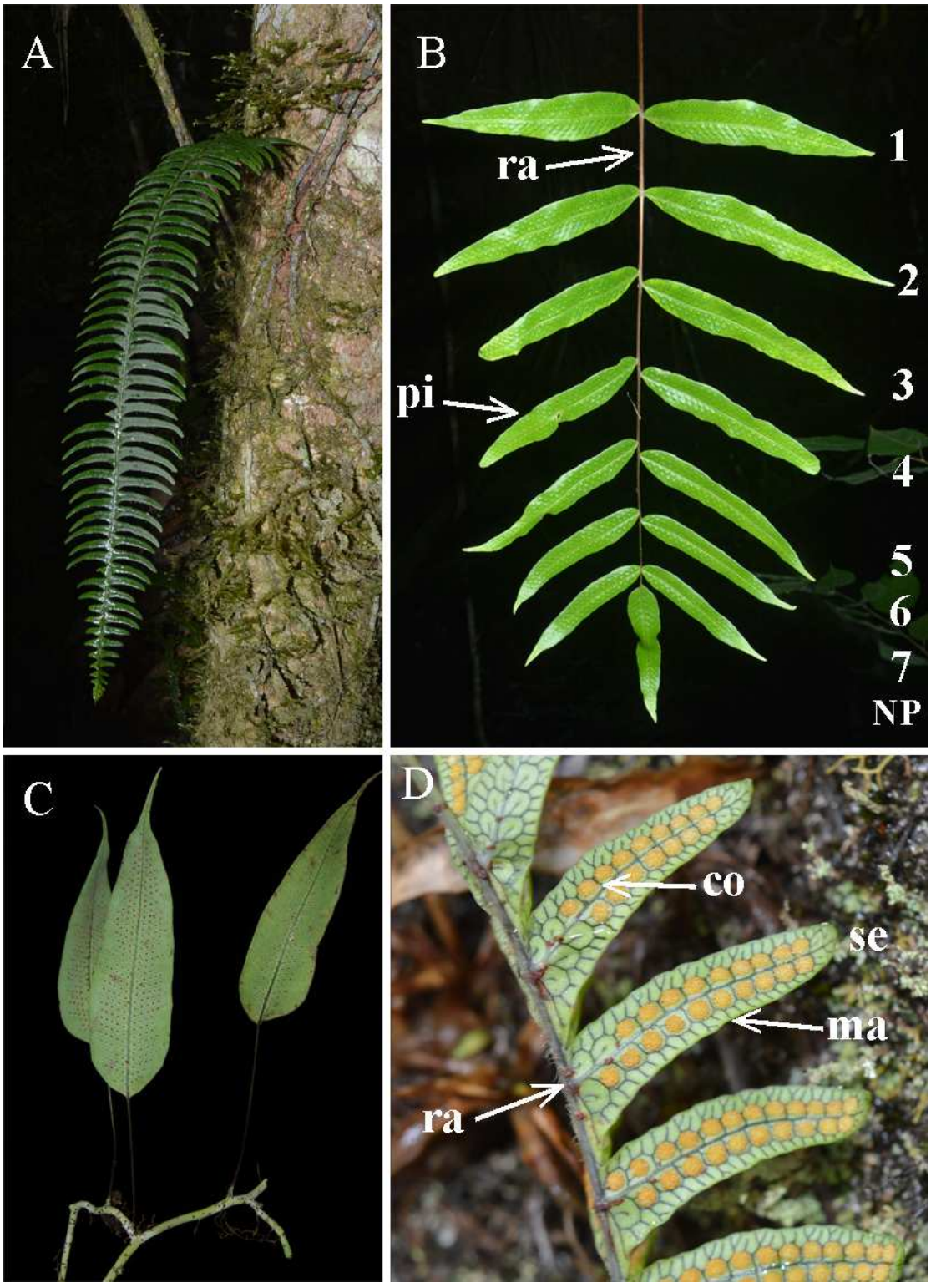


Figure 8. Laminae morphology I. —A. Pinnatisect lamina, *S. patentissimum* (from *Sanín & Duarte 6860* (HUA). —B. Pinnate lamina, *S. polystichum*, from *Sanín 6836* (BHCB). —C. Simple laminae, *S. levigatum*, from *Sanín 6160* (BHCB). —D. Pinnatisect leaves morphology, *S. subandinum* from *Sanín* 7098 (COL). Abbreviations, co= costa, ma= margin, pi= pinna, se= segment, ra= rachis.

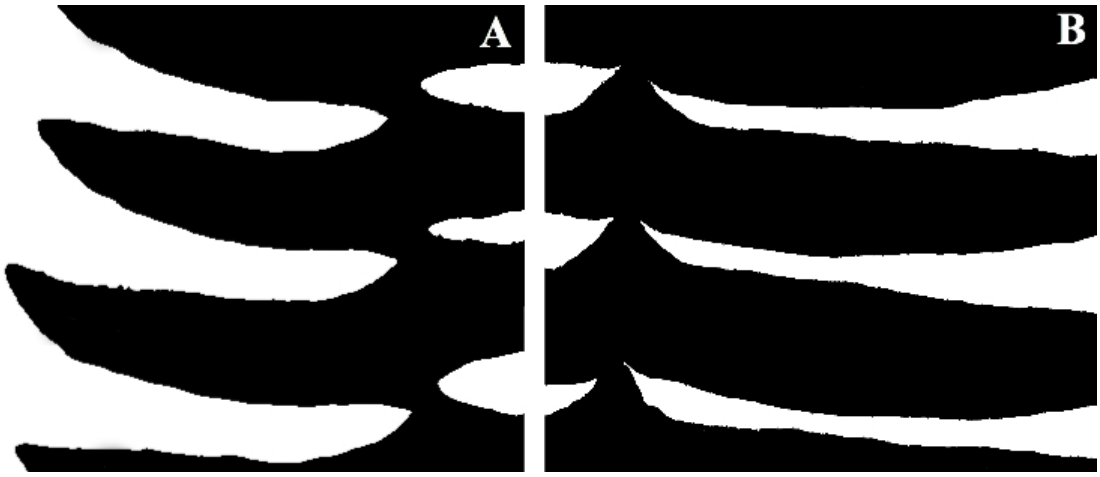


Figure 9. Laminae morphology II. Segments attachment. —A. Decurrent. —B. Surcurrent.

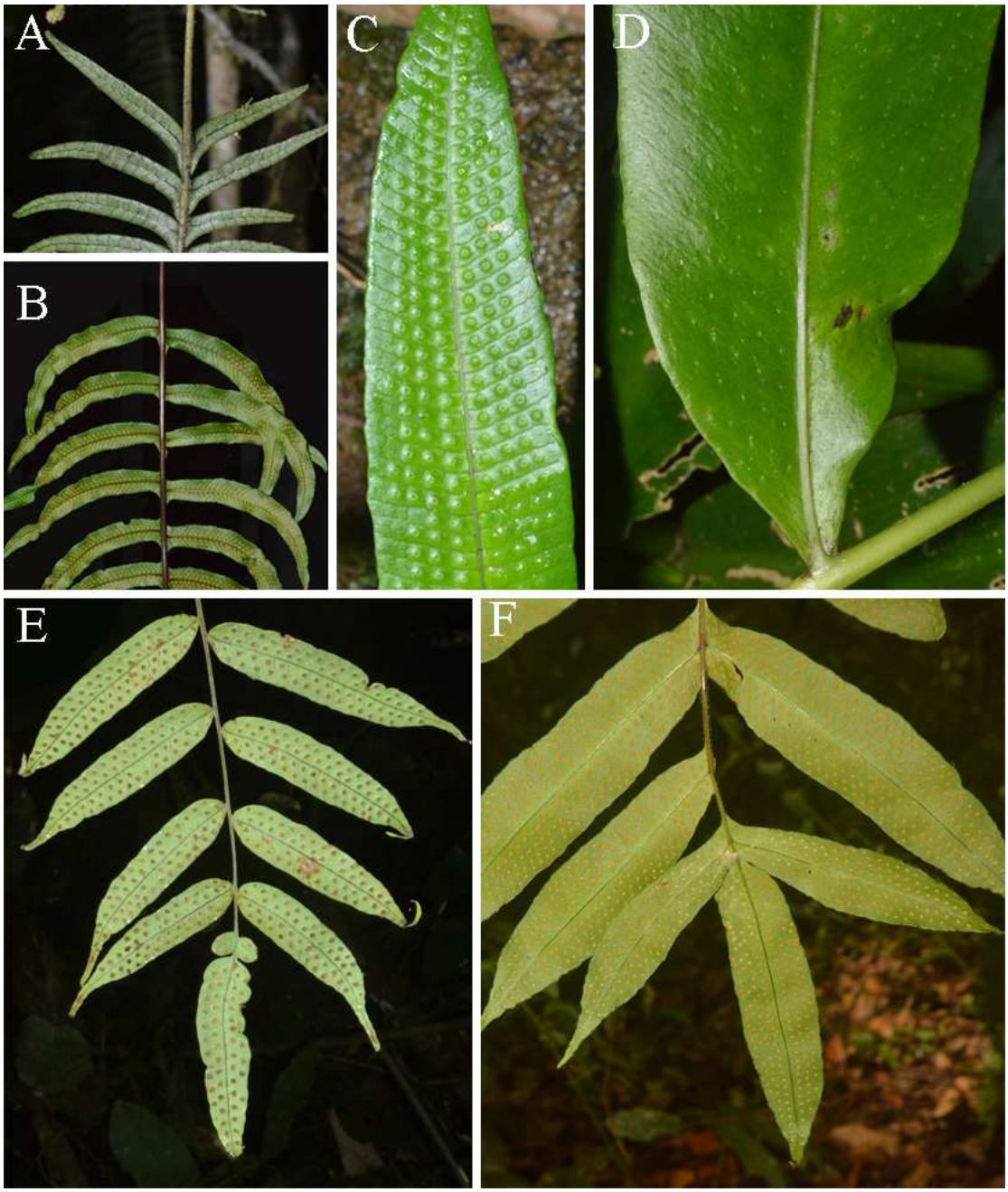


Figure 10. Laminae morphology III. —A. Reflexed base, *S. patentissimum* (from *Sanín & Duarte 6860* (HUA). —B. Truncate base, *S. maritimum* (from *Sanín & Duarte* 6862 COL). —C. Impressed veins, *S. psychotrium* (from *Sanín et al. 6449* (HUA). —D. Immersed veins, *S. articulatum* (from *Sanín 6151* COL). —E. Pinnate laminae with sessile pinnae, *S. fraxinifolium* (from *Sanín et al.* 6927 COL). —F. Pinnate laminae with adnate pinnae, *S. richardii* (from *Sanín & Santiago 7267* (BHCB).

Figure 11. Laminae morphology IV. Heteroblastic leaf development in *Serpocaulon catharinae.* —A. Simple juvenile leave. —B. Lobulate juvenile leave. —C. Pinnatisect juvenile leave. —D. Pinnatisect mature plants.

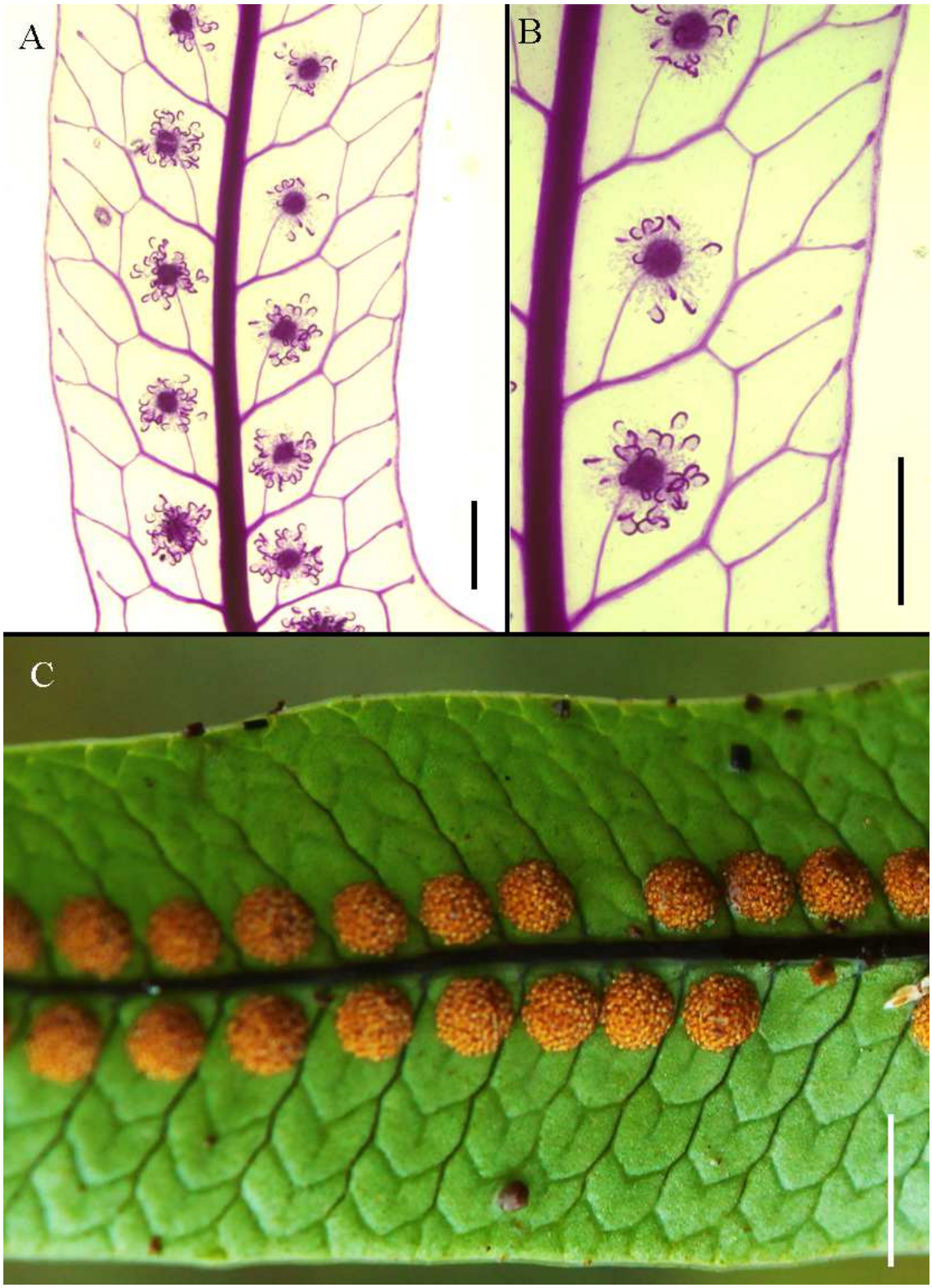


Figure 12. Laminae morphology V. Pattern venation in *Serpocaulon* following Rödl-Linder (1990). —A, B. Subauriculatum type in *S. latipes*. —C. Percussum type in *S. levigatum*. A. and B from *Sanín et al. 6768* (BHCB). C. from *Sanín 768* (FAUC). Scale bars: A, B= 2 mm, C= 1 cm.

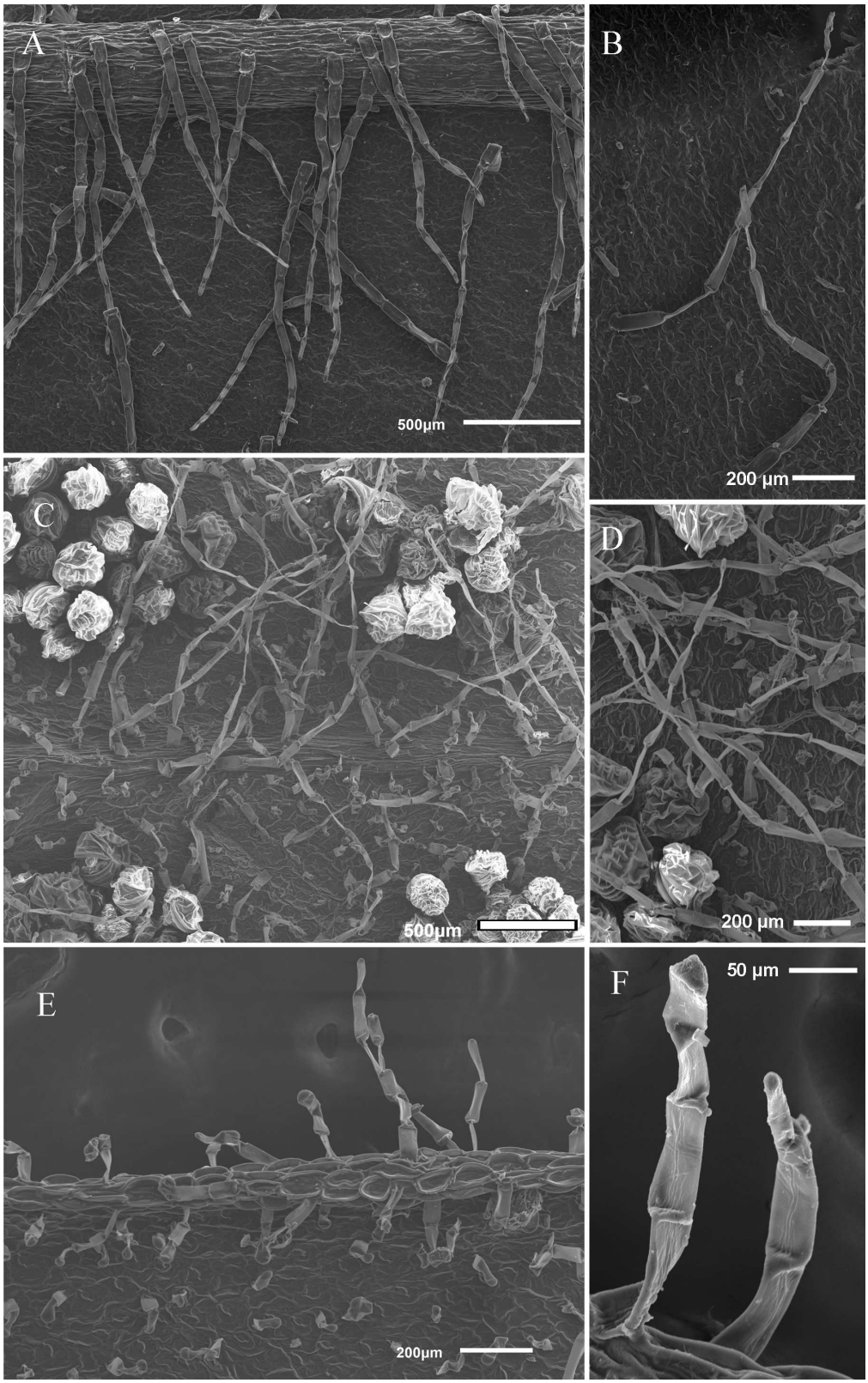


Figure 13. Trichomes in *Serpocaulon* I. Villous induments conformed by patents and catenate trichomes. —A–B. *S. appressum*, *Mexia 7821* (UC). —C–F. *S. lasiopus*, from *de la Sota 4445* (LP) (C–D), and E–F from *Acevedo 13026* (NY).

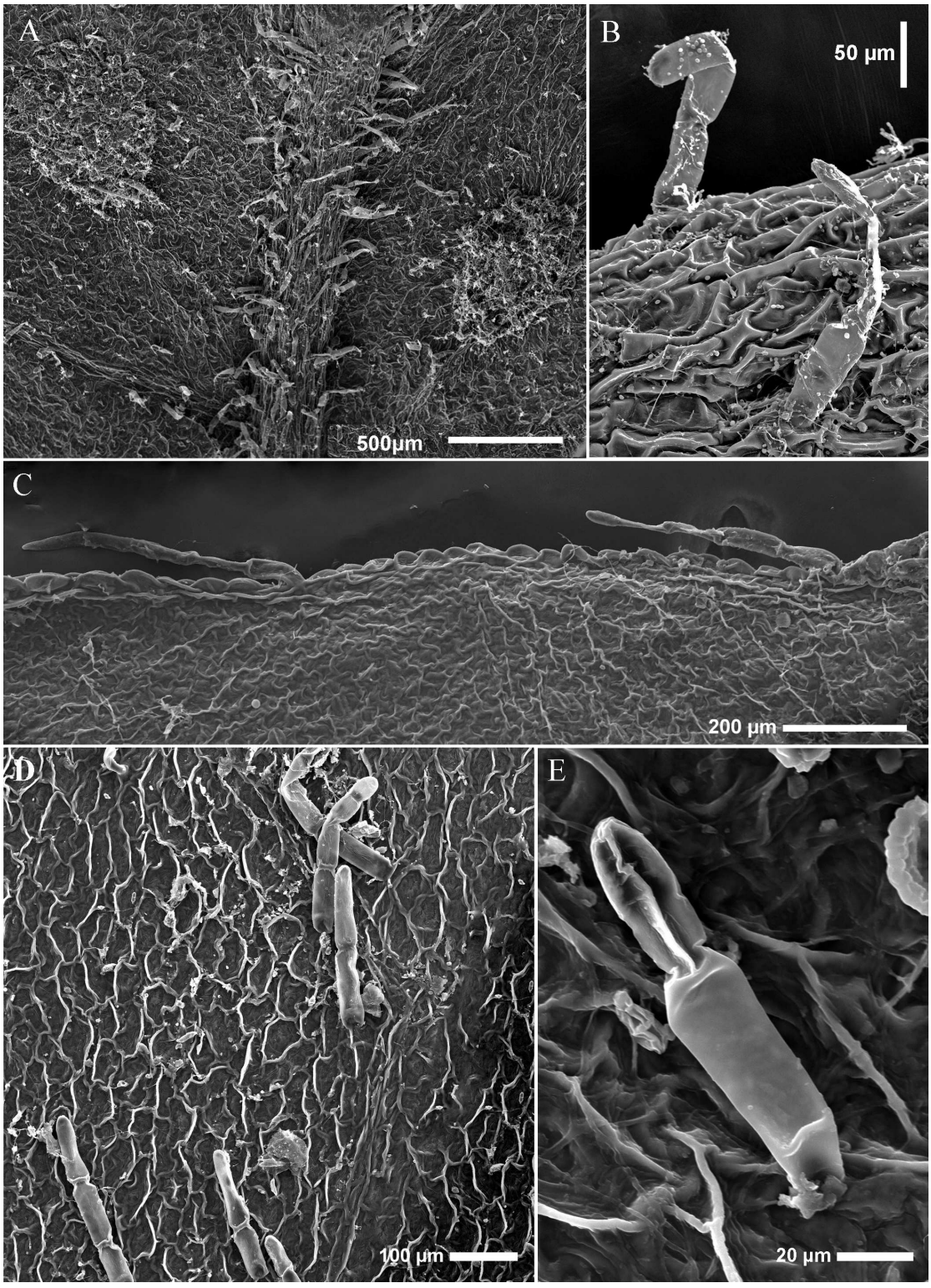


Figure 14. Trichomes in *Serpocaulon* II. Strigose induments conformed by appressed and catenate trichomes. —A–B. *S. crystalloneurum*, from *Buchtien 421* (SI). —C. *S. falcaria,* from *Williams 24754* (F). —D–E. *S. intricatum*, from *Kessler 9429* (UC*).

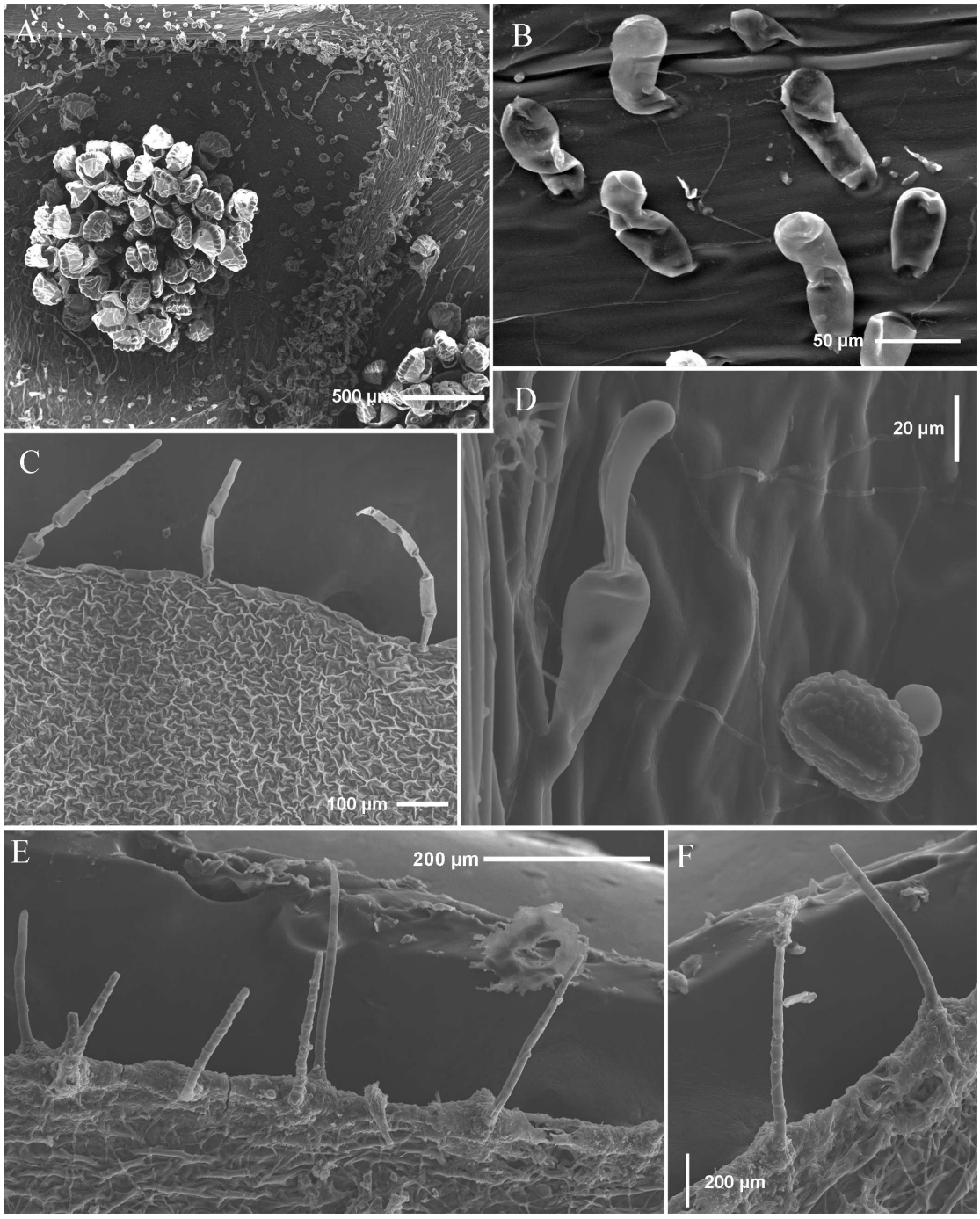


Figure 15. Trichomes in *Serpocaulon* III. Glandular and strigose trichomes and miscellaneous. —A–B. Glandular trichomes in *S. glandulosissimum,* from *Salino 13045* (BHCB). —C. Patents and catenate trichomes of *S. richardii*, from *Almeida et al. 2437* (BHCB) in comparison with E–F. —D. Strigose trichome in *S. triseriale*, from *Salino 14378* (BHCB). —E–F. Fungous lichen *Tricharia sp.* that looks-like-trichomes black structures, from *Sanín & Duarte 6859* (COL).

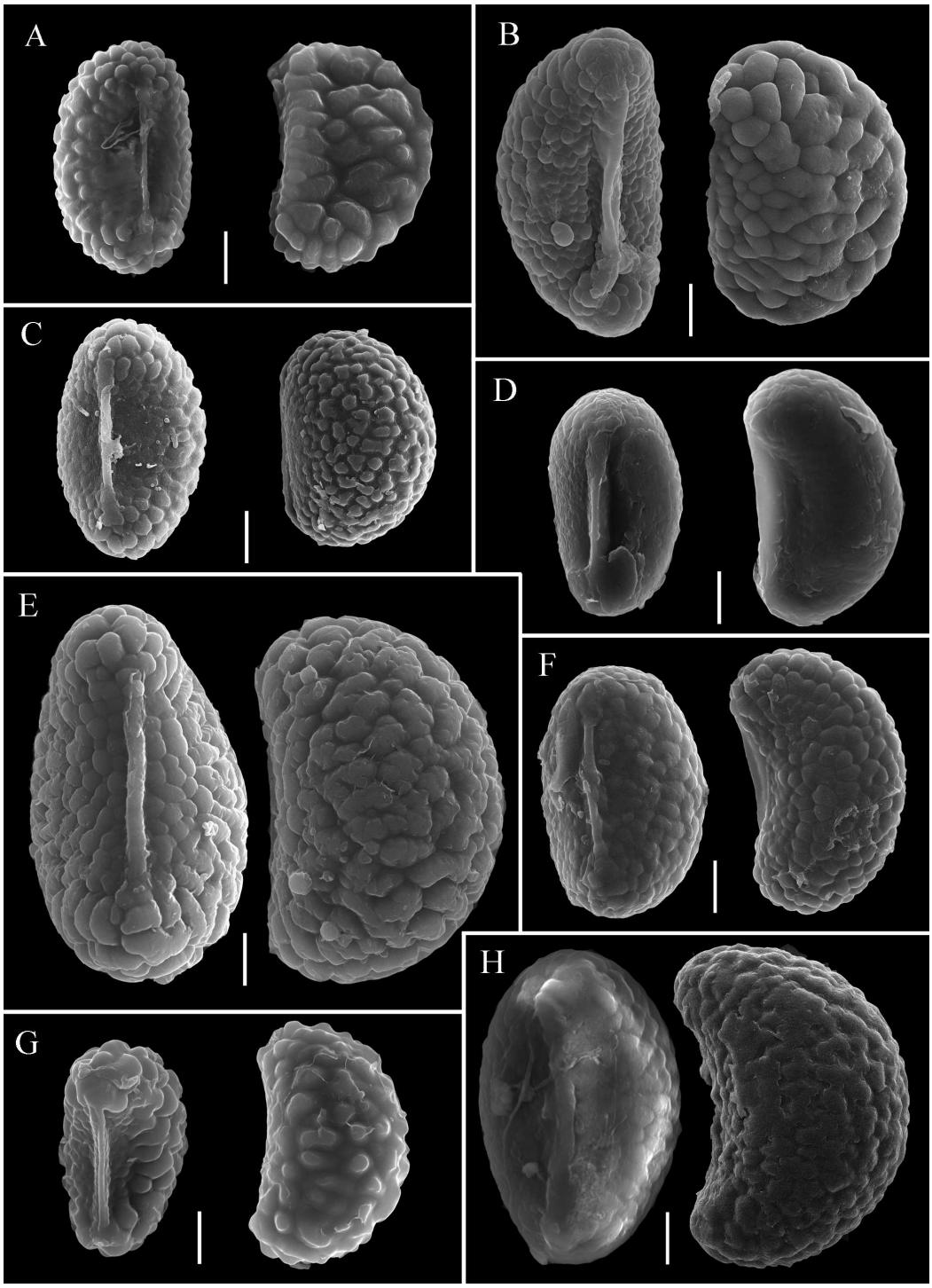


Figure 16. Spores in *Serpocaulon*, Group I. Irregularly depressed verrucae. —A. *S. appressum*, lateral view and ornamentation details from *Mexia 7821* (UC*). —B. *S. australe*, from *de la Sota 2040* (LP), and *Martin & Ospina 2234* (SI*). —C. *S. attenuatum*, from *von Luetzelburg 20341* (R), and *Echeverry 2037* (COL). —D. *S. concolorum*, from *Kessler 11922* (UC). —E. *S. crystalloneuron*, from *Fewerer 8274a* (F). —F. *S. demissum*, from *Salino et al. 14539* (BHCB). —G. *S. intricatum*, from *Kessler 9429* (UC*). —H. *S. lasiopus*, from *Moritz 256* (K*), and *de la Sota 4445* (LP). Scale bars= 10 µm.

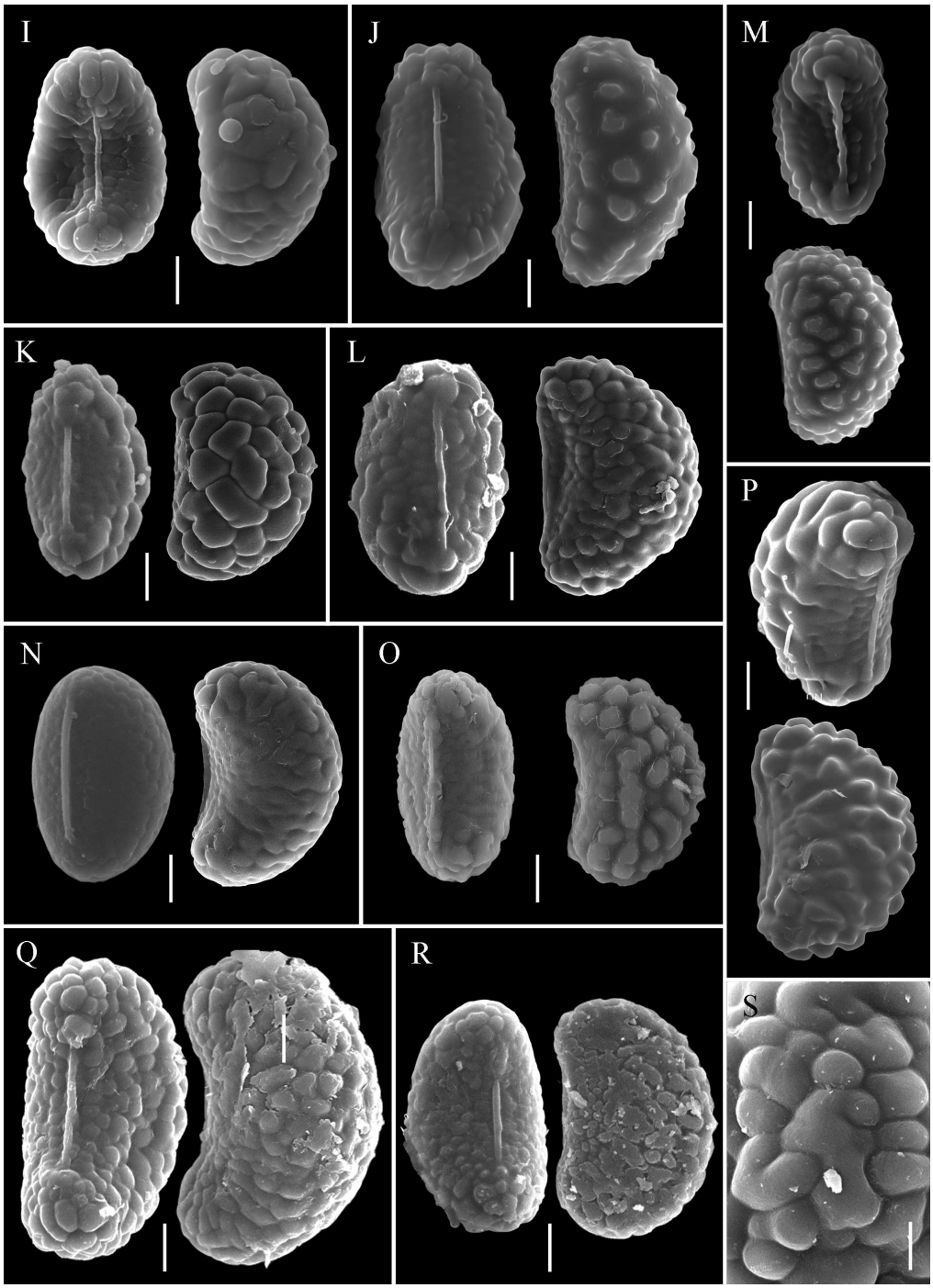


Figure 17. Spores in *Serpocaulon*, Group I. Irregularly depressed verrucae (Continuation). —I. *S. falcaria*, from *Galeoti 6336* (P*) and *Williams 24754* (F). —J. *S. fraxinifolium*, from *Sanín et al.* 7061 (BHCB) and *Sanín & Duarte* 6859 (BHCB). —K & S. *S. funckii*, from *Rodriguez et al. 4133* (HUA). —L. *S. levigatum*, from *Sanín 768* (FAUC) and *Sanín et al*. *3315* (FAUC). —M. *S. meniscifolium*, from *Sanín et al.* 7203 (BHCB) and *Sanín* 7138 (BHBC). —N. *S. nanegalense*, from *Sanín 5067* (FAUC). —O. *S. polystichum*, from *Sanín* 7080 (BHCB). —P. *S. ptilorhizon*, from *Echeverry 195* (HUA). —Q. *S. subandium,* from *Sanín* 5521 (HUA). —R. *S. triseriale,* from *Sanín* 2606 (FAUC). Scale bars, I–R= 10 µm, S= 5 µm. I-R= equatorial and lateral views, S= ornamentation detail.

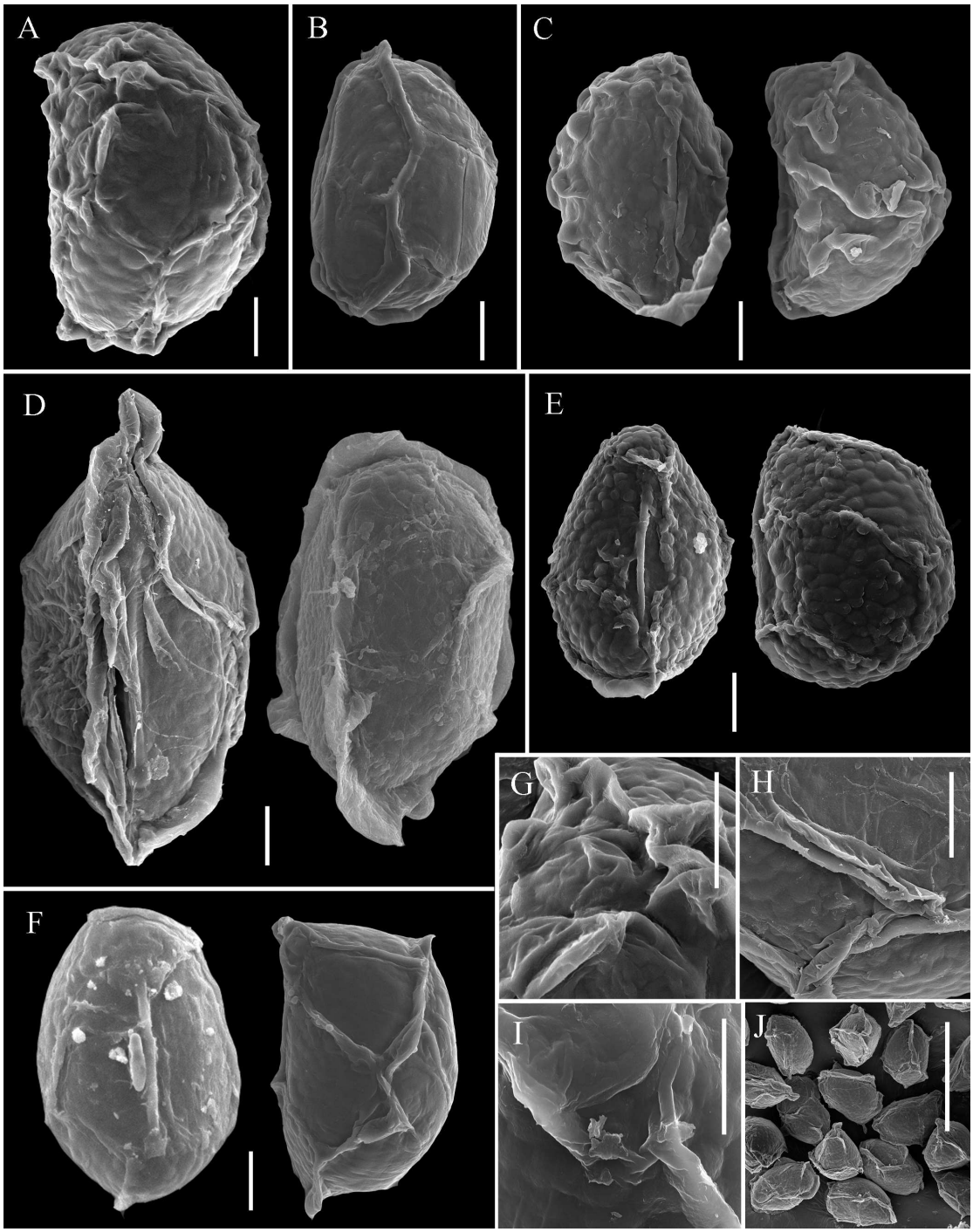


Figure 18. Spores in *Serpocaulon*, Group II. Folded perinae. —A, G. *S. catharinae*, lateral view and ornamentation details from *Sanín 7154* BHCB). —B. *S. dissimile*, lateral view from *Sanín & Santiago 5019* (HUA). —C. *S. glandulosissimum*, equatorial and lateral view from *Brade 10182* (R*). —D, H, J. *S. sessilifolium*, equatorial and lateral view, and ornamentation details from *l'Herminier s.n.* (RB*). —E. *S. vacillans*, equatorial and lateral view from *Sanín et al. 6855* (BHCB), and —F, I. *S. wagneri*, equatorial and lateral view, and ornamentation details from *Fernández-Alonso 16217* (COL). Scale bars, A–I= 10 µm, J= 100 µm. Asterisk pointed types.

Figure 19. Spores in *Serpocaulon*, Group III. Depressed regular verrucae. —A. *S. adnatum*, equatorial and lateral view from *Sanín et al. 6855* (BHCB), —B. *S. eleutherophlebium*, equatorial and lateral view from *Idrovo 3382* (COL). —C. *S. latipes*, equatorial and lateral view from *Sanín et al. 6848* (BHCB). —D. *S. patentissimum*, equatorial and lateral view from *Arbeláez 325* (HUA). Scale bars= 10 µm.

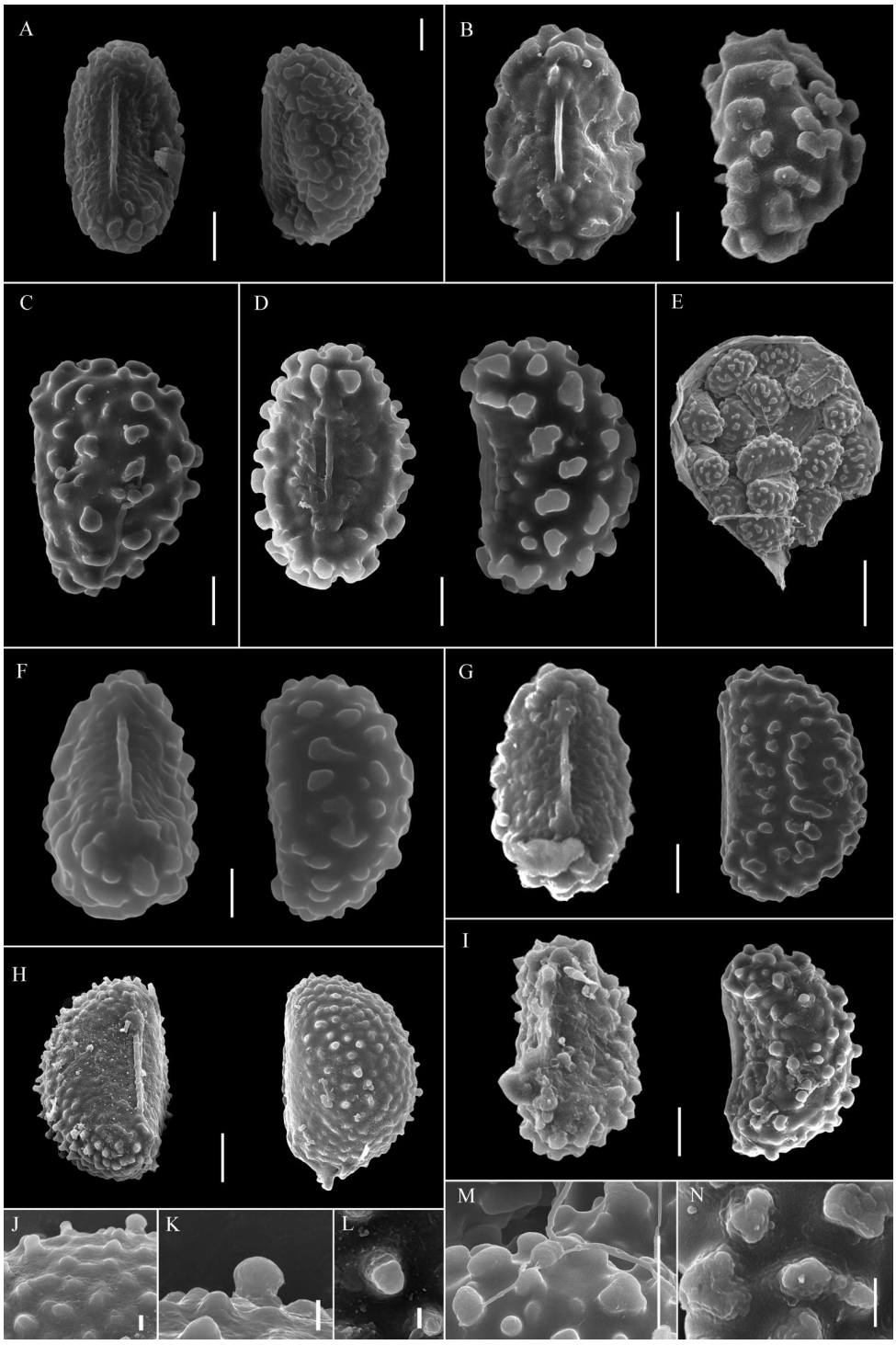


Figure 20. Spores in *Serpocaulon*, Group IV. Prominent verrucae and gemmulate. —A, M. *S. articulatum*, from *Pittier s.n.* (BR*). —B, N. *S. dasypleuron*, from *Schultes 16501* (COL). —C. *S. maritimum*, from *Haegemann & Leist 1750* (COL). —D–E. *S. latissimum*, from *Sanín et al. 5109* (LPB). —F. *S. loriceum*, from *Anonymous s.n.* (P*). —G. *S. psychotrium*, from *Giraldo-Cañas 71* (HUA). —H, J–L. *S. rex*, from *P.B. Schwartsburd & L.M. Alves 2596* (VIC*). —I. *S. richardii*, from *Jaramillo-Mejía et al. 3650* (COL). Scale bars, A–D, F–I, M–N= 10 µm, E= 50 µm, J–L= 1 µm. A–B, D, F–I= equatorial and lateral views, C= lateral view, E= sporangium, J–N= ornamentation details. Asterisk pointed types.

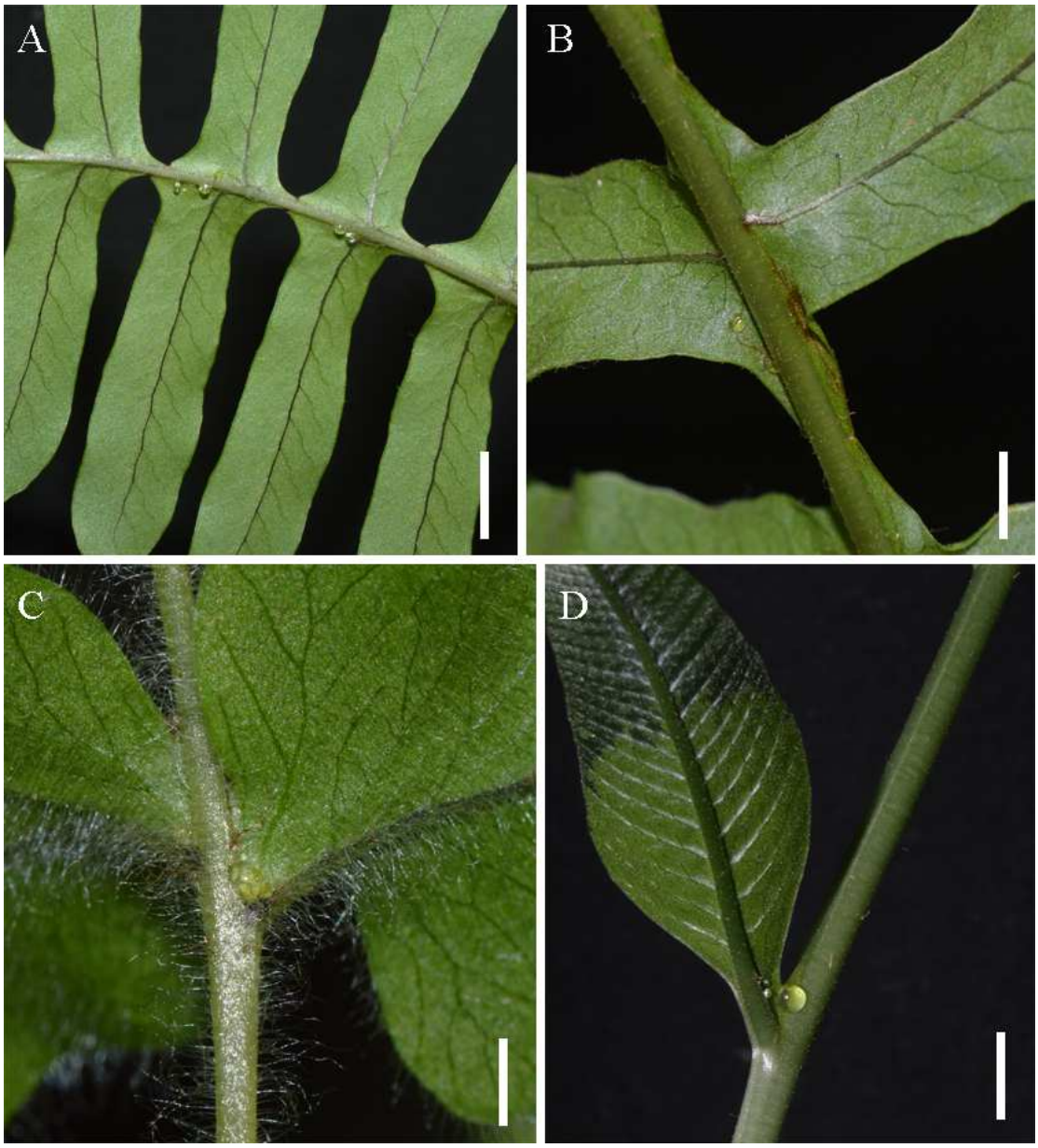


Figure 21. Nectaries in *Serpocaulon*. —A. *S. catharinae*. —B. *S. latipes*, —C. *S. meniscifolium,* —D. *S. rex,* Scale bars= A, D= 1 cm, B- C= 5 mm.

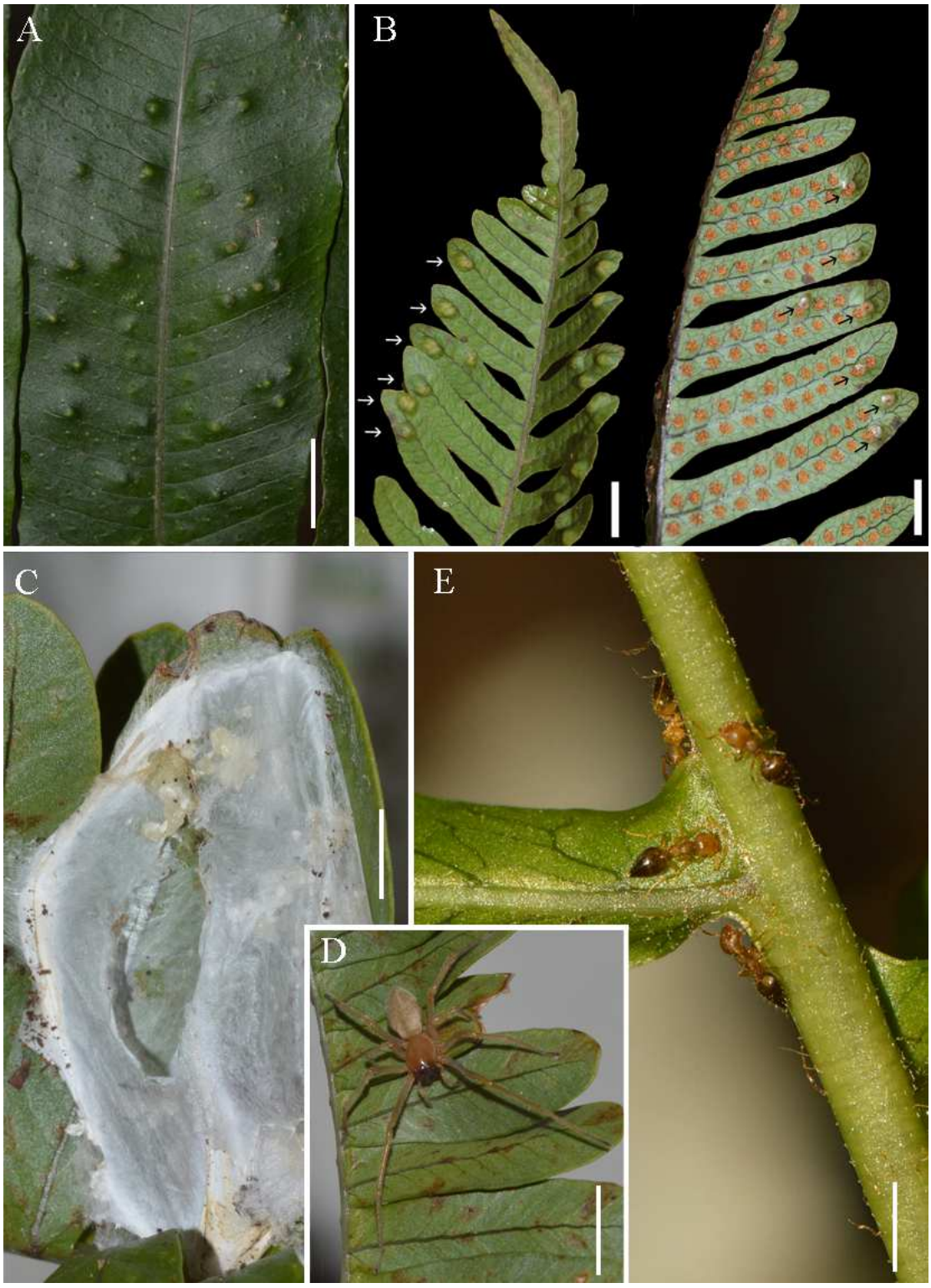


Figure 22. *Serpocaulon* interactions with other groups. —A. Galls in *S. adnatum*. —B. Galls in *S. catharinae.* —C. Spider nest of *Anyphaenoides* sp., Anyphaenidae in *S. demissum.* —D. Spider *Anyphaenoides* sp., Anyphaenidae in *S. demissum.* —E. Ants of *Crematogaster* sp., Formicidae, harvesting in *S.* ×*tabuleirense* nectaries. Scale bars, A= 1 cm, B= 1 cm, C= 1 mm, D= 1 cm, E= 5 mm.

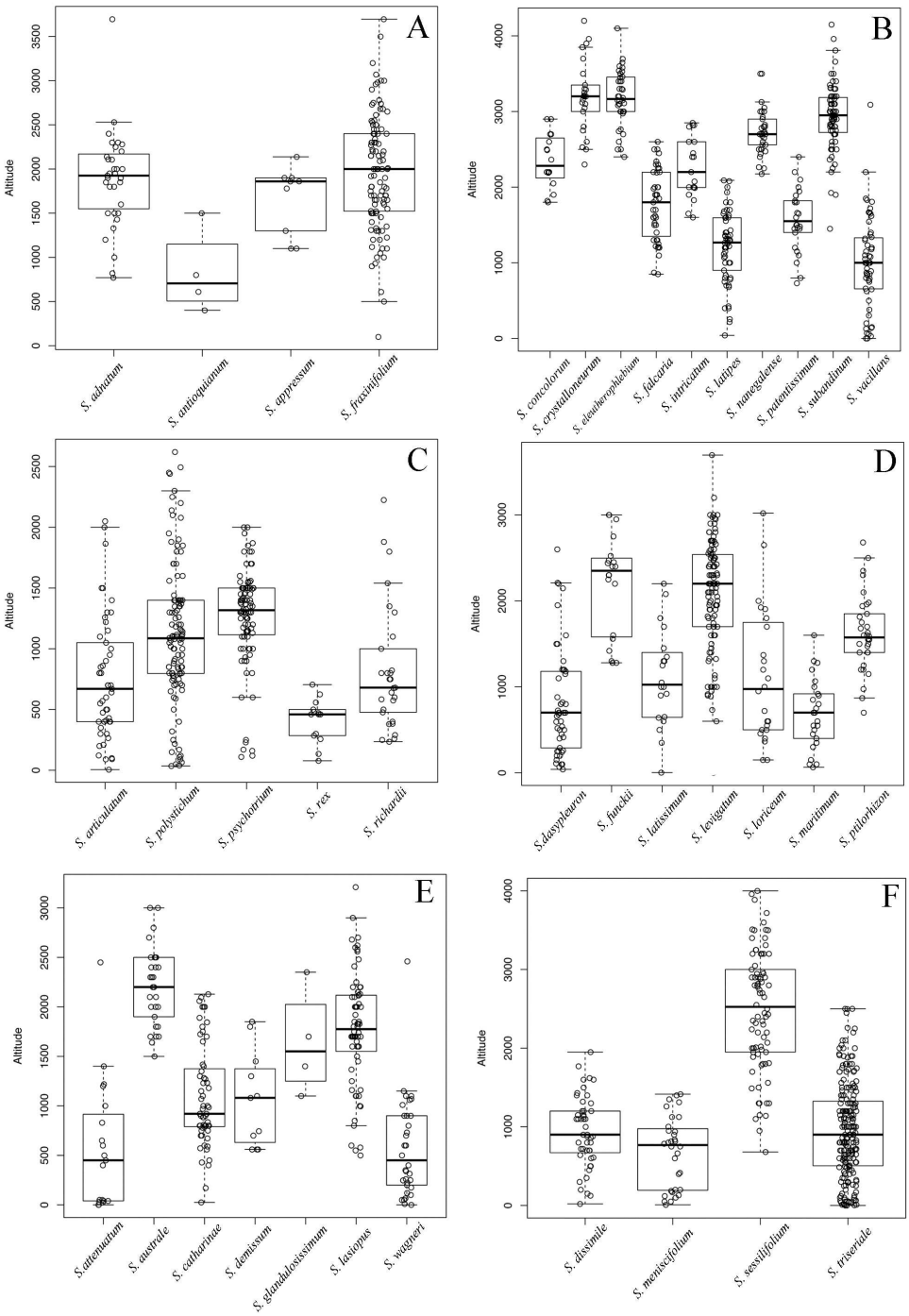


Figure 23. Elevational distribution of *Serpocaulon* species. —A. Species with pinnate laminae, long-creeping rhizome and appressed scales. —B. Species with pinnatisect laminae, long-creeping rhizome and patent scales. —C. Species with pinnate laminae, long-creeping rhizome and patent scales. —D. Species with pinnatisect laminae, long-creeping rhizome and appressed scales. —E. Species with pinnatisect laminae, short-creeping rhizome and appressed scales. —F. Species with pinnate laminae (or pinnate proximally and pinnatisect distally as *S. dissimile*), short-creeping rhizome and patent scales.

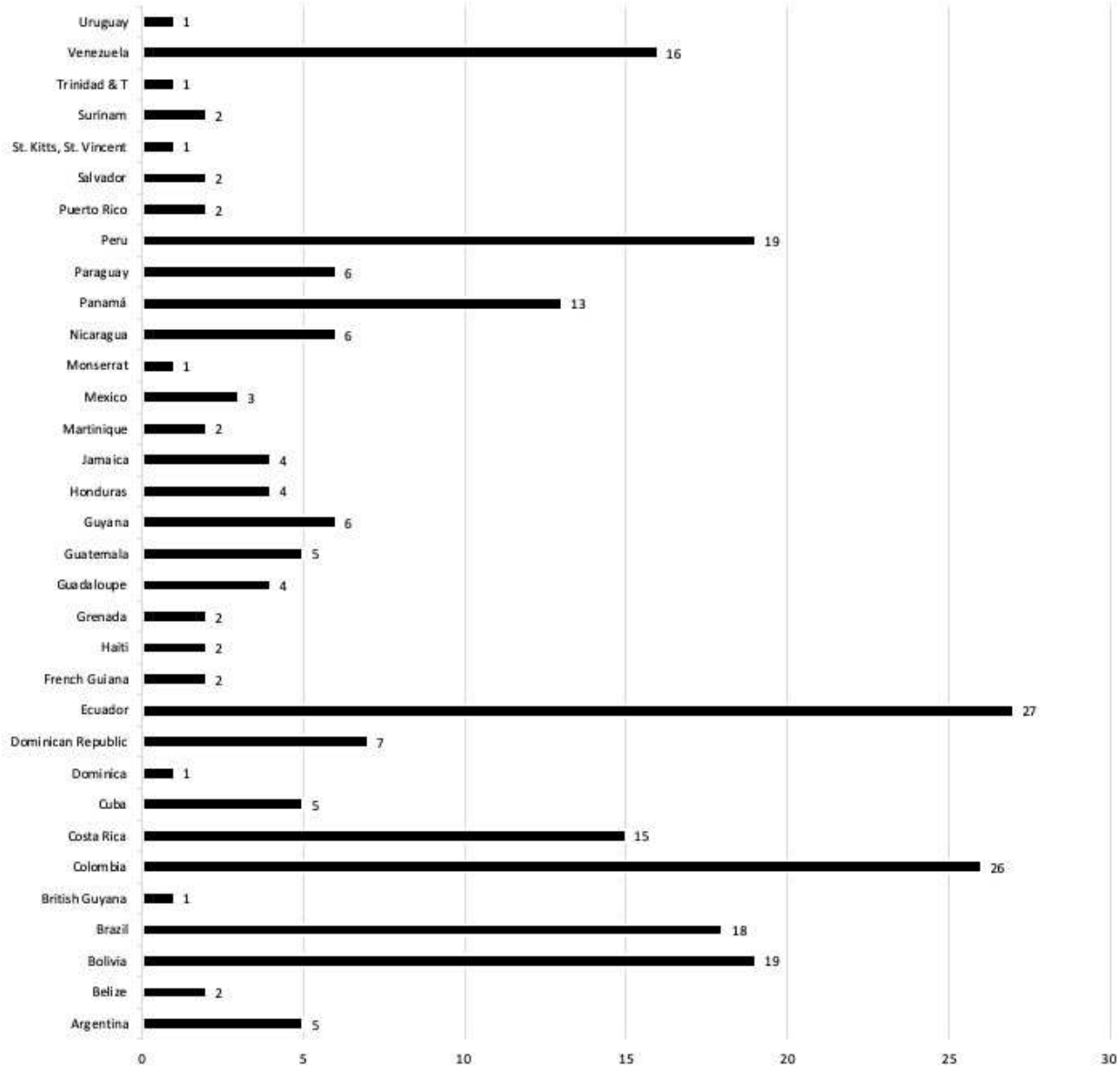


Figure 24. Distribution of *Serpocaulon* species by country.

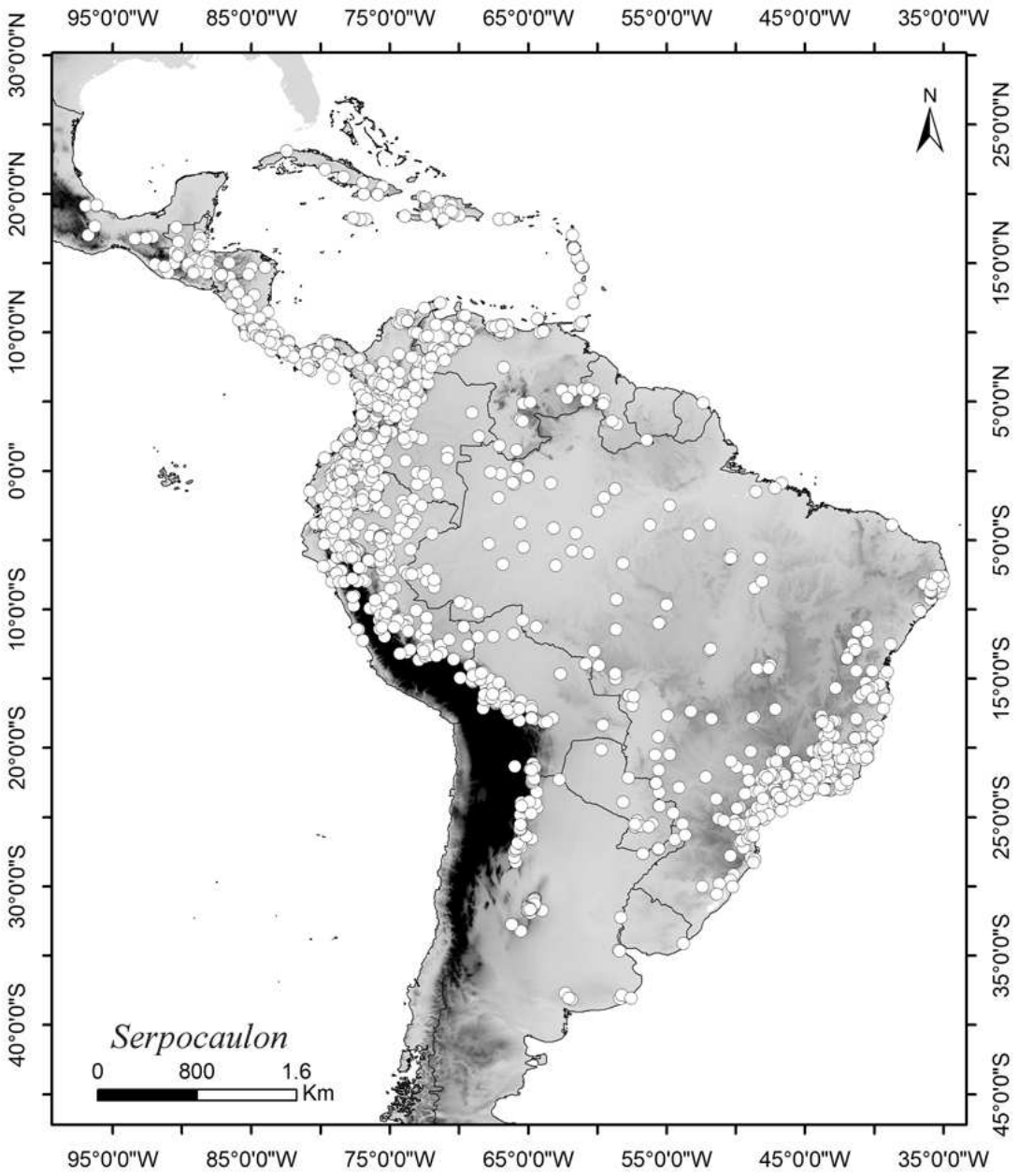


Figure 25. Distribution of all *Serpocaulon* specimens examined.

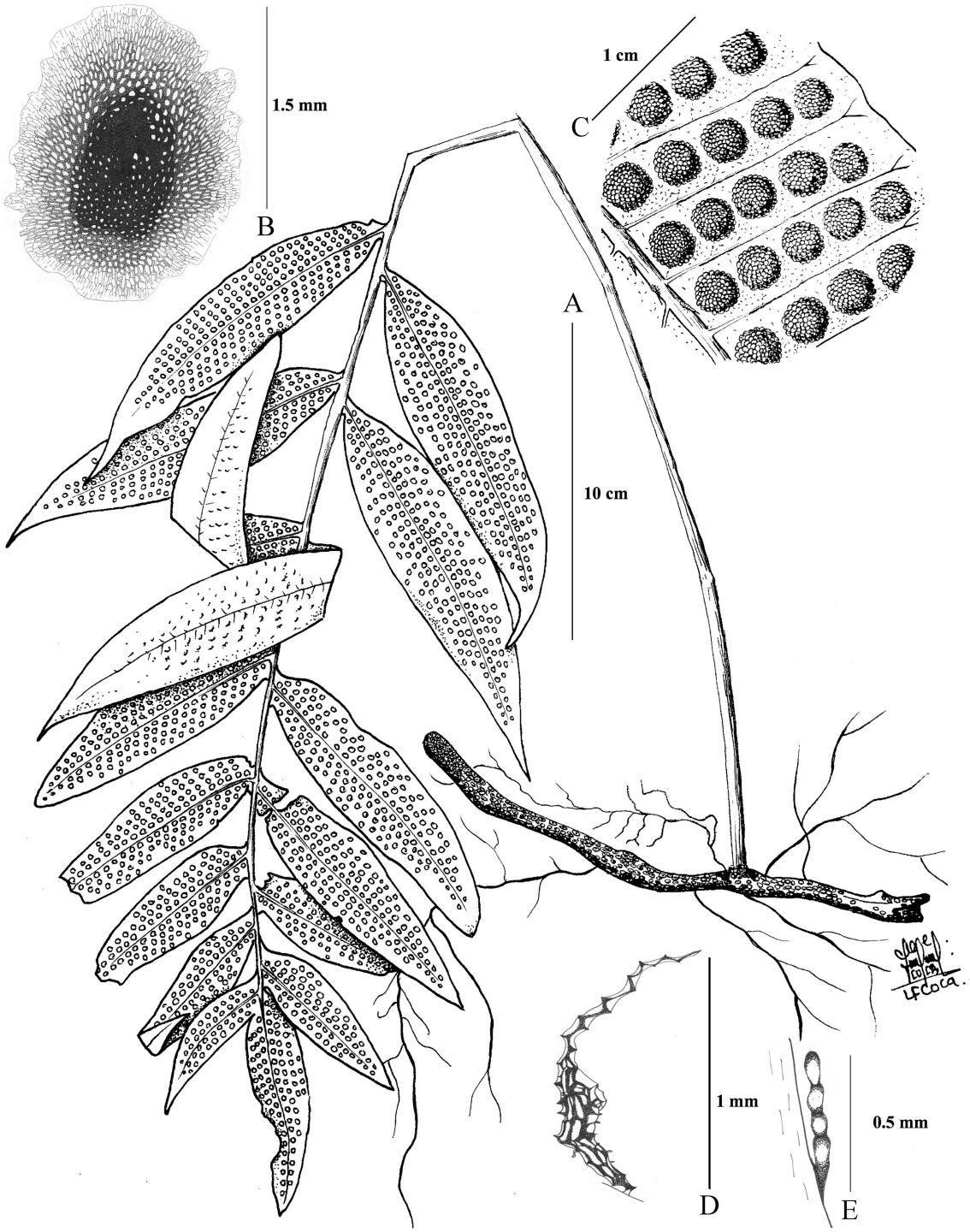


Figure 26. *Serpocaulon adnatum.* —A. Habit. —B. Rhizome scale. —C. Middle segments. —D. Laminar scale. —E. Laminar trichome. All from *Sanín 4192* (FAUC).

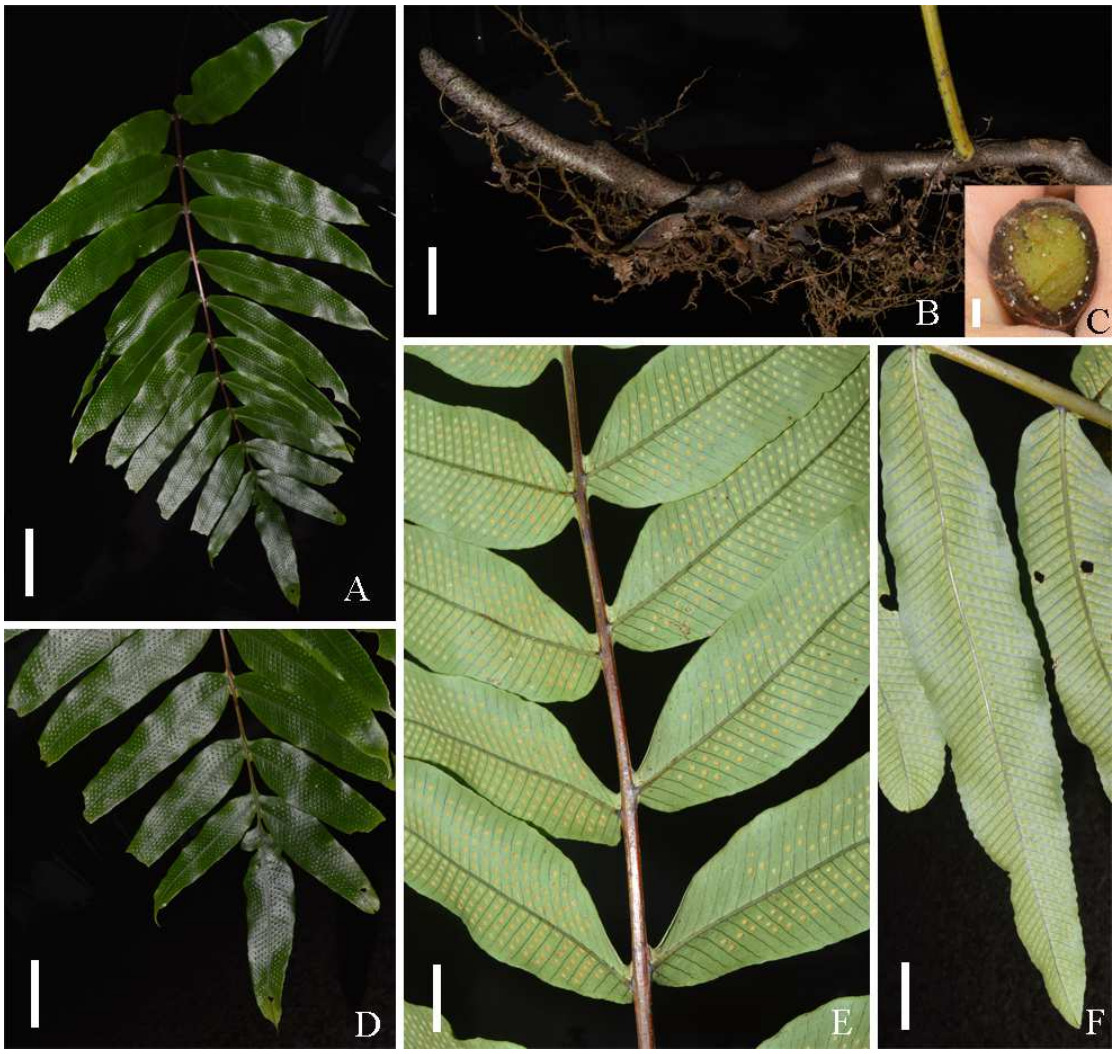


Figure 27. *Serpocaulon adnatum.* —A. Lamina. —B. Rhizome. —C. Rhizome cross-section. —D. Apex of the lamina. —E. Adnate pinna insertion. —F. Proximal pinna. Scale bars, A= 10 cm, B= 2 cm, C= 2 mm, D= 5 cm, E–F= 2 cm. All from *Sanín et al. 6870* (HUA).

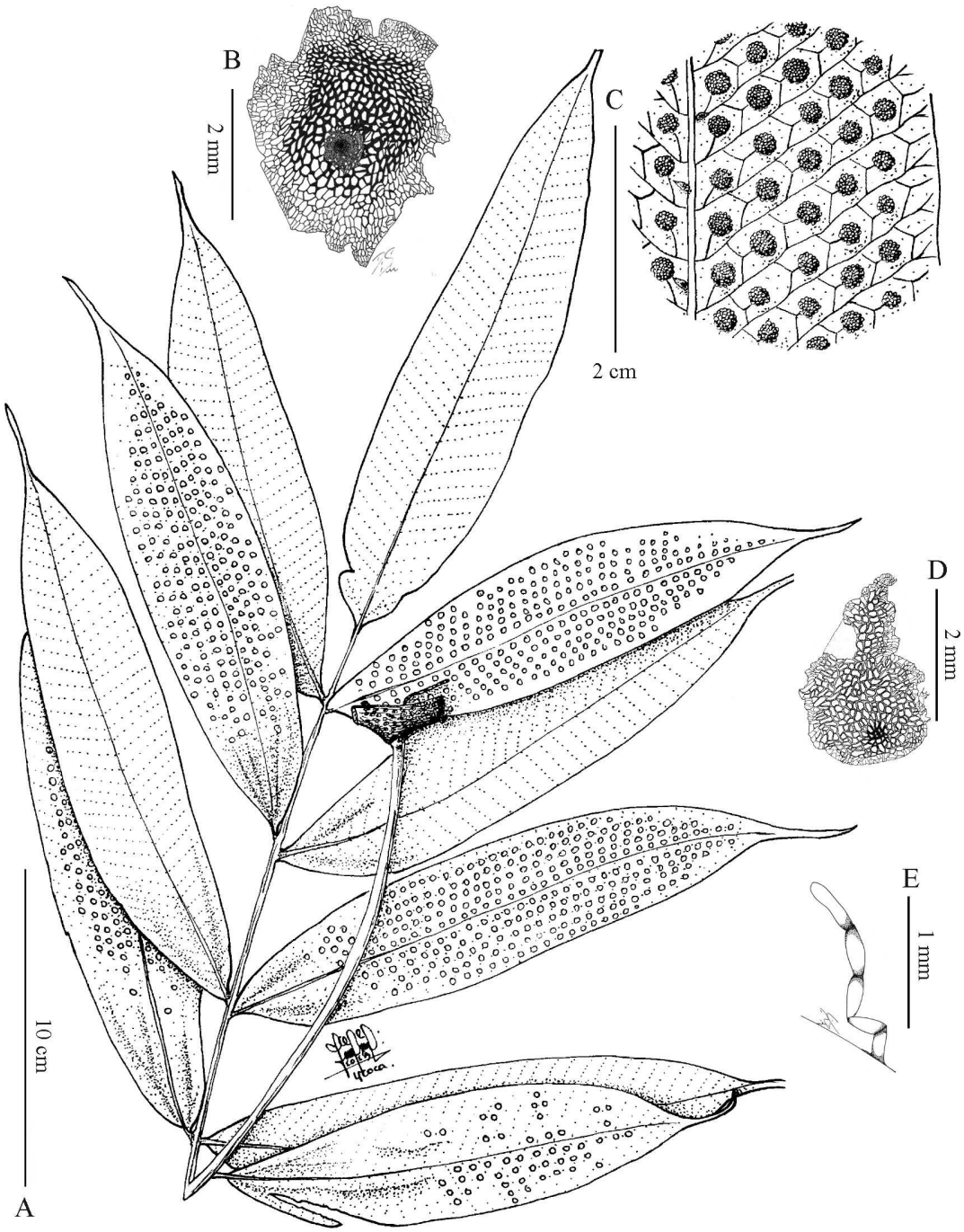


Figure 28. *Serpocaulon antioquianum.* —A. Habit. —B. Rhizome scale. —C. Middle pinna veins. —D. Laminar scale. —E. Laminar trichome. All from *Hoyos 816,* (JAUM).

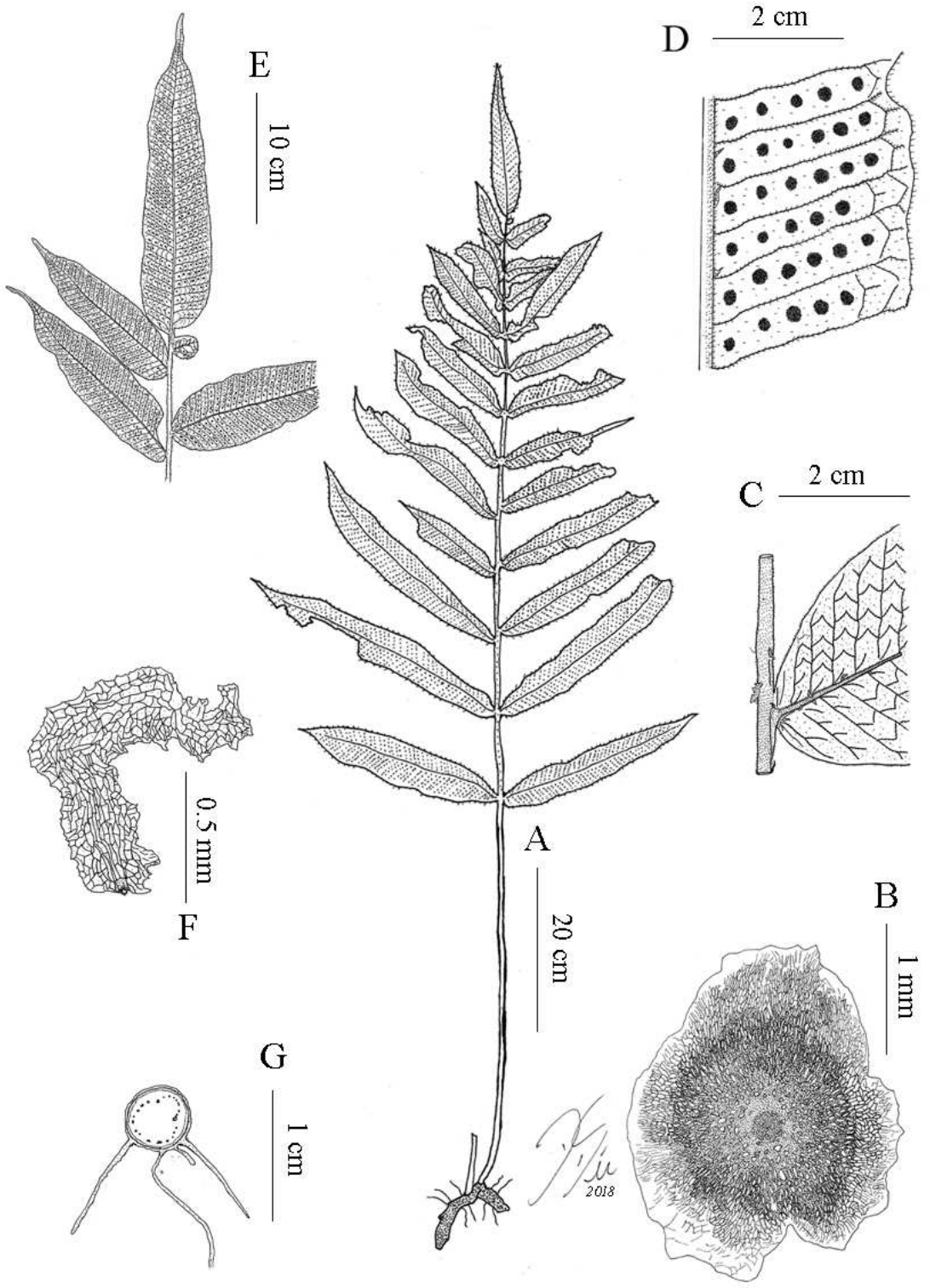


Figure 29. *Serpocaulon appressum.* —A. Habit. —B. Rhizome scale. —C. Middle segments veins. —D. Laminar scale. —E. Laminar trichome. All from *Sanín et al. 7055* (HUA).

Figure 30. *Serpocaulon appressum.* —A. Habit. —B. Rhizome and its cross-section. —C. Abaxial view of the sterile lamina. —D. Adaxial view of the fertile lamina. —E. Pinna insertion in the rachis. —F. Conform apical pinna and lateral sessile pinna. —G. Abaxial view of the fertile lamina. —H. Pubescence in the costae. Scales bars, A= 10 cm, B= 1 cm and 5 mm, C= 2 cm, D= 1 cm, E= 2 cm, F= 4 cm, G= 1 cm, H= 5 mm. All from *Sanín et al. 7055* (HUA). Photos by W. Testo.

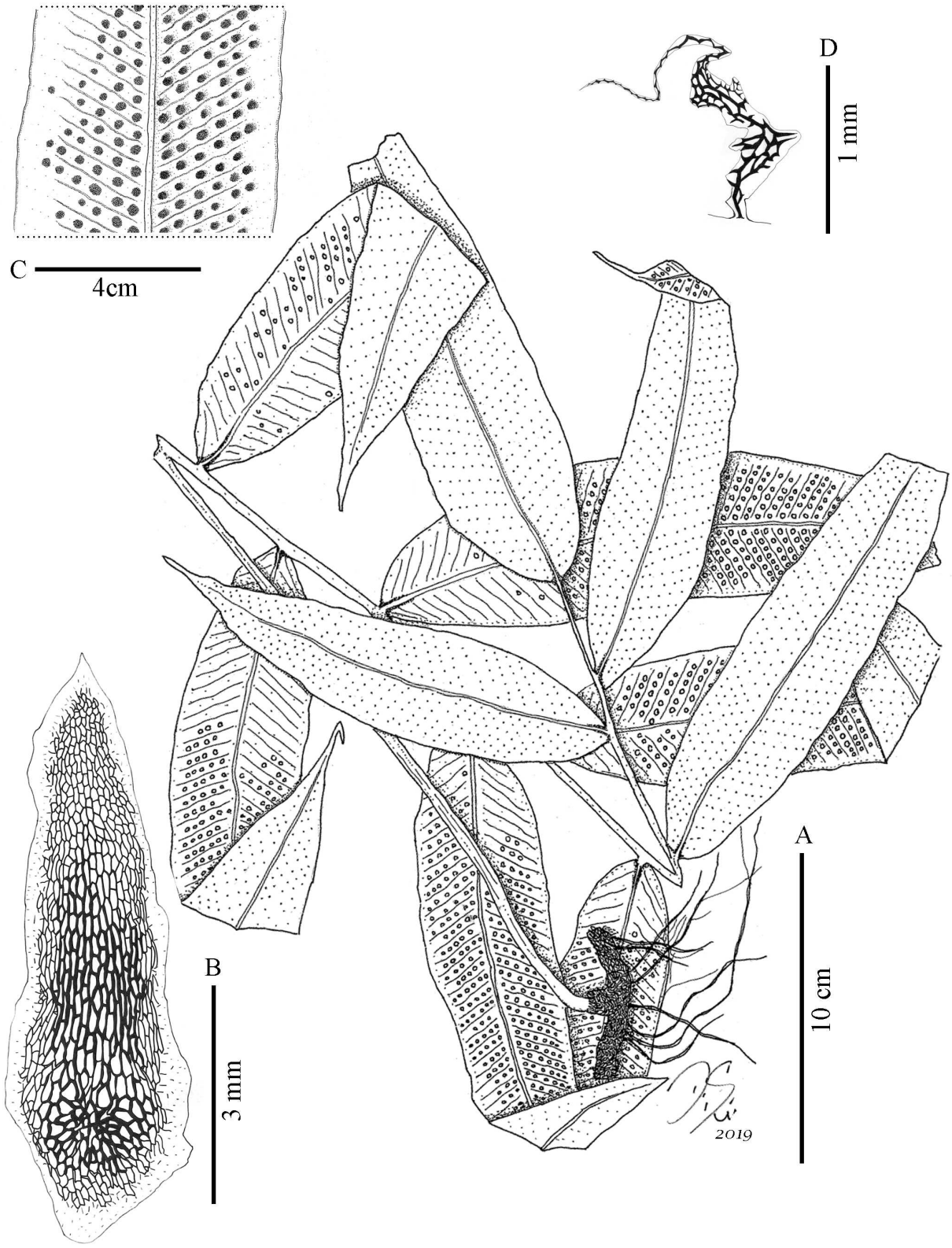


Figure 31. *Serpocaulon articulatum.* —A. Habit. —B. Rhizome scale. —C. Middle segments. —D. Laminar scale. All from *Sanín 2976* (FAUC).

Figure 32. *Serpocaulon articulatum.* —A. Habit. —B. Rhizome. —C. Rhizome cross-section. —D. Adaxial view of the pinnae. —E. Lamina apex with conform terminal pinna. —F. Abaxial view of the fertile pinnae. Scales bars, A= 7 cm, B= 6 mm, C= 4 mm, D= 2 cm, E= 5 cm, F= 1 cm. All from *Sanín 6151* (COL).

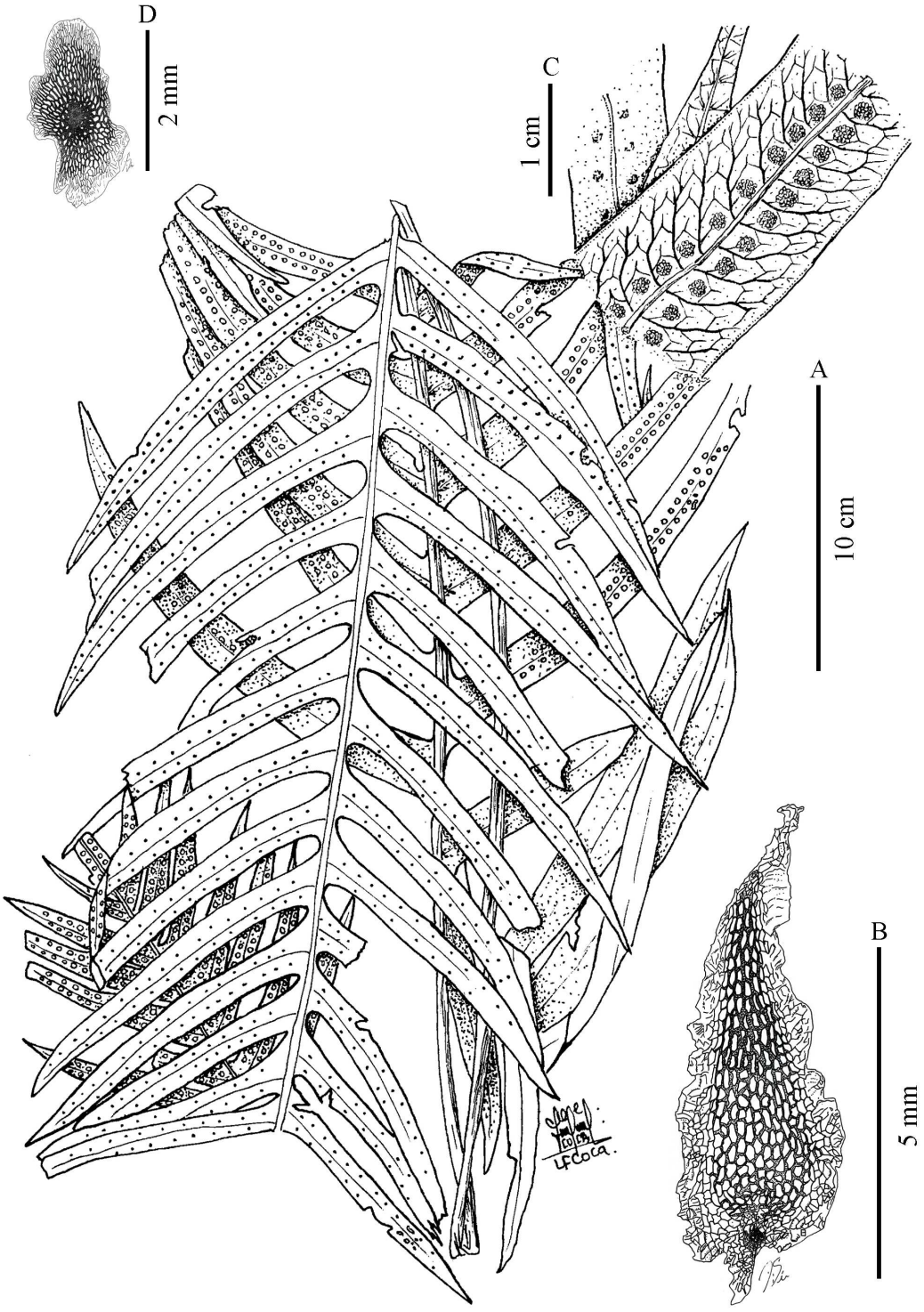


Figure 33. *Serpocaulon attenuatum.* —A. Habit. —B. Rhizome scale. —C. Middle segments. —D. Laminar scale. A, C from *Echeverry 2037* (COL), B, D from *Pitieri 2621* (BR*).

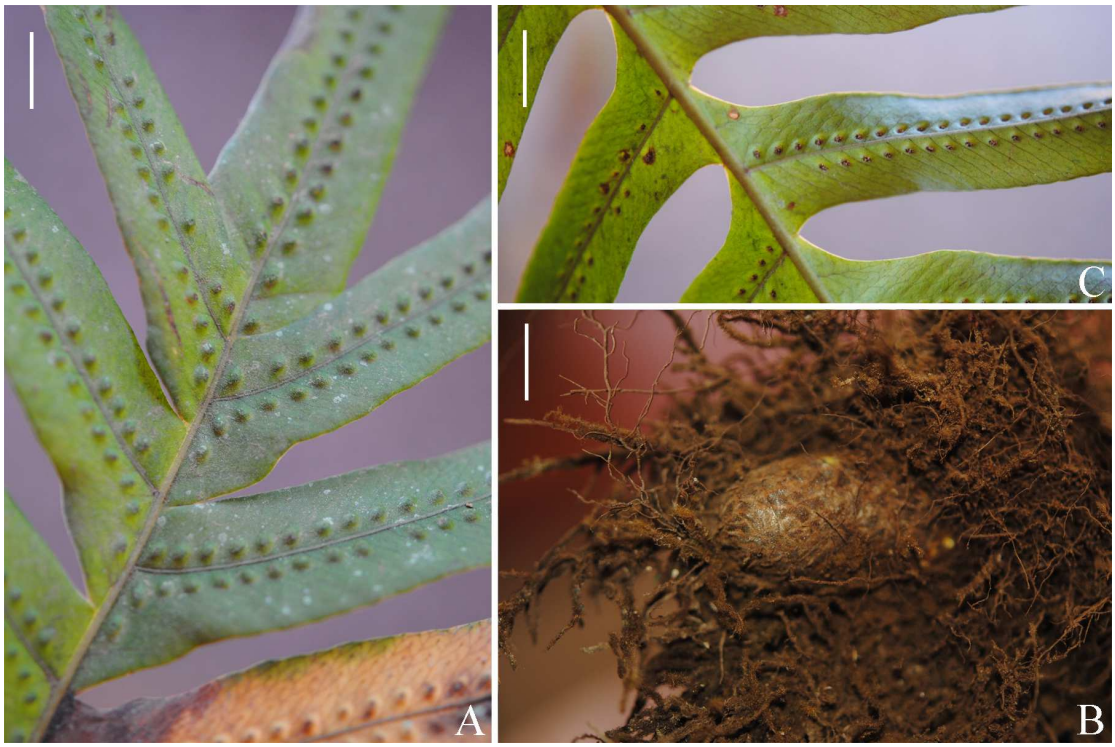


Figure 34. *Serpocaulon attenuatum.* —A. Pinnatisect apex of the lamina. —B. Rhizome. —C. Middle segment. Scale bars, A= 2 cm, B= 1 cm, C= 2 cm. All from *Testo 1241* (VT).

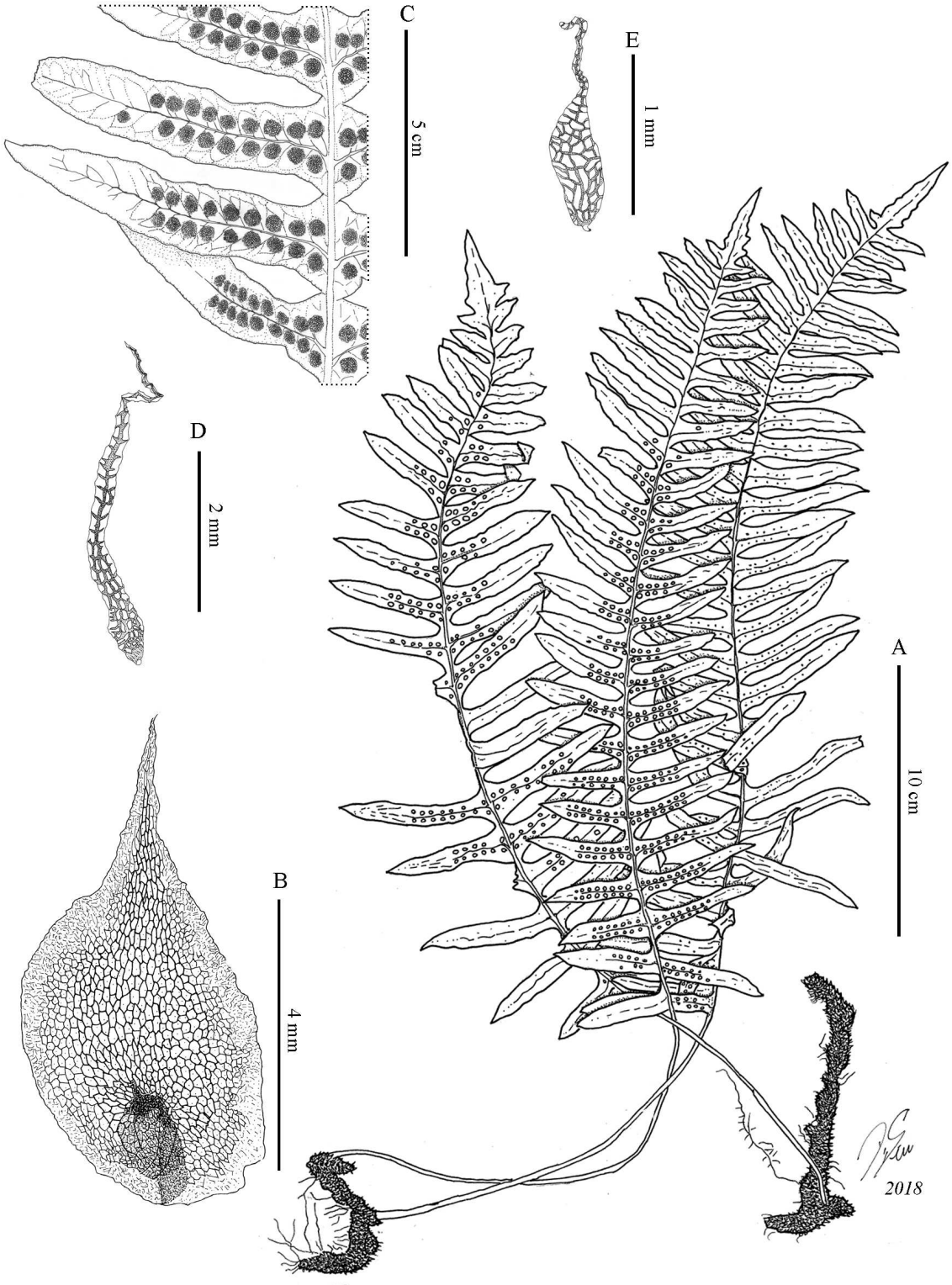


Figure 35. *Serpocaulon australe.* —A. Habit. —B. Rhizome scale. —C. Middle segments. —D–E. Laminar scales. All from *Marítn & Ospina 2234* (SI*).

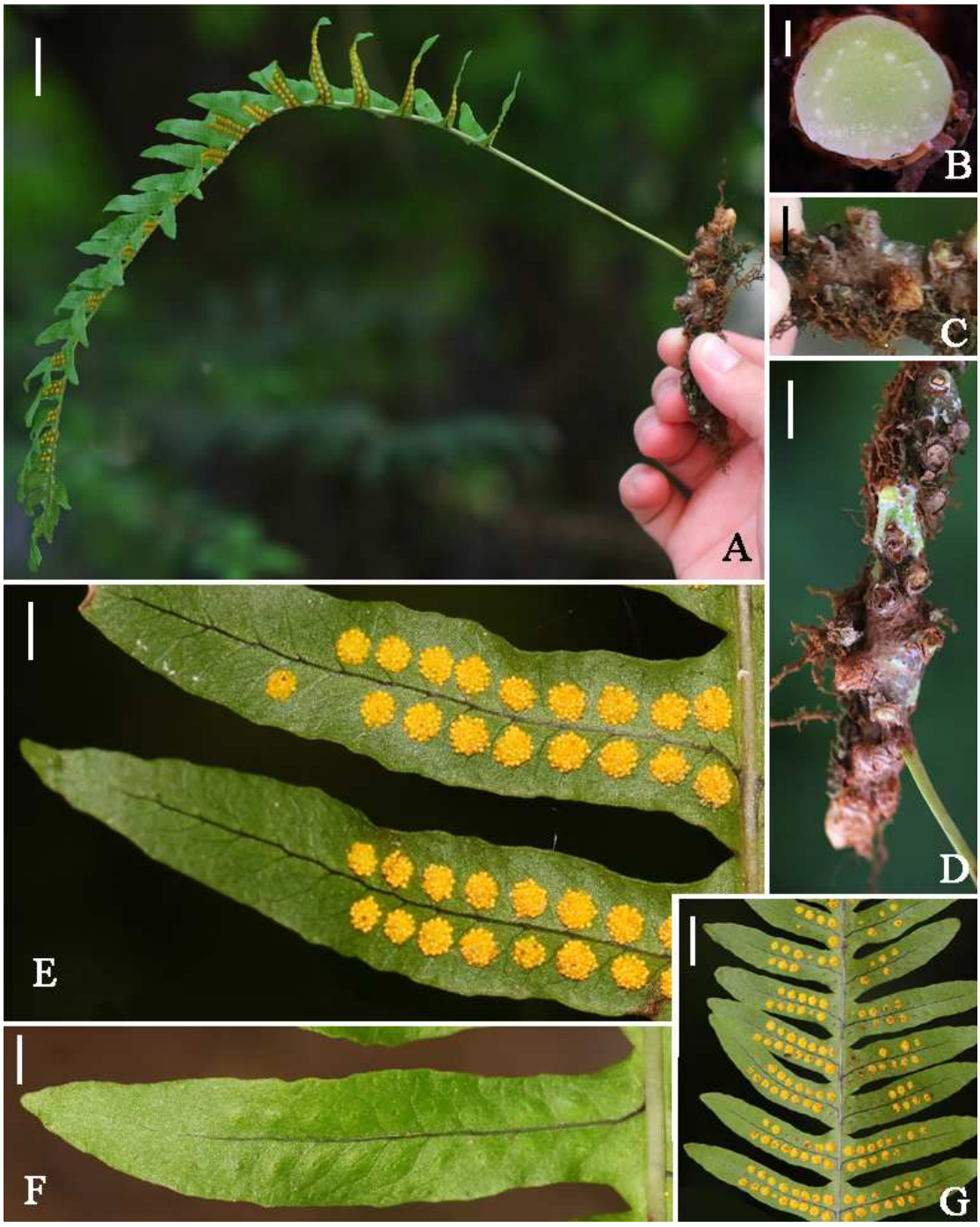


Figure 36. *Serpocaulon australe.* —A. Habit. —B. Rhizome cross-section. —C. Details of the phyllopodia. —D. Rhizome. —E. Abaxial view of the fertile segment. —F. Adaxial view of the fertile segment. —G. Abaxial view of the fertile lamina. Scale bars, A= 3 cm, B= 1 mm, C= 1 cm, D= 2 cm, E= 5 mm, F= 3 mm, G= 1 cm All from *Martins & Ospina 2234* (SI*). Photos by C. Martins.

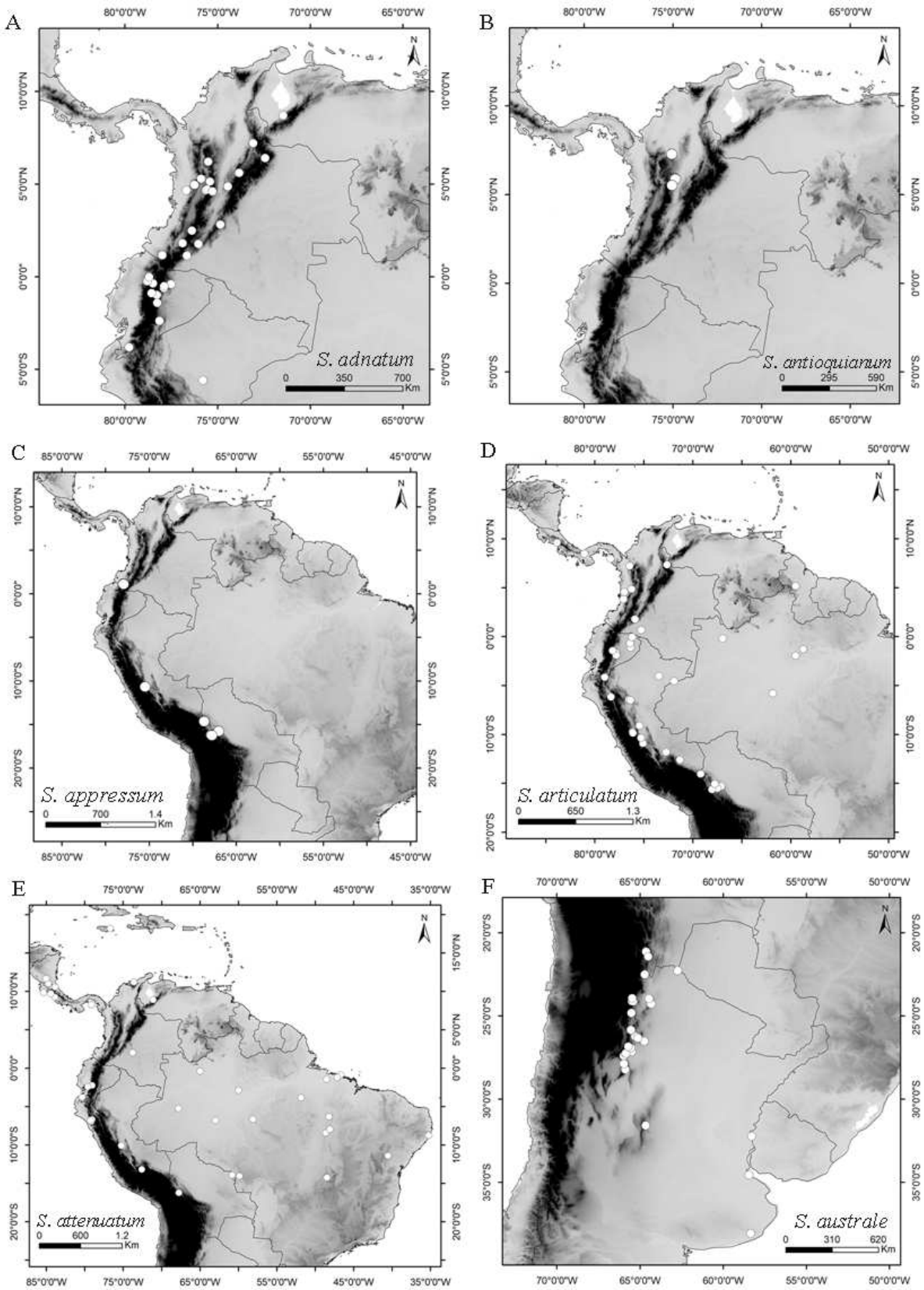


Figure 37. Distribution of *Serpocaulon adnatum*, *S. antioquianum*, *S. appressum*, *S. articulatum*, *S. attenuatum*, and *S. australe*.

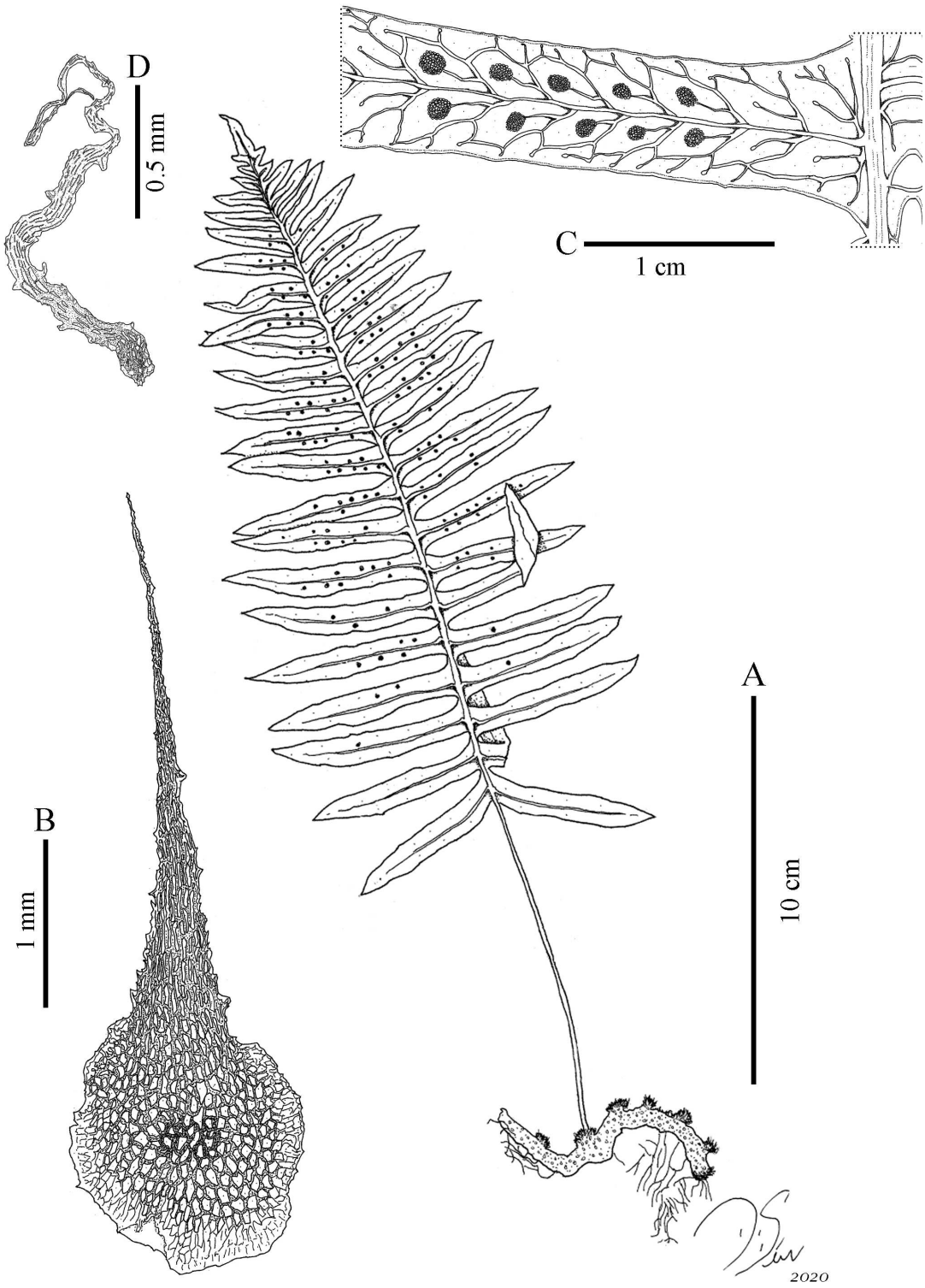


Figure 38. *Serpocaulon catharinae.* —A. Habit. —B. Rhizome scale. —C. Middle segment. —D. Lamina scale. All from *Sanín 7154* (BHCB).

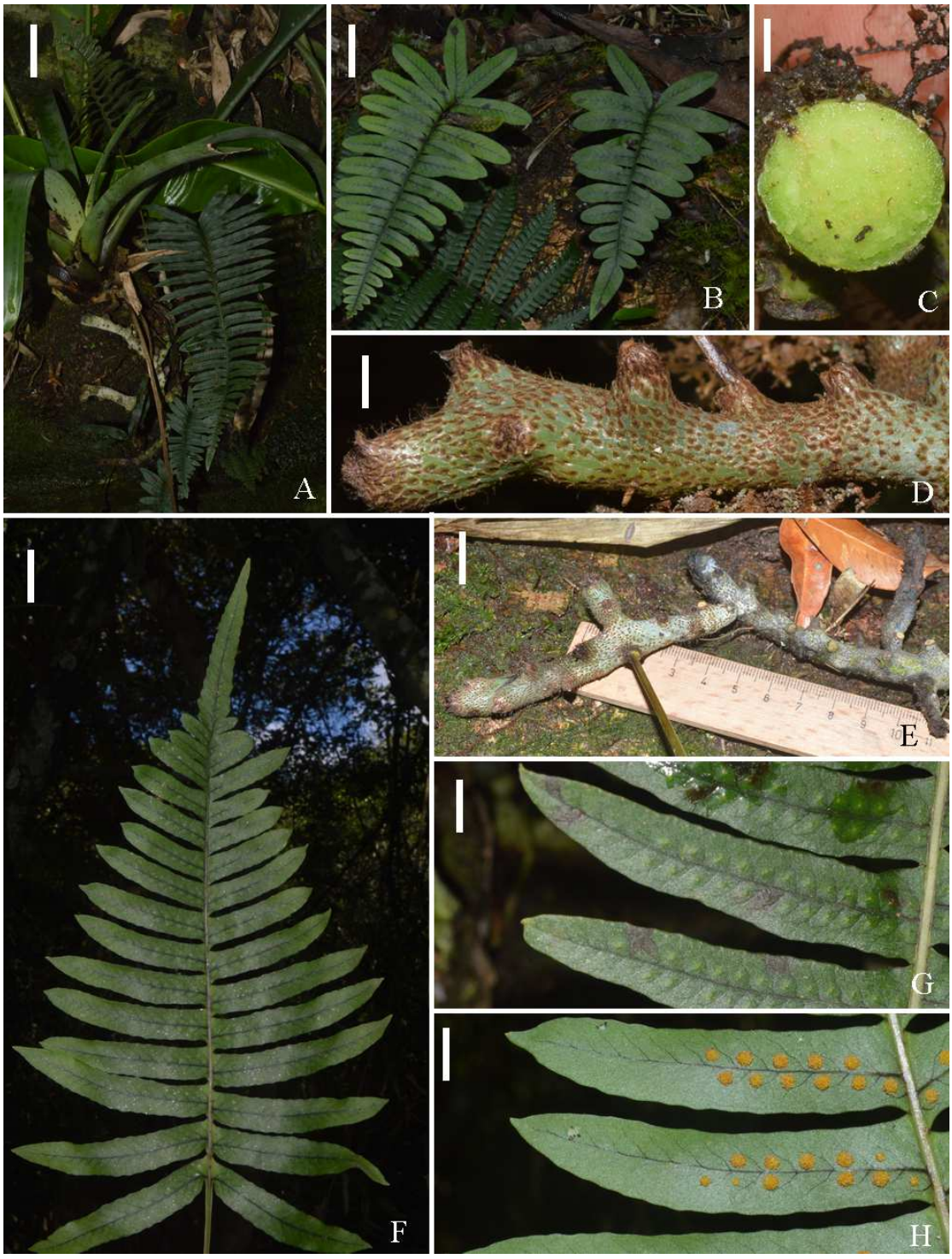


Figure 39. *Serpocaulon catharinae.* —A. Epiphytic plant. —B. Terrestrial plant. —C. Rhizome cross-section. —D. Rhizome farely pruinose. —E. Pruinose rhizome. —F. Lamina. —G. Adaxial view of the segments. —H. Abaxial view of the segments. Scale bars, A= 3 cm, B= 2 cm, C= 2 mm, D= 5 mm, E= 1.5 cm, F= 1.5 cm, G–H= 5 mm. A–D from *Sanín et al. 7154* (BHCB), E–H from *Sanín 7154* (BHCB).

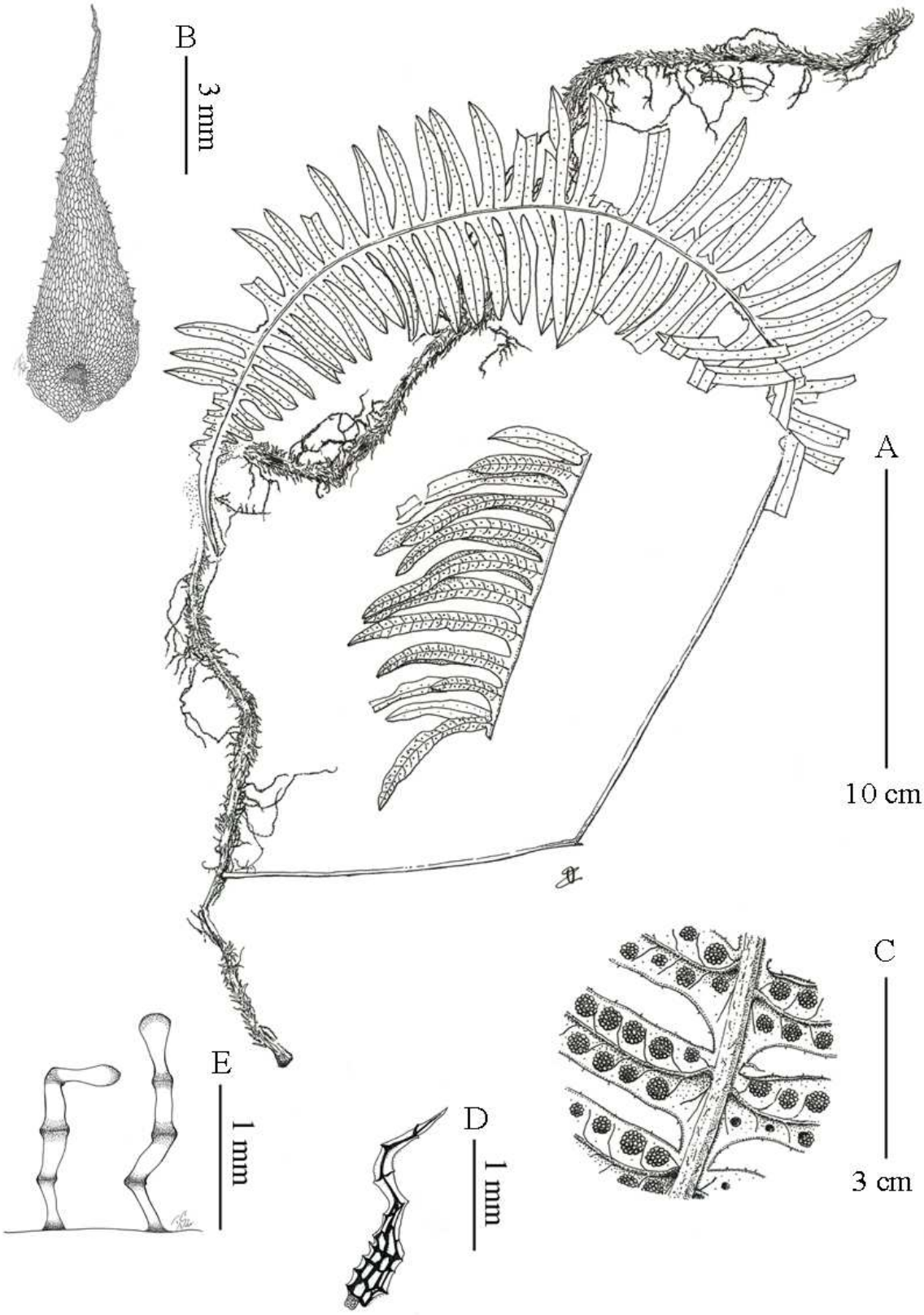


Figure 40. *Serpocaulon concolorum.* —A. Habit. —B. Rhizome scale. —C. Middle segment. —D. Laminar scale. —E. Laminar trichome. All from *Hagemann & H. Leist 1898* (PSO).

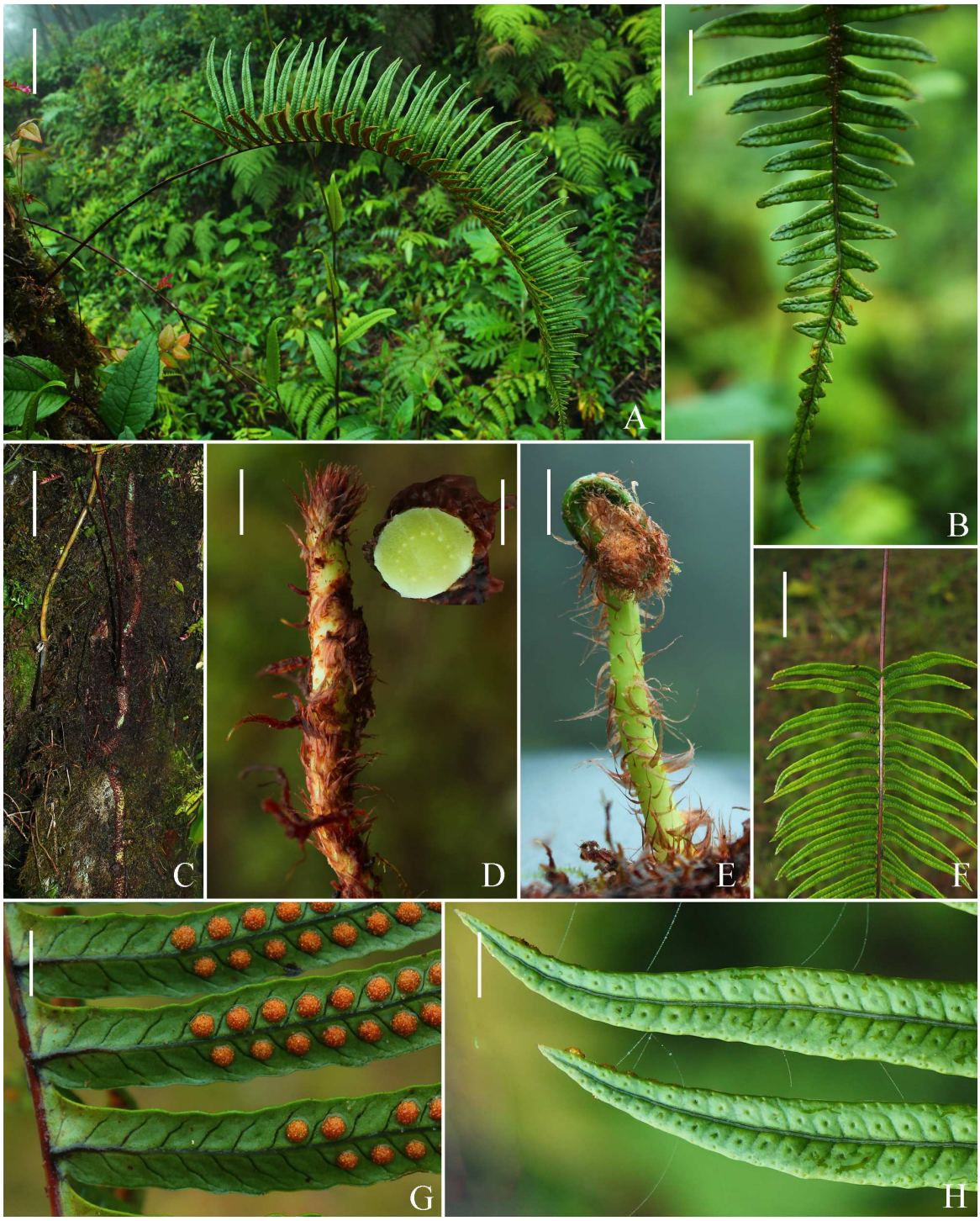


Figure 41. *Serpocaulon concolorum.* —A. Habit. —B. Lamina apex. —C. Rhizome. —D. Rhizome apex and cross-section. —E. Fiddlehead. —F. Lamina base. —G. Fertile abaxial surface. —H. Adaxial surface of the middle segments. Scale bars, A= 5 cm, B= 2 cm, C= 5 cm, D= 1 cm and 3 mm, E= 1 cm, F= 4 cm, G= 6 mm, H= 5 mm. All from *Sanín & Peña 6371* (COL).

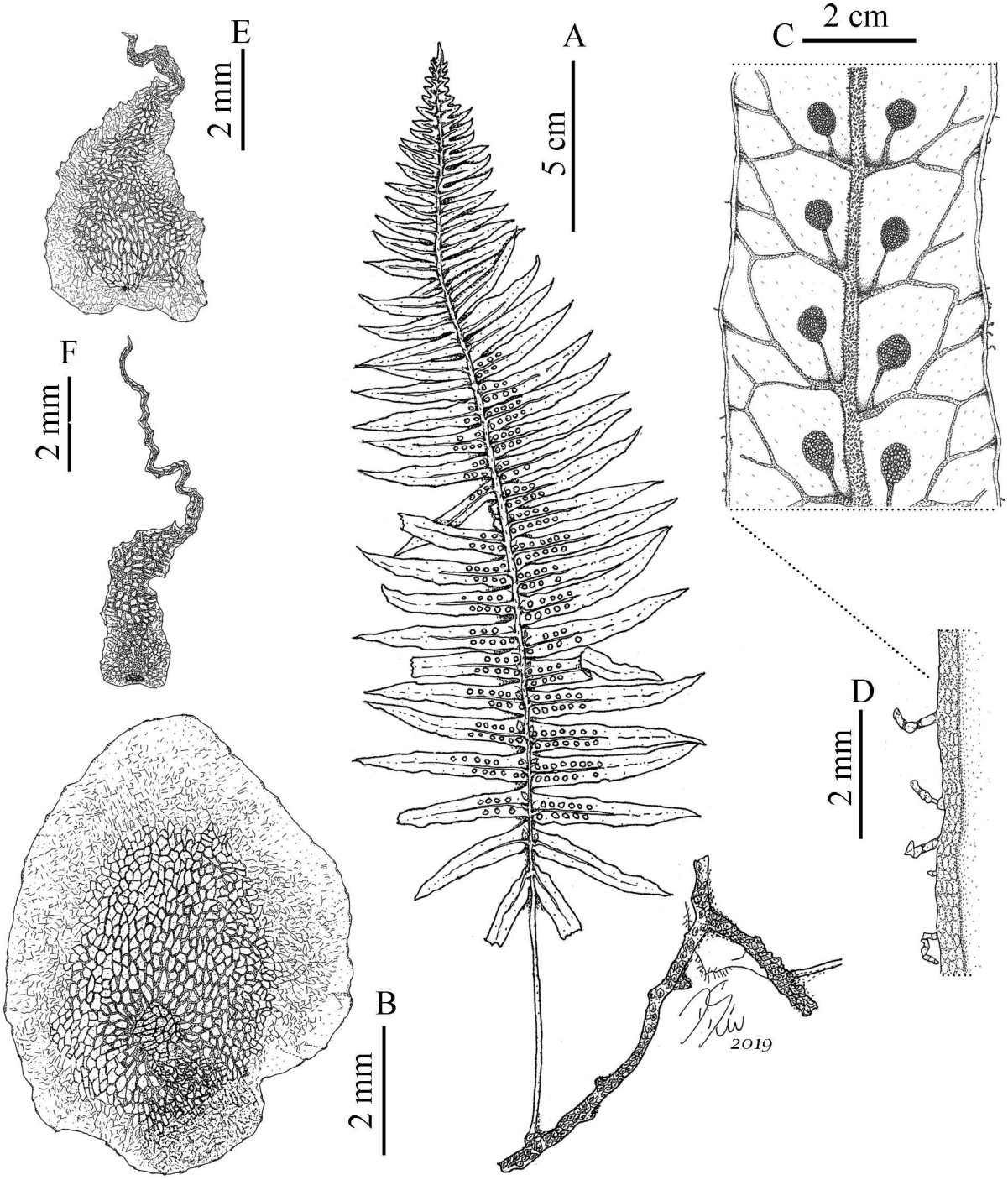


Figure 42. *Serpocaulon crystalloneurum*. —A. Habit. —B. Rhizome scale. —C. Detail of the middle segment. —D. Marginal trichomes. —E–F. Laminar scales. A–B, E–F from *Salinas 2807* (LPB), C–D from *Buchtieni 421* (L).

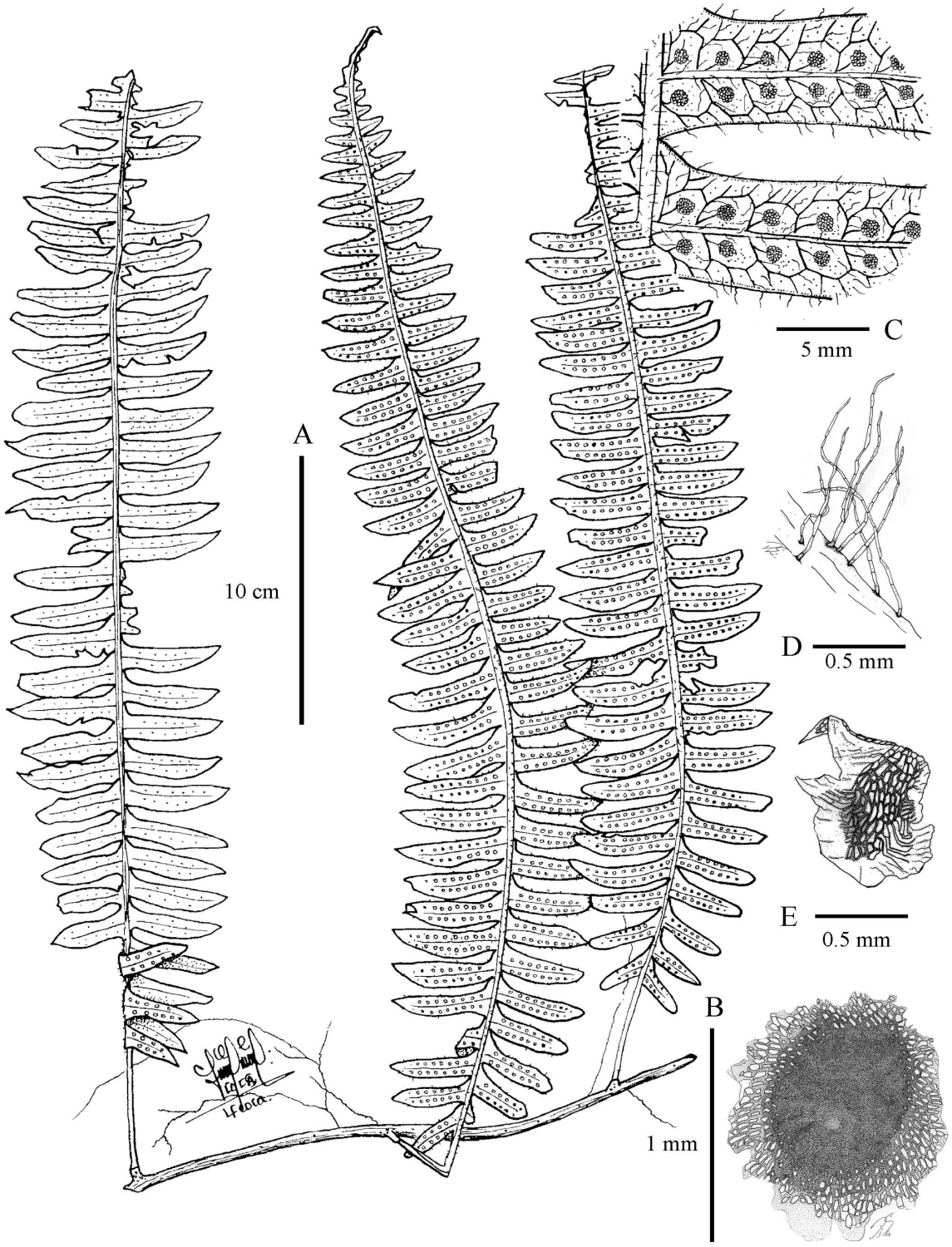


Figure 43. *Serpocaulon dasypleuron.* —A. Habit. —B. Rhizome scale. —C. Middle segments. —D. Laminar scale. —E. Trichomes. All from *Fonnegra 375* (HUA).

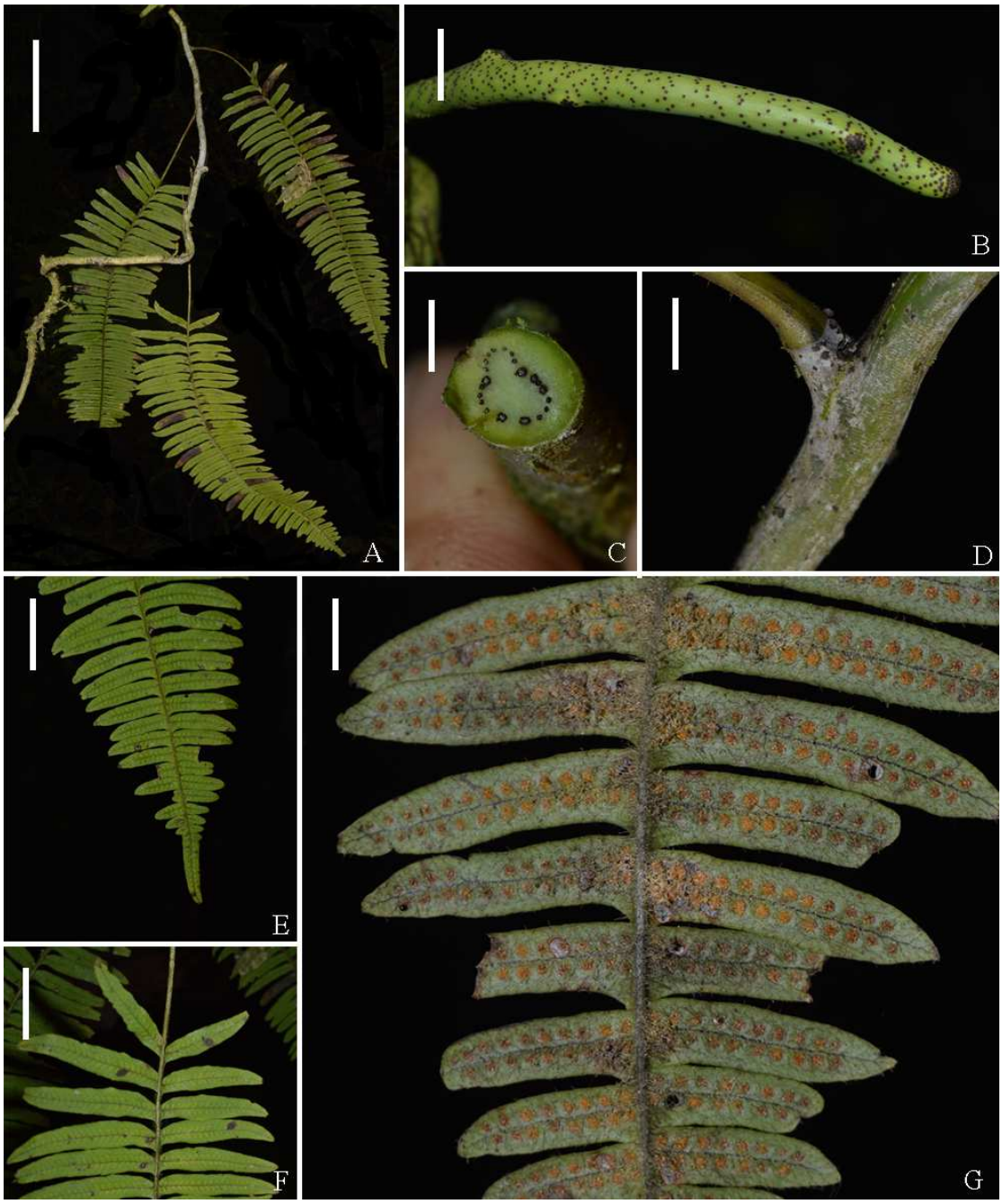


Figure 44. *Serpocaulon dasypleuron.* —A. Habit. —B. Rhizome. —C. Rhizome cross-section. —D. Rhizome pruinosity and phyllopodium. —E. Lamina apex. —F. Lamina base. —G. Abaxial view of the fertile lamina with the details of the pubescence in the costae. Scale bars, A= 10 cm, B= 5 mm, C= 5 mm, D= 1 cm, E= 2 cm, F= 2.5 cm, G= 5 mm. All from *Sanín et al. 6050* (COL).

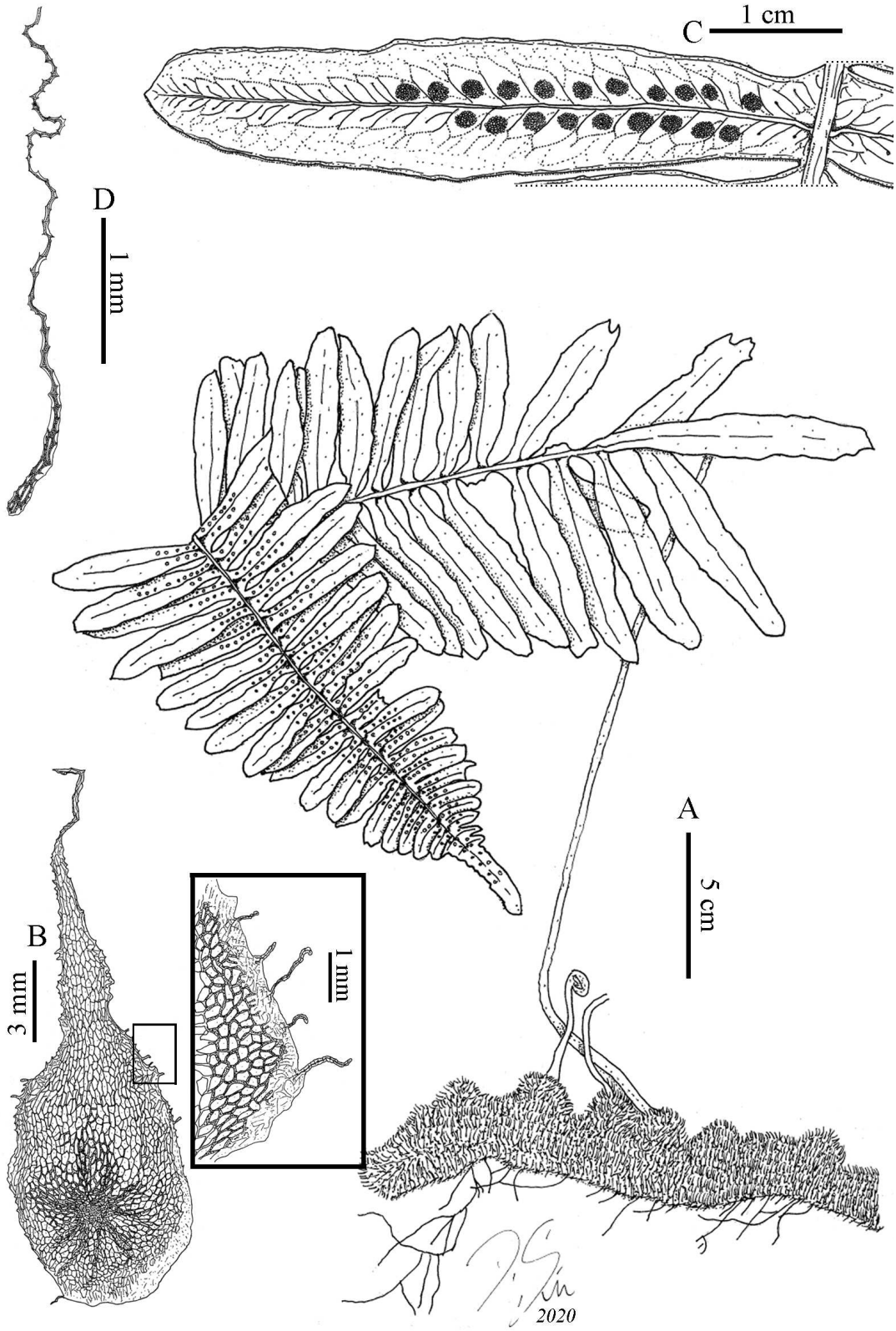


Figure 45. *Serpocaulon demissum.* —A. Habit. —B. Rhizome scale and marginal projections. —C. Detail of the middle segment. —D. Lamina scale. All from *Sanín 7229* (BHCB).

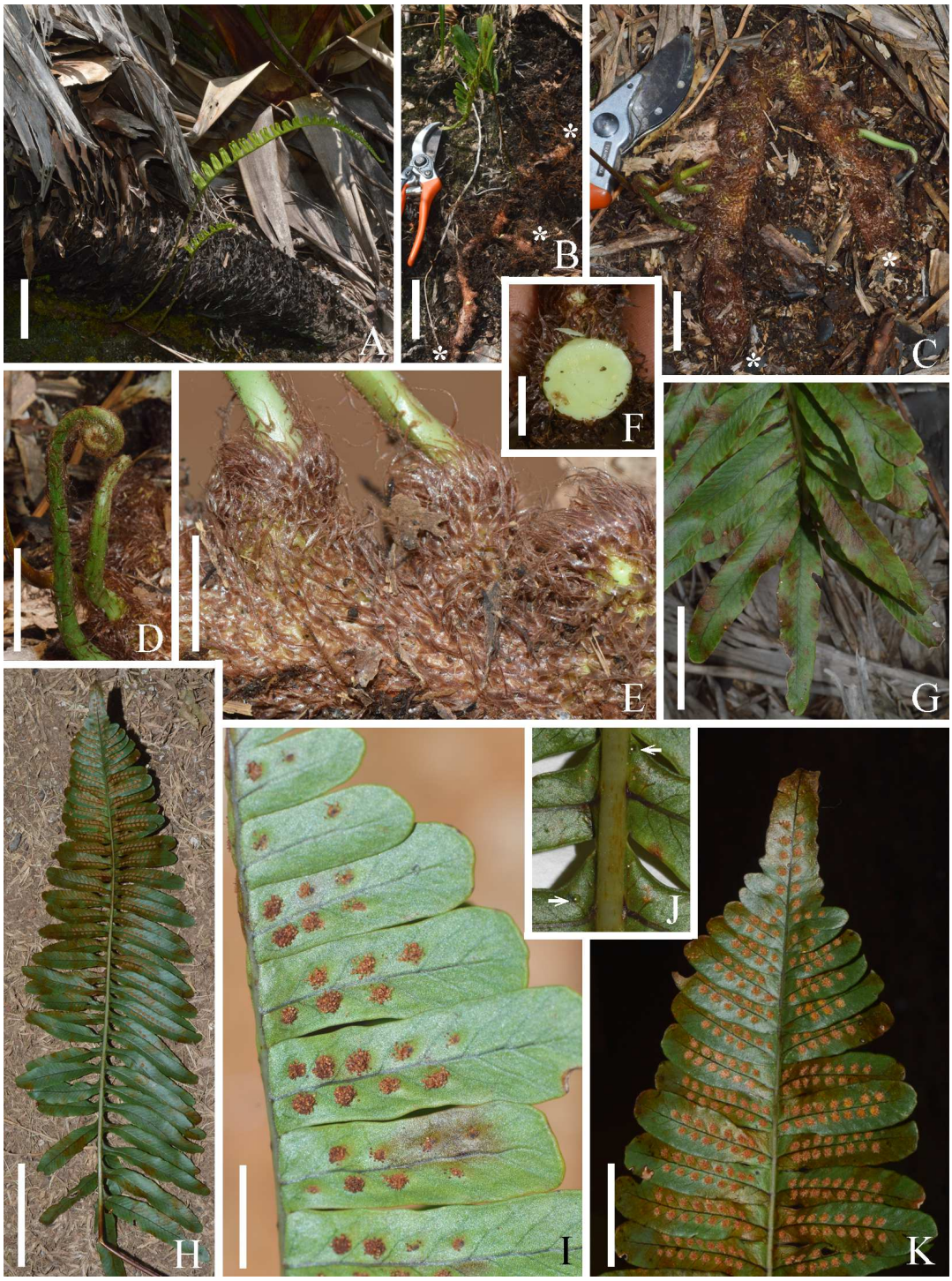


Figure 46. *Serpocaulon demissum.* —A. Habit. —B. Rhizome with perspective. —C. Rhizome branching. —D. Fiddlehead. —E. Phyllopodia. —F. Rhizome cross-section. —G. Lamina base. —H. Lamina. —I. Middle segment. —J. Proximal segments with nectaries. —K. Lamina apex. Scale bars, A= 10 cm, B= 5 cm, C= 2 cm, D= 4 cm, E= 1 cm, F= 7 mm, G= 3 cm, H= 4 cm, I= 1.5 cm, K= 2 cm. All from *Sanín et al. 7229* (BHCB). The asterisk indicates the rhizome apex and the arrows indicate the location of nectaries.

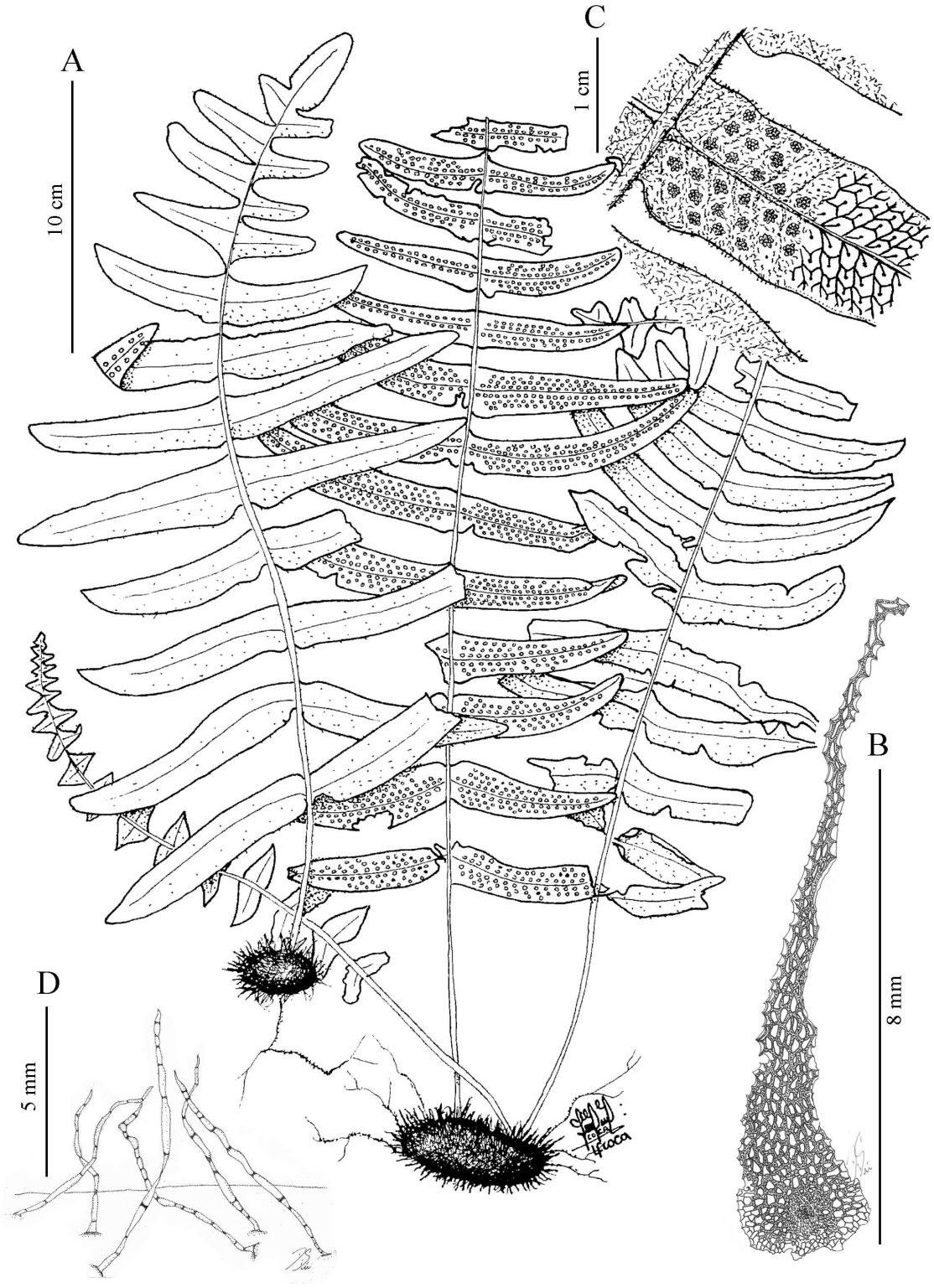


Figure 47. *Serpocaulon dissimile.* —A. Habit. —B. Rhizome scale. —C. Middle segment. —D. Laminar trichomes. All from *Giraldo-Cañas 749* (HUA).

Figure 48. *Serpocaulon dissimile.* —A. Habit. —B. Rhizome. —C. Abaxial view of the lamina. —D. Adaxial insertion of the pinna. —E. Base of the lamina. Scale bars, A= 10 cm, B–C, E= 1 cm, D= 5 mm. B and E from *Sanín et al. 5141* (NY). A, C and D by R.C. Moran.

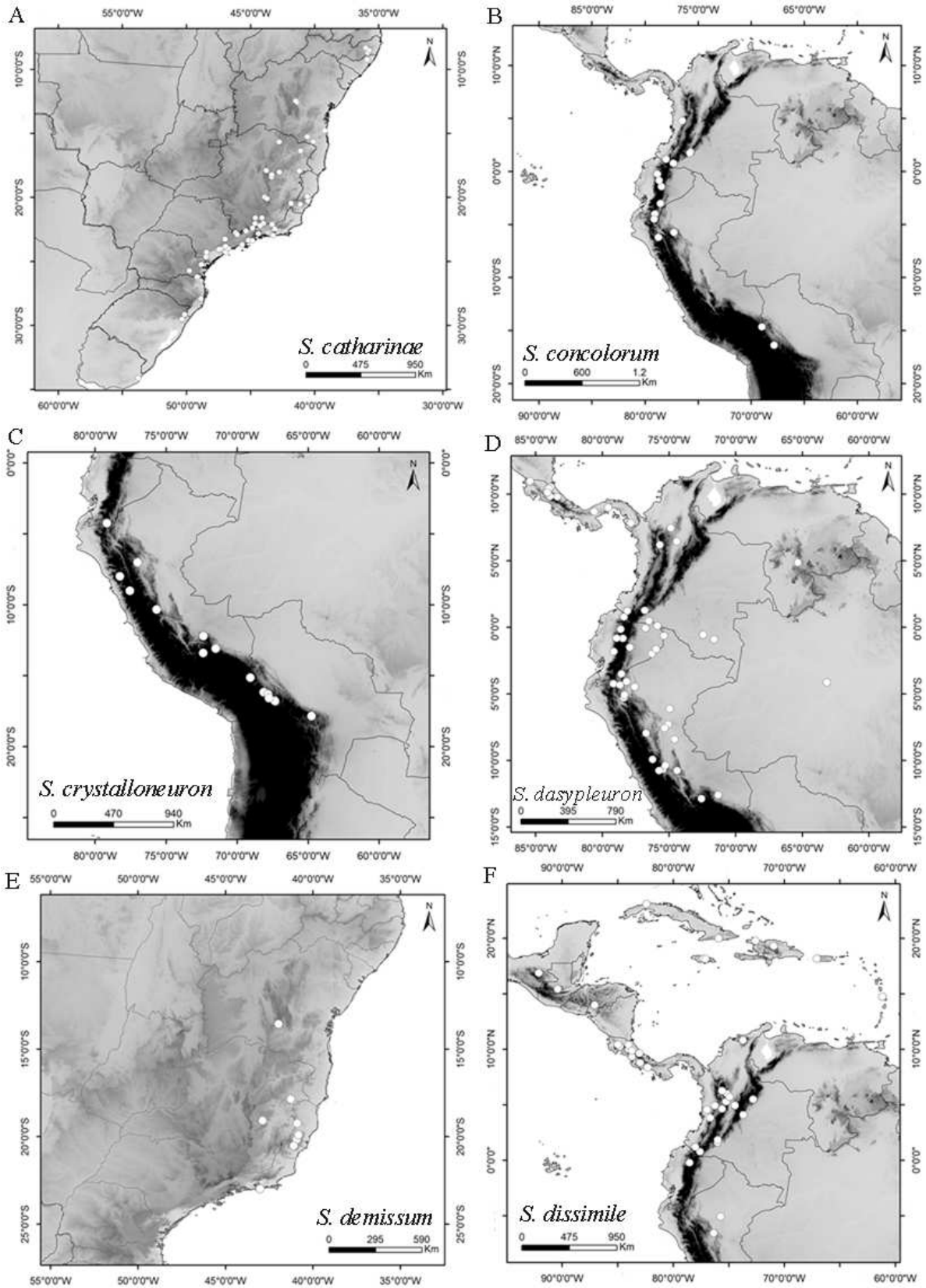


Figure 49. Distribution of *Serpocaulon catharinae*, *S. concolorum*, *S. crystalloneurum*, *S. dasypleuron*, *S. demissum*, and *S. dissimile*.

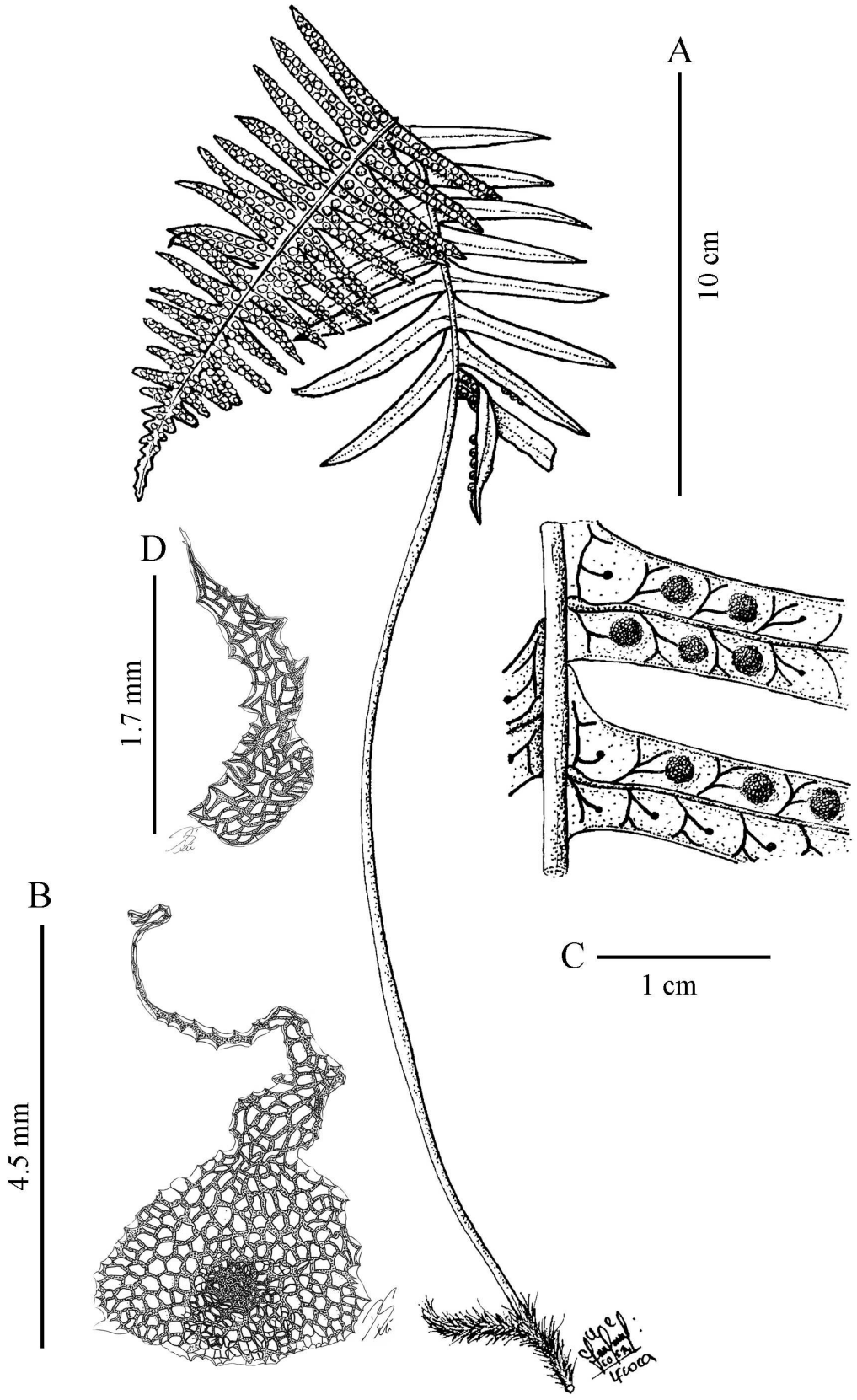


Figure 50. *Serpocaulon eleutherophlebium.* —A. Habit. —B. Rhizome scale. —C. Middle segment. —D. Laminar scale. A, C–D from *Sanín 1308* (FAUC), B from *Mora-Osejo 4382* (COL).

Figure 51. *Serpocaulon eleutherophlebium.* —A. Habit. —B. Fertile lamina. —C. Scale rhizome. —D. Rhizome. —E. Fertile laminae. Scale bars, A= 5 cm, B= 7 cm, C= 5 mm, D= 1 cm, E= 2 cm. A, C, E from *Pinto-Zárate 423* (HJJT). B and D from *Sanín et al. 4350* (HUA). A, C, E photos by Pinto-Zárate from Triana Herbarium (HJJT).

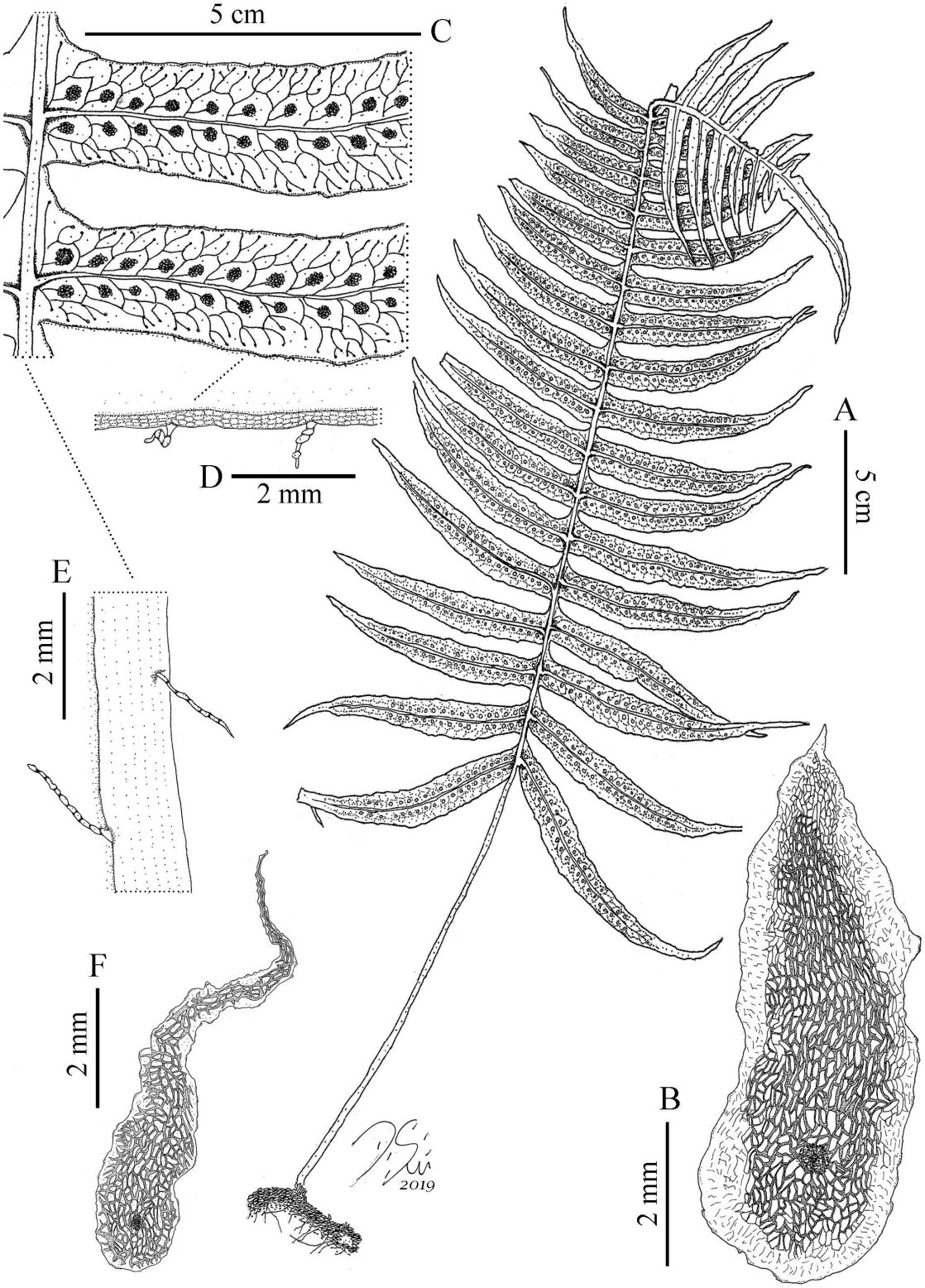


Figure 52. *Serpocaulon falcaria.* —A. Habit. —B. Rhizome scale. —C. Central segments. —D. Marginal trichome of the central segment. —E. Trichomes of the rachis. —F. Lamina scale. All from *Williams et al. 42002* (F).

Figure 53. *Serpocaulon falcaria.* —A. Habit of the plant. —B. Lamina. —C. Falcate lamina base. —D. Rhizome. —E. Rhizome scales. —F. Rhizome apex. Scale bars, A= 10 cm, B= 5 cm, C–D= 4 cm, E= 1 cm, F= 2 cm. All from Costa Rica by R.C. Moran, available in http://www.plantsystematics.org

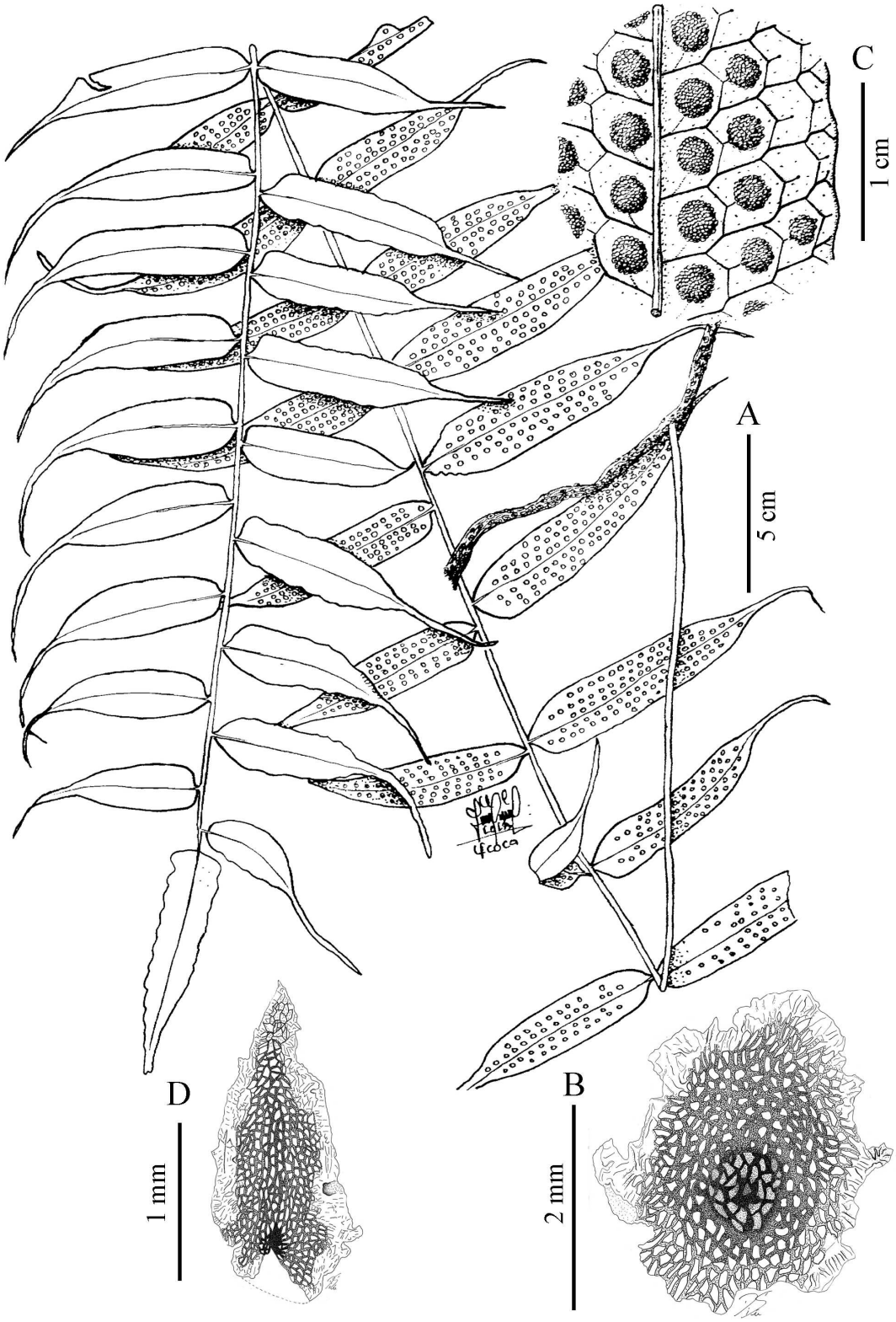


Figure 54. *Serpocaulon fraxinifolium.* —A. Habit. —B. Rhizome scale. —C. Central segment. —D. Laminar scale. All from *Sanín 3210* (FAUC).

Figure 55. *Serpocaulon fraxinifolium.* —A. Habit. —B. Rhizome with goldish and strongly attached scales. —C. Rhizome with brown and scarcely attached scales. —D. Rhizome cross-section. —E. Rhizome cross-section showing oxidation. —F. Pinnae insertion. —G. Lamina apex with auriculate terminal pinna. —H. Lamina apex without auriculate. —I. Base of the fertile pinna showing the auricle. —J. Adaxial view of the fertile pinna base showing the auricle. Scale bars, A= 10 cm, B= 7 mm, C= 7 cm, D= 4 mm, E= 4 cm, F= 1 cm, G= 10 cm, H= 10 cm, I= 5 mm, J= 5 mm. A, C, H–J from *Sanín et al. 6887* (COL), B, D–E, G from *Sanín et al.* 6927 (COL), F from *Sanín & Duarte* 6859 (COL).

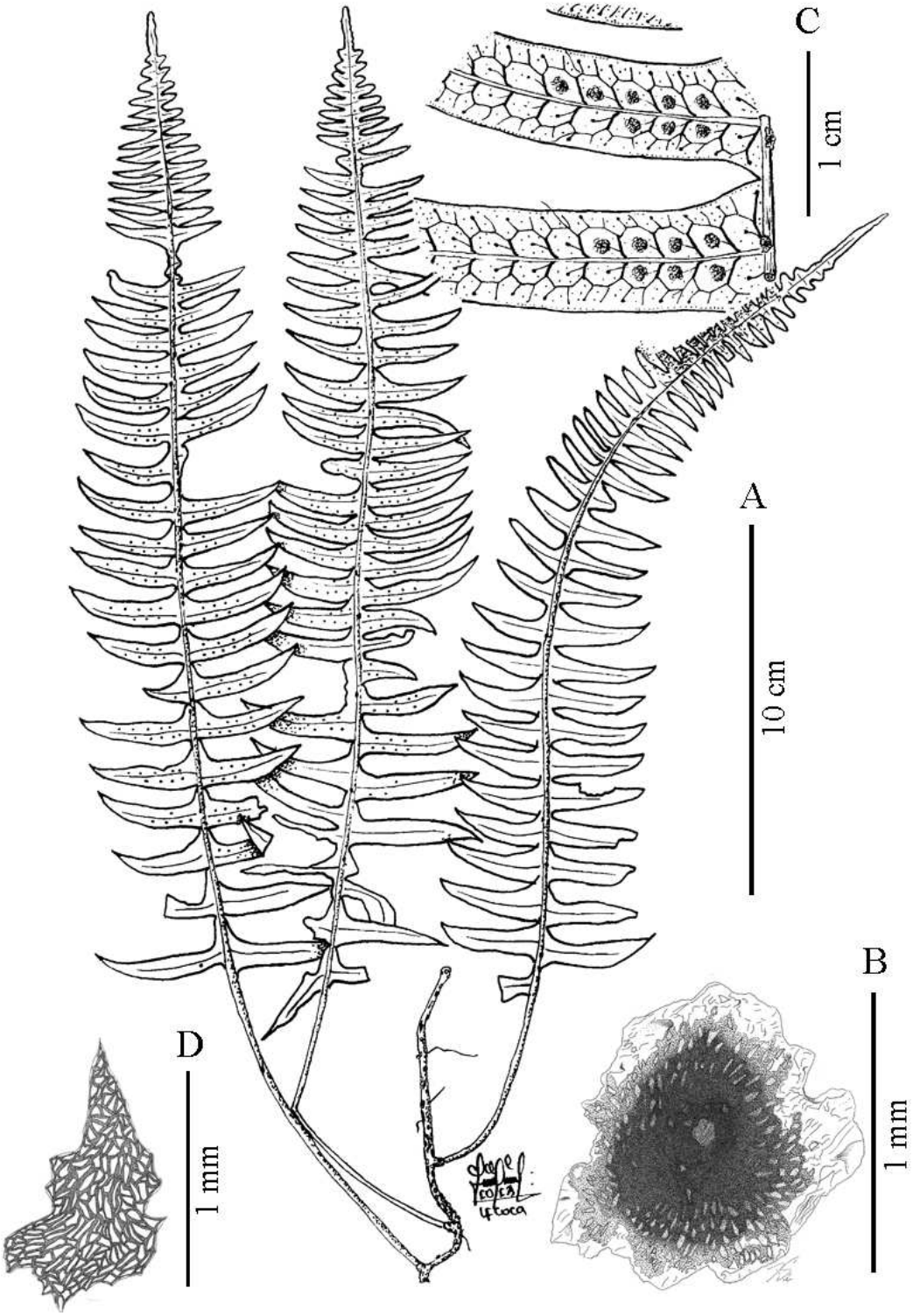


Figure 56. *Serpocaulon funckii.* —A. Habit. —B. Rhizome scale. —C. Central pinna detail. —D. Laminar scale. All from *Rodríguez-D. 4840* (HUA).

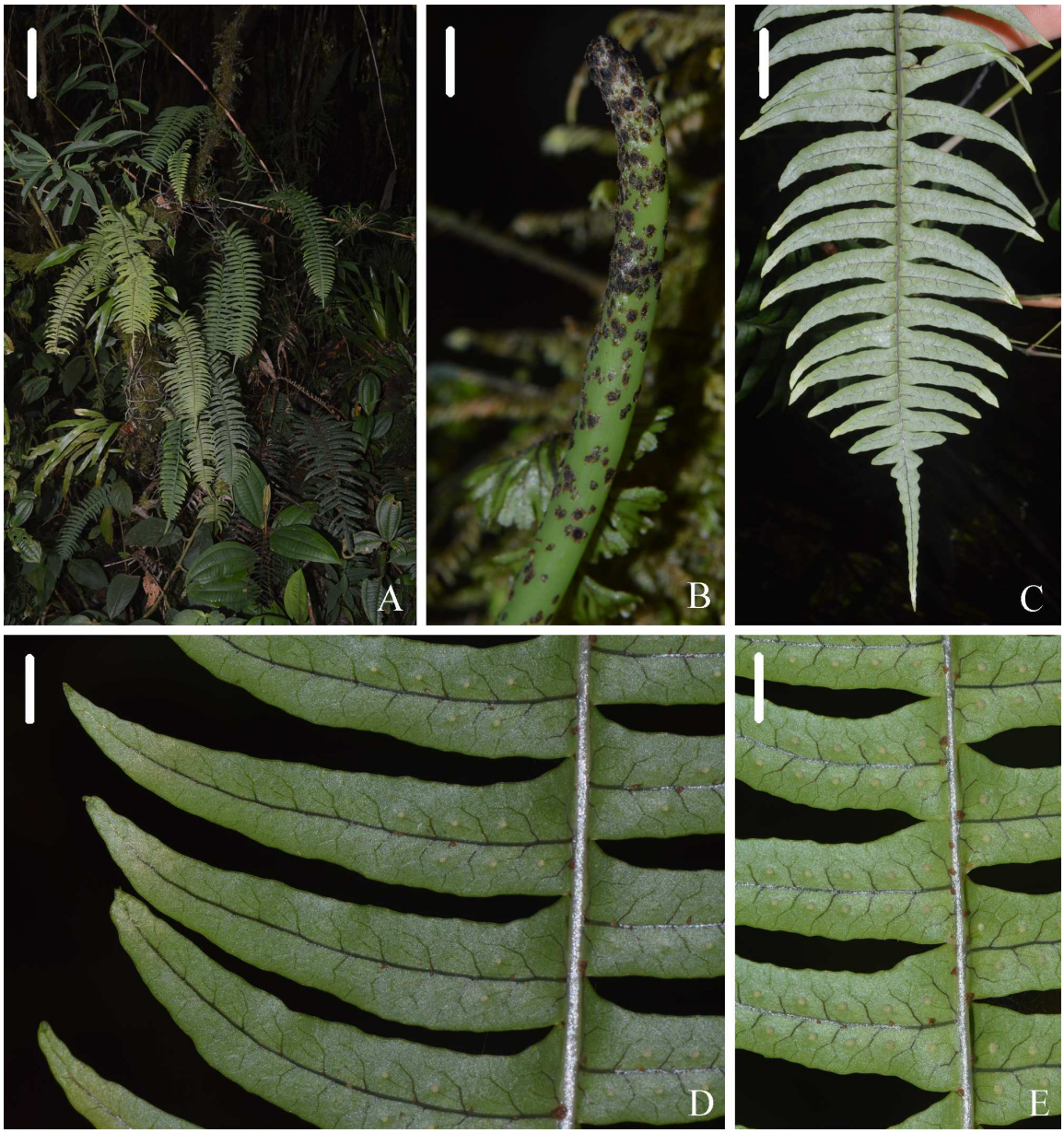


Figure 57. *Serpocaulon funckii.* —A. Habit. —B. Rhizome. —C. Apex of the lamina. —D. Middle segments. —E. Scales from the rachis. Scale bars, A= 10 cm, B= 3 mm, C= 1 cm, D–E= 5 mm. All from *Castro & Sanín 1359* (HUA).

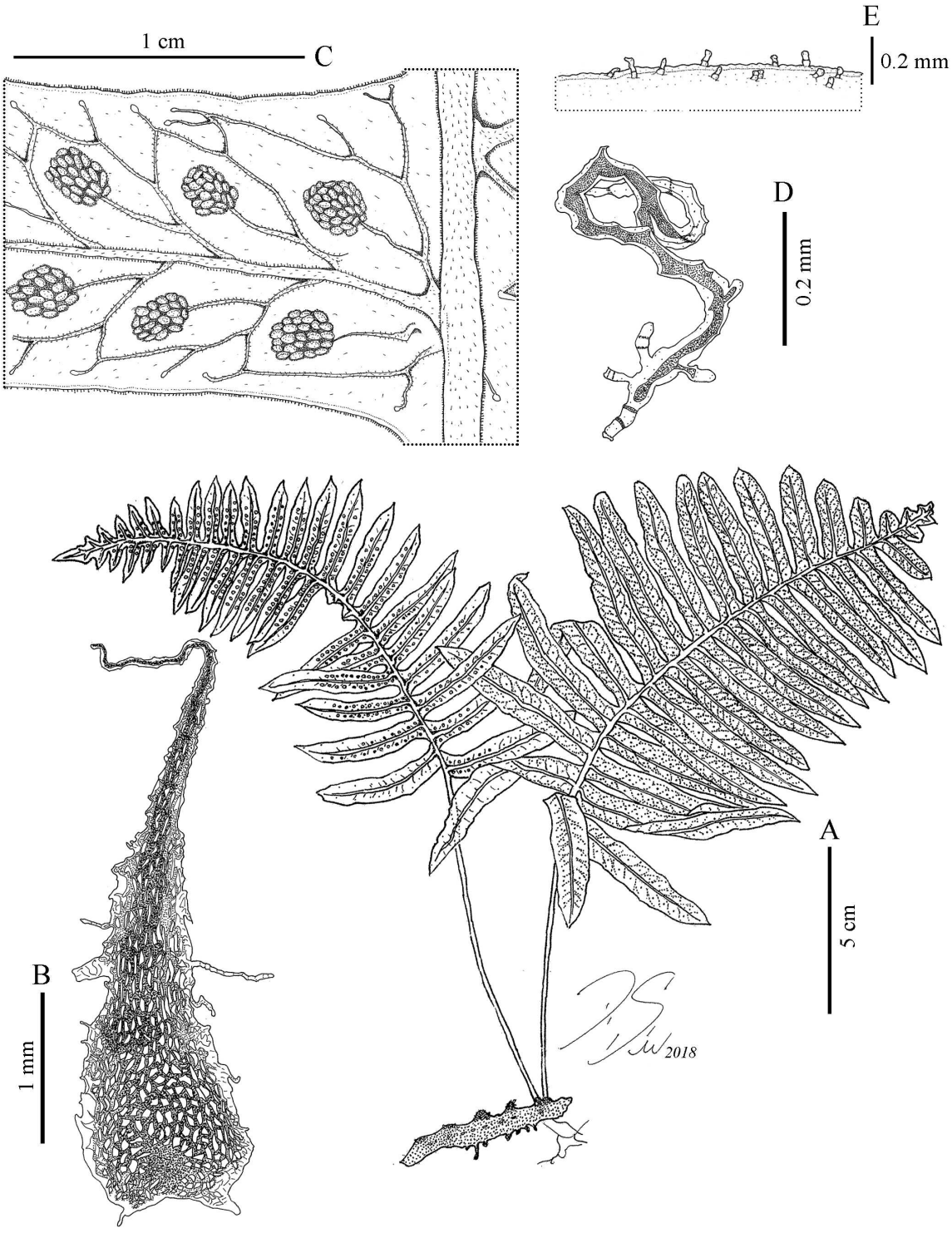


Figure 58. *Serpocaulon glandulossisimum.* —A. Habit. —B. Rhizome scale. —C. Central pinna detail. —D. Laminar scale. —E. Glandular trichomes. All from *Sanín 6828* (BHCB).

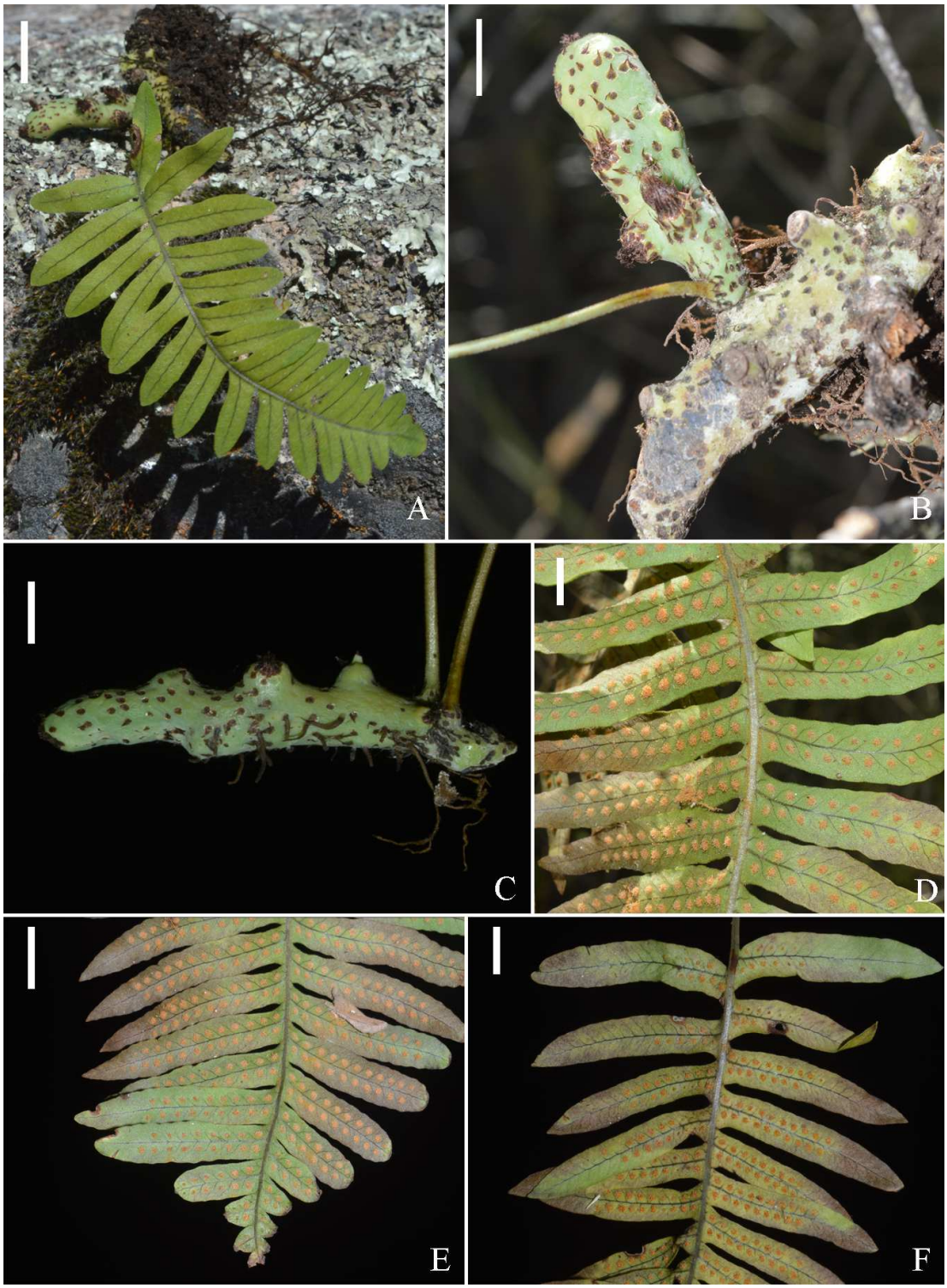


Figure 59. *Serpocaulon glandulossisimum.* —A. Habit. —B. Rhizome ramification. —C. Young rhizome. —D. Middle segments. —E. Lamina apex. —F. Lamina base. Scale bars, A= 2 cm, B–C= 5 mm, D= 5 mm, E= 1.5 cm, F= 1 cm. All from *Sanín 6828* (BHCB).

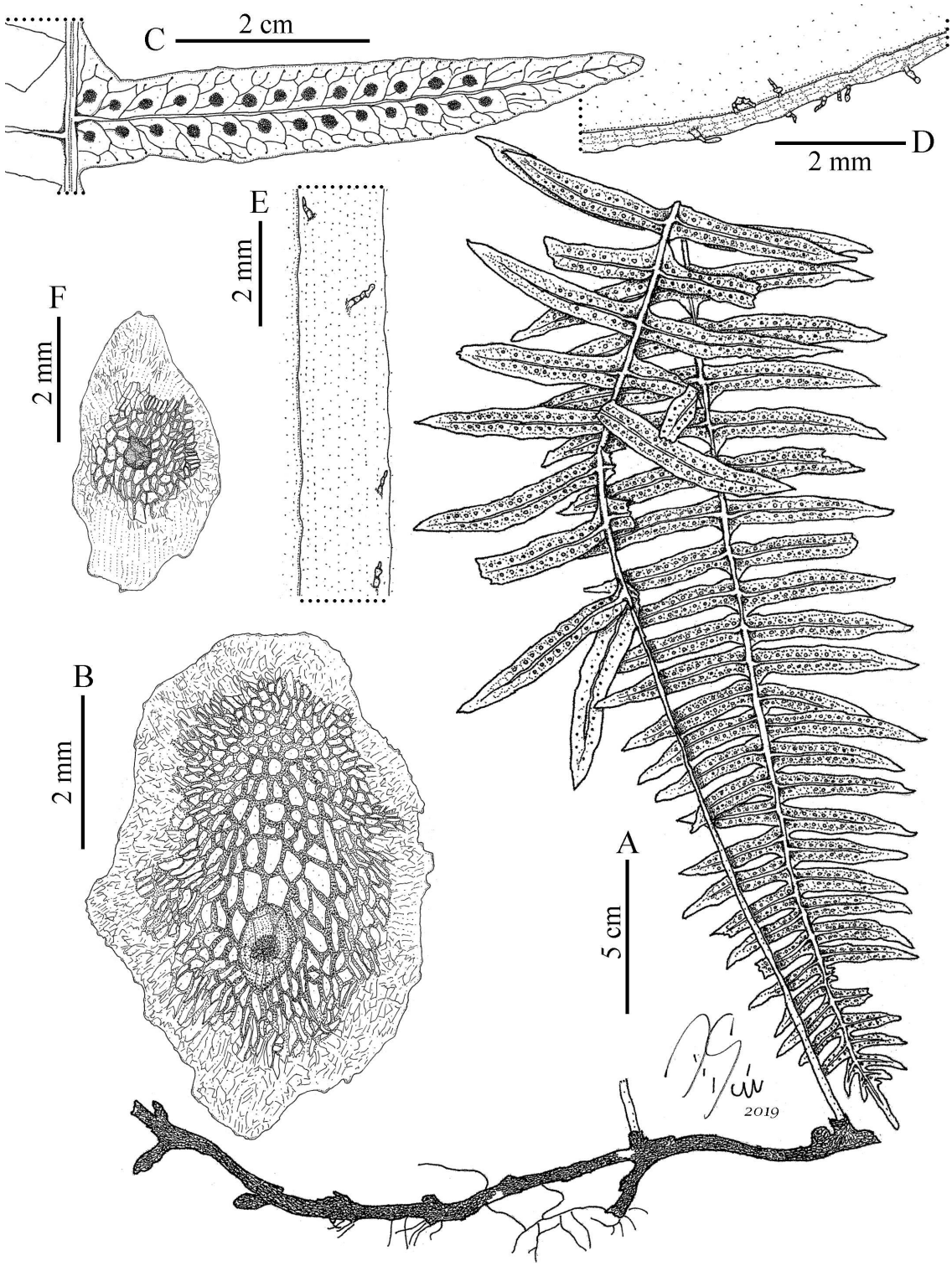


Figure 60. *Serpocaulon intricatum.* —A. Habit. —B. Rhizome scale. —C. Central segment. —D. Marginal trichomes. —E. Trichomes of the rachis. —F. Laminar scale. All from *Kessler et al. 9429* (LPB).

Figure 61. *Serpocaulon intricatum.* —A. View of the plant. —B. Juvenile rhizome. —C. Older rhizome. —D. Lamina apex. —E. Lamina base. Scale bars, A= 5 cm, B= 2 cm, C= 1 cm, D= 2 cm, E= 2 cm. All from *Sanín et al. 5526* (LPB).

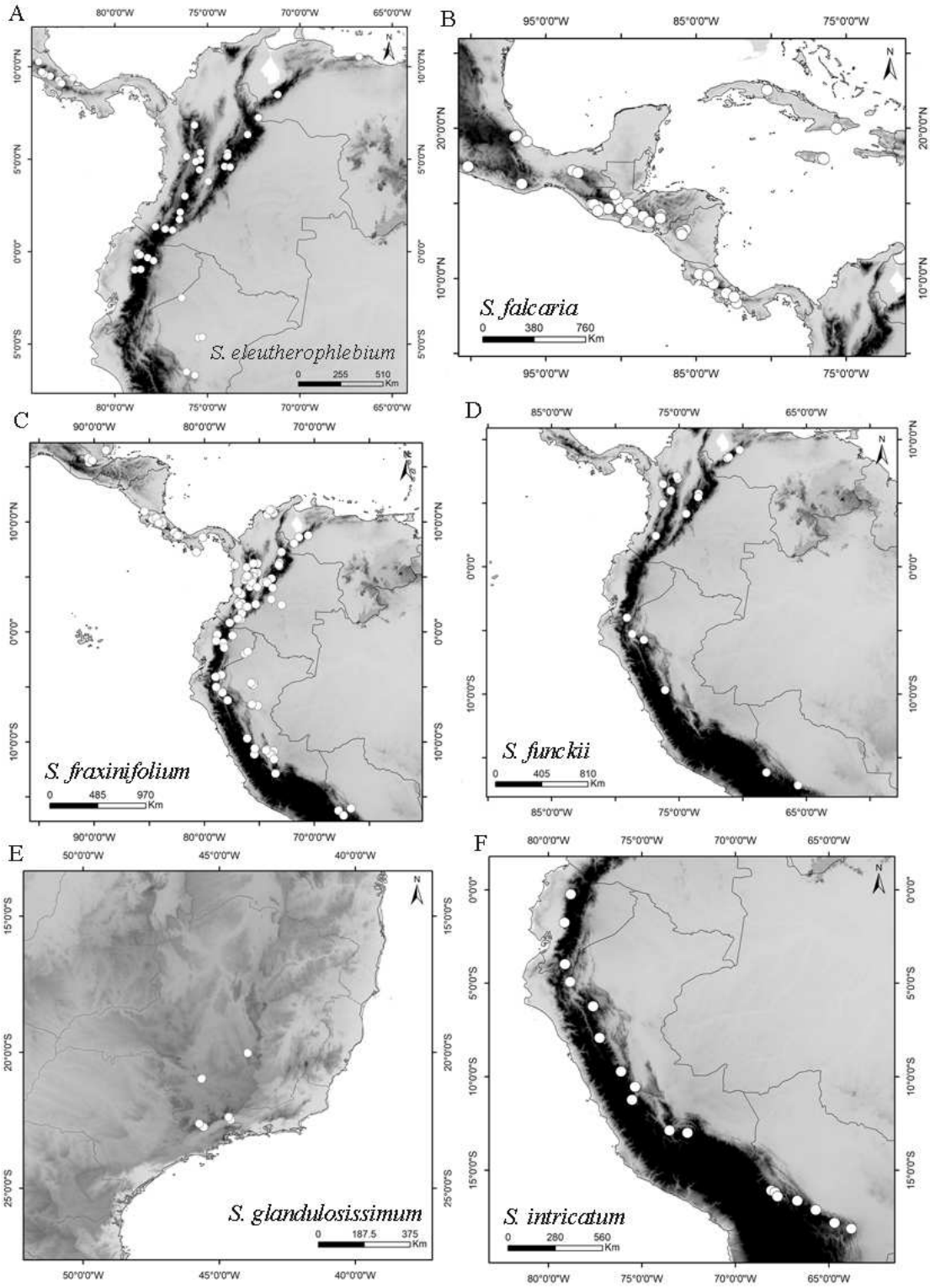


Figure 62. Distribution of *Serpocaulon eleutherophlebium*, *S. falcaria*, *S. fraxinifolium*, *S. funckii*, *S. glandulosissimum*, and *S. intricatum*.

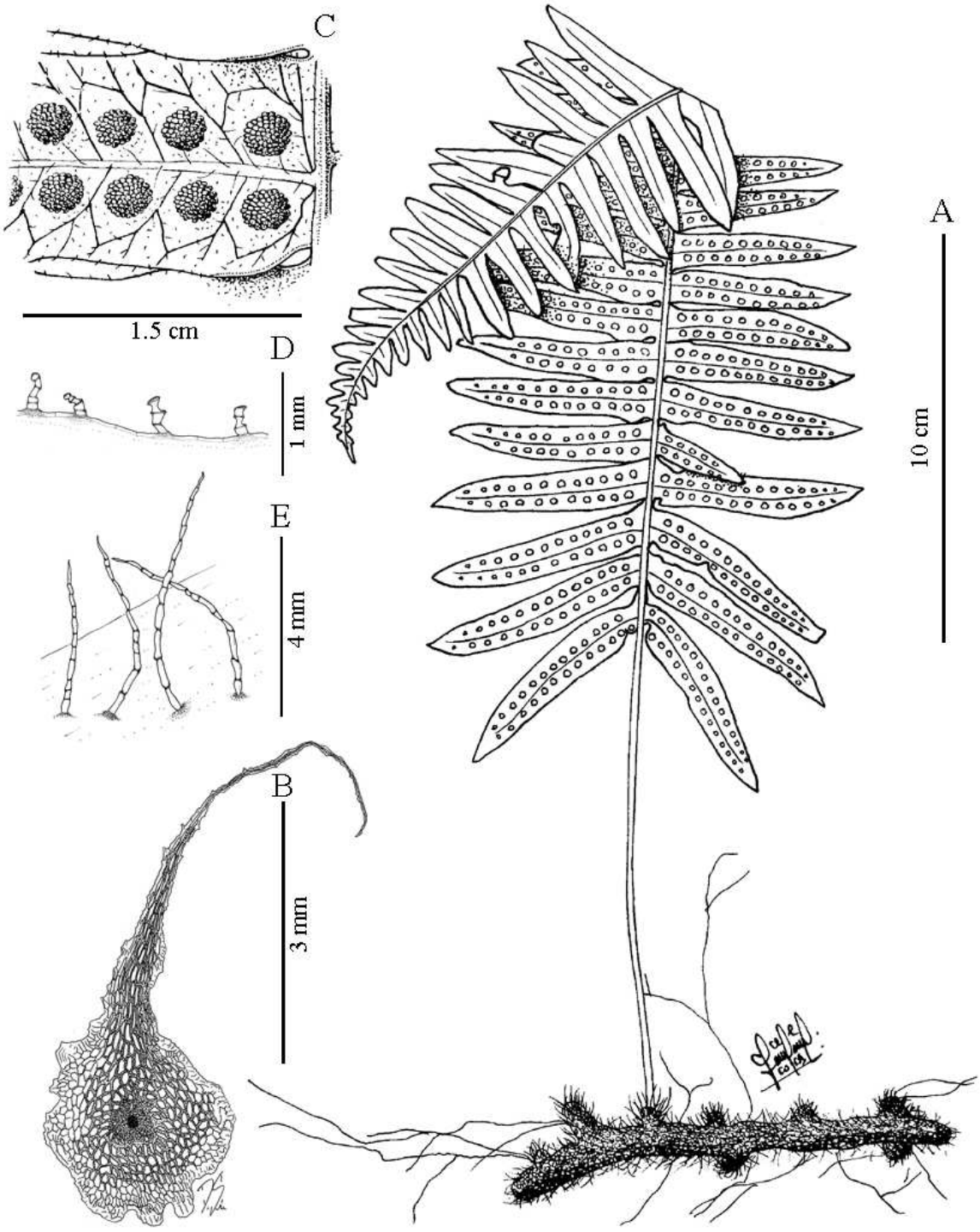


Figure 63. *Serpocaulon lasiopus.* —A. Habit. —B. Rhizome scale. —C. Central segment detail. —D. Trichomes from the margin of the lamina. —E. Trichomes from the laminar surface. All from *Rodríguez-D. 3268* (HUA).

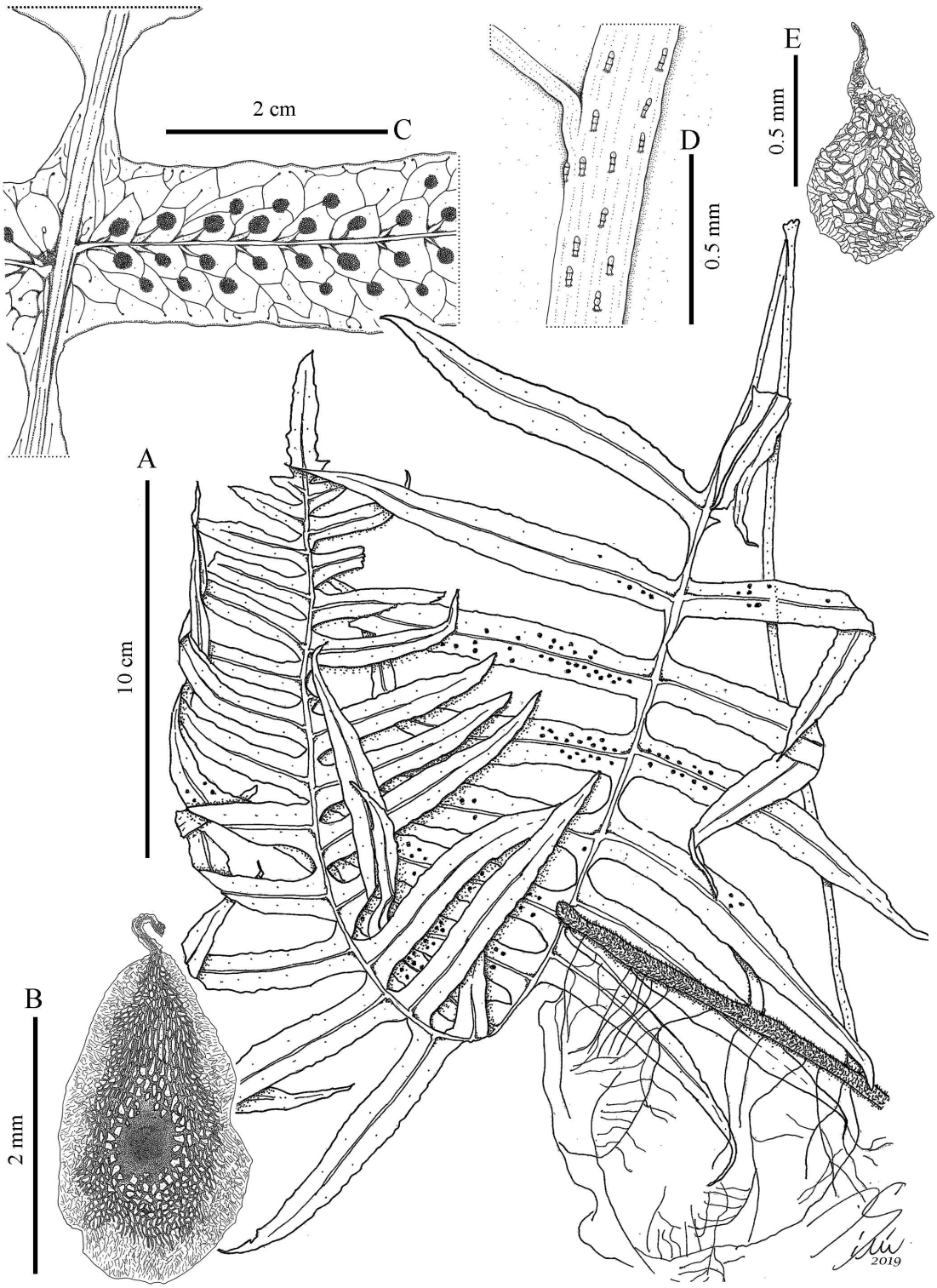


Figure 64. *Serpocaulon latipes.* —A. Habit. —B. Rhizome scale. —C. Central segment. —D. Trichomes of the rachis. —E. Lamina scale. All from *Sanín et al. 6824* (BHCB).

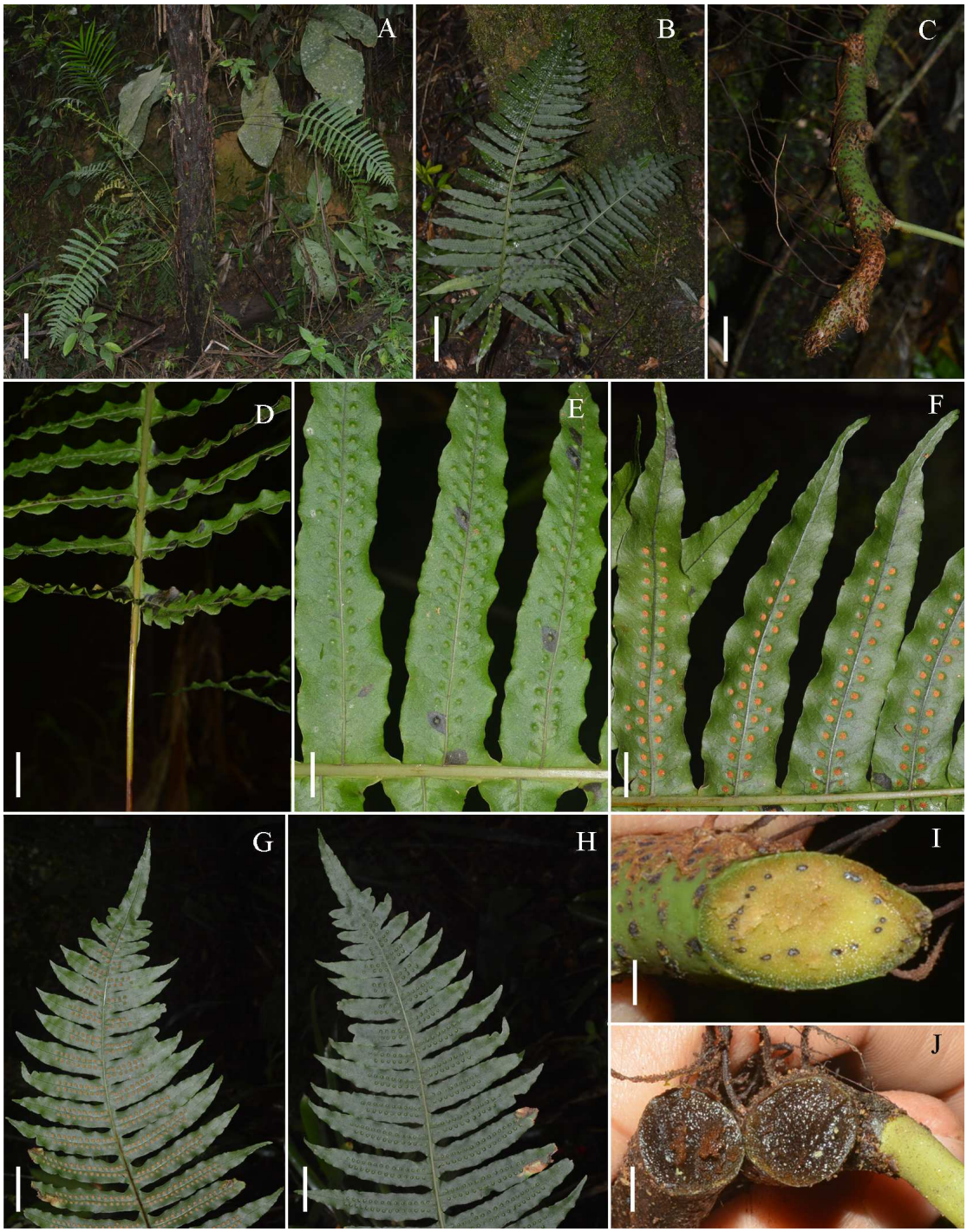


Figure 65. *Serpocaulon latipes.* —A. Hemiepiphytic plant. —B. Terrestrial plant. —C. Rhizome. —D. Lamina base. —E. Adaxial view of the middle segments. —F. Abaxial view of the middle segments. —G. Abaxial view of the apex of the lamina. —H. Adaxial view of the apex of the lamina. —I. Rhizome cross-section. —J. Rhizome cross-section showing oxidation. Scale bars, A= 8 cm, B= 5 cm, C= 1 cm, D= 2 cm, E= 5 mm, F= 7 mm, G= 1.5 cm, H= 2 cm, I= 1 mm, J= 1.5 mm. All from *Sanín et al. 6824* (BHCB).

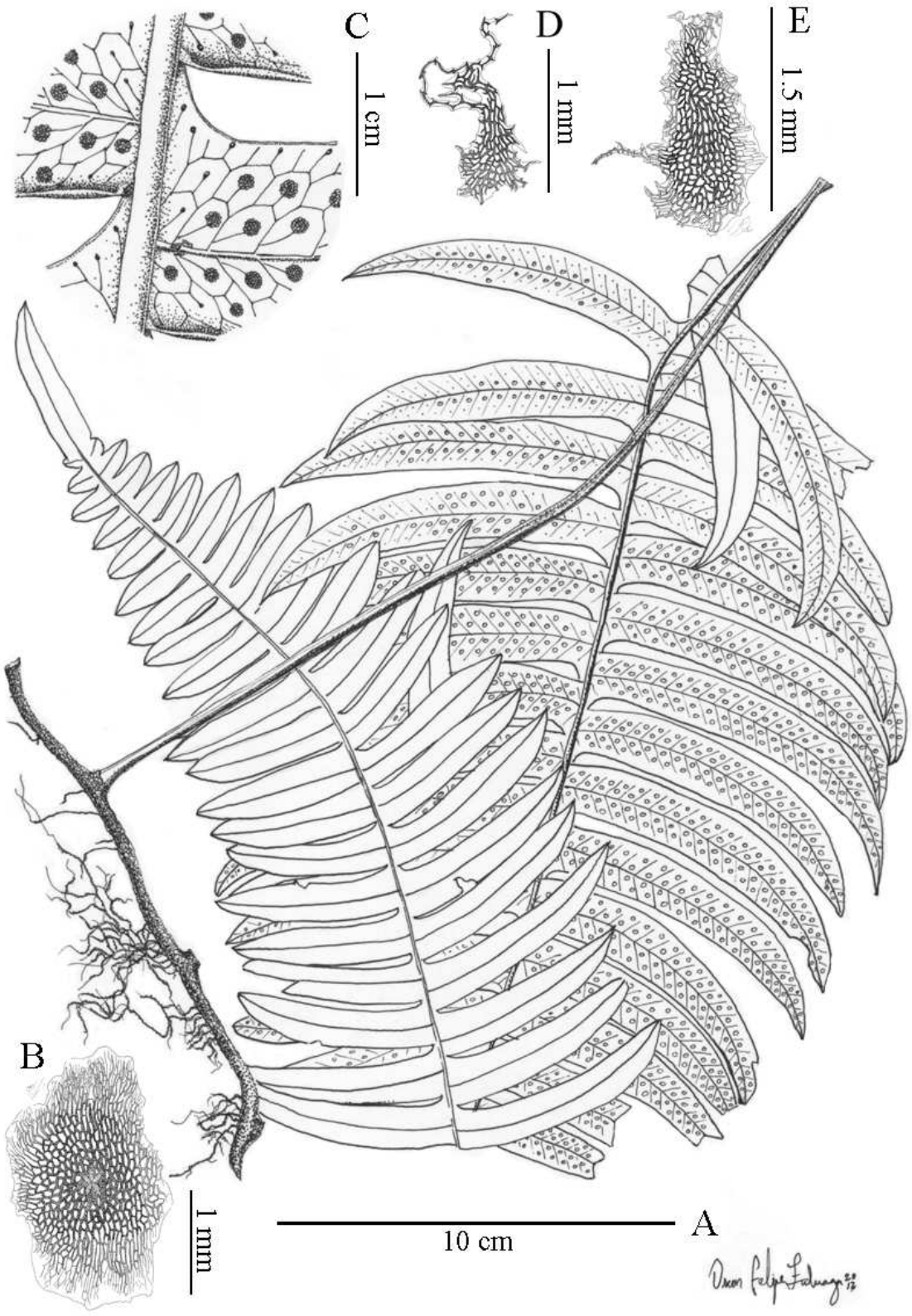


Figure 66. *Serpocaulon latissimum*. —A. Habit. —B. Rhizome scale. —C. Central pinna detail. —D–E. Laminar scales. —E. All from *Sanín 2977* (HUA).

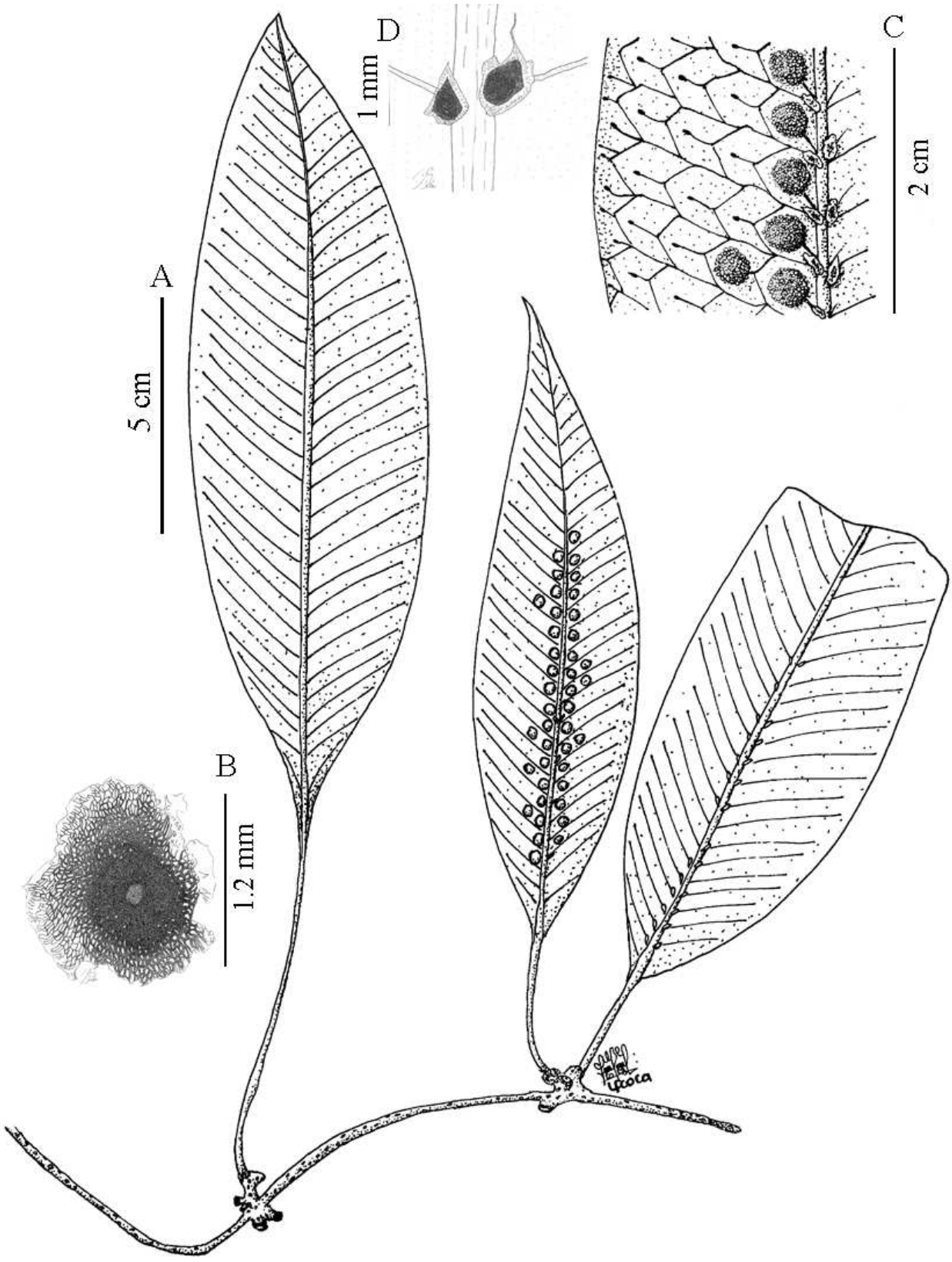


Figure 67. *Serpocaulon levigatum.* —A. Habit. —B. Rhizome scale. —C. Lamina detail. —D. Laminar scale. All from *Sanín 3107* (FAUC).

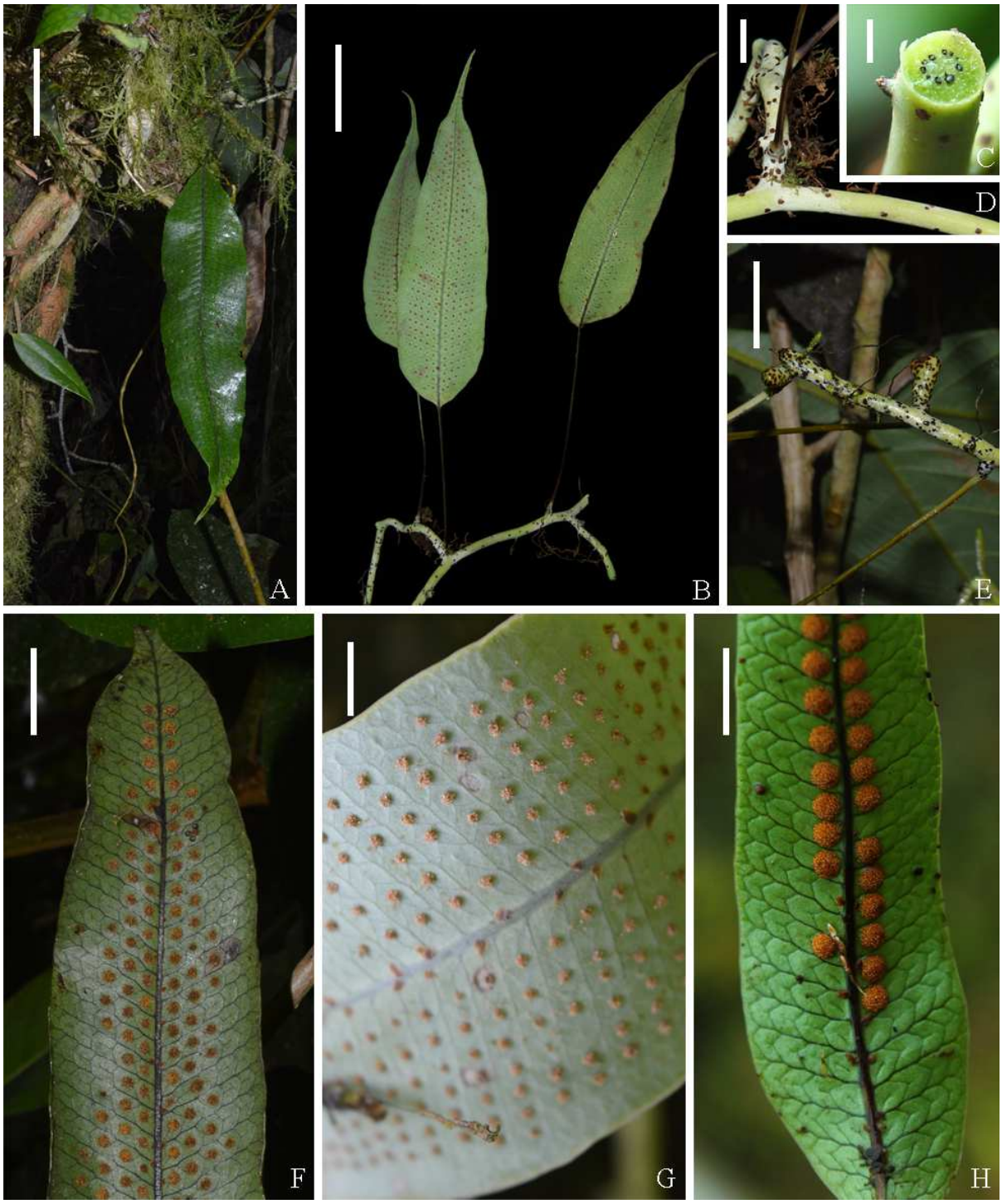


Figure 68. *Serpocaulon levigatum.* —A. Habit. —B. Glaucus form. —C. Rhizome cross-section. —D. Pruinose form of the rhizome. —E. Slightly pruinose form of the rhizome. —F. Abaxial view of non-pruinose lamina form. —G. Abaxial view of the pruinose lamina form. —H. Adaxial view of the non-pruinose lamina from high lands. Scale bars, A–B, E–F= 3 cm, C= 5 mm, D= 2 mm, G–H= 1 cm. A, E from *Sanín* 3262 (COL). B–D, G from *Sanín 6160* (COL). F from *Sanín 6101* (COL). H from *Sanín 768* (FAUC).

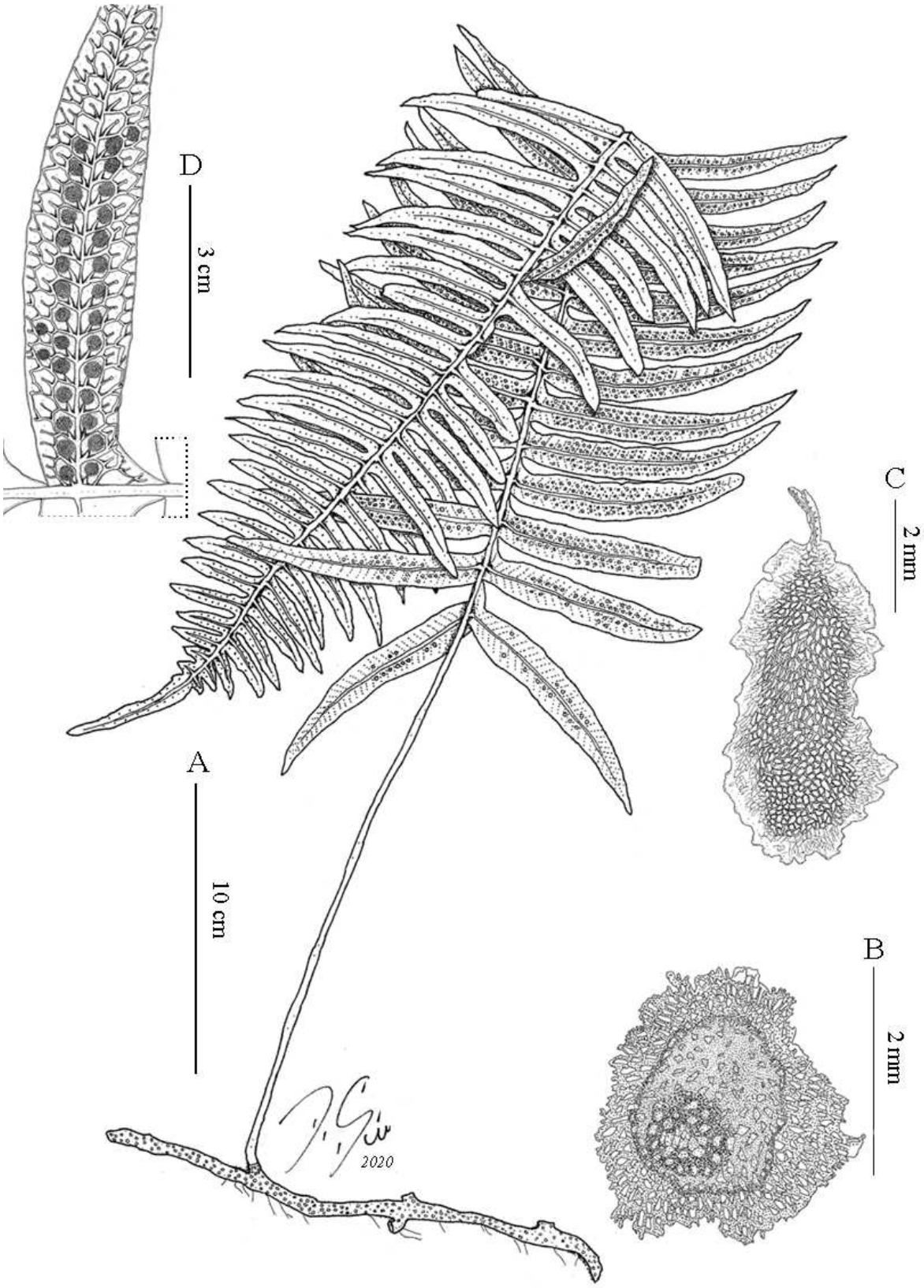


Figure 69. *Serpocaulon loriceum*. —A. Habit. —B. Rhizome scale. —C. Lamina detail. —D. Laminar scale. —E. Laminar trichome. All from *P. Duss 4072* (F).

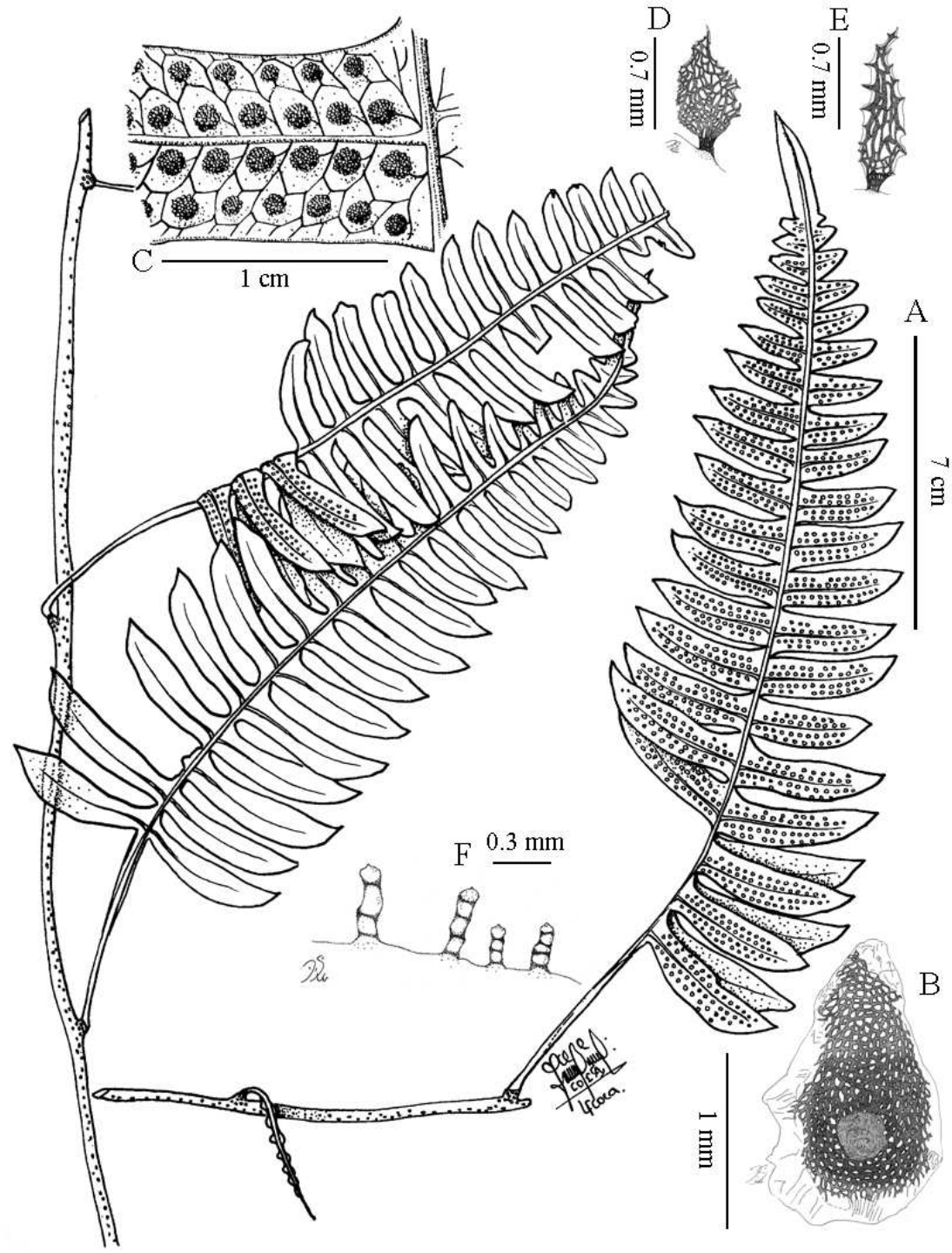


Figure 70. *Serpocaulon maritimum.* —A. Habit. —B. Rhizome scale. —C. Lamina detail. —D–E. Laminar scales. —F. Laminar trichomes. All from *Foster 2086* (COL).

Figure 71. *Serpocaulon maritimum.* —A. Habit. —B. Rhizome ramification. —C. Rhizome apex. —D. Fiddlehead. —E. Detail of the rhizome. —F. Rhizome cross-sections. —G. Lamina perspective. —H. Middle segments. —I. Abaxial view of the fertile apex. —J. Adaxial view of the fertile apex. —K. Lamina base. Scale bars, A= 10 cm, B= 4, C= 2 cm, D= 1 cm, E= 5 mm, F= 1 mm, G= 5 cm, H= 5 mm, I= 4 cm, J= 3 cm, K= 3 cm. A–C, E–F, I–K from *Sanín & Duarte* 6862 (COL), D, G–H from *Sanín et al. 5134* (HUA, NY).

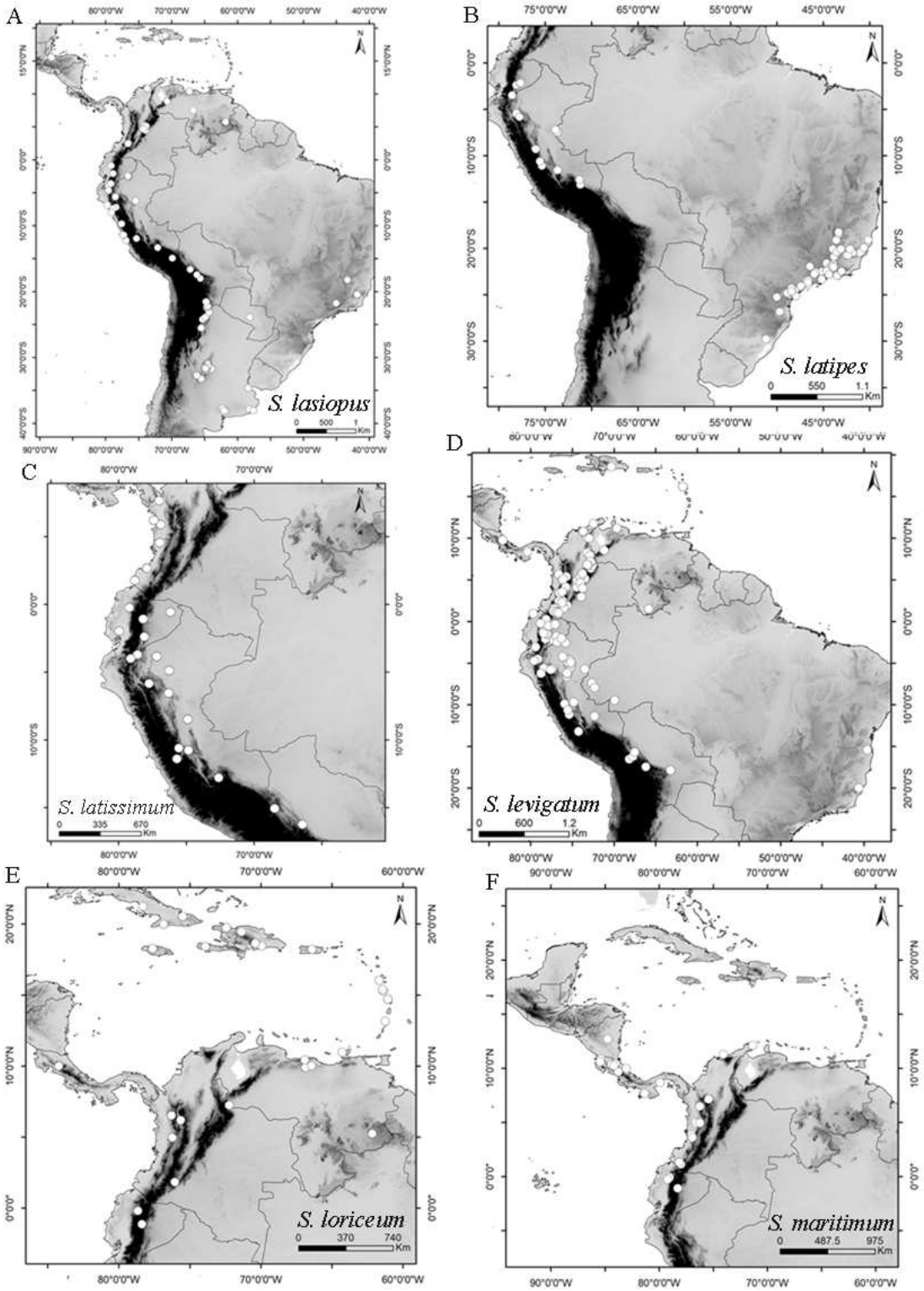


Figure 72. Distribution of *Serpocaulon lasiopus*, *S. latipes*, *S. latissimum*, *S. levigatum*, *S. loriceum*, and *S. maritimum*.

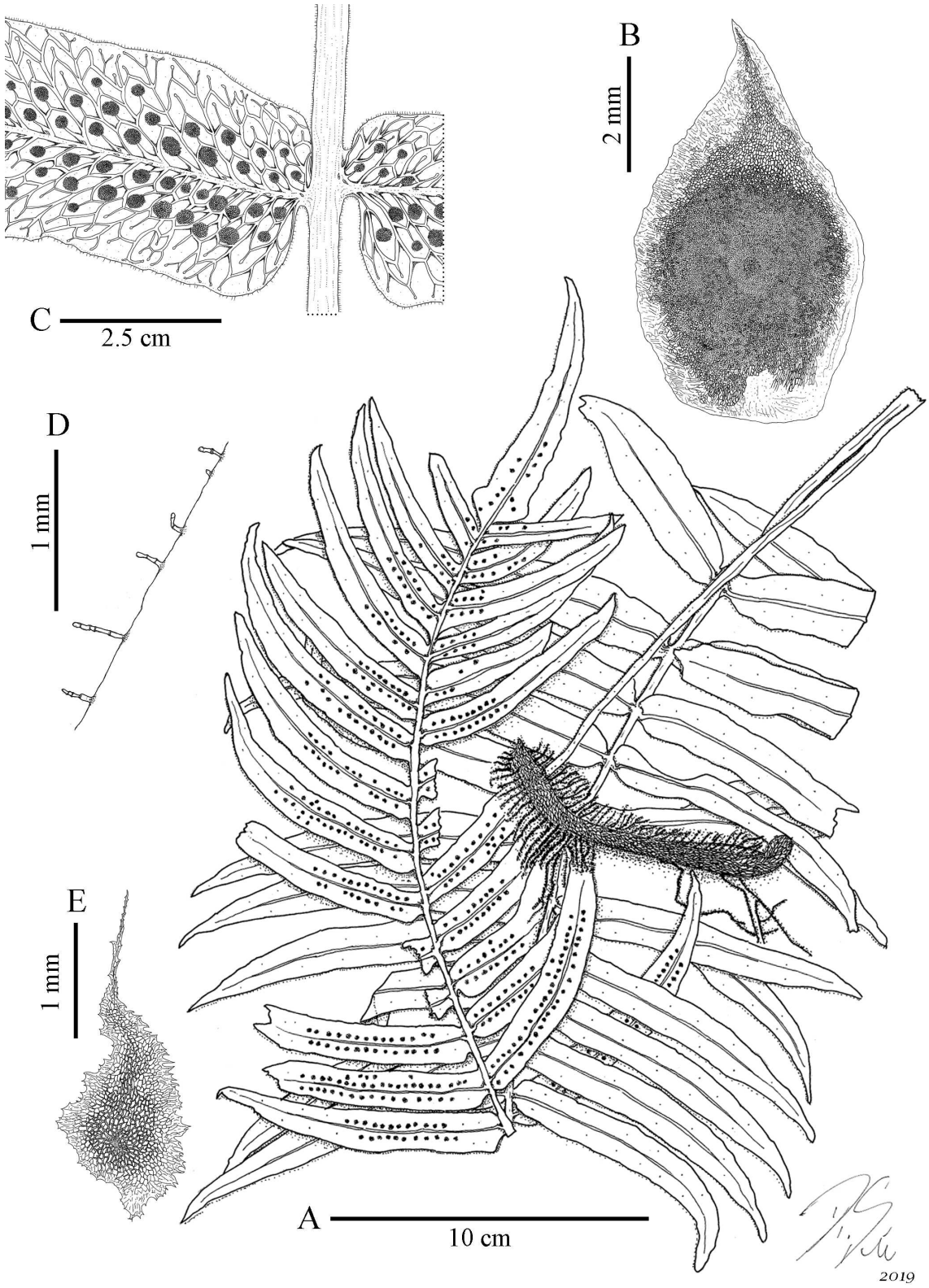


Figure 73. *Serpocaulon meniscifolium.* —A. Habit. —B. Rhizome scale. —C. Central segment. —D. Trichomes of the rachis. —E. Lamina scale. All from *Sanín et al. 7138* (BHCB).

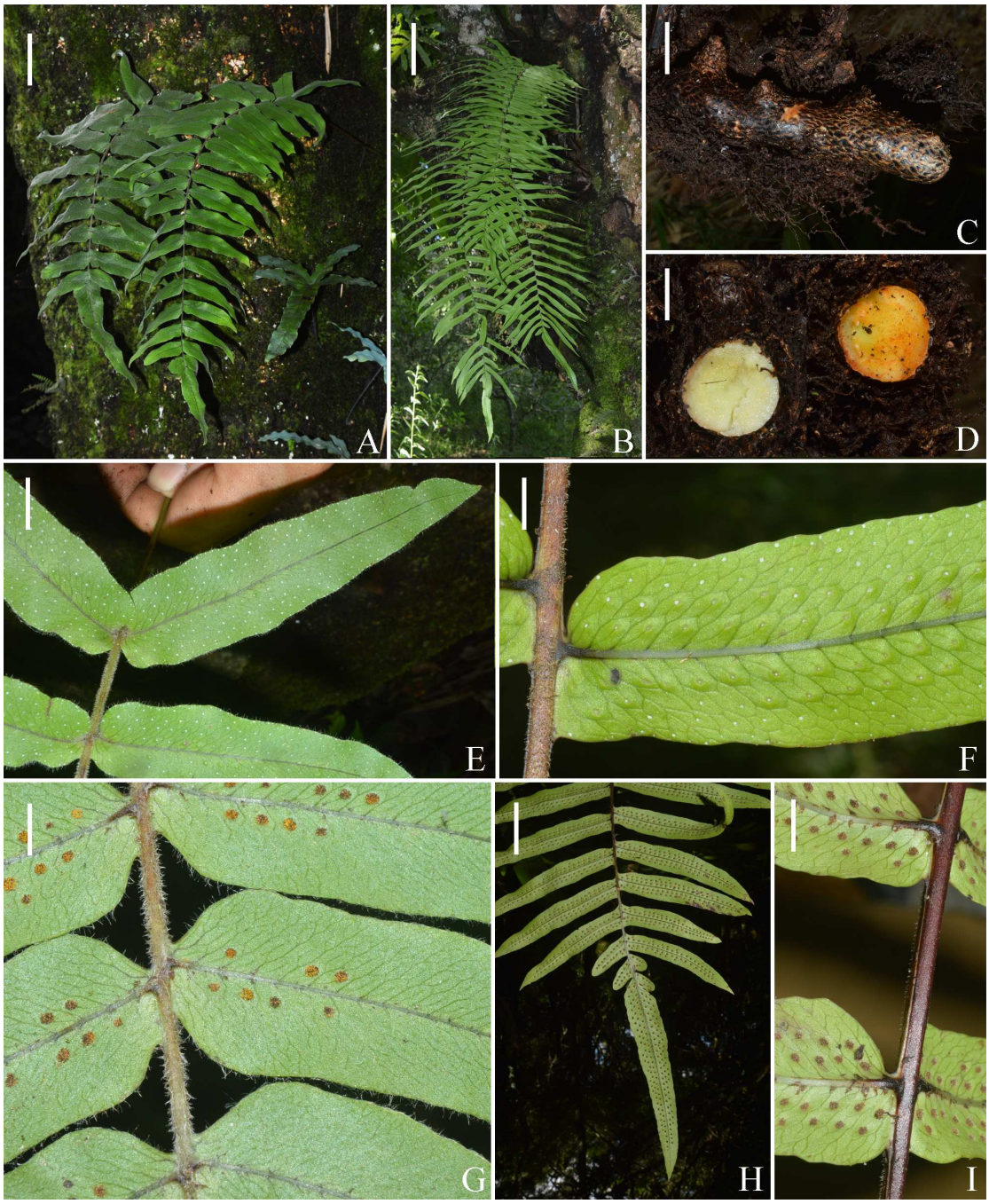


Figure 74. *Serpocaulon meniscifolium.* —A. Habit of a juvenile plant. —B. Habit of a mature plant. —C. Rhizome. —D. Transversal view of the rhizome showing oxidation transition. —E. Lamina base from a juvenile plant. —F. Pinna base from a mature plant. —G. Pinna base from a juvenile plant. —H. Apex of the lamina from a mature plant. —I. Abaxial view from the pinna base of mature plant with nectaries. Scale bars, A= 10 cm, B= 5 cm, C–E= 1 cm, F–G, I= 5 mm, H= 2 cm. Both plants collected at the same spot in Tiradentes, MG, Brazil. A, E, G from *Sanín 7138* (F). B–D, F, H–I from *Sanín 7137* (BHCB).

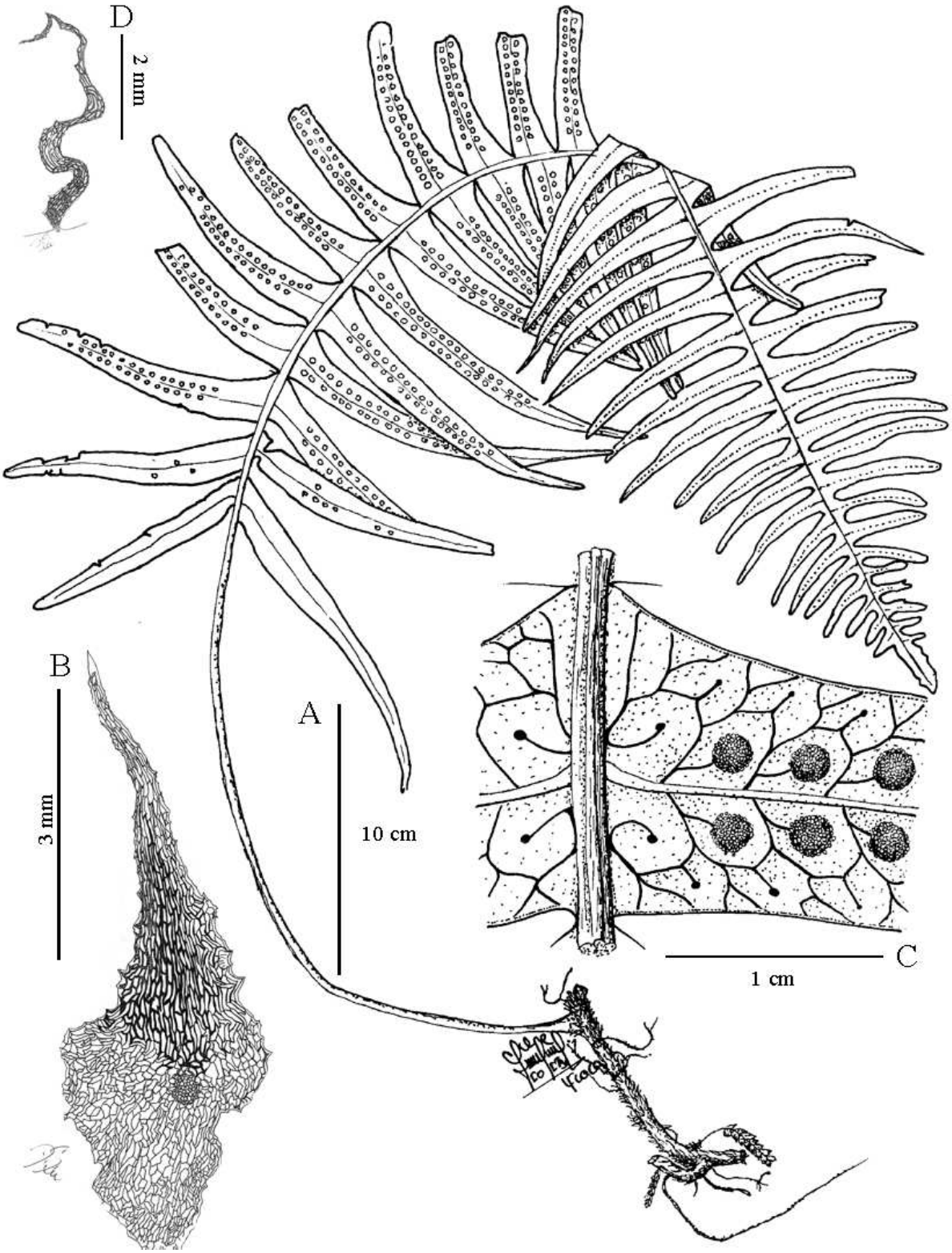


Figure 75. *Serpocaulon nanegalense.* —A. Habit. —B. Rhizome scale. —C. Central segment. —D. Laminar scale. All from *Rivas 642* (HUA).

Figure 76. *Serpocaulon nanegalense.* —A. Habit. —B. Rhizome with subpatent scales. —C. Rhizome with patent scales. —D. Rhizome cross-section. —E. Abaxial view of the fertile lamina. —F. Apex of the lamina. —G. Falcate base of the lamina. All from *Sanín et al. 4262* (HUA).

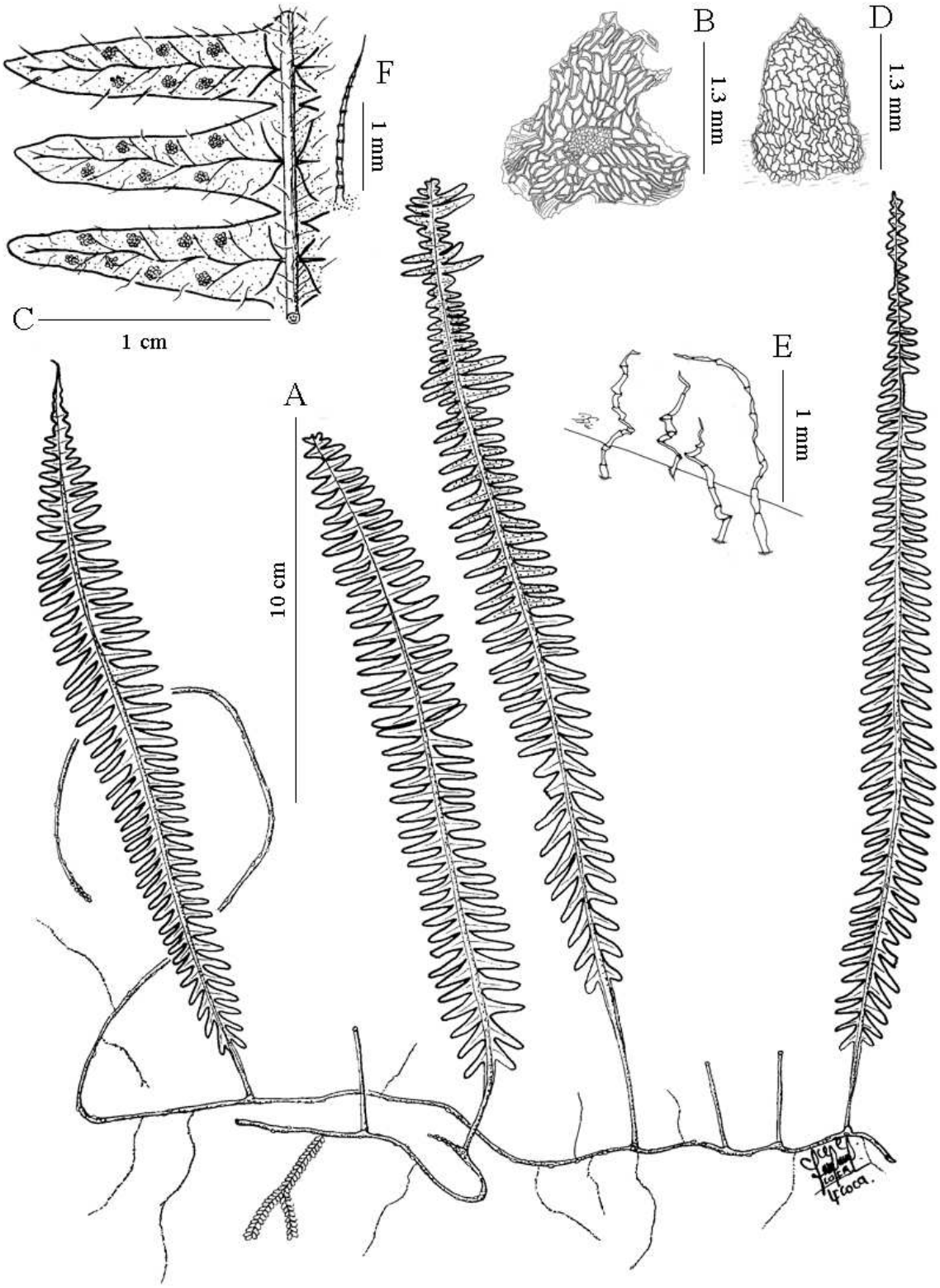


Figure 77. *Serpocaulon patentissimum.* —A. Habit. —B. Rhizome scale. —C. Central segments. —D. Laminar scale. —E. Laminar trichomes. All from *Arbeláez et al. 325* (HUA).

Figure 78. *Serpocaulon patentissimum.* —A. Habit. —B. Rhizome. —C. Abaxial view of the fertile lamina with costal trichomes. —D. Lamina perspective. —E. Lamina base. —F. Lamina apex. Scale bars, A= 5 cm, B= 5 mm, C= 1 cm, D= 5 cm, E–F= 1 cm. All from *Sanín et al. 6860* (HUA).

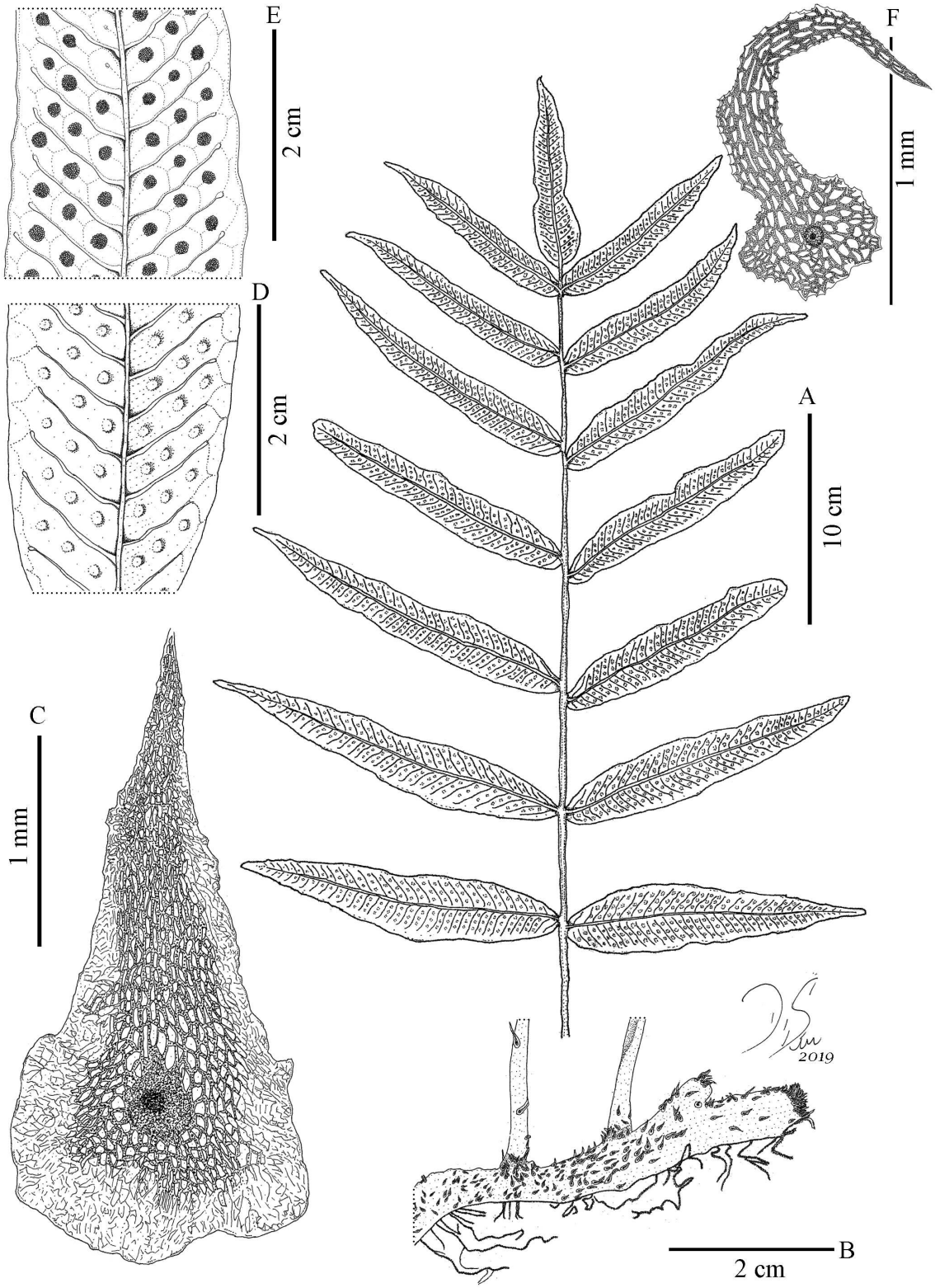


Figure 79. *Serpocaulon polystichum.* —A. Habit. —B. Rhizome. —C. Rhizome scale. —D. Adaxial surface of central pinna. —E. Abaxial surface of central pinna. —F. Laminar scale. All from *Sanín 6836* (BHCB).

Figure 80. *Serpocaulon polystichum.* —A. Habit. —B. Lamina. —C. Rhizome. —D. Lamina apex. —E. Lamina base. —F. Abaxial view of the fertile pinna. —G. Adaxial view of the fertile pinna. —H. Rhizome cross-section. Scale bars, A–B= 3 cm, C= 3mm, D–E= 2 cm, F–G= 5mm, H= 3 mm. All from *Sanín 6836* (BHCB).

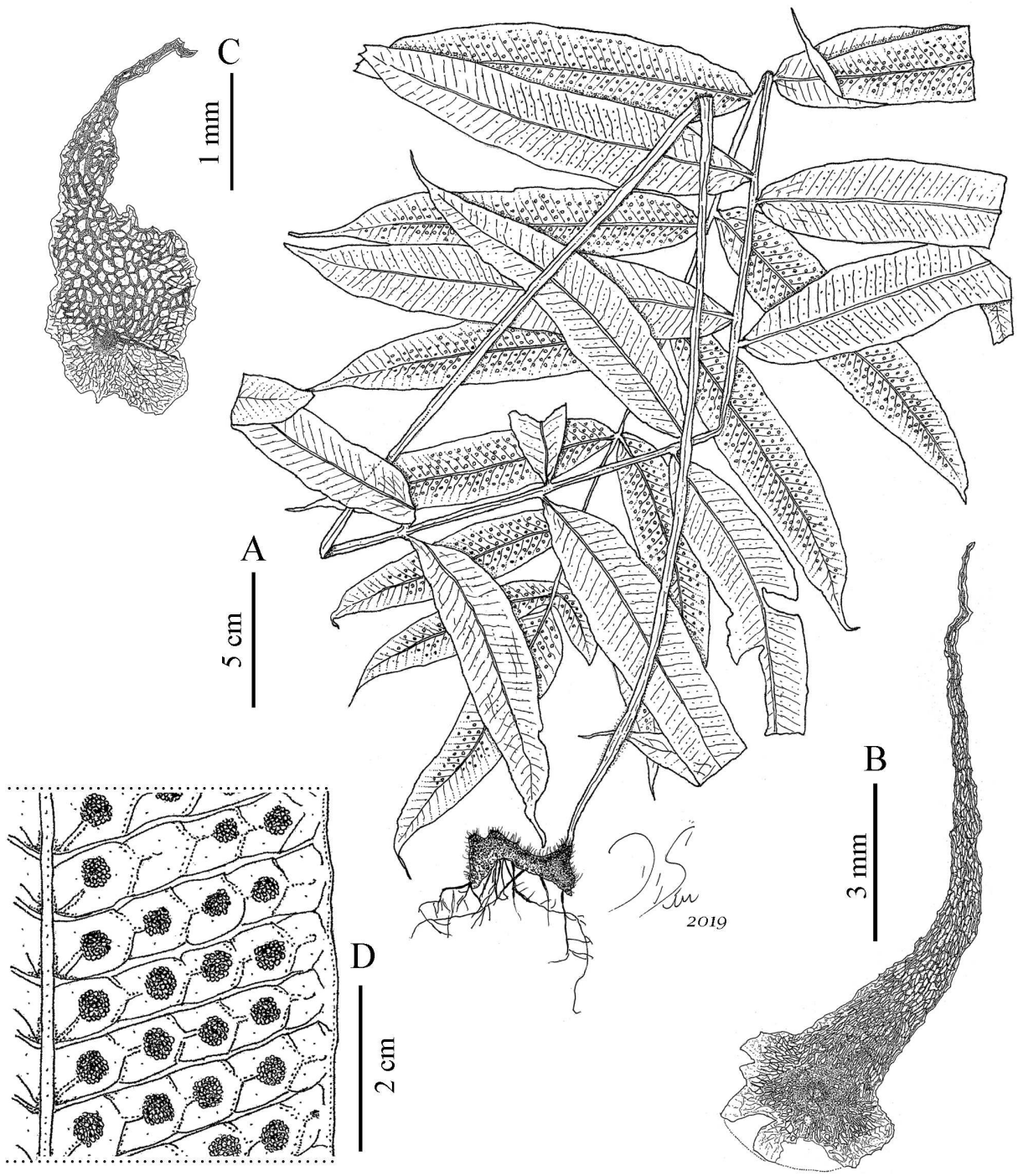


Figure 81. *Serpocaulon psychotrium.* —A. Habit. —B. Rhizome scale. —C. Laminar rhizome. D. Abaxial surface of central pinna. All from *Dorr et al. 7102* (NY).

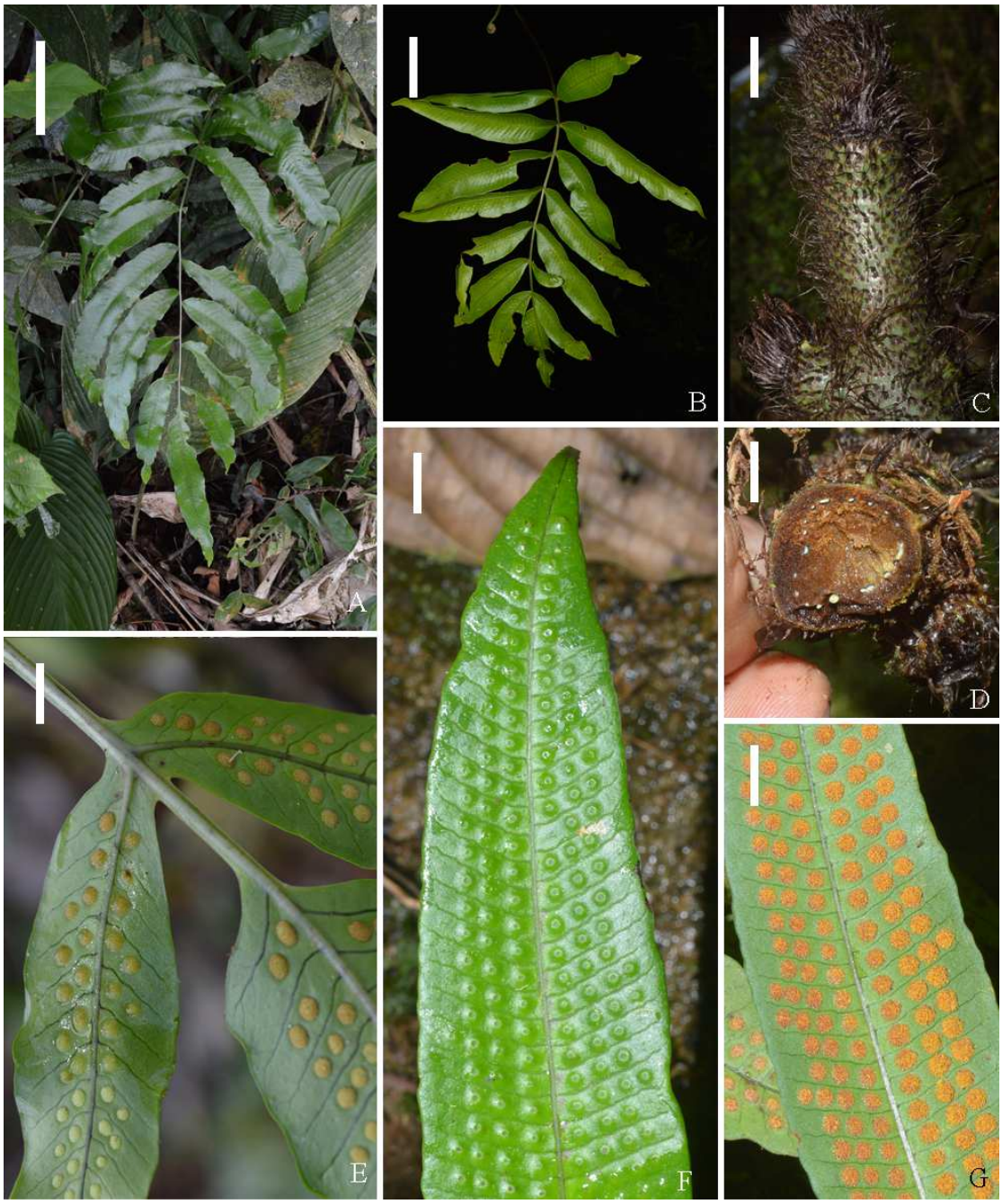


Figure 82. *Serpocaulon psychotrium.* —A. Habit. —B. Lamina. —C. Rhizome. —D. Rhizome cross-section. —E. Apical pinna base. —F. Adaxial view of the middle pinna showing the impressed sori. —G. Abaxial view of the medial pinna showing the sori. Scale bars, A= 10 cm, B= 7 cm, C= 5 mm, D= 5 mm, E= 1 cm, F= 1 cm, G= 1 cm. All from *Sanín et al. 6449* (HUA).

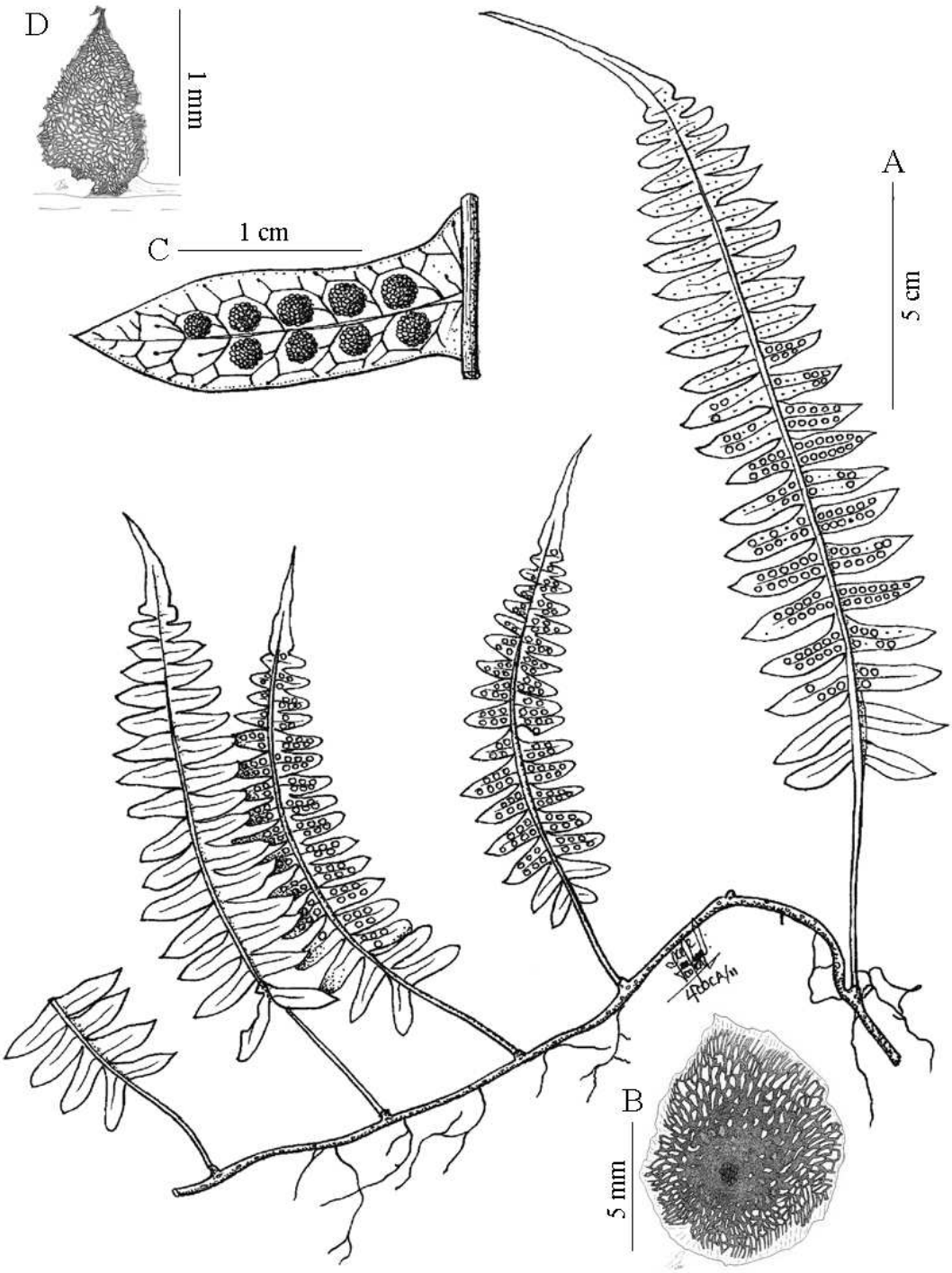


Figure 83. *Serpocaulon ptilorhizon.* —A. Habit. —B. Rhizome scale. —C. Central segments. —D. Laminar scale. All from *Fonnegra 5329* (HUA).

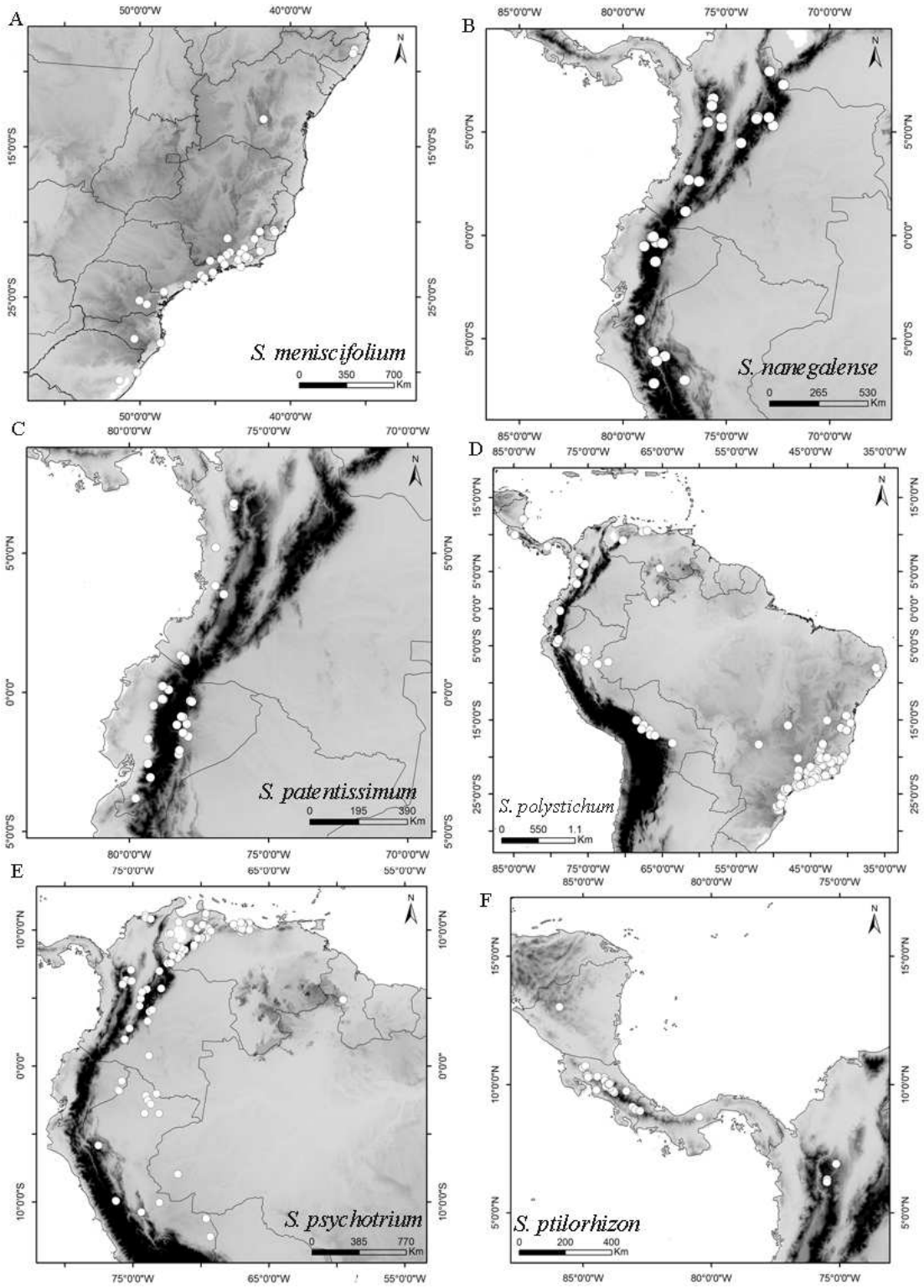


Figure 84. Distribution of *Serpocaulon meniscifolium*, *S. nanegalense*, *S. patentissimum*, *S. polystichum*, *S. psychotrium*, and *S. ptilorhizon*.

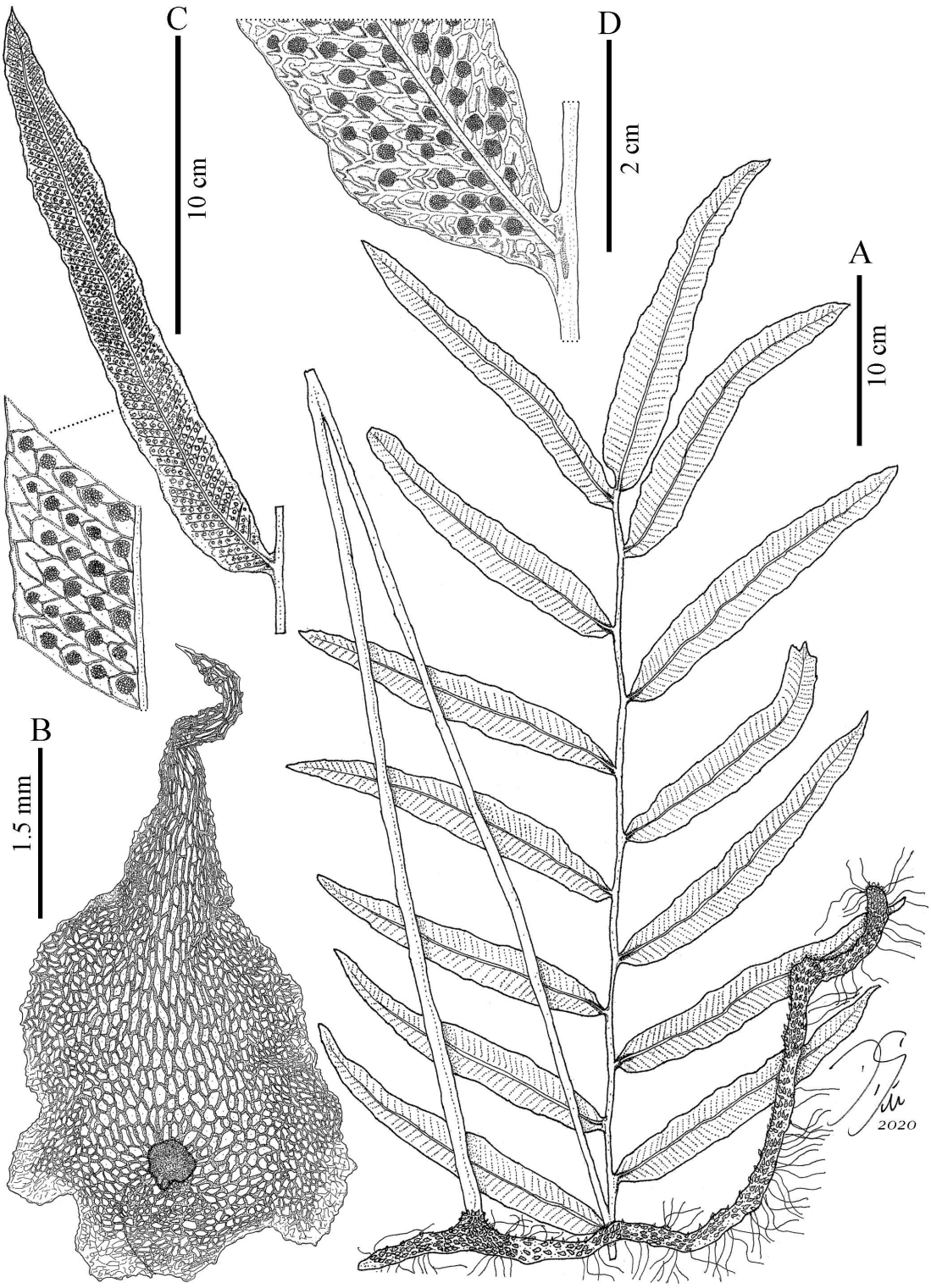


Figure 85. *Serpocaulon rex.* —A. Habit of the plant. —B. Rhizome scale. —C. Central pinna and detail. —D. Base of the central pinna. All from *Sanin & Duarte 7111* (BHCB).

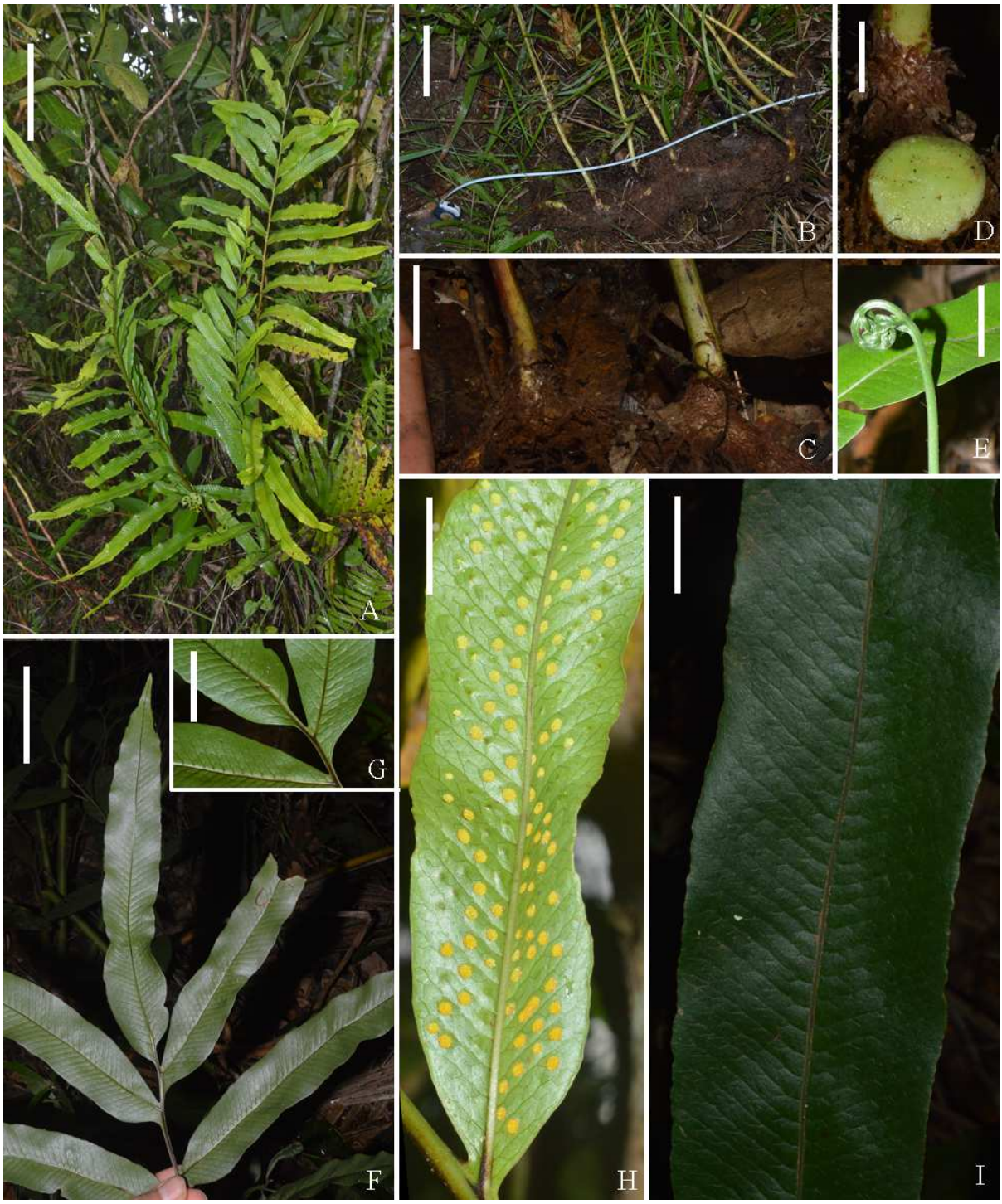


Figure 86. *Serpocaulon rex*. —A. Habit. —B. Size perspective of the rhizome. —C. Rhizome with phyllopodia. —D. Rhizome cross-section. —E. Fiddlehead. —F. Conform apical pinna and lateral adnate pinnae. —G. Lateral pinna insertion from the apex of the laminae. —H. Middle pinna sori. —I. Adaxial view of the middle pinna. Scale bars, A= 15 cm, B= 10 cm, C= 5 cm, D= 5 mm, E= 2 cm, F= 7 cm, G= 5 cm, H–I= 1.5 cm. All from *Sanín et al. 7111* (BHCB).

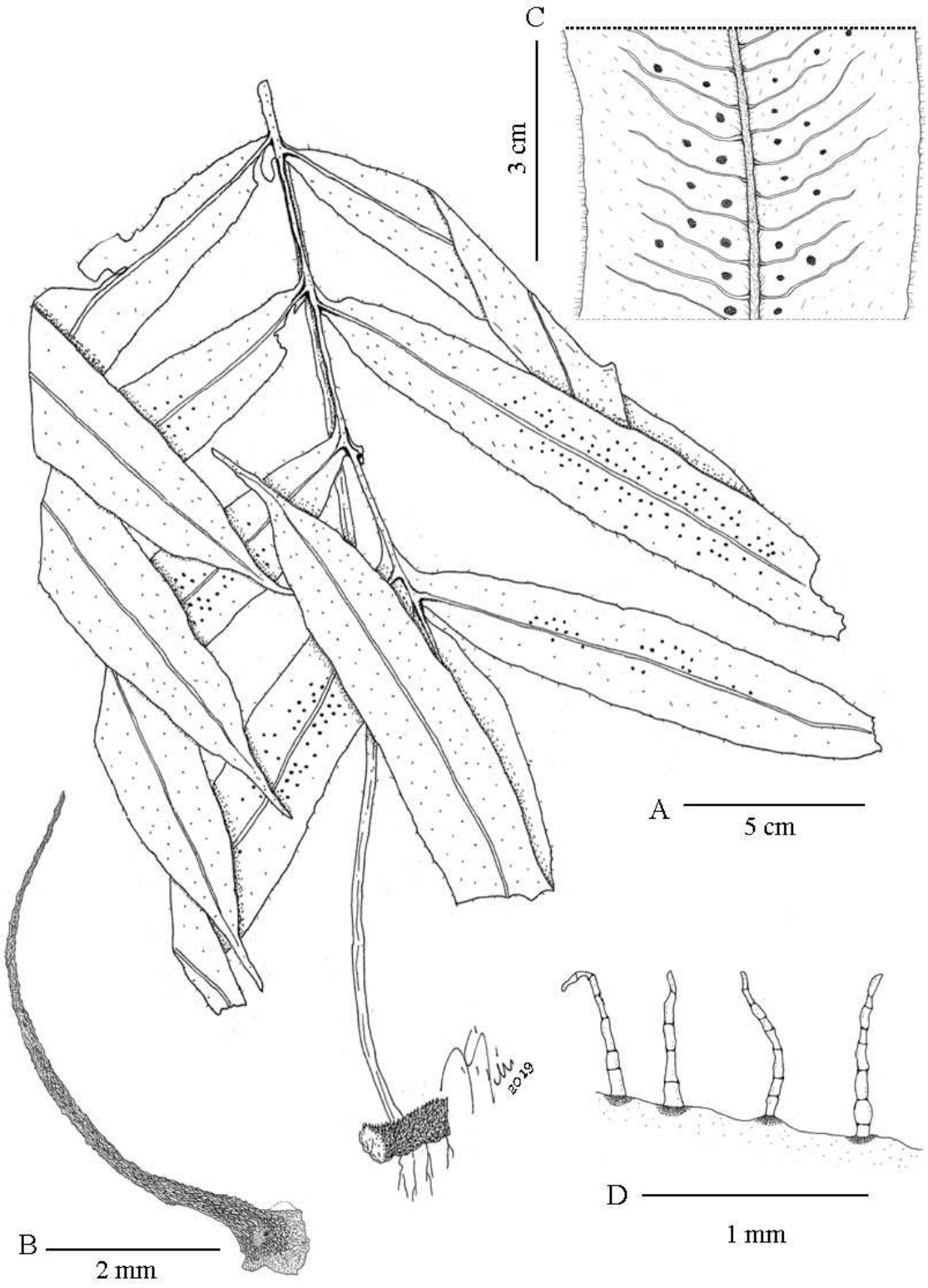


Figure 87. *Serpocaulon richardii.* —A. Habit. —B. Rhizome scale. —C. Central pinna detail. —D. Trichomes. All from *M.R. Pietrobom-Silva 4229* (BHCB, PEUFR).

Figure 88. *Serpocaulon richardii.* —A. Habit. —B. Lamina. —C. Rhizome apex. —D. Rhizome cross-section. —E. Petiole cross-section. —F. Lamina apex. —G. Fiddlehead. —H. Adnate pinna insertion. —I. Distal portion of the rachis. —J. Fertile middle pinna. —K. Proximal portion of the rachis. —L. Basal pinnae. Scale bars, A= 30 cm, B= 10, C= 7 mm, D= 5 mm, E= 3 mm, F= 7 cm, G= 5 mm, H= 4 cm, I= 4 mm, J= 4 cm, K= 5 mm, L= 4 cm. All from *Sanín & Santiago 7267* (BHCB).

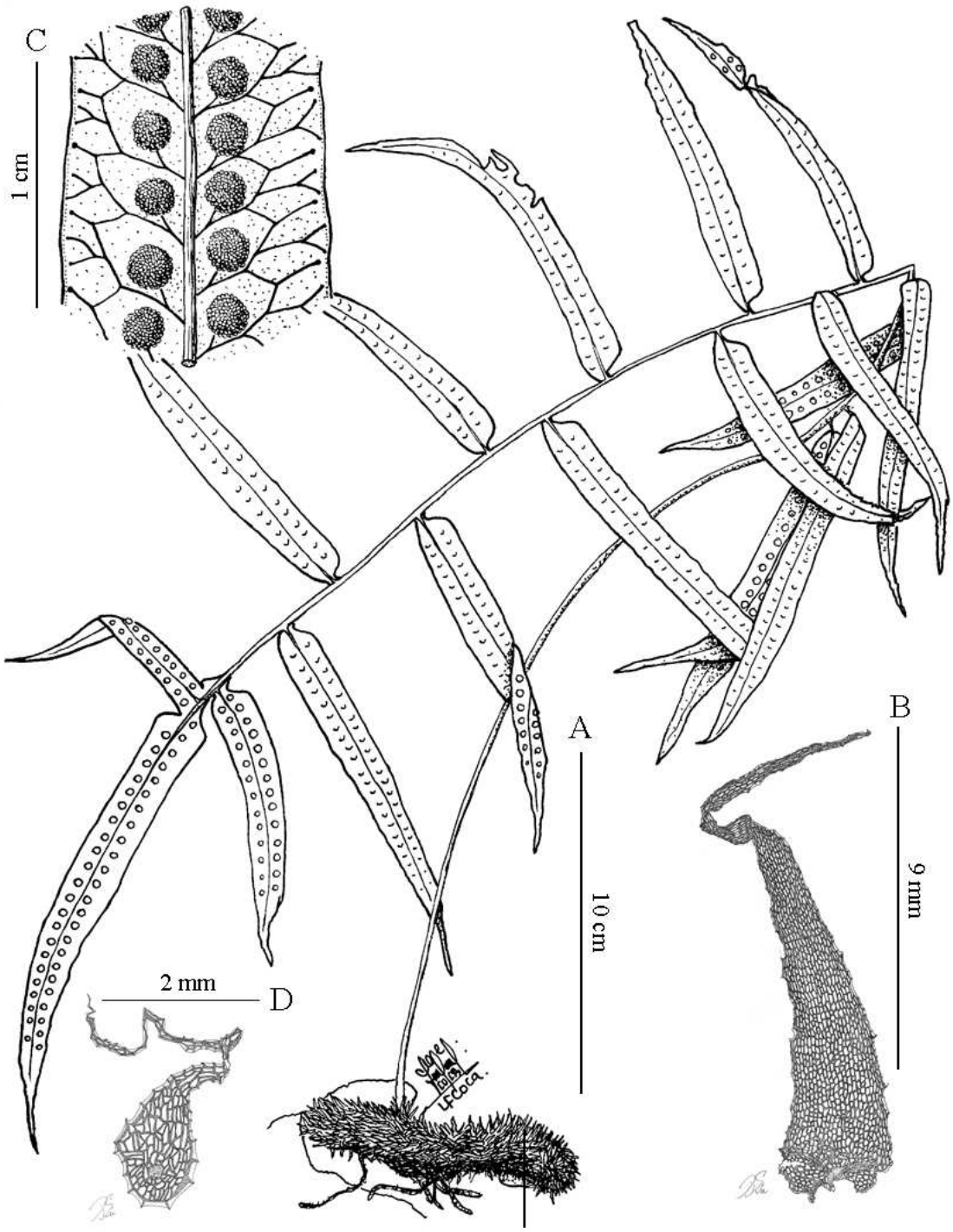


Figure 89. *Serpocaulon sessilifolium.* —A. Habit. —B. Rhizome scale. —C. Central pinna detail. —D. Laminar scale. All from *Sanín 2362* (FAUC).

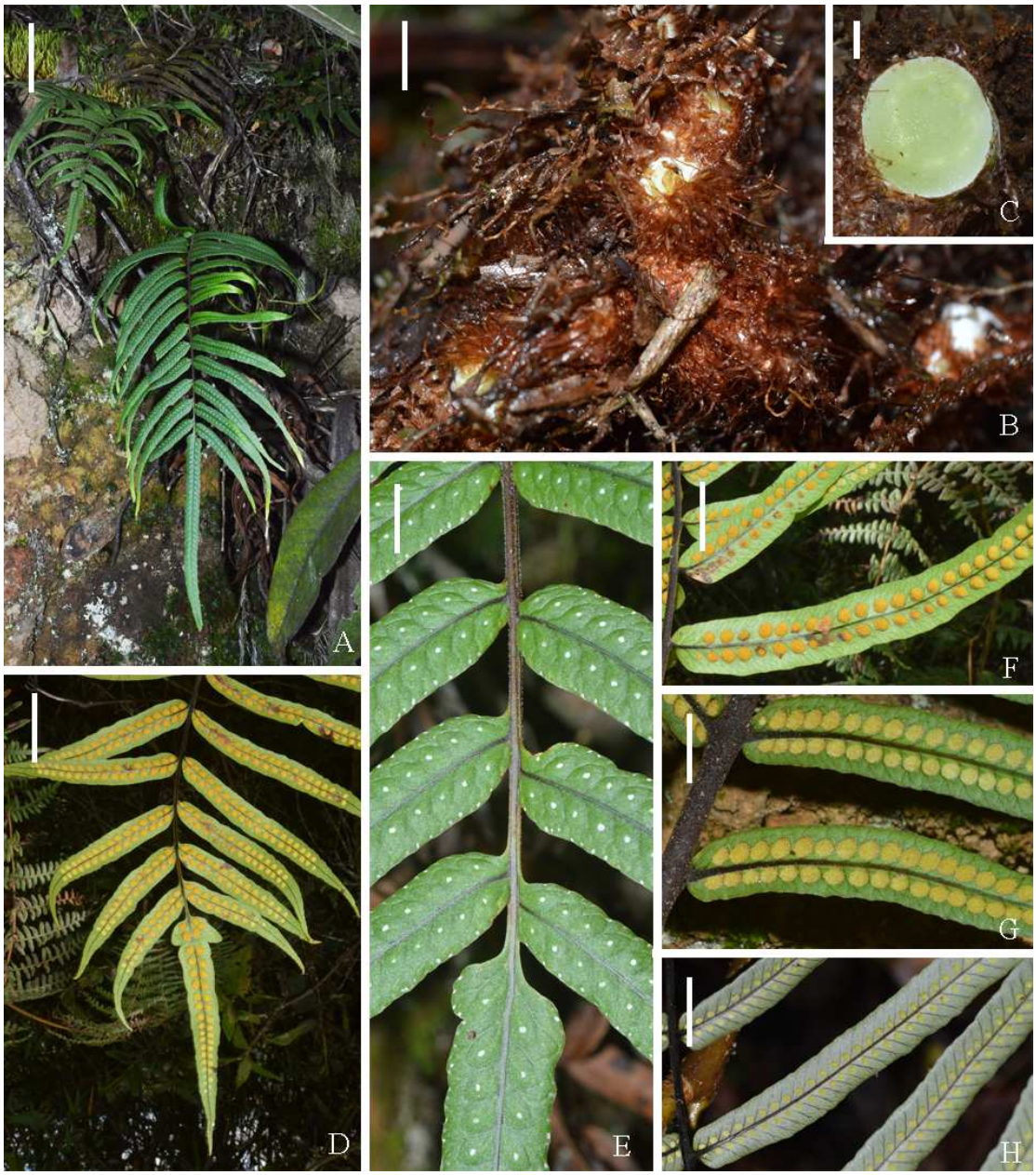


Figure 90. *Serpocaulon sessilifolium.* —A. Habit. —B. Rhizome. —C. Rhizome cross-section. —D. Abaxial view of the fertile lamina apex. —E. Adaxial view of the insertion of the pinnae showing hidathodes. —F–H. Fertile middle pinnae variation Scale bars, A= 10 cm, B= 1 cm, C= 1 cm, D= 3 cm, E= 1 cm, F= 6 cm, G= 6 cm, H= 6 cm. A–C, E, G from *Sanín et al. 6860* (HUA), D, F from *Sanín et al. 6883* (HUA), H from *Sanín et al.6205*, HUA).

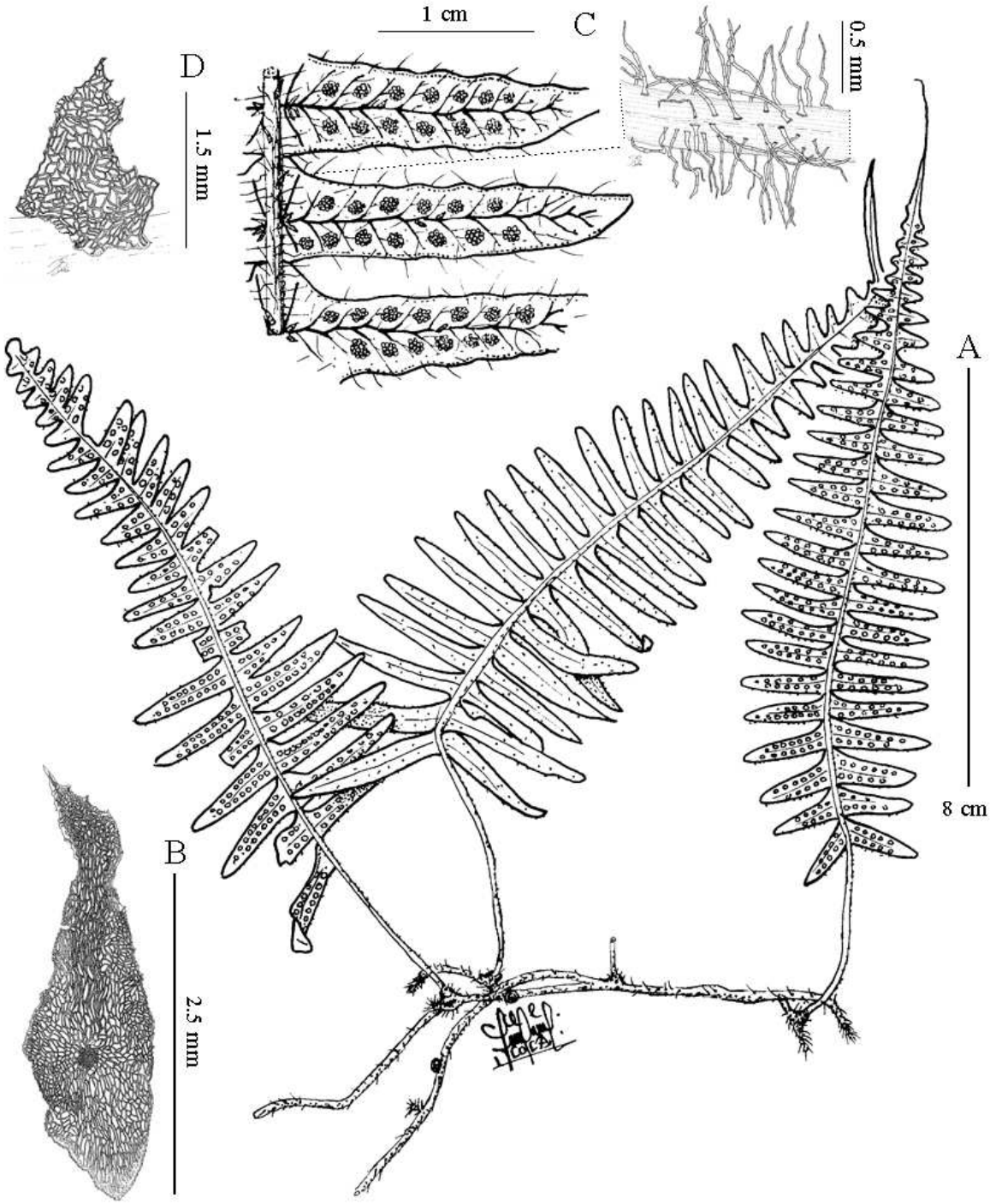


Figure 91. *Serpocaulon subandinum.* —A. Habit. —B. Rhizome scale. —C. Central segments detail. —D. Laminar scale. —E. Trichomes from the lamina and rachis. All from *Sanín 2759* (FAUC).

Figure 92. *Serpocaulon subandinum.* —A. Habit. —B, Rhizome. —C. Lamina. —D. Abaxial view of the fertile lamina with the details of the sori and the pubescence in the costae. —E. Adaxial view of the lamina with the details of the pubescence in the costae. Scale bars, A= 10 cm, B= 05 mm, C= 2 cm, D= 3 mm, E= 3 mm.
A from *Sanín 3151* (HUA), B-C, E from *Sanín 4265* (HUA), D from *Sanín 7098* (COL, HUA).

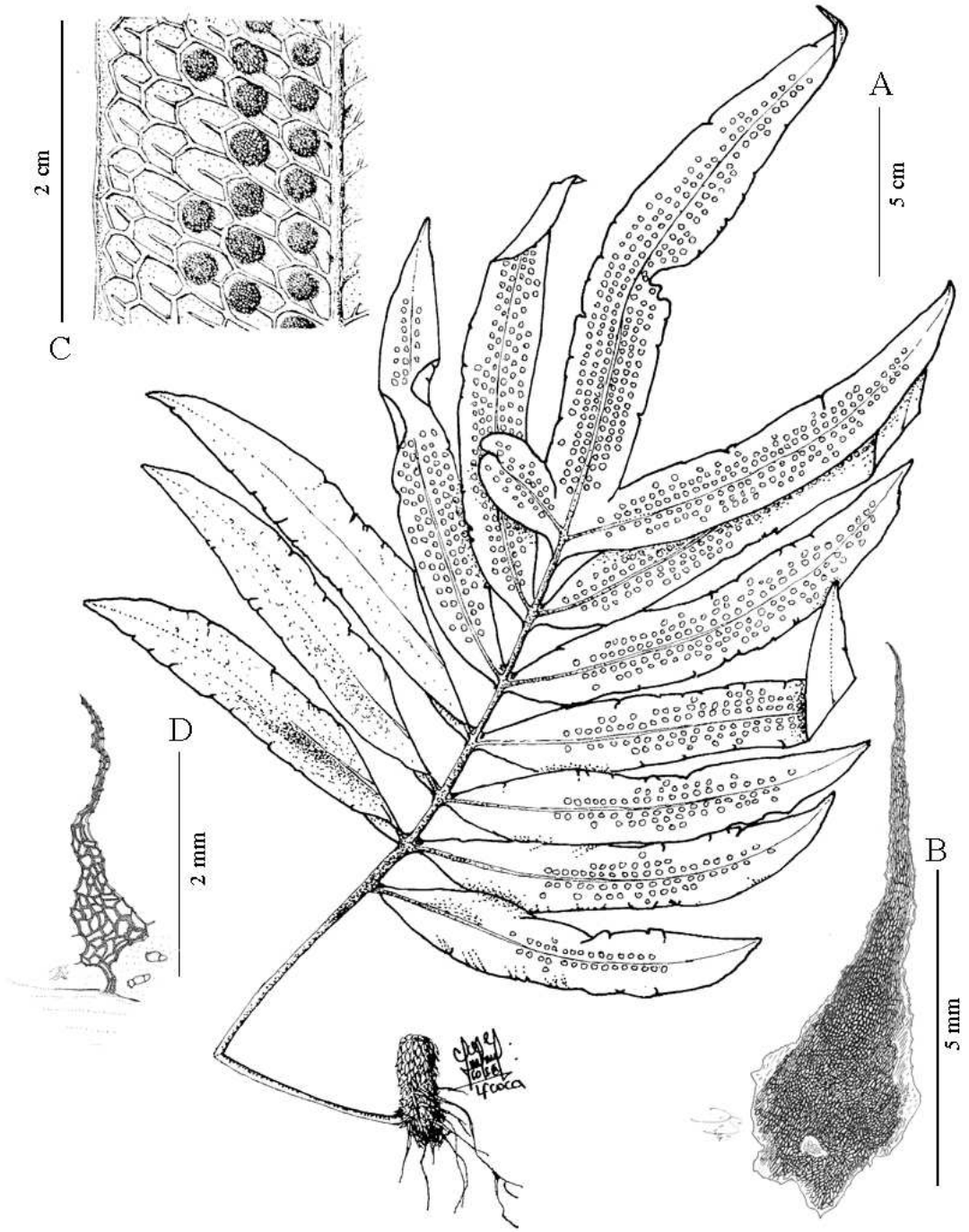


Figure 93. *Serpocaulon triseriale.* —A. Habit. —B. Rhizome scale. —C. Central pinna detail. —D. Laminar scale and trichomes. All from *Sanín 4193* (FAUC).

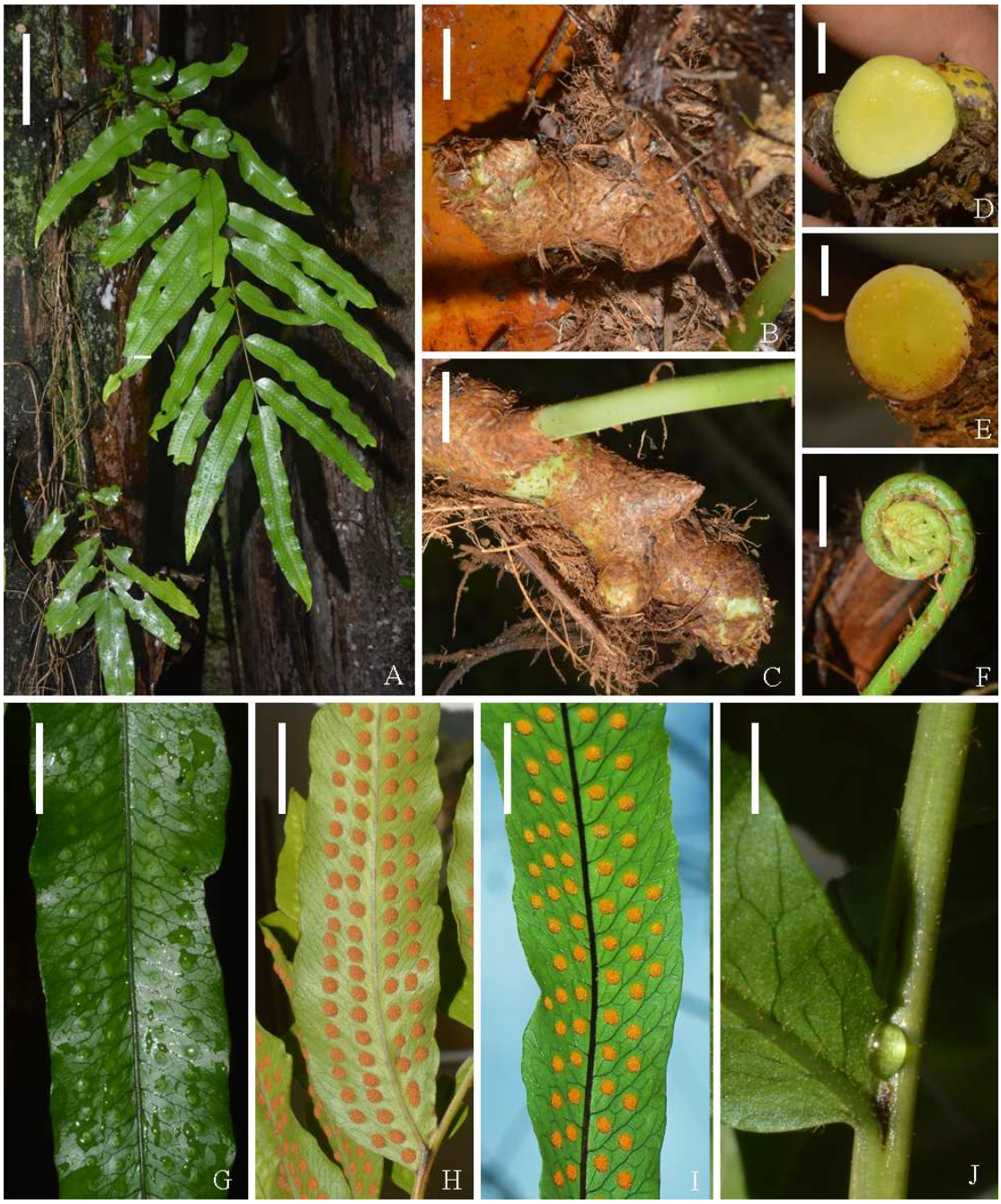


Figure 94. *Serpocaulon triseriale.* —A. Habit. —B. Dorsal view of the rhizome. —C. Ventral view of the rhizome. —D. Rhizome cross-section. —E. Rhizome cross-section with oxidation. —F. Fiddlehead. —G. Adaxial view of middle pinna. —H–I. Pinna variation. —J. Nectary. Scale bars, A= 10 cm, B–C= 1 cm, D–E= 5 mm, F= 1 cm, G–I= 1.5 cm, J= 5 mm. A–F from *Sanín & Santiago 7274* (BHCB), G from *Sanín et al. 7217.* H from *Sanín et al. 7075* (HUA), I from *Ramos s.n*. (MCNS), J from *Sanín et al. 7202* (BHCB).

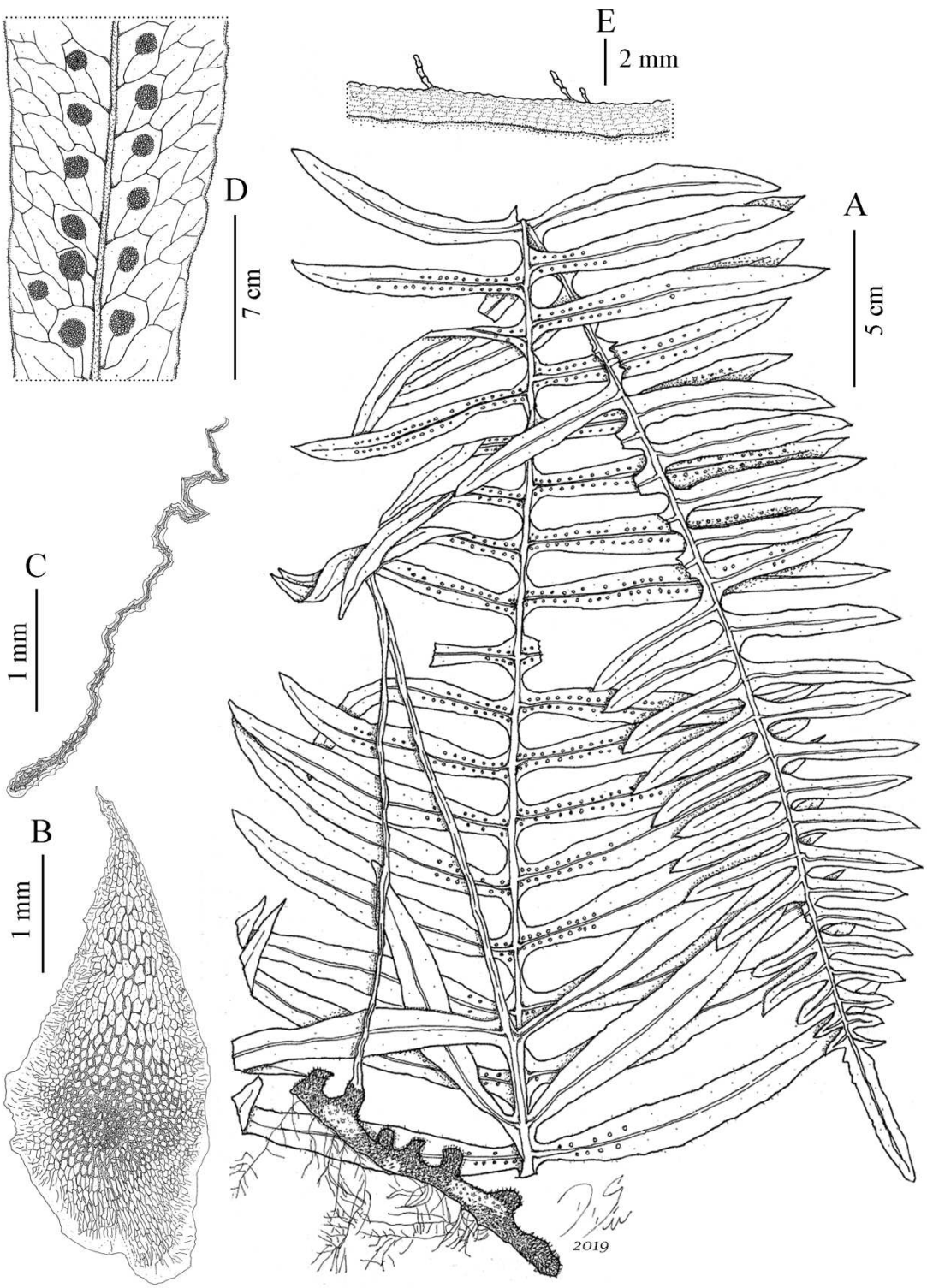


Figure 95. *Serpocaulon vacillans.* —A. Habit. —B. Rhizome scale. C. Lamina scale. —D. Segment detail. E. Laminar trichomes. All from *Sanín et al. 6800* (BHCB).

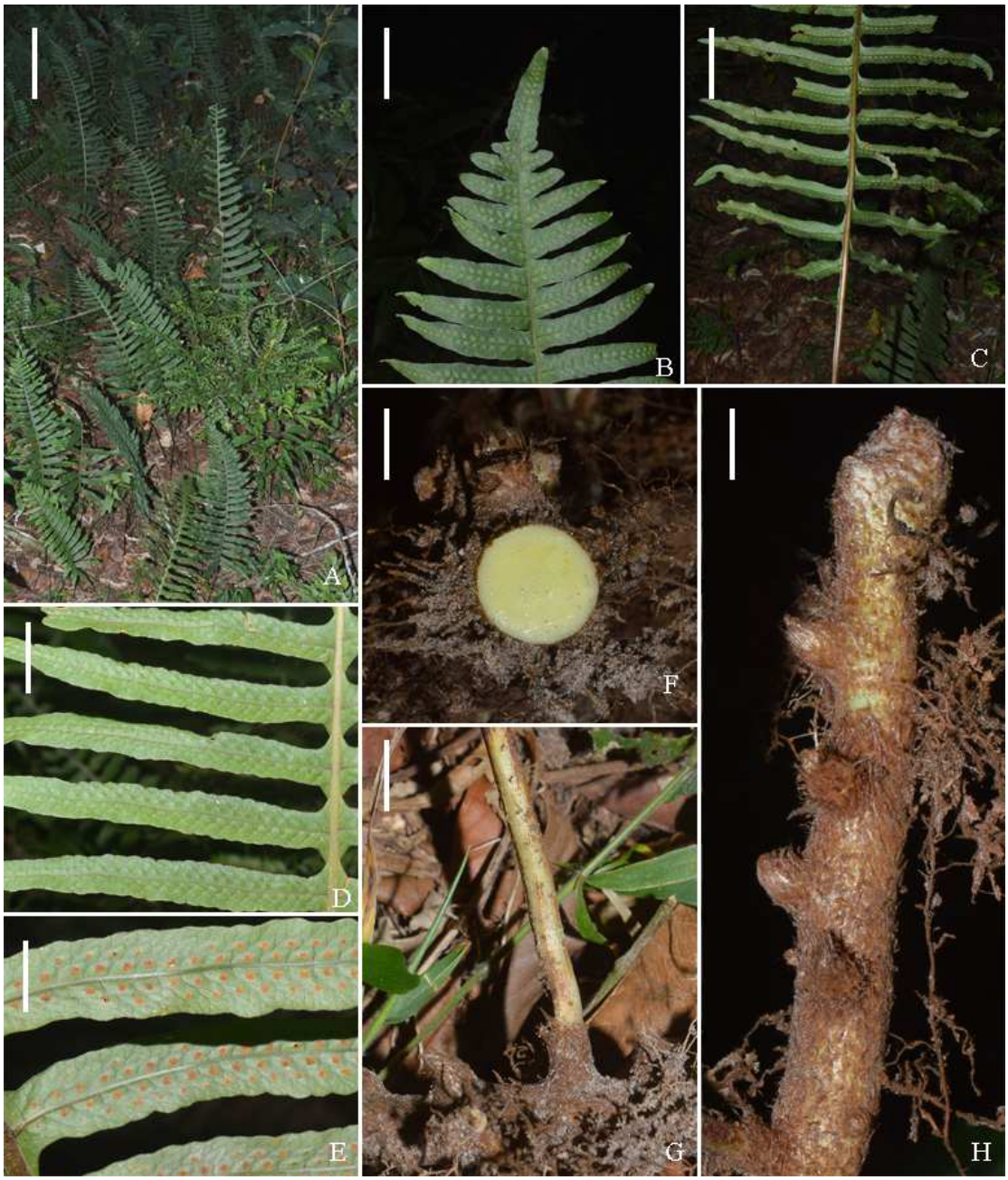


Figure 96. *Serpocaulon vacillans.* —A. Habit. —B. Lamina apex. —C. Lamina base. —D. Adaxial view of the fertile lamina. —E. Abaxial view of the fertile lamina. —F. Rhizome cross-section. —G. Sinuate base of the petiole. —H. Rhizome. Scale bars, A= 15 cm, B= 4 cm, C= 5 cm, D= 2 cm, E= 1 cm, F= 8 mm, G= 1 cm, H= 5 mm. From *Sanín 7130* (BHCB).

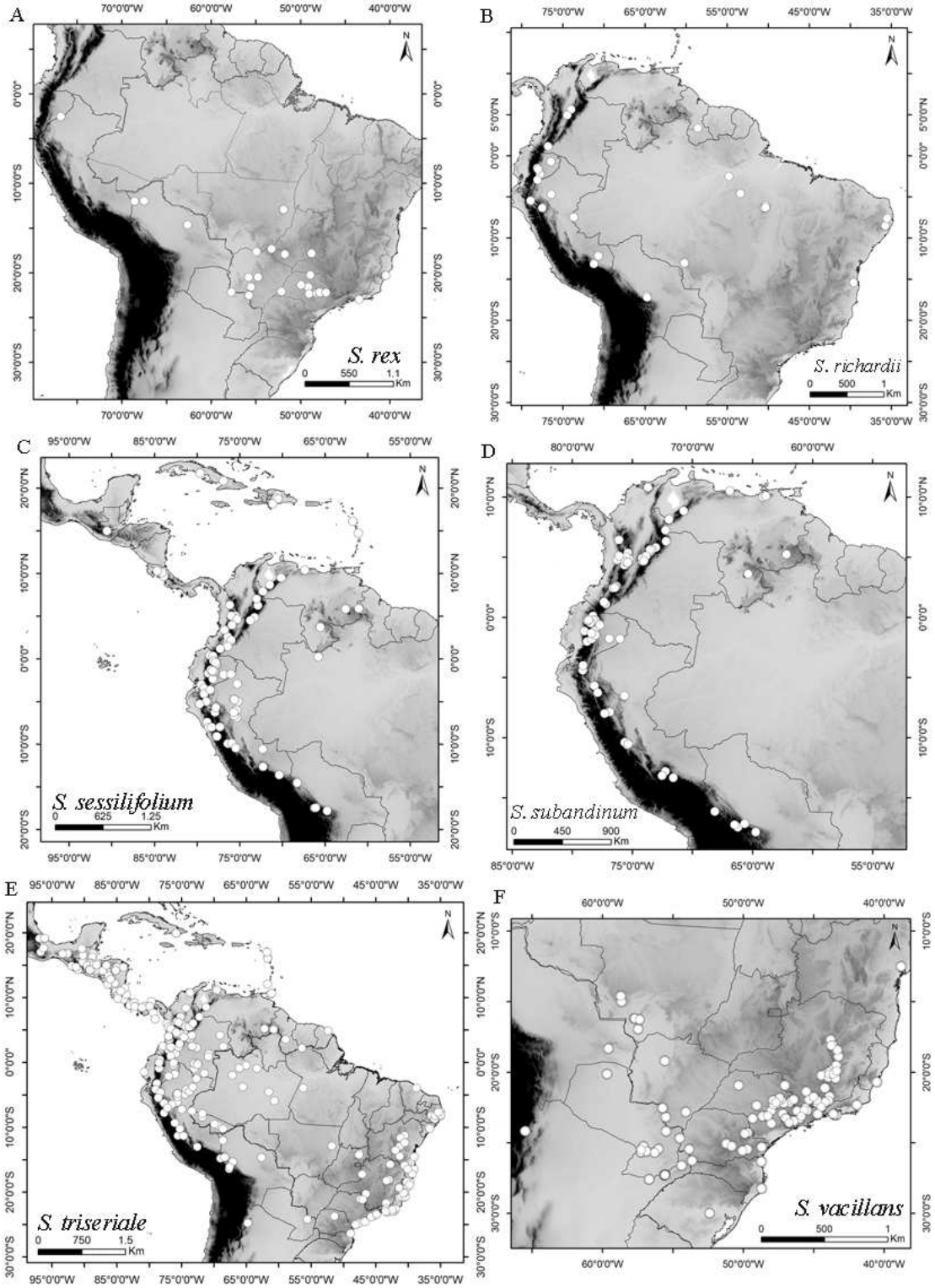


Figure 97. Distribution of *Serpocaulon rex*, *S. richardii*, *S. sessilifolium*, *S. subandinum*, *S. triseriale*, and *S. vacillans*.

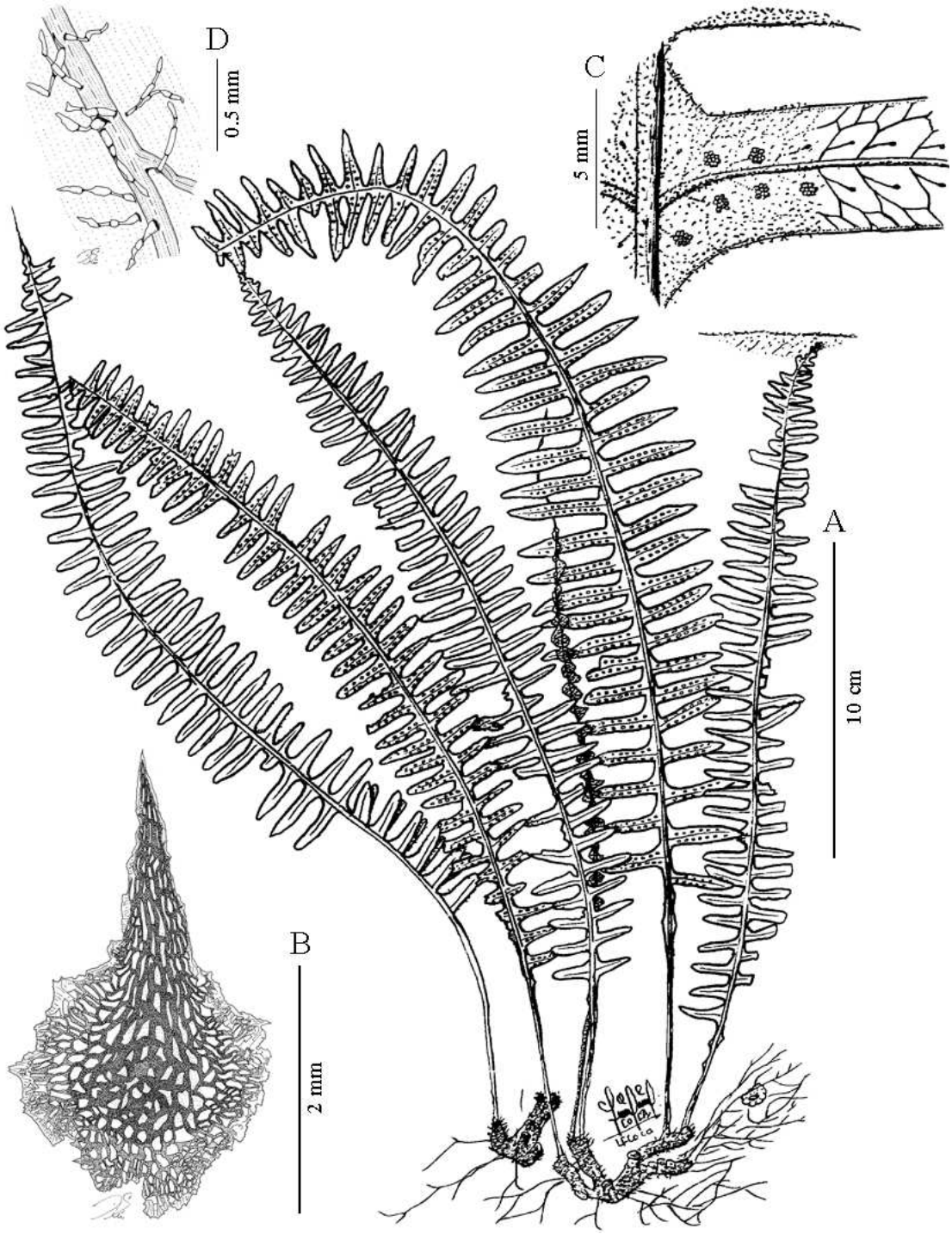


Figure 98. *Serpocaulon wagneri.* —A. Habit. —B. Rhizome scale. C. Central pinna detail. —D. Laminar scale and trichomes. All from *Mercado 21* (HUA).

Figure 99. *Serpocaulon wagneri.* —A. Habit. —B. Rhizome. —C. Lamina. Scale bars, A= 15 cm, B= 5 cm, C= 5 cm, D. From *Salino 15333* (BHCB). Fotos by A. Salino.

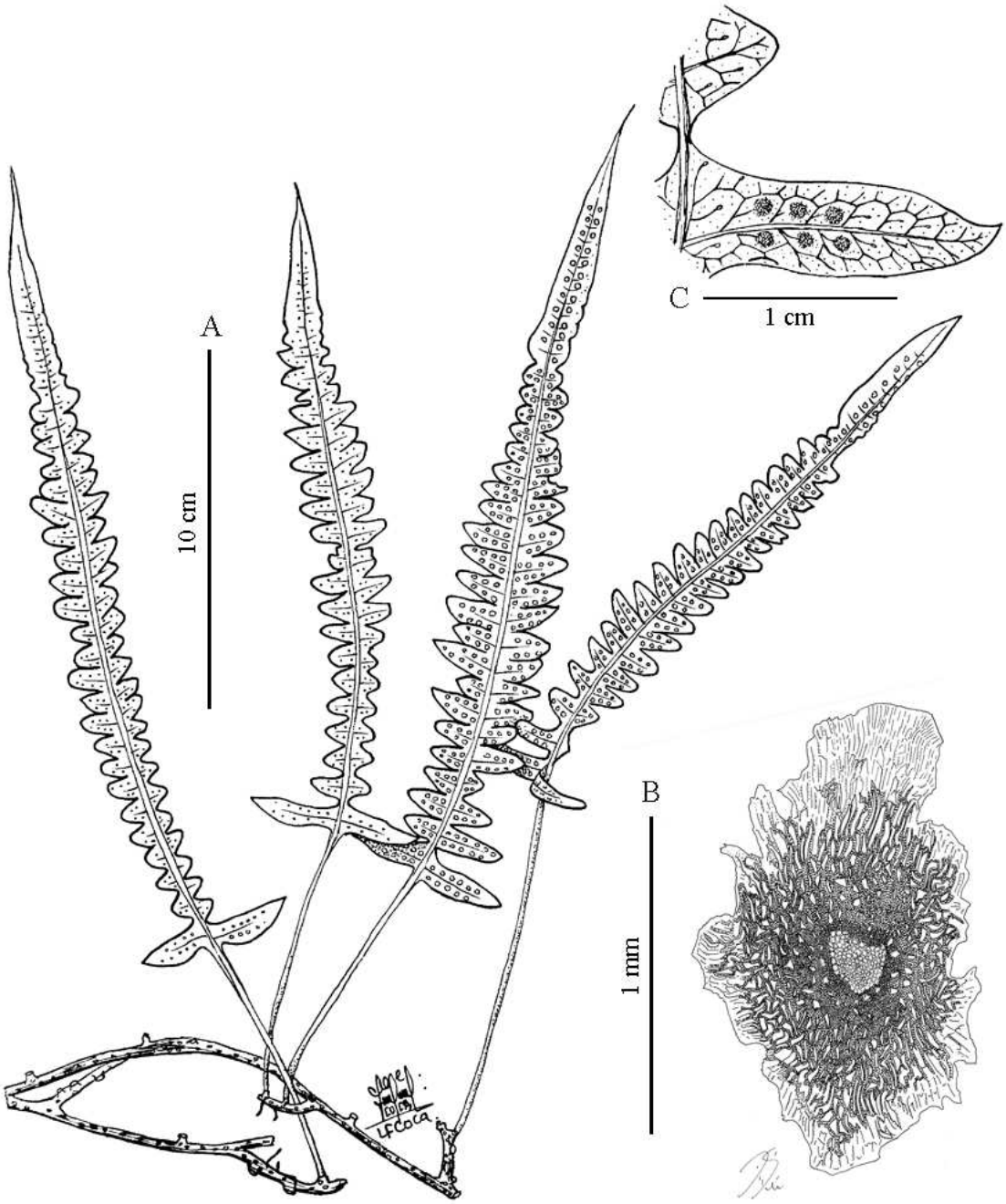


Figure 100. *Serpocaulon* ×*semipinnatifidum*. —A. Habit. —B. Rhizome scale. C. Central pinna detail. All from *Rodríguez-D 3251* (HUA).

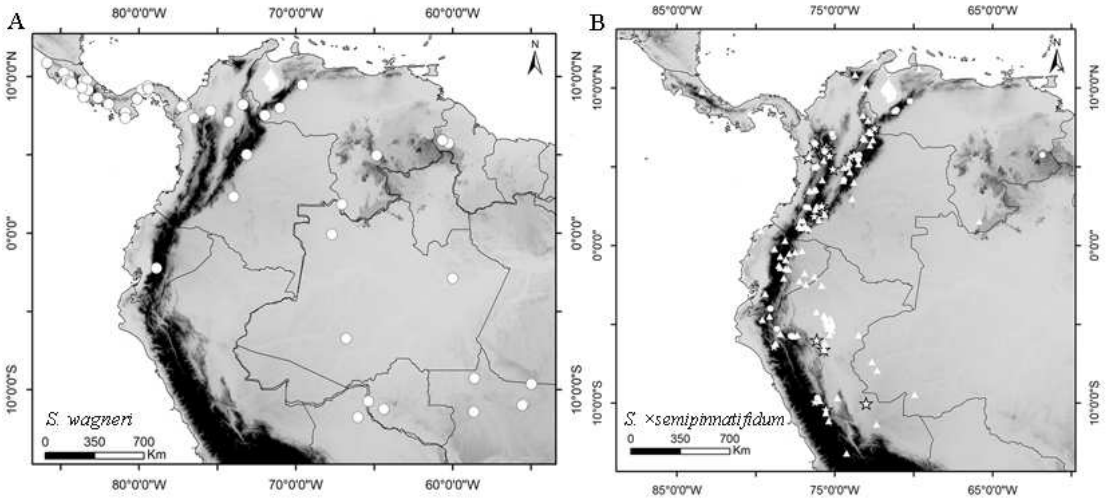


Figure 101. Distribution of *Serpocaulon wagneri*, and *S.* ×*semipinnatifidum.* Image captions from the map B, Stars= *S.* ×*semipinnatifidum*; triangle (Δ) = *S. levigatum*; circle (○) = *S. funckii.*

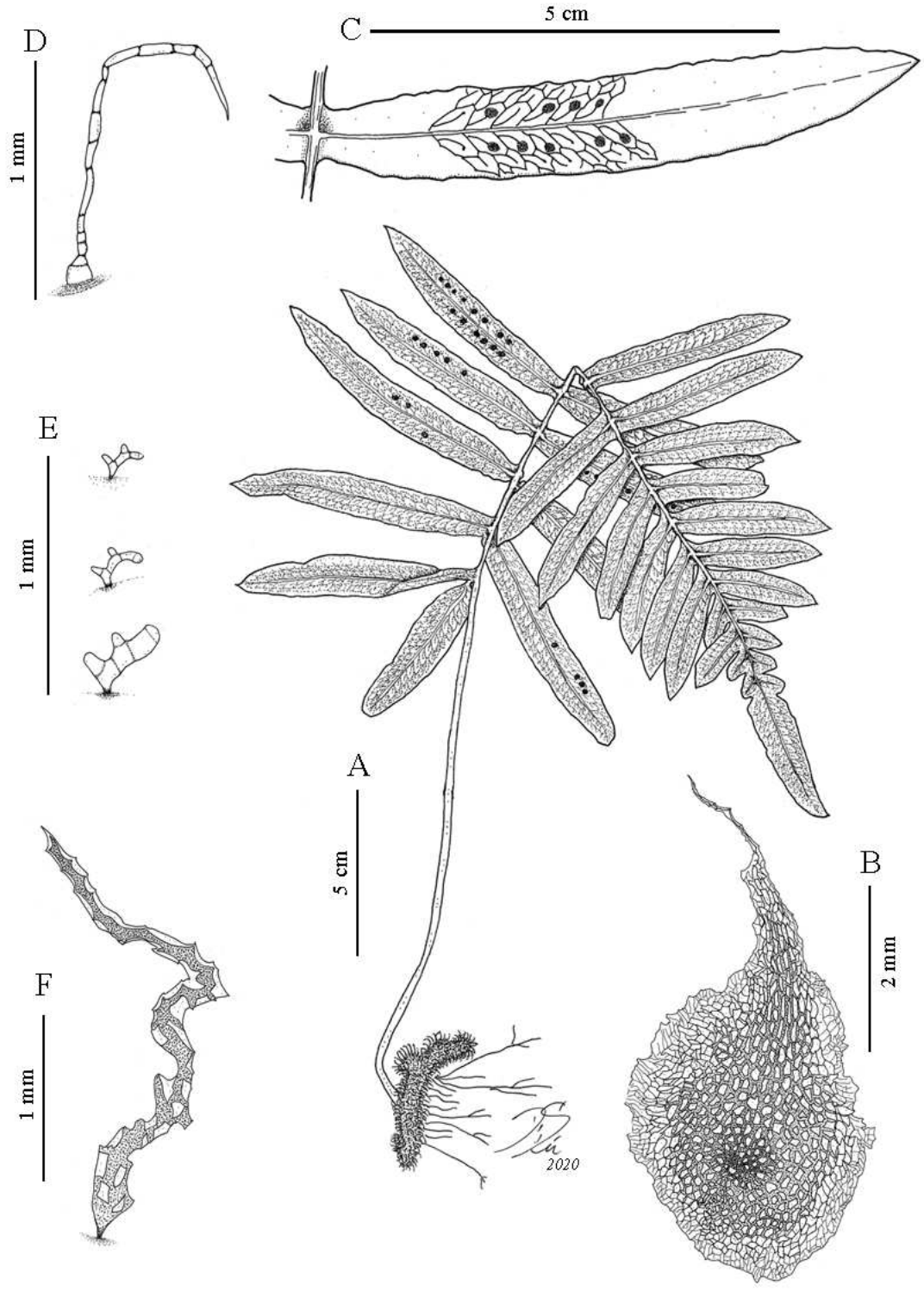


Figure 102. *Serpocaulon ×tabuleirense.* —A. Habit. —B. Rhizome scale. C. Central pinna detail. —D. Laminar scale and trichomes. All from *Sanín & Torrez 6782* (BHCB).

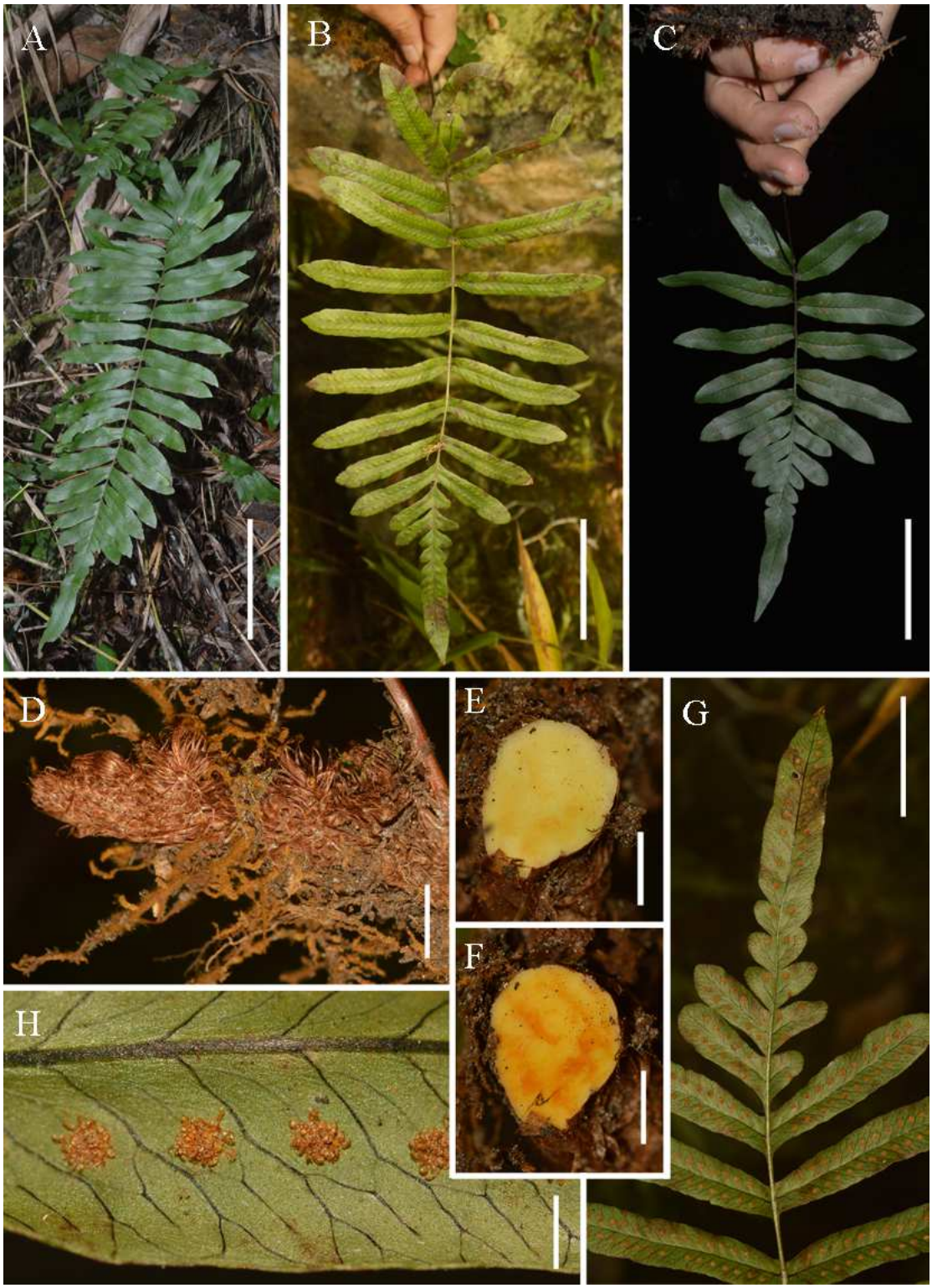


Figure 103. *Serpocaulon ×tabuleirense.* —A. Habit. —B. Lamina apex. —C. Lamina base. —D. Adaxial view of the fertile lamina. —E. Abaxial view of the fertile lamina. —F. Rhizome cross-section. —G. Sinuate base of the petiole. —H. Rhizome. Scale bars, A= 15 cm, B= 4 cm, C= 5 cm, D= 2 cm, E= 1 cm, F= 8 mm, G= 1 cm, H= 5 mm. From *Sanín & Torrez 6782* (BHCB).

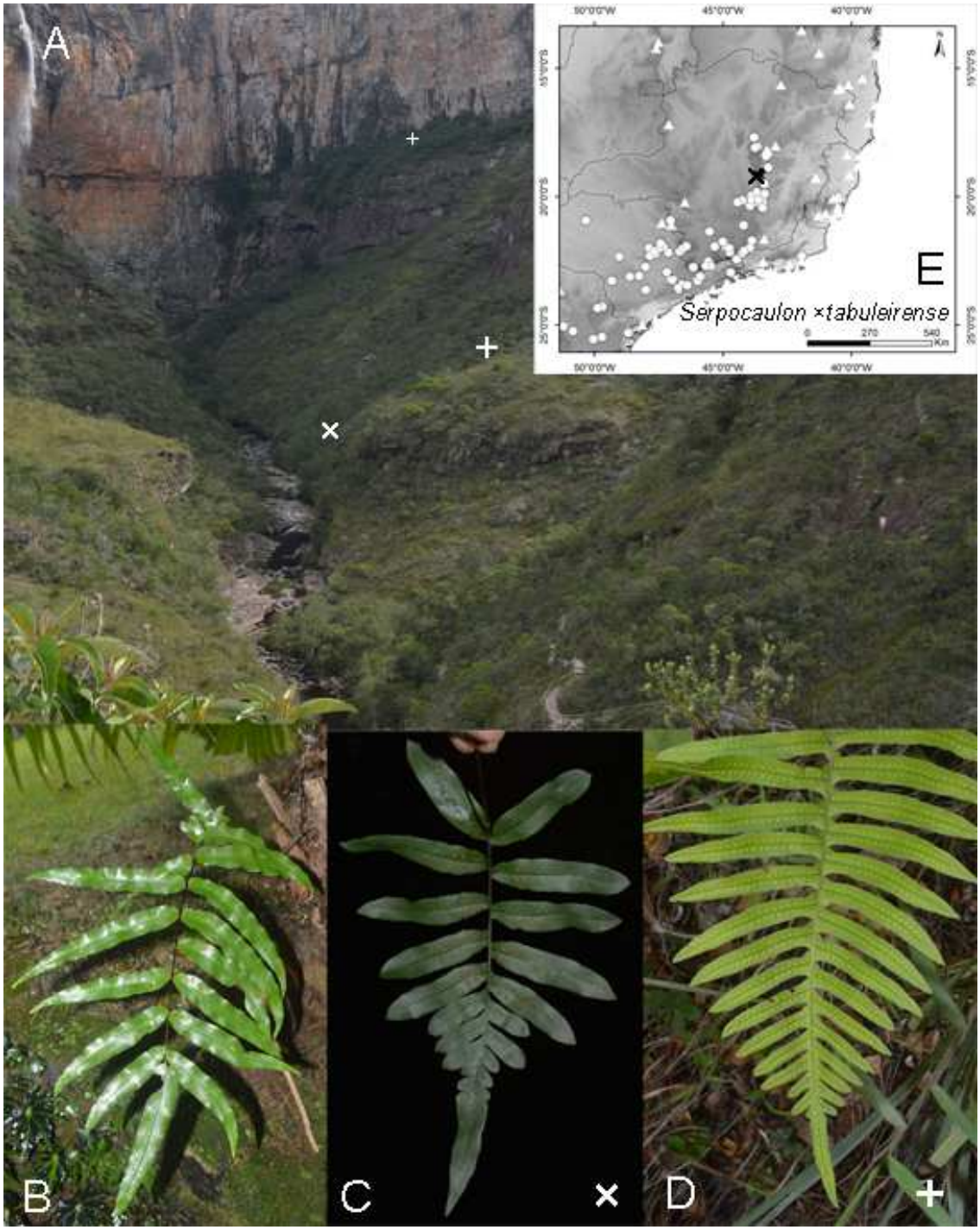


Figure 104. Type locality, distribution and relative's species of *Serpocaulon ×tabuleirense.* —A. Tabuleiro waterfall, MG, Brazil. —B. *S. triseriale*, from *Sanín & Duarte 7116* (BHCB). —C. *S. ×tabuleirense*, from *Sanín & Torrez 6782* (BHCB). —D. *S. vacillans*, from *Sanín & Duarte 7277* (BHCB). —E. Distribution of *×tabuleirense.* Image captions, ×= *S. ×tabuleirense*, += *S. vacillans*; from the map, triangle (Δ) = *S. triseriale*; circle (○) = *S. vacillans.*

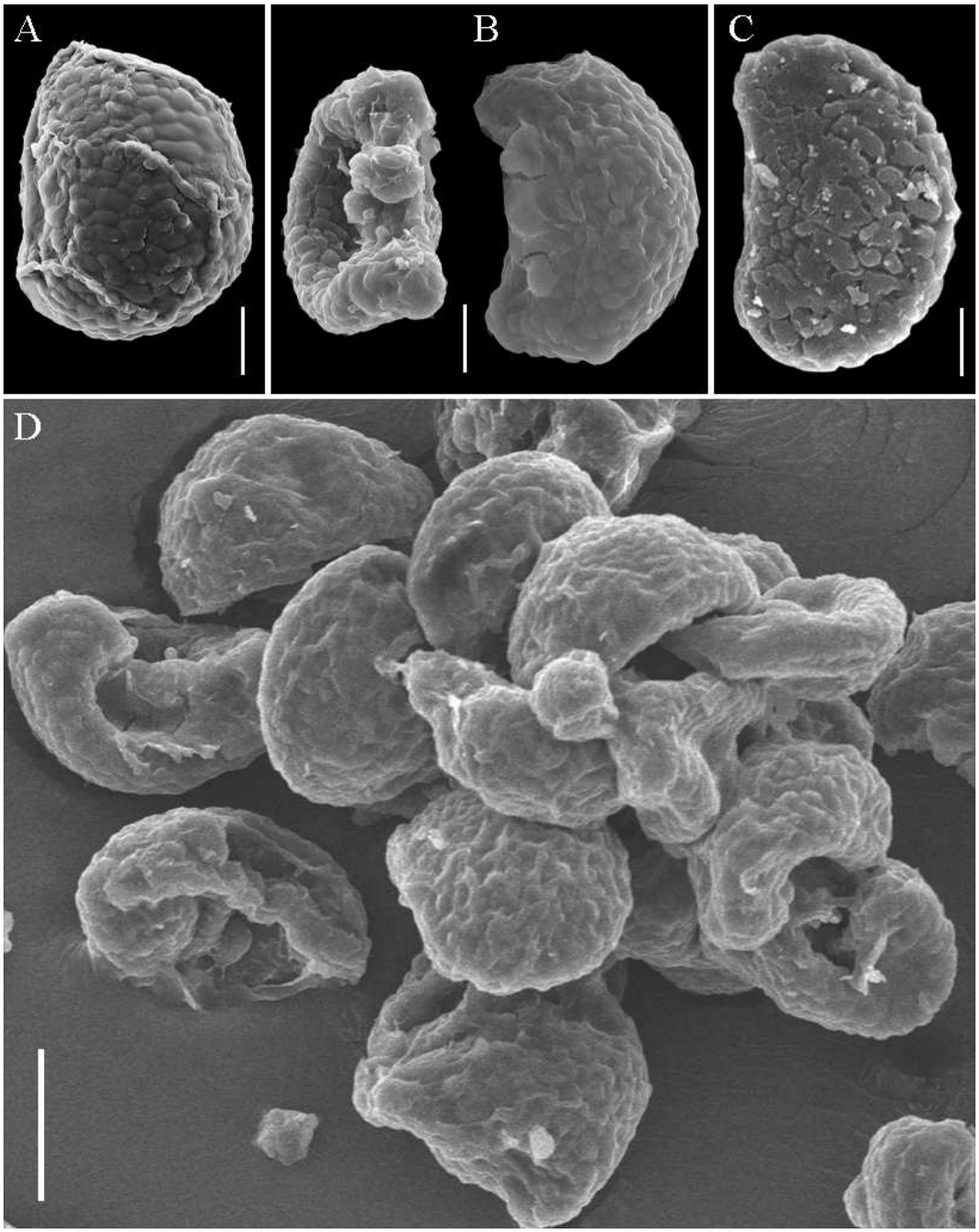
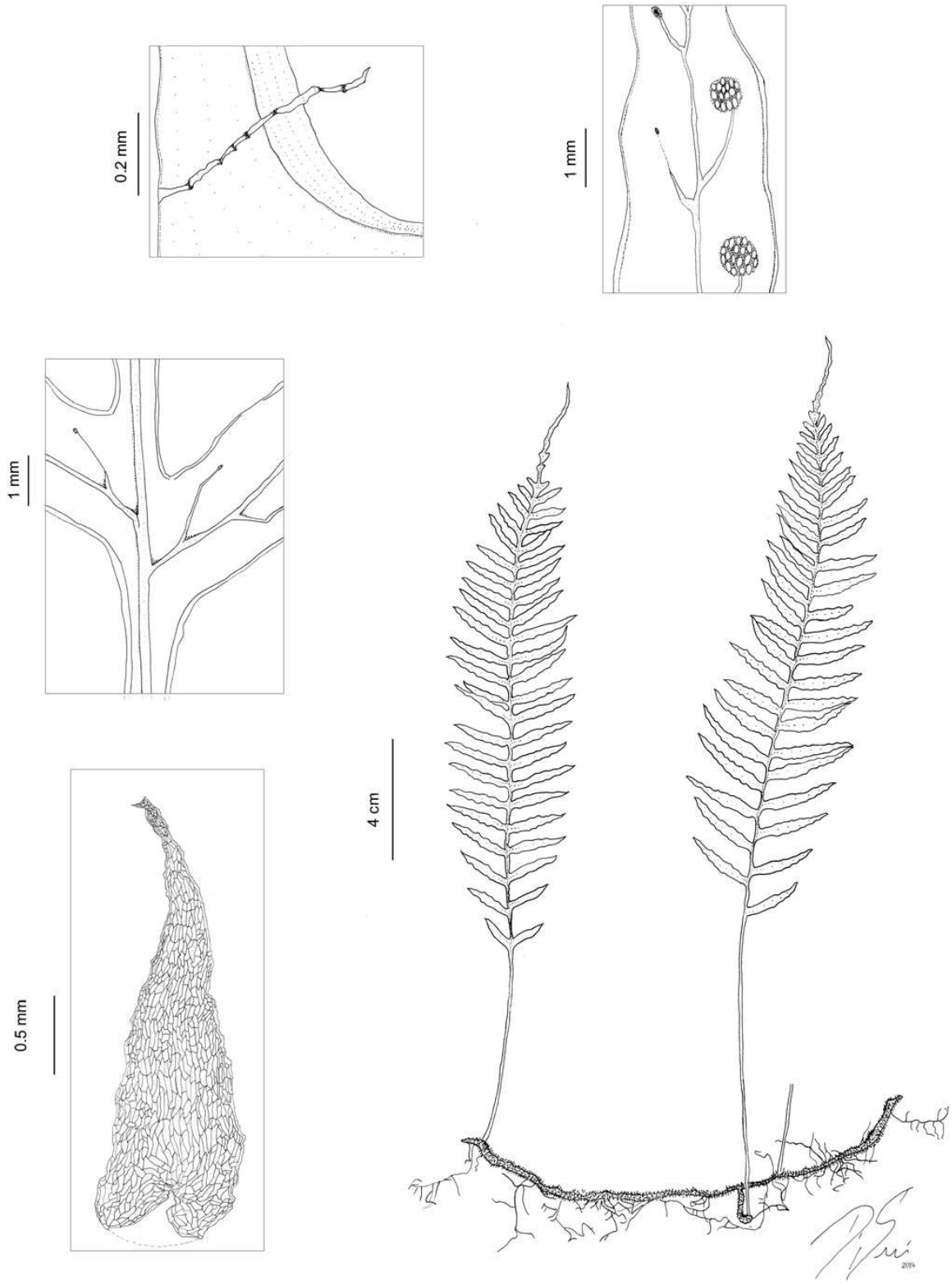


Figure 105. Spores comparison of the related species of *Serpocaulon ×tabuleirense*. —A. *S. vacillans*. —B. *S. ×tabuleirense*. —C. *S. triseriale,*—D. Group of collapsed/aborted spores of *S. ×tabuleirense*. A= lateral view from *Sanín et al. 6855* (BHCB). B= equatorial and lateral view from *Sanín & Torrez 6782* (BHCB). C= lateral view from *Sanín 2606* (FAUC). D. From *Sanín & Torrez 6782* (BHCB). Scale bars, A–C= 10 µm, D= 20 µm.



Serpocaulon tayronae from Sanín (2015) in Phytotaxa 213: 243–252.

CAPÍTULO 2

CAPÍTULO 2.

NEITHER *POLYPODIUM* NOR A *SERPOCAULON*: PHYLOGENETIC AND SYSTEMATIC POSITION OF *CAMPYLONEURUM TAYRONAE* (POLYPODIACEAE)

Artigo a ser submetido para a revista Annals of the Missouri Botanical Garden

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ABSTRACT

The phylogenetic position of *Serpocaulon tayronae* is inferred from the analysis of cpDNA sequences of *rbc*L and *trn*G-*trn*R. Our dataset included 99 species from the polygrammoid clade, plus three species of *Oleandra*. *Serpocaulon tayronae* is endemic to the Sierra Nevada de Santa Marta, Colombia, where it grows from 1520 to 1600 m. It superficially resembles some species of *Polypodium*, particularly those of the *P. plesiosorum* complex, to which it was compared in the protologue. The results of our molecular phylogenetic study, however, support the taxonomic placement of this species within the Pruinose Clade of *Campyloneurum*. Despite the pinnatisect laminae, the following morphological characters agree with this clade: long-creeping rhizomes, auriculate, strongly attached, spread, concolorous, yellowish, light-colored rhizome scales with isodiametric cells, branched trichomes, and spores with an ellipsoid or sub-ellipsoid to globular shape and dense, rounded, evenly distributed verrucae. The new combination *Campyloneurum tayronae* is provided, along with photographs of the plants in the field and SEM images of spores and hairs.

Key words: Molecular inference, new combination, Pruinose clade, Sierra Nevada de Santa Marta.

Serpocaulon A.R. Sm. (Polypodiaceae) comprises 37 species distributed in tropical America, from Mexico and the Antilles to Argentina and E. Brazil, with the highest diversity in the mountainous areas of northern Andes (Chapter 1). The genus was segregated from *Polypodium* L. by Smith et al. (2006), who included 40 neotropical species characterized by short- to (predominantly) long-creeping rhizomes, clathrate rhizome scales, and areolate veins. Since then, new taxa, combinations, and synonyms have been published in Argentina (Sanín et al., 2019), Brazil (Labiak & Prado, 2008; Schwartsburd & Smith, 2013; Sanín & Salino, 2018, 2020), Colombia and Venezuela (Sanín, 2015, 2018; Sanín & Torrez, 2014; Sanín et al. in prep.), and Costa Rica (Rojas-Alvarado & Chaves-Fallas, 2013; Chaves-Fallas et al., 2015).

One of these novelties, *Serpocaulon tayronae* D. Sanín (Fig. 1) deserves special attention, not only because it is a rare and endemic species from the Sierra Nevada de Santa Marta, Colombia, but also, for its controversial taxonomic circumscription (Sanín, 2015). It is characterized morphologically by slender, long-creeping rhizomes, yellowish or light-colored rhizomes scales, pectinate laminae, and ascending, long-attenuate segments with free veins (Sanín, 2015). This last feature contrasts with the description provided by Smith et al. (2006), who mentioned the presence of regularly anastomosing veins (goniophlebioid), the areoles chevron-shaped and with a single, free, included veinlet as a diagnostic feature for *Serpocaulon.*

By the ascending segments of the laminae with free veins, *S. tayronae* resembles some species of the *Polypodium plesiosorum* complex (sensu Tejero-Díez, 2005), especially *P. tenuifolium* Willd. However, *S. tayronae* differs from these species by its long-creeping (vs. compact)

rhizomes, glabrous (vs. puberulent) rachises, and glabrous (vs. setulose) sporangia (Moran, 1995; Sanín, 2015).

The pinnatisect laminae with ascending segments and free veins also resemble *Lellingeria subsessilis* (Baker) A.R. Sm. & R.C. Moran, which differs by radially arranged fronds and the green trilete spores (Labiak, 2013). The slender, long-creeping rhizomes, the yellowish or light-colored rhizome scales, and the spores with short leasure are found in some species of *Campyloneurum* C. Presl (e.g., *C. falcoideum* (Kuhn ex Hieron.) M. Mey. ex Lellinger) (León, 1993). Unfortunately, these characters have been commonly overlooked in fern taxonomy (Wagner, 1974; Hovenkamp, 1990).

DNA sequences can improve our understanding of fern systematics in cases where morphology is misleading. A good example of this in Polypodiaceae is *Campyloneurum anetioides* (Christ) R.M. Tryon & A.F. Tryon, which was first described in *Polypodium* and then segregated into *Hyalotrichopteris* W.H. Wagner, a monotypic genus, before being finally placed in *Campyloneurum* by Kreier et al. (2007). No fewer than four different families (Aspidiaceae, Grammitidaceae, Polypodiaceae, and Vittariaceae) have been suggested for this species (Kreier et al. 2007). *Serpocaulon* also has a complicated taxonomic history. Most of its species have been described in *Polypodium*, then these were partially transferred to *Goniophlebium* (Blume) C. Presl, *Marginaria* Bory, and finally segregated as a new genus by Smith et al. (2006). In another example, Almeida et al. (2017) created the monotypic genus *Adetogramma* T.E. Almeida to accommodate *A. chrysolepis* (Hook.) T.E. Almeida, a species that was originally described in *Polypodium* (Hooker, 1844) and then transferred to *Lepicystis* (Sm.) Sm. (Diels, 1899) and *Microgramma* C. Presl (Crabbe, 1967). In that same paper, Almeida et al. (2017) suggested that molecular

phylogenetic evidence is necessary to elucidate the generic position of *S. tayronae*, pinpointing the presence of free veins as a key character to reject its placement in *Serpocaulon*.

The purpose of this article is to determine the phylogenetic position of *S. tayronae* within Polypodiaceae using DNA sequence data.

MATERIALS AND METHODS

TAXON SAMPLING

A sample of the rare *Serpocaulon tayronae* was collected near the type locality, in September 2017 (*Sanín 7104*, BHCB, COL, HUA). To investigate the phylogenetic relationships of this species within the Polypodiaceae, we built a matrix with 104 terminals representing 99 species of the following genera and the respective number of individuals and species evaluated: *Adetogramma* T.E. Almeida (1/2), *Campyloneurum* (37/37), *Microgramma* (4/4), *Niphidium* J. Sm. (3/3), *Pleopeltis* Humb. & Bonpl. ex Willd. (3/3), *Polypodium* (9/9), and *Serpocaulon* (4/4), and into grammitids, *Alansmia* M. Kessler, Moguel, Sundue & Labiak (1/1), *Ascogrammitis* Sundue (6/6), *Ceradenia* L.E. Bishop (2/2), *Cochlidium* Kaulf. (1/1), *Enterosora* Baker (3/2), *Galactodenia* Sundue & Labiak (3/2), *Grammitis* Sw. (2/2), *Lellingeria* A.R. Sm. & R.C. Moran (2/2), *Leucotrichum* Labiak (1/1), *Melpomene* A.R. Sm. & R.C. Moran (3/2), *Moranopteris* R.Y. Hirai & J. Prado (3/3), *Mycopteris* Sundue (1/1), *Oreogrammitis* Copel. (4/4), *Stenogrammitis* Labiak (4/4), *Terpsichore* A.R. Sm. (1/1), and *Zygophlebia* L.E. Bishop (2/2) (Appendix 1). Three species of *Oleandra* Cav. (Oleandraceae) were included as outgroups (Appendix 1), mainly because of the close relationship of this genus to the polygrammoid clade (Hasebe et al., 1995). This was also done by other authors (e.g., Schneider et al., 2004; Almeida et al., 2017). Except for the *Serpocaulon* species, we used sequences available on GenBank from the following studies:

Kreier et al. (2007); Otto et al. (2009); Labiak et al. (2010a, 2010b); Hirai et al. (2011); Sigel et al. (2014); Sundue et al. (2014, 2018); Almeida et al. (2017); Bauret et al. (2017); Labiak & Moran (2018); and Shalisko et al. (2019).

DNA EXTRACTION, AMPLIFICATION AND SEQUENCING

Total genomic DNA was extracted from silica gel-dried material using standard protocols of the Qiagen DNeasy Plant Mini Kit (Valencia, CA). The cpDNA markers *rbc*L and were amplified by PCR in 25-μL reactions including 1 μL of non-diluted genomic DNA, 12.5 μL of RedTaq polymerase (Sigma-Aldrich), 1 μL of the primers forwards and 1 μL reverse, and 9.5 μL of ultra-pure water. For *rbc*L the primer C34F (Wolf et al., 1994), and for *trn*G-*trn*R the primer TRNG1F and TRNR22R (Nagalingun et al., 2007) were used. For *rbc*L a PCR program with initial denaturation step of 3 min at 94ºC, followed by 35 cycles of 45 sec. at 94ºC, 45 sec. at 52ºC, 1.30 min at 72º, and a final extension period of 3 min at 72º were performed. For *trn*G-*trn*R one initial denaturation step of 3 min at 94ºC, followed by 35 cycles of 45 sec. at 94ºC, 15 sec. at 54ºC, 1.15 min at 72º, and a final extension period of 3 min at 72º were used. Sequencing reactions were electrophoresed on a 3730 DNA Analyser (Applied Biosystems). Sequence fragments obtained were assembled with SeqMaq 4.03 (DNAStart) and manually adjusted.

ALIGNMENT AND PHYLOGENETIC ANALYSES

Sequence electropherograms were edited and assembled sequences were obtained from the forward and reverse reads using the De Novo Assemble function from Geneious ver 9.1.2.

(Biomatters). Consensus sequences were automatically aligned using MUSCLE (Edgar, 2004) and the resulting alignment was adjusted manually using MEGA 7 (Kumar et al., 2016).

A concatenate matrix including *rbc*L and *trn*G-*trn*R regions were analyzed using maximum likelihood (ML) and Bayesian inference (BI). Maximum likelihood was performed using TNT v.1.1 (Golodoff et al., 2008), codified characters with same weight, and using heuristics search with 1000 replicates of random sequences addition (RAS), branch interchange with TBR (tree-bisection-and-reconstruction) and saving 10 trees for replica. The optimum trees were submitted to a new round of branch interchange by TBR until the most parsimonious topologies were found. The support value of the nodes was estimated using Bootstrap index (Felsenstein, 1985), using 2000 replicates of 10 RAS, saving 4 trees by replicate and using the probability of removal by defect (p= 0.36). For Bayesian inference, phylogenetic analyzes based on Markov chain Monte Carlo were made using MrBayes v3.2.2 (Ronquist et al., 2012) through Cypres Science Gateway (Miller et al. 2010), determining each DNA region (*rbc*L and *trn*G-*trn*R) as separated partitions. The evolutionary model for each DNA region using the Bayesian Information Criterion (BIC) was selected by jModeltest v3.7 (Posada & Crandall, 1998), and for both region the model was GTR+I+G. Each analysis considered of two independent runs with four simultaneous Markov Chains run for 20,000,000 generations, starting with random initial trees and sampling one tree every 1,000 generations. To check the convergence of the runs, ESS (effective sample size) and PSRF (potential scale reduction factor) were performed (Ronquist et al., 2012) using Tracer v.1.7 (Rambaut & Drummond, 2007).

Ten per cent (10%) of the trees were discarded as part of the burn in process. The remaining trees of each analysis were combined and used to estimate the majority consensus tree (%50), informing the posterior probability (PP) of each node.

RESULTS

The combined dataset has 2510 bp, 1299 from *rbc*L and 1211 from *trn*G-*trn*R. Phylogenetic reconstructions using MP and BI retrieved with well support (100 MP, 1.0 BI) the main polygrammoid clade (Fig. 2a). This group included the campyloneuroid clade (MP 100 and BI 100%) (Fig. 2b), a group composed by *Pleopeltis* and the grammitidoids clade (grammitids plus *Adetogramma*/*Serpocaulon*) (MP 100, BI 700%), and the clade formed by the nine species of *Polypodium* (MP 94, BI 100%, Fig. 2d).

Serpocaulon tayronae was embedded in *Campyloneurum*, which formed a group with *Microgramma* and *Niphidium*, the Campyloneuroid clade (MP 100, BI 85%, Fig. 2b). *Campyloneurum* was recovered as monophyletic (MP 100, BI 98%, Fig. 2b, 3). And inside of this clade, the seven groups resolved previously by Labiak and Moran (2018) were retrieved (Fig. 2b, 3). Within the so-called Pruinose clade of *Campyloneurum* (Labiak & Moran, 2018) (MP 72, BI 100%, Fig. 3), *Serpocaulon tayronae* is more closely related to *C. amphostenon* (Kunze ex Klotzsch) Fée, *C. cochense* (Hieron.) Ching, and *C. solutum* (Klotzsch) Fée, forming a clade with these species (MP 58, BI 95%) (Fig. 2, 3).

The other divergent lineages were recovered into the group known as grammitidoid clade (MO 100, BI 100%), plus the group composed by three species of *Pleopeltis* (MP 100, BI 100%). The four species of *Serpocaulon* formed a monophyletic group highly supported (MP 100, BI 100%, Fig. 2) that was retrieved as the sister group of the monotypic genus *Adetogramma* (MP 100, BI 79%), and altogether were close related with the grammitid clade (MP 100, BI 100%).

DISCUSSION

In general terms, the topology recovered was similar to previous contributions (Schneider et al., 2004; 2006; Salino et al., 2008; Otto et al., 2009; Labiak et al., 2010a; 2010b; Hirai et al., 2011; Sigel et al., 2014; Sundue et al., 2014; 2018; Testo & Sundue, 2016; Almeida et al., 2017; Bauret et al., 2017; Labiak & Moran, 2018; Shalisko et al., 2019) (Figs. 2, 3). Where after the outgroup *Oleandra* (Dryopteridaceae), the Polygrammoid group (sensu Schneider et al., 2006) was retrieved. Inside this group, the topology of *Polypodium* agrees with Sigel et al. (2014), as well as the clade of *Pleopleltis*, *Adetogramma*, *Serpocaulon* and the grammitidoids (*sensu* Almeida et al., 2017). For the last ones, we corroborate the recognition of the monophyletic groups found by Bauret et al. (2017), as well as the artificial nature of *Enterosora*, *Grammitis*, and *Zygophlebia* (Shalisko et al., 2019).

As expected from previous studies (Schneider et al., 2004; Kreier et al., 2007; Salino et al., 2008; Almeida et al., 2017; Labiak & Moran, 2018), the Campyloneuroid clade was recovered as monophyletic, with *Niphidium* sister to a clade comprised of *Campyloneurum* and *Microgramma* (Figs. 2b, 3). With respect to morphology, this clade is mostly comprised of species with simple entire laminae and anastomosing veins (Labiak & Moran, 2018). However, there is considerable variation of these characters within *Campyloneurum* and *Microgramma*. For example, 15 out of the 29 species of *Microgramma* have dimorphic fronds, or as the subgenus *Solanopteris* that present lobulate laminae (Almeida et al., 2014). Within *Campyloneurum*, subgenus *Decurrentia* (Moran & Labiak, 2017) is comprised of three species with 1-pinnate laminae, illustrating that a more dissected pattern can be present. In fact, there is evidence to support that, at least for

Campyloneurum, the simple lamina shape derived from an ancestor with more divided fronds (Squinabol, 1889–1891; León, 1993; Moran & Labiak, 2017; Labiak & Moran, 2018).

The Pruinose clade of *Campyloneurum*, where the former *S. tayronae* is nested, probably contains more than 30 species (Labiak & Moran, 2018). The presence of pruinose rhizomes was suggested as a possible synapomorphy for the clade (Labiak & Moran, 2018). Although, the authors mentioned that this character can be variable. In this respect, León (1993), in the only available taxonomic revision for *Campyloneurum*, commented that pruinosity is present and persistent in *C. amphostenon* (Fig. 4b), *C. angustifolium* Fée, *C. densifolium* (Hieron.) Lellinger, and *C. solutum*, whereas in *C. lorentzii* (Hieron.) Ching and *C. cochense* - retrieved here in the same clade of *S. tayronae* -, it is less common. This feature was not observed by Sanín (2015), and it was also not evident in the field, where rhizomes seemed pale-green (Fig. 1). However, it was fairly observed in recently dried material (Fig. 4c). Labiak and Moran (2018) suggested that this is largely caused by the use of high heat during specimen drying and perhaps to a lesser degree by abrasion.

Labiak and Moran (2018) suggested that spores are relatively uniform throughout the genus and do not provide characters to distinguish the main clades or species. Nevertheless, the authors described that surfaces vary from smooth to shallowly or prominently verrucae. A comparison of the spores of *S. tayronae* with other species of the Pruinose clade (Fig. 3a) showed that they are similar, sharing the ellipsoid, sub-ellipsoid to globular shape and dense rounded and regular verrucae that are evenly distributed (Sanín, 2015) (Fig. 3b).

The narrow laminae (<3 cm) and lateral veins that are not prominent, being approximately the same thickness as the cross veins are characters cited by Labiak and Moran (2018) for this clade. This last feature is also present in *S. tayronae*, where lateral veins are almost of the same size of

the midvein (Fig. 1e). Additionally, León (1993), found branched trichomes in *Campyloneurum*, composed of three cells, one forms the base, another is small, lateral and glandular, while the third is an enlarged cell with gradually obtuse apex. A description that fits *S. tayronae* trichomes, previously omitted by Sanín (2015), but noticed and presented here (Fig. 3c).

There is the general idea that fronds constitute the dominant organ of nearly all ferns (Vasco et al., 2013), providing a taxonomic bias for classification, as rhizome characters are usually overlooked. Rhizomes are longeval structures, growing up to 15 m in tropical forest as occurs in *Polybotrya* (Moran, 1987), support winter seasons in temperate zones as *Matteuccia struthiopteris* (L.) Tod. (Hovenkamp et al., 2016). Or as was recorded in the endemic Brazilian inselberg fern, *S. demissum*, stores starch in such a thick rhizome providing an advantage for the survival of the species in such a harsh environment (Sanín & Salino, 2020). These examples show the importance of rhizomes for some ferns, suggesting that more attention should be given to these structures in fern taxonomy.

This seems to be the case of *Serpocaulon tayronae*, which was included in *Serpocaulon* because of its long-creeping rhizomes with patent, light-colored, concolorous scales and pinnatisect laminae. It was also compared with some species of *Polypodium* (Sanín, 2015), which have different, thicker rhizomes. This mistake could have been avoided if the author had thought of the rhizome and rhizome scales of *Campyloneurum*. *Serpocaulon tayronae* has slender, long-creeping rhizomes with yellowish or light-colored scales that in fact, are prevalent in the species that currently belongs to Pruinose clade (León, 1993). In light of this, it is now more logical to compare it with this group, instead of to *Serpocaulon*. Specially because *Serpocaulon* did not presents the rhizome scales yellowish or light-colored with auriculate base (Sanín, 2018).

Rhizomes scales are considered the main source of characters with taxonomic value in *Campyloneurum* (Sota, 1960; 1973; Lellinger, 1972; 1988; León, 1993), where the apices of the rhizome scales are usually spread or, in a few species, appressed, but always concolorous (León, 1993), all features presented in *S. tayronae*. Regarding the rhizome scales' thickness and coloration of the cell wall in *Campyloneurum*, León (1993) described three main types: clathrate, slightly clathrate, and non-clathrate. Evident similitudes between *S. tayronae* with others *Campyloneurum* species are: 1) the slightly clathrate rhizome scale of *C. vulpinum* (Lindm.) Ching (León, 1993) that resembles cell and thickness architecture of *S. tayronae* rhizome scale. 2) the rhizome scales of *C. aglaolepis* (Alston) Sota, *C. amphostenon* and *S. tayronae* are strongly attached to the rhizome, avoiding removing (Sanín & Salino obs. pers.), a feature no recorded in *Serpocaulon* (Sanín obs. pers.). 3) the compared species also present two separate auriculate (Fig. 4), which in the case of *C. amphostenon* is overlapping. This character is also suggested by León (1993) in *Campyloneurum*, and not recorded in *Serpocaulon* (Sanín, 2018). Finally, Labiak and Moran (2018) suggested that a possible synapomorphy of *Campyloneurum* is the isodiametric shape of the cells in the rhizome scales, which was verified in the species compared here (Fig. 4).

In a morphologically problematic group such as Polypodiaceae, it became evident the importance to set up an accurate taxonomy in light of molecular analyses to propose a taxonomic circumscription. This practice supports that *S. tayronae* should be transferred to *Campyloneurum*, modifying the genus concept regarding the laminae shape from simple, pinnatisect and pinnate with anastomosing and free veins. And in the same respect, emended the proposal of Sanín (2015) in *Serpocaulon* from having anastomosing and free veins, to anastomosing with marginal free veins.

TAXONOMIC TREATMENT

Campyloneurum tayronae (D. Sanín) D. Sanín, *comb. nov*. TYPE: Colombia. Magdalena: Santa Marta, Sierra Nevada de Santa Marta, Las Nubes, 1524 m, 1899 1901, *H.H. Smith 1025* (holotype, BR!; isotypes, BP!, CM!, DAO!, E!, ISC, MICH!, MPU!, NY!, TEX!). (Fig. 1).

Basionym. *Serpocaulon tayronae* D. Sanín, Phytotaxa 213: 243–252.

Distribution. Endemic to the Sierra Nevada de Santa Marta, Colombia, from 1524–1600 m.

Additional specimen examined. Colombia, Magdalena, Minca, zona amortiguadora del Parque Nacional Natural Sierra Nevada de Santa Marta, 1600 m, 2 Sep. 2017, *D. Sanín & G. F. Peñaloza Bojacá 7104* (BHCB, COL, HUA).

Description, commentaries, line drawings, SEM images, light micro and macro photographs and distribution map are provided by Sanín (2015; 2018).

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Figures

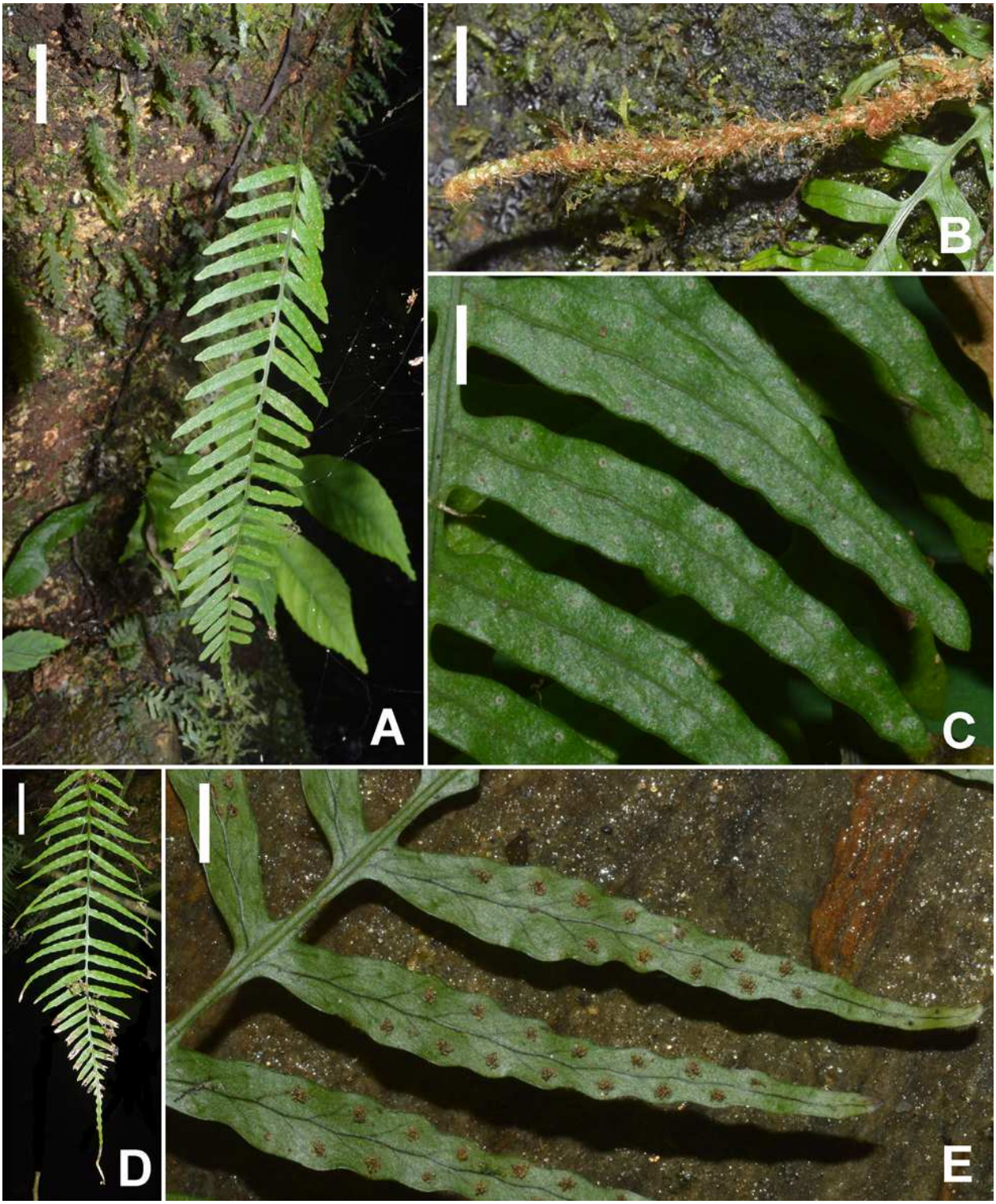

Figure 1. *Serpocaulon tayronae.* A. Habit of the plant. B. Rhizome. C. Details of the adaxial surface of the segments. D. Lamina. E. Details of the abaxial surface of the fertile segments. From *D. Sanín 7104* (BHCB). Scale bars: A: 3 cm. B: 2 mm. C-D: 5 mm.

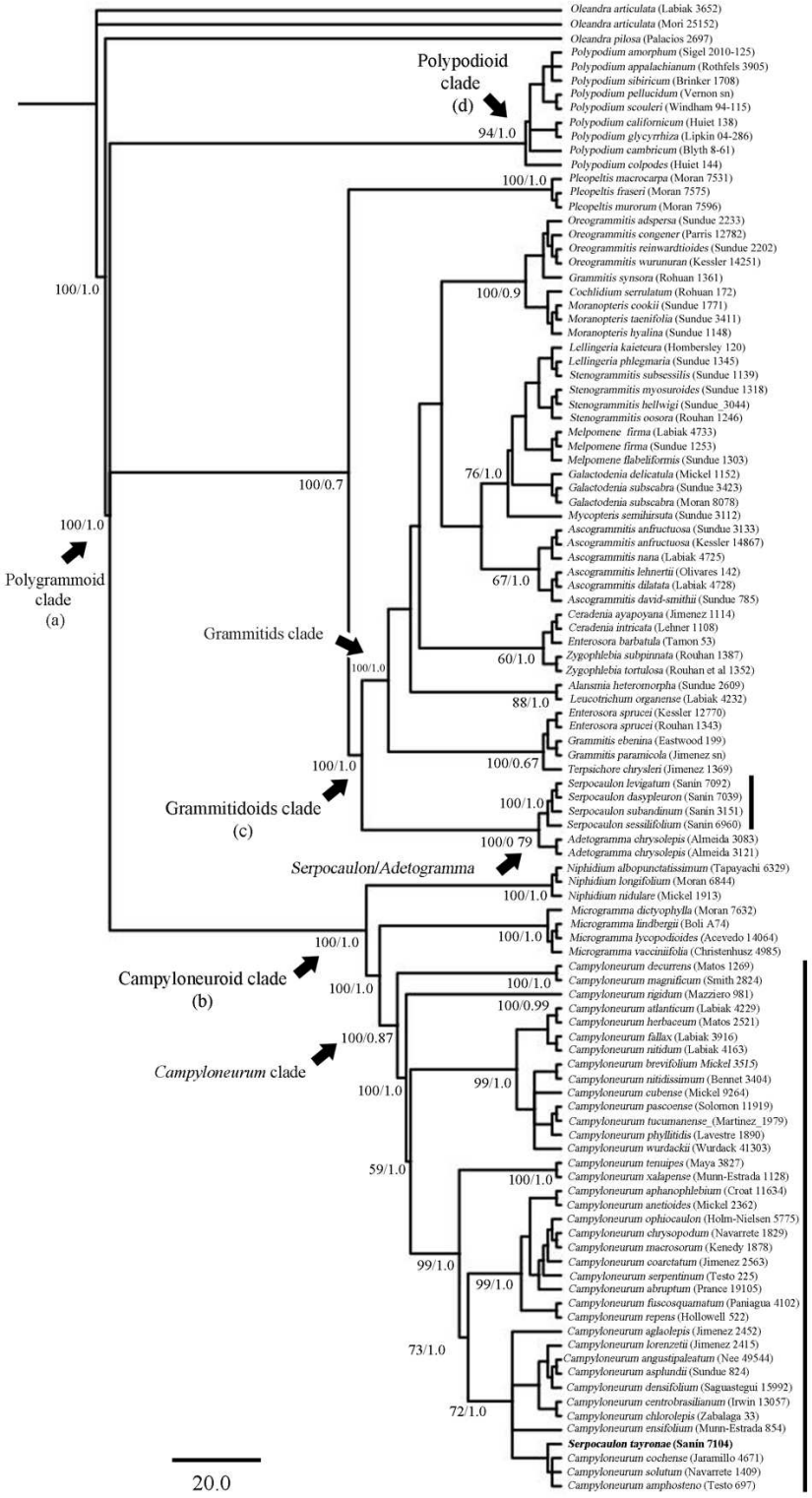

Figure 2. Cladogram from the Bayesian inference (BI) of the combined data matrixes of the plastidial regions *rbc*L and *trn*G-*trn*R. Numbers of the branches represents the bootstraps values of the Maximum parsimony, and the posterior probability (PP) of the Bayesian inference. Lateral bars represent the focused groups of this study (*Serpocaulon* and *Campyloneurum*). *S. tayronae* is in **bold**.

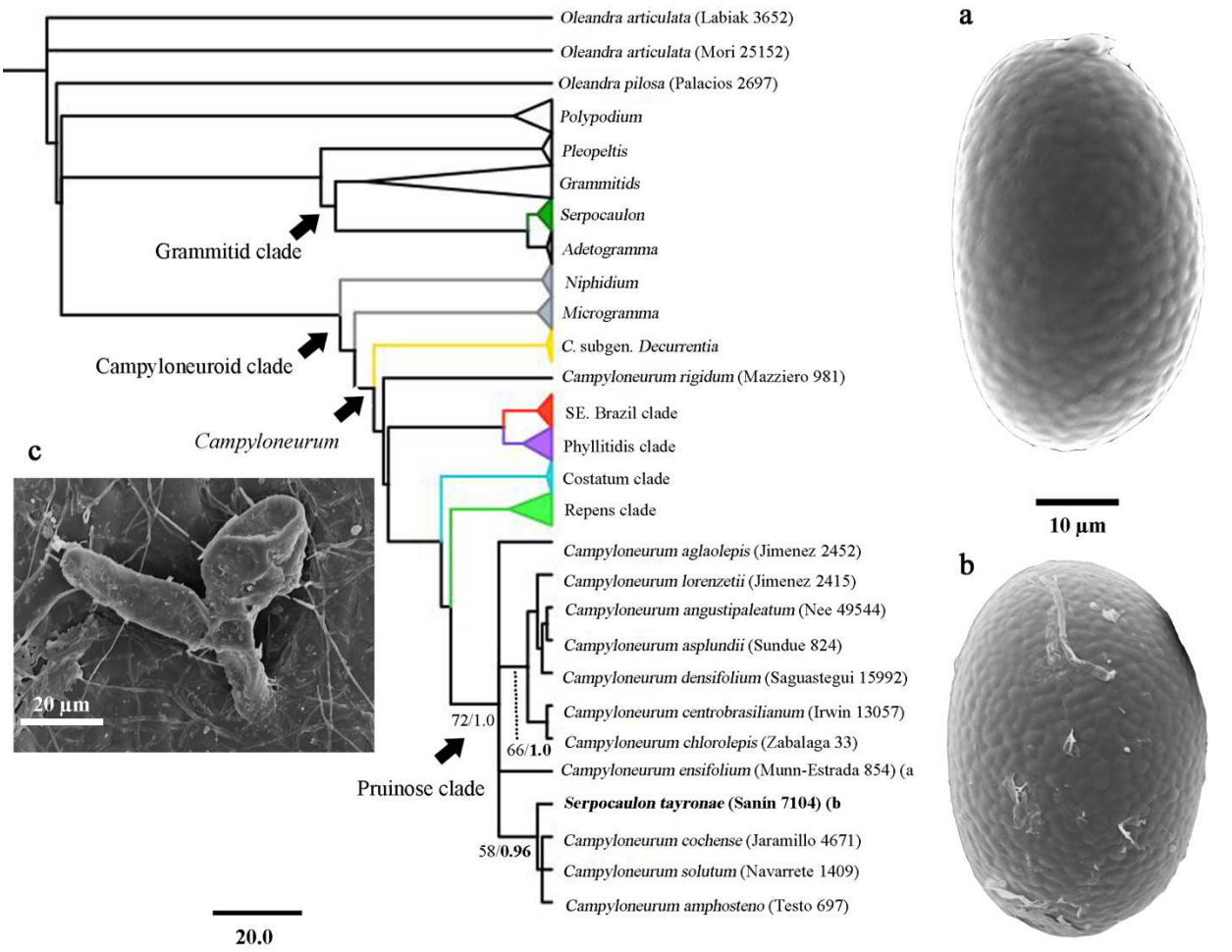

Figure 3. Cladogram from the Bayesian inference (BI) of the combined data matrixes of the plastidial regions *rbc*L and *trn*G-*trn*R with the main clade collapsed and the Pruinose clade inside *Campyloneurum* showing micromorphological characters sharing with *S. tayronae*. A. *C. ensifolium* spore. B. *S. tayronae* spore. C. Branched hair (sensu León, 1993) from the lamina of *S. tayronae*. A: From www.plantsystematics.org. B-C: from the type *H.H. Smith 1025* (BR). Colors represent collapsed groups.

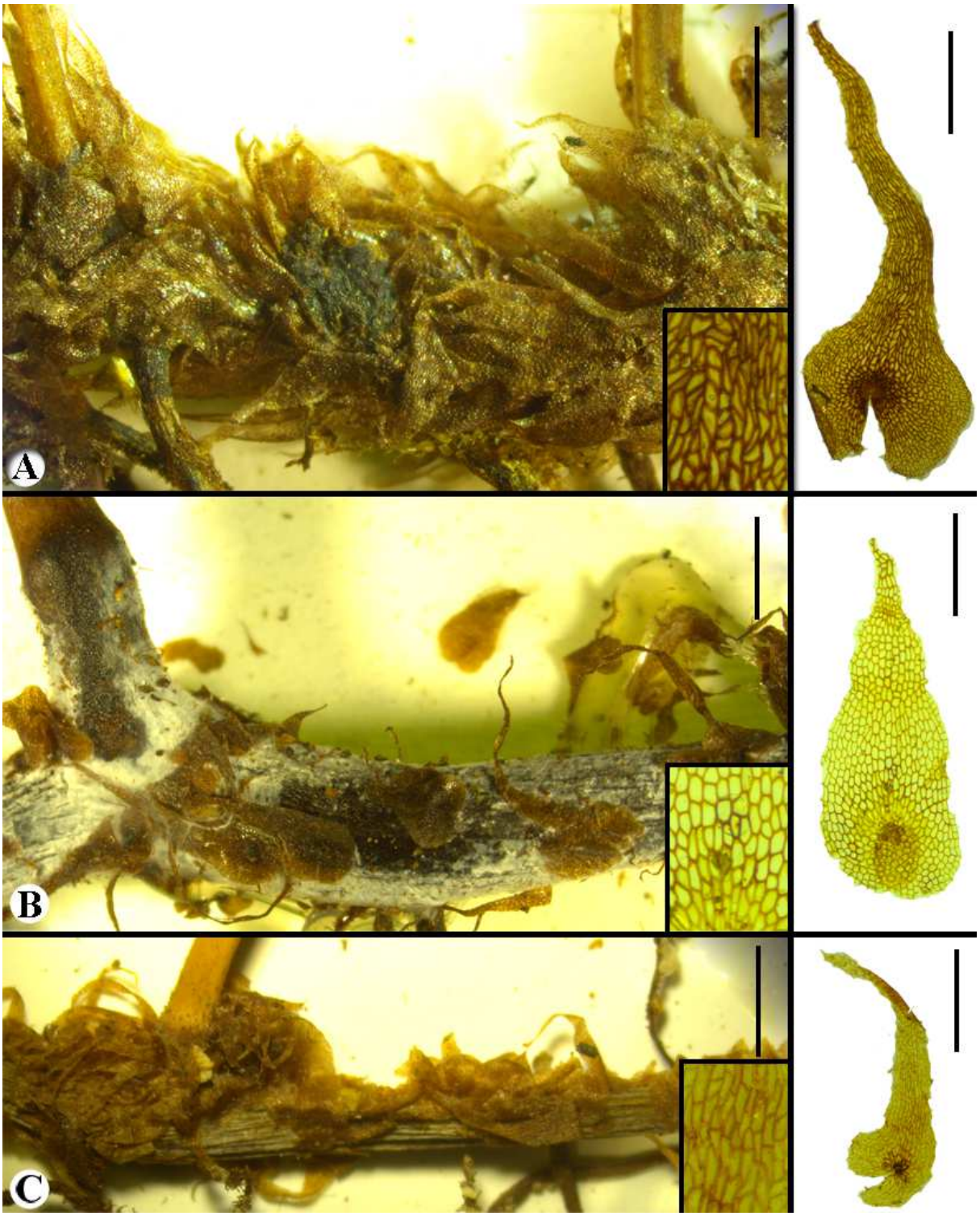

Figure 4. Rhizome, rhizome scales and cells shape comparison from species of the Pruinose clade of *Campyloneurum*. A. *C. aglaolepis*, *Salino 11369* (BHCB). B. *C. amphostenon*, *Windisch 6117* (BHCB). C. *S. tayronae*, *Sanín 7104* (BHCB). Scale bars: A, B and C: 2 mm for rhizomes and 1 mm for the rhizome scales.

Appendix 1. List of specimens and GenBank accession numbers of the species studied. Species name, voucher information, herbaria and the markers analyzed are provided. Missing sequences are labeled by a dash (—).

No.	Taxon	Country	*rbc*L	*trn*G-*trn*R
1	*Adetogramma chrysolepis*, *Almeida 3083* (BHCB)	Bolivia	KY847865	—
2	*Adetogramma chrysolepis*, *Almeida 3121* (BHCB)	Bolivia	KY847859	—
3	*Alansmia heterophylla*, *Sundue 2609* (NY)	Ecuador	KM218803	KM105966
4	*Ascogrammitis anfructuosa*, *Kessler 14867* (VT)	Ecuador	MG948938	MG966519
5	*Ascogrammitis anfructuosa*, *Sundue 3133* (VT)	Mexico	MK319098	MK319050
6	*Ascogrammitis lehnertii*, *Olivares 142* (VT)	Ecuador	MG948939	MG966520
7	*Ascogrammitis nana*, *Labiak 4725* (UPCB)	Bolivia	GU387031	GU387208
8	*Ascogrammitis dilatata*, *Labiak 4728* (UPCB)	Bolivia	GU387033	GU387206
9	*Ascogrammitis david-smithii*, *Sundue 785* (NY)	Bolivia	GU387012	GU387205
10	*Campyloneurum abruptum*, *Prance 19105* (NY)	Brazil	MF318030	MF318195
11	*Campyloneurum aglaolepis*, *Jimenez 2452* (NY)	Bolivia	MF317973	MF318197
12	*Campyloneurum amphostenon*, *Testo 697* (VT)	Costa Rica	MF318050	MF318201
13	*Campyloneurum anetioides*, *Mickel 2362* (NY)	Costa Rica	MF317991	MF318202
14	*Campyloneurum angustipaleatum*, *Nee 49544* (NY)	Bolivia	MF318017	MF318209
15	*Campyloneurum aphanophlebium*, *Croat 11634* (NY)	Panama	MF317961	MF318213
16	*Campyloneurum asplundii*, *Sundue 824* (NY)	Bolivia	MF318044	MF318255
17	*Campyloneurum atlanticum*, *Labiak 4229* (NY)	Brazil	MF318027	MF318217
18	*Campyloneurum brevifolium*, *Mickel 3515* (NY)	Costa Rica	MF317994	MF318221
19	*Campyloneurum centrobrasilianum*, *Irwin 13057* (NY)	Brazil	MF317968	MF318225
20	*Campyloneurum chlorolepis*, *Zabalaga 33* (NY)	Bolivia	MF318062	MF318227
21	*Campyloneurum chrysopodum*, *Navarrete 1829* (NY)	Ecuador	MF318016	MF318228
22	*Campyloneurum coarctatum*, *Jimenez 2563* (NY)	Bolivia	MF317974	MF318229
23	*Campyloneurum cochense*, *Jaramillo 4671* (NY)	Ecuador	MF317969	MF318232
24	*Campyloneurum cubense*, *Mickel 9264* (NY)	Haiti	MF317996	MF318301
25	*Campyloneurum decurrens*, *Matos 1269* (NY)	Brazil	MF317982	MF318239
26	*Campyloneurum densifolium*, *Saguastegui 15992* (NY)	Peru	MF318035	MF318241
27	*Campyloneurum ensifolium*, *Munn-Estrada 854* (NY)	Mexico	MF318010	MF318318
28	*Campyloneurum fallax*, *Labiak 3916* (NY)	Brazil	MF318024	MF318245
29	*Campyloneurum fuscosquamatum*, *Paniagua 4102* (NY)	Bolivia	MF318022	MF318251
30	*Campyloneurum herbaceum*, *Matos 2521* (NY)	Brazil	MF317985	MF318218
31	*Campyloneurum lorentzii*, *Jimenez 2415* (NY)	Bolivia	MF317971	MF318253

32	*Campyloneurum macrosorum*, *Kenedy 1878* (NY)	Panama	MF317976	MF318258
33	*Campyloneurum magnificum*, *Smith 2824* (NY)	Ecuador	MF318039	MF318259
34	*Campyloneurum nitidum*, *Labiak 4163* (NY)	Brazil	MF318025	MF318261
35	*Campyloneurum ophiocaulon*, *Holm-Nielsen 5775* (NY)	Ecuador	MF317966	MF318264
36	*Campyloneurum phyllitidis*, *Lavestre 1890* (NY)	Dominican Republic	MF317977	MF318276
37	*Campyloneurum repens*, *Hollowell 522* (NY)	Guyana	MF317965	MF318278
38	*Campyloneurum rigidum*, *Mazziero 981* (NY)	Brazil	MF318013	MF318283
39	*Campyloneurum serpentinum*, *Testo 225* (VT)	Costa Rica	MF318046	MF318282
40	*Campyloneurum solutum*, *Navarrete 1409* (NY)	Ecuador	MF318015	MF318287
41	*Campyloneurum tenuipes*, *Maya 3827* (NY)	Mexico	MF317987	MF318297
42	*Campyloneurum tucumanense*, *Martinez 1979* (NY)	Argentina	MF317983	MF318270
43	*Campyloneurum wurdackii*, *Wurdack 41303* (NY)	Venezuela	MF318058	MF318304
44	*Campyloneurum xalapense*, *Munn-Estrada 1128* (NY)	Mexico	MF318009	MF318317
45	*Ceradenia ayapoyana*, *Jimenez 1114* (UC)	Bolivia	KM218811	KM105975
46	*Ceradenia intricata*, *Lehnert 1108* (UC)	Bolivia	KM218791	KM105978
47	*Cochlidium serrulatum*, *Rohuan et al 172* (P)	Mauritius	KY711940	KY712107
48	*Enterosora barbatula*, *Tamon 53* (P)	Reunion	KY711956	KY712122
49	*Enterosora sprucei*, *Kessler 12770* (UC)	Madagascar	KY712241	KY712084
50	*Enterosora sprucei*, *Rouhan et al 1343* (P)	Madagascar	KY711963	KY712128
51	*Galactodenia delicatula*, *Mickel 1152* (US)	Mexico	MK319102	MK319054
52	*Galactodenia subscabra*, *Sundue 3423* (VT)	Costa Rica	MK319108	MK319060
53	*Galactodenia subscabra*, Moran 8078 (NY)	Costa Rica	GU476860	GU387209
54	*Grammitis ebenina*, *Eastwood 199* (E)	Saint Helena	KY712064	—
55	*Grammitis paramicola*, *Jimenez sn* (UC)	Bolivia	KM218801	KM105994
56	*Grammitis synsora*, *Rohuan et al 1361* (P)	Madagascar	KY712005	KY712169
57	*Lellingeria kaieteura*, *Hombersley 120* (NY)	Trinidad & Tobago	GU386978	GU387151
58	*Lellingeria phlegmaria*, *Sundue 1345* (NY)	Colombia	GU387008	GU387168
59	*Lellingeria subsessilis*, *Sundue 1139* (NY)	Ecuador	GU386997	GU387178
60	*Leucotrichum organense*, *Labiak 4232* (UPCB)	Brazil	GU376492	JN654959
61	*Melpomene firma*, *Labiak 4733* (UPCB)	Bolivia	GU387035	GU387195
62	*Melpomene firma*, *Sundue 1253* (NY)	Colombia	GU387003	GU387194
63	*Melpomene flabelliformis*, *Sundue 1303* (NY)	Colombia	GU387005	GU387196
64	*Microgramma dictyophylla*, *Moran 7632* (NY)	Ecuador	MF318005	MF318306
65	*Microgramma lindbergii*, *Boli A74* (NY)	Paraguay	MF317957	MF318307
66	*Microgramma lycopodioides*, *Acevedo-Rodríguez 14064* (NY)	Dominican Republic	MF317950	MF318308

CONSIDERAÇÕES FINAIS

1. Foram esclarecidos os conceitos de *Serpocaulon catharinae*, *S. eleutherophlebium*, *S. fraxinifolium*, *S. lasiopus*, *S. loriceum* e *S. triseriale* e as suas espécies similares.
2. Foi possível verificar que *Serpocaulon fraxinifolium* não habita o Brasil, sendo confundida pela espécie *S. polystichum*, assim como outras 27 espécies que expandiram a sua distribuição.
3. Observações em campo permitiram reconhecer que a maior parte das espécies do gênero não são epífitas (holoepífitas), mas sim hemiepífitas secundarias ou facultativas.
4. A morfologia intermediária, a sobreposição das distribuições e o registro de zonas híbridas, verificaram que as barreiras reprodutivas entre espécies foram frágeis, registrando cinco híbridos publicados e vários outros para serem descritos.
5. O tratamento taxonômico fundamenta as bases para futuras estudos ecológicos, filogenéticos e biogeográficos no gênero.
6. O estudo dos 259 nomes relacionados ao gênero, resultou na sinonimização de 19 nomes, lectotipificação de 75 nomes, designação de dois neótipos, a exclusão de cinco nomes e a consideração de 24 nomes como *nomina dubia* e cinco como *nomina nuda*.
7. As relações filogenéticas de *Serpocaulon tayronae* indicaram que pertence ao gênero *Campyloneurum.*
8. São reconhecidas 37 espécies e cinco híbridos, das quais *S. australe* e *S. psychotrium* foram descritas como novas. *Serpocaulon demissum* (Fée) D. Sanín foi uma nova combinação para o gênero. *Serpocaulon* ×*semipinnatifidum* (Fée) D. Sanín recebeu um novo status como híbrido, e *S.* ×*tabuleirense* representa um novo híbrido.