Phytotaxa 360 (2): 125–134
http://www.mapress.com/j/pt/

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

https://doi.org/10.11646/phytotaxa.360.2.4

Five new synonyms in *Serpocaulon* (Polypodiaceae)

DAVID SANÍN[1] & ALEXANDRE SALINO[2]
Herbarium BHCB, Instituto de Ciências Biológicas, Departamento de Botânica, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil, 486, 30123-970.
[1]*email: dav.sanin@gmail.com*
[2]*email: salinobh@gmail.com*

Abstract

A new taxonomic circumscription is proposed for *Serpocaulon sessilifolium* and *S. wagneri*. We compared the type specimens of *S. sessilifolium* and *S. wagneri* with those of the new proposed synonyms: *S. acuminatum*, *S. antillense* and *S. chacapoyense* for the former, and *Polypodium kuhlmannii* and *S. panorense* for the latter. Diagnostic descriptions, synonymy, taxonomic discussion, and pictures of diagnostic characters for each species are provided. In addition, lectotypes for two names are designated.

Key words: Antilles, Brazil, Peru, Nomenclature, *Serpocaulon sessilifolium*, *S. wagneri*

Introduction

Serpocaulon Smith (2006: 924) (Polypodiaceae) is a monophyletic tropical American fern genus (Smith *et al*. 2006) segregated from *Polypodium* Linnaeus (1753: 1082) based on molecular, morphological and biogeographic evidence (see Smith *et al*. 2006). As a consequence, its taxonomic history is closely associated to the Linnean concept of *Polypodium* and its subsequent taxonomical problems.

Hensen (1990) presented the revision of 22 especies named collectively as "the *P. loriceum* complex", which currently are circumscribed as *Serpocaulon*. In this respect, Moran (1990) mentioned serious problems with Hensen's work: 1) too few herbaria were consulted, 2) infraspecific names were not accounted for, 3) representative specimens, with locality data, were not cited, and 4) at least 11 species that seem readily distinct to him were lumped there. However, Hensen's work was important because the author studied several type collections that helped clarifying the current taxonomic concept of the genus.

Lellinger (1993) proposed the subgenus *Polygoniophlebium* Lellinger (1993: 37) to include the American species of *Polypodium* with long creeping rhizomes, appressed scales, and pinnate laminae. Nevertheless, Moran (1995) did recognize this subgenus neither in the Flora de Mesoamerica, nor Moran & Øllgaard (1995) and Kessler & Smith (2005) who designated new species for Ecuador and Bolivia respectively.

In this sense, although the genus has been described, its taxonomy, nomenclature and relationships among its constituent species remained unclear (Smith *et al*. 2006). Several factors make the circumscription of *Serpocaulon* complicated, for example: a) the incomplete typification for names of several species complexes within the genus [e.g. *S. fraxinifolium*, *S. loriceum* (sensu Smith *et al*. 2006), and *S. catharinae* (obs. pers.)], b) new combinations, synonyms and taxa that have been recently proposed (Labiak & Prado 2008, Rojas-Alvarado & Chaves-Fallas 2013, Schwartsburd & Smith 2013, Sanín & Torrez 2014, Sanín 2014, 2015, Chaves-Fallas *et al*. 2015), and c) the lack of fern collections from remote areas where the genus can occur represents a limitation for the accurate determination of its diversity (Sanín 2015). Additionally, in *Serpocaulon*, a single species has been described several times and has many synonyms, e.g. *S. triseriale* (Swartz 1801: 26) Smith (2006: 929), *S. fraxinifolium* (von Jacquin 1789: 187) Smith (2006: 928), *S. loriceum* (Linnaeus 1753: 1086) Smith (2006: 928) and *S. sessilifolium* (Desvaux 1827: 238) Smith (2006: 929) with 16, eleven, nine and eight synonyms, respectively. Many of those names were previously recognised by Hensen (1990) and then by Smith *et al*. (2006). This is especially notable in Brazil, where ten species of *Serpocaulon* are known from the Atlantic Forest (Labiak & Prado 2008), although ca. 35 basionyms are linked to them

Accepted by Marcus Lehnert: 23 Jun. 2018; published: 13 Jul. 2018

(e.g., Raddi 1825, Fée 1869, 1873, Baker 1870, Hensen 1990, Smith *et al*. 2006, Labiak & Prado 2008, Schwartsburd & Smith 2013). A monographic revision is required to reveal whether some basionyms currently considered synonyms should be reconsidered as species, or vice-versa.

This could be the case of Antillean [*S. acuminatum* (Fée 1866: 68) Christenhuz (2009: 270)*, S. antillense* (Maxon 1930: 83) Smith (2006: 927)], Peruvian [(*S. chacapoyense* (Hooker 1864: 29) Smith (2006: 928)] and Brazilian [*S. panorense* (Christensen 1928: 97) Smith (2006: 928), *P. kuhlmannii* Sampaio (1916: 27)] species that may potentially represent synonyms for the species *S. sessilifolium* from the Antilles and Peru, and *S. wagneri* (Mettenius 1864: 255.) Smith (2006: 929) from Brazil. To verify this we studied vegetative (rhizome scales, shape and size of the segments/pinnae of the lamina and venation of the lamina) and reproductive (number of sori along the segments/ pinnae and ornamentation, and size of the spores) characters from the type collections of the mentioned species to clarify the taxonomy of *S. sessilifolium* and *S. wagneri* by establishing accurate typifications, synonymy and diagnostic morphological descriptions for each of these species. The final conclusions were made based on morphological data and on the careful study of the nomenclatural history and literature related to these species.

Materials and Methods

We studied 114 specimens, including types specimens of *Polypodium kuhlmannii, S. acuminatum, S. antillense, S. chacapoyense, S. panorense, S. sessilifolium* and *S. wagneri* from the collections based at BHCB, BM, BR, CAUP, COL, CUVC, FAUC, HUA, INB, K, LPB, MO, NHN, NY, PSO, R, RB and TOLI herbaria (abbreviation after Thiers 2018), plus nine specimen photographs and ten freshly collected specimens. The observed specimen photographs are available on INCT (2018), JSTOR (2018), KEW (2018), MNHN (2018) and TROPICOS (2018). In addition, the original description of each name was consulted.

Spores from the type collections of all the reviewed species were examined with the scanning electron microscopy (SEM) following the recommendations of Ramírez-Valencia *et al.* (2013) and Ramírez-Valencia & Sanín (2016). Images were captured and observations were made using a FEI Quanta 200 SEM, with an accelerating voltage of 30 kV, in the Center for Microscopy at the Federal University of Minas Gerais.

Results and discussion

Our comparatives studies of the species treated, which included the carefully examination of their types, showed that no constant morphological differences exist between *Serpocaulon acuminatum, S. antillense S. chacapoyense* and *S. sessilifolium.* Similarly, no significant differences were observed between *Polypodium kuhlmannii*, *S. panorense* and *S. wagneri*.

In the case of *Serpocaulon acuminatum, S. antillense S. chacapoyense* and *S. sessilifolium,* the plants were similar in the short-creeping rhizomes with acicular-lanceolate shape, iridescence concolored dark brown rhizome scales, pinnate lamina with one row of sori and conform apical pinnae (Fig. 1), and spores with folded perine (Fig. 2A–B).

On the other hand, *Polypodium kuhlmannii*, *S. panorense* and *S. wagneri* share the short-creeping rhizome, pubescent pinnatisect laminae (Fig. 3A, C), the lanceolate shape, rounded base and caudate apex of the scales, bicolor rhizome scales (translucent to the margin and red-brown to the centre) (Fig. 3B, D), and the presence of perine in the spores (Fig. 2C–D).

Taxonomic treatment

Serpocaulon sessilifolium (Desvaux 1827: 238) Smith (2006: 927).—*Polypodium sessilifolium* Desvaux (1827: 238). Lectotype (designated by Hensen 1990):—PERU. Province unknown: "In montosis Peruvianis", *Anonymus s.n.* (P 01818732!, isolectotype B 200087688! [fragment]). Figs. 1, 2A–B**.**

Polypodium surucuchense Hooker (1837: 69). *Goniophlebium surucuchense* (Hook.) Moore (1857: 74). Lectotype (designated by Hensen 1990):—ECUADOR. Azuay: Surucucho, near Cuenca, 1830, *Jameson s.n.* (K 000642048!).

Polypodium andinum Karsten (1861: 171). Lectotype (designated by Hensen 1990):—COLOMBIA. Cundinamarca: near Bogotá, *T. Karsten s.n*. (LE).

Serpocaulon chacapoyense (Hooker 1864: 29) Smith (2006: 928). *Polypodium chacapoyense* Hooker (1864: 29), *syn. nov.* Lectotype (designated by Hensen 1990):—PERU. Sesuja: Chachapoyas, *Mathews 3278* (K 000642046!).

Serpocaulon acuminatum (Fée 1866: 68) Christenhuz (2009: 270). *Goniophlebium acuminatum* (Fée 1866: 68), *syn. nov.* Lectotype (designated by Hensen 1990):—GUADALOUPE. Rivière St. Louis au Matouba, *l'Herminier s.n.* (P!, isolectotypes B, RB!, BM 000937454!, K!).

Polypodium remotum Baker (1891: 470), invalid homonym of *Polypodium remotum* Desvaux (1827: 232). *Polypodium uniseriale* Christensen (1906: 572). Lectotype (designated by Hensen 1990):—COLOMBIA. Norte de Santander: Salazar, *Kalbreyer 843* (K 000642050!, photo: US).

Serpocaulon antillense (Maxon 1930: 83) Smith (2006: 927). *Polypodium antillense* Maxon (1930: 83), *syn. nov*. Lectotype (designated here):—GUADALOUPE. *l'Herminier s.n.* (RB!, isolectotype P 00624734!).

Polypodium pseudofraternum Smith (1931: 307). Lectotype (designated by Hensen 1990):—VENEZUELA. Amazonas: Summit of Mount Duida, summit of Peak No 7, 2164 m, 1929, *Tate 645* (NY 00144897!).

Plants epiphytic, rarely terrestrial or rupicolous. *Rhizomes* short-creeping, pruinose; *scales* dense, 5−16 × 2.1−3.6 mm, acicular lanceolate, patent, basifixed with a conspicuous insertion, concolorous, dark brown, iridescent. *Laminae* 18−81 × 10−39 cm, ovate-oblong to ovate-lanceolate, pinnate, base truncate, apex conform and acute. *Pinnae* 3−22 pairs, generally adnate or with basal auricules, coriaceous, usually with hydathodes over the adaxial surface. *Areolae* forming 1 row between the costa and the margin, impressed, with scattered scales and trichomes, mainly distributed between the rachises. *Sori* from the middle pinnae forming one row between the costa and the margin. *Spores* 58−64 × 37−42 µm with folded perine.

Distribution:—*Serpocaulon sessilifolium* is distributed from Guatemala to Bolivia and Brazil. It is also found in the West Indies (Cuba, Hispaniola, Jamaica, Haiti, Dominican Republic and Guadeloupe) at 1100–3900 m.

Selected specimens examined:—BRAZIL. Amazonas: Parque Nacional do Pico da Neblina, Trilha para a cachoeira do Anta, Alto da Serra da Neblina, Acampamento do Marco 5 da fronteira do Brasil com a Venezuela, São Gabriel da Cachoeira, 2343 m, 31 December 2004, *Carvalho* 377 (INPA).—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, *Ritter 3177* (NY). 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 June 2002, *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, 2200m, 17°47'41"S, 64°43'01"W, 18 June 2003, *Nuñez 214* (MO).—COLOMBIA. Antioquia: Belmira, páramo de Belmira, localidad Montañita, 2839 m, 06º37'N, 75º38'W, 09 February 2012, *Sanín 5002* (HUA); La Unión, carretera de la Unión-San Miguel, 2340−2430 m, 05º58'N, 75º21'W, 05 July 1987, *Arbeláez 50* (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, 05 November 2003, *Murillo-A. 3479* (COL). Caldas: Salamina, corregimiento de San Félix, sector La Samaria, relictos detrás de la escuela, 2945 m, 04º59'N, 75º10'W, 28 August 2009, *Sanín 3459* (FAUC). Cauca: Popayán, Parque Nacional Natural Puracé, sector anexo a las bases militares, 3887 m, 26 July 2009, *Sanín 3294* (FAUC). Cundinamarca: Fómeque, páramo de Chingaza, La Laja y alrededores, 2700−3250 m, 11 December 1963, *Huertas 5802* (COL). Huila: Pitalito, vereda Charguayaco, reserva de la comunidad El Arroyuelo, 1925 m, 01º46'N, 76º01'W, 28 July 2009, *Sanín 3204* (FAUC). Nariño: Pasto, Pasto-Bosque Daza, 2700 m, 20 November 1980, *de Benavides 2565* (PSO). Quindío: Salento, vereda Boquia, sector La Patasola, flanco sur-oriental del río Boquia, frente al Quindío y detrás del Santuario Otún Quimbaya, 1950 m, 04º41'N, 75º41'W, 20 July 2009, *Sanín 3084* (FAUC). Risaralda: Pereira, Santuario de Fauna y Flora Otún Quimbaya, senderos al interior del Santuario, 1783 m, 04º46'N, 75º37'W, 20 April 2012, *Sanín 5124* (HUA). Santander: Carretera del páramo de Guantiva a Onzaga, 2970 m, 01 December 1967, *Jaramillo-Mejía 4442* (COL). Tolima: Ibagué, El Vergel, vía Termales de Cañón, escuela rural, bosques a mano derecha, sur este, 3500 m, 23 July 2009, *Sanín 3147* (TOLI). Valle del Cauca: 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, 02 January 2009, *Sanín 2731* (CUVC).—COSTA RICA. Cartago: Oreamuno, Pastures along road to the top of Volcán Irazú, 09°55'12"N, 83°52'12"W, 2600−2900 m, 23 June 1983, *Moran 3031* (MO). Heredia: Cantón de Barva, P.N. Braulio Carrillo, Cuenca del Tárcoles, Estación Barva, 2700−2900 m, 10º07'20"N, 84º06'00"W, 30 May 1997, *Rojas 3555* (INB).—CUBA: Lomas de la Hemita, 16 August 1918, *Bro. Hioram 2095* (NY); June 1941, *Howard 5355* (MO); June 1941, *Howard 5395* (MO). Matanzas: 10 October 1950, *Liogier 1651* (MO); 20º52'N, 76º54'W, *Wright 804* (MO).—DOMINICAN REPUBLIC. La Vega: between Constanza and Valle Nuevo, 22 December 1964, *Jones 1053* (NY); 1889 m, 18º51'N, 70º43'W, 16 April 1981, *Zanoni 12656* (MO, NY). Peravia: Cordillera Central, 20 km NW of Rancho Arriba, 1300 m, 01 March 1983, *Mickel 9122* (NY). Caña Brava: Barahona, 1300 m, 24 April

1976, *Liogier 25139* (NY).—ECUADOR. Azuay: Cuenca, Parroquia Baños, Hacienda Yanasacha, 3000−3200 m, 20 July 1978, *Boeke 2451* (NY). Carchi: Estación Biológica La Guandera, 3310 m, 00°35'N, 77°42'W, 18 February 2004, *Moran 6878* (MO). Loja: Parque Nacional Podocarpus, S of Loja, wet montane forest at the Centro de Información E of Nudo de Cajanuma, 2850−2950 m, 04°05'S, 79°10'W, 21 February 1985, *Øllgaard 57904* (MO). Morona: - Santiago, near city of Macas, 1100 m, 02°20'S, 78°08'W, 07 October 1993, *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, *Fay 3904* (MO). Pastaza: Pastaza, north of city of Puyo, in city park by the river, 950 m, 01°29'00"S, 77°59'30"W, 14 July 1992, *Fay 3610* (MO). Tungurahua: 1300 m, 01°24'S, 78°10'W, 18 March 1985, *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, 03°37'46"S, 78°26'17"W, 14 July 2004, *Croat 91048* (MO).—GUADELOUPE. Without locality, 1864, *L'Herminier s.n.* (RB).—GUATEMALA. Baja Verapaz: Purulha, Purulhá, Centro de visitantes en Biotopo Universitario para la conservación del Quetzal, 29 February 2009, *Jiménez Barrios 879* (MO).—GUYANA. Pakaraima: Mts Aymatoi, 1150 m, 05º55'N, 61º00'W, 17 October 1981, *Maas 5804* (NHN).—PERU. Amazonas: close to the border with Depto. San Martin, 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 Martin side) and the Río Chiriaco (the Amazonas side), 1950 m, 05°41'S, 77°48'W, 04 March 2001, *van der Werff 16738* (MO). Ancash: Huaylas, Huascarán National Park, Paro Valley, 3500−4000 m, 09°01'S, 77°42'W, 29 September 1985, *Smith 11553* (MO). Cajamarca: Contumaza, La Pampa de Guzmango, 2000 m, 21 April 1984, *Sagástegui 11440A* (MO). Cusco: Calca, Road Quebrada-Alto Lacco, 2800 m, 12°37'22"S, 72°14'40"W, 30 April 2006, *van der Werff 21208* (MO). Huánuco: Muna, 11 March 1959, *Woytkowski 5180* (MO). La Libertad: Otuzco, Cerro Ragache (Salpo), 3400 m, 08°00'S, 78°37'W, 23 May 1984, *Sagástegui 11609* (MO); Santiago de Chuco, 3960 m, 07°59'S, 78°15'W, 25 August 1982, *Smith 2298* (MO). Pasco: Oxapampa, Laguna San Daniel, 2400 m, 10°25'58"S, 75°27'23"W, 08 November 2009, *van der Werff 23383* (MO). Piura: Huancabamba, Subiendo al Cerro La Viuda (Distrito Sondor), 2170 m, 05°15'18"S, 79°41'34"W, 21 July 1975, *Sagástegui 8208* (MO). Puno: Carabaya, Ollachea alsojo rocas, 1500 m, *Vargas 6910* (MO).—VENEZUELA. Amazonas: Atabapo, Cerro Marahuaca, riverine forest upstream from "Sima Camp" along branch of Caño Negro, 1140 m, 03°43'N, 65°31'W, 28 February 1985, *Steyermark 130903* (MO). Bolivar: Piar, Auyan-tepui, summit, in south central region, headwaters of Río Churun, 1700−1800 m, 05°51'N, 62°32'W, 31 March 1987, *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, 09 December 1982, *Steyermark 127905* (MO). Lara: Morán, Carretera desde Humacaro Alto hacia Guaito, 2200 m, 09°28'N, 70°01'W, 14 November 1984, *van der Werff 7868* (MO). Tachira: Lobatera, La Cazadora, 2000 m, 07°56'00"N, 72°14'48"W, 22 July 1983, *van der Werff 5492* (MO). Trujillo: Carache, via Páramo Cende, margenes del Río Cende, 3000 m, 09°32'N, 70°08'W, 15 April 1988, *Rivero 1641* (MO).

Notes:—According to the International Code of Nomenclature (McNeill *et al.* 2012, ICN Article 11.4), the correct name of a species is the combination of the final epithet of the earliest legitimate name of the taxon in the same rank, with the correct name of the genus or species to which it is assigned. The earliest name available is *Polypodium sessilifolium* Desvaux (1827: 238) = *Serpocaulon sessilifolium*, but apparently it was not considered by Hooker (1864) when he described *P. chacapoyense* Hooker (1864: 29) = *S. chacapoyense* from Peru. As a result, this name must be considered as a new synonym under *S. sessilifolium,* as suggested previously by Hensen (1990) and Tryon and Stolze (1993).

Goniophlebium acuminatum, described by Fée in 1866, was redesignated to *Polypodium* by Maxon (1930). He correctly proposed a new name, *P. antillense* (= *S. antillense*), because there were already earlier combinations, *P. acuminatum* Houttuyn (1783: 181) and *P. acuminatum* (Fée 1866: 68) Sodiro (1893: 354), blocking the further use of this epithet. It is remarkable that Maxon (1930) noted that "it (*P. antillense*) is allied to the continental *P. surucuchense* Hooker (1837: 69)", because both names are currently regarded synonyms of *S. sessilifolium* (Hensen 1990, Smith *et al.* 2006). Later, Christensen (1913), kept *G. acuminatum* as synonym for *P. antillense* = *S. antillense*, and but Hensen (1990) treated it as synonym of *P. sessilifolium* = *S. sessilifolium*. Recently, Christenhusz (2009) suggested a new combination, *S. acuminatum* (Christenhusz 2009: 270), for this name. Christenhusz (2009) mentioned that *P. antillense* should be considered as a synonym of *S. acuminatum*, and inadvertently designated a lectotype for this name, despite the lectotype designation by Hensen (1990). Intriguingly, *S. antillense* was also recently recognized in the fern flora of Cuba (Sánchez 2017). However, in order to apply those names, the authors did not review the older name *P. sessilifolium* = *S. sessilifolium*. In this sense, *S. sessilifolium* should be considered to represent all the mentioned collections and names above (McNeill *et al*. 2012, ICN Article 11).

This species can be very variable, especially in the diameter of its short-creeping rhizomes, the number of pinnae, the plant size and the size and number of the sori (Sanín 2018) (Figs. 1, 2A–B). However, the combination of short-creeping rhizomes, concolorous iridescent patent scales, pinnate laminae, one row of sori, and spores with folded perine (Ramírez-Valencia *et al.* 2013, Ramírez-Valencia & Sanín 2016, Sanín 2018) allow for its determination. Although it could be recorded as terrestrial and rupicolous, it is usually epiphytic.

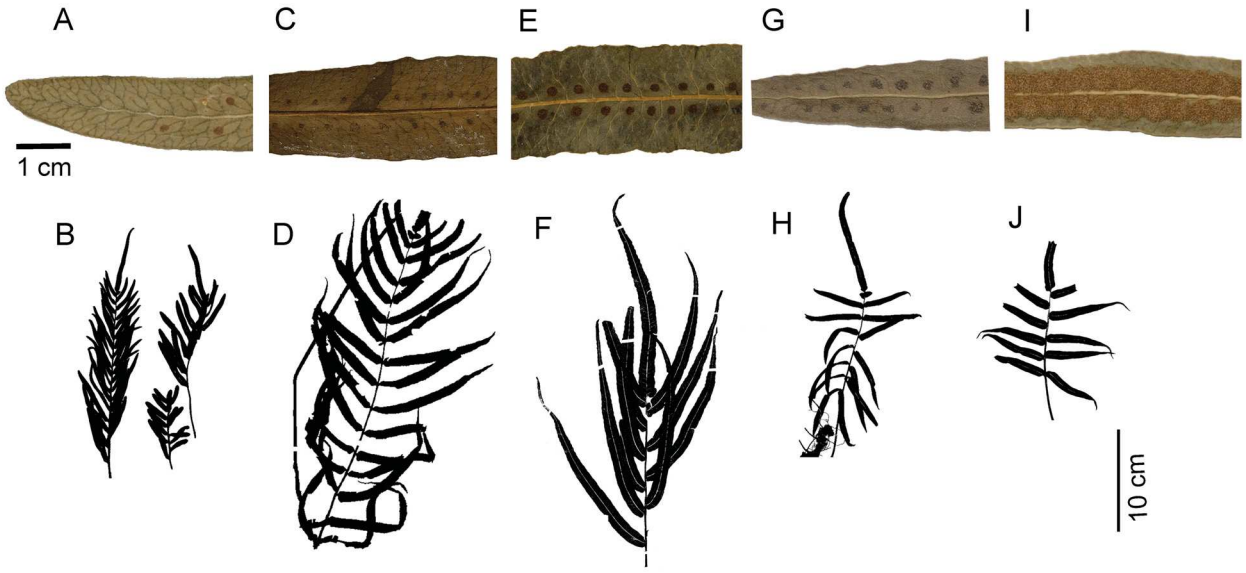

FIGURE 1. Comparison of the synonyms of *Serpocaulon sessilifolium*. A–B. *S. chacapoyense* from *Mathews 3979* (K). C–D. *S. antillense* from *l'Herminier s.n.* (P). E–F. *S. sessilifolium* from *Anonymus s.n.* (P). G–H. *S. acuminatum* from *l'Herminier s.n.* (RB). I–J. *P. surucuchense* from *Jameson s.n.* (K). Top half: A, C, E, G and I are pinnae of the type specimens. Bottom half: B, D, F, H, and J are the silhouettes of its respective type collections.

Serpocaulon wagneri (Mett.) Smith (2006: 929). *Polypodium wagneri* Mettenius (1864: 255). Lectotype (designated by Hensen 1990):—PANAMA. Chiriqui, *Wagner s.n.* (B 20 0087731!). Remaining syntypes:—COLOMBIA. Ocaña, *Schlim 636* (B 20 0087732!, BR 0000006970819!, P 00632877, RB!). Figs. 2C–D, 3.

Goniophlebium pectinatum Smith (1854: 230). Lectotype (designated by Hensen 1990):—PANAMA. Panama: new city of Panama, *Seemann 14* (K not seen, isolectotype US 00065832!). Invalid homonym of *Goniophlebium pectinatum* (Linnaeus 1753: 1085–1086) Smith (1854: 230) = *Pecluma pectinata* (Linnaeus 1753: 1085–1086) Price (1983: 115).

Polypodium costaricense Christ (1896: 660). Lectotype (designated by Hensen 1990):—COSTA RICA. Puntarenas: Plaine de Surubres au S. de Puntarenas, côte du Pacifique, 18 July 1890, *Biolley 2677* (BR!).

Polypodium kuhlmannii Sampaio (1916: 27), *syn. nov.* Lectotype (designated here):—BRAZIL. Matto-Grosso: Salto Augusto, flum. Tapajóz, January 1915, *Kuhlmann 1* (R!).

Serpocaulon panorense (Christensen 1928: 97) Smith (2006: 928). *Polypodium panorense* Christensen (1928: 97), *syn. nov.* Lectotype (designated by Hensen 1990):—BRAZIL. Amazonas: Río Waupés, Panoré, *Spruce 2324* (B 200087731!).

Plants epiphytic. *Rhizomes* short-creeping, dark brown to reddish, scarcely pruinose; *scales* dense 1.3−4.3 × 0.6−1.2 mm, subulate, subappressed, peltate, bicolor (whitish at the margin, reddish towards the center). *Laminae* 26−39 × 4.8−7 cm, linear, pinnatisect, bases truncate, apices pinnatifid and attenuate. *Segments* 35−49 pairs, basal segment reflexed and surcurrent, medial and apical segments decurrent, terminal segment softly attenuate, membranaceus to papyraceus. *Areolae* forming one row between the costa and the margin, inconspicuously covered by dense trichomes. *Sori* from the middle segments forming one row between the costa and the margin. *Spores* 54−58 × 34−36 µm with thin perine.

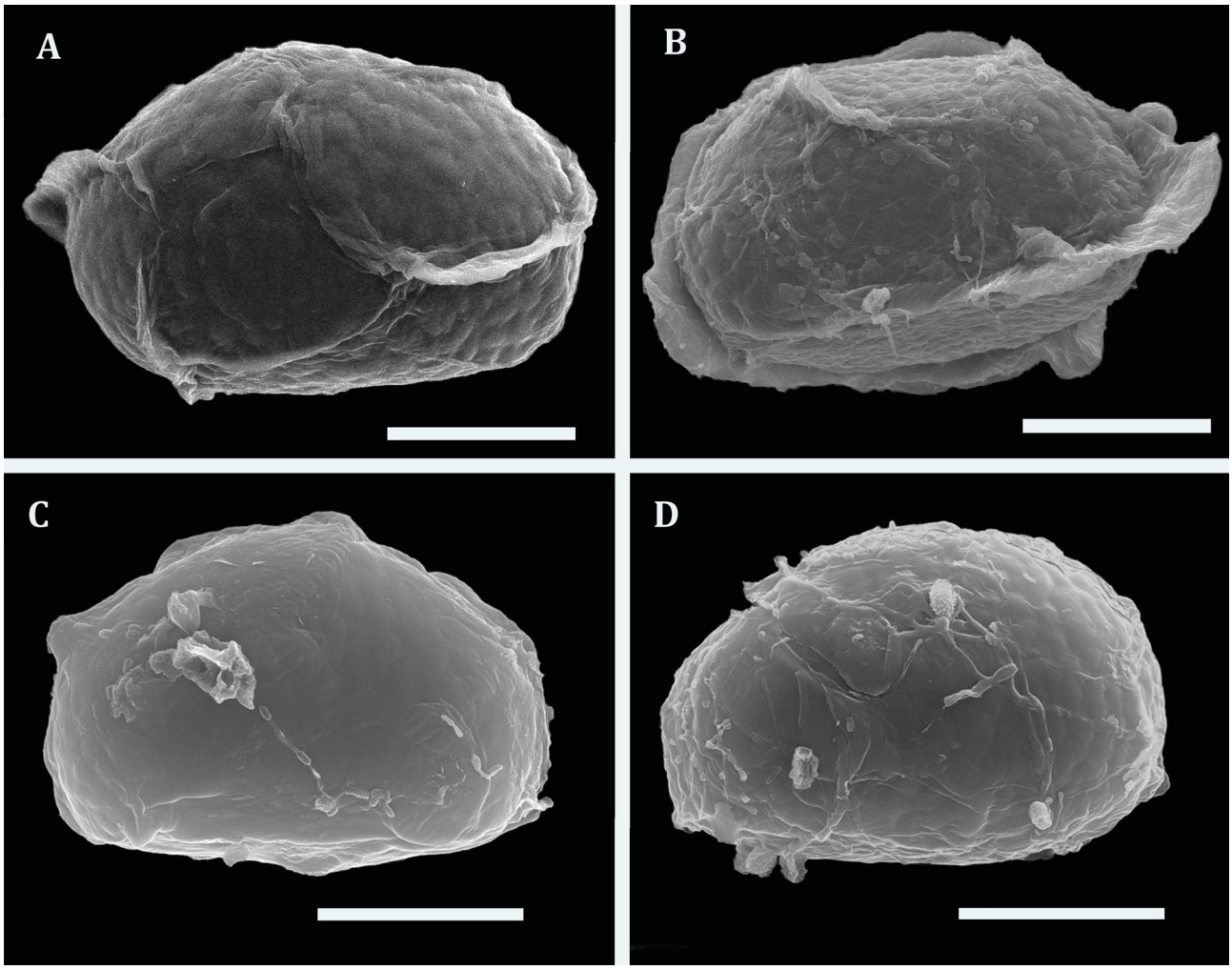

FIGURE 2. Spore comparison of the synonyms of *Serpocaulon sessilifolium* (A and B) and *S. wagneri* (C and D). A. *S. acuminatum,* from the type *l'Herminier s.n.* (RB). B. *S. sessilifolium* from *Anonymus s.n.* (P). C. *Polypodium kuhlmannii,* from the type *Kuhlmann 1* (R). D. *S. wagneri,* from *Schlim 636* (BR). Scale bars: 20 µm. All spores are in lateral view.

Distribution:— *Serpocaulon wagneri* is distributed from Costa Rica to Brazil at 50–2000 m.

Specimens examined:—BOLIVIA. Beni: Prov. Vaca Díez, vicinity of the Chácobo, village Alto Ivon, 200 m, 11º45'S, 66º02'W, 18 June 1984, *Boom 5050* (LPB).—BRAZIL. Amazonia: Manaus-Itacoatiara, km 26, Reserva Forestal Ducke, 02º53'S, 59º58'W, 24 May 1996, *Costa 546* (NY); Basin of río Purus, río Cunhuá at Deni Indian village, 06º43'S, 66º47'W, *Prance 16421* (NY). Mato Grosso: Alta Floresta, R.P.P.N. Cristalino, local conhecido como Inferno, margem direita do Río Cristalino na direçao do Río Teles Pires, 248−274 m, 09º38'11.4"S, 54º57'00"W, 09 December 2014, *Lombardi 10563* (BHCB); Colider, Fazenda Geo-Acu, 15 February 1988, *Salino 313* (BHCB); Itaúba, area de inundaçao da Usina Hidroeléctrica Colíder, Río Teles Pires, desde o ancoradouro até corredeiras, 225−254 m, 10º59'35.6"S, 55º31'50.6"W, *Lombardi 10525* (BHCB); Juina: beira do Río Perdido, 20 April 1985, *da Costa 710* (R); Salto Augusto, flum. Tapajóz, January 1915, *Kuhlmann 2* (R).—COLOMBIA. Antioquia: Cáceres, corregimiento de Manizales, 06 July 1978, *Mercado 21* (HUA); Mutatá, vereda Cauchera, 66 m, 06 July 1987, *Giraldo 112* (HUA). Chocó: Upper Río Tigre near base of Serranía del Darién, E of Unguía, 250−300 m, 08°07'12"N, 77°08'01"W, 18 July 1976, *Gentry 16759* (MO). Cundinamarca: Ubalá, vereda San Roque, camino a Campo Hermoso, 1150 m, 30 June 1998, *Fernández-Alonso 16217* (COL); Meta: Mesetas, Inspección de Polícia "La Uribe", Vereda "La Lagartija", 500 m, 07°07'04"N, 74°16'06"W, 13 August 1989, *Betancur 1388* (MO). Norte de Santander: Ocaña, San Pedro, May 1846−52, *Schlim 636* (BR, RB).—COSTA RICA. Arejuela: San Ramón, bosque demostrativo de la Universidad de Costa Rica, sede occidente, 1070 m, 10º05'25"N, 84º29'10"W, 11 August 1999, *Pérez s.n.* (INB). Cartago: Turrialba, Cordillera de Talamanca, Tayutic, Jicotea, 1100−1600 m, 09°46'48"N, 83°32'24"W, 22 June 1995, *Rojas 2022* (MO). 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 August

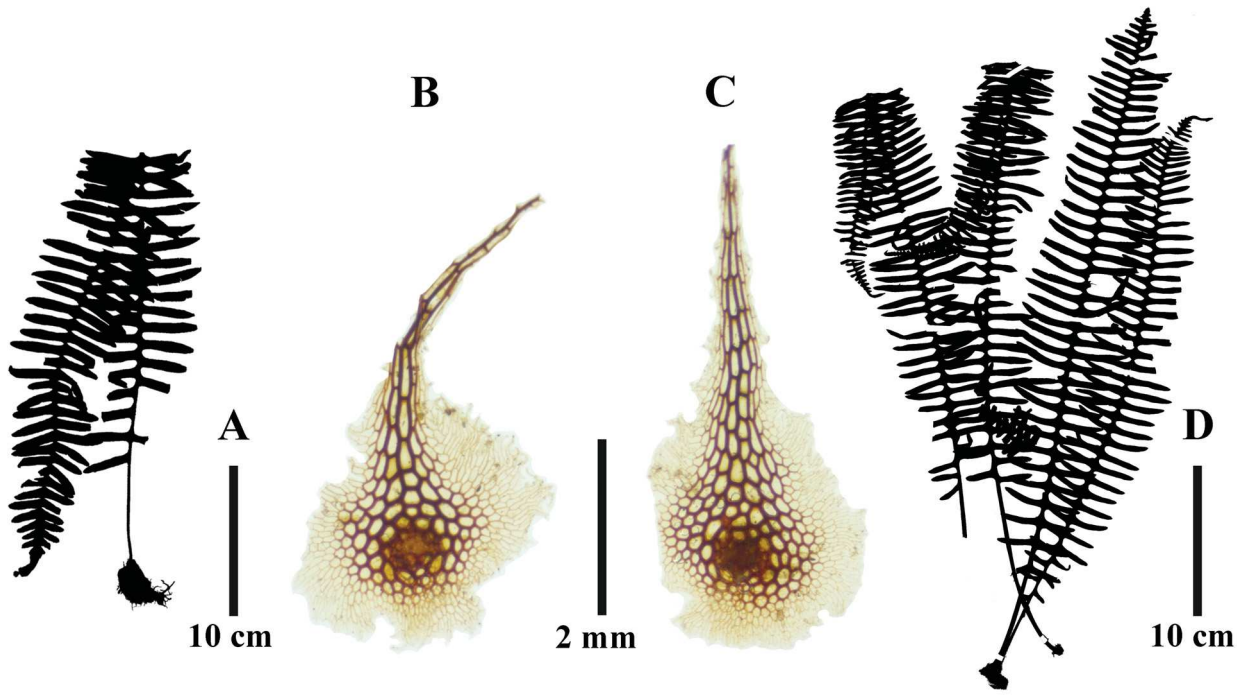

FIGURE 3. Morphological comparison between the synonyms of *Serpocaulon wagneri*. A. *S. panorense,* silhouette of the type *Spruce 2324* (B). B. *Polypodium kuhlmannii*, rhizome scale from *Kuhlmann 1* (R). C–D. *Serpocaulon wagneri*, from *Schlim 636* (BR); C. Silhouette. D. Rhizome scale.

2003, *Grayum 11925* (MO). Limón: Limón, R.I. Chirripó, Fila de Matama, Admirante, 1060−1330 m, 09°46'12"N, 83°19'48"W, 10 August 1995, *Rojas 2188* (MO). Puntarenas: Osa, Vicinity of Boscosa at Quebrada Aguabuena, 08°42’01”N, 83°30’48”W, 11 September 1996, *Croat 79295*[a] (MO). San José: Puriscal, Zona Protectora La Cangreja, along Río Negro, east of Santa Rosa de Puriscal, 315 m, 09°42’00”N, 84°23’30”W, 21 July 1988, *Grayum 8611* (MO). Puntarenas: Cantón de Golfito, Península de Osa, Puerto Jiménez, río Nuevo, 0 m, 08º32’19”N, 83º18’21”W, 09 November 1997, *Azofeifa 408* (INB). Puntarenas: R.B. Monteverde, Cordillera de Tilarán, Finca Buen Amigo, 1100−1200 m, 10º16’41”N, 84º47’43”W, 22 April 1995, *Azofeifa 133* (INB). San José: Cantón de Pérez Zeledón, Cordillera de Talamanca, San Isidro de El General, 700 m, 09º17’50”N, 83º38’55”W, 01 September 1993, *Aguilar 2086* (INB).—GUAYANA. Cuyuni-Mazaruni: Pakaraima Mts; 8.6 km NE of Imbaimadai, 900−925 m 05º46’N, 60º15’W, 27 May 1992, *Hoffman 1921* (NHN). Mazuruni: Mount Latipu, ca. 8 km N of Kamarang, 600 m, 05º57’N, 60º38’W, *Renz 14305* (NHN).—PANAMA. Canal Area: Edge of lake near Madden Dam, 50 m, 09°12’32”N, 79°37’00”W, 18 September 1974, *Mori 1995* (MO). Chiriquí: Along road between Concepción and El Hato del Volcán, 16 km above Concepción, 800 m, 08°39’N, 82°38’W, 06 August 1974, *Croat 26249* (MO). Coclé: El Valle, 100−800 m, 08°36'N, 80°08'W, 05 September 1938, *Allen 740* (MO). Colón: Cerro Jefe, Parque Nacional Chagres, 1010 m, 04 July 2012, *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, 08°05'N, 77°16'W, 25 October 1987, *Hammel 16515* (MO). Herrera: Las Minas, 18 km W of Las Minas, N slope of Alto Higo, 731−914 m, 07°43'48"N, 80°52'25"W−07°43'24"N, 80°51'47"W, 08 August 1978, *Hammel 4358* (MO). Near summit of Cerro Jefe, 900−1000 m, 09°14'02"N, 79°22'30"W, 21 July 1972, *Gentry 5533* (MO); Lago Maden, 02 September 1960, *Sucre 92* (RB); Lago Maden, 24 September 1960, *Sucre 95* (RB). Salamanca: Hydrographic Station, Río Pequení, 80 m, 28−29 July 1938, *Woodson 1598* (NHN). Veraguas: Along Río Grande, Arenas del Quebro, Península de Azuero, 10 m, 07°22’N, 80°52’W, 21 July 1990, *Grayum 9917* (MO).—VENEZUELA. Amazonas: Río Negro, 2 km E and SE of San Carlos de Río Negro, 120 m, 01°51’N, 67°03’W, 12 November 1987, *Liesner 23019* (MO). Barinas: Between la Esmeralda and El Curito, 4 km southwest of Río Capitanejo, 175 m, 25−26 August 1966, *Steyermark 96530* (NHN). Bolívar: Municipio Sucre, alrededores de Santa María de Erebato, alto Río Erebato, 340 m, 04°59’N, 64°49’W, February 1989, *Fernández 5021* (MO). 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, 09°28’N, 69°33’W, 01 November 1982, *Steyermark 126907* (MO). Táchira: Montaña de Guafitas, just west and north of El Piñal, 0 m, 07°32’30”N, 71°58’20”W, 07 November 1979, *Steyermark 119527* (MO).

Notes:—There is evidence that support the idea that *Serpocaulon panorense* and *Polypodium kuhlmannii* are synonyms of *S. wagneri*. Morphological features such as the pubescence, the laminae linear pinnatifid (Fig. 3A, C) and the thin perine on the spores (Fig. 2C–D) are similar in all three type specimens. Given that the earliest name available is *P. wagneri* Mettenius (1864: 255), the correct name is indeed *S. wagneri* according to ICN Article 11 (McNeill *et al*. 2012).

Serpocaulon wagneri can be confused with *S. patentissimum* Mett. ex Kuhn (1869: 134) Smith (2006: 928) and *S. dasypleuron* (Kunze 1834: 43) Smith (2006: 228), both species with linear to linear-lanceolate laminae and more than 20 pairs of segments. However, those species have long-creeping rhizomes with small scales 1.3 mm long, which can be either triangular (*S. patentissimum*) or rounded (*S. dasypleuron*). Furthermore, *S. wagneri* exhibits spores with thin perine (Ramírez-Valencia *et al.* 2013, Ramírez-Valencia & Sanín 2016, Fig. 2C–D).

Acknowledgements

We are in debt with Germinal Rouhan (P), Alan Paton (K) and Anna Haigh (K) for allowing the use of digital images of some specimens, and for their kind support by sending type specimens' spores and scale samples. We would like to thank the curators and staff of the herbaria cited in this paper for granting the authors access to their collections, especially to Rafaela Forzza and Claudine Mynsen at RB. We thank the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior and the Universidade Federal de Minas Gerais for a scholarship to DS, and to Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for the research grants (proc. 306868/2014−8, 201414/2017–1) to AS, and Fundação de Amparo à Pesquisa do Estado de Minas Gerais (Fapemig) for financial support (APQ–03041–17). Many thanks to Breno Barbosa Moreira from Centro de Microscopia, Universidade Federal de Minas Gerais for taking the SEM pictures. We are sincerely grateful to Carolina Romero (MO), Susan Fawcett (VT), Michael Sundue (VT), Marcus Lehnert (BONN), Syd Ramdhani (UDW) and the anonymous reviewers for their critical reading of the manuscript and suggestions.

References

Baker, J.G. (1870) Cyatheaceae et Polypodiaceae. *In:* C.F.P. Martius & Eichler, A.G. (Eds.) *Flora Brasiliensis* 1 (2). Fleischer, Munich & Leipzig, pp. 306–624.

Baker, J.G. (1891) A summary of the new ferns which have been discovered or described since 1874. *Annals of Botany* 5: 450–500. https://doi.org/10.1093/oxfordjournals.aob.a090650

Chaves-Fallas, J.M., Moran, R.C. & Oviedo-Brenes, F. (2015) *Serpocaulon* × *rojasianum* (Polypodiaceae): A new fern hybrid from Costa Rica. *Brittonia* 67: 185–190. https://doi.org/10.1007/s12228-015-9368-2

Christ, H. (1896) *Polypodium costaricence. In*: Bommer, J.E. & Chist, H. Filices novae. *Bulletin de l'Herbier Boissier* 4: 657–663.

Christenhuz, M.J.M. (2009) *Index pteridophytorum guadalupensium* or a revised checklist to the ferns and club mosses of Guadalupe (French West Indies). *Botanical Journal of the Linnean Society* 161: 213–277. https://doi.org/10.1111/j.1095-8339.2009.01005.x

Christensen, C. (1906) *Index Filicum, 1753–1905.* Copenhagen. Reprint by O. Koeltz Antiquariat (1973) Königstein, Germany.

Christensen, C. (1913) *Index Filicum, supplementum tertium pro annis 1917–1933.* Hagerup, Copenhagen, 219 pp.

Christensen, C. (1928) On a small collection of ferns from the state of Amazonas, Brazil, made by Mr. A. Roman 1924. *Dansk Botanisk Arkiv* 6 (8): 1–97.

Desvaux, N.A. (1827) Prodrome de la famille des fougères. *Mémoires de la Société Linnéenne de Paris* 6: 171–337.

Fée, A.L.A. (1866) *Histoire des FougeÌres et des Lycopodiaceìes des Antilles*. *OnzieÌme et dernier MeìmoiÌre sur la Famille des FougeÌres. Lib. V*. Berger-Levrault et Fils, Paris et Strasbourg. J.B. BailleÌre, Paris, 164 pp.

Fée, A.L.A. (1869) *Cryptogames vasculaires* (fougères, lycopodiacées, hydroptéridées, équisétacées) du Brésil. J.B. Baillière et Fils Libraires, Paris, 269 pp. https://doi.org/10.5962/bhl.title.110137

Fée, A.L.A. (1873) *Cryptogames vasculaires (fougères, lycopodiacées, hydroptéridées, équisétacées) du Brésil*. IIe partie: supplément et révision. J.B. Baillière et Fils Libraires, Paris, 115 pp.

Hensen, R.V. (1990) Revision of the *Polypodium loriceum*-complex. *Nova Hedwigia* 50: 279–236.

Hooker, W.J. (1837) *Icones Plantarum* 1. Longman, Rees, Orme, Brown, Green & Longman, London, UK, 100 pp.

Hooker, W.J. (1864) *Species Filicum* V. Dulau & Co, London, 105 pp.

Houttuyn, M. (1783) Natuurlyke Historie of Uitvoerige Beschryving der Dieren, Planten en Mineraalen, Volgens het Samenstel van den Heer Linnaeus 2 (14). Te Amsterdam, 698 pp.

INCT (2018) *Herbário Virtual da Flora e dos Fungos*. © Powered by WordPress. Available from: http:/inct.florabrasil.net/ (accessed 19 January 2018)

JSTOR (2018) *Global Plants*. ITHAKA. Available from: http:// www.plants.jstor.org (accessed 19 January 2018)

Karsten, G.K.W.H. von (1861) *Florae Columbiae* I. F. Dümmler, Berlin, 203 pp.

Kessler, M. & Smith, A.R. (2005) Seven new species, 13 new combinations, and one new name of Polypodiaceae from Bolivia. *Candollea* 60: 271–288.

KEW (2018) *The Herbarium Catalogue, Royal Botanic Gardens, Kew,* London U.K. Available from: http://www.kew.org/herbcat/ (accessed 19 January 2018)

Kuhn, F.A. (1869) Reliquiae Mettenianae. *Linnaea* 36: 41–169.

Kunze, G. (1834) Synopsis planatarum cryptogamicarum ab ed. Poeppig in Cuba insula et in America meridionali collectarum. *Linnaea* 9: 1–112.

Labiak, P. & Prado, J. (2008) New combinations in *Serpocaulon* and a provisional key for the Atlantic Rain Forest species. *American Fern Journal* 98: 139–159.
https://doi.org/10.1640/0002-8444(2008)98[139:NCISAA]2.0.CO;2

Lellinger, D.B. (1993) Application of the name *Goniophlebium* and a new subgeneric name in *Polypodium*. *American Fern Journal* 83: 37–38.
https://doi.org/10.2307/1547360

Linnaeus, C.V. (1753) *Species Plantarum*. *Vol. 2*. Salvius, Stockholm, 1200 pp.

Maxon, W. (1930) Fern Miscellany. *Proceedings of the Biological Society of Washington* 43: 81–88.

McNeill, J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Marhold, K., Prado, J., Prud'Homme Van Reine, W.F., Smith, G.F., Wiersema, J.H. & Turland, N.J. (Eds.) (2012) *International Code of Botanical Nomenclature (Melbourne Code) Adopted by Eighteenth International Botanical Congress Melboure, Australia, July 2011*. [Regnum Vegetabile 154] Koeltz Scientific Books.

Mettenius, G. (1864) Filices. *In*: Triana, M.M.J. & Planch, J.E. (Eds.) Prodromus Florae Novo-Granatensis. *Annales des Sciences Naturelles; Botanique* [sér. 5] 2: 255.

MNHN (2018) Virtual Herbarium of Paris (P). *Muséum National D'Histoire Naturelle,* Paris, France. Available from: https://science.mnhn.fr/institution/mnhn/collection/p/item/search/ (accessed: 19 January 2018).

Moran, R.C. (1990) Review of R. V. Hensen's Revision of the *Polypodium loriceum* complex. *American Fern Journal* 80: 118–119.
https://doi.org/10.2307/1547183

Moran, R.C. (1995) Polypodiaceae. *In*: Davidse, G. Sousa, M. & Knapp, S. (Eds.) *Flora Mesoamericana, Psilotaceaea a Salviniceae*. Universidad Nacional Autónoma de México, Ciudad de México, pp. 333–366.

Moran, R.C. & Øllgaard, B. (1995) Six new species of ferns (Polypodiopsida) from Ecuador. *Nordic Journal of Botany* 15: 177–185.
https://doi.org/10.1111/j.1756-1051.1995.tb00138.x

Moore, T. (1857) *Index Filicum*: *a sinopsis, with characters, of the genera, and a numeration of the species of ferns, with synonymies, references, etc*. W. Pamplin, London, 396 pp.

Price, M.G. **(**1983) *Pecluma* a new tropical American fern genus. *American Fern Journal* 73: 109–116.
https://doi.org/10.2307/1546961

Raddi, G. (1825) *Plantarum Brasilensium nova genera et species novae, vel minus cognitae*. Pars I (Filices). A. Pezzati, Florence, 101 pp.

Ramírez-Valencia, V., Sanín, D. & Pardo-Trujillo, A. (2013) Análisis morfológico de las esporas de *Serpocaulon* (Polypodiaceae) de la Cordillera Central de Colombia. *Caldasia* 35: 177–197.

Ramírez-Valencia, V. & Sanín, D. (2016) Spores of *Serpocaulon* (Polypodiaceae): morphometric and phylogenetic analysis. *Grana* 56: 1–18.

Rojas-Alvarado, A.F. & Chaves-Fallas, J.M. (2013) A new hybrid of *Serpocaulon* (Polypodiaceae) from Costa Rica. *American Fern Journal* 103: 175–181.
https://doi.org/10.1640/0002-8444-103.3.175

Sampaio, A.J. de (1916) Historia Natural, Pteridophytas (I). *In: Relatorio Commissão de Linhas Telegraphicas Estrategicas de Matto-Grosso ao Amazonas.* Publicação no. 33. Bot. 7. 27 pp., pl. 5.

Sánchez, C. (2017) Lista de los helechos y licófitos de Cuba. *Brittonia*: 69: 482–503.
https://doi.org/10.1007/s12228-017-9485-1

Sanín, D. (2014) *Serpocaulon obscurinervium* (Polypodiaceae), a new fern species from Colombia and Ecuador. *Plant Ecology and Evolution* 147: 127–133.
https://doi.org/10.5091/plecevo.2014.915

Sanín, D. (2015) *Serpocaulon tayronae* (Polypodiaceae), a new species from the Sierra Nevada de Santa Marta, Colombia. *Phytotaxa* 213: 243–252.
https://doi.org/10.11646/phytotaxa.213.3.4

Sanín, D. (2018) *Serpocaulon* (Polypodiaceae), Flora de Colombia. No. 32. Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá, 137 pp.

Sanín, D. & Torrez, V. (2014) *Serpocaulon* × *manizalense*: a new hybrid between simple- and pinnate-leaved species of *Serpocaulon* (*Polypodiaceae*) from Colombia. *Blumea* 59: 123–130.
https://doi.org/10.3767/000651914X685375

Schwartsburd, P. & Smith, A.R. (2013) Novelties in *Serpocaulon* (Polypodiaceae). *Journal of the Botanical Research Institute of Texas* 7: 85–93.

Smith, A.C. (1931) Polypodiaceae. *In*: Gleason, H.A. (Ed.) Botanical results of the Tyler-Duida expedition. *Bulletin of the Torrey Botanical Club* 58: 277–344.
https://doi.org/10.2307/2997213

Smith, A.R., Kreier, H.P., Haufler, C.H., Ranker, T.A. & Schneider, H. (2006) *Serpocaulon*, a new genus segregated from *Polypodium*. *Taxon* 55: 919–930.
https://doi.org/10.2307/25065686

Smith, J. (1854) *The Botany of the Voyage of H.M.S*. Herald. 484 pp.

Sodiro, L.A. (1893) *Cryptogamae vasculares Quitenses*. Univeristy Press, Quito, 656 pp.

Swartz, O.P. (1801) Genera et Species Filicum. *Journal für die Botanik* 2: 1–487.

Thiers, B. (2018) *Index Herbariorum: a global directory of public herbaria and associated staff*. New York Botanical Gardens Virtual Herbarium. Available from: http://sweetgum.nybg.org/ih/ (accessed 28 January 2018)

TROPICOS (2018) *Tropicos data base*. Missouri Botanical Garden. Available from: http://www.tropicos.org/ (accessed 19 January 2018)

Tryon, R.M. & Stolze, R.G. (1993) Pteridophyta of Perú. Part V. 18. Aspleniaceae-21. Polypodiaceae. *Fieldiana Botany New Series* 32: 1–190.

von Jacquin, N.J. (1789) *Collectanea Vol. III*. Wappler, Vienna, 306 pp.