

Serpocaulon obscurinervium (Polypodiaceae), a new fern species from Colombia and Ecuador

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Background and aims – In a treatment of *Serpocaulon* for Colombia, a new species was found with pinnatisect laminae, patent rhizome scales and long creeping rhizome. The aim of this paper is to describe this new species and distinguish it from the most morphologically similar one, *S. eleutherophlebium*.

Methods – Specimens and digital images from CAUP, CHOCO, COL, CUVC, MO, NY, P and PSO herbaria were studied. From the literature 59 morphological characters were selected (41 were qualitative and eighteen quantitative). The minimum, medium and maximum values were calculated for the quantitative characters, then along with the qualitative characters were used for the description and the key. Its conservation status was assessed using the IUCN Red List Categories and Criteria.

Key results – *Serpocaulon obscurinervium* D.Sanín sp. nov. is described and illustrated. It resembles *S. eleutherophlebium*, by pinnatisect laminae, long creeping rhizome, and patent rhizome scales, but it differs by rhizome scales linear-lanceolate (versus subulate), dark orange (versus dark brown), larger size (5.2–(6.3)–8.5 mm) (versus 3.5–(5.1)–7.1 × 0.5–(1.1)–1.7 mm), more areolae per segment, the fertile veinlets are inconspicuous (versus conspicuous), and have trichomes in the blade and rachis (versus trichomes absent). The new species is known from three localities at the western Andes of Colombia and one from the eastern Andes of Ecuador. A key to the Colombian and Ecuadorian species of *Serpocaulon* with pinnatisect lamina and patent scales is provided. The species is considered as Endangered (EN).

Key words – Conservation status, *Serpocaulon*, new species, pinnatisect lamina, eupolypods I, Pteridophyte.

INTRODUCTION

Serpocaulon (Polypodiaceae) is a neotropical genus segregated from *Polypodium* L. and *Goniophlebium* (Blume) C.Presl (Smith et al. 2006). It has been called the “*Polypodium loriceum* L. complex” (Hensen 1990, Moran 1990, 1995) and is synonym of *Polypodium* L. subg. *Polygoniophlebium* Lellinger (Lellinger 1993, Smith et al. 2006). Its monophyly was supported by cpDNA sequence data (Schneider et al. 2004a, 2004b, Smith et al. 2006). The morphological characters that support the recognition of the genus are rhizomes usually very long creeping (short creeping in a few species), rhizome scales clathrate, veins regularly anastomosing (goniophleboid), areoles polygonal and each with a single, free, included vein (Smith et al. 2006). The species of the genus exhibit three kinds of lamina division: (1) pinnatisect, (2) pinnate and (3) simple (with just one species: *S. levigatum*) (Hensen 1990, Moran 1995, Smith et al. 2006, Labiak & Prado 2008). Several hybrids between parental species with pinnatisect and pinnate laminae have irregularly intermediate, pinnatifid laminae (Sanín 2011).

Serpocaulon, which contains 46 specific names, is restricted to the American tropics and subtropics (Smith et al. 2006, Labiak & Prado 2008, Schwartzburd & Smith 2013). Its species occur mainly in the humid forests (Smith et al. 2006). Reported evidence by Kreier et al. (2008) support the important role of the Bolivian–Brazilian region as an area of origin for the Andean diversity of *Serpocaulon*.

The Colombian Andes harbour 26 species in the inter Andean valleys, the Chocó Region, the Sierra Nevada de Santa Marta, Los Llanos Orientales, and Amazonía (Sanín 2011). Most of the species occur in the humid forests of the Andes and the Chocó Region (Sanín 2011).

During a review of *Serpocaulon* from Colombia (Sanín 2011), a new species with a pinnatisect lamina and patent scales was found, and it is hereafter referred as *S. obscurinervium*. The specimens of this new species were previously identified as *S. eleutherophlebium*. To distinguish these two species and others of *Serpocaulon* from Colombia with pinnatisect laminae and patent scales, a key is provided.

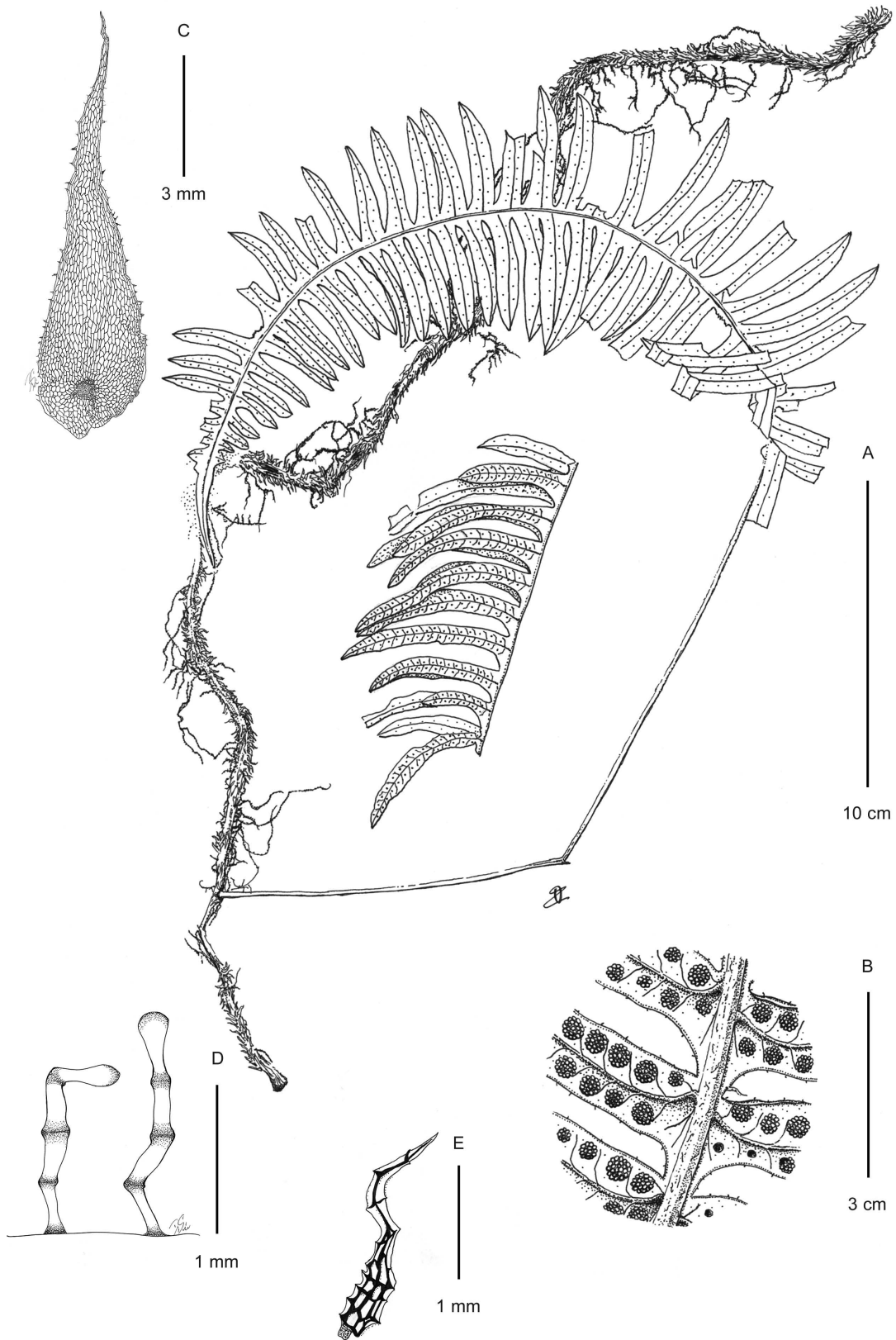


Figure 1 – *Serpocaulon obscurinervium*: A, habit; B, detail of the segments; C, rhizome scale; D, lamina hairs; E, rachis scale. All from Hagemann & Leist 1898 (PSO). Drawn by O.F. Zuluaga (A & B) and the author (C, D & E).

MATERIAL AND METHODS

Herbarium material and digital images were studied from CAUP, CHOCO, COL, CUVC, MO, NY, P and PSO herbaria. Following Rödl–Linder (1990), Moran (1995) and Lellinger (2002), 59 morphological characters were selected. From this, 41 were qualitative and eighteen were quantitative. Only for quantitative characters minimum, median and maximum values were calculated, with these values and the qualitative data the description and the key were done. Statistical analyses were made with the R program (R Development Core Team 2008).

The conservation status of the new species was assessed by applying the IUCN Red List Categories and Criteria (IUCN 2001).

SPECIES DESCRIPTION AND DISCUSSION

Serpocaulon obscurinervium D.Sanín, **sp. nov.**

Serpocaulon obscurinervium D.Sanín a *S. eleutherophlebium* (Fée) A.R.Sm. differt squamis linearibus lanceolatis (versus subulatas), atroaurantiacis (versus atrobrunneas), statura majore 5.2–(6.3)–8.5 × 1.6–(1.7)–2.3 mm (versus 3.5–(5.1)–7.1 × 0.5–(1.1)–1.7 mm), areolis magis numerosis secus medium segmentum 19–(20)–28 series (versus 6–(12)–21 series), subsidiariis venis sororum inconspicuis (versus conspicuas), trichomatisque in lamina et rachis praesentibus, 2–(3)–4 cellulae longis, dispersis, catenatis, teretibus et atrobrunneis (versus trichomata absentia). – Type: Colombia. Nariño: Carretera La Victoria–Monopamba, [01°10'N 78°00'W], alt. 2500 m, 10 Jan. 1973, *Hagemann & Leist* 1898 (holo-: PSO; iso-: COL).

Polypodium loriceum var. *obscurum* Rosenst. (Rosenstock 1909: 308, as “var. *obscura*”), **synon. nov.** – Type: Ecuador, Tungurahua: Mt. Abitagua [near Baños], Andes of Quito, s.d., *Spruce* 5234 (iso-: P, <http://dsipho.mnhn.fr/sonnerat/LAPI/ScanN/N20080624/P00624574.jpg>).

Epiphytic and terrestrial ferns. Rhizomes 3.3–(3.5)–3.7 mm in diameter, long creeping, pruinose, color orange to reddish in the apex, yellowish brown in the base. **Phyllopo-dia** distance 2.3–(2.6)–4 cm. **Scales** 5.2–(6.3)–8.5 × 1.6–(1.7)–2.3 mm, peltate, with appressed rounded base and patent acuminate apex, lanceolate linear, numerous and dense along the rhizome, concolorous, dark orange iridescent, with ciliate margin. **Petiole** 25–(26)–28 cm, proximally subterete, distally triangular, dark stramineous. **Lamina** 29–(29.5)–33 × 9–(9.4)–9.7 cm, pinnatisect, narrowly lanceolate, reflexed, truncate base, attenuated apex, gradually tapering to a caudate apical segment. **Segments** 33–(34)–35 pairs, firm to coriaceous consistency, middle and basal segments surcurrent, apical segments sursumcurrent. **Middle segment** 4.7–(4.9)–5.2 × 0.7–(0.75)–0.8 cm. **Areoles** 19–(20)–28 along the segment and one open row between the costae and margin, fertile veinlets are inconspicuous. **Segment scales** 0.9–(1.2)–1.6 × 0.29–0.33 mm, 2–4 cells wide, lanceolate, patent, rounded at base with one stalk insertion, acuminate to largely acicular at apex, concolorous, dark brown. **Trichomes in the blade and rachis** 2–(3)–4 celled long, dispersed, catenate, terete, dark brown, darker in the apex. **Sori** 19–(20)–28

along the segment and one row between the costa and margin. Fig 1.

Habitat, distribution and phenology – Cloud forests in the western Andes of Colombia and eastern Ecuador (fig. 2). Found in the open areas of vegetation, with shrubs, herbs, grasses, ferns, palm trees and little trees, and into trails in the primary forest. Altitude 1820–2800 m. Collected fertile in January and August.

The new species is known in three different locations in Colombia, and the oldest collection was register in Ecuador (i.e., the type of *Polypodium loriceum* var. *obscurum*). In Colombia, two of those locations have recently botanical explorations (Cerro del Torrá and La Planada). In the Cerro del Torrá location a monotypic family was described (Alzateaceae) (Silverstone-Sopkin & Graham 1986) and at least 25 new species from different taxa (Silverstone-Sopkin & Ramos-Pérez 1995, Pérez-Zabala 2007, Moncada et al. 2013), including a new fern species (*Pityrogramma opal-escens* Sundue) (Sundue 2011). The other location is the Natural Reserve La Planada, which is a private area on the Pacific slope of the Andes and is part to the Chocó biogeographic province (Arens & Smith 1998), where the annual rainfall average is 4500 mm and the average daily temperature is 19°C (Arens 2001). The flora of the area was studied by Mendoza-Cifuentes & Ramírez-Padilla (2000), Ramírez-Padilla & Mendoza-Cifuentes (2002). Arens & Smith (1998) described a new tree fern (*Cyathea planadae* N.C.Arens & A.R.Sm.). La Planada was catalogued like one of the places with more epiphytism in the Andean forests (Gentry 1995).

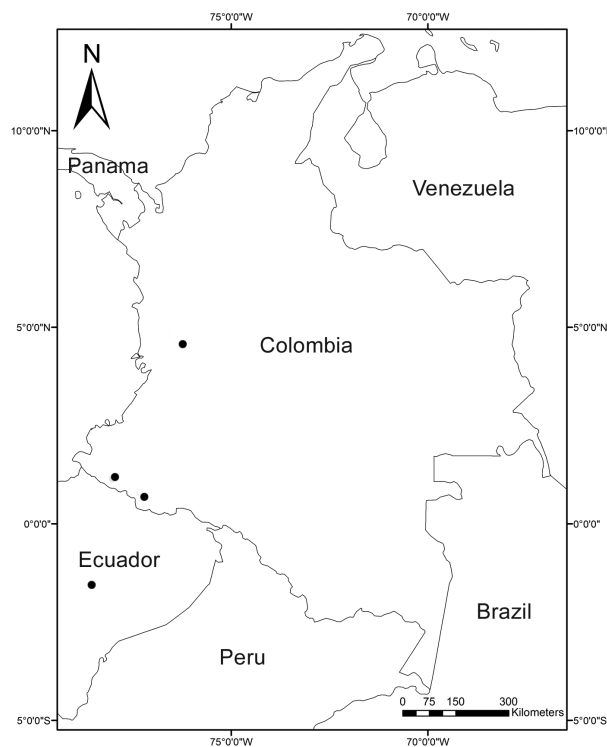


Figure 2 – Distribution of *Serpocaulon obscurinervium*.

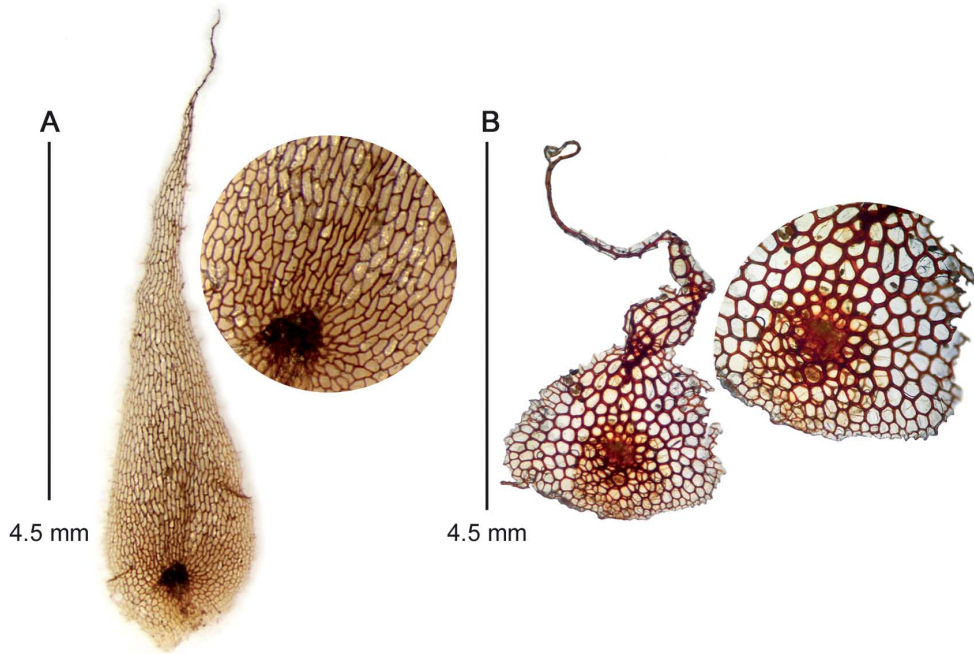


Figure 3 – Comparison between the scales of the related species of *Serpocaulon*. A, *S. obscurinervium* (from Hagemann & Leist 1898, PSO); B, *S. eleutherophlebium* (from Rodríguez *et al.* 5970, COL).

Table 1 – Principal differences between *Serpocaulon obscurinervium* and *S. eleutherophlebium*.

Character	Species	
	<i>S. obscurinervium</i>	<i>S. eleutherophlebium</i>
1. Rhizome diameter (mm)	3.3–(3.5)–3.7	1.3–(2.2)–3.7
2. Scale size (mm)	5.2–(6.3)–8.5 × 1.6–(1.7)–2.3	3.5–(5.1)–7.1 × 0.5–(1.1)–1.7
3. Scale shape	Lanceolate	Subulate
4. Scale color	Dark orange	Dark brown
5. Petiole size (cm)	24–(26.5)–28	3.4–(12)–25
6. Areole numbers along the middle segment (rows)	19–(20)–28	6–(12)–21
7. Sori number along the middle segment (rows)	19–(20)–28	4–(11)–19
8. Fertile veinlets	Inconspicuous	Conspicuous
9. Lamina trichomes	Present	Absent

The type collection area was in the trail between two towns “La Victoria–Monopamba” in Nariño department, therefore this population can be considered at high risk. However, it does not have any other studies or a protected status.

Other material examined – **Colombia. Chocó:** San José del Palmar, Cerro Torrá, Filo de Cumbre, [04°48' N, 76°29' W], alt. 2700–2800 m, 21 Aug. 1988, *Silverstone-Sopkin* 4633 (CHOCO, CUVC, MO, UC n.v.). **Colombia. Nariño:** Reserva Natural La Planada, sendero entre El Hondón y Los Horquetas, Bosque primario, 01°10'N 78°00'W, alt. 1820 m, 31 Jan. [no year given], *Herrera* 9302, 9193 (PSO, CUVC, UC n.v.).

Notes on related taxa – *Serpocaulon obscurinervium* is closely related to *S. eleutherophlebium* (Fée) A.R.Sm. Both species have similar long creeping rhizomes, scales with a patent apex, concolorous and pinnatisect laminae. Howev-

er *S. obscurinervium* differs from *S. eleutherophlebium* by linear-lanceolate scales (versus subulate), dark orange (versus dark brown), larger size 5.2–(6.3)–8.5 × 1.6–(1.7)–2.3 mm (versus 3.5–(5.1)–7.1 × 0.5–(1.1)–1.7 mm) (fig. 3), longer petioles 24–(26)–28 cm (versus 3.4–(12)–25.5 cm) (fig. 4), more areoles along the middle segment 19–(20)–28 rows (versus 6–(12)–21 rows), inconspicuous fertile veinlets (versus conspicuous fertile veinlets) (fig. 5), and the presence on the blades and rachises of trichomes 2–4 celled, dispersed, catenate, terete and dark brown (versus absent trichomes) (table 1).

Richard Spruce collected the first exemplar of this new species on Mount Abitagua near Baños. Rosenstock (1909) noticed the distinctness of this plant and published it as *Poly-*

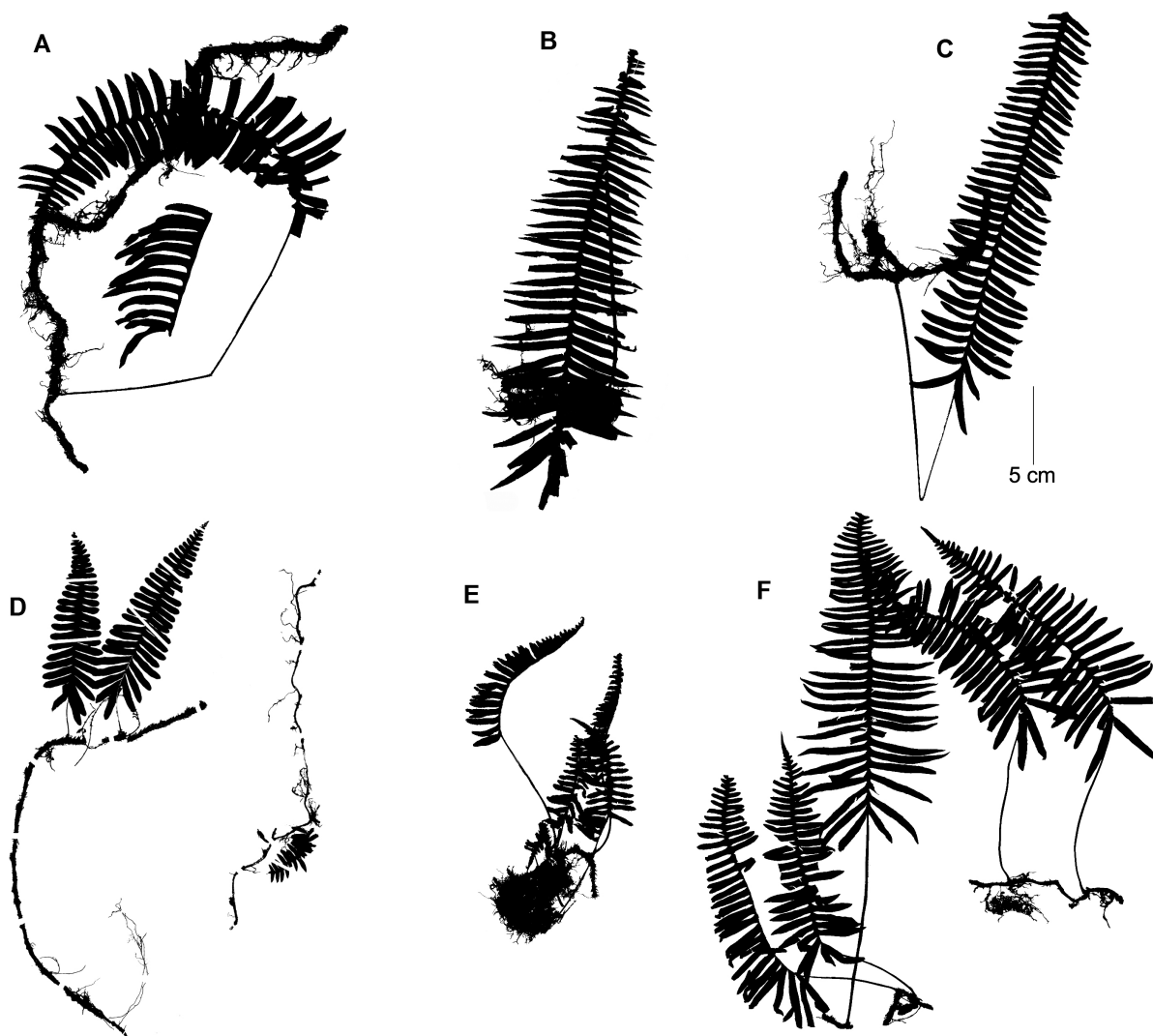


Figure 4 – Silhouettes of related *Serpocaulon* species. A–C, *S. obscurinervium*; D–F, *S. eleutherophlebium*. A from Hagemann & Leist 1898 (PSO); B from Hagemann & Leist 1898 (COL); C from Herrera 9302 (PSO); D from Murillo 483 (COL); E from Ramirez-P. 2002 (PSO); F from Jaramillo-Mejía 6451 (CAUP).

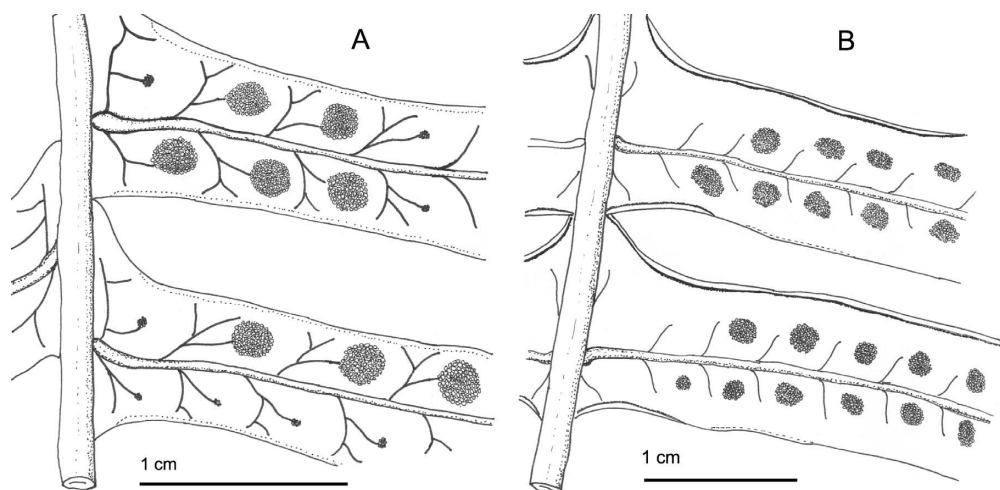


Figure 5 – Comparison between the venation in the pinnae of the related species of *Serpocaulon*: A, *S. eleutherophlebium* (from Rodríguez *et al.* 5970, COL); B, *S. obscurinervium* (from Hagemann & Leist 1898, PSO). Drawn by the author.

**Key to the species of *Serpocaulon* with pinnatisect laminae
and patent scales known from Colombia and Ecuador**

1. Proximal pinnae with 50–(54)–60 areoles along the costa and 3–4 areoles between the costa and margin.....*S. attenuatum* (Humb. & Bonpl. ex. Willd.) A.R.Sm.
- 1'. Proximal pinnae with 5–(14)–31 areoles along the costa and 1–2 areoles between the costa and margin.....2
2. Concolorous rhizome scales.....3
- 2'. Bicolorous rhizome scales.....5
3. Rhizome 5–(8.7)–12 mm in diameter, short creeping; blade densely pubescent with dimorphic hairs (on the rachis with 4–(6)–8 cells long and on the lamina with 12–(13)–15 cells long).....*S. dissimile* (L.) A.R.Sm.
- 3'. Rhizome 1.3–(3.0)–6.5 mm in diameter, long creeping; blade glabrous or with dispersed monomorphic hairs.....4
4. Rhizome scales 5.2–(6.3)–8.5 × 1.6–(1.7)–2.3 mm; petiole 25–(26)–28 cm long; the proximal segment with 19–(20)–28 areoles along the costa, inconspicuous fertile veinslets*S. obscurinervium* D.Sanín
- 4'. Rhizome scales 3.5–(5.1)–7.1 × 0.5–(1.1)–1.7 mm, petiole 3.4–(12)–25 cm long; the proximal segment with 6–(12)–21 areoles along the costa, conspicuous fertile veinslets*S. eleutherophlebium* (Fée) A.R.Sm.
5. Lamina 12–(16.5)–26 cm long, basal segment 6–(10)–13.5 cm long; sori in 1–2 rows between the costa and margin.....*S. nanegalense* (Sodirol) A.R.Sm.
- 5'. Lamina 2.2–(5.8)–12 cm long, basal segment 1.1–(2.4)–7.2 cm long; sori in 1 row between the costa and margin.....6
6. Rhizome scales subulate, dense along the rhizome, their margin brown to reddish brown.....7
- 6'. Rhizome scales ovate-lanceolate or lanceolate to triangular, scattered to dense along the rhizome, their margin gold brown, dark brown to yellowish.....8
7. Segments 35–(48)–49 pairs; distance between phyllopodia 3.8–(5.2)–6.5 cm; petiole 3.8–(4.2)–5.5 cm long.....*S. wagneri* (Mett.) A.R.Sm.
- 7'. Segments 16–(26)–31 pairs; distance between phyllopodia 1–(1.5)–2.5 cm; petiole 5–(9.2)–23.5 cm long.....*S. lasiopus* (Klotzsch) A.R.Sm.
8. Segments 36–(44)–61 pairs, lamina glabrous to sparsely pubescent, dimorphic trichomes, appressed on the lamina and patent on the rachis.....*S. patentissimum* (Mett. ex. Kuhn) A.R.Sm.
- 8'. Segments 16–(22)–35 pairs, lamina dense to sparsely pubescent, monomorphic trichomes, patent on the lamina and rachis.....*S. subandinum* (Sodirol) A.R.Sm.

podium loriceum var. *obscurum* Rosenst., a species with type from the West Indies whose rhizome scale are minute (< 1 mm wide), circular, and appressed. On the basis of morphology, *P. loriceum* does not appear close to *Serpocaulon obscurinervium* D.Sanín (syn: *P. loriceum* var. *obscurum*); instead, it seems closer to *S. eleutherophlebium* because of its spreading linear-lanceolate rhizome scales. In either case, it seems amply distinct and merits recognition at the rank of species.

Etymology – The specific epithet refers to the obscure veins that supply the observed sori.

Conservation assessment – The conservation status was assessed using the IUCN Red List Categories and Criteria (IUCN 2001), and the new species falls under the category Endangered, [EN B1ab(i, ii, iii) + B2ab(i, ii, iii)]. The EOO estimated for *Serpocaulon obscurinervium* is 24.669 km². The AOO is 36 km², and it falls completely outside any protected area under Colombian and Ecuadorian System of Protected Areas. In addition, more than 50% of the estimated AOO is outside of pristine areas.

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