
A New *Microgramma* Subgenus *Solanopteris* (Polypodiaceae) from Peru and a New Combination in the Subgenus

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ABSTRACT. Based on a collection from north-central Peru, a new tuberous species of Polypodiaceae is recognized and described as *Microgramma fosteri*. It differs from other coenosoric species by the presence of laminar scales intermixed among the sori and slender paraphyses with elongate apical cells possessing clear lumina and thin walls. A key for species identification in subgenus *Solanopteris*, to which the new species belongs, is provided. In addition, a new combination is made for a species previously recognized in the genus *Solanopteris*.

Key words: *Microgramma* subg. *Solanopteris*, Neotropics, Peru, Polypodiaceae.

In the Neotropics, modified stems resembling tubers generally inhabited by ants are known only in the genus *Microgramma* subg. *Solanopteris* (Copeland) Lellinger (Wagner, 1972; Rauh, 1973; Gómez, 1974; Lellinger, 1977; Moran, 1992). This subgenus currently includes four species: *M. bifrons* (Hooker) Lellinger, *M. bismarckii* (Rauh) B. León, comb. nov., *M. brunei* (Wercklé ex Christ) Lellinger, and *M. tuberosa* (Maxon) Lellinger, all with dimorphic fronds. In Peru, two species have been reported: *M. bifrons* from the Departments of Amazonas, Cusco, Loreto, Madre de Dios, Pasco, San Martín, and Ucayali, growing below 1000 m elevation; and *M. bismarckii* from Cusco, Pasco, and San Martín from altitudes above 1000 m (Tryon & Stolze, 1993). Based on a collection made by the second author in the Department of Ucayali at 1220 m, a new species is recognized and described here.

Microgramma fosteri B. León & H. Beltrán, sp. nov. TYPE: Peru. Ucayali: Cordillera Azul del Biabo, cabeceras del río Pisqui, 8°28'45.6"S, 75°43'5.21"W, 1220 m, 12 Sep. 2000, H. Beltrán, R. B. Foster & W. Alverson 3643 (holotype, USM). Figures 1, 2A, B.

A Microgramma bismarckii et *M. tuberosa* squamis laminaribus inter soros positis et paraphysibus gracilibus, cellulis apicalibus elongatis luminibus hyalinis praeditis recedit.

Epiphyte (Fig. 1A). Rhizomes long-creeping, 1.5–2 mm wide, branched, glaucous to dark brown, apices and young parts covered with broadly elliptic non-clathrate peltate scales 0.5–0.75 mm long, white or brown with white margins (Fig. 1B–E); tuberous rhizome hollow, 1.5–2 cm wide, covered with long acuminate scales from a round peltate base, 1.4–1.5 mm long (Fig. 1F), shiny dark-brown in the center. Phyllopodia short, inconspicuous. Leaves dimorphic, 0.2–0.5 cm apart, subcoriaceous, simple with entire margins, subsessile to short-petiolate, petiole 1–2 mm long. Trophophylls (Fig. 1G) obovate to broadly elliptic, apex obtuse, 1.3–2 × 0.8–1.2 cm, scattered scales on both surfaces; scales linear, 1.1–1.4 mm long (Fig. 1H, I); costa prominent abaxially $\frac{2}{3}$ of leaf length, primary veins slightly prominulous. Sporophylls (Fig. 1J, K), oblong, apex retuse, 1.2–2 × 0.7–0.8 cm, adaxially with scattered dark brown scales, persistent along margins, sporangia and paraphyses borne on a 2 mm broad receptacular line completely covering the abaxial surface at maturity, with dark brown laminar scales (Fig. 1L, M) 1 × 0.5 mm, base peltate with 0.1 mm long stalk, intermixed with sporangia and paraphyses. Paraphyses hairlike, 0.8–1 mm in length, 8–10 cells long, 1 cell wide, apical cell hyaline, 40–60 μ m long (Fig. 2A, B). Spores 65–75 μ m long, with spines 8–13 μ m long.

The specific epithet honors Robin B. Foster for his work in Peru and his efforts in neotropical conservation. *Microgramma fosteri* is characterized by its leaves with entire margins, scattered persistent abaxial scales, acrostichoid coenosori, 1 mm long

laminar scales intermixed with the sporangia, 1 cell-wide paraphyses with elongate apical cells having clear lumina, and spores with long spines 8–13 μm . It differs from *M. bifrons* and *M. brunei* by its trophophylls with entire margins, acrostichoid coenosori, and paraphyses with elongate apical cells. It can be distinguished from *M. bismarckii* and *M. tuberosa*, both of which also have coenosori, by its trophophyll with a retuse apex, completely covered abaxially with sporangia when mature (vs. having a nonsoriferous expanded apex), the presence of shiny dark brown laminar scales among the sporangia (vs. none or inconspicuous), and the paraphyses with elongate cells, clear lumina, and thin apical cell walls (vs. having blunt apical cells with dark lumina). *Microgramma bismarckii* and *M. tuberosa*, which are known from few collections, are poorly understood taxonomically and may represent different phases of a single species.

Wagner (1986) studied soral patterns in pleopeltid ferns and commented on the parallel situation in *Solanopteris* and *Microgramma* with regard to soral series ranging from discrete to confluent sori to coenosori. The soral pattern in this newly described species links coenosoric development with a reduction of the fertile blade. The presumed closest relative, *M. bismarckii*, better represented in herbaria, presents laminar expansions beyond the proximal and distal border of the sori but no concurrent frond reduction. In the overall distribution of *Microgramma* subg. *Solanopteris*, coenosoric species occupy altitudes above 1000 m.

Taxonomic characters used for species recognition in subgenus *Solanopteris* have included leaf morphology, venation patterns, and soral shape. However, with the exception of Wagner (1972), little attention has been paid to other characters such as those found in paraphyses. Paraphyses in *Solanopteris* can be described as one cell wide for most of their length. Differences from species to species appear in the distal portions, where variation occurs in cell number, dimensions, shape, and coloration of the apical cell lumina (Fig. 2A–E). The distinctive acrostichoid coenosori in *M. fosteri* mostly contain thin paraphyses with elongate cells, and the most distal cells have a clear lumina and thin walls

(Fig. 2A, B). The paraphyses in this new species do not resemble those found in the discrete-sori species (Fig. 2C, D), where the most distal cells are broader than long and the conformed apex has one or two blunt cells. They differ from those other coenosoric species (Fig. 2E), in which the distal cells are also broader than long, and the terminal cell has the lumina dark yellow-brown filled with tannin at maturity. This is similar to the situation in *Polypodium virginianum* L. (Peterson & Kott, 1974) in which the marginal cells are similarly darkened.

Affinities between subgenus *Solanopteris* and some species of subgenus *Microgramma* are manifest in the paraphyses (e.g., Sota, 1986). For *M. baldwinii* Brade and *M. ulei* (Ule) Stolze, both also found in Peru, paraphyses are one cell wide. In *M. baldwinii*, the three to four of the most distal cells are broader than long. In some cases, the third row is bicellular, as in *M. bifrons* and *M. brunei*, and the apical cell is hooked, with the lumina filled with tannin. In *M. ulei*, the apical cell is blunt and dark, more like those seen in *M. bismarckii*. Further research on paraphyses development and characteristics for these and other species of *Microgramma* may contribute to a better understanding of these affinities.

NEW COMBINATION

Microgramma bismarckii (Rauh) B. León, comb. nov. Basionym: *Solanopteris bismarckii* Rauh, Abh. Akad. Wiss. Abh. Lit. Mainz, Math.-Naturwiss. Kl. 5: 232. 1973. TYPE: Peru. Pasco: Oxapampa, 1800–2000 m, Ceja de la Montaña, July 1971, *Werner Rauh 25790* (holotype, HEID).

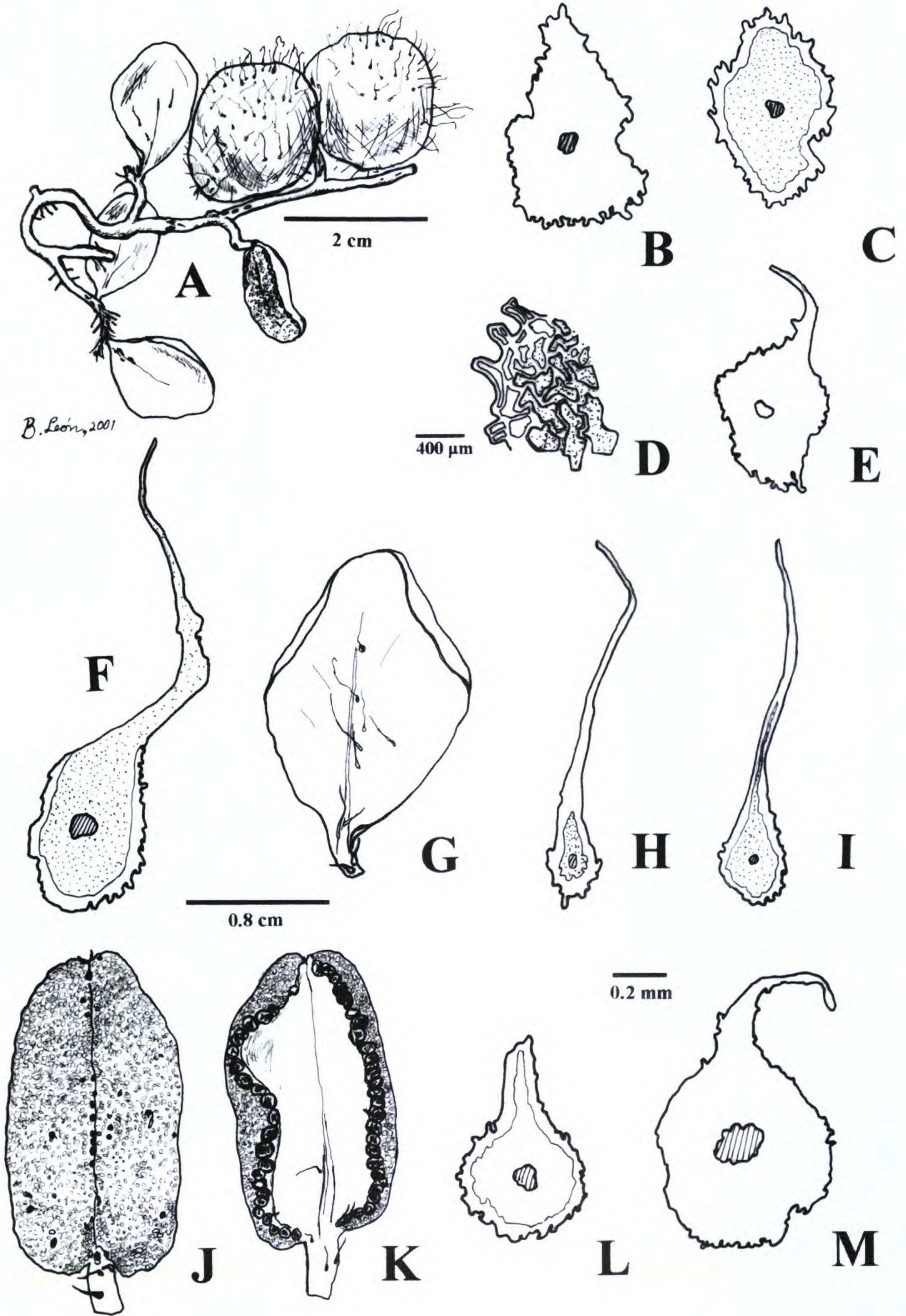
The following key distinguishes all currently recognized species of *Microgramma* subg. *Solanopteris*.

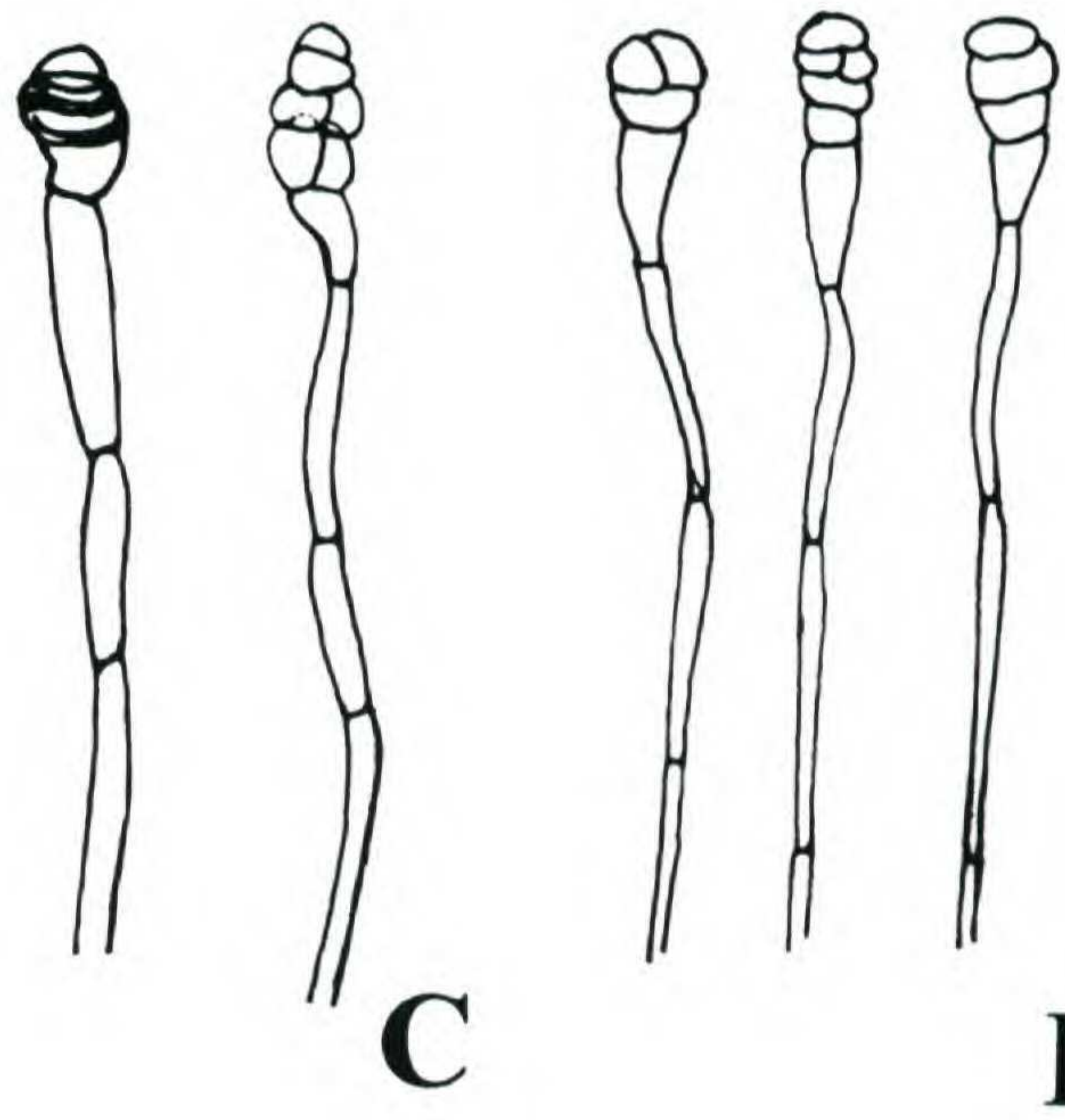
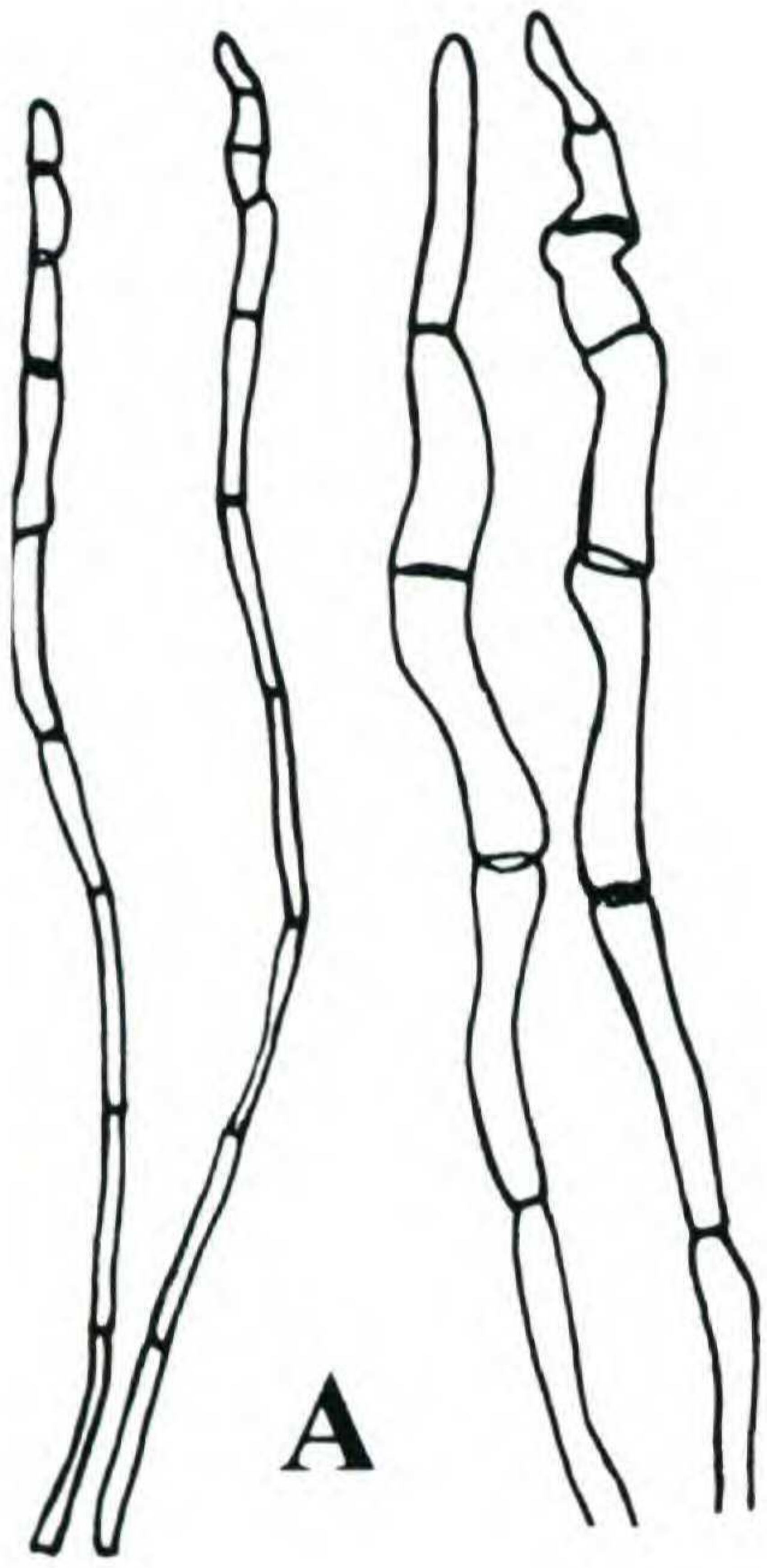
KEY TO THE SPECIES OF *MICROGRAMMA* SUBG. *SOLANOPTERIS*

1. Sporophylls with discrete sori; leaves chartaceous to subcoriaceous; paraphyses with blunt apical cells 2
- 1'. Sporophylls only with coenosori, occasionally intermixed discrete sori present; leaves coria-

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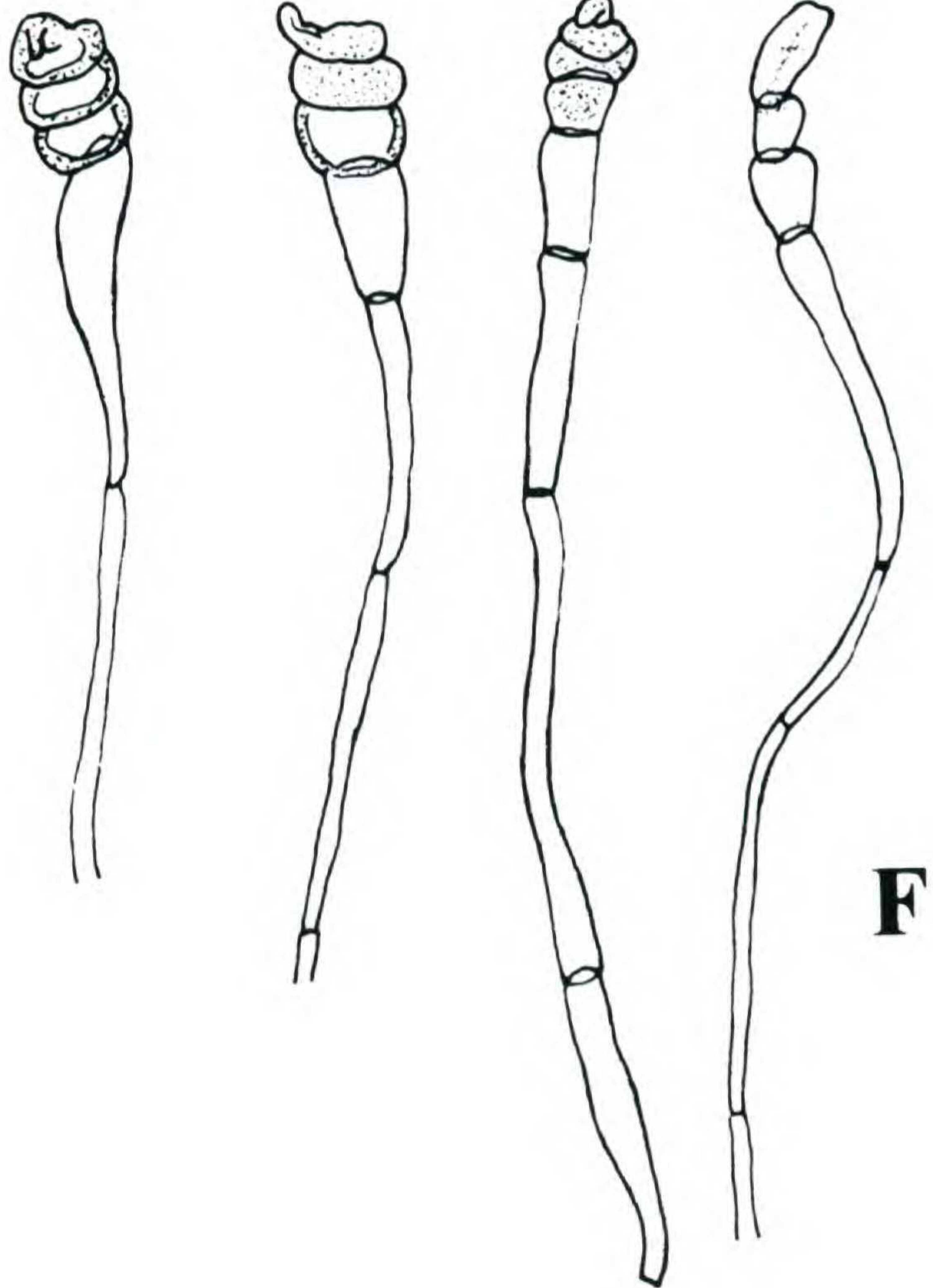
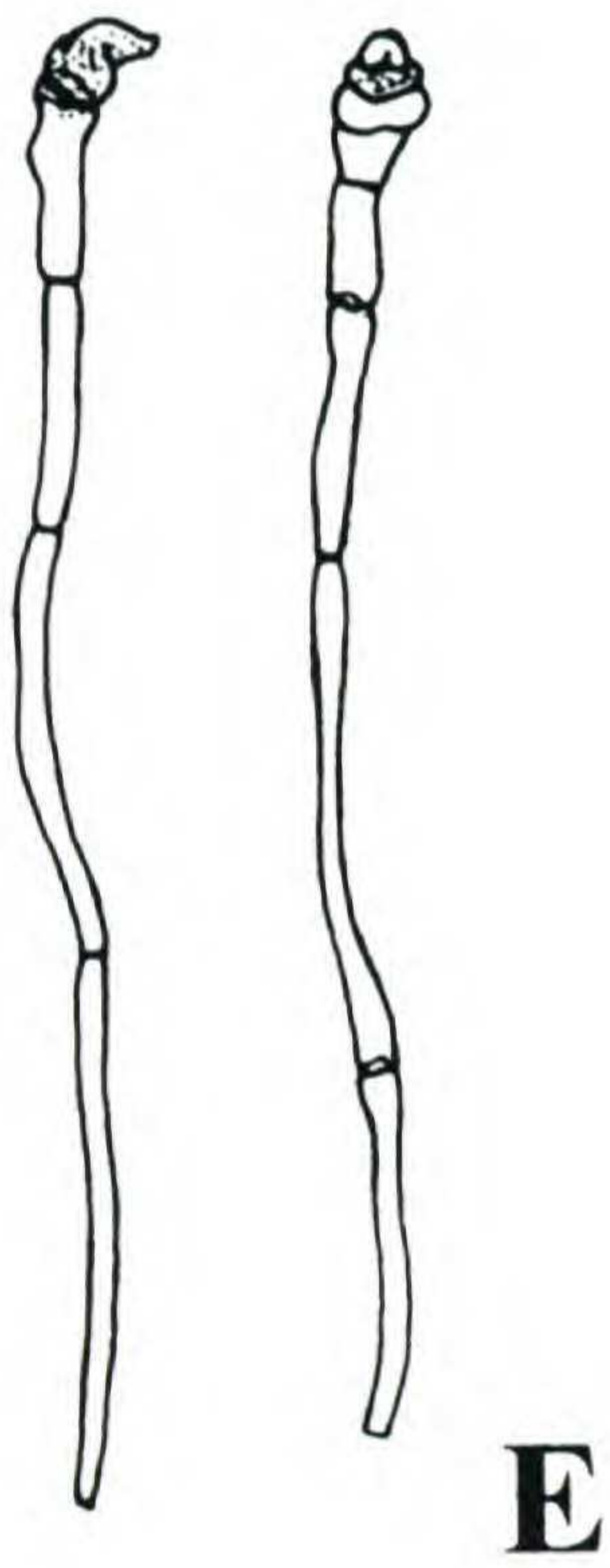
Figure 1. *Microgramma fosteri* B. León & H. Beltrán. —A. Habit. —B–E. Rhizome scales. —D. Central basal portion of rhizome scale. —F. Tuber scale. —G. Abaxial view of trophophyll. —H. Adaxial trophophyll scale. —I. Abaxial trophophyll scale. —J. Abaxial view of sporophyll. —K. Adaxial view of sporophyll. —L. Adaxial sporophyll scale. —M. Abaxial sporophyll scale. Drawn from *Beltrán, Foster & Alverson 3824* (USM). Stippled areas represent dark lumina cells; striped areas represent insertion. The 0.2 mm bar applies to B, C, E, F, H, I, L, and M. The 0.8 cm bar applies to G, J, and K.





200 μm

130 μm



- ceous; paraphyses with elongate apical cells or broader than long apical cells with lumina filled with tannin 3
- 2(1). Trophophyll margins lobed; leaves chartaceous *M. bifrons*
- 2'. Trophophyll margins entire or rarely slightly repand; leaves subcoriaceous *M. brunei*
- 3(1). Sporophylls with retuse apex; sori acrostichoid; dark brown laminar scales dispersed on both surfaces; paraphyses with elongate apical cells and terminal cell without tannin *M. fosteri*
- 3'. Sporophylls with mucronate to acute apex; sori elongate to discrete; laminar scales absent or inconspicuous; paraphyses with distal cells broader than long; terminal cell brown filled with tannin 4
- 4(3). Trophophyll apex mucronate *M. bismarckii*
- 4'. Trophophyll apex acute or obtuse *M. tuberosa*

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Figure 2. Paraphyses. A, B. Paraphyses of *Microgramma fosteri*. Drawn from Beltrán, Foster & Alverson 3824 (USM). —A. Paraphyses. —B. Detail of distal portion. —C. Paraphyses of *Solanopteris bifrons*. Drawn from Dick 270 (MO). —D. Paraphyses of *Solanopteris brunei*, drawn from Forero et al. 6022 (MO). —E. Paraphyses of *Solanopteris bismarckii*, drawn from Rauh 35685 (USM). —F. Paraphyses of *Solanopteris bismarckii*, two left figures drawn from Cerón et al. 5799 (MO), two right figures from Gentry & Smith 45184 (MO). The 200 µm bar applies to A, C, D, and E. The 130 µm bar applies to B and F.