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Five new species of *Asplenium* L. (Aspleniaceae) from Bolivia

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ABSTRACT

KESSLER, M. & A. R. SMITH (2006). Five new species of *Asplenium* L. (Aspleniaceae) from Bolivia. *Candollea* 61: 305-313. In English, English, French and Spanish abstracts.

Five new species of *Asplenium* L. are described from Bolivia: *Asplenium ayopayense* M. Kessler & A. R. Sm., *Asplenium bolivianum* M. Kessler & A. R. Sm., *Asplenium micropaleatum* M. Kessler & A. R. Sm., *Asplenium mosetenense* M. Kessler, and *Asplenium tunquiniense* M. Kessler & A. R. Sm. The last three of these species belong to the taxonomically difficult complex surrounding *Asplenium serra* Langsd. & Fisch, for which a discussion and key of the Bolivian species are presented.

RÉSUMÉ

KESSLER, M. & A. R. SMITH (2006). Cinq nouvelles espèces d'*Asplenium* L. (Aspleniaceae) de Bolivie. *Candollea* 61: 305-313. En anglais, résumés anglais, français et espagnol.

Cinq nouvelles espèces d'*Asplenium* L. de Bolivie sont décrites: *Asplenium ayopayense* M. Kessler & A. R. Sm., *Asplenium bolivianum* M. Kessler & A. R. Sm., *Asplenium micropaleatum* M. Kessler & A. R. Sm., *Asplenium mosetenense* M. Kessler, et *Asplenium tunquiniense* M. Kessler & A. R. Sm. Ces trois espèces appartiennent à un complexe taxonomique difficile entourant *Asplenium serra* Langsd. & Fisch., pour lequel une discussion et une clé des espèces boliviennes sont présentées.

RESUMEN

KESSLER, M. & A. R. SMITH (2006). Cinco nuevas especies de *Asplenium* L. (Aspleniaceae) de Bolivia. *Candollea* 61: 305-313. En inglés, resúmenes en inglés, francés y en español.

Cinco nuevas especies de *Asplenium* L. de Bolivia se describe: *Asplenium ayopayense* M. Kessler & A. R. Sm., *Asplenium bolivianum* M. Kessler & A. R. Sm., *Asplenium micropaleatum* M. Kessler & A. R. Sm., *Asplenium mosetenense* M. Kessler y *Asplenium tunquiniense* M. Kessler & A. R. Sm. Las últimas tres de estas especies pertenecen al grupo taxonómicamente difícil de *Asplenium serra* Langsd. & Fisch, para el cual presentamos una discusión y clave de las especies bolivianas.

KEY-WORDS: ASPLENIACEAE – *Asplenium* – Ferns – Bolivia – Taxonomy – Tropical Andes

Introduction

During studies for our forthcoming pteridophyte flora for Bolivia, we have encountered five unnamed species of *Asplenium* L. (*Aspleniaceae*) that are here described. *Asplenium* is one of the largest and taxonomically most complex fern genera. Detailed studies of selected, mostly extratropical, species groups have revealed numerous polyploid complexes, cryptic species, apogamous taxa, and hybridization (e.g. REICHSTEIN, 1981; BRAITHWAITE, 1986). The new species described here belong to difficult species complexes, involving *A. serra* Langsd. & Fisch., *A. tabinense* Hieron. and *A. triphyllum* C. Presl.

1. *Asplenium ayopayense* M. Kessler & A. R. Sm., **spec. nova** (Fig. 1A-C).

Holotypus: BOLIVIA. Cochabamba: Ayopaya; 2 km de Casay Vinto a Choro, 16°52'S 66°38'W, 3350 m, 4.V.1997, *Kessler 9272* (UC; iso-: LPB).

Ab Asplenio triphylo C. Presl *statura generaliter maiore, pinnis cum auriculis sessilibus acroscopicis (vs. cum auriculis petiolatis), nervatura pinnata, rhachidibus alatis vel sulcatis differt.*

Plants terrestrial; **rhizomes** erect, ca. 4-5 mm in diameter; **rhizome scales** linear-lanceolate, 3-4 × 0.4-0.7 mm, dark brown, clathrate; **leaves** erect, to 40 × 2.5 cm; **petioles** to 12 cm × 1 mm, ca. 1/3-1/4 of the leaf length, dull reddish brown, narrowly winged (wings 0.1 mm wide), with scattered scales, the scales linear, often only 2 cell rows wide, 0.2-1 × 0.05-0.1 mm, dark brown, clathrate; **blades** once pinnate-pinnatisect to twice pinnate, to 28 × 2.5 cm, linear-lanceolate, widest in lower third, the bases subabruptly reduced, the apices acuminate, the lowermost pinnae ca. 50% as long as the longest pinnae, bearing a scaly bud at the base of the lowermost pinnae, the bud often developing while the leaf is still erect; **rachises** dull brown, adaxially grooved, with scattered scales resembling those of the petioles but smaller; **pinnae** 20-30 pairs, short-petiolate (0.5-2 mm), the dark rachis color extending to base of the veins; **pinnae** ovate-rhomboid, with a distinct sessile basal acroscopic auricle, usually not overlapping the rachises, to 15 × 11 mm, chartaceous, glabrous, the bases cuneate, the apices obtuse, the margins irregularly crenate; **veins** 2-4-forked, subpinnate, midveins not well defined; hydathodes lacking; **sori** 2-8 per pinna; **indusia** ca. 3-4 × 0.7-0.8 mm, olive-gray to brown, entire.

Distribution and habitat. – Known only from two collections from humid *Polylepis lanosa* Bitter forests at 3300-3600 m in the province of Ayopaya, Cochabamba department, Bolivia.

Discussion. – This species belongs to the difficult complex surrounding *A. triphyllum*. This complex is in need of monographic study and comprises perhaps a half dozen distinct species over its Andean range. In Bolivia, we recognize two distinct species. *Asplenium ayopayense* differs from typical *A. triphyllum* by its much larger frond size, longer pinnae with one large, sessile acroscopic auricle (vs. auricles clearly stalked), pinnate venation, and grooved or narrowly winged (vs. terete) rachises. Another similar species is *A. sessilifolium* Desv., but this has longer, narrower pinnae, and lacks buds on the proximal pinnae.

Specimens examined. – BOLIVIA. Cochabamba: Ayopaya, 2 km al este de Saila Pata, 16°54'S 66°56'W, 3600 m, 23.XI.1997, *Kessler 12539* (LPB, UC).

2. *Asplenium bolivianum* M. Kessler & A. R. Sm., **spec. nova** (Fig. 1D-E).

Holotypus: BOLIVIA. Cochabamba: Ayopaya, 10 km from Cocapata to Cotacajes, 16°38'S 66°41'W, 2700 m, 7.V.1997, Kessler 9335 (UC; iso-: LPB).

Ab Asplenio tabinensi Hieron. statura maiore, pinnis profunde crenatis (vs. acute serratis), textura laminae crassiore discriminatur.

Plants terrestrial; **rhizomes** erect, 0.4-0.8 mm thick; **rhizome scales** lanceolate, 0.8-1.2 × 0.4-0.6 mm, blackish, clathrate; **leaves** erect, to 22 × 2.3 cm; **petioles** 3-5 cm × 1-1.2 mm, ca. ¼-½ of the leaf length, dull gray-brown, glabrous, with narrow wings ca. 0.1 mm wide; **blades** once-pinnate, 12-18 × 2-2.3 cm, linear-lanceolate to lanceolate, widest near the middle or just below it, the apices acuminate, pinnatifid, non-proliferous, the bases gradually reduced, lowermost pinnae 0.8-2 mm long; **rachises** dull greenish brown, with narrow wings ca. 0.3 mm wide; **pinnae** 20-28 pairs, spreading, shortly petiolulate (0.3-0.5 mm), not overlapping the rachises, oblong, obtuse, to 11 × 4 mm, chartaceous, glabrous, basiscopically entire except for (1)2(3) apical crenations, acroscopically with 5-7 crenations, basally sometimes auriculate; **veins** basiscopically 3-4, simple, acroscopically 5-7, simple except for usually once-forked basal vein; **hydathodes** lacking; **sori** 1-3 per pinna, placed on one or both sides of the midveins; **indusia** ca. 2 × 0.8 mm, light brown, entire.

Distribution and habitat. – Local and uncommon in semihumid, *Weinmannia*-dominated montane forests at 2500-2900 m in rainshadowed valleys in the departments of La Paz and Cochabamba, Bolivia.

Discussion. – This species differs from *Asplenium tabinense* by its deeply crenate (vs. sharply serrate) pinnae, larger frond size, and thicker blade texture. Other similar species are *A. harpeodes* Kunze and its allies, but these are larger with more sharply serrate pinna margins and thinner-textured blades. *Asplenium bolivianum* resembles *A. sellowianum* (Hieron.) Hieron. from Paraguay and southeastern Brazil, but that species bears 4-6 pairs of sori per pinna, has more serrations on the basiscopic pinna side that extend further toward the rachis, has the basal pinna auricles contiguous with or slightly overlapping the rachises, and occurs at lower elevations; we believe that these two are probably not closely related. In Bolivia, a number of other 1-pinnate species of *Asplenium* share the dull petioles and basally reduced pinnae with *A. bolivianum*. These include *A. bangii* Hieron. and *A. clausenii* Hieron., both of which are readily distinguished by their more shallowly incised pinnae (incisions to 0.5 mm vs. 1 mm or more in *A. bolivianum*), and *A. harpeodes* and *A. raddianum* Gaudich., whose mature petioles are 1-2 mm thick (vs. 0.4-0.8 mm in *A. bolivianum*).

Specimens examined. – BOLIVIA. Cochabamba: Ayopaya, 10 km de Cocapata a Cotacajes, 16°38'S 66°41'W, 2700 m, 11.V.1997, Kessler 9508 (LPB, UC). La Paz: Bautista Saavedra, 12 km de Charazani a Apolo, 15°11'S 68°46'W, 2500 m, 1.VII.1997, Kessler 10479 (LPB, UC).

The remaining species all belong to the species complex surrounding *A. serra*, which, as delimited by TRYON & STOLZE (1993) and most other pteridologists working in the Andes, is highly variable with respect to rhizome scale color and size, pinna size and number, and degree of pinna dissection. In Bolivia, we recognize six morphologically, ecologically and biogeographically distinct entities, three of which, *A. micropaleatum*, *A. mosetenense*, and *A. tunquiniense*, are here described as new. The type of *A. serra* at B (Brazil, Santa Catarina, *Herb. Willdenow 19880*, B!) unfortunately consists of only the distal half of a blade and therefore lacks the crucial rhizome characters. We therefore base our concept of *A. serra* on other specimens collected in southeastern Brazil, where the type was collected. In Bolivia, *A. serra* is found at 650-3350 m in humid tropical montane forests in the northern Bolivian Andes, south to the Andean elbow (18°30'S) where the climate turns dryer and more seasonal.

3. *Asplenium micropaleatum* M. Kessler & A. R. Sm., **spec. nova** (Fig. 2G-H).

Holotypus: BOLIVIA. **La Paz:** Murillo, Zongo valley, 1.6 km down the valley from Sainani, 16°07'S 68°05'W, 2100 m, 5-6.08.1990, *Fay & Fay 2899* (UC; iso-: LPB, MO).

Ab Asplenio serra Langsd. & Fisch. *squamis rhizomatis valde minoribus (1.3-2 mm longis), paribus pinnarum pluribus (9-28) differt.*

Plants terrestrial, epipetric, growing on rotten logs, rarely epiphytic; **rhizomes** creeping, ca. 3-12 mm in diameter; **rhizome scales** ovate-lanceolate, 0.2-2 × 0.1-1 mm, dark brown, clathrate, but the lumina scarcely visible; **leaves** erect, to 150 × 20 cm; **petioles** 20-50 cm × 2-4 mm, ca. 1/3-1/4 of the leaf length, dull brown, flattened adaxially, with scattered brown scales 0.1-1 mm long; **blades** once pinnate, to 100 × 20 cm, lanceolate, widest near the middle, apices acuminate, pinnatifid, non-proliferous, the bases truncate, the lowermost pinnae ca. 60-80% as long as the longest; **rachises** dull brown, adaxially grooved, with scattered brown scales 0.05-0.5 mm long; **pinnae** 9-28 (mean 18) pairs, short-petiolate (2-4 mm), the dark rachis color extending to the pinna stalks; **pinnae** lanceolate, exauriculate, not overlapping the rachises, to 16 cm × 17 mm, coriaceous, glabrous, the bases cuneate to truncate, the apices long-acuminate, the margins serrate or biserrate; **veins** 3-4-forked, ca. 30-40° to costae, lowermost acroscopic vein branch in each vein group initially ± parallel to costa, then strongly upcurved; **hydathodes** lacking; **sori** 15-30 per pinna, placed on lowermost acroscopic vein branch on both sides close to the midvein and nearly parallel to it; **indusia** ca. 6-13 × 1 mm, light brown, entire.

Distribution and habitat. – Common in humid forests at 1250-3300 m in the tropical Andes of Bolivia and southern Peru.

Discussion. – *Asplenium micropaleatum* differs from *A. serra* by its smaller (0.2-2 mm vs. 2-5 mm long) rhizome scales and greater number of pinna pairs. *Asplenium micropaleatum* has, on average, 18 pinna pairs (range 9-28, N = 22 specimens studied), *A. serra* has 10 pairs (range 6-16, N = 18). *Asplenium micropaleatum* further has a tendency towards longer, more creeping rhizomes and towards more widely spaced marginal serrations on the pinnae. Another undescribed species with similarly small rhizome scales, but of much larger overall size with thicker rhizomes, petioles, and blades, and different pinna shape occurs in the Colombian Chocó (e.g., *Bittner 2719*, UC).

Specimens examined. – **BOLIVIA. Cochabamba:** Ayopaya, Comunidad Pampa Grande, por el sendero a Carmen Pampa, area de cultivo recién habilitada denominado Tunki, 16°40'S 66°28'W, 1980 m, 9.XI.2002, *Jimenez 1512* (GOET, LPB, UC); Carrasco, km 143 antigua carretera Cochabamba a Villa Tunari, 17°07'S 65°34'W, 1300 m, 27.VIII.1996, *Kessler 7835* (GOET, LPB, UC); Chapare, Kuriloma bei San Onofre, 17°08'S 65°42'W, 1700 m, 20.II.1929, *J. Steinbach 9274* (NY, UC). **La Paz:** Franz Tamayo, Pelechuco, 14°45'S 68°56'W, 1930 m, 15.VIII.1984, *Graf 943* (LPB); PN-ANMI Madidi, sendero Keara-Mojos, bajando por la senda de Tokuaque a Fuertecillo, antes de llegar a Lagunillas, 14°36'S 68°56'W, 2150 m, 11.V.2001, *Jimenez 826* (GOET, LPB, UC); PN-ANMI Madidi, senda Keara-Mojos, abajo de Chunkani, 14°38'S 68°57'W, 2870 m, 11.VIII.2001, *Jimenez 901* (LPB, UC); PN-ANMI Madidi, senda Keara-Mojos, entre Lagunillas y Fuertecillos, sendero que baja hacia el río Tabakuni, 14°36'S 68°55'W, 1660 m, 11.XII.2001, *Jimenez 1042* (GOET, LPB, UC); Along trail between Pelechuco and Pata, along the Río Pelechuco downstream from Pelechuco, 14°46'S 69°01'W, 2500-2650 m, 18.XI.1988, *Lewis 881752* (LPB, MO, UC); Murillo, Valle de Zongo, a lo largo del camino a Santa Rosa, 16°07'S 68°06'W, 2250 m, 4.II.2000, *De Boer 1347* (LPB, UC); 32.7 km N of (below) dam at Lago Zongo, a few hundred meters above Planta Hidroeléctrica Chururaqui, 16°06'S 68°04'W, 2000 m, 29.XI.1982, *Solomon 9046* (LPB, MO, UC); 24.5 km N of (below) the pass at the head of the Zongo Valley, 16°19'S 68°07'W, 3100 m, 16.IX.1984, *Solomon 12363 pp* (LPB); Nor Yungas, Estación Biológica de Tunquini, senda cafetal, al camino de la mina, 16°12'S 67°53'W, 2400 m, 8.IV.2001, *Bach 1396* (GOET, LPB, UC); Unduavi, 3300 m, XI.1910, *Buchtien 103* (UC); km 8 de Chuspipata a Coroico, 16°23'S 67°48'W, 2650 m, 19.IX.1997, *Kessler 12055* (LPB, UC); Prov. unknown, Cordillera Real, Nequejahuira, 2500 m, *Tate 623*

(NY); Yungas, 1250 m, 1885, *Rusby 384* (NY). **PERU. Huánuco:** Huánuco, Mirador, road Acomayo to Chinchao, 2400 m, 5.XI.1935, *Mexia 4135, 7758* (UC); Leoncio Prado, Dist. Hermilio Valdizan, cerca a la Divisoria, 1500-1600 m, 27.VI.1976, *Schunke V. 9437* (UC); Dist. Rupa Rupa, near Tingo María, road to Huánuco, ca. 9°18'S 75°59'W, ca. 700 m, 21.III.1982, *King 341* (NY, UC). **Junín:** Satipo, Cordillera Vilcabamba, Satipo, upper Río Poyeni watershed, 11°33'35"S 73°38'28"W, 1850-1950 m, 3.VII.1997, *Boyle 4993* (UC).

4. *Asplenium mosetenense* M. Kessler, **spec. nova** (Fig. 2C-E).

Holotypus: BOLIVIA. **Cochabamba:** Chapare, Territorio Indígena Parque Nacional Isiboro Sécure, Cordillera de Mosetenes, cresta arriba de la Laguna Carachupa, 16°14'S 66°25'W, 1550 m, 2.IX.2003, *Kessler 13142* (LPB; iso-: GOET, UC).

Ab Asplenio incurvato Fée rhizomate compacte erecto cum squamis aurantiacis usque castaneis differt.

Plants epiphytic; **rhizomes** compact-erect, ca. 0.5-2 cm in diameter (excluding scales); **rhizome scales** linear-lanceolate, 0.3-1.2 × 8-18 mm, orange to castaneous, clathrate, minutely remotely denticulate; **leaves** erect, to 100 × 32 cm; **petioles** 25-55 cm × 2-4 mm, ca. 2/5 of the leaf length, dull brown, flattened adaxially, moderately scaly, the scales similar to the rhizome scales but decreasing in length from the petiole bases; **blades** once-pinnate, to 70 × 32 cm, broadly lanceolate, widest near the bases, the apices acuminate, conform, non-proliferous, the bases truncate; **rachises** dull brown, adaxially grooved, with scattered brown scales 0.2-2 mm long; **pinnae** 18-23 (mean 20) pairs, short-petiolate (3-4 mm), the dark rachis color extending to the costal bases; pinnae lanceolate, exauriculate, not overlapping the rachises, to 16 cm × 18 mm, subcoriaceous, abaxially glabrous or with scattered orange hairs 0.3-1.8 mm, especially near the costae, the bases cuneate to truncate, apices long-acuminate, the margins serrate; **veins** 2-3-forked, ca. 30-40° to costae, lowermost acroscopic vein branch in each vein group initially ± parallel to costa, then strongly upcurved; **hydathodes** lacking; **sori and indusia** unknown.

Distribution and habitat. – Fairly common in stunted humid ridge forest at 1500-1600 m on the isolated Cordillera de Mosetenes, Cochabamba department, Bolivia. In the same area, *A. incurvatum* Fée was found mainly in taller slope forest at 1250-1400 m (M. Kessler, *pers. obs.*), and both species co-occurred at some sites at 1500 m.

Discussion. – This is another species in the *A. serra* complex. It is most similar to *A. incurvatum*, but differs by its compact rhizomes with orange to chestnut rhizome scales. Both species co-occur at the type locality of *A. mosetenense* and were readily distinguishable in the field (M. Kessler, *pers. obs.*).

5. *Asplenium tunquiniense* M. Kessler & A. R. Sm., **spec. nova** (Fig. 2A-B).

Holotypus: BOLIVIA. **La Paz:** Nor Yungas, Estación Biológica de Tunquini, 16°11'S 67°53'W, 1730 m, 19.IX.2000, *Eberhardt 550* (UC; iso-: GOET, LPB).

Ab Asplenio serra Langsd. & Fisch. foiliis pinnato-pinnatisectis usque bipinnato-pinnatifidis differt.

Plants epiphytic and epipetric; **rhizomes** short- to long-creeping, ca. 6-10 mm in diameter; **rhizome scales** linear-lanceolate, 3-6 × 0.4-0.8 mm, dark brown, clathrate; **leaves** erect, to 95 × 25 cm; petioles 20-35 cm × 2-3 mm, ca. 1/5 of the leaf length, dull brown, flattened to grooved adaxially, with a few scattered scales at the base, otherwise glabrous; **blades** 1-2-pinnate-pinnatifid, to 60 × 25 cm, ovate-lanceolate, widest in lower third, the apices acuminate, non-proliferous, the bases abruptly reduced, the lowermost pinnae ca. 80% as long as the longest; **rachises** dull

brown to castaneous, adaxially grooved, glabrous; **pinnae** 12-16 pairs, short-petiolate (3-6 mm), the dark rachis color extending to the midveins; **pinnae** lanceolate, exauriculate or distal ones slightly auriculate, not overlapping the rachises, to 17 × 5 cm, chartaceous, glabrous, bases cuneate to truncate, apices long-acuminate, margins serrate; **segments** irregularly shaped, to 3.5 × 0.6 cm; **veins** 3-4-forked, ca. 30-40° to costae, but the lowermost acroscopic vein branch in each vein group initially ± parallel to costa, then strongly upcurved; **hydathodes** lacking; **sori** 8-25 per pinna, placed on the lowermost acroscopic vein branch of each vein group on both sides of costae, close and roughly parallel to the costae, sometimes also on segments (pinnules); **indusia** ca. 6-13 × 1 mm, light brown, entire.

Distribution and habitat. – Known only from the vicinity of Estación Biológica de Tunquini, where it is a locally fairly common epiphytic and saxicolous species at 1700-2800 m in humid montane forests.

Discussion. – This distinctive species resembles *A. serra* but has 1-2-pinnate-pinnatisect blades. There is some variation in blade dissection, with *Portugal 480* having the most highly dissected leaves. Because this species resembles syntopic *A. serra* in every aspect except blade dissection, it is likely that *A. tunquiniense* has evolved as a local form from *A. serra*. Since *A. tunquiniense* has a fairly large population near the type locality and co-occurs with *A. serra*, it seems best to treat both variants as species.

Specimens examined. – **BOLIVIA. La Paz:** Nor Yungas, Estación Biológica de Tunquini, senda cafetal, al camino de la mina, 16°12'S 67°53'W, 2500 m, 8.V.2001, *Bach 1412* (LPB, UC); Senda paralela al camino principal a la mina hasta el pantánon, 16°12'S 67°53'W, 2800 m, 16.VII.2002, *Bach 1882* (LPB, GOET); Estación Biológica de Tunquini, 16°11'S 67°51'W, 1810 m, 10.VIII.1998, *Portugal 480* (LPB, UC), 1810 m, 10.VIII.1998, *Portugal 492* (LPB, UC); Estación Biológica de Tunquini, Bajo Hornuni, senda del campo de Dn. Pedro al camino de la mina, 16°13'S 67°54'W, 2000 m, 25.VII.2000, *Wegner 119* (GOET, LPB, UC); Yungas, 1850 m, 1885, *Rusby 388* (NY).

Discussion

Among the other species closely related to *A. serra*, we provisionally use the name *A. incurvatum* (typus: Brazil, Rio de Janeiro, Morro da Fazenda, 850 m, *Glaziou 2340*, P, Morton photos 4246, 4247 at US!) for specimens with long, narrow rhizome scales. Some Andean specimens match the Brazilian specimens closely, however others differ by having broader (to 1.2 mm), paler scales and less prolonged scale apices. Collections of *A. incurvatum* from Brazil have uniformly dark, narrow (to 0.6 mm wide) rhizome scales with very long apices. Until there is a more detailed study of this complex, we prefer to use an existing name. In Bolivia, this is a rather uncommon species at 850-2500 m in humid forests in the tropical northern Bolivian Andes, but also with a single collection from near the Argentinian border.

The third of the already named species in this complex is *A. achalense* Hieron. (typus: Argentina, Achala, *Hieronymus 846*, fragment NY!). It differs from *A. serra* by having more and narrower pinnae (18-36 pairs, 12-23 mm wide) that are usually gradually reduced towards the blade apices. It is found at 800-3100 m in humid to semihumid forests, mostly in southern Bolivia and adjacent northwestern Argentina, but scattered specimens have been collected further north in the more tropical Bolivian Andes, mostly in fairly dry valleys with climatic conditions resembling those of the subtropics.

A key to the Bolivian species in the *A. serra* complex is provided below. There still is considerable variability with the species (especially within *A. serra* and *A. incurvatum*), and we believe that more detailed studies will enable the differentiation of additional taxa. Intriguingly, the limited juvenile material available to us shows that some forms of the *A. serra*-complex have

finely dissected juvenile leaves that become less divided as the plants mature, whereas in other specimens of this complex the reverse seems to be true. The taxonomic significance of this, if any, remains obscure. Further, we are aware of morphological variation within the *A. serra*-complex further north in the Andes and in Mesoamerica that our Bolivian treatment does not account for.

Key to mature specimens of the Bolivian species belonging to the *Asplenium serra*-complex

1. Blades 1-pinnate-pinnatisect to 2-pinnate-pinnatifid..... *A. tunquiniense*
- 1a. Blades 1-pinnate 2
2. Rhizome scales 5-18 mm long 3
- 2a. Rhizome scales 1-5 mm long..... 4
3. Rhizome scales dark brown to blackish; rhizomes short-creeping..... *A. incurvatum*
- 3a. Rhizome scales orange to castaneous; rhizomes compact..... *A. mosetenense*
4. Rhizome scales 1-2 mm long *A. micropaleatum*
- 4a. Rhizome scales 2-5 mm long..... 5
5. Pinnae 18-36 pairs, 12-23 mm wide, usually gradually reduced near blade apic *A. achalense*
- 5a. Pinnae 4-16 pairs, (17-)20-45 mm wide, with the distal pinnae almost as large as those in mid-leaf..... *A. serra*

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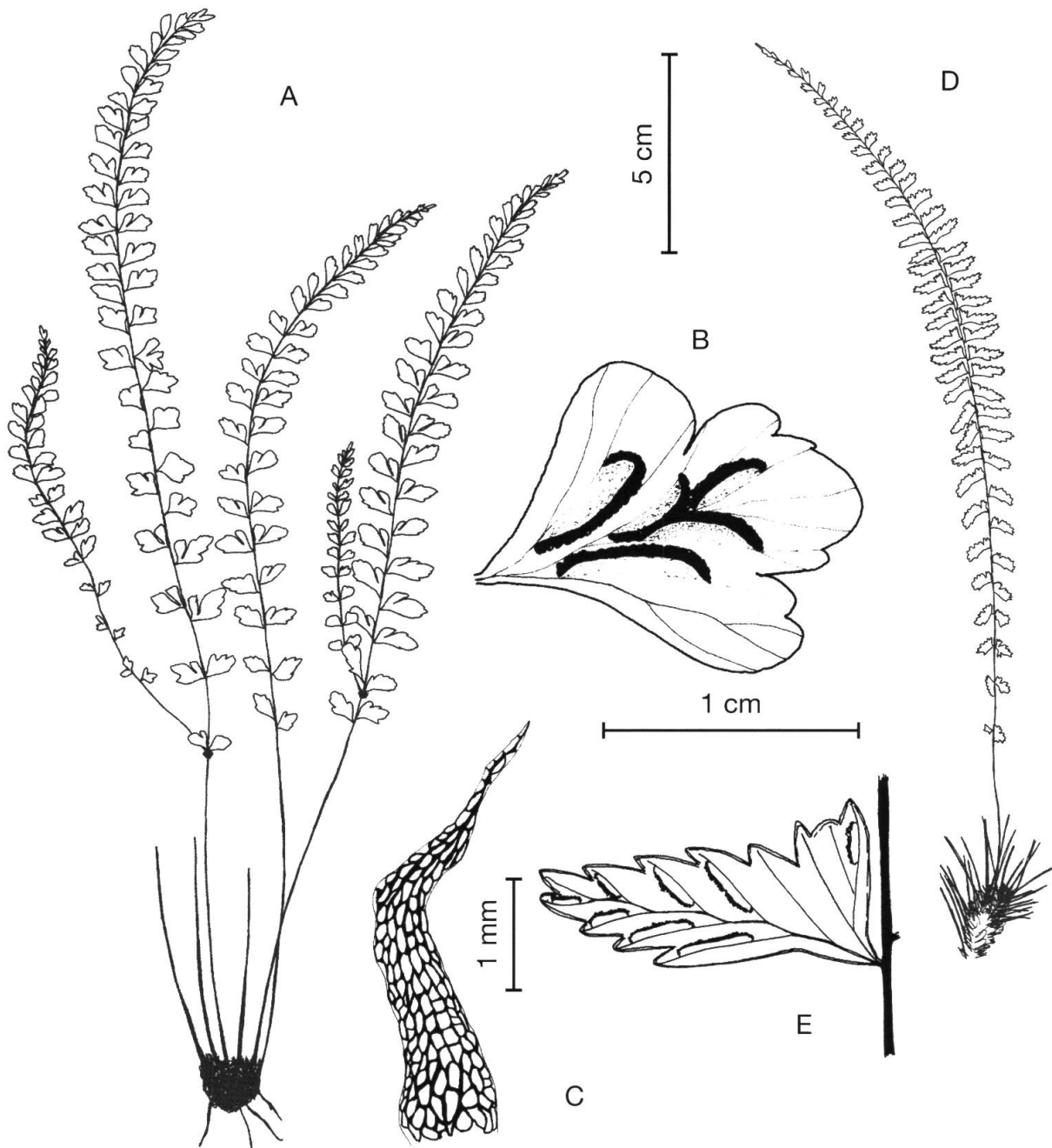


Fig. 1. – *Asplenium ayopayense* M. Kessler & A. R. Sm.: **A:** Habit; **B:** Pinna; **C:** Rhizome scale. *Asplenium bolivianum* M. Kessler & A. R. Sm.: **D:** Habit; **E:** Pinna.

(Drawn by Jorge Jácome and Michael Kessler)

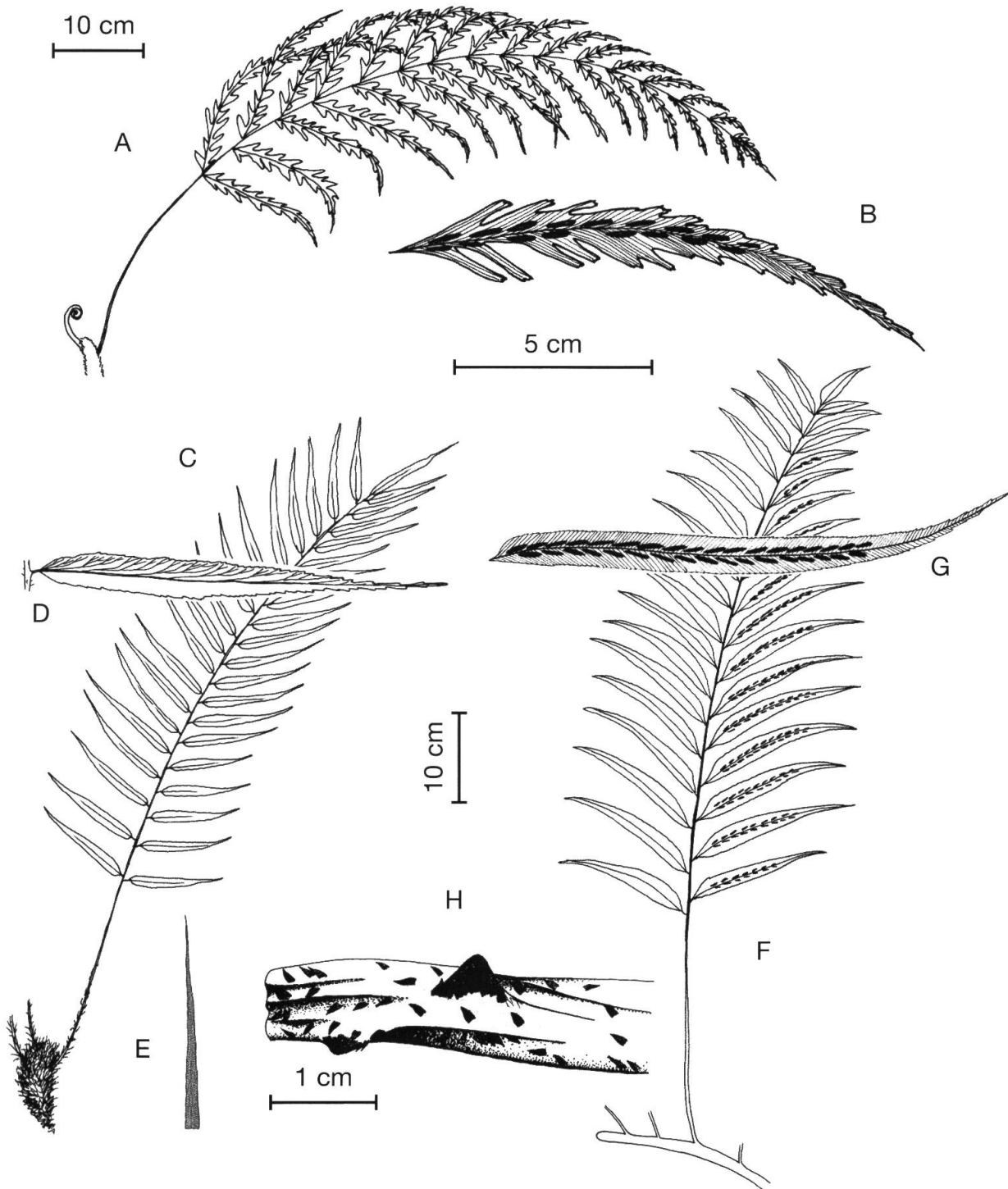


Fig. 2. – *Asplenium tunquiniense* M. Kessler & A. R. Sm.: **A:** Habit; **B:** Pinna. *Asplenium mosetenense* M. Kessler; **C:** Habit; **D:** Pinna; **E:** Rhizome scale. *Asplenium micropaleatum* M. Kessler & A. R. Sm.: **F:** Habit; **G:** Pinna; **H:** Rhizome detail with scales.

(Drawn by Michael Kessler and Jorge Jácome)

