Three new species of Selaginella (Selaginellaceae) from Cuba

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Three new species of *Selaginella (Selaginellaceae)* from Cuba

Abstract

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The three new species are narrow-range endemics: *Selaginella caluffii* is restricted to Topes de Collantes and its surroundings (Alturas de Trinidad, central Cuba), *S. ivanii* is only known from Pico San Juan (same area) and *S. achotalensis* occurs on the Mogotes de Yambeque and their neighbourhood (Monte Rus, Guantánamo province, eastern Cuba). All are described and illustrated. The two central Cuban species are the second and third known Cuban representatives of the articulate selaginellas, *S.* subg. *Stachygynandrum*.

The most recent revision of Cuban *Selaginella* is that by Alston (1952), who reported 16 species from the island. Duek (1971), when listing the Cuban pteridophytes, mentioned 18 *Selaginella* species. Since 1980 an intensive study of the Cuban pteridoflora is being undertaken, including numerous collecting trips. The present paper, which forms part of our study of the *Selaginellaceae* for the "Flora de la República de Cuba", bears witness of the progress brought about by our investigations.

The specific terminology used in this paper to describe spore ornamentation comes from Lellinger & Taylor (1997). Works revised in the preparation of this paper are: Alston & al. (1981), Fraile & al. (1995), Proctor (1977, 1985, 1989).

Selaginella caluffii Shelton, **sp. nova** – Holotype: *Caluff 1444* (BSC; isotypes: B, HAC, HAJB). – Fig. 1

Caulis articulatus, 4-7.5(-22) cm longus, inconspicue nodosus. *Rhizophora* dorsalia. *Folia lateralia* ovato-lanceolata vel obovato-lanceolata, 2-2.5 × 1-2 mm metientia, inaequilatera, basi biauriculata, auriculis ciliatis acroscopica quam basiscopica majore, margine dissite denticulata, apice acuta. *Folia mediana* lanceolata, 1.1-2.2 × 0.4-0.7 mm metientia, basi extus auricula

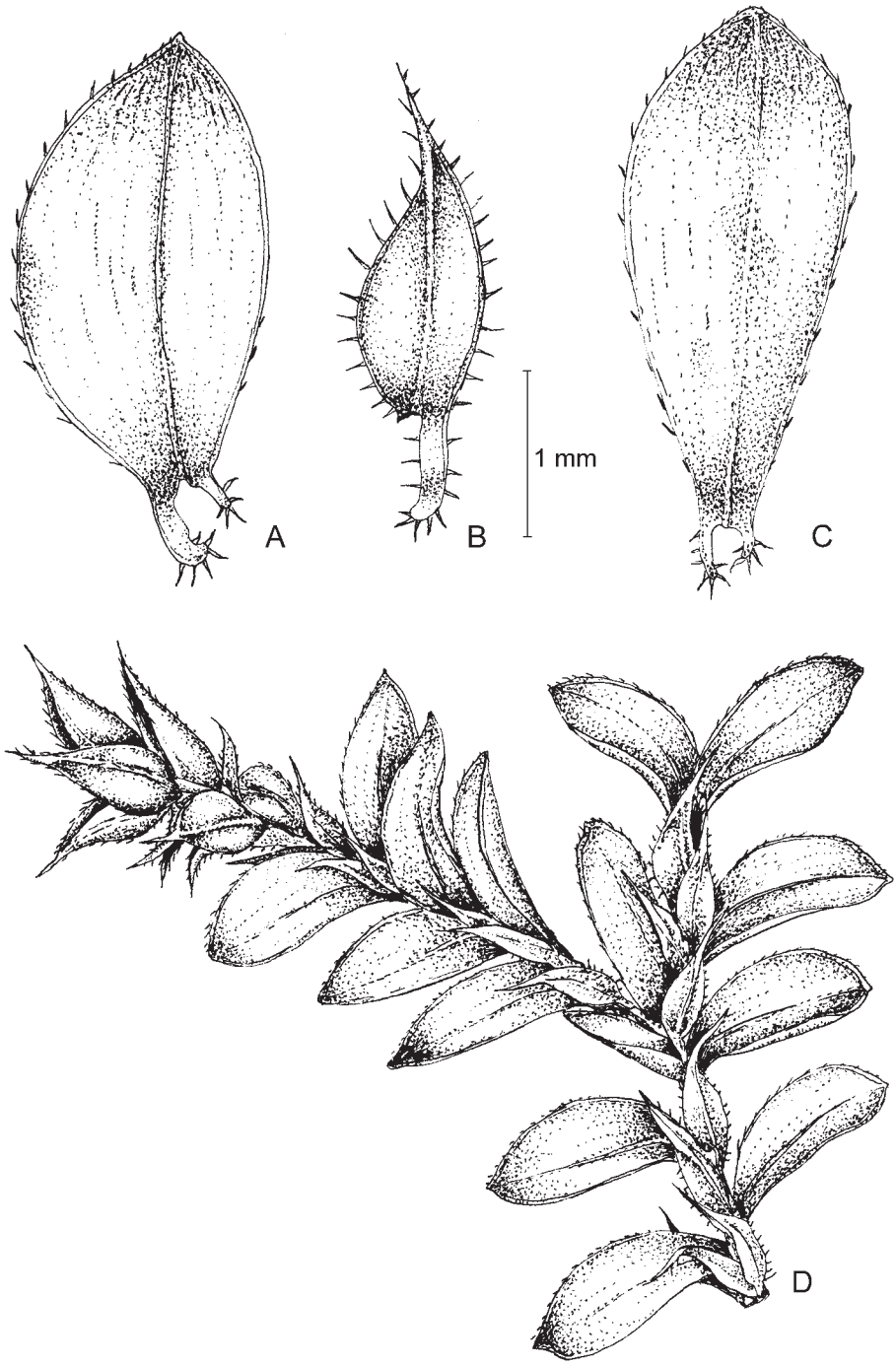

Fig. 1. *Selaginella caluffii* – A: lateral leaf; B: median leaf; C: axillary leaf; D: habit. – Drawn from the holotype by M. G. Caluff.

elongata praedita, margine ciliata, apice acuminata vel aristata. *Folia axillarum* aequilatera, biauriculata, auriculis conformibus rectis vel incurvis. *Strobili* quadrangulares, 2-15 × 1-1.5 mm metientes.

Plants prostrate. *Stem* 4-7.5(-22) cm long and 0.4-0.9 mm in diameter, monostelic, straw-coloured, not flagelliform, lacking stolons, up to three times branched into short alternating branches, articulate, the nodes inconspicuous, concolorous with the stem, sometimes with small protuberance adaxial in each bifurcation. *Rhizophores* all along the stem, dorsal, extra-axillary, descending at one side of the stem, filiform, 0.1-0.3 mm in diameter. *Leaves* herbaceous, glabrous, pale olive green on either side. *Lateral leaves* spaced by 2-3 mm along the main stem, ovate-lanceolate to obovate-lanceolate, 2-2.5 × 1-2 mm, asymmetrical (the acroscopic half wider and more strongly curved than the basiscopic), spreading at right angles, the base cuneate, unequally biauriculate (the basiscopic auricle c. 1/2 as long as the acroscopic, recurved, ciliate; the acroscopic expanded, incurved, overlapping the stem, with conical, hyaline, unicellular cilia), the margins wide, greenish, opaque, with 3-5 rows of papillate cells, ciliate towards the base then with scattered cilia and ascending teeth, the midnerve reaching the acute tip, the surface without ideoblasts, with sinuous cells, scattered bands of papillate cells, more abundant apically, and a few stomata on either side along the midnerve. *Median leaves* imbricate, ascending, lanceolate to widely lanceolate, 1.1-2.2 × 0.4-0.7 mm, the base somewhat narrowed, with an enlarged, straight or slightly curved auricle outwardly that is ciliate as are those of the lateral leaves, the margins with 1-2 rows of enlarged, papillate cells, with conical, unicellular, ascending, hyaline teeth all along, the inner cells like in the lateral leaves, the apex long acuminate to aristate, ending in two teeth. *Axillary leaves* equilateral, with two auricles of similar size and form, straight or curved, the margins with 3-4 rows of elongate, papillate cells, spacely denticulate, the inner cells like in the lateral leaves. *Strobili* terminal on the lateral branches, subtended by 1-2 leaves similar to the lateral leaves, compact, quadrangular, 2-22 × 1-1.5 mm. *Sporophylls* ovate-acuminate, concolorous, marginate, the margin serrate, the keel lacking teeth or cilia, the apex acute, cartilaginous, straight or recurved. *Megasporophyll* solitary at the strobilus base, 2.1 × 1.4 mm. *Microsporophylls* 1-1.5 × 0.7-0.8 mm. *Megaspores* cream, 500-600 µm in diameter, the exine muriform, rough, the muri free or connected and delimiting areoles. *Microspores* pale yellow, 25-35 µm in diameter, the surface echinate.

Specimens seen. – Prov. Sancti Spíritus, Sierra del Escambray, Arboretum of Topes de Collantes, 600 m, 28.3.1985, *Caluff 1444* (BSC); id., Topes de Collantes, Cudina, Arroyo Jesús Delgado, 500-600 m, gallery forest, 25.4.1985, *Caluff 1450* (BSC); id., Cudina, headwaters of the río Cañas, 600 m, gallery forest, on rocks and cliffs, 17.1.1986, *Caluff 2002, 2004, 2005* (BSC); id., Topes de Collantes, gorge of the reserve, toward the peripheral road, 12.4.1997, *Sánchez & Cuesta 74133* (BSC, HAJB).

Distribution and habitat. – Endemic to the environs of Topes de Collantes, Alturas de Trinidad, in central Cuba, growing in natural or secondary gallery forest, on rocks and cliffs or on soil of humid slopes of gorges, between 500 and 650 m above sea level. Locally frequent.

Eponymy. – This species is dedicated by the first author to the second, Manuel G. Caluff, who aroused his interest in *Selaginella* and, by skill and experience, promoted his scientific training.

Selaginella caluffii is but the second Cuban representative, after *S. plumosa* (L.) C. Presl, of the group of species known as "the articulates". The species of this group are characterised, first by their articulate stem with dorsally emerging rhizophores; second, by strobili with only one large, basal megasporophyll (rarely two), subtended by one or more sterile leaves; and third, by their large megaspores with an exine ornamentation of high, reticulate walls or muri, pale microspores covered with acute spines, and a unique type of microsporangia with adaxial rather than bivalvar dehiscence (Somers 1982, unpublished PhD thesis, University of Tennessee). *S. caluffii* is, in addition, the only species in Cuba with biauriculate lateral leaves.

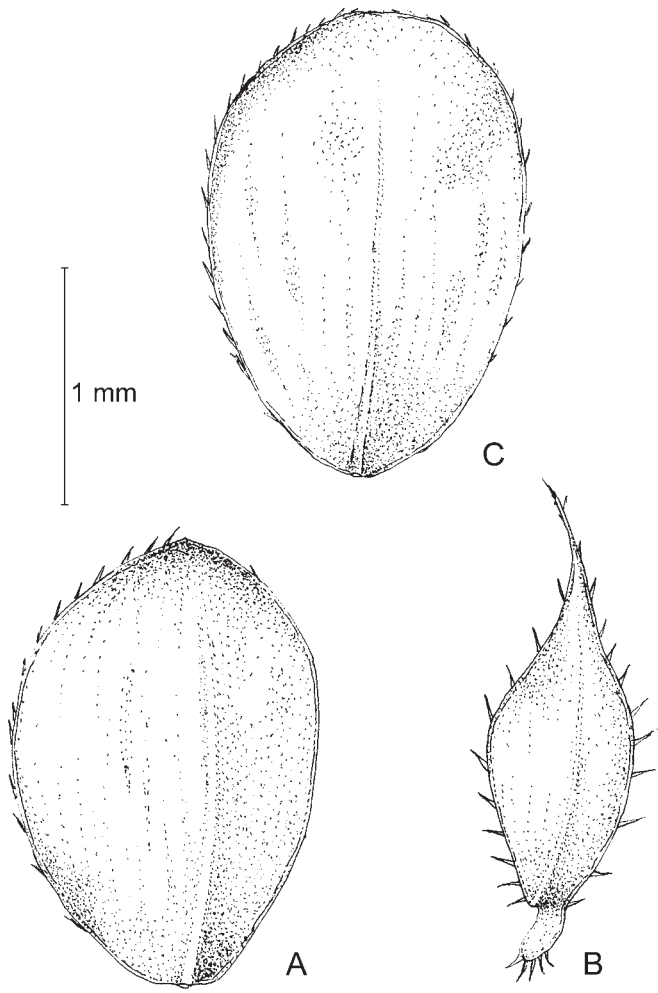

Fig. 2. *Selaginella ivanii* – A: lateral leaf; B: median leaf; C: axillary leaf. – Drawn from the holotype by M. G. Caluff.

Selaginella ivanii Shelton & Caluff, **sp. nova** – Holotype: *Shelton & Caluff 3400* (BSC; isotypes: B, HAC, HAJB). – Fig. 2

Caulis articulatus, 2.3-8 cm longus, inconspicue nodosus. *Rhizophora* dorsalia. *Folia lateralia* ovato-elliptica vel obovata, 1.6-2 × 0.9-1.2 mm metientia, inaequilatera, angulo recto patentia, basi rodundata vel truncata exauriculata, margine acroscopico ciliolato-denticulata basiscopico integra vel apicem versus parce denticulata, apice subacuta vel obtusa. *Folia mediana* imbricata, lanceolato-ovata, 1.1-1.3 × 0.4-0.6 mm metientia, quasi aequilatera, basi extus auricula elongata praedita, margine ciliata, apice aristata. *Folia axillarum* obovata, 1.3-1.9 × 0.9-1.1 mm metientia, aequilatera, exauriculata, margine denticulata et apicem versus serrata. *Strobili* inconspicuis, 2-3 mm longis, dorsiventralis.

Plants prostrate, matted. *Stem* 2.3-8 cm long and 0.2 mm in diameter, monostelic, straw-coloured, not flagelliform, lacking stolons, twice branched, the branches short and alternate, the

nodes inconspicuous, concolorous with the stem. *Rhizophores* all along the stem, dorsal, extra-axillary, descending at one side of the stem, filiform, 0.1 mm or less in diameter. *Leaves* herbaceous, glabrous. *Lateral leaves* spaced by 0.3-0.5 mm along the main stem, ovate-elliptic to obovate, 1.6-2 × 0.9-1.2 mm, asymmetrical (the acroscopic half wider and more strongly curved than the basiscopic), spreading at right angles, the base rounded to truncate, exauriculate, the margins narrow, greenish to straw-coloured, with 4-5 rows of elongate cells, the acroscopic ciliolate-denticulate by unicellular, strongly ascending teeth, the basiscopic entire or with occasional teeth distally, the midnerve evident, reaching the obtuse to subacute tip, the surface with ± rounded cells, without idioblasts, with stomata on either side along the midnerve. *Median leaves* imbricate, ascending, lanceolate-ovate, 1.1-1.3 × 0.4-0.6 mm, the base narrowed, with an enlarged and slightly incurved auricle outwardly, the margins ciliate, the cilia perpendicular, ascending and sometimes descending with 3-5 rows of elongate cells, the inner cells sinuous, the apex with an arista at least half as long as the body of the leaf, the arista occasionally with 2 divergent teeth at tip. *Axillary leaves* obovate, 1.3-1.9 × 0.9-1.1 mm, equilateral, exauriculate, the margin denticulate, serrate towards the apex, the cellular structure similar to the lateral leaves, the inner cells more elongate towards the distal part. *Strobili* inconspicuous, apical on the lateral branches, subtended by 1-3 large lateral leaves, 2-3 mm long. *Sporophylls* forming a rosette, without an evident keel, ovate-lanceolate, 1.5-2 × 0.5-0.8 mm, the margin ciliate, the tip acuminate to aristate. *Megasporangium* pale brown, c. 1.2 mm wide. *Megaspores, microsporangia* and *microspores* not seen.

Specimen seen. – Central Cuba, prov. Cienfuegos, Alturas de Trinidad, north face of the Pico San Juán, Mandulo, 900 m, 2.6.1995, *Shelton & Caluff 3400* (BSC).

Distribution and habitat – Only known from the type collection, made in montane rainforest, where the pants grew on humus and decaying leaves.

Eponymy. – This species we take pleasure to dedicate to Dr Iván Valdespino of Panama, specialist of neotropical *Selaginella*.

After *Selaginella caluffii,* just described, *S. ivanii* is the third Cuban representative of articulate species. It is morphologically related to *S. fuertesii,* an endemic of Hispaniola. Both species share the obtuse, exauriculate lateral leaves, the median leaves with an extended outer auricle, and the exauriculate axillary leaves. *S. ivanii* differs from *S. fuertesii* mainly in its aristate and ciliate median leaves, with a narrow outer auricle, and by leaves that bear stomata only along the midvein.

Selaginella achotalensis Shelton & Caluff, **sp. nova** – Holotype: *Caluff & Shelton 3413* (BSC; istotypes: B, HAC, HAJB). – Fig. 3

Caulis non articulatus, ad 9 cm longus. *Rhizophora* axillaria. *Folia lateralia* late ovata, obovata, late elliptica vel suborbicularia, ad 1.2-1.4(-1.6) × 0.9-1.2 mm metientia, fere aequilatera, angulo recto patentia, basi truncata exauriculata, margine denticulata, apice rotundata. *Folia mediana* cordata vel cordato-lanceolata, 0.6-0.7 × 0.4-0.5 mm metientia, margine ciliata, apice aristata. *Folia axillarum* spathulato-ovata, aequilatera, basi anguste cuneiformia, margine apicem versus denticulata, apice rotundata. *Strobili* inconspicui, prope basim dorsiventrales, apicem versus quadrangulares, 1-2(-3) mm longi.

Plants resembling a moss, prostrate, matted. *Stem* up to 9 cm long (usually shorter), monostelic, 0.2 mm in diameter, straw-coloured, grooved when dry, flagelliform, lacking stolons, not articulated, 1-2 times branched, the branches alternate and up to 1 cm long. *Rhizophores* axillary all along the stem, variably positioned, sometimes arising dorsally but bending down between the branches of the bifurcation, filiform, up to 0.1 mm in diameter. *Leaves* herbaceous, glabrous, pale olive green, somewhat darker above. *Lateral leaves* spaced by c. 1.5 mm along the main stem, widely ovate to obovate, widely elliptical or sub-orbicular, up to 1.2-1.4(-1.6) × 0.9-

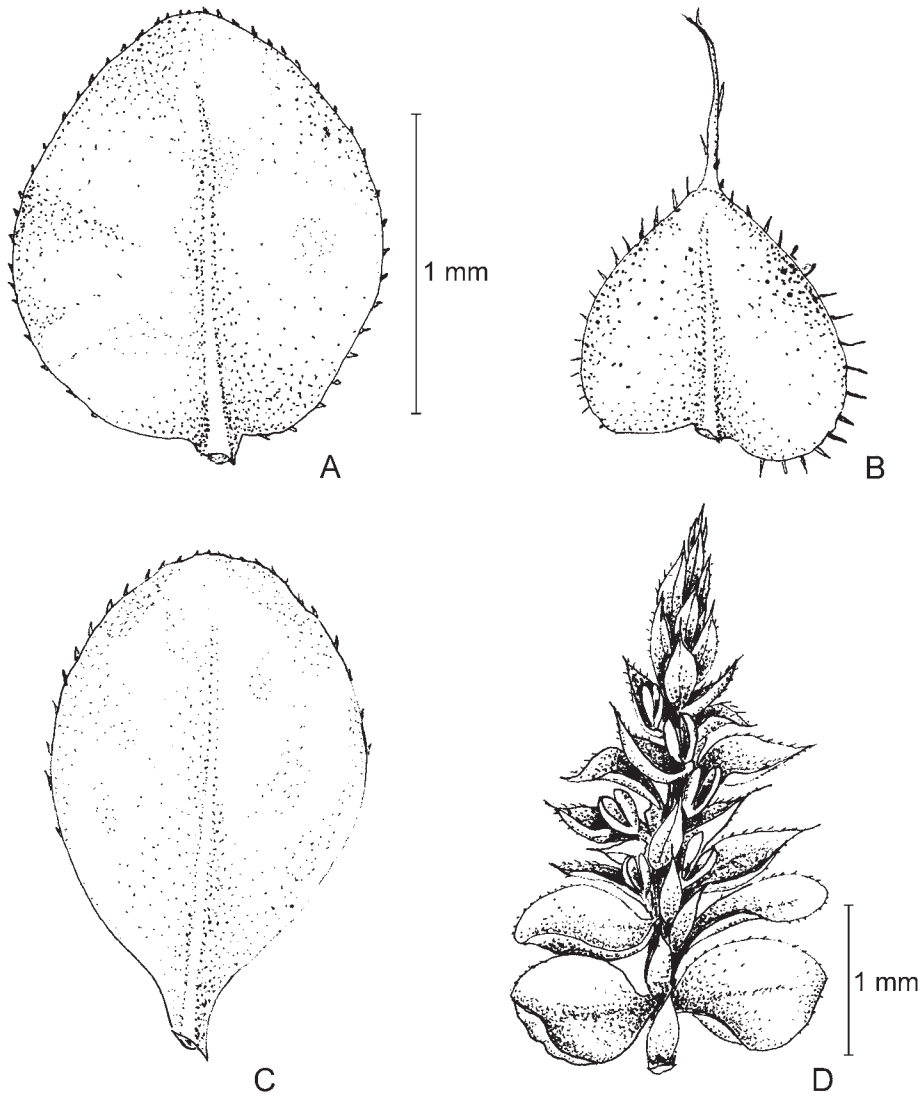

Fig. 3. *Selaginella achotalensis* – A: lateral leaf; B: median leaf; C: axillary leaf; D: tip of a branch. – Drawn from the holotype by M. G. Caluff.

1.2 mm, almost symmetrical, spreading at right angles, the base truncate, lacking auricles, the margins without differentiated cells, the acroscopic denticulate all along, and the basiscopic occasionally distally, by unicellular, ascending teeth, the inner cells ± rounded and with sinuous walls the tip rounded, obtuse or occasionally subacute. *Median leaves* spaced by 2-3 mm, cordate to cordate-lanceolate, 0.6-0.7 × 0.4-0.5 mm, subequilateral, the margins as in the lateral leaves but short-ciliate, tipped with a whitish to subhyaline arista usually more than half as long as the body of the leaf, sometimes with two divergent cilia at tip, the inner cells with sinuous walls, rounded, elongate towards the distal part of the leaves. *Axillary leaves* borne sideways at the axilla or sometimes at the base of one branch (occasionally 1-3, similar but ciliate, adaxially at the strobilus base), spathulate-ovate, equilateral, the base narrowly cuneate, the margin entire

but denticulate in the distal third, the tip rounded, the cell structure similar to the lateral leaves. *Strobili* terminal on the lateral branches, dorsiventral near the base, quadrangular distally, 1-2(-3) mm long. *Sporophylls* subdimorphic, concolorous, the basal ones forming a rosette, those following disposed in 4 rows, ascending, ovate-lanceolate, the margins ciliate, the keel sometimes ill defined, ciliolate-denticulate or with but a few cilia distally, the tip acuminate and ending in a small subhyaline arista. *Megasporophylls* (0-)1(-2) at the base of each strobilus, larger than the microsporophylls, laterally expanded to include the megasporangia, with a well defined keel. *Microsporophylls* 1-1.1 × 0.4-0.5 mm, decreasing in size distally, the apical ones shorter than the microsporangia. *Megasporangia* globular, 0.5-0.6 mm in diameter, bivalvate. *Microsporangia* ovoid, 2-3(-7) per strobilus. *Megaspores* pale orange, 200-300 µm in diameter, the exine muriform, netted, the muri low, rounded, forming a reticulum. *Microspores* brilliant orange, 20-30 µm in diameter, the exine with baculate to clavate projections.

Specimens seen. – Eastern Cuba, prov. Guantánamo, El Salvador, Sabaneta, Farallones de Achotal, 500 m, moist shady limestone cliffs, copious, 24.1.1994, *Caluff & Shelton 3413* (BSC); id., Limonar, Monte Rus, Yambeque, 500 m, moist limestone cliffs, copious, 8.4.1995, *Caluff 3416* (BSC); id., same place, 450 m, cliffs among limestone mogotes, copious, 10.4.1995, *Caluff 3417* (BSC); id., same place, 550-580 m, 10.5.1995, *Motito & Vicario 3392* (BSC); id., Sabaneta, at the re-surfacing of Río Cuzco, limestone cliffs, 250 m, 3.4.1988, *Caluff & Reyes 2707* (BSC).

Distribution and habitat. – Endemic to the Meseta del Guaso: Mogotes of Yambeque, Monte Rus and environs (Guantánamo province, Eastern Cuba), growing intermingled with bryophytes on moist limestone cliffs, in shade, between 250 and 580 m of altitude. Locally abundant.

Among Cuban species, *Selaginella achotalensis* is characterised by combining obtuse, denticulate, basally truncate and exauriculate lateral leaves with cordiform, ciliolate, glabrous median leaves. From the similar *S. plagiochila* Baker, *S. achotalensis* differs principally by its glabrous leaves and its ecology, being confined to limestone substratum. A remarkable feature of the new species is the variable position of rhizophore insertion, sometimes almost dorsal. This might lead to confusion with the "articulate" species. In *S. plumosa* and *S. ivanii* the rhizophores arise dorsally, in an extra-axillary position, and they descend at one side of the stem, whereas in *S. achotalensis,* when dorsal, they originate in the axilla and descend in front of the insertion point, between the stem branches.

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