The musciform Selaginella species (Selaginellaceae) with broad lateral leaves in the West Indies

Authors: Caluff, Manuel G., and Shelton, Gustavo

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MANUEL G. CALUFF & GUSTAVO SHELTON

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Abstract

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The musciform *Selaginella* species with broad lateral leaves, which form a well defined group, are revised for the West Indies. Six species are recognized, of which three localised endemics of Cuba are described as new to science: *S. undata,* from the mountainous southeastern region (Nipe-Sagua-Baracoa Massif, Holguín, Santiago de Cuba and Guantánamo provinces), *S. cristalensis,* restricted to the Sierra Cristal (Holguín and Santiago de Cuba provinces), and *S. orbiculifolia,* only known from the Alturas de Trinidad (central Cuba, Cienfuegos and Sancti Spiritus provinces). Illustrations for and a key to all six species are provided.

Alston (1952) in his "Revision of the West Indian species of *Selaginella*" characterised two musciform species in the key by "lateral leaves broadly elliptical": *S. ovifolia* Baker, from Puerto Rico, Hispaniola, Jamaica and Belize, and *S. rotundifolia* Spring, from the Lesser Antilles. Recently, in the studies that are being carried out for the *Selaginellaceae* for the "Flora de la República de Cuba", a third species with musciform appearance and broad lateral leaves, *S. achotalensis* Shelton & Caluff (2003), has been described. Three further species, *S. undata, S. orbiculifolia* and *S. cristalensis* have been discovered on Cuba and are described in this contribution, rising the species number of this group in the Caribbean to six. The musciform West Indian species with broad lateral leaves are related to the South American *S. microdonta* A. C. Smith (Alston 1952, Alston & al. 1981) and *S. hemicardia* Valdespino (1992), both from the mountains of Venezuela.

Several morphological characteristics are common to the musciform *Selaginella* species with broad lateral leaves:
– Musciform habit, forming thin mats.
– Stem prostrate, filiform, less than 0.2 mm in diameter.
– Leaves dimorphic along the stem, membranous, glabrous.
– Lateral leaves broad, ovate to orbiculate, perpendicular to slightly ascending in the main stem.
– Median leaves very small compared with the lateral ones, spaced.
– Strobili inconspicuous, 1-5(-9) mm long.

Table 1. Comparison of morphological features of the six musciform *Selaginella* species with broad lateral leaves of the West Indies.

Character	***S. achotalensis***	***S. undata***	***S. orbiculifolia***	***S. rotundifolia***	***S. ovifolia***	***S. cristalensis***
Main stem						
length [cm]	to 9	to 6	to 5	to 10	to 15	to 9.5
diameter [mm]	0.2	0.2	0.15	0.2	0.25	0.25
appearance dry	striate	striate to terete	striate	striate	striate	terete
rizophore position	axillary to dorsal	axillary	axillary	axillary	axillary	axillary
Lateral leaves						
posture on the stem	perpendicular	perpendicular to slightly ascending	perpendicular	perpendicular	slightly ascending	perpendicular to slightly ascending
base outline	rounded to truncate	rounded	rounded to truncate	rounded	subcordiform	rounded
margin structure	undifferentiated	little differentiated	little differentiated	differentiated	differentiated	little differentiated
margin indument	denticulate	absent	denticulate-ciliolate	denticulate	ciliolate to ciliate	ciliolate
apex outline	rounded to obtuse	rounded to obtuse	short-aristate	acuminate	acuminate	short-aristate
spicular idioblasts	absent	absent	absent	present, scarce	copious	absent
Median leaves						
outline	cordiform	ovate	lanceolate	ovate	ovate	ovate
base outline	cordiform	rounded	narrowly rounded	round., subauriculate	round., auriculate	rounded
margin indument	ciliolate	denticulate	denticulate-ciliolate	denticulate	ciliolate	ciliate
apex outline	aristate	obtuse to subacute	aristate	acuminate	acuminate	aristate
arista length [mm]	0.2-0.25	—	0.2-0.3	—	—	0.1
Sporophylls						
margin indument	ciliolate	entire	denticulate	denticulate	denticulate	ciliolate
Megaspores						
colour	pale orange	pale orange	pale brown	cream	straw-coloured	cream
diameter [µm]	200-300	250-300	150-170	180-220	400-500	400-600
ornamentation	muriform-reticulate	rugate	baculate	verrucate	colliculate	granulate
Microspores						
ornamentation	baculate to clavate	verrucate	smooth to finely tuberculate	nearly smooth	nearly smooth	granulate to finely tuberculate

– Sporophyll dimorphic, more or less forming a rosette.
– Megasporophyll bigger than the microsporophyll, 1-3 per strobilus, usually situated in or near the strobilus base.

The morphological features of the six species in the West Indies are compared in Table 1 and a key to the species is given below.

The terminology of Lellinger & Taylor (1997) is used to describe the spore ornamentation.

Key to the species

1. Lateral leaves with the apex rounded to obtuse 2
– Lateral leaves with the apex acute, acuminate to aristate 3
2. Median leaves with the apex long-aristate and the base cordate . . . . . *S. achotalensis*
– Median leaves with the apex obtuse to subacute and the base rounded . . . . . *S. undata*
3. Lateral leaves denticulate 4
– Lateral leaves ciliolate to ciliate 5
4. Lateral leaves short-aristate; median leaves lanceolate, long-aristate . . . *S. orbiculifolia*
– Lateral leaves acuminate; median leaves ovate, acuminate . . . . . *S. rotundifolia*
5. Median leaves ciliolate, the base auriculate outwardly, the apex acuminate; lateral leaves ascending in relation to the principal stem, the base subcordiform, the acroscopic side overlapping the stem . . . . . *S. ovifolia*
– Median leaves strongly ciliate, the base without auricles, the apex aristate; lateral leaves perpendicular in relation to the principal stem, the base rounded to truncate, not overlapping the stem . . . . . *S. cristalensis*

Selaginella achotalensis Shelton & Caluff in Willdenowia 33: 163. 2003. – Fig. 1

This species is endemic to the Meseta del Guaso, Guantánamo province, northeastern Cuba. It grows plentiful, intermingled with bryophytes, on the moist, shady limestone cliffs of the Mogotes of Yambeque, at 250-580 m altitude.

S. achotalensis has very distinctive features, such as the variable origin of the rhizophores, from axillary to dorsal, and the cordiform median leaves. It has some affinities with *S. undata* (see comments under that species).

Variation in *S. achotalensis* regards the apex of the lateral leaves, which can be rounded, obtuse or rarely subacute, and the shape of the base of the median leaves, which ranges from cordate and broad (on the main stems) to nearly rounded and narrow (near the apices of the branches).

Specimens seen. – See Shelton & Caluff (2003: 165).

Selaginella undata Shelton & Caluff, **sp. nova** – Holotype: *Shelton & Caluff 4514* (BSC; isotypes: B, HAC, HAJB). – Fig. 2

A *Selaginella prasina* Baker foliis lateralibus obovatis vel late obovatis, horizontaliter patentibus, integerrimis, apice rotundatis, foliis medianis ovatis, integris vel rariter obscure denticulatis, apice obtusis vel subacutis differt.

Plants prostrate, musciform. *Stem* 3.5-6 cm long and 0.15-0.2 mm in diameter, monostelic, straw-coloured, terete to striate on drying, neither flagelliform nor articulate, lacking stolons, up to two times branched into alternating branches, the primary ones 0.5-1.5 cm long, 0.5-0.8 cm apart, the secondary branches shorter. *Rhizophores* axillary, all along the stem, 0.1 mm in diameter. *Leaves* strongly dimorphic, membranaceous, glabrous, green on either side, paler on the abaxial side, the margins differentiated, with 1-2 rows of elongate, non-papillate cells, these sometimes discontinuous, the midvein inconspicuous, ending 0.3-0.4 mm from the leaf apex, the surface without idioblasts, with rounded cells, sometimes with sinuous walls. *Lateral leaves* variously undulate on drying, 0.6-1.5 mm apart along the main stem, obovate to broadly obovate, up

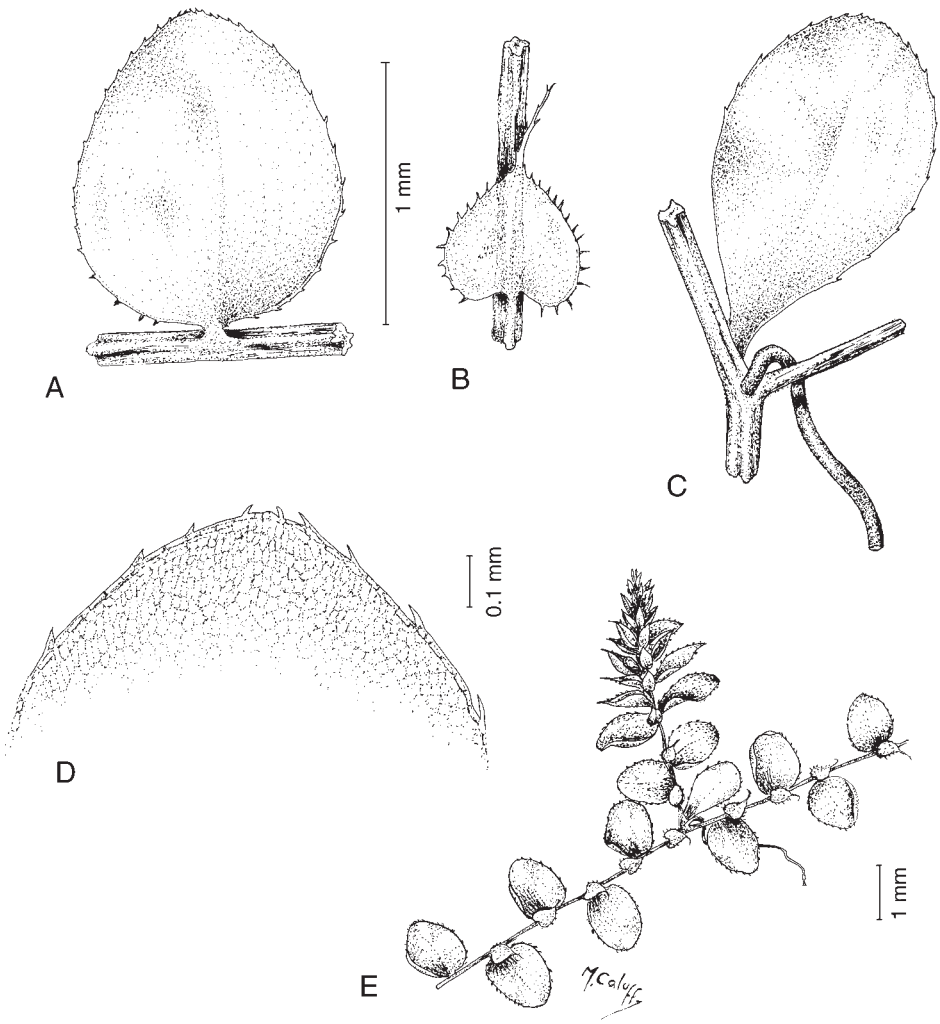

Fig. 1. *Selaginella achotalensis* Shelton & Caluff – A: lateral leaf; B: median leaf; C: axillary leaf; D: apex of lateral leaf; E: habit. – After *Shelton & Caluff 3413* (BSC).

to 1-1.2 × 0.7-1 mm, slightly inequilateral, spreading at right angles, the base narrowed to cuneate, without auricles, the margin entire, the apex rounded to obtuse. *Median leaves* 0.4-1 mm apart, ovate, 0.5-0.6 × 0.3-0.35 mm, subequilateral, the base rounded, without auricles, the margins entire or rarely with scarce and distant teeth, the apex obtuse to subacute. *Axillary* leaves obovate to obovate-spathulate, nearly equilateral, entire, the base cuneate, the apex rounded. *Strobili* terminal on the lateral branches, dorsiventral, lax, 1-2 mm long. *Sporophylls* dimorphic, concolourous, forming a few definite rosettes, the keel not well definite, the base rounded, the margin entire, the apex obtuse to subacute. *Megasporophylls* broadly ovate, 1-1.4 × 0.8-1.1 mm, one or two variably situated in the strobili, sometimes absent. *Microsporophylls* ovate, 0.8-1 × 0.5-0.6 mm. *Megasporangia* broadly ovoid, 0.4-0.6 × 0.3-0.4 mm. *Microsporangia* ellipsoid, 0.3-0.4 × 0.2-0.25 mm. *Megaspores* pale orange, 250-300 µm in diameter, the exine rugate. *Microspores* brilliant orange, 20-30 µm in diameter, the exine verrucate.

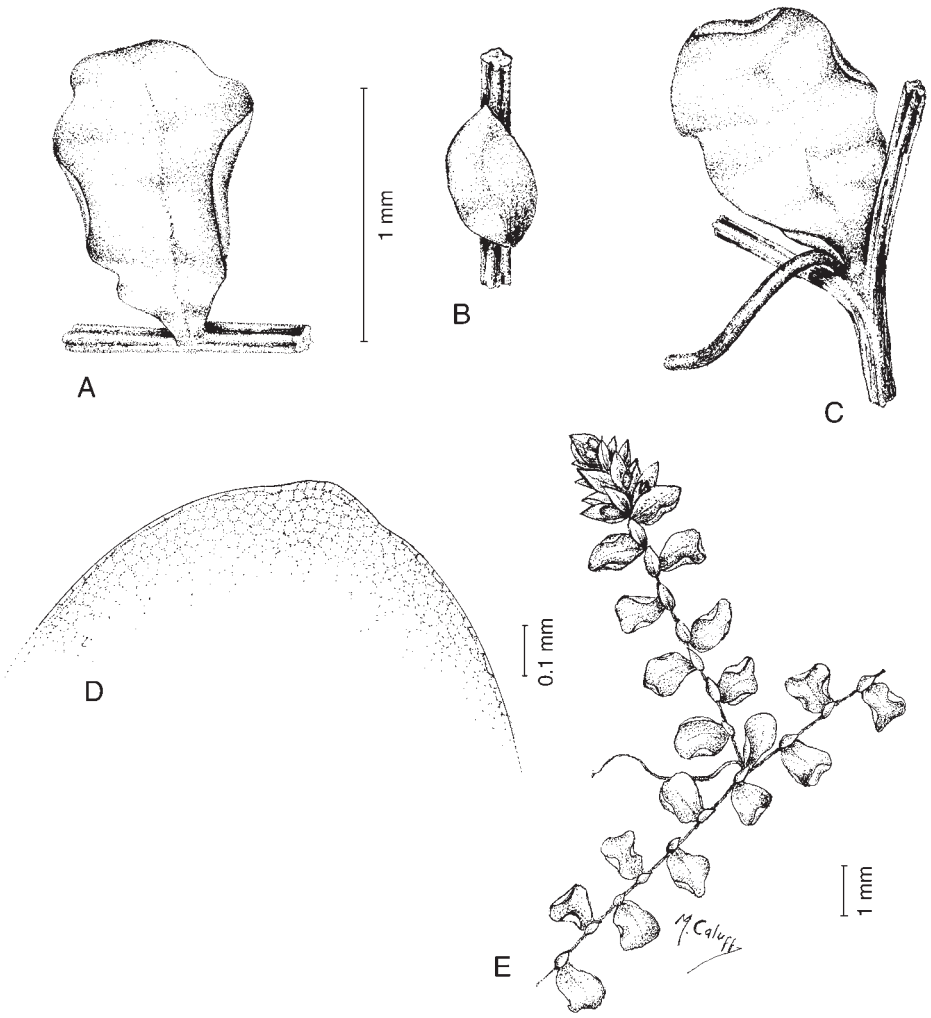

Fig. 2. *Selaginella undata* Shelton & Caluff – A: lateral leaf; B: median leaf; C: axillary leaf; D: apex of lateral leaf; E: habit. – After *Caluff & J. Reyes 2708* (BSC).

Specimens seen. – CUBA: SINE LOCO: *Hioram 2172* (BSC). — PROV. SANTIAGO DE CUBA: San Benito, 900 m, 24.2.1916, *D. Jennings 4096* (B). — PROV. HOLGUIN: Margin of Río Jaguaní, Arroyo Bueno, La Melba, Moa, submontane rainforest, 200 m, in the very limit of the water, forming brilliant green mats, 18.9.1997, *Caluff 4323, 4324* (BSC); Moa, margins of Arroyo Palmares, La Melba, 150-200 m, dripping slopes near the river and sometimes in the very limit of the water, forming great mats, gallery forest, 19.9.1997, *Caluff 4326, 4327* (BSC). — PROV. GUANTÁNAMO: Resurgence of Río Cuzco, Sabaneta, terrestrial over limestone rocks and over humid cliffs, 250 m, 3.4.1988, *Caluff & J. Reyes 2708* (BSC); La Melba, Moa, over ground, 3.4.1972, *A. Cárdenas 29517* (HAC); margins of Río Cuzco, after the resurgence, over calcareous rocks, mixed with *S. eatonii* Hieron and *S. subcaulescens* Baker, Mogote vegetation, 300 m, 5.10.1994, *A. Lobaina 4443* (BSC); Arroyo Blanco, Baracoa, surroundings of the ancient saw-house, on dripping rocks in river slopes, 200 m, 8.3.2001, *Shelton & Caluff 4514* (B, BSC, HAC, HAJB).

Distribution and habitat. – *Selaginella undata* is endemic to the southeastern mountainous region of Cuba (Nipe-Sagua-Baracoa Massif), occurring in Holguín, Santiago de Cuba and Guantánamo, at 150-300(-900) m altitude. It grows as a rheophyte of river margins in gallery forests where the fluctuating water level covers periodically the plants. The substrate is commonly serpentine and metamorphic rocks but the species has also been collected on calcareous rocks.

The most distinctive morphological characteristics of *Selaginella undata* are the entire margin of all leaves (only the median leaves are very rarely obscurely denticulate), the obovate to broadly obovate lateral leaves and the obtuse to subacute median leaves. Another noticeable character is that the lateral leaves, when dry, become twisted and undulate in different ways, taking a wavy (Latin: undatus) appearance, hence the specific name.

Within the group studied, the main affinity of *S. undata* is with *S. achotalensis* through the rounded to obtuse lateral leaves and the pale orange coloured megaspores, 250-300 µm in diameter. The differences are: in *S. achotalensis* the lateral leaves are broadly ovate and denticulate, whereas obovate and entire in *S. undata;* the median leaves are cordiform and ciliolate in *S. achotalensis,* whereas ovate and entire to obscurely denticulate in *S. undata*.

S. undata resembles *S. prasina* Baker, another endemic species from central and western Cuba (not included in this study because its lateral leaves are oblong), in the ovate, non-aristate median leaves, which are, however, usually entire and obtuse to subacute in *S. undata* but always denticulate and subacute to acute in *S. prasina.* The lateral leaves of *S. undata* are obovate and rounded to obtuse, perpendicular to and with the base not overlapping the stem, whereas those of *S. prasina* are oblong to ovate-oblong, (sub)acute, ascending and the acroscopic side of the base overlaps the stem. The sporophylls of *S. undata* are entire, those of *S. prasina* denticulate.

Selaginella orbiculifolia Shelton & Caluff, **sp. nova** – Holotype: *Shelton & Caluff 3410* (BSC; isotypes: B, HAC, HAJB). – Fig. 3

A *Selaginella rotundifolia* Spring caulibus minoribus, 1.5-5 cm longis, foliis lateralibus ovatis vel orbiculatis, denticulatis vel ciliolatis, apice breviaristatis (arista 0.1 mm longa), foliis medianis lanceolatis vel lanceolato-ovatis, c. 0.4-0.8 × 0.2-0.3 mm, denticulatis vel ciliolatis, basi rotundatis, exauriculatis, apice aristatis (arista 0.25-0.3 mm longa) differt.

Plants prostrate, musciform. *Stem* 1.5-5 cm long and 0.1-0.15 mm in diameter, monostelic, straw-coloured, striate on drying, not flagelliform or articulate and lacking stolons, up to two times branched into alternating branches, the primary ones 3-7 mm long, 5-12 mm apart, the secondary branches shorter. *Rhizophores* axillary, all along the stem, 0.05 mm in diameter. *Leaves* dimorphic, membranaceous, glabrous, green on either side, the margins barely differentiated, greenish, with 1-3 rows of elongate, non-papillate cells, these sometimes discontinuous, the midvein ending 0.3-0.4 mm from the leaf apex, the lamina surface without idioblasts, with rounded to pentagonal cells with non-sinuous walls. *Lateral leaves* spaced by 1-1.5 mm along the main stem, ovate to orbiculate, up to 0.9-1.2 × 0.7-0.8 mm, nearly symmetrical, spreading at right angles, the base rounded to truncate, without auricles, denticulate, sometimes ciliolate towards the base in the acroscopic side, the apex abruptly short-aristate, cartilaginous, the arista 0.1 mm long, straight to curved, ending in two teeth. *Median leaves* 0.7-1 mm apart, lanceolate to lanceolate-ovate, 0.4-0.8 × 0.2-0.3 mm, subequilateral, the base narrowly rounded, without auricles, the margins denticulate, ciliolate toward the base, the apex aristate, arista 0.25-0.3 mm long. *Axillary leaves* equilateral, the base cuneate, the margins denticulate, the apex abruptly short-aristate. *Strobili* terminal on the lateral branches, dorsiventral, lax, 1.1-1.6 mm long, sometimes one to some microsporophyll(s) with functional micosporangia alternating with sterile parts of the plant. *Sporophylls* subdimorphic, concolourous, broadly ovate, forming a few definite rosettes, the keel not well definite, denticulate, the apex aristate, the arista denticulate. *Megasporophylls* broadly ovate, 0.6-1 × 0.3-0.6 mm, one or two situated near the strobilus base and sometimes absent. *Microsporophylls* obovate, 0.5-0.9 × 0.2-0.4 mm, the keel with greater teeth than in the megasporophylls. *Megasporangia* broadly ovoid, 0.4-0.6 ×

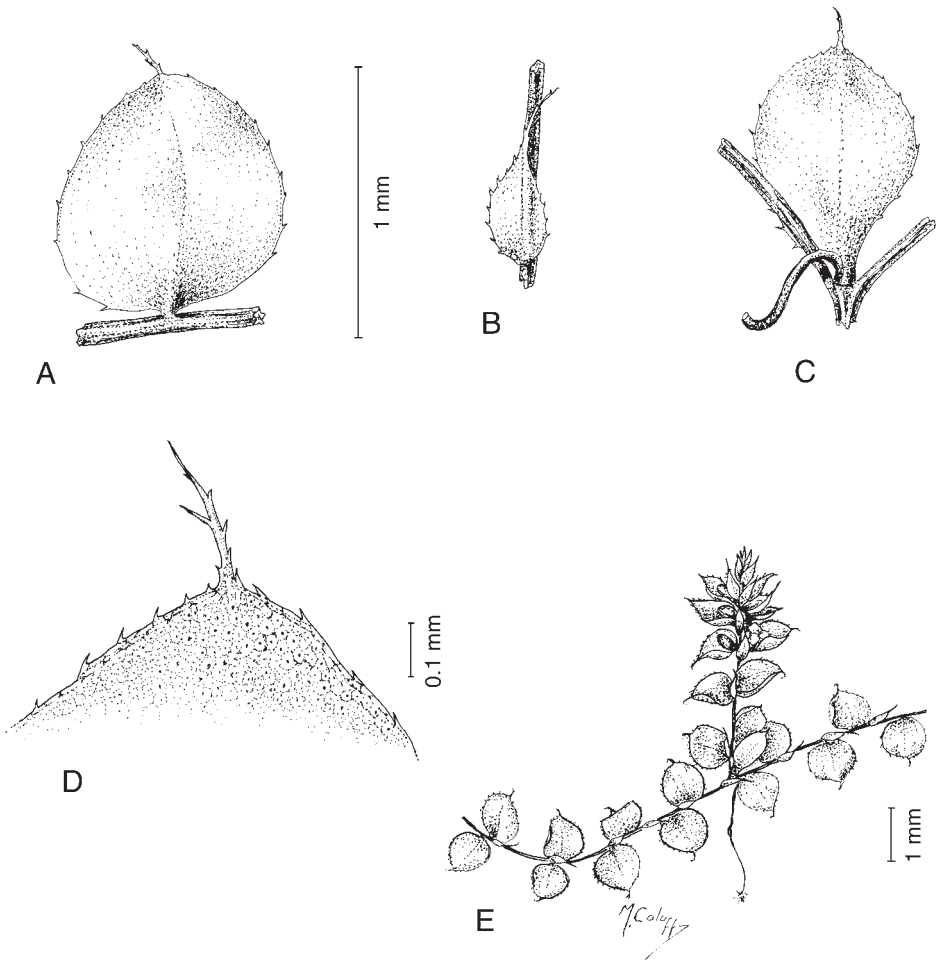

Fig. 3. *Selaginella orbiculifolia* Shelton & Caluff – A: lateral leaf; B: median leaf; C: axillary leaf; D: apex of lateral leaf; E: habit. – After *Shelton & Caluff 3410* (BSC).

0.3-0.4 mm. *Microsporangia* ellipsoid, 0.3-0.4 × 0.2-0.25 mm. *Megaspores* pale brown, 150-170 µm in diameter, the exine with well-spaced fine baculae. *Microspores* brilliant orange, 20-30 µm in diameter, the exine smooth to finely tuberculate.

Specimens seen. – CUBA: PROV. CIENFUEGOS: Alturas de Trinidad, Sierra del Escambray, Las Lagunas, Carso de Buenos Aires, San Blás, 650 m, mogote vegetation, in humid, shaded limestone cliffs, 3.6.1995, *Shelton & Caluff 3408, 3410* (BSC). — PROV. SANCTI SPIRITUS: Mogote Mi Retiro, Loma del Mirador, surroundings of the visiting house of La Agricultura, limestone and earthy cliffs, scarce, 600-800 m, 16.4.1997, *C. Sánchez & A. Cuesta 74278* (BSC, HAJB).

Distribution and habitat. – Endemic to the Alturas de Trinidad (provinces of Cienfuegos and Sancti Spiritus, central Cuba). Growing intermixed with the bryophytes *Porotrichum* sp., *Isopterygium* sp., *Metzgeria elliottii* Steph., *Riccardia* sp. and *Plagiochila* sp., in humid, shaded limestone cliffs, at 600-800 m altitude. Very rare and perhaps overlooked because of its tiny size.

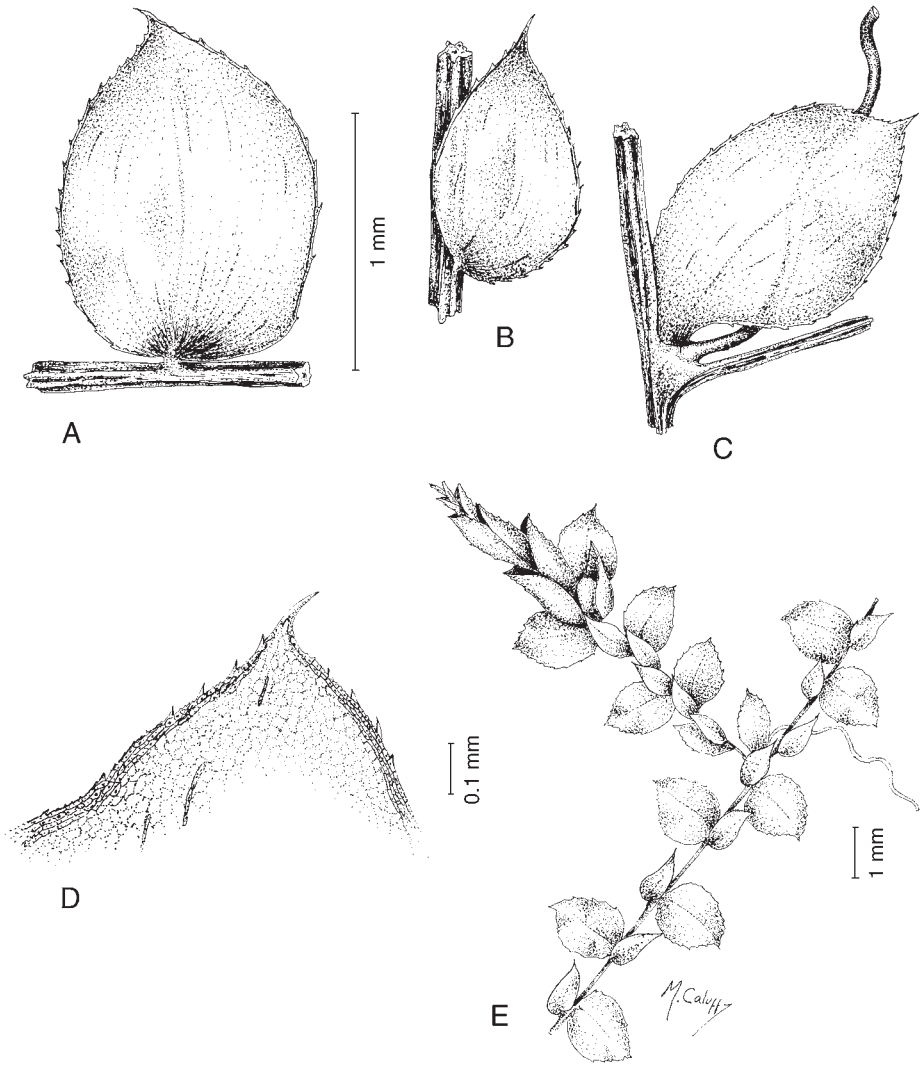

Fig. 4. *Selaginella rotundifolia* Spring – A: lateral leaf; B: median leaf; C: axillary leaf; D: apex of lateral leaf; E: habit. – After *W. H. & B. T. Hodge 1022* (HAC) from Dominica.

The distinctive characteristic of *Selaginella orbiculifolia* is the tiny size of all structures, which makes it the smallest species of the group studied. The main affinity of *S. orbiculifolia* is with *S. rotundifolia,* a Lesser Antillean species. However, the margins of the lateral and median leaves are denticulate throughout in *S. rotundifolia* but denticulate and basally ciliate in *S. orbiculifolia;* the apex of the lateral leaves is acuminate to rarely short-aristate in *S. rotundifolia* but abruptly short-aristate in *S. orbiculifolia;* the median leaves are ovate with subauriculate base and acuminate apex in *S. rotundifolia* but lanceolate to lanceolate-ovate, with narrowly-rounded base and long-aristate apex in *S. orbiculifolia*. Likewise, the leaves of *S. rotundifolia* are firmer and more opaque, having spicular idioblasts, whereas the leaves of *S. orbiculifolia* have a fine membranous texture, are somewhat translucid and lack spicular idioblasts. Both species also differ in

the spores: the megaspores of *S. rotundifolia* are cream coloured, 180-220 µm in diameter, with verrucate exine, those of *S. orbiculifolia* pale brown, 150-170 µm in diameter, with baculate exine; the microspores of *S. rotundifolia* have a nearly smooth exine, those of *S. orbiculifolia* a smooth to finely tuberculate exine.

Selaginella rotundifolia Spring in Bull. Acad. R. Bruxelles 10(1): 139. 1843 ≡ *Lycopodioides rotundifolia* (Spring) Kuntze, Rev. Gen. Pl. 1: 827. 1891. – Fig. 4
= *Jungermannia mastigophora* Spreng., Syst. Veg., ed. 16, 4(1): 222. 1827
– *Selaginella confusa* sensu Griseb., Fl. Brit. W. Ind. Isl.: 643. 1864

Selaginella rotundifolia is a Lesser Antillean species, which usually grows on humid rocks near watercourses at low to medium altitudes (Hodge 1954), according to Alston (1952) at 500-1100 m.

In the group studied, *S. rotundifolia* is characterised by throughout denticulate leaf margins. The leaves possess a firm, membranous texture and a well differentiated margin, with 4-5 rows of papillate cells, with the papillae protruding laterally to a micro-denticulate border between the teeth. In *S. rotundifolia,* spicular idioblasts are frequent on the abaxial surface of the lateral leaves.

The uniformity of the morphological characteristics of this species throughout its range is noticeable. No material of *Selaginella rotundifolia* var. *denticulata* Spring has been seen by the authors.

In this group, the nearest affinity of *S. rotundifolia* is with *S. orbiculifolia,* but in general, *S. rotundifolia* is a bigger and stronger plant. For other differences see under *S. orbiculifolia*.

Specimens seen. – CURAÇAO: Gourbeyre Houclurit, 4.1936, *P. Quentin 1109* (P); Bois du Grand Etange, 6.1936, *H. Stelhé 541* (P). — DOMINICA: Between Sylvania and Mt Joy, 500 m, in large colonies forming cushion-like mats on trunk of old fallen tree lying in wet wooded ravine at base of the twin waterfalls of Massacre River, 9.2.1940, *W. & B. Hodge 1010* (HAC). — GUADALUPE: Cascade Vauchelet, 20.4.1936, *P. Allorge* (P); 1938, *M. Beaupertuis* (P, two sheets).

Selaginella ovifolia Baker in J. Bot. 22: 90. 1884 ≡ *Lycopodioides ovifolia* (Baker) Kuntze, Rev. Gen. Pl. 1: 827. 1891. – Fig. 5

This species occurs in the Greater Antilles (Puerto Rico, Jamaica and Hispaniola), moreover in Belize, but is absent from Cuba.

According to Proctor (1977, 1985, 1989), *Selaginella ovifolia* grows in humid and shaded slopes in Jamaica, on non-calcareous soil, at 910-1150 m altitude. In Puerto Rico it grows on clay soil in rocky, humid slopes, commonly near rivers and waterfalls and sometimes at the base of tree-fern stems.

Morphologically distinctive characteristics of *S. ovifolia,* in the group studied, are the subcordiform base of the lateral leaves, with the acroscopic side ciliate and decidedly overlapping the stem, the median leaves auriculate on the outer side, and the presence of copious spicular idioblasts on the leaf surface.

Jamaican specimens of *S. ovifolia* have more strongly ciliate lateral leaves than specimens from Porto Rico and Hispaniola. The authors revised specimens of *S. ovifolia* subsp. *philipsonii* Jermy & Rankin [*Idrobo 4837, 4838* (BM)], which possess characteristics that differentiate it from the West Indies specimens, such as oblong, lateral leaves with obtuse to mucronate apex and less ciliate median leaves. These details induce us to think that this taxon is actually a species related to but independent of *S. ovifolia,* in agreement with Alston's original opinion (Alston & al. 1981). A more detailed study is needed. Specimens from Belize have not been seen by the authors, but according to Fraile & al. (1995), *Schipp 924* (BM) has the lateral leaves "subentire, occasionally with 1-2 short cilia, inconspicuous, in the base"; specimens from the Greater Antilles have regularly ciliate lateral leaves.

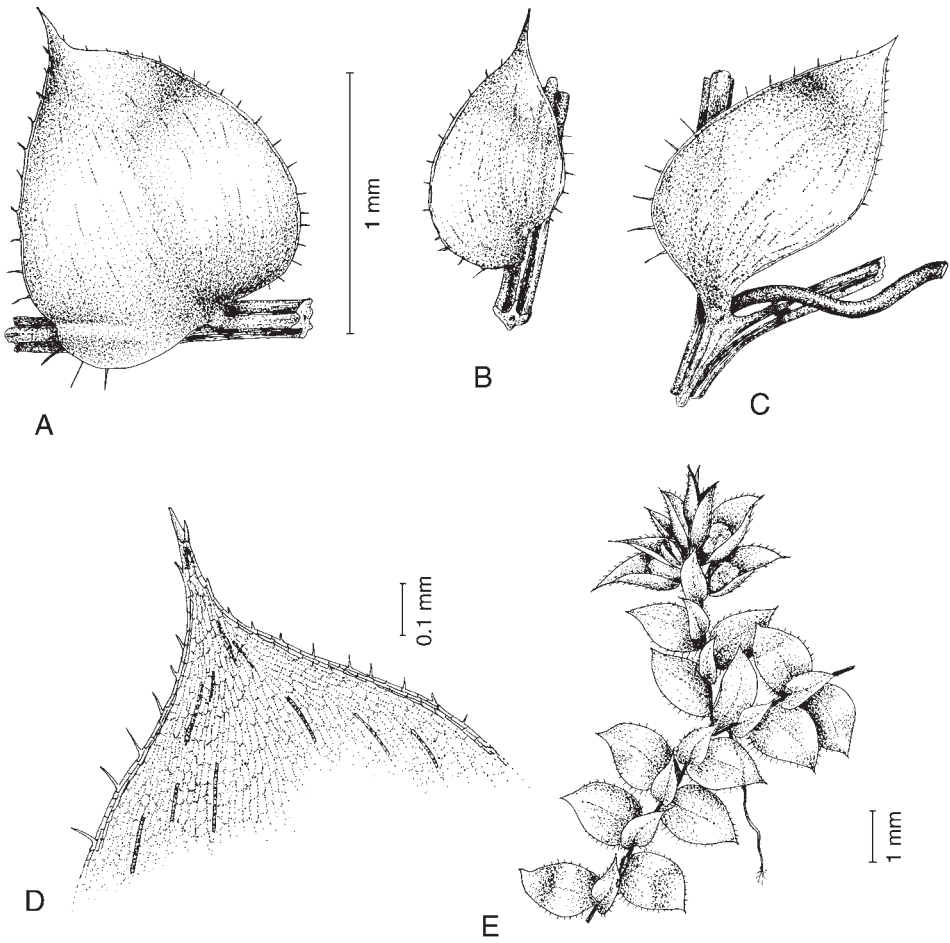

Fig. 5. *Selaginella ovifolia* Baker – A: lateral leaf; B: median leaf; C: axillary leaf; D: apex of lateral leaf; E: habit. – After *E. & G. Leonard 13728* (BM).

S. ovifolia has affinities with *S. rotundifolia* and *S. cristalensis*. With *S. rotundifolia* it shares the firm membranous texture of the leaves, the well differentiated margin, the presence of spicular idioblasts that are visible abaxially and the acuminate apex; both species have in common, moreover, the ovate inequilateral median leaves, with an auricle on the shorter side, prominent in *S. ovifolia* and incipient in *S. rotundifolia*. The principal differences between both species are in the leaf margin, which is ciliolate to ciliate in *S. ovifolia* but denticulate in *S. rotundifolia,* as well as in the base of the lateral leaves, which is subcordiform in *S. ovifolia* but rounded in *S. rotundifolia*.

For the affinities with *S. cristalensis,* an endemic of Sierra Cristal, see under that species.

Specimens seen. – Porto Rico: Sierra de Las Piedras, at Los Rábanos, 30.10.1886, *W. Clute 5479* (B); prope Cayey, ad rupes humitas, 18.10.1885, *E. Ebbeke 2179* (B); Sierra de la Piedras, in sylvis primaeris monte, Los Rábanos, 30.10.1986, *C. Ebbeke 1550, 5478* (B); Sierra de Naguabo, 7.8.1914, *J. Shafer 3323* (GH); Sierra de Las Piedras, at Los Rábanos, 30.10.1886,

Sintenis 5479 (P). — Dominican Republic: Cordillera Central, La Vega, ad the falls of Rio Jimenoa, moist cliff, 800 m, not common, 18.11.1929, *E. Ekman 14182* (S); La Vega, La Cienaga, south bank Rio Los Guanos, just above the confluence of Río de la Izquierda, 110-1200 m, 16.7.1967, *G. Gastony 241* (GH); creeping on rocks, in wet places, near Loma de Oro, Mata Grande, San Jose de las Matas, 1100 m, 13.6.1969, *Hno. Liogier 15692-B* (GH). — Haiti: Massif du Nord, Mermelade, steep hillsides, near pineland, 700 m, 31.5.1927, *E. Ekman 8314* (B); Dept. du Nord, vicinity of Dondon, 400 m, 7.12.1926, *E. Leonard 8612* (BM); vicinity of Ennery, L'Atibonite, 325-900 m, 20.6-20.8.1926, *E. Leonard 9053* (BM); vicinity of Jean Rabel, on damp rocks, 22.6.1929, *E. & G. Leonard 12276* (BM); vicinity of Port de Paix, on damp rocks in bed of a mountain stream, 26.2.1929, *E. & G. Leonard 12292* (BM, HAC); vicinity of Jean Rabel, mountain south of town, on damp rocks in ravine, 1.3.1929, *E. & G. Leonard 13728* (BM). — Jamaica: Farm Hill, 15.9.1927, *K. Wilson & W. Murray 3473* (B); Farm Hill Work, 31.3.1931, *K. Wilson & W. Murray 5473* (B); Farm Hill Works, St Thomas, 15.10.1927, *C. Orcutt 3465* (HAC).

Selaginella cristalensis Shelton & Caluff, **sp. nova** – Holotype: *Shelton 4531* (BSC; isotypes: B, HAC, HAJB) – Fig. 6

A *Selaginella ovifolia* Baker caulis teretibus, foliis idioblastos carentibus, foliis lateralibus margine ciliolatis, basi rotundatis, apice breviaristatis (arista 0.15-0.2 mm longa), foliis medianis minutis, ovatis, 0.4-0.7 × 0.3-0.4 mm, margine longiciliatis, basi rotundatis, exauriculatis, apice breviaristatis (arista 0.1-0.15 mm longa) differt.

Plants prostrate, musciform. *Stem* 3-9.5 cm long and 0.2-0.25 mm in diameter, monostelic, straw-coloured, terete on drying, not flagelliform or articulate, lacking stolons, up to two times branched into alternating branches, 1-3 cm long, 1-1.5 cm apart, secondary branches developed only occasionally and are shorter. *Rhizophores* 0.2 mm in diameter, axillary and frequently far away from the bifurcations, all along the stem. *Leaves* dimorphic, membranaceous, glabrous, green on either side, some brilliant abaxially, the midvein ending 0.5 mm from the leaf apex, the margins differentiated, greenish, with 1 row of elongate, non-papillate cells, the lamina surface without idioblasts, with rectangular to rounded cells, some with sinuous walls, and sparse stomata on both sides of the midvein. *Lateral leaves* spaced by 1.3-1.7 mm along the main stem, ovate to broadly ovate, up to 1.1-1.6 × 0.8-1.3 mm, nearly symmetrical, spreading at right angles or a little ascending, the base rounded, without auricles, sparsely ciliolate on the acroscopic side and on the distal part of the basiscopic one, the apex abruptly short-aristate, the arista cartilaginous, 0.15-0.2 mm long, ending in one or two cilia, straight to frequently curved. *Median leaves* well spaced, 0.8-1.2 mm apart, ovate, 0.4-0.7 × 0.3-0.4 mm, subequilateral, the base rounded, without auricles, the margins sparsely ciliate on the inner side and on the distal part of the outer side, the apex short-aristate, arista 0.1-0.15 mm long, ending in one cilia. *Axillary leaves* obovate, 1.4-1.5 × 0.7-0.8 mm, equilateral, the base cuneate, the margins ciliolate, the apex short-aristate. *Strobili* terminal on the stem apex and on the lateral branches, lax, subquadrangular, 2-9 mm long, frequently some sporophylls with functional microsporangia alternating with sterile parts of the stem. *Sporophylls* subdimorphic, concolourous, keeled, the margin and the keel ciliolate. *Megasporophylls* broadly ovate, one to four situated at or near the strobilus base, sometimes absent, 1.8-2 × 0.9-1 mm, the apex abruptly acuminate. *Microsporophylls* ovate, 1.1-1.9 × 0.6-0.8 mm, the apex acute to shortly acuminate. *Megasporangia* globular, 1.4-1.5 mm in diameter. *Microsporangia* ellipsoid, 0.7-0.8 × 0.4-0.5 mm. *Megaspores* cream to straw-coloured, 400-600 µm in diameter, the exine finely baculate. *Microspores* brilliant orange, 25-35 µm in diameter, the exine finely granulate to tuberculate.

Specimens seen. – Cuba: Prov. Holguín: Sierra Cristal, northern side, SE of El Culebro, ascending to Pico El Cielo, 13.4.1987, *M. Bässler, H. Dietrich, J. Gutiérrez, L. Lepper, E. Méndez, B. Bory, R. Oviedo R. Rankin 61134* (BSC, HAJB). — Prov. Santiago de Cuba: Near top of

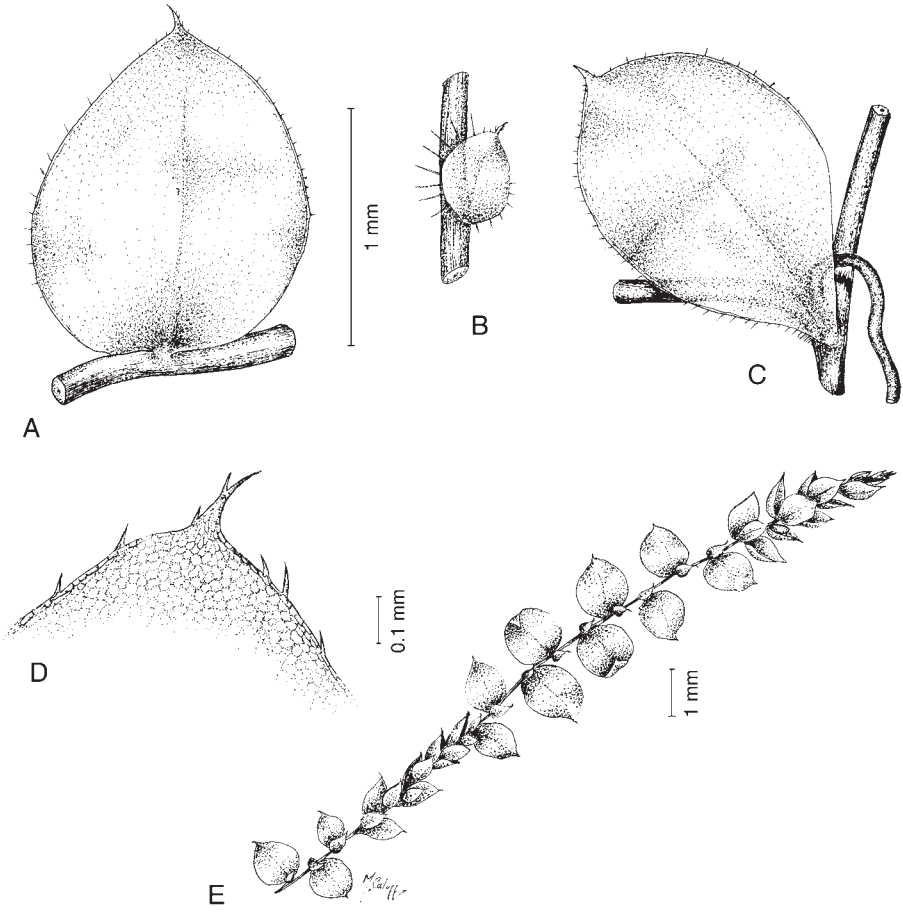

Fig. 6. *Selaginella cristalensis* Shelton & Caluff – A: lateral leaf; B: median leaf; C: axillary leaf; D: apex of lateral leaf; E: habit. Branch showing alternation of fertile and sterile zones. – After *Shelton & Caluff 4524* (BSC).

Pico Cristal, Sierra Cristal, in humus between rocks in the ground, charrascal nublado, 1200 m, 28.3.2001, *Shelton 4531* (B, BSC, HAC, HAJB); top of Pico Cristal, over mossy rocks in the ground, charrascal nublado, 1269 m, 28.3.2001, *Shelton 4528* (BSC); Sierra Cristal, first rivulet after Batista, ascending, in shaded slopes, serpentine rainforest, 750-800 m, 25.3.2001, *Shelton & Caluff 4523* (BSC); Sierra Cristal, first rivulet after Batista, ascending, in a dropping cliff of a cascade, near water, serpentine rainforest, 800-850 m, 25.3.2001, *Shelton & Caluff 4524* (BSC); Sierra Cristal, in charrascal nublado, on a hole in the ground, near the water, colonial, hills in SE of Loma del Gallego, serpentine rainforest, 1020 m, 26.3.2001, *Shelton & Caluff 4525* (BSC).

Distribution and habitat. – Endemic to the Sierra Cristal (provinces of Holguín and Santiago de Cuba, eastern Cuba), growing on dropping cliffs, on shaded slopes and on the ground, on very humid and wet places, over mossy rocks, intermixed with the bryophytes *Acroporium pungens* (Hedw.) Broth., *Syrrhopodon prolifer* var. *acanthoneurus* (C. Müll.) C. Müll., *Frullania brasiliensis* Raddi and *Prionolejeunea aemula* Gottsche. *S. cristalensis* is serpentinicolous, living in rainforest and charrascal nublado, at 750-1269 m altitude, being locally frequent.

The most distinctive characteristics of *Selaginella cristalensis* are its strongly ciliate, tiny and well spaced median leaves and its main stem becoming terete on drying. Another interesting frequent characteristic are the intermittant fertile parts of the stem, with only microsporophylls containing functional microsporangia. This characteristic is seen, occasionally, also in *S. orbiculifolia.*

In the species group studied, the main affinity of *S. cristalensis* with *S. ovifolia,* from which it differs mainly in the median leaves being short-aristate, strongly ciliate and not auriculate, whereas they are ovate, acuminate, ciliolate and auriculate on the outer side in *S. ovifolia*. In *S. ovifolia* the lateral leaves vary in their posture from perpendicular to somewhat ascending in relation to the main stem, they are ciliolate and have a subcordiform base, the acroscopic side overlaps the stem and the apex is acuminate; in *S. cristalensis* the lateral leaves are always patent, the base rounded and not overlapping the stem, and the apex is short-aristate. In *S. ovifolia* the leaf margins are well differentiated and have one or two rows of enlarged papillose cells; in *S. cristalensis* the margins are barely differentiated and have only one row of sometimes contiguous, enlarged, non-papillose cells. The leaves of *S. cristalensis* lack spicular idioblasts, which are very abundant in the leaves of *S. ovifolia.* Finally, the microspores of *S. cristalensis* are finely granulate to tuberculate, whereas those of *S. ovifolia* are nearly smooth.

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Address of the authors:
Manuel G. Caluff & Gustavo Shelton, Jardin de los Helechos de Santiago de Cuba, Carretera del Caney No. 129, “La Caridad”, Caney, C.P. 90400, Santiago de Cuba, Cuba; e-mail: manolito@bioeco.ciges.inf.cu.