MANUEL G. CALUFF & GUSTAVO SHELTON

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

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.

<table>
<thead>
<tr>
<th>Character</th>
<th><em>S. achotalensis</em></th>
<th><em>S. undata</em></th>
<th><em>S. orbiculifolia</em></th>
<th><em>S. rotundifolia</em></th>
<th><em>S. ovifolia</em></th>
<th><em>S. cristalensis</em></th>
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<tbody>
<tr>
<td><strong>Main stem</strong></td>
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<tr>
<td>length [cm]</td>
<td>to 9</td>
<td>to 6</td>
<td>to 5</td>
<td>to 10</td>
<td>to 15</td>
<td>to 9.5</td>
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<td>axillary to dorsal</td>
<td>axillary</td>
<td>axillary</td>
<td>axillary</td>
<td>axillary</td>
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<tr>
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<td>perpendicular to slightly ascending</td>
<td>perpendicular</td>
<td>perpendicular</td>
<td>slightly ascending</td>
<td>perpendicular to slightly ascending</td>
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<td>rounded to truncate</td>
<td>rounded to truncate</td>
<td>little differentiated</td>
<td>rounded</td>
<td>subcordiform</td>
<td>little differentiated</td>
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<tr>
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<td>little differentiated</td>
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<td>denticulate</td>
<td>denticulate</td>
<td>ciliolate to ciliate</td>
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<tr>
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<td>rounded to obverse</td>
<td>rounded to obverse</td>
<td>short-aristate</td>
<td>acuminate</td>
<td>present, scarce</td>
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<td>spicular idioblasts</td>
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<td><strong>Sporophylls</strong></td>
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<tr>
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<td>entire</td>
<td>denticulate</td>
<td>denticulate</td>
<td>denticulate</td>
<td>ciliolate</td>
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<td><strong>Megaspores</strong></td>
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<td>pale orange</td>
<td>pale brown</td>
<td>cream</td>
<td>straw-coloured</td>
<td>cream</td>
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<td>180-220</td>
<td>400-500</td>
<td>400-600</td>
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<tr>
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<td>muriform-reticulate</td>
<td>rugate</td>
<td>baculate</td>
<td>verrucate</td>
<td>colliculate</td>
<td>granulate</td>
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<td><strong>Microspores</strong></td>
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<tr>
<td>ornamentation</td>
<td>baculate to clavate</td>
<td>verrucate</td>
<td>smooth to finely tuberculate</td>
<td>nearly smooth</td>
<td>nearly smooth</td>
<td>granulate to finely tuberculate</td>
</tr>
</tbody>
</table>
– 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 ................. \( S. \) \textit{achotalensis}
– Median leaves with the apex obtuse to subacute and the base rounded ........ \( S. \) \textit{undata}
3. Lateral leaves denticulate .................................................................................. 4
– Lateral leaves ciliolate to ciliate ...................................................................... 5
4. Lateral leaves short-aristate; median leaves lanceolate, long-aristate .... \( S. \) \textit{orbiculifolia}
– Lateral leaves acuminate; median leaves ovate, acuminate ................. \( S. \) \textit{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 ................................................................. \( S. \) \textit{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 ........................................................................ \( S. \) \textit{cristalensis}

**\( Selaginella \) \textit{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.

\( S. \) \textit{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 \( S. \) \textit{undata} (see comments under that species).

Variation in \( S. \) \textit{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).


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

A \( Selaginella \) \textit{prasina} Baker foliis lateralis 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
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.
Specimens seen. – Cuba: Sine loco: Hioram 2172 (BSC). — Prov. Santiago de Cuba: San Benito, 900 m, 24.2.1916, D. Jennings 4096 (B). — Prov. Holguín: Margin of Río Jaguani, 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).

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).
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 obute 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 obute 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 obute 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 obute, 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 lanceolato 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, sub- equilateral, 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 microsporangia 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 ×
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.


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.
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 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*.


*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.


Morphologically distinctive characteristics of *S. ovifolia*, in the group studied, are the subcordiform base of the lateral leaves, with the acrosopic 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.
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 Río Jimenoa, moist cliff, 800 m, not common, 18.11.1929, E. Ekman 14182 (S); La Vega, La Cienaga, south bank Río 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, 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 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 longi ciliatis, 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 ciliate 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, subequalateral, 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 ciliate, 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 ciliate. 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 acuminately. Microsporophylls ovate, 1.1-1.9 × 0.6-0.8 mm, the apex acute to shortly acuminate. Microsporangia globose, 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.

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 slope s, 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 brasilensis 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 intermittent 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 acuminated; 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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References


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