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The moss genus Isopterygium (Hypnaceae) in Latin America

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Abstract. The pleurocarpous moss genus *Isopterygium* (Hypnaceae) is revised for Latin America. Although as many as 92 species and varieties have been reported for the region over past years, these are currently accommodated by the present revision into only eight species. The most common taxon throughout most of Latin America, *Isopterygium tenerum* (Sw.) Mitt., is also the most polymophic and presently 45 taxa are recognized as synonyms. The other seven species are *I. affusum* Mitt. (Guadeloupe, Honduras, Venezuela, Brazil), *I. acutifolium* Irel. (Venezuela, Guyana), *I. byssobolax* (C. Müll.) Par. (Brazil, Bolivia, Argentina), *I. jamaicense* (Bartr.) Buck (Mexico, Guatemala, Jamaica), *I. subbrevisetum* (Hampe) Broth. (West Indies, Costa Rica to southern Brazil), *I. subglobosum* Herz. (Bolivia), and *I. tenerifolium* Mitt. (West Indies, southern Mexico to northern Argentina).

Isopterygium is a genus of pleurocarpous mosses that occurs predominantly in terrestrial habitats at low elevations in the subtropics and tropics. It was described in 1869 by William Mitten who placed it in the tribe Stereodonteae. According to him, members of this tribe differ from other closely related tribes by sharing important distinguishing features of capsules on long setae, short, double leaf costae or costae lacking, and dense alar cells. Besides *Isopterygium*, the tribe contains an assemblage of 12 other genera, many of which are not considered very closely related today, such as *Acrocladium* Mitt., *Ctenidium* (Schimp.) Mitt., *Entodon* C. Müll., *Heterocladium* B.S.G., *Leucomium* Mitt., *Plagiothecium* B.S.G., *Pleurozium* Mitt. and *Ptychomnion* (Hook. f. & Wils.) Mitt. Later, as moss taxonomy was refined and these heterogeneous taxa were sorted out, bryologists past (Brotherus 1923; Sainsbury 1955) and present (Corley *et al*. 1981; Iwatsuki 1987), placed *Isopterygium* in the family Plagiotheciaceae. At the same time, other bryologists (Crum & Anderson 1981; Gangulee 1978; Vitt 1984) have placed it in the Hypnaceae. Buck and Ireland (1985), however, did a morphological evaluation of the genera in the Plagiotheciaceae and, as a result, removed all genera except *Plagiothecium* from the family. Therefore, in this treatment, *Isopterygium* is placed in the Hypnaceae where it is one of approximately 40 genera.

When Mitten (1869) described *Isopterygium* he used very few taxonomic characters that would be considered important by present day bryologists. His description stated stems procumbent, branches of unequal length, arranged in fascicles, leaves complanate, distichous, three upper rows (a central and intermediate ones) scarcely evident, three lower rows undifferentiated, very shortly bicostate, cells narrow, smooth, capsules inclined or horizontal, oblong, cilia united into one. It is puzzling what Mitten meant when he

described the branches in fascicles. Within his new genus he placed only eight species: *I. affusum* Mitten, *I. planissimum* Mitten, *I. tenerifolium* Mitten, *I. brachyneuron* (C. Müller) Mitten, *I. chrismarii* (C. Müller) Mitten, *I. curvicolle* (C. Müller) Mitten, *I. leucophyllum* (Hampe) Mitten and *I. tenerum* (Swartz) Mitten. All of the species were from localities in the West Indies, Mexico and South America. The genus soon became a depository for scores of miscellaneous complanate-foliate and difficult to determine pleurocarpous mosses. It grew enormously during the next century as species were either described as new or were transferred into it from the large, unwieldy genus *Hypnum* Hedw. Eventually *Isopterygium* comprised about 390 taxa in the world, 92 of which have been reported for Latin America (van der Wijk *et al.* 1964, 1969).

Taxonomic studies during the last 20-30 years now make it possible to clearly delimit the genus *Isopterygium* as it occurs in Latin America and elsewhere. The Japanese bryologist, Zennoske Iwatsuki, has done more than anyone to clarify the classification of this complex and disorganized genus. His studies of *Taxiphyllum* Fleisch. (Iwatsuki 1963), *Herzogiella* Broth. (Iwatsuki 1965, 1970, synonyms *Dolichotheca* Lindb., *Sharpiella* Iwats.), *Plagiothecium* B. S. G. (Iwatsuki 1970), *Isopterygiopsis* Iwats. (Iwatsuki 1970) and recently, *Isopterygium* Mitt. and *Pseudotaxiphyllum* Iwats. (Iwatsuki 1987) have helped immensely to unravel the taxa in the closely related genera so that *Isopterygium* is more clearly defined. Studies on the North American (Ireland 1969), Mexican (Ireland 1984) and Latin American (Ireland 1991) *Isopterygium* species also have helped to a certain extent. A reasonable estimate would be that there are presently only about 40-50 species of *Isopterygium* in the world.

I am recognizing eight species of *Isopterygium* in the present treatment which has been prepared as a contribution to the family Hypnaceae for Flora Neotropica. Admittedly, the species are often very similiar morphologically and difficult to separate even when sporophytes are present. Some of the species may conceivably be only environmental forms. However, I believe it is prudent to recognize these eight species at this time until future field and laboratory studies dictate otherwise.

Morphology

Stems

The stems of *Isopterygium* are yellowish green to reddish brown, creeping and usually sparsely and irregularly branched. There are 1-3 outer rows of small, thick-walled cells in cross-section, surrounding several larger, thin-walled cells, usually with no evidence of a central strand. Filamentous pseudoparaphyllia, which are always present, are generally abundant and easy to find. They consist of 3-6 cells and they are 1, rarely 2, cells wide at the base.

Rhizoids

Rhizoids are reddish brown, smooth, with oblique end walls, arising in small clusters immediately below the juncture of the leaf and stem, primarily on the ventral surface of stems and branches.

Leaves

Both stem and branch leaves are similar. The leaves are smooth, often wrinkled and contorted when dry, ovate to lanceolate, generally flaccid, rarely rigid, close and imbricate, sometimes distant, complanate or occasionally concave, non-decurrent, rarely with 1-2 cells decurrent, usually erect to erect-spreading but some species have widespreading to squarrose leaves. Leaf margins are mostly plane to erect or sometimes recurved at base, often serrulate near apex, commonly entire below. The costa is short and double, often indistinct, occasionally lacking.

Leaf Cells

The upper and median leaf cells are always smooth, flexuose, linear-fusiform and thin- to firm-walled. The alar cells are clearly differentiated, quadrate, rectangular or rarely transversely elongate. There usually are no pits in the cell

walls although occasionally some of the basal cells are pitted.

Asexual Reproduction

Only two species, *I. tenerum* and *I. subbrevisetum*, were observed with asexual reproductive bodies. The bodies, produced infrequently on the stems and branches, are uniseriate, often branched, filamentous, and multicellular with papillose cells.

Sexual Condition

The plants are mostly autoicous, rarely dioicous, and occasionally no sex organs occur on any of the plants in some collections. No sex organs or sporophytes have ever been found on plants of *I. acutifolium*.

Setae

The setae are yellowish to brown when developing, becoming reddish brown at maturity. They are smooth, straight to somewhat curved and usually slightly twisted.

Capsules

The capsules are brown to reddish brown and inclined to cernuous in all of the species except *I. jamaicense*, which usually has erect ones. They are mostly ovoid to ellipsoid, sometimes cylindric, rarely subglobose as in *I. subglobosum*, straight or curved, smooth except for a few wrinkles at the neck and usually contracted below the mouth when dry.

Opercula

The opercula vary from conic to short-rostrate in each species and they are usually much shorter than the urn.

Peristome

The peristome of *Isopterygium* is hypnaceous, i.e. diplolepidous. The exostome teeth are light- to dark-yellowish and range in length from 200-350 μm. The endostome segments are nearly as long as the exostome teeth. There are usually 1-3 cilia in all species except *I. jamaicense*, which has erect capsules without cilia like so many other hypnaceous mosses with erect capsules.

Calyptrae

The calyptrae are white to yellow, cucullate, smooth and naked. They usually cover most of the capsule.

Spores

The spores are green, yellow or yellowish brown, spherical to ovoid, ranging in size from 7-14 μm. They appear smooth or minutely papillose under the light microscope but viewed under higher magnifications with the scanning electron microscope they have gemmate ornamentation.

Generic Relationships

Despite the fact that *Isopterygiopsis* and *Pseudotaxiphyllum* have been recently segregated from *Isopterygium* they are not as closely related to it as other genera. The filamentous pseudoparaphyllia commonly present on the stems of *Isopterygium* will clearly differentiate the genus from both of these genera which have no pseudoparaphyllia. *Isopterygium* is further distinguished from *Isopterygiopsis* by the rhizoids that are smooth, arising below leaf insertion, the small and thick-walled cortical stem cells, the filamentous propagula with papillose cell walls, the leaf margins that are usually serrate at the apex and the lack of an annulus. In contrast, *Isopterygiopsis* has papillose rhizoids arising in the leaf axils, sometimes an outer layer of large, thin-walled stem cells, cylindrical or fusiform propagula with smooth walls, leaf margins that are usually entire at apex and a differentiated annulus. *Pseudotaxiphyllum* is further distinguished from *Isopterygium* by its smooth-walled propagula in the form of various types of branchlets, its usually dioicous plants and its differentiated annulus.

Ectropothecium Mitt. and *Syringothecium* Mitt., two genera that Mitten (1869) placed in the tribe

Stereodonteae, are probably the nearest relatives of *Isopterygium*. *Ectropothecium*, whith about 237 taxa (van der Wijk *et al.* 1962), is badly in need of revision; many of the species within it differ primarily from *Isopterygium* by the filamentous pseudoparaphyllia that are wider at the base, often 2-3 cells wide instead of 1 cell or rarely 2 cells wide. *Syringothecium*, which contains only two species, is very similar gametophytically to *Isopterygium* but both taxa differ from those of *Isopterygium* by possessing a row of inflated cells across their leaf bases and, more important, an erect, much longer peristome (see discussion in Excluded Taxa). *Vesicularia*, still another genus closely related to *Isopterygium*, differs by possessing filamentous pseudoparaphyllia like *Ectropothecium* and it is distinguished from both genera by the much shorter and wider leaf cells.

In summary, *Isopterygium* is distinguished by the ± complanate plants, smooth rhizoids arising below leaf insertion, filamentous, 3-6-celled pseudoparaphyllia, small and thick-walled cortical stem cells, usually serrate apical leaf margins, occasional presence on the stems of simple or branched, filamentous, uniseriate, multicellular propagula with papillose cells, usually autoicous sexual condition and capsules that lack an annulus.

ISOPTERYGIUM Mitt., J. Linn. Soc. Bot. 12: 21. 1869. Type. *Isopterygium tenerum* (Sw.) Mitt., J. Linn. Soc. Bot. 12: 499. 1869. (Lectotype selected by Iwatsuki & Crosby 1979).

Plants often ± complanate, small to medium-sized, in thin to dense, light- to yellow-green glossy mats. Stems creeping, simple or sparingly and irregularly branched, cortical cells small and thick-walled in cross-section, surrounding larger, thinner walled cells, central strand usually absent; rhizoids smooth, on ventral surface of stems and branches just below juncture of leaves; filamentous pseudoparaphyllia present, of 3-6 cells in 1 row or rarely 2 rows near base. Asexual reproductive bodies sometimes present on stems and branches, uniseriate, often branched, filamentous, multicellular bodies with papillose cells. Stem and branch leaves similar, rigid or flaccid, crowded and imbricate to remote, erect-spreading or squarrose, commonly complanate-foliate, sometimes contorted when dry, smooth, flat or somewhat concave, symmetric or asymmetric, non-decurrent or rarely with 1-2 cells decurrent, ovate or lanceolate, sometimes oblong, acute to acuminate; margins plane to erect, sometimes recurved at base, serrulate above the middle, mostly entire below, sometimes entire throughout; costa short and double, sometimes lacking; cells often flexuose, thin to firm-walled, linear-fusiform, smooth, with walls not pitted or occasionally those of basal cells pitted; alar cells usually clearly differentiated, quadrate to rectangular, rarely transversely elongate. Autoicous or rarely dioicous; perigonia scattered along the stems; perichaetia at base of stems, leaves oblong-lanceolate, gradually acuminate, margins plane. Setae smooth, elongate, straight to curved, usually twisted, yellow, brown or reddish brown; capsules inclined to cernuous, or sometimes erect, straight or curved when mature, brown to red-brown, cylindric, ellipsoid or ovoid, smooth or sometimes wrinkled at neck when dry, usually contracted below the mouth when dry; operculum conic to short-rostrate, shorter than the urn; annulus none; peristome double, exostome teeth cross-striolate below, papillose above, bordered, trabeculate at back; endostome with a high to low basal membrane, keeled segments, and cilia shorter than the segments and in groups of 1-3, sometimes absent. Spores spherical to ovoid, smooth or minutely papillose. Calyptra cucullate, smooth, naked.

Key to the Species of *Isopterygium*

1. Leaves narrowly lanceolate, mostly more than 3 times as long as broad, usually distant, wide-spreading to squarrose, straight and symmetric; West Indies, Costa Rica, Nicaragua, Panama, Venezuela, Surinam, French Guiana, Ecuador, Peru, Brazil.....8. *I. subbrevisetum*

1. Leaves ovate, ovate-lanceolate or oblong, mostly less than 3 times as long as broad, close or rarely distant, erect to squarrose, often curved and asymmetric.

2. Leaves with alar regions strongly differentiated, composed of quadrate to rectangular cells in several rows, 4-15 cells on margins.

3. Leaves short, 0.4-0.8 mm in length, acuminate; plant terrestrial; Brazil, Bolivia, Argentina .....4. *I. byssobolax*

3. Leaves long, 0.8-1.2 mm in length, acute; plantsaquatic;Venezuela,Guyana..... ..... 5. *I. acutifolium*

2. Leaves with alar regions weakly differentiated, only a small group of quadrate to rectangular cells present, 2-4 cells on margins.

4. Leaves 1-3 mm long; plants aquatic; Honduras, Guadeloupe,Venezuela, Brazil..... .....3. *I. affusum*

4. Leaves 0.7-1.5 mm long; plants terrestrial.

5. Capsules erect or rarely inclined, not or scarcely contracted below mouth when dry; Jamaica, Mexico, Guatemala.....6. *I. jamaicense*

5. Capsules inclined to horizontal, rarely erect, usually strongly contracted below mouth when dry.

6. Capsules subglobose, about as broad as long, not contracted below mouth when dry; Bolivia.....7. *I. subglobosum*

6. Capsules ovoid to ellipsoid, longer than broad, strongly contracted below mouth when dry.

7. Plants large, stems often 2-4 cm long; leaves 1.0-1.5 mm long; setae usually 2-3 cm long; asexual reproductive bodies lacking; West Indies, southern Mexico to Panama and from Colombia and Venezuela to northern Argentina .....2. *I. tenerifolium*

7. Plants small, stems seldom over 2 cm long; leaves 0.7-1.2 mm long; setae usually 0.5-1.2 cm long; asexual reproductive bodies sometimes present on stems, filamentous, simple or branched, multicellular, with papillose cells; West Indies, Mexico to northern Argentina and Uruguay.....1. *I. tenerum*

1. *Isopterygium tenerum* (Sw.) Mitt., J. Linn. Soc. London, Bot. 12: 499. 1869.

Hypnum tenerum Sw., Fl. Ind. Occ. 3: 1817. 1806; *Isothecium tenerum* (Sw.) Brid., Bryol. Univ. 2: 385. 1827. Type. Jamaica. *Swartz 2719* (holotype, S; isotypes, BM, C).

Hypnum micans Sw., Adnot. Bot. 175. 1829; *Rhynchostegium micans* (Sw.) Aust., Bot. Gaz. 1: 30. 1875; *Isopterygium micans* (Sw.) Kindb., Enum. Bryin. Exot. 21. 1888; *Plagiothecium micans* (Sw.) Par., Index Bryol. (Ed.l) 963. 1896.

Hypnum splendidulum Hornsch., Fl. Bras. l(2): 77. 1840; *Isopterygium splendidulum* (Hornsch.) Broth., Nat. Pfl. l(3): 1081. 1908.

Hypnum fulvum Hook. & Wils. *in* Drumm., Musci Amer. (Southern States) 110. 1841, hom. illeg.; *Plagiothecium fulvum* Jaeg. & Sauerb., Ber. St. Gall. Naturw. Ges. 1876-77: 450. 1878; *Isopterygium fulvum* (Jaeg. & Sauerb.) Kindb., Can. Rec. Sci. 6(2): 72. 1894; *Plagiothecium micans* var. *fulvum* (Jaeg. & Sauerb.) Par., Index Bryol. (Ed.1) 963. 1896.

Hypnum brachyneuron C. Müll., Bot. Zeit. 3: 109. 1845; *Isopterygium brachyneuron* (C. Müll.) Mitt., J. Linn. Soc. Bot.12: 498. 1869.

Hypnum curvicolle C. Müll., Syn. 2: 684. 1851, "*curvicollum*"; *Isopterygium curvicolle* (C. Müll.) Mitt., J. Linn. Soc. Bot. 12: 498. 1869; *Isopterygium curvicolle* var. *majus* Broth. *in* Bauer, Verh. Zool. Bot. Ges. Wien 55: 576, 578. 1905, Rev. Bryol. 32: 11. 1905, nom. nud.

Hypnum leucophyllum Hampe *in* C. Müll., Syn. 2: 280. 1851; *Isopterygium leucophyllum* (Hampe) Mitt., J. Linn. Soc. Bot. 12: 499. 1869.

Hypnum hospitans Hampe, Ann. Sci. Nat. Bot.

ser. 5,5: 313. 1866; *Isopterygium hospitans* (Hampe) Jaeg. & Sauerb., Ber. St. Gall. Naturw. Ges. 1876-77: 434. 1878.

Hypnum cordovense C. Müll., Linnaea 38: 652. 1874; *Isopterygium cordovense* (C. Müll.) Jaeg. & Sauerb., Ber. St. Gall. Naturw. Ges. 1876-77: 436. 1878.

Hypnum leptomiton C. Müll., Linnaea 38: 652. 1874; *Isopterygium leptomiton* (C. Müll.) Jaeg. & Sauerb., Ber. St. Gall. Naturw. Ges. 1876-77: 436. 1878.

Hypnum laxum Hampe, Vid. Medd. Naturh. For. Kjoebenh. ser. 3,6: 166. 1875, hom. illeg. non P. Beauv. 1805; *Ectropothecium laxum* Jaeg. & Sauerb., Ber. St. Gall. Naturw. Ges. 1877-78: 266. 1880; *Isopterygium laxum* (Jaeg. & Sauerb.) Broth., Bih. K. Svensk. Vet. Ak. Handl. 21 Afd. 3(3): 56. 1895.

Hypnum divaricatulum C. Müll. *ex* Hampe, Vid. Medd. Naturh. For. Kjoebenh. ser. 3,6: 167. 1875; *Isopterygium divaricatulum* (Hampe) Broth., Nat. Pfl. 1(3): 1081. 1908.

Hypnum lamprophyllum Hampe, Vid. Medd. Naturh. For. Kjoebenh. ser. 3,6: 167. 1875, hom. illeg. non (Mitt.) C. Müll. 1874 ; *Ectropothecium lamprophyllum* Jaeg. & Sauerb., Ber. St. Gall. Naturw. Ges. 1877-78: 266. 1880; *Isopterygium lamprophyllum* (Jaeg. & Sauerb.) Broth., Nat. Pfl. 1(3): 1081. 1908.

Ectropothecium clandestinum Ångstr., Oefv. K. Vet. Ak. Fohr. 33(4): 43. 1876; *Isopterygium clandestinum* (Ångstr.) Broth., Nat. Pfl. 1(3): 1081. 1908.

Isopterygium streptopodium Besch., Ann. Sci. Nat. Bot. ser. 6,3: 257. 1876.

Hypnum brachystelium Hampe, Vid. Medd. Naturh. For. Kjoebenh. ser. 4,1: 139. 1879; *Isopterygium brachystelium* (Hampe) Kindb., Enum. Bryin. Exot. 100. 1891.

Hypnum citrinum Hampe, Vid. Medd. Naturh. For. Kjoebenh. ser. 4,1: 142. 1879; *Isopterygium citrinum* (Hampe) Kindb., Enum. Bryin. Exot. 100. 1891.

Hypnum cacti C. Müll., Linnaea 42: 437. 1879; *Isopterygium cacti* (C. Müll.) Kindb., Enum. Bryin. Exot. 20. 1888.

Hypnum eutrypherum C. Müll., Linnaea 42: 497. 1879; *Isopterygium eutrypherum* (C. Müll.) Par., Ind. Bryol. 707. 1897.

Hypnum restitutum Hampe, Vid. Medd. Naturh. For. Kjoebenh. ser. 4,1: 141. 1879; *Isopterygium restitutum* (Hampe) Kindb., Enum. Bryin. Exot. 100. 1891.

Hypnum chlorosum Hampe, Flora 64: 414. 1881; *Isopterygium chlorosum* (Hampe) Par., Ind. Bryol. 706. 1897.

Isopterygium subtenerum Besch., J. de Bot. 5: 348. 1891.

Isopterygium guarapense Besch., J. de Bot. 5: 349. 1891.

Plagiothecium radicisetum C. Müll., Malpighia 10: 515. 1896; *Isopterygium radicisetum* (C. Müll.) Broth., Nat. Pfl. 1(3): 1082. 1908.

Taxicaulis adflatus C. Müll., Hedwigia 36: 115. 1897; *Isopterygium adflatum* (C. Müll.) Par., Ind. Bryol. Suppl. 217. 1900.

Taxicaulis cylindraceus C. Müll., Nuov. Giorn. Bot. Ital. n. ser. 4: 151. 1897; *Isoptergyium cylindraceum* (C. Müll.) Par., Ind. Bryol. Suppl. 218. 1900.

Taxicaulis trichopelma C. Müll., Bull. Herb. Boiss. 5: 210. 1897; *Isopterygium trichopelma* (C. Müll.) Par., Ind. Bryol. Suppl. 221. 1900.

Taxicaulis weigeltii C. Müll., Hedwigia 37: 252. 1898, "*weigelti*"; *Isopterygium weigeltii* (C. Müll.) Broth., Nat. Pfl. 1(3): 1081. 1908.

Taxicaulis rufisetulus C. Müll., Hedwigia 37: 253. 1898; *Isopterygium rufisetulum* (C. Müll.) Par., Ind. Bryol. Suppl. 220. 1900.

Taxicaulis araneosetus C. Müll., Hedwigia 37: 255. 1898; *Isopterygium araneosetum* (C. Müll.) Par., Ind. Bryol. Suppl. 218. 1900, "*araucosetum*".

Isopterygium callochlorum Broth., Bih. K. Svensk. Vet. Ak. Handl. 26 Afd. 3(7): 46. 1900.

Microthamnium angustirete Broth., Bih. K. Svensk. Vet. Ak. Handl. 26 Afd. 3(7): 48. 1900; *Isopterygium angustirete* (Broth.) Broth., Nat. Pfl. 1(3): 1082. 1908.

Plagiothecium bromeliophilum C. Müll., Hedwigia 40: 59. 1901; *Isopterygium bromeliophilum* (C. Müll.) Broth., Nat. Pfl. 1(3): 1082. 1908.

Plagiothecium aurantiacum C. Müll., Hedwigia 40: 60. 1901; *Isopterygium aurantiacum* (C. Müll.) Broth., Nat. Pfl. 1(3): 1082. 1908.

Plagiothecium flaviusculum C. Müll., Hedwigia 40: 59. 1901; *Isopterygium flaviusculum* (C. Müll.) Broth., Nat. Pfl. 1(3): 1082. 1908.

Taxicaulis bahiense C. Müll., Hedwigia 40: 59. 1901; *Isopterygium bahiense* (C. Müll.) Broth., Nat. Pfl. 1(3): 1081. 1908.

Taxicaulis afflictus C. Müll., Hedwigia 40: 68. 1901; *Isopterygium afflictum* (C. Müll.) Broth., Nat. Pfl. 1(3): 1083. 1908.

Taxicaulis ammophilus C. Müll., Hedwigia 40: 66. 1901; *Isopterygium ammophilum* (C. Müll.) Broth., Nat. Pfl. 1(3): 1081. 1908.

Taxicaulis fabroniiformis C. Müll., Hedwigia 40: 69. 1901; *Isopterygium fabroniiforme* (C. Müll.) Broth., Nat. Pfl. 1(3): 1083. 1908, "*fabroniaeforme*".

Plagiothecium pseudotenerum Broth. & Kindb. *ex* Kindb., Rev. Bryol. 28: 54. 1901; *Isopterygium pseudotenerum* (Broth. & Kindb.) Broth., Nat. Pfl. 1(3): 1082. 1908.

Isopterygium peruvianum Broth., Bot. Jahrb. 56(Beibl. 123): 21. 1920.

Isopterygium fernandezianum Broth. *in* Skotts., Nat. Hist. Juan Fernandez 2(12): 440. 1924.

Isopterygium fernandezianum var. *longisetum* Broth. *in* Skotts., Nat. Hist. Juan Fernandez 2(12): 440. 1924.

Isopterygium brachyneuroides Broth., Denkschr. Ak. Wiss. Wien Math. Nat. Kl. 83: 327. 1926.

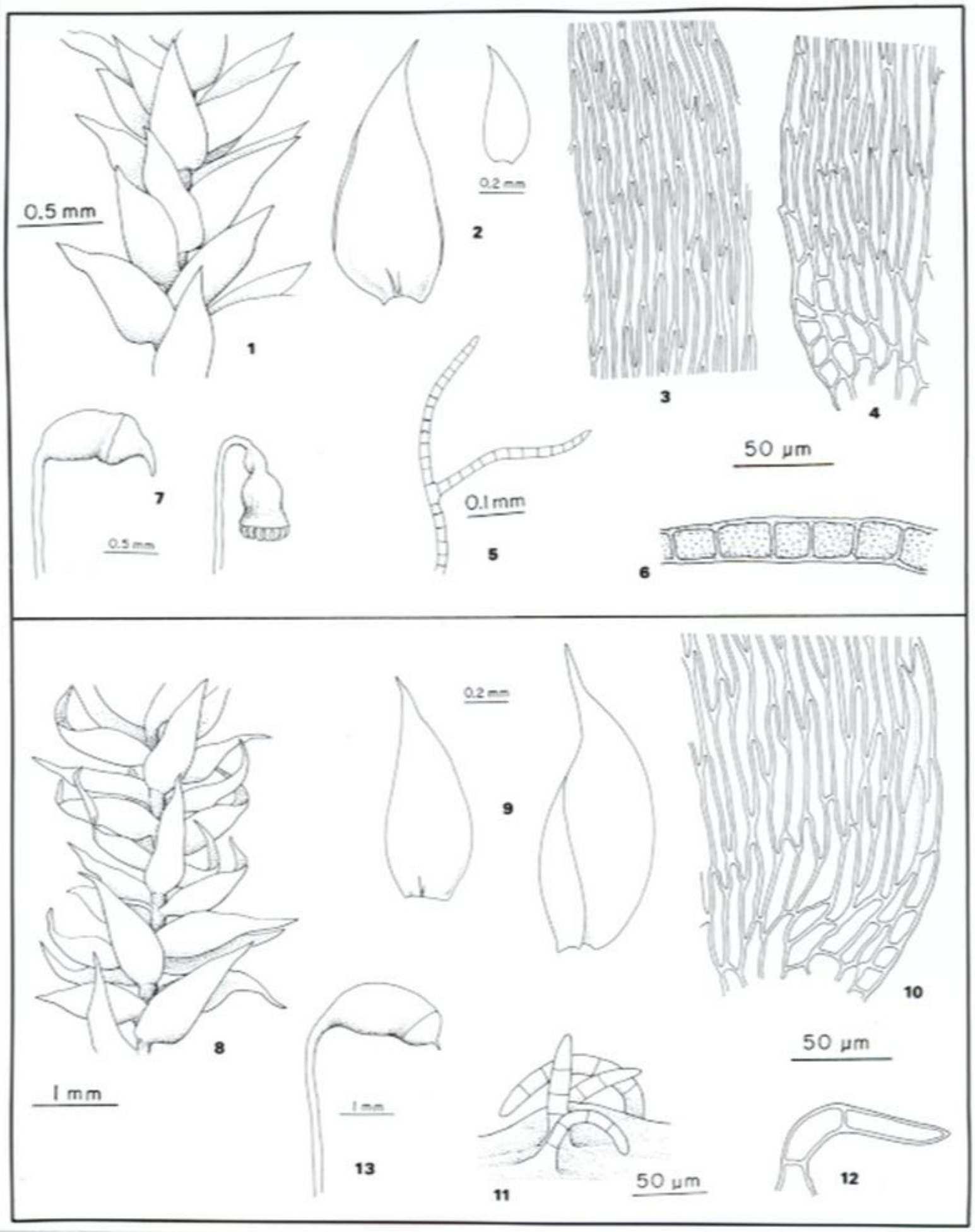
Isopterygium diminutivum Bartr., J. Washington Acad. Sci. 18: 581. 1928, "*dimunitivum*".

Plants white- to yellow-green, in thin to dense mats. Stems 1-2 cm long, rarely 3 cm, 0.5-1.5(3) mm wide, complanate-foliate, simple or irregularly branched. Asexual reproductive bodies sometimes present on stems, uniseriate, multicellular, simple or branched, often more than 0.5 mm long, green or brown, cells papillose. Leaves flaccid, close, complanate, erect-spreading, often secund at the tips, smooth, 0.7-1.2 mm long, 0.2-0.5 mm wide, ovate to lanceolate, often asymmetric, acuminate; margins plane, serrate to serrulate above the leaf middle, serrulate to entire below, rarely entire throughout; costa none or weak, short and double; cells smooth, 38-132 µm long, 5-12 µm wide; alar cells short-rectangular to quadrate or transversely elongate, in small groups. Autoicous. Setae yellow to reddish brown, (0.3)0.5-1.2(2.2) cm long. Capsules cernuous or rarely erect, curved or sometimes straight, 0.5-1.5 mm long, ovoid to ellipsoid, usually strongly contracted below the mouth when dry. Opercula conic-apiculate to obliquely short-rostrate. Peristome teeth up to 0.2 mm long. Spores 9-14 µm in diameter.

Illustrations: Crum and Anderson 1981 (Figs. 585 A-H, 586 A-B); Breen 1963 (Plate 87, figs. 1-7 as *I. micans*); Ireland 1969 (Plate 14-15); Ireland (in press) Moss Flora of Mexico; Ireland (in press) Flora Neotropica; Figs. 1-7.

Chromosome number: n=11+m (as *I. micans* (Sw.) Kindb., Al-Aish & Anderson 1960, 1961).

Distribution: An extremely common species occurring throughout the West Indies, and from Mexico to northern Argentina and Uruguay.



Figs. 1-7. *Isopterygium tenerum*. 1. Enlargement of portion of stem. 2. Leaves. 3. Median leaf cells. 4. Alar cells. 5. Asexual reproductive body. 6. Cells of asexual reproductive body. 7. Operculate and inoperculate capsules (dry).

Figs. 8-13. *Isopterygium tenerifolium*. 8. Enlargement of portion of stem. 9. Leaves. 10. Alar cells. 11. Pseudoparaphyllia around branch primordium. 12. Enlargement of pseudoparaphyllium. 13. Operculate capsule (wet).

Ecology: In forests on tree trunks, rotting logs and stumps, woody debris, humus, soil banks, and rock, especially sandstone and limestone; sometimes in swamps, humid grasslands and on river banks. Primarily at low elevations from sea level to 500 m but known to occur up to 3200 m.

Representative specimens examined.

MEXICO. Colima: Laguna María, Parque Nacional El Jabalí, *Arreguin 790e* (MEXU). **Quintana Roo:** Laguna Ciega, Isla de Cozumel, 5 m, ca. 20° 36' N, 86° 44' W, *Delgadillo 4402* (MEXU, MICH, MO). **San Luis Potosí:** W of Xilitla, 1035 m, *Sharp 5935* (CANM, MEXU, MICH, TENN).

GUATEMALA. Quezaltenango: Vicinity of Fuentes Georginas, slopes of Volcán de Zunil, 2500-2800 m, *Standley 85946* (F, FH, MICH, NY).

BELIZE. El Cayo: San Agustín, *Mains 4084* (F, FH, MICH, NY).

HONDURAS. Atlántida: Lancetilla Valley, near Tela, 20-600 m, *Standley 55803* (F, FH, NY, US).

NICARAGUA. Sierra de Managua, 600-900 m, *Garnier 715* (NY).

COSTA RICA. Limón: Near Carmen Station on Indiana Branch, ca. 30 m, *Standley & Valerio 48390* (FH, US).

PANAMA. Bocas del Toro: Cerro Colorado, 6.9 km above Chami Camp, 1700 m, *Allen 5335* (MO).

BERMUDA. Paget Marsh, *Britton 1855* (MICH, MO, NY, TENN).

BAHAMAS. Andros Is.: Coppice, near Nicholl's Town, *Small & Carter 8968* (NY, US). **Great Bahama I.:** *Britton & Millspaugh 2628* (NY). **New Providence I.:** Prospect Ridge, *Degener 19095* (NY).

CUBA. Santiago: Slopes and summit of El Yunque, near Baracoa, 305-610 m, *Pollard & Palmer 110* (BM, NY, US).

JAMAICA. Portland: Murdock's Gap, 1740 m, *Crosby 3536* (CANM, MEXU, MO, NY).

HAITI. Département du Nord, vicinity of Dondon, ca. 400 m, *Leonard 8578* (CANM).

DOMINICAN REPUBLIC. Prov. El Seibo, 19 km N of Hato Mayor on road to El Valle, 300 m, *Mejía et al. 10259* (MO, NY).

PUERTO RICO. Río Sabana, Sierra de Luquillo, S from Luquillo, *Steere 5172* (MICH, MO).

VIRGIN ISLANDS. St. Thomas: Slopes of St. Peter Mt., just off Crown Mt. Rd., 425 m, *Buck 3280* (NY).

WINDWARD ISLANDS. Guadeloupe: Rivière Pérou, *Le Gallo 811, 814, 815, 819, 820, 823* (CANM). **Dominica:** Morne Micotrin, *Elliott 1129c* (BM). **Martinique:** Rivière de Tivoli, 320 m, *Stehlé 4039* (NY). **St. Lucia:** Between Castries and Dennery, *Hegewald 9607* (NY). **St. Vincent:** Morn Garn, 460 m, *Elliott 56b* (BM). **Grenada:** St. George's, 26 Jun 1906, *Broadway* (NY).

COLOMBIA. Meta: Outskirts of Villavicencio, 500 m, *Schultes 11097* (H, TENN, US), *11110* (BM, CANM, COL, F, MICH, MO, NY).

VENEZUELA. Amazonas: Dept. Río Negro, along Río Mawarinuma, just outside Cañón Grande, vicinity of Neblina base camp, ca. 140 m, *Buck 11227, 11352* (NY).

TRINIDAD. Vicinity of Tabaquite, *Britton 2615* (FH, NY, US).

GUYANA. Demerara-Mahaica Region, along Linden-Soesdyke Hwy., ca. 1.6 km E of Soesdyke, 1-50 m, *Pipoly 9286A, 9295* (NY).

SURINAM. Dist. Nickerie, Kabalebo Dam project, 0-50 m, *Florschütz-de Waard & Zielman 5496, 5687, 5712* (U).

ECUADOR. Azuay: Gualaquiza, *Allioni 8300, 8362, 8379* (H). Galapagos Is., Isla Santa Cruz, trail from Bella Vista to Media Luna, 550 m, *Sipman M-234* (U).

PERU. Loreto: Iquitos, ca. 100 m, *Killip & Smith 26942* (CANM, NY).

BRAZIL. Acre: 15 km E of Rio Branco along road to Abuna, *Reese & McPherson 13195* (CANM, NY). **Amazonas:** Estrada Manaus-Itacoatiara, km 26, reserva florestal Ducke, *Lisbôa 57, 63, 70* (MG).

BOLIVIA. La Paz: Prov. Nor Yungas, 'Alto Coro Coro', 7 km N of Caranavi, 15° 46' S, 67° 32' W, *Lewis 84-066* (LPB).

CHILE. Juan Fernández Is., Masatierra, Valle Colonial, 435 m, *Skottsberg & Skottsberg 484* (NY).

PARAGUAY. Amambay: Parque Nacional Cerro Corá, trail up Cerro Muralla, ca. 300 m, ca. 22°40' S, 56°00' W, *Buck 12518* (NY).

ARGENTINA. Lago Encondido, *Matteri 799* (BA).

URUGUAY. Canelones, Banado del Negro, cerca de Airoyo Pando, *Castellanos 8582* (FH).

Isopterygium tenerum is the most common species of *Isopterygium* in Latin America. It is also the most variable and its polymorphism undoubtedly accounts for the large number of taxa that have been placed in synonymy. A total of 45 taxa are recognized as synonyms of *I. tenerum* in the present treatment. Many of the taxa were described as new on the basis of differences in the length and shape of their stem leaves. However, a study of scores of *I. tenerum* specimens from Latin America indicates that these characters are extremely variable and they are therefore unreliable criteria when delimiting taxa of *Isopterygium* using only these two features.

Redfearn (1956) reached a similar conclusion after a biometric analysis of the stem leaf variation of subspecific taxa in the *P. micans* (Sw.) Par. (= *I. tenerum*) complex in the southeastern United States.

Isopterygium tenerum in its typical form is best distinguished by the usually complanate, medium-sized plants with stems 1-2 cm long, 0.5-1.5 mm wide, leaves ovate-lanceolate, asymmetric, acuminate, close, erect-spreading, 0.7-1.2 mm long, alar cells in small groups of short-rectangular to quadrate or transversely elongate cells, asexual reproductive bodies sometimes present on stems, filamentous, multicellular, the cells papillose, setae 0.5-1.2 cm long, rarely up to 2.2 cm, and capsules ovoid to ellipsoid, inclined to horizontal, usually strongly contracted below the mouth when dry, 0.5-1.5 mm long.

2. *Isopterygium tenerifolium* Mitt., J. Linn. Soc. Bot. 12: 499. 1869. Type. Brazil. Amazon River, *Spruce 1060* (holotype, NY; isotype, BM).

Plagiothecium inordinatum Mitt. *ex* Spruce, Cat. Musc. Amaz. And. 16. 1867. nom. nud.

Ectropothecium longisetum Schimp. *ex* Besch., Ann. Sci. Nat. Bot. ser. 6,3: 258. 1876; *Isopterygium longisetum* (Schimp. *ex* Besch.) Broth., Nat. Pfl. 1(3): 1082. 1908, hom. illeg., non Brotherus 1895. *Isopterygium altisetum* Crum & Steere, Bryologist 59: 254. 1956.

Plagiothecium villae-ricae Besch., Mem. Soc. Sci. Nat. Cherbourg 21: 271. 1877.

Isopterygium longisetum Broth., Bih. K. Svensk. Vet. Ak. Handl. 21 Afd. 3(3): 55. 1895.

Taxicaulis stigmocarpus C. Müll., Nuov. Giorn. Bot. Ital. n. ser. 4: 150. 1897; *Isopterygium stigmocarpum* (C. Müll.) Par., Ind. Bryol. Suppl. 220. 1900.

Taxicaulis excelsipes C. Müll., Hedwigia 37: 253. 1898; *Isopterygium excelsipes* (C. Müll.) Par., Ind. Bryol. Suppl. 219. 1900.

Plagiothecium meteoriaceum C. Müll., Bull. Herb. Boiss. 6: 120. 1898; *Isopterygium meteoriaceum* (C. Müll.) Par., Ind. Bryol. Suppl. 220. 1900.

Plagiothecium proximum C. Müll., Hedwigia 38(Beibl.): 59. 1899. nom. nud.

Plagiothecium paludigenum C. Müll., Hedwigia 40: 58. 1901; *Isopterygium paludigenum* (C. Müll.) Broth., Nat. Pfl. 1(3): 1082. 1908.

Plagiothecium lonchopelmatum C. Müll., Hedwigia 40: 59. 1901; *Isopterygium lonchopelmatum* (C. Müll.) Broth., Nat. Pfl. 1(3): 1082. 1908.

Plagiothecium restingae C. Müll., Hedwigia 40: 60. 1901; *Isopterygium restingae* (C. Müll.) Broth., Nat. Pfl. 1(3): 1082. 1908.

Plagiothecium restingae var. *tenue* C. Müll., Hedwigia 40: 60. 1901.

Plagiothecium jamaicense C. Müll., Hedwigia 40: 61. 1901.

Isopterygium fecundum Ren. & Card., Bull. Soc. R. Bot. Belg. 41(1): 140. 1905.

Isopterygium manaosense Broth., Hedwigia 45: 286. 1906.

Isopterygium vagans Herz., Biblioth. Bot. 87: 152. 1916.

Plants yellow-green to green, in thin, loose mats. Stems up to 4 cm long, 2-3 mm wide, complanate-foliate, simple or irregularly and freely branched. Asexual reproductive bodies lacking. Leaves flaccid, close, complanate, wide-spreading to squarrose, smooth, usually wrinkled and contorted when dry, 1.0-1.5 mm long, 0.4-0.7 mm wide, ovate-lanceolate to ovate, often curved and asymmetric, acuminate; margins plane to erect throughout, serrate to serrulate above, serrulate below; costa none or weak, short and double; cells smooth, 71-141 µm long, 5-7 µm wide; alar cells short-rectangular to quadrate, in small groups with 1-2 cells on margins. Autobrown to reddish brown, (1.5)2-3(4) cm long.. Capsules horizon-

tal to pendulous, sometimes nearly erect, 1.0-1.5 mm long, ovoid to ellipsoid, contracted below the mouth when dry. Opercula obliquely short-rostrate. Peristome teeth up to 0.2 mm long. Spores 9-14 μm in diameter.

Illustrations: Ireland (in press) Flora Neotropica; Figs. 8-13.

Chromosome number: unreported.

Distribution: West Indies, southern Mexico to Panama, and from
Colombia and Venezuela to northern Argentina.

Ecology: On tree trunks, rotten stumps, woody debris and humus in forests, sometimes on soil banks and wet cliffs along rivers and near waterfalls, rarely in moist grasslands. At low to high elevations from 200-3000 m.

Representative specimens examined.
MEXICO. Chiapas: 9 km S de Finca Liquidambar, municipio Angel Albino Corzo, 15° 42' N, 92° 45' W, *Delgadillo 4676, 4678, 4679b, 4726, 4728a* (MEXU); *Cárdenas 4163, 4189* (MEXU).
HONDURAS. El Paraiso: Between Las Mesas and Ojo de Agua, 700 m, *Morton 6981, 6982* (US).
COSTA RICA. Limón: Ca. 2 km S and 1 km E of Río Colorado, *Stevens et al. 25048* (MO).
PANAMA. Bocas del Toro: Vicinity of Fortuna Dam, 4.5 km along pipeline road leaving Chiriqui Grande road at Continental Divide, 850-950 m, *Allen 5635* (MO). Barro Colorado I., Canal Zone, Jan-Feb 1938, *Willis s.n.* (MICH).
CUBA. San Mateo, near Pinar del Río, *Wright 160* (CANM, FH, MICH, NY, TENN).
JAMAICA. Clarendon: Mason River Savanna, 4.4 km NW of Kellits, 700 m, *Crosby 3118* (NY).
DOMINICAN REPUBLIC. Peravia, La Nevera area, 47 km S of Constanza, 2070-2100 m, *Buck 5247* (NY).
PUERTO RICO. Cerro de la Punta, Cordillera Central, S of Jayuya, *Steere 6212* (MICH, MO, NY, US), *6238* (MICH, MO).
WINDWARD ISLANDS. Guadeloupe: Without locality, *Duss 124* (H, NY), *1045, 1046, 1092, 1260* (NY). **Dominica:** Grand Souffriere, on lip of crater, *Elliott 1841, 1843* (BM). **Martinique:** Without locality, *Duss 1* (H, NY), *25, 332* (NY).
COLOMBIA. Santander: Vicinity of Las Vegas, 2600-3000 m, *Killip & Smith 16026* (NY).
VENEZUELA. Bolívar: Distrito Roscio, 13 km al Noreste de Santa Elena de Uairén, 900 m, *Steyermark & Liesner 127566* (MO). **Tachira:** 12 km SW of Punta de Piedra, towards Sacramento, 175 m, *Steyermark & Rabe 96615* (US).
GUYANA. Without locality, *Parker s.n.* (NY).
SURINAM. Sabanpassie, *Teunissen & Wildschut 11931* (U).
ECUADOR. Oriente: Without locality, 1800 m, Jun 1910, *Allioni s.n.* (H).
BRAZIL. Bahia: Between Ibirapitanga and Ubaitaba, 200 m, *Schäfer-Verwimp & Verwimp 8753* (NY). **Pará:** Ponta Grossa, Rio Tapajas, *Swallen 6936* (FH, US). **Santa Catarina:** Tubarao, *Ule 982* (H). **Sao Paulo:** Near Cerqueira-Cesar, 500 m, Kryptogamae exsiccatae *2898, Schiffner* (H, M, US).
BOLIVIA. Santa Cruz: Prov. Chiquitos, 'Cerro Tataraqui', 13 km NE of Roboré, 18° 16' S, 59° 39' W, *Lewis* 85-1307 (LPB).
PARAGUAY. Santo Antonio, Colonia "Elis", *Lindman B231* (NY).
ARGENTINA. Posados, Misiones, *Eckman 2096* (FH).

Isopterygium tenerifolium is best recognized by the large plants, stems up to 4 cm long, 2-3 mm wide, leaves ovate-lanceolate to ovate, often curved and asymmetric, acuminate, flaccid, close, complanate, usually wrinkled and contorted when dry, 1.0-1.5 mm long, with poorly developed alar cells, 1-2 short-rectangular to quadrate cells on the margins, setae, 2-3 cm long, rarely up to 4 cm, and capsules ovoid to ellipsoid, horizontal to pendulous, contracted below the mouth when dry, 1.0-1.5 mm long.

The species often has been confused with many other Latin American *Isopterygium* species, especially large forms of *I. tenerum* ("*fulvum*" form). Fortunately, both species usually produce sporophytes and the long setae of *I. tenerifolium*, longer than any of the other Latin American species of *Isopterygium*, will distinguish it from *I. tenerum* as well as the others.

3. *Isopterygium affusum* Mitt., J. Linn. Soc. Bot. 12: 499. 1869. Type. Brazil. Taruma River, *Spruce 1059* (lectotype selected by Z. Iwatsuki in 1966, NY; isolectotype, BM); Province Ceara, Sierra de Araripe, *Gardner 106c* (isosyntype, BM).

Isopterygium herminieri Schimp. *ex* Besch., Ann. Sci. Nat. Bot. ser. 6,3: 256. 1876.

Ectropothecium submersum Broth., Bih. K. Svensk. Vet. Ak. Handl. 26 Afd. 3(7): 48. 1900; *Isopterygium submersum* (Broth.) Broth., Nat. Pfl. 1(3): 1081. 1908.

Plagiothecium fontigenum C. Müll., Hedwigia 40: 58. 1901; *Isopterygium fontigenum* (C. Müll.) Buck & Irel., Flora Neotropica, Monograph 50: 19. 1989.

Isopterygium aquaticum Robins., Bryologist 67: 453. 1964, hom. illeg., non Dixon 1922; *Isopterygium irelandii* Robins., Bryologist 70: 43. 1967.

Plants yellow-green to green, in thin, loose masses. Stems up to 10 cm long, 1.5-3.5 mm wide, complanate-foliate, simple or irregularly branched. Asexual reproductive bodies lacking. Leaves flaccid, close, complanate, erect-spreading, smooth, usually wrinkled and contorted when dry, 1-3 mm long, 0.4-1.0 mm wide, ovate-lanceolate to ovate, symmetric or often asymmetric, acuminate to long-acuminate; margins plane, serrulate above, entire below; costa none or weak, short and double; cells smooth, 66-118 µm long, 5-7 µm wide; alar cells weakly differentiated, rectangular or rarely quadrate, in small groups with 1-2 cells on margins. Autoicous or rarely dioicous. Setae brown to reddish brown, 1.5-2.2 cm long. Capsules inclined, 1.0-1.2 mm long, ovoid to ellipsoid, somewhat contracted below the mouth when dry. Opercula obliquely short-rostrate. Peristome teeth up to 0.2 mm long. Spores immature.

Illustrations: Robinson 1964 (Figs. 33-36); Ireland (in press) Flora Neotropica; Figs. 14-17.

Chromosome number: unreported.

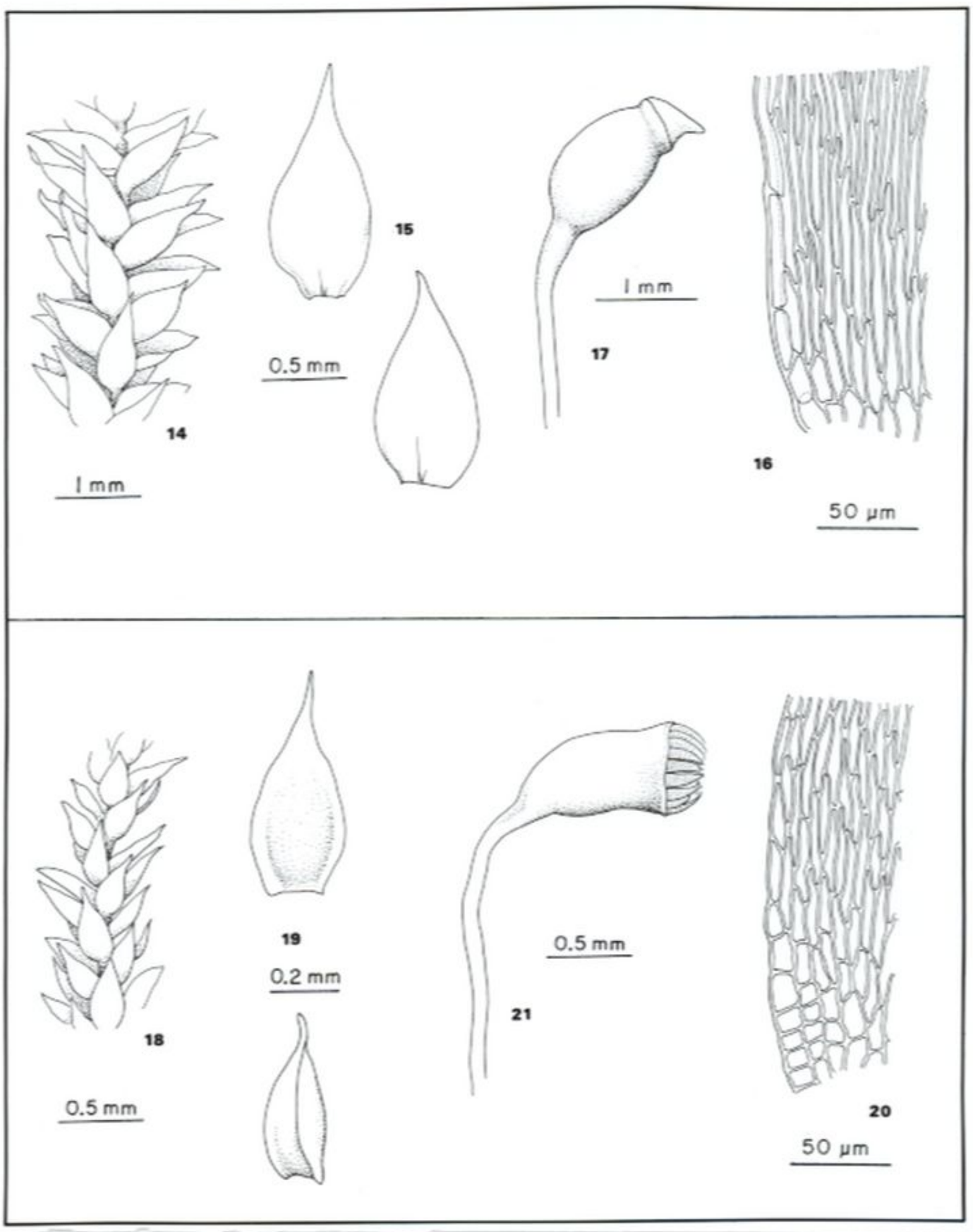
Distribution: Honduras, Guadeloupe, Venezuela and Brazil.

Ecology: An aquatic species on rock in and beside rivers and streams, near waterfalls, or occasionally at bases of tufts of grasses and sedges in marshes. Occurring at altitudes of 430-1350 m.

Representative specimens examined. **HONDURAS. Morazán:** El Quebracho, above El Zamorano, ca. 950 m, *Standley 353* (F); region of Agua Amarilla, above El Zamorano, ca. 780 m, *Standley & Williams 13* (F), 900-1100 m, *Standley et al. 5047* (BM, F), *5044*, *5050* (F); near Joya Grande, on road from El Zamorano to Suyapa, 1200-1350 m, *Standley & Molina R. 4511* (F).
WINDWARD ISLANDS. Guadeloupe: No other locality data (known only from type collection of *I. herminieri*).
VENEZUELA. Bolívar: Morichal cercano al conuco de Odremán, Santa Elena, Gran Sabana, *Tamayo 3068* (FH, US).
BRAZIL. Amazonas: Taruma Alta, 5 km N of Manaus-Itacoatiara road, near Manaus, *Griffin 283-A* (CANM, F, MEXU, MO, NY, SP); between Manaus & Sao Gabriel, along shores of Río Curicuriari & Igarapé Branco (Río Cariua) from the Río Curicuriari to Cachoeira de Bôto (Cachoeira Piraiauara), *Buck 2549* (CANM). **Santa Catarina:** Serra Geral, *Ule 1197* (H). **Goiás:** Region of the Chapada dos Veadeiros, 4 km N of Veadeiros, *Dawson 14745* (CANM). **Minas Geraes:** Between Serro & Datas, Diamantina, *Frahm 1421, 1499* (MO); National Park Serra de Itatiaia, 1950 m, *Schäfer-Verwimp & Verwimp 9571* (NY). **Sao Paulo:** Icem County, *Vital DV-1826* (CANM). **Mato Grosso:** Serra do Roncador, ca. 86 km N of Xavantina, 550 m, *Irwin et al. 16370* (NY). **Pará:** Serra do Cachimbo, Base Aérea do Cachimbo and vicinity, along bank of Río Braco Norte, ca. 20 km N of border of Mato Grosso, 430-480 m, *Reese 16169* (MICH, NY, US), *16193* (MICH), *16197*, *16418* (MICH, NY).

The aquatic habit will immediately indicate the identity of this species and distinguish it from the other Latin American taxa, except *Isopterygium acutifolium*, which are terrestrial. The important morphological features are the large plants, stems to 10 cm long, 1.5-3.5 mm wide, leaves ovate-lanceolate to ovate, symmetric to asymmetric, acuminate, flaccid, close, erect-spreading, strongly wrinkled and contorted when dry, 1-3 mm long, alar regions weakly differentiated, 1-2 rectangular or rarely quadrate cells on margins, setae 1.5-2.2 cm long, capsules rarely produced, ovoid to ellipsoid, inclined, contracted below the mouth when dry, 1.0-1.2 mm long.

4. *Isopterygium byssobolax* (C. Müll.) Par., Ind. Bryol. Suppl. 218. 1900.



Figs. 14-17. *Isopterygium affusum*. 14. Enlargement of portion of stem. 15. Leaves. 16. Alar cells. 17. Operculate capsule (wet).

Figs. 18-21. *Isopterygium byssobolæx*. 18. Enlargement of portion of stem. 19. Leaves. 20. Alar cells. 21. Inoperculate capsule.

Taxicaulis byssobolax C. Müll., Hedwigia 36: 114. 1897. Type. Argentina. Tucumanensis, Siambon near Tucuman, Sierra de Tucuman, 1873, *Lorentz s.n.* (lectotype, JE); Cuesto de Siambon, *Lorentz s.n.* (isosyntype, JE).

Taxicaulis pyrrhopus C. Müll., Hedwigia 36: 116. 1897; *Isopterygium pyrrhopum* (C. Müll.) Par., Ind. Bryol. Suppl. 220. 1900.

Taxicaulis saprophilus C. Müll., Hedwigia 36: 115. 1897; *Isopterygium saprophilum* (C. Müll.) Par., Ind. Bryol. Suppl. 220. 1900.

Plants light green to yellowish green, in dense mats. Stems up to 1.3 cm long, 0.5-1.0 mm wide, simple or irregularly and freely branched. Asexual reproductive bodies lacking. Leaves somewhat rigid, close, concave, erect to slightly spreading at tips, smooth, somewhat contorted when dry, 0.4-0.8 mm long, 0.2-0.3 mm wide, ovate to ovate-lanceolate, symmetric, acuminate; margins erect, entire to minutely serrulate; costa none or weak, short and double; cells smooth, 28-52 µm long, 5-7 µm wide; alar cells strongly differentiated, short-rectangular to quadrate or transversely elongate, in 2-4 rows with 4-10 cells on margins. Autoicous. Setae yellow to reddish brown, 0.6-1.0 cm long. Capsules inclined to horizontal, 0.5-1.0 mm long, ovoid to ellipsoid, contracted below the mouth when dry. Opercula short-rostrate. Peristome teeth up to 0.2 mm long. Spores 7-9 µm in diameter.

Illustrations: Ireland (in press) Flora Neotropica; Figs. 18-21.

Chromosome number: unreported.

Distribution: Brazil, Bolivia and Argentina.

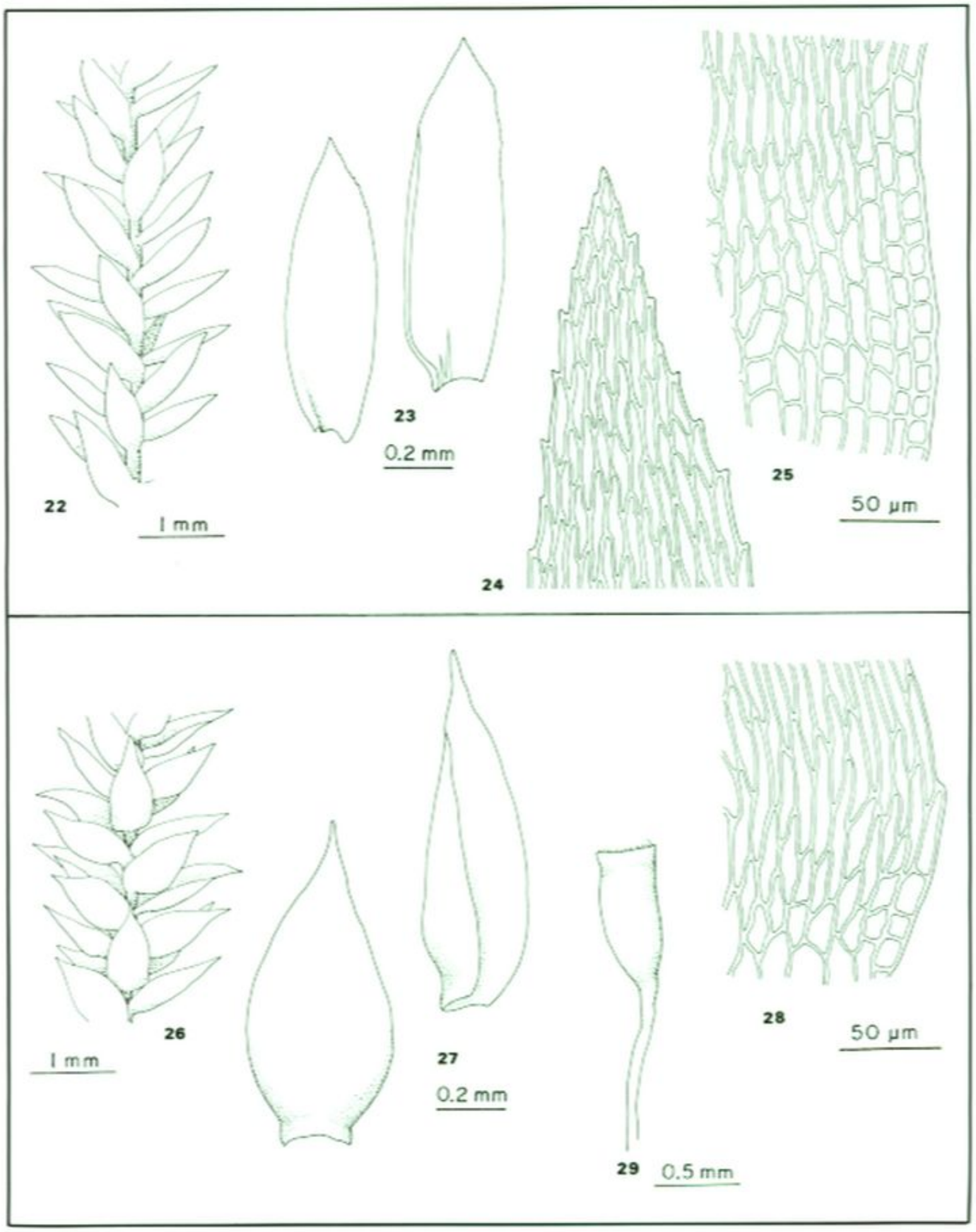
Ecology: Usually in forests on rotten wood and tree bases, sometimes on soil and rock. At altitudes of 30-1180 m.

Representative specimens examined. **BRAZIL. Espirito Santo:** Domingos Martins, Reserva Florestal Pedra Azul, 1180 m, *Schäfer-Verwimp & Verwimp 10078* (CANM). **Mato Grosso:** Palmeiras, Serra do Chapada, *Lindman B413* (BM). **Rondônia:** Ridges of Serra dos Pacaás Novos, along Río Pacaás Novos, ca. 400 m, *Reese 13550, 13553* (NY). **Santa Catarina:** Munic. de Lajes, 27° 48' S, 50° 21' W, *Vital 9397* (CANM, SP). **Sao Paulo:** Itapecirica, near Barra Mansa, ca. 1000 m, *Schiffner 1572* (BM).
BOLIVIA. Chuquisaca: Prov. Luis Calvo, "Inca Huasi 2", W slope of Serranía Inca Huasi, 7 km NNE of Muyupampa (Vaca Guzmán), 19° 50' S, 63° 43' W, *Lewis 84-1050* (LPB). **Cochabamba:** Prov. Chapare, "Puerto San Francisco", between Puerto San Francisco and the alligator ranch near Río Salbasuma, 16° 41' S, 65° 10' W, *Lewis 83-1346* (LPB). **Santa Cruz:** Prov. Chiquitos, "Río Natividad", 17 km 15 S of W from San José de Chiquitos, 17° 53' S, 60° 53' W, *Lewis 85-1139* (LPB). **Tarija:** Prov. Arce, along trail from Communidad Salado to Cambari, 3.5 km N of YPFB Campamento Conchas and 53 km N of Bermejo, 22° 16' S, 64° 24' W, *Lewis 84-2442, 84-2448* (LPB); Prov. Arce, slope of Cerro Nogal, parallel to and 0.5 km N or Quebrada Nogal, 2-5 km NW of Communidad La Mamora, 22° 09' S, 64° 41' W, *Lewis 84-2169* (LPB).
ARGENTINA. **Tucumán:** Quebrada de Lules, *Garolera 6971* (FH). **Jujuy:** Arroyo de los Matos ad Sierra Santa Bárbara, *Fries 43* (H).

Isopterygium byssobolax is readily recognized because it is the smallest of all the Latin American species. The small stems reach only 1.3 cm long, 0.5-1.0 mm wide, the minute leaves are ovate to ovate-lanceolate, symmetric, acuminate, rigid, close, concave, less than 1 mm long, with distinct alar regions of short-rectangular to quadrate or transversely elongate cells in 2-4 rows with 4-10 cells on margins, setae 0.6-1.0 cm long, capsules ovoid to ellipsoid, contracted below the mouth when dry, 0.5-1.0 mm long.

5. *Isopterygium acutifolium* Irel., Bryologist 93: 343. 1990 Type. Venezuela. Bolivar, Meseta de Jáua, NNE of Mission of Campamento Sanidad of the Kanarakuni R., *Steyermark 97784* (holotype, US).

Plants light green to yellowish green, in thin mats. Stems up to 2.5 cm long, 1-2 mm wide, simple or sparingly and irregularly branched. Asexual reproductive bodies lacking. Leaves somewhat rigid, distant, flat to slightly concave, erect-spreading, smooth, scarcely contorted when



Figs. 22-25. *Isopterygium acutifolium*. 22. Enlargement of portion of stem. 23. Leaves. 24. Apical leaf cells. 25. Alar cells.

Figs. 26-29. *Isopterygium jamaicense*. 26. Enlargement of portion of stem. 27. Leaves. 28. Alar cells. 29. Inoperculate capsule (dry).

dry, 0.8-1.2 mm long, 0.4-0.5 mm wide, ovate-lanceolate or oblong, symmetric to somewhat asymmetric, acute; margins erect, serrulate from apex to leaf middle or just below; costa none or weak, short and double; cells smooth, 70-103 µm long, 7-9 µm wide; alar cells strongly differentiated, quadrate to rectangular, in several rows with 4-15 cells on margins. Sex organs and sporophytes unknown.

Illustrations: Ireland 1990 (Figs. 1-9); Ireland (in press) Flora Neotropica; Figs. 22-25.

Chromosome number: unreported.

Distribution: Known only from the type locality in Venezuela and from one locality in Guyana.

Ecology: Attached to rocks near waterfalls and in running water along rapids of rivers. Apparently at low altitudes, ca. 400 m.

Specimens examined.

VENEZUELA. Known only from type locality.

GUYANA. First falls of Essequibo River, *Richards 359* (NY).

Only known from sterile plants but easily distinguished from the other Latin American species by the acute leaves that have prominent alar regions composed of several rows of quadrate to rectangular cells with 4-15 cells on the margins. The other species have acumimate leaves and, except for *Isopterygium byssobolax*, they have only a few differentiated cells in the alar regions. *Isopterygium byssobolax* has about half the number of quadrate to rectangular alar cells that *I. acutifolium* possesses. The aquatic habit is also a clue to the identity of *I. acutifolium* since *I. affusum* is the only other aquatic species in Latin America. *Isopterygium tenerum* sometimes occurs in swamps or on river banks but it has never been found on rocks in rivers.

6. *Isopterygium jamaicense* (Bartr.) Buck, Brittonia 36: 88. 1984.

Platygyriella jamaicensis Bartr., J. Washington Acad. Sci. 26: 14. 1936. Type. Jamaica. Newmarket, *Orcutt 7263* (holotype, FH; isotype, CANM).

Plants white- to yellow-green, in thin to dense mats. Stems up to 2 cm long, 1-2 mm wide, complanate-foliate, simple or irregularly branched. Asexual reproductive bodies lacking. Leaves flaccid, close, complanate, erect to erect-spreading, smooth, 0.7-1.5 mm long, 0.3-0.5 mm wide, ovate to ovate-lanceolate, usually symmetric, acuminate; margins plane, entire or serrulate nearly to the base; costa none or rarely weak, short and double; cells smooth, 52-85 µm long, 5-9 µm wide; alar cells rectangular to quadrate, in small groups, sometimes inflated at the margins. Autoicous. Setae yellow to reddish brown, 0.5-0.8 cm long. Capsules erect to somewhat inclined, 0.5-1.3 mm long, straight, cylindric to somewhat ovoid, not or slightly contracted below the mouth when dry. Opercula short-rostrate. Peristome teeth up to 0.3 mm long, endostome segments linear, cilia lacking. Spores 14-24 µm in diameter.

Illustrations: Ireland (in press) Moss Flora of Mexico (as *I. miradoricum*); Ireland (in press) Flora Neotropica; Figs. 26-29.

Chromosome number: unreported.

Distribution: Mexico, Guatemala and Jamaica.

Ecology: In humid forests on bamboo stems and on moist soil. Occurring at low altitudes from near sea level to 350 m.

Specimens examined.

MEXICO. Oaxaca: Tuxtepec, El Cerro de Palacios, NE side of Chiltepec, *Santos 3854* (CANM, F, MICH, TENN). **Puebla:** Río Tonto, Paseo Asihualt, 150 m, *Sharp 1326a* (CANM). Tabasco, *Gilly & Hernández 307* (CANM, MICH).

GUATEMALA. Alta Verapaz, Cubilquitz, 350 m, *Türckheim 6938* (BM, FH, H). Vicinity of Puerto Barrios, near sea level, *Maxon & Hay 3072, 3076, 3078* (US).

JAMAICA. Portland: Soyo Falls, 1.3 km SW of Reach, 120 m, *Proctor 37208* (NY); 11 km NW of Muirton, John Crow Mts., 350 m, *Buck 5662* (M,).

This species is easily distinguished with sporophytes but impossible to distinguish from others,

like *Isopterygium tenerum* or *I. tenerifolium*, when sterile. It is the only Latin American species with a usually cylindric, erect to inclined capsule that is not or little contracted under the mouth when dry. The gametophyte is very similiar to *I. tenerum* except that the leaves are nearly always symmetric and no asexual reproductive bodies like those of that ubiquitous species have ever been seen.

The name *Isopterygium miradoricum* (C. Müll.) Jaeg. & Sauerb., an older species described in 1874 from Mirador, Mexico, has previously been used for plants that fit the description and type of *I. jamaicense* (Ireland 1984). However, since the type of *I. miradoricum* could not be located it seems best to use the name of a species whose type could be found. My use of *I. miradoricum* was based mainly on herbarium specimens that were named by various bryologists rather than on the description of the species. The type description states that the capsules are inclined to nodding which does not fit the capsules in the specimens that I examined. If the type of *I. miradoricum* should be found and the plants are identical to *I. jamaicense*, the former name, of course, has priority over the latter.

Pterogonidium pulchellum (Hook.) C. Müll. of the Sematophyllaceae is often confused with *Isopterygium jamaicense*. The gametophytes of the two are strikingly similiar except *Pterogonidium* is smaller and the leaves are seldom spread as much as *I. jamaicense*. Fortunately, *Pterogonidium* usually produces sporophytes and the erect capsules have a single peristome instead of a double one like species of *Isopterygium*.

7. ***Isopterygium subglobosum*** Herz., Biblioth. Bot. 87: 151. 1916. Type. Bolivia. Santa Rosa del Chapare, *Herzog 2738* (holotype, JE; isotypes, H, M).

Plants light green to yellowish green, in thin to dense mats. Stems up to 2.5 cm long, 1.0-1.5 mm wide, complanate-foliate, simple or irregularly and freely branched. Asexual reproductive bodies lacking. Leaves flaccid, close, concave, widespreading to squarrose, smooth, somewhat contorted when dry, 0.7-1.0 mm long, 0.3-0.5 mm wide, ovate to ovate-lanceolate, often curved and asymmetric, short to long-acuminate; margins erect, serrulate above, entire or nearly so below; costa none; cells smooth, 52-108 µm long, 7-9 µm wide; alar cells rectangular, in small groups with 1-2 cells on margins. Autoicous. Setae yellowish red to reddish, 1.4-2.2 cm long. Capsules inclined, 0.5-1.2 mm long, subglobose, not contracted below the mouth when dry. Opercula high-conic to short-rostrate. Peristome teeth up to 0.3 mm long. Spores 9-12 µm in diameter.

Illustrations: Ireland (in press) Flora Neotropica; Figs. 30-33.

Chromosome number: unreported.

Distribution: Known only from type locality in Bolivia.

Ecology: Occurring on decaying leaves at margin of creek at ca. 1700 m altitude.

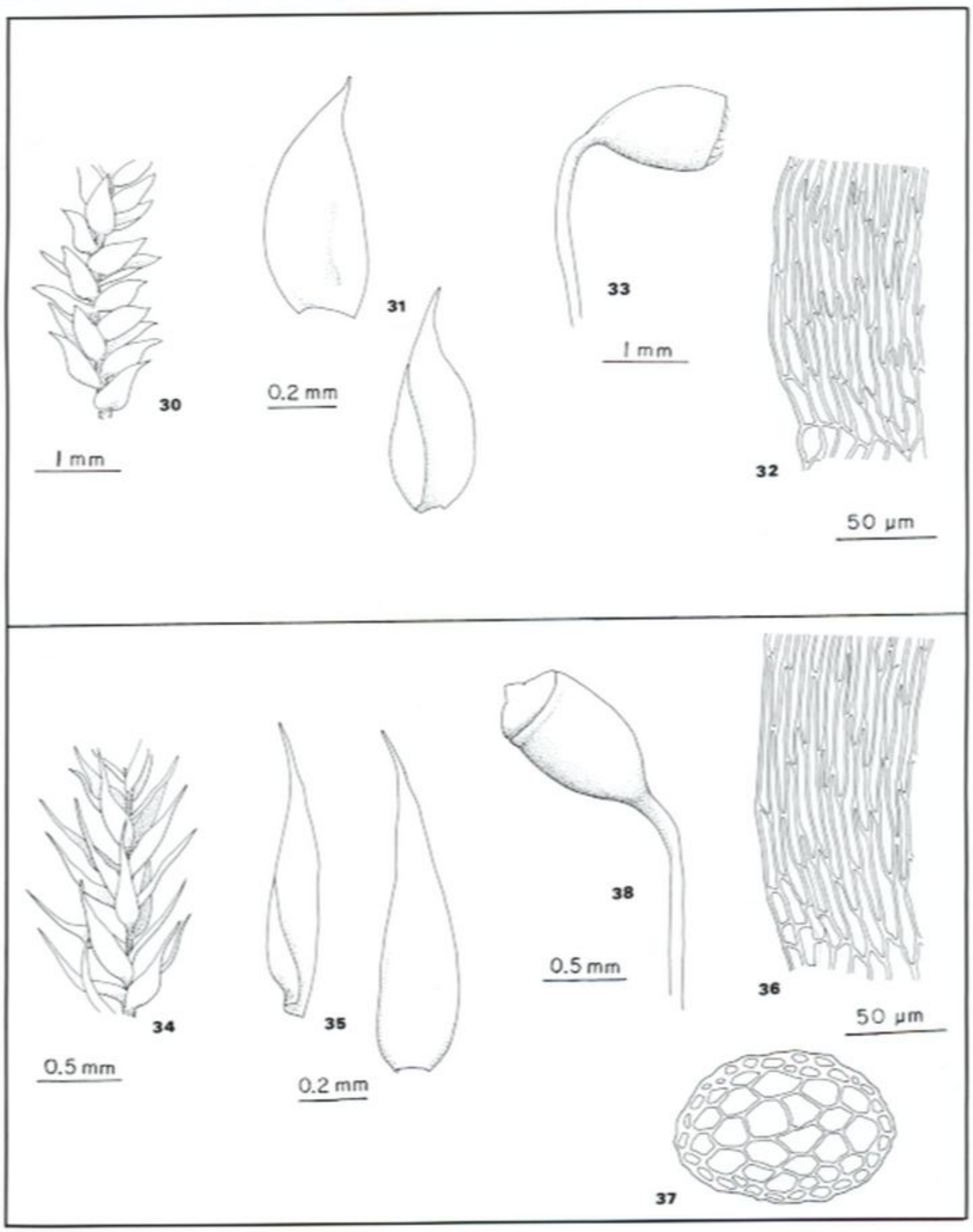
Specimens examined. Only the type seen.

This species, like the previous one, is impossible to distinguish from several of the other Latin American species when capsules are not present. The subglobose capsules that are not contracted under the mouth when dry are very distinctive but this may possibly represent an environmental response with no genetic basis. However, I have elected to retain *Isopterygium subglobosum* as a separate species until more collecting is done, especially in Bolivia where the only collection was made. The gametophytes of this species are very similiar to *I. tenerum*.

8. ***Isopterygium subbrevisetum*** (Hampe) Broth., Nat. Pfl. 1(3): 1081. 1908.

Hypnum subbrevisetum Hampe, Vid. Medd. Naturh. For. Kjoebenh. ser. 3,6: 165. 1875. Type. Brazil. Vicinity of Rio de Janeiro, *Glaziou 6356* (holotype, BM; isotype, H).

Taxicaulis subtenerrimus C. Müll., Hedwigia 37: 253. 1895; *Isopterygium subtenerrimum* (C.



Figs. 30-33. *Isoptergyium subglobosum*. 30. Enlargement of portion of stem. 31. Leaves. 32. Alar cells. 33. Inoperculate capsule (dry).

Figs. 34-38. *Isopterygium subbrevisetum*. 34. Enlargement of portion of stem. 35. Leaves. 36. Alar cells. 37. Cross-section of stem. 38. Operculate capsule (dry).

Müll.) Par., Ind. Bryol. Suppl. 221. 1900.

Isopterygium pusillum Ren. & Card., Bull. Soc. R. Bot. Belg. 41(1): 107. 1905.

Isopterygium tenerrimum Ren. & Card., Bull. Soc. R. Bot. Belg. 41(1): 107. 1905. nom. nud.

Plants light green to yellowish green, in thin to dense mats. Stems up to 0.8 cm long, 1.0-1.7 mm wide, irregularly and freely branched. Asexual reproductive bodies rarely present on stems, uniseriate, multicellular, simple or branched, green or brown, cells papillose. Leaves somewhat rigid, distant, somewhat concave, wide-spreading to squarrose, smooth, scarcely changed when dry, 0.5-1.0 mm long, 0.2-0.3 mm wide, lanceolate, symmetric, acuminate; margins plane, often erect below, entire to minutely serrulate; costa none or sometimes weak, short and double; cells smooth, 66-99 µm long, 5-7 µm wide; alar cells quadrate to short-rectangular, in small groups with 2-4 cells on margins. Autoicous. Setae yellow to orange, 0.5-1.0 cm long. Capsules inclined, 0.5-1.0 mm long, ovoid to ellipsoid, contracted below the mouth when dry. Opercula short-rostrate. Peristome teeth up to 0.2 mm long. Spores 9-14 µm in diameter.

Illustrations: Ireland (in press) Flora Neotropica; Figs. 34-38.

Chromosome number: unreported.

Distribution: West Indies, Costa Rica, Nicaragua, Panama, Venezuela, Surinam, French Guiana, Ecuador, Peru and Brazil.

Ecology: On tree trunks, stumps, rotten logs, humus, earth banks and occasionally limestone and serpentine rock in humid or wet forests. Occurring from 30-1940 m altitude.

Representative specimens examined.

NICARAGUA. Sandy Bay, 11 Dec. 1920, *Hamilton s.n.* (NY).

COSTA RICA. Alajuela: San Pedro de San Ramón, *Brenes 19, 20* (NY), *99* (FH, NY). **Heredia:** Finca La Selva, ca. 11 km S of Puerto Viejo, *Koch 4938* (MICH). **Limón:** Along Río Tortuguero, ca. 3 km SW of village of Tortuguero, *Steere CR-180, CR-195* (NY).

PANAMA. Coclé: Near El Valle de Anton, ca. 550 m, *Brako 8457* (NY). **Panamá:** Isla de Barro Colorado, *Arrocha 204* (NY), *204a* (PMA). **San Blas:** 23 km from Interamerican Hwy. on El Llano-Carti Road, *Allen 4960* (H, MO, NY), *4968* (MEXU, MO).

CUBA. Habana: Vicinity of Santiago de las Vegas, *Baker 691* (NY). **Las Villas:** Santa Clara, Sierra de Cantu, *León & Clement 5476* (MICH, US). **Oriente:** Sierra Maestra, Gran Piedra, near Santiago de Cuba, *Imshaug 25063* (CANM, MICH). **Santiago:** Slopes and summit of El Yunque, near Baracoa, 305-610 m, *Pollard & Palmer 104* (MO); 1-2 km W of La Gran Piedra, *Shaw 5261* (NY).

JAMAICA. Manchester: Marshall's Pen, 4.8 km WNW of Mandeville, 700 m, *Crosby 13816* (NY). **Portland:** E slope of John Crow Mts., ca. 2.4 km SW of Ecclesdown, 460 m, *Webster 5179* (CANM). **St. Ann:** Reynolds Mines area, near Lydford, *Howard & Proctor 14032* (CANM). **St. Andrew:** Summit of Coopers Hill, 775 m, *Farr 1441* (CANM). **ST. THOMAS:** Mountain trail between House Hill and Cuna Cuna Gap, 550-725 m, *Maxon 8901* (BM). **Trelawny:** Windsor estate, ca. 120 m, *Powell 335* (CANM).

HAITI. Canape Verte, above Port-au-Prince, *Mackaness 285* (MICH). Dept. de la Grand'anse, Massif de la Hotte, along small stream entering Rivière Glace at jct. of road from Beaumont to Camp Perrin, 41 km S of Roseaux, 710 m, *Buck 9060* (NY). Dept. de Nord, vicinity of Pilate, ca. 325 m, *Leonard 9594* (CANM, FH, US). Dept. de l'Ouest, above road NW of Foret des Pins, *Imshaug & Wetmore 22888* (CANM, MSC).

DOMINICAN REPUBLIC. Prov. Independencia, Sierra de Baoruco, 30.5 km S of Puerto Escondito, 1940 m, *Buck 14661* (NY). Prov. Santo Domingo, vicinity of Colonia Ramfis, 400-500 m, *Allard 16290* (NY, US). Prov. Pedernales, Las Abejas, ca. 40 km N along road from Cabo Rojo from jct. of road from Oviedo to Pedernales, 1190 m, *Reese 14959* (NY). Prov. La Vega, La Culata, 9 km NNW of Constanza, 1280 m, *Buck 5356* (NY). Prov. Dajabon, Cañada Tirolis, 1 km S of Villa Anacaona, 400 m, *Buck 4837* (NY).

PUERTO RICO. Sierra de Yabucoa, 500 m, *Britton et al. 6313* (NY). Ponce District, above Villalba, Doña Juana Recreation Area, 800-1000 m, *Buck 15984* (NY). Near Mayagüez, *Heller 4495* (F, MICH). Santa Rosa, Jayuya, *Pagán 299* (MICH, MO). Above Toro Negro Reservoir, S of Jayuya, *Steere 6878* (MICH, MO). Toro Negro Unit, Río Doña Juana, N of Villalba, *Steere 6015* (MICH, NY, US).

LEEWARD ISLANDS. Montserrat: Chauers Mtn., 610-760 m, *Shafer 806* (CANM, NY).

WINDWARD ISLANDS. Martinique: Bois de la Capote, *Stehle 4002* (NY). **Grenada:** Grand Etang, 760 m, *Howard 264* (FH).

VENEZUELA. Bolívar: Cerro Sarisariñama, Sima Mayor, 1020 m, *Buck & Brewer 15602A, 15619B* (NY).
TRINIDAD. Caura R. Valley, *Britton et al. 1224* (NY).
TOBAGO. Murray's Land, Cardiff Road, *Broadway 4292* (CANM).
SURINAM. Brokopondo: Brownsberg, near trail to Witti Creek, ca. 500 m, *Florschütz-de Waard & Zielman 5036A* (U).
FRENCH GUIANA. NE of Saül, summit S of Pio Matecho, 13 km N of Saut Nais, 590 m, *Cremers 6291* (U).
ECUADOR. Galápagos Is., Isla Santa Cruz, around Media Luna, 600-650 m, *Gradstein & Weber M-37* (F); Isabela, S slope of Volcán Alcedo, *van der Werff 1477* (U).
PERU. Santa Elena, upper Amazon, Tingo María, *Morrow 9584* (FH).
BRAZIL. Amazonas: Along the Río Negro, along BR 307, N from Sao Gabriel de Cachoeira to Cucuí, at Km 41, *Buck 2598* (NY). **Bahia:** Serra da Agua de Rega, ca. 24 km N of Seabra, road to Agua de Rega, 1000 m, *Irwin et al. 31095* (CANM). **Minas Geraes:** Vicosa, *Mexia 4499-a* (FH). **Rio de Janeiro:** Petropolis, Pedreira da Quitandinha, *Bandeira 191* (NY). **Santa Catarina:** Without locality, *Ule 970* (H). **Sao Paulo:** Sierra de Sao Pedro, Sao Pedro, 680 m, *Schäfer-Verwimp & Verwimp 9526* (NY).

The general aspect of this species is striking because of its lanceolate, slightly concave, rigid, distant, wide-spreading to squarrose leaves. The distinct leaves and the phyllotaxy will immediately identify *Isopterygium subbrevisetum* from the other Latin American species. The plants are otherwise most similar to *I. tenerum* except the leaves are somewhat narrower (0.2-0.3 mm wide) and shorter (0.5-1.0 mm long).

The leaf morphology and the phyllotaxy that sets this species apart from all the other *Isopterygium* taxa may not seem very important until one considers the North American plants. Among the hundreds of North American plants of *Isopterygium* that I studied (Ireland 1969) none of them approached the distinctive leaf morphology and the phyllotaxy of *I. subbrevisetum*.

EXCLUDED TAXA

Buck (1989) recently made *Syringothecium*, which was described by Mitten (1869) at the same time as *Isopterygium* and placed in the same tribe Stereodonteae, a synonym of *Isopterygium*. Mitten described the new genus primarily on the basis of the endostome that was longer than the exostome. Buck did not think that was a good generic distinction and since he could find no gametophytic differences he transferred two of the species contained in the genus into *Isopterygium*, namely *I. sprucei* (Mitt.) Buck and *I. brasiliense* (Broth.) Buck. The only other species in the genus, *S. nemodontium* Herz., was considered a synonym of *I. sprucei*. After examining the type of the genus *Syringothecium*, *S. sprucei* Mitt. (Ecuador, Andes Quitenses, Montana de Canelos, *Spruce 1517*, holotype, NY), as well as *S. brasiliense* Broth. (Brazil, Paraná, Serra do Mar, Ypirango, *Dusen 3895*, slide of lectotype, NY), I believe the genus should remain distinct from *Isopterygium*. Therefore, I have excluded the two species that Buck recently transferred into *Isopterygium*, i.e. *I. sprucei* and *I. brasiliense*, and I have left them in the genus *Syringothecium*.

The primary reason for recognizing *Syringothecium* is because of the long, 450-600 µm, narrow peristome teeth that are more or less erect when dry. In *Isopterygium*, on the other hand, the plants have short, 200-350 µm, broad teeth that are incurved when dry. The peristome distinction (i.e., the endostome that is longer than the exostome) that influenced Mitten to describe *Syringothecium* is also valid. However, other genera, even *Isopterygium*, have this feature although not to the same degree as *Syringothecium* whose endostome segments are often 100 µm longer than the exostome teeth.

The gametophytes of *Isopterygium* and *Syringothecium* are similar except plants of the latter sometimes have a basal row of large, somewhat swollen cells compared to the smaller, slightly enlarged but seldom swollen cells of the former. This feature may have been the reason that Fleischer (1923) and later others like Brotherus (1925) placed *Syringothecium* in the Sematophyllaceae since many of its taxa have somewhat similar bubble-like basal cells.

Because of the differences between *Syringothecium* and *Isopterygium*, especially in the peristome, I have elected to exclude the two species *S.*

sprucei Mitt. and *S. brasiliense* Broth. from the genus *Isopterygium*.

NOMINA DUBIA

The status of the following Latin American taxa must remain unknown until their types can be found and examined.

Isopterygium brevisetum (Hornsch.) Broth., Nat. Pfl. 1(3): 1081. 1908; *Hypnum brevisetum* Hornsch., Fl. Bras. 1(2): 78. 1840. Type. Brazil. Near Rio de Janeiro, July & August, *Merkel s.n.* Type apparently not in BM.

Isopterygium chrismarii (C. Müll.) Mitt., J. Linn. Soc. Bot. 12: 500. 1869; *Hypnum chrismarii* C. Müll., Syn. 2: 682. 1851. Type. Mexico. Michoacán, Cerro San Andrés, March 1849, *Chrismar s.n.*

Isopterygium exiguum Kindb., Enum. Bryin. Exot. 100. 1891; *Hypnum exiguum* Geheeb & Hampe *in* Hampe, Vid. Medd. Naturh. For. Kjoebenh. ser. 4,1: 140. 1879, hom. illeg. Type. Brazil. Near Apiahy, June 1877, *Puiggari s.n.* Type apparently not in BM.

Isopterygium exile (C. Müll.) Par., Ind. Bryol. Suppl. 219. 1900; *Taxicaulis exilis* C. Müll., Hedwigia 36: 116. 1897. Type. Paraguay. *Balansa 3619*.

Isopterygium fruticola (C. Müll.) Par., Ind. Bryol. Suppl. 219. 1900; *Taxicaulis fruticola* C. Müll., Hedwigia 37: 252. 1898, "*fruticolus*". Type. Surinam. Near Paramaribo, August 1844, *Kegel s.n.*

Isopterygium gracillimum (Hornsch.) Broth., Nat. Pfl. 1(3): 1081. 1908; *Hypnum gracillimum* Hornsch., Fl. Bras. 1(2): 78. 1840. Type. Brazil. Province Minarum, collector unknown. Type apparently not in BM.

Isopterygium hookeriophilum (C. Müll.) Broth., Nat. Pfl. 1(3): 1083. 1908; *Taxicaulis hookeriophilus* C. Müll., Hedwigia 40: 67. 1901. Type. Brazil. Sao Paulo: 1891, *Wohltmann s.n.*

Isopterygium microplumosum (C. Müll.) Broth., Nat. Pfl. 1(3): 1083. 1908; *Taxicaulis microplumosus* C. Müll., Hedwigia 40: 68. 1901. Type. Brazil. Minas Gerais: Serra Ouro Preto, *Ule 1486*.

Isopterygium miradoricum (C. Müll.) Jaeg. & Sauerb., Ber. St. Gall. Naturw. Ges. 1876-77: 436. 1878; *Hypnum miradoricum* C. Müll., Linnaea 38: 650. 1874. Type. Mexico. Mirador, April 1873, *Sartorius s.n.*

Isopterygium pseudosubulatum (C. Müll.) Par., Ind. Bryol. Suppl. 220. 1900; *Taxicaulis pseudosubulatus* C. Müll., Flora 83: 340. 1897. Type. Venezuela. *Goebel s.n.*

Isopterygium pygmaeocarpum (C. Müll.) Broth., Nat. Pfl. 1(3): 1081. 1908; *Taxicaulis pygmaeocarpus* C. Müll., Hedwigia 40: 66. 1901. Type. Brazil. Santa Catarina: Tubarao, *Ule 973*.

Isopterygium sapricola (C. Müll.) Broth., Nat. Pfl. 1(3): 1083. 1908; *Taxicaulis sapricola* C. Müll., Hedwigia 40: 67. 1901. Type. Brazil. Rio de Janeiro: Monte Corcovado, *Ule 165*.

Taxicaulis sapricola var. *minor* C. Müll., Hedwigia 40: 68. 1901. Type. Brazil. Rio de Janeiro: Monte Corcovado, *Ule 1722*.

Isopterygium subcurvicolle (C. Müll.) Par., Ind. Bryol. ed. 2,3: 125. 1905, "subcurvicollum"; *Taxicaulis subcurvicollis* C. Müll., Hedwigia 40: 65. 1901. Type. Brazil. Santa Catarina: April 1888, *Ule s.n.*; Tubarao, *Ule 640, 783*; Serra Geral, *Ule 1202*.

Isopterygium subsplendidulum (C. Müll.) Par., Ind. Bryol. Suppl. 221. 1900; *Taxicaulis subsplendidulus* C. Müll., Bull. Herb. Boiss. 5: 210. 1897. Type. Guatemala. Mazatenango, *Bernoulli & Cario 75, 84*.

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