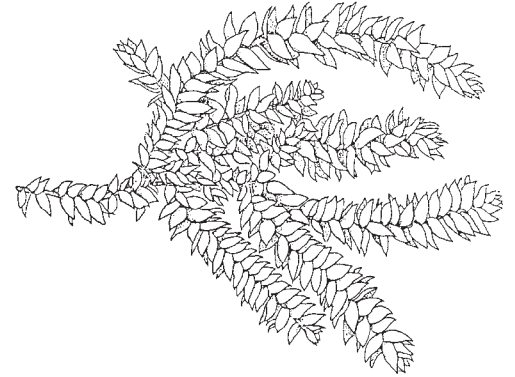
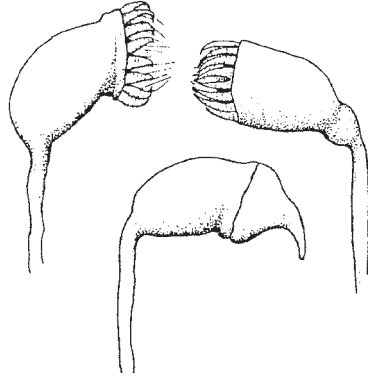
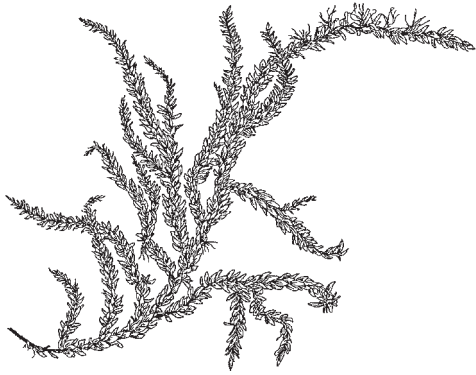




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Some Latin American Genera of Hypnaceae (Musci)

*Robert R. Ireland
and William R. Buck*

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WASHINGTON D.C.

2009

ABSTRACT

Ireland, Robert R. and William R. Buck. Some Latin American Genera of Hypnaceae (Musci). *Smithsonian Contributions to Botany*, number 93, viii + 97 pages, 37 figures, 2009.—A taxonomic revision of 16 of the 21 genera of the large pleurocarpous moss family Hypnaceae is presented for Latin America (Mexico, Caribbean, Central America, and South America). This study includes the genera *Ctenidium* (Schimp.) Mitt., *Elmeriobryum* Broth., *Herzogiella* Broth., *Homomallium* (Schimp.) Loeske, *Irelandia* W. R. Buck, *Isopterygiopsis* Z. Iwats., *Isopterygium* Mitt., *Phyllodon* Bruch & Schimp. in Bruch, Schimp. & W. Gümbel, *Platygyriella* Cardot, *Platygyrium* Schimp. in Bruch, Schimp. & W. Gümbel, *Pseudotaxiphyllum* Z. Iwats., *Puiggariopsis* M. Menzel, *Pylaisia* Bruch & Schimp. in Bruch, Schimp. & W. Gümbel, *Rhacopilopsis* Renaud & Cardot, *Syringothecium* Mitt., and *Taxiphyllum* M. Fleisch. A total of 35 species are recognized for the entire 16 genera. All taxa were studied taxonomically with each genus and its associated species described in detail. Included in this revision are a description of the family, keys to the genera and species in the Hypnaceae, detailed descriptions of each species with complete information on the known distribution throughout Latin America, habitat information, and nomenclature, and discussions on distinguishing features. Illustrations and distribution maps are provided for many of the species. The following six names are lectotypified: *Hypnum micans* Sw., *Isopterygium cylindricarpum* Cardot, *Isopterygium planissimum* Mitt., *Plagiothecium bolivianum* Broth., *Plagiothecium restingae* var. *tenue* Müll Hal., and *Stereodon distichaceus* Mitt.

Cover images, left to right: Figures 1A, 24I, and 32A (rotated 90°).

Published by Smithsonian Institution Scholarly Press
P.O. Box 37012 / MRC 957
Washington, D.C. 20013-7012
www.scholarlypress.si.edu

Library of Congress Cataloging-in-Publication Data

Ireland, Robert R.

Some Latin American genera of Hypnaceae (Musci) / Robert R. Ireland and William R. Buck.

p. cm. — (Smithsonian contributions to botany ; no. 93)

Includes bibliographical references and index.

1. Mosses—Latin America. I. Buck, William R., 1950– II. Title. III. Series: Smithsonian contributions to botany ; no. 93.

QK541.8.I74 2009

588'.2—dc22

2009014948

ISSN (print): 0081-024X, ISSN (online): 1938-2812

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Dedication

This work is dedicated to the memory of
Dr. Wilfred B. Schofield (1927–2008), Professor Emeritus,
University of British Columbia, Vancouver, Canada—
A great friend, an excellent bryologist,
and an authority of the Hypnaceae.

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Some Latin American Genera of Hypnaceae (Musci)

INTRODUCTION

The family Hypnaceae is defined by plants with leaves typically homalious to falcate-secund, with a short, double costa, and alar cells often differentiated. The peristome is typically well developed with the exostome teeth cross-striolate on the front surface and with prominent trabeculae at back; the endostome has a high basal membrane, broad segments, and cilia. However, any of the peristomial features may be reduced when the capsule is erect and the plants are corticolous.

The family is very heterogeneous and is little more than those Hypnalean pleurocarps with a short, double costa that have not been placed in other families. It may well prove worthwhile, after greater study, to break the family into more natural groups. On the other hand, though, some of the current subfamilies, most notably the Pylaisioideae, are probably conglomerations of convergences on ecological morphotypes and thus polyphyletic.

Recent work has only emphasized the heterogeneity of the Hypnaceae. Nishimura et al. (1984) tried to define the Hypnaceae on the basis of seven characters: (1) paraphyllia absent; (2) costa double or absent; (3) alar cells mostly differentiated but nonvesiculate-inflated in a transverse row; (4) capsules inclined to horizontal or cernuous, occasionally erect; (5) exothecial cells noncolenchymatous; (6) operculum conic-obtuse to rostrate, mostly not subulate; and (7) exostome teeth usually with a zigzag center line, well developed, projecting trabeculae, and rather broadly bordered. However, by their strict standards, they included the nonparaphylliate Hylocomiaceae in the Hypnaceae, as well as *Plagiothecium*, *Calliergonella*, *Pseudohygrohypnum*, and *Campylophyllum*. Few researchers in the last 20 plus years have followed this definition. In an initial look at the Hypnales using molecular data, Buck et al. (2000) found that even different species of *Hypnum* seemed not to be closely related to one another and that a number of genera, specifically *Isopterygium* and *Platygyrium*, seem to be more closely related to a noncore group of Sematophyllaceae, including *Pylaisiadelpha* and *Taxithelium*. This subsequently led Goffinet and Buck (2004) to describe the Pylaisiadelphaceae for the genera *Aptychella* (Broth.) Herzog, *Brotherella* M. Fleisch., *Clastobryopsis* M. Fleisch., *Clastobryum* Dozy & Molk., *Heterophyllum* (Schimp.) Kindb., *Isocradiella* Dixon, *Isopterygium*

Robert R. Ireland, Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA, irelandr@si.edu; William R. Buck, Institute of Systematic Botany, The New York Botanical Garden, Bronx, New York, USA, bbuck@nybg.org. Manuscript received 17 April 2008; accepted 9 December 2008.

Mitt., *Mastopoma* Cardot, *Platygyrium* Schimp. in Bruch, Schimp. & W. Gümbel, *Pterogonidium* (Hook.) Müll. Hal. in Broth., *Pseudotrismegistia* H. Akiy. & Tsubota, *Pylaisiadelphina* Cardot, *Taxitheliella* Dixon, *Taxithelium* Mitt., *Trismegistia* (Müll. Hal.) Müll. Hal. and *Wijkia* H. A. Crum. Although many of the genera more traditionally aligned with the Plagiotheciaceae (e.g., Ireland, 1969) have subsequently been considered better placed within the Hypnaceae, some recent work (Pedersen and Hedenäs, 2001) has nevertheless continued to argue that genera such as *Pseudotaxiphyllum*, *Catagonium*, *Isopterygiopsis*, *Bardunovia*, *Platydictya*, *Myurella*, *Struckia*, *Orthothecium*, *Rhizofabronia*, and *Herzogiella* should be placed in an expanded Plagiotheciaceae. Like most other workers, we have not been convinced of this expanded concept of the Plagiotheciaceae. The definition of the Hypnaceae has become even more confused by the recent work of Ignatov and Ignatova (2004), who restricted *Hypnum* to *H. cupressiforme* and its allies, moving the residue into *Breidleria* and *Stereodon*, both in the Pylaisiaceae rather than the Hypnaceae. Within Latin America there are members of the *H. cupressiforme* complex, but it is unclear to what other genus (or genera) the other Latin American species of *Hypnum* s.l. might be assigned. Ignatov and Ignatova (2004) also placed *Pseudohygrohypnum*, *Calliergonella*, *Calli cladium*, *Ptilium*, *Homomallium*, and *Pylaisia* in the Pylaisiaceae. *Platygyrium* was enigmatically moved to the Entodontaceae, despite molecular evidence to the contrary (Buck et al., 2000). The Ignatov and Ignatova (2004) treatment is entirely in Russian, and because of our language inadequacies, their motivation is not entirely clear and is made even more confusing by their widely separating the Hypnaceae from the Pylaisiaceae. Also impacting upon a comprehensive family definition of the Hypnaceae is the recent transfer by Hedenäs (2003) of *Calliergonella*, as well as *Campylophyllum* (see Nishimura et al., 1984), into the Amblystegiaceae.

We have used a more traditional definition of the Hypnaceae in this work, with minimal exception. We readily admit that this broad definition of the family may not withstand future molecular work. However, until such data result in a stable classification, this approach will at least allow researchers to identify material at hand.

In this publication, 16 genera of Hypnaceae containing 35 species which occur in Latin America are taxonomically treated. The five remaining genera in the family, i.e., *Chrysohypnum* Hampe, *Ectropothecium* Mitt., *Hypnum* Hedw., *Mittenothamnium* Henn., and *Vesicularia* (Müll. Hal.) Müll. Hal., most of them containing a large number of taxa, will require an enormous amount of time to resolve a number of taxonomic complexes. All five will have to

wait to be revised until more time can be spent on solving the numerous species-level problems within each genus.

This study was based on observation of approximately 1,900 herbarium specimens, in addition to 195 type specimens, belonging to 42 institutions, which are abbreviated as follows for subsequent mention in the text:

AAU	Herbarium Jutlandicum, Botanical Institute, University of Aarhus, Aarhus C., Denmark.
ALTA	Herbarium, Botany Department, University of Alberta, Edmonton, Alberta, Canada.
B	Herbarium, Botanischer Garten und Botanisches Museum, Berlin-Dahlem, Berlin, Germany.
BA	Herbario, Museo Argentino de Ciencias Naturales, Bernardino Rivadavia, Buenos Aires, Argentina.
BIGU	Herbario, Universidad de San Carlos de Guatemala, Guatemala City, Guatemala.
BM	Herbarium, Department of Botany, The Natural History Museum, London, UK.
C	Herbarium, Botanical Museum, University of Copenhagen, Copenhagen K., Denmark.
CANM	Herbarium, Bryology Section, Canadian Museum of Nature, Ottawa, Ontario, Canada.
COL	Herbario Nacional Colombiano, Universidad Nacional de Colombia, Bogotá, Colombia.
COLO	Herbarium, Museum, University of Colorado, Boulder, Colorado, USA.
CONC	Herbario, Departamento de Botánica, Universidad de Concepción, Concepción, Chile.
DUKE	Herbarium, Botany Department, Duke University, Durham, North Carolina, USA.
F	Herbarium, Botany Department, Field Museum of Natural History, Chicago, USA.
FH	Farlow Reference Library and Herbarium of Cryptogamic Botany, Cambridge, Massachusetts, USA.
FLAS	Herbarium, University of Florida, Gainesville, Florida, USA.
G	Herbarium, Conservatoire et Jardin botaniques de la Ville de Genève, Genève, Switzerland.
H	Herbarium, Botanical Museum, University of Helsinki, Helsinki, Finland.
H-BR	Helsinki: Brotherus Herbarium (part of the Botanical Museum, University of Helsinki, Finland).
H-SOL	Helsinki: Lindberg Herbarium (part of the Botanical Museum, University of Helsinki, Finland).
HIRO	Botanical Institute, Hiroshima University, Hiroshima, Japan.
INPA	Herbário, Departamento de Botânica, Instituto Nacional de Pesquisas da Amazônica, Manaus, Amazonas, Brazil.

- JBSD Herbarium, Jardín Botánico Nacional Dr. Rafael M. Moscoso, Santo Domingo, Dominican Republic.
- JE Herbarium Haussknecht, Friedrich-Schiller-Universität, Jena, Germany.
- L National Herbarium Nederland, Leiden University branch, Leiden, Netherlands.
- LPB Herbario Nacional de Bolivia, La Paz, Bolivia.
- M Herbarium, Botanische Staatssammlung, München, Germany.
- MEXU Herbario Nacional, Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City, D.F., Mexico.
- MG Herbário, Departamento de Botânica, Belém, Pará, Brazil.
- MICH Herbarium, University of Michigan, Ann Arbor, Michigan, USA.
- MO Herbarium, Bryology Section, Missouri Botanical Garden, Saint Louis, Missouri, USA.
- MSC Herbarium, Botany and Plant Pathology Department, Michigan State University, East Lansing, Michigan, USA.
- NY William and Lynda Steere Herbarium, New York Botanical Garden, Bronx, New York, USA.
- PC Herbarium, Laboratoire de Cryptogamie, Muséum National d'Histoire Naturelle, Paris, France.
- PH Herbarium, Botany Department, Academy of Natural Sciences, Philadelphia, Pennsylvania, USA.
- PMA Herbarium, Departamento de Botánica, Universidad de Panamá, Panamá, Panama.
- S Herbarium, Botany Departments, Swedish Museum of Natural History, Stockholm, Sweden.
- SP Herbário, Instituto de Botânica, São Paulo, Brazil.
- TENN Herbarium, Botany Department, University of Tennessee, Knoxville, Tennessee, USA.
- TNS Herbarium, Botany Department, National Science Museum, Tokyo, Japan.
- U Herbarium, Institute of Systematic Botany, State University of Utrecht, Utrecht, Netherlands.
- U at L Utrecht Bryophyte Herbarium; all bryophyte specimens are now at Leiden (see L).
- UBC Herbarium, Botany Department, University of British Columbia, Vancouver, British Columbia, Canada.
- UPS Botanical Museum (Fytoteket), Uppsala University, Uppsala, Sweden.
- US United States National Herbarium, Department of Botany, Smithsonian Institution, Washington, D.C., USA.
- USJ Herbario, Escuela de Biología, Universidad de Costa Rica, San José, Costa Rica.
- WTU Herbarium, Botany Department, University of Washington, Seattle, Washington, USA.

Other symbols and abbreviated terms used in this publication are defined as follows:

- † Dagger; when appearing after a name, it indicates the individual is deceased.
- ± Plus or minus sign; indicates more or less as used in the descriptions.
- ~ Approximately; used in "Specimens examined" sections.
- BR National highway in Brazil; used in specimens examined.
- Cd. Spanish abbreviation for *ciudad* ("city" in English); used in specimens examined.
- Mpio. Spanish abbreviation for municipality; used in specimens examined.
- s.l. Latin abbreviation for *sensu lato* (in the broad sense).
- s.n. Latin abbreviation for *sine numero* (without a number); used in specimens examined.
- Syn. nov. Latin abbreviation for *synonymum novum* (new synonym); used in specimens examined.
- YPFB Abbreviation for a truck compound in Bolivia; used in specimens examined.

Definitions of other italicized Latin abbreviations appearing in the family, genus, and species type citations may be found in van der Wijk et al. (1959).

Nearly all information presented in "Specimens examined" sections is reproduced exactly as it appeared on actual specimen labels. Minor editorial changes included substitution of "~" for "ca." and making capitalization and abbreviations consistent. However, Spanish, Portuguese, German, and other foreign language phrases appearing on specimen labels were left untranslated. In addition, conversion into metric of distances given in English units in these sections and in type descriptions is left to the reader.

SYSTEMATIC TREATMENT

Family HYPNACEAE Schimp.

Family HYPNACEAE Schimp., Coroll. Bryol. Eur. 113. 1855 [1856].—Orthotheciaceae Schimp., Coroll. Bryol. Eur. 103. 1855 [1856].—Pylaisiaceae Schimp., Syn. Musc. Eur. 241. 1860, "Pylaisiae"; Hypnaceae subfam. Pylaisioideae (Schimp.) M. Fleisch., Musci Buitenzorg 4: 1379. 1923, "Pylaisiae".—Microthamniaceae Kindb., Bot. Centralbl. 77: 386. 1899, *nom. illeg.*

Plants small to robust, in lax or dense mats, often lustrous, green to golden, sometimes reddish. Stems mostly creeping, sometimes ascending or rarely erect or pendent, irregularly branched to regularly pinnate, sometimes complanate-foliate, rarely julaceous; rhizoids smooth or papillose, in leaf axils or abaxial to leaf insertions; stems in cross section sometimes with a unistratose hyalodermis, subtended by small, firm- or thick-walled cells surrounding larger, thinner-walled cells, central strand present or absent; paraphyllia usually none, rarely present; pseudoparaphyllia filamentous or foliose; axillary hairs with 1–2(–4) short brown basal cells and 1 to several elongate, hyaline distal cells. Stem and branch leaves mostly similar, sometimes differentiated, straight to homomalous to falcate-secund, occasionally complanate, linear to broadly oblong-ovate, but typically lanceolate-ovate, often asymmetric, obtuse to acuminate, often concave, sometimes plicate, sometimes decurrent; margins not or very rarely bordered, entire to serrulate, rarely serrate, plane, recurved or incurved; costa short and double or absent; cells mostly linear, occasionally shorter, usually smooth, rarely prorulose or papillose, mostly thin-walled; alar cells usually differentiated, often quadrate, sometimes enlarged and inflated. Asexual propagula

sometimes present, mostly cylindrical to fusiform, uniseriate, and clustered in leaf axils, or sometimes multicellular, twisted-vermiform, with acute teeth at apices or bearing reduced leaves from apex to base of propagula. Autoicous or dioicous. Perichaetial leaves differentiated. Setae elongate, mostly smooth, usually reddish; capsules inclined to horizontal, sometimes erect, mostly asymmetric, arcuate or straight, ovoid to long-cylindrical, usually smooth, often constricted below the mouth when dry and empty; exothecial cells quadrate to rectangular, thin- or thick-walled, mostly not collenchymatous; annulus usually differentiated; operculum conic to rostrate; peristome typically double, the endostome rarely lacking, usually attached at the mouth, exostome teeth typically shouldered and bordered, on the front surface cross-striolate below, coarsely papillose above, sometimes reduced and papillose throughout or \pm smooth, typically strongly trabeculate at back; endostome usually free, sometimes fused to the exostome, mostly with a high, or rarely low, basal membrane, endostome broad or rarely narrow, keeled, usually perforate, usually as long as the exostome, cilia mostly in groups of 1–3 or rarely absent. Spores spherical to oval or ovoid, smooth or often papillose. Calyptrae cucullate, usually naked, rarely hairy, usually smooth.

KEY TO THE GENERA

(Only the numbered genera are treated in this publication.)

1. Stems with a hyalodermis 2
 2. Pseudoparaphyllia present, foliose to broadly filamentous *Hypnum* p.p.
 2. Pseudoparaphyllia lacking 3
 3. Leaves entire to minutely serrulate; asexual propagula often present 6. *Isopterygiopsis*
 3. Leaves serrulate to serrate; asexual propagula absent 3. *Herzogiella*
1. Stems lacking a hyalodermis 4
 4. Leaf cells smooth or inconspicuously and irregularly prorulose; branch and stem leaves scarcely differentiated 5
 5. Leaf areolation very lax; pseudoparaphyllia filamentous, cells thin-walled and bulging *Vesicularia*
 5. Leaf cells narrowly prosenchymatous; pseudoparaphyllia filamentous or foliose, cells firm-walled 6
 6. Leaves dimorphic (lateral and ventral leaves differentiated) 14. *Rhacopilopsis*
 6. Lateral and ventral leaves similar 7
 7. Leaves falcate-secund 8
 8. Capsules erect 12. *Pylaisia*
 8. Capsules inclined 9
 9. Alar cells well developed; pseudoparaphyllia foliose to broadly filamentous *Hypnum* p.p.
 9. Alar cells scarcely differentiated; pseudoparaphyllia, especially outer ones, filamentous or narrowly foliose *Ectropothecium* p.p.
 7. Leaves not falcate-secund 10
 10. Pseudoparaphyllia foliose; alar cells moderate in number 11
 11. Plants not complanate 12
 12. Capsules erect; branches often terminating in tuft of axillary brood branches 10. *Platygyrium*
 12. Capsules inclined; branches not terminating in tuft of axillary brood branches 13
 13. Costa $\frac{1}{4}$ – $\frac{1}{2}$ the leaf length; laminal cells sparsely prorulose 3. *Elmeriobryum*

13. Costa $\frac{1}{4}$ or less the leaf length; laminal cells smooth 14
14. Upper laminal cells ~3:1 **4. Homomallium**
14. Upper laminal cells more than 5:1 15
15. Branches soft, prostrate, often with hooked apices *Hypnum p.p.*
15. Branches stiff, erect, with straight apices **5. Irelandia**
11. Plants complanate, often strongly so **16. Taxiphyllum**
10. Pseudoparaphyllia filamentous or absent; alar cells few 16
16. Plants mostly without propagula or with small, ovoid ones; pseudoparaphyllia mostly filamentous, rarely absent; plants primarily occurring at low to moderate elevations, often weedy 17
17. Plants not complanate; leaves with a single, enlarged cell in the basal angles 18
18. Capsules small, ovoid, inclined; annulus differentiated *Ectropothecium p.p.*
18. Capsules cylindrical, erect; annulus not differentiated **9. Platygyriella**
17. Plants \pm complanate; leaves with weakly differentiated alar cells but not with a single enlarged cell in angles 19
19. Rhizoids smooth; exostome better developed than endostome **7. Isopterygium**
19. Rhizoids smooth to slightly roughened; endostome better developed than exostome **15. Syringothecium**
16. Plants with abundant elongate propagula in leaf axils; pseudoparaphyllia none; plants rare, at low to high elevations **13. Pseudotaxiphyllum**
4. Leaf cells conspicuously prorulose; branch and stem leaves \pm differentiated 20
20. Stems bearing paraphyllia **11. Puiggariopsis**
20. Stems without paraphyllia 21
21. Stem leaves decurrent, with well-developed alar regions **1. Ctenidium**
21. Stem leaves not decurrent, with poorly developed alar regions 22
22. Plants stipitate, with arched stems and slender, tapering branches; operculum conic-rostrate *Mittenothamnium*
22. Plants not stipitate, prostrate, with \pm blunt branches; operculum conic to apiculate 23
23. Leaves obtuse; laminal cells prorulose and papillose **8. Phylloдон**
23. Leaves acuminate; laminal cells only prorulose *Chryso-hypnum*

1. *Ctenidium* (Schimp.) Mitt.

Ctenidium (Schimp.) Mitt., J. Linn. Soc., Bot. 12: 509. 1869.

Hypnum subg. *Ctenidium* Schimp., Syn. Musc. Eur. 631. 1860. *Stereodon* sect. *Ctenidium* (Schimp.) Mitt., J. Linn. Soc., Bot. 8: 153. 1864. Type: *Ctenidium molluscum* (Hedw.) Mitt.

Plants small to medium-sized, in often extensive, dense mats, often lustrous, soft, green to yellow-green to

yellow-brown. Stems creeping to ascending, irregularly to regularly pinnately branched, the branches sometimes branched, unequal, not complanate-foliate; stems in cross section without a hyalodermis, with small thick-walled cells surrounding larger thinner-walled cells, central strand present; rhizoids finely papillose, reddish brown; paraphyllia none; pseudoparaphyllia foliose, large; axillary hairs consisting of 1–4 short, hyaline basal cells and 1 to several mostly elongate hyaline distal cells. Asexual reproductive bodies none. Stem and branch leaves differentiated, stem

leaves erect-spreading to squarrose-recurved, often secund, broadly ovate, abruptly acuminate, often plicate, especially when dry, cordate and broadly decurrent at base; margins serrate to serrulate throughout, plane to erect; costa short and double or none; cells linear to oblong-linear, low-prorulose at upper and sometimes lower ends on abaxial leaf surface, sometimes smooth, firm-walled, becoming shorter in a few rows across the insertion; alar cells decurrent, subquadrate to oblong, enlarged. Branch leaves smaller than stem leaves, erect-spreading to squarrose, obscurely homomallous to falcate-secund, lanceolate to ovate-lanceolate, gradually acuminate, concave, subplicate, short-decurrent; margins serrate to serrulate above, subentire to serrulate below, plane to recurved; costa short and double or none; cells linear to oblong-linear, conspicuously prorulose at upper and sometimes lower ends on abaxial leaf surface, firm-walled, becoming shorter in a few rows across the insertion; alar cells subquadrate to short-rectangular. Dioicous or phyllo dioicous. Perichaetial leaves erect with spreading apices, oblong to broadly oblong, abruptly long-acuminate, concave; margins serrulate above, serrulate to entire below, plane; costa short and double or none; cells oblong-linear to linear-flexuose, usually smooth, becoming laxly rectangular toward the insertion; alar cells not differentiated. Setae elongate, smooth or rarely roughened, reddish; capsules inclined to horizontal, arcuate, asymmetric, ovoid to broadly cylindrical; exothecial cells \pm isodiametric, thick-walled on vertical walls, thinner-walled on cross walls; annulus differentiated; operculum conic, mostly short-rostrate; peristome double, exostome teeth shouldered, bordered, on the front surface cross-striolate below, sometimes with overlying papillae, papillose above, trabeculate at back; endostome with a high basal membrane, segments keeled, perforate, nearly as long as the exostome, cilia in groups of 2–3, well developed to rudimentary. Spores spherical, finely papillose. Calyptrae cucullate, usually hairy, smooth.

Distribution: Most of the 21 species of *Ctenidium* occur in eastern Asia although the type species, *C. molluscum*, is circum-North Temperate. Only a single species occurs in Latin America.

Discussion: *Ctenidium* has differentiated stem and branch leaves and, in many ways, is like *Mittenothamnium* but is distinguished by decurrent leaves, especially those of the stem, with better alar cell development. *Ctenidium* is also characterized by serrate leaves with prorulose cells and stem leaves that are broadly ovate and abruptly tapered to an acuminate apex. A relationship to *Mittenothamnium* is unmistakable not only because of gametophytic characters but also because of its unequally thickened exothecial cells.

Ctenidium malacodes

Ctenidium malacodes Mitt., J. Linn. Soc., Bot. 12: 509. 1869. Type: Colombia. Andes Bogotensis, in sylvis supra Pacho ad arbores, 6000 ped., *J. Weir* 243 (lectotype: NY!, designated by Nishimura 1985); Ecuador. Guarapata, *Spruce* 1053 (syntype: NY!).

Cupressina anacamptopteris Müll. Hal., Bull. Herb. Boiss. 6: 123. 1898. *Ctenidium anacamptopteris* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1048. 1908. Type: Brazil. Serra Itatiaia, 2100 m, *E. Ule* 1882 (isotypes: H, US!).

Meteorium terrestre Müll. Hal., Hedwigia 40: 97. 1901. *Ctenidium terrestre* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1048. 1908. Type: Brazil. Santa Catharina: Serra Geral, *E. Ule* 1206 (isotype: H-BR).

Ctenidium muenchii Broth. ex H. A. Crum & Sharp, Bol. Soc. Bot. México 15: 15. 1953, *nom. nud. in syn.* BASED ON: Mexico. Chiapas: distr. San Cristobal, "los Llanos," 2500 m, 23 Dec 1907, *Münch* 7433 (H, NY!).

Plants medium-sized, often in extensive mats, lustrous, soft, yellow-green to golden. Stems to 6 cm long, creeping to ascending, subpinnately to pinnately branched, the branches often unequal, not complanate-foliate; stems in cross section with 3–5 rows of small thick-walled cells, the outermost row sometimes with \pm thin outer walls, surrounding larger thinner-walled cells, central strand of small thin-walled cells; pseudoparaphyllia foliose, large, serrulate; axillary hairs consisting of a single short hyaline basal cell, 1–2 long-rectangular hyaline intercalary cells and a single elongate hyaline distal cell. Stem and branch leaves differentiated, stem leaves 0.8–1.1 mm long, erect to wide-spreading with flexuose apices, broadly ovate-triangular, abruptly acuminate, the acumen flexuose, sometimes twisted, somewhat concave, usually somewhat plicate, broadly decurrent; margins serrate to sharply serrulate almost to base, plane or occasionally erect; costa short and double, the two forks not united at base; cells linear to oblong-linear, sparsely prorulose at upper ends on abaxial surface, firm-walled, becoming oblong to rectangular in 1–3 rows across the insertion; alar cells extending into the decurrencies, subquadrate to short-rectangular in a sizable group, surrounding 4–8 larger, oblong, \pm inflated cells often in a somewhat excavated area. Branch leaves (0.5–) 0.7–1.0(–1.1) mm long, wide-spreading, sometimes \pm secund, lanceolate to ovate-lanceolate, gradually acuminate, the apex curved to subflexuose and occasionally twisted, concave, subplicate, short-decurrent; margins serrate to serrulate above, subentire to serrulate below, plane above,

usually erect below; costa short and double, or often none; cells linear to oblong-linear, sparsely to densely prorulose at upper and sometimes lower ends at back, firm-walled, becoming rectangular in 1–2 rows across the insertion; alar cells few, only scarcely extending above the short decurrencies, subquadrate to oblong. Asexual propagula none. Dioicous. Perichaetial leaves 2.0–2.5 mm long, erect, oblong, abruptly slenderly long-acuminate, concave, subplicate; margins serrate in the acumen, coarsely serrate at the shoulder, serrulate to entire below, plane or rarely erect; costa none; cells oblong-linear, smooth, becoming laxly rectangular toward the insertion; alar cells not differentiated. Setae 1.6–2.3 cm long, elongate, smooth, reddish; capsules 1.5–2.0 mm long, inclined to horizontal, arcuate, asymmetric, ovoid to cylindrical; exothecial cells subquadrate, the vertical walls thick, the cross walls thin, often \pm sigmoid; annulus broad, of 2–3 rows of elongate firm-walled cells, deciduous; operculum short conic-rostrate; exostome teeth shouldered, bordered, on the front surface cross-striolate below, with fine, overlying papillae, the papillae becoming denser at midtooth and coarser above, trabeculate at back; endostome with a high, finely papillose basal membrane, segments finely papillose, keeled, perforate, sometimes gaping with age, about as long as the teeth, cilia finely papillose, in groups of 2–3, short to rudimentary. Spores 13–17 μ m in diameter, spherical, finely papillose. Calyptrae cucullate, appearing naked or with a few scattered hairs, smooth.

Distribution and ecology: Mexico to northern South America; controversially in eastern North America; growing typically on rocks but also soil and logs, in humid and often open forests, above 1500 m.

Illustrations in publications: Fig. 180G–J in Bartram (1949: 408); Pl. 130 in Buck (1998: 330); Fig. 776 in Nishimura and Ando (1994: 1047).

Discussion: *Ctenidium malacodes* is distinguished by its broadly ovate-triangular stem leaves that have large decurrencies of differentiated alar cells. The stem leaves are also abruptly acuminate and sharply serrate. The branch leaves are only shortly decurrent and gradually acuminate but usually more serrate than the stem leaves. The cells are prorulose on the abaxial surface of the leaves.

Ctenidium malacodes has been reported by Nishimura (1985) as occurring in eastern North America, where collections of the genus had previously been called *C. molluscum* (Hedw.) Mitt. Pedano (1996) suggested that this material is neither *C. molluscum* nor *C. malacodes* but rather a taxon intermediate between the two and worthy of species rank. Buck and Allen (2004) made the appropriate combination as *C. subrectifolium* (Brid.) W. R. Buck & B. H. Allen.

Selected specimens examined: **MEXICO.** Chiapas: San Cristoval, 2500 m, *Münch* 7433 (H, NY). México: Mpio. Ocuilán, Barranca de Mexicapa, 2200–2350 m, *Buck* 28148 (NY). Michoacán: 4.1 km W of Mil Cumbres, ~2800 m, *McGregor* 16574 (NY). Oaxaca: 34.5 km above Valle Nacional in Sierra Juárez on Hwy. 175, *Sharp et al.* 4750-*b* (TENN). Veracruz: Paß an der Straße Orizaba–Tehuacan, 23 Mar 1979, *Frabm s.n.* (NY). **GUA-TEMALA.** Huehuetenango: Sierra de los Cuchumatanes, 2400 m, *Steyermark* 50030 (NY). San Marcos: Barranco Eminencia, 2500–2700 m, *Standley* 86365 (NY). Sololá: Volcán Santa Clara, 2100–3000 m, *Steyermark* 46954 (NY). Totonicapán: Above Totonicapán, 2800–3100 m, *Standley* 84472 (NY). **COSTA RICA.** Alajuela: La Palma de San Ramón, *Brenes* 113 (NY). **PANAMA.** Chiriquí: Boquete, *Helion* 812 (H, NY). **JAMAICA.** Blue Mountains, St. Helen's to Morce's Gap, *Britton* 1075 (NY). **DOMINICAN REPUBLIC.** La Estrelleta: Sierra de Neiba, ~1700 m, *Buck* 4790 (NY). La Vega: Vicinity of La Lagunita, ~2600 m, *Norris et al.* B5738 (H). **Peruvia:** San José de Ocoa, La Nevera, ~2100 m, *Mejía & Zanoni* 8721 (JBSD, NY). **COLOMBIA.** Boyacá: Mpio. Duitama, Páramo "La Rusia," 3550 m, 06°N, 73°W, *Ireland* 23626 (CANM, US). **Caldas:** Cordillera Central, Magana, 3000–3300 m, *Killip & Hazen* 12098 (NY); Mpio. Río Sucio, on the Río Sucio, 1900–2080 m, ~05°20'N, 75°15'S, *Churchill & Arbeláez A.* 15658 (US). **Nariño:** Mpio. Pasto, between km 13 and 15, Cocha Lagoon, 3100 m, 01°12'N, 77°12'W, *Churchill & Arbeláez A.* 15960-*b* (US). **Norte de Santander:** Cordillera Oriental, 2800–3000 m, *Killip & Smith* 19868 (NY). **VENEZUELA.** Trujillo: Distr. Urdaneta, S and above La Mesa de Esnujaque, 3100 m, *Griffin III et al.* 1377 (FLAS, NY, TNS). **GUYANA.** Mt. Roraima, *Quelch & McConnell* 340 (H). **ECUADOR.** Andes Quitenses, ~1800 m, *Spruce* 1051 (H-SOL); Tim-giragia. 2700–3050 m, *Spruce s.n.* (NY). **PERU.** **Conven-ción:** Dept. Cuzco, 3200 m, *Bües* 1468 (NY). **BOLIVIA.** **Santa Cruz:** Vallegrande, Calaculo, ~26 km S of Vallegrande, road to Khasamonte, 2450 m, 18°38'S, 64°02'W, *Churchill & Arroyo P.* 21200 (US); Tablas, ~3400 m, *Herzog* 2817 (JE); Río Tocorani, ~2200 m, *Herzog* 4082 (H, JE). **BRAZIL.** Santa Catarina: Serra Geral, *Ule* 1157 (H).

2. *Elmeriobryum* Broth.

Elmeriobryum Broth., Leaf. Philipp. Bot. 6: 1974. 1913, *nom. inval. sin. descr. gen., in Engl., Nat. Pflanzenfam.* ed. 2, 11: 204. 1925. Type: *Elmeriobryum philippinense* Broth.

Plants somewhat shiny, golden brown to yellow-green, in relatively robust, extensive mats. Stems creeping, irregularly branched, procumbent to ascending; stems in cross section without a hyalodermis, with small thick-walled cells surrounding larger thin-walled cells, central strand present; pseudoparaphyllia narrowly foliose; axillary hairs consisting of 1(–2) short brown basal cells and 2–3 elongate hyaline distal cells. Stem and branch leaves somewhat differentiated, imbricate, erect- to wide-spreading, ovate to oblong, apiculate to short-acuminate, strongly concave, somewhat plicate; margins mostly serrulate above, entire below, plane to incurved; cells linear, smooth or minutely prorulose, thin- to firm-walled; alar cells not or somewhat differentiated. Asexual propagula not seen. Dioicous. Perichaetia large, leaves oblong, long-acuminate, plicate; margins subentire, plane; costa usually none; cells linear-flexuose, smooth, becoming laxly rectangular toward the insertion; alar cells not differentiated. Setae elongate, smooth, reddish; capsules inclined, weakly arcuate, \pm asymmetric, oblong; exothecial cells subquadrate to irregularly short-rectangular, firm-walled, not collenchymatous; annulus well-differentiated; operculum apiculate; peristome double, exostome teeth yellow-brown, shouldered, bordered, on the front surface with a zigzag median line, not furrowed, cross-striolate below, coarsely papillose above, trabeculate at back; endostome with a high basal membrane, segments keeled, narrow, perforate, about as long as the teeth, cilia in groups of 1–3, nodose. Spores spherical, papillose. Calyptrae small-cucullate, naked, smooth.

Discussion: A taxonomic study of the genus *Elmeriobryum* is currently in progress by the junior author. It was recently reviewed by Buck and Tan (2008). Thus far, the genus is known to have one species in Central America, one in eastern Asia (Philippines and Taiwan), and one in Papua New Guinea. It is sometimes combined with *Gollania*, but according to Rohrer (1985), *Elmeriobryum* differs from that genus by its heteromallous, broadly ovate leaves with acute to apiculate apices and porose basal cells. *Gollania* is characterized by mostly homomallous, ovate to ovate-lanceolate, acuminate leaves with nonporose to subporose basal cells.

Elmeriobryum guatemalense

FIGURE 1

Elmeriobryum guatemalense J. R. Rohrer, Bryologist 89: 29. 1986. Type: Guatemala. San Marcos: Barranco Eminencia, road between San Marcos and San Rafael

Pie de la Cuesta, in upper part of the barranco between Finca La Lucha and Buena Vista, 2500–2700 m, 6 Feb 1941, *Standley* 86466 (holotype: MICH; isotypes: F, FH, NY!).

Plants relatively robust, in extensive loose mats, shiny, golden brown to yellow-green. Stems to ~10 cm, creeping, elongate, irregularly and distantly 1–2-pinnately branched; stems in cross section with 2–3 rows of small thick-walled cells surrounding abruptly larger thin-walled cells, central strand of small very thin-walled cells; pseudoparaphyllia foliose; axillary hairs consisting of 1 short brown basal cell and 2 elongate hyaline distal cells. Stem and branch leaves somewhat differentiated; stem leaves 1.0–1.8 mm long, 0.7–1.4 mm wide, erect to erect-spreading when dry, spreading when moist, broadly ovate to oblong, abruptly apiculate, concave, plicate; margins serrulate above, entire below, reflexed at base, plane or broadly inrolled above; costa double, the two forks separated at base and \pm parallel, extending $\frac{1}{4}$ – $\frac{1}{2}$ the leaf length; median cells 25–75 \times 4–7 μ m, narrowly elliptic to linear, smooth or sometimes minutely prorulose, basal cells wider, porose; alar cells scarcely differentiated, slightly wider than other basal cells. Branch leaves 1.0–1.5 mm long, 0.4–0.7 mm wide, ovate to elliptic, less plicate than stem leaves. Asexual propagula none. Apparently dioicous. Perichaetia unknown. Sporophytes unknown.

Distribution and ecology: Known only in Central America from Guatemala, El Salvador, and Costa Rica (Figure 2). Usually on tree trunks and branches or sometimes on leaves. Also occurring on wet banks and rocks in moist forests. At moderate to high elevations from 1800 to 3000 m.

Discussion: This little-known species was formerly confused with *Leptohymenium* (Hylocomiaceae), but the distinction between it and *Leptohymenium* was resolved by Rohrer (1986). Unlike *Leptohymenium* and the rest of the Hylocomiaceae, the branching in *Elmeriobryum* is monopodial rather than sympodial, the leaves are not at all decurrent, and the alar cells scarcely if at all differentiated. This New World species differs from its Asian counterpart, *E. philippinense* Broth., by having leaves more strongly plicate, with an apiculate rather than an acute apex, and a stronger costa. Also, in *E. guatemalense* the alar cells are more poorly differentiated than in *E. philippinense*.

Selected specimens examined: GUATEMALA. **Guatemala:** Volcán de Pacaya, *Standley* 80724 (F, FH, MICH, US). **Quezaltenango:** El Pocito, S of San Martín Chile Verde, *Standley* 85043 (F, MICH, NY). **San Marcos:** Barranco Eminencia, *Standley* 68524 (F, FH). **Sololá:**

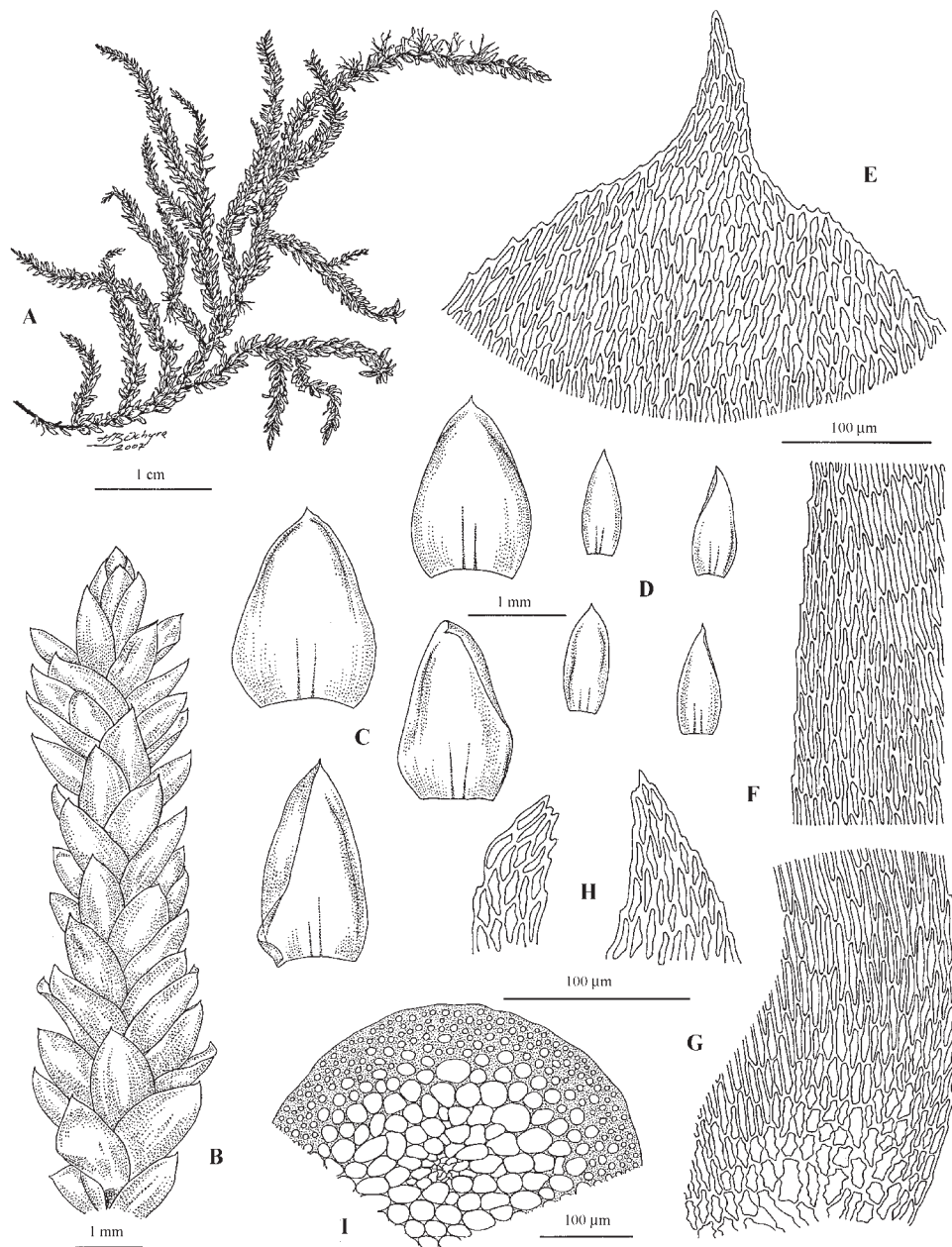


FIGURE 1. *Elmeriobryum guatemalense*. A. Habit. B. Enlargement of portion of branch. C. Stem leaves. D. Branch leaves. E. Apical leaf cells. F. Median-marginal stem leaf cells. G. Alar cells of stem leaf. H. Pseudoparaphyllia. I. Portion of stem cross section. All illustrations drawn from *Standley 80724* (US).

Volcán Atitlán, *Steyermark 47464* (F, FH, MICH, NY, TENN). EL SALVADOR. Santa Ana: Cerro Miramundo NW of Metapán, *Carlson 962b* (F, FH). COSTA RICA. Heredia: Volcán Barba, *Griffin et al. D-268* (CANM, F, MO, NY).

3. *Herzogiella* Broth.

Herzogiella Broth. in Engl., Nat. Pflanzenfam. ed. 2, 11: 466. 1925. Type: *Herzogiella boliviana* (Broth.) M. Fleisch. in Broth.

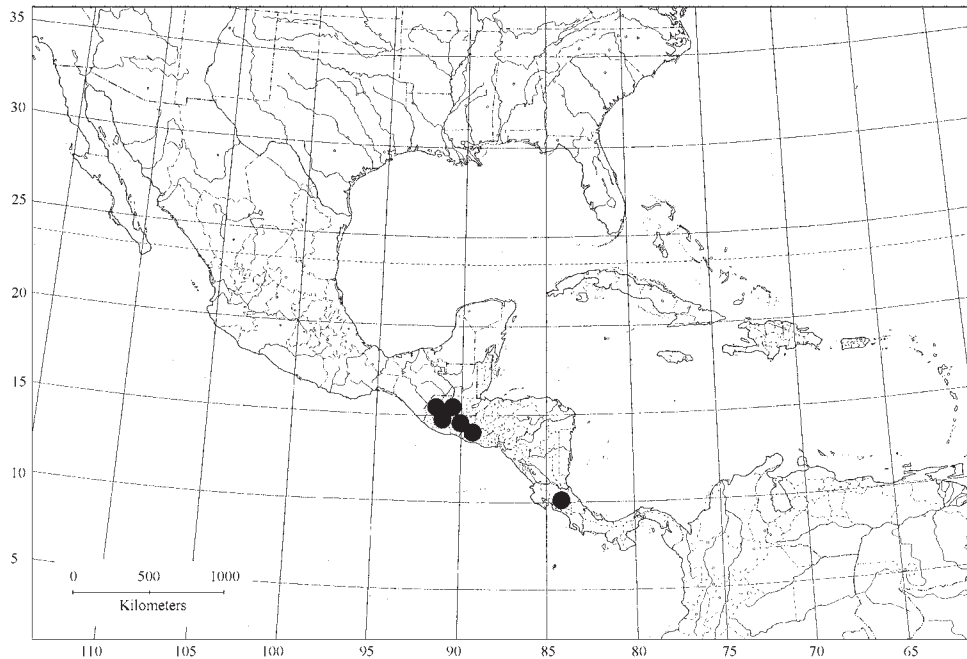


FIGURE 2. Distribution of *Elmeribryum guatemalense* in Latin America.

Dolichotheca Lindb., Not. Sällsk. Fauna Fl. Fenn. Förh. 13: 417. 1874. illeg. homonym (*non Dolichotheca* Cass., Dict. Sci. Nat. 51: 476. 1827. = *Coreopsis* in Asteraceae).

Isopterygium Mitt. subgen. *Dolichotheca* (Lindb.) Lindb., Musci Scand. 39. 1879.

Sharpiella Z. Iwats., J. Hattori Bot. Lab. 28: 202. 1965 (new name for *Dolichotheca* Lindb.). Type: *Plagiothecium repens* Lindb.

Plants medium-sized, in thin to dense mats, glossy, light green to yellow-green. Stems creeping to ascending, simple or sparingly and irregularly branched; stems in cross section with a hyalodermis, surrounding a few rows of smaller thick-walled cortical cells and large thin-walled cells in center, central strand usually absent; rhizoids sparse, papillose, in leaf axils of single Latin American species or in leaf axils or abaxial to leaf insertions in species from elsewhere, often restricted to base of stems; pseudoparaphyllia lacking; axillary hairs consisting of 1 short brown basal cell and 2–3 elongate hyaline distal cells. Asexual reproductive bodies lacking. Stem and branch leaves similar, rigid, crowded and imbricate to somewhat remote, spreading to squarrose, sometimes tips secund at stem and branch apices, concave, smooth, sym-

metric, nondecurrent or 1–2 cells decurrent, ovate or lanceolate, acuminate; margins serrulate to strongly serrate above the middle, serrate to nearly entire below, plane; costa short and double, rarely lacking; median cells thick-walled, linear-fusiform, smooth, the wall of cells at leaf base usually pitted, sometimes pits lacking; alar cells usually clearly differentiated, a few quadrate, rectangular, or abruptly inflated and rounded cells present with 1–4 cells on margins. Autoicous; perigonia and perichaetia near base of stems, leaves ovate-lanceolate, gradually acuminate; margins plane. Setae smooth, elongate, straight to curved, often twisted, yellow, brown or red; capsules erect to cernuous, straight or slightly curved, yellow, brown or reddish brown, oblong or cylindrical, when dry smooth or striate, tapering to a sometimes wrinkled neck, often contracted below mouth; operculum conic to short-rostrate; annulus of 2 or 3 rows of large cells, deciduous; peristome cross-striolate below, papillose above, bordered, trabeculate at back; endostome papillose, consisting of narrow keeled segments from a high basal membrane, cilia in groups of 1–3, approximately the length of segments, sometimes lacking. Spores spherical to ovoid, smooth or minutely papillose. Calyptra cucullate, smooth, naked.

Distribution: The eight species of *Herzogiella* known in the world occur in terrestrial habitats at low

to high elevations predominately in temperate and boreal regions.

Discussion: The genus *Herzogiella* is represented by five species in North America, with only one, *H. cylindricarpa* (Cardot) Z. Iwats., present in Latin America. Many of the taxa presently in *Herzogiella*, particularly the North American members, have had a checkered history of name changes. *Dolichotheca* Lindb. was once used as the generic name for many of the eight taxa but it was soon discovered to be a later homonym of *Dolichotheca* Cass. (= *Coreopsis*) in the Asteraceae. The species were then transferred to *Sharpiella* Z. Iwats., described in honor of A. J. Sharp, but Iwatsuki (1970) later discovered that it was synonymous with *Herzogiella*.

Herzogiella is characterized by autoicous plants, stems with a hyalodermis, papillose rhizoids in leaf axils of *H. cylindricarpa*, pseudoparaphyllia lacking, leaves non-decurrent or 1–2 cells decurrent, leaf margins serrate to serrulate throughout, capsules with conic to short-rostrate opercula, and urns usually striate when dry (except in *H. cylindricarpa*).

A synopsis of the genus *Herzogiella* and its five North American species, including *H. cylindricarpa*, has recently been published (Ireland, 1991b) showing the distribution of the species on the continent. The spores of *Herzogiella cylindricarpa* and six other species in the genus were recently studied under the scanning electron microscope (Ireland, 1990). All seven species had the gemmate type of spore ornamentation. However, two of the species, *H. cylindricarpa* and *H. striatella* (Brid.) Z. Iwats., more frequently had the verrucate type of ornamentation, indicating a closer relationship to each other than to the other five species studied, namely, *H. adscendens* (Lindb.) Z. Iwats. & W. B. Schofield, *H. perrobusta* (Cardot) Z. Iwats., *H. renitens* (Mitt.) Z. Iwats., *H. seligeri* (Brid.) Z. Iwats., and *H. turfacea* (Lindb.) Z. Iwats. The eighth species in the genus, *H. letestui* (Dixon & P. de la Varde) Ando, was not studied.

Herzogiella cylindricarpa

FIGURE 3

Herzogiella cylindricarpa (Cardot) Z. Iwats., J. Hattori Bot. Lab. 33: 374. 1970.

Isopterygium cylindricarpum Cardot, Rev. Bryol. 37: 56. 1910; *Ctenidiadelphus cylindricarpus* (Cardot) E. B. Bartram, Bryologist 49: 124. 1946. Type: Mexico. Amecameca, Pringle, *Plantae Mexicanae* 10606 (lectotype: MO!, here designated; isolectotypes: F!, FH!, H!, MICH!, TENN!, US!).

Plagiothecium bolivianum Broth. in Herzog, Biblioth. Bot. 87: 153. 1916; *Herzogiella boliviana* (Broth.) M. Fleisch. in Broth. in Engl., Nat. Pflanzenfam. ed. 2, 11: 466. 1925. Type: Bolivia. Waldgrenze über Tablas, Herzog 2821 (lectotype: H!, here designated); zwischen San Mateo u. Sunchal, Herzog 4435 (syntype: NY!).

Plants in thin, loose mats, glossy, yellowish green. Stems 0.6–1.5 cm long, 1–2 mm wide, ascending, simple to irregularly branched; rhizoids papillose, in leaf axils. Leaves 1.0–1.5 mm long, 0.4–0.6 mm wide, somewhat rigid, close to distant, loosely complanate-foliate, erect to wide-spreading, sometimes distinctly secund, smooth or weakly plicate, lanceolate, slightly concave, slenderly acuminate; margins sharply serrate above, serrulate below to base, plane; costa short and double or none; median cells 47–70 × 5–6 μm, smooth, linear; alar regions with a few quadrate, rectangular or rounded cells, often 1–4 cells on margins. Autoicous. Setae 1.0–1.8 cm long, reddish brown, sometimes yellowish above; capsules 1.5–3.0 mm long, 0.3–0.4 mm wide, yellowish, erect, sometimes slightly curved, 1.5–3.0 mm long, 0.3–0.4 mm wide, narrowly cylindrical, usually contracted below mouth when dry, narrow at the sometimes wrinkled neck; operculum conic to obliquely short-rostrate; peristome teeth up to 0.2 mm long, cilia none. Spores 10–12 μm in diameter, minutely papillose.

Distribution and ecology: Infrequent and thus far known from Mexico, Guatemala, Costa Rica, and a few localities in Colombia, Venezuela, Bolivia, Peru, and Ecuador (Figure 4); also known from Rwanda (Africa). Usually occurring on humus on moist, rotting logs, bases of trees and tree trunks, mainly coniferous, and rarely on rock. Predominately at high elevations, mostly over 2500 m and known up to ~4100 m; recorded as low as 1830 m.

Discussion: Recognized by the erect- to wide-spreading, lanceolate, slightly concave, slenderly acuminate leaves with plane margins that are serrate above and serrulate below to the base. The stems have a prominent hyalodermis which is evident in cross section. The plants are autoicous and the sporophytes are distinctive because of the very slender, long, erect capsules, narrowed at the neck and contracted below the mouth when dry.

Herzogiella cylindricarpa was originally described as an *Isopterygium* by Cardot (1910), but Bartram (1946) transferred it to *Ctenidiadelphus* M. Fleisch., a genus then known to have species only in Java and Borneo. Iwatsuki (1970) eventually transferred *C. cylindricarpa* to *Herzogiella* when he revised that genus.

The lectotype (*Herzog* 2821) of *Plagiothecium bolivianum* Broth. in Herzog was designated from a collection

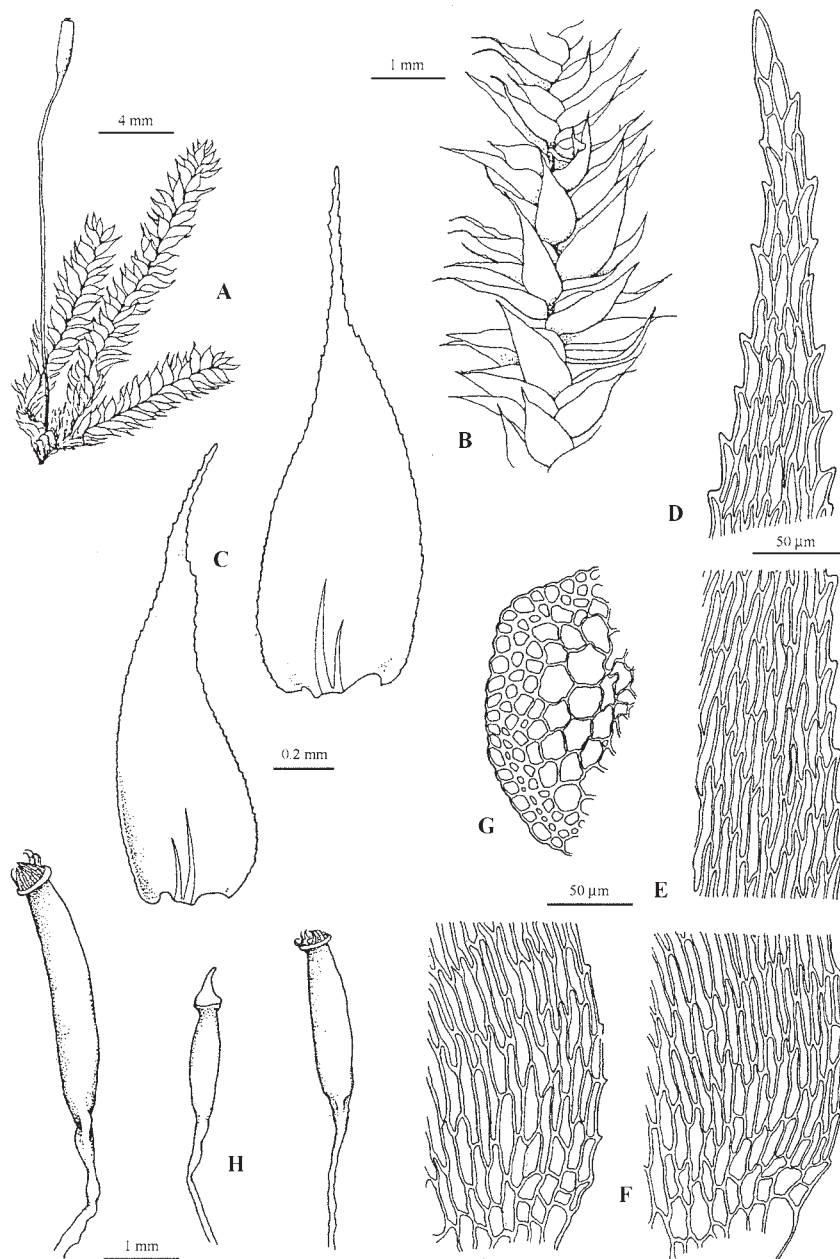


FIGURE 3. *Herzogiella cylindricarpa*. A. Habit. B. Enlargement of portion of stem. C. Leaves. D. Apical leaf cells. E. Median-marginal leaf cells. F. Cells of alar region. G. Portion of stem cross section. H. Capsules (dry). Illustrations A–F drawn from *Sharp* 2287 (MEXU); G drawn from *Cárdenas* 4276 (MEXU); H, one on left from *Sharp* 2287 (MEXU), two on right from *Sharp* 2160 (TENN).

in the Brotherus herbarium in Helsinki. The species is here considered synonymous with *Herzogiella cylindricarpa* although the lectotype has capsules that are much shorter (1.5–2.0 mm) than those in most of the other Latin American collections of *H. cylindricarpa*. The capsules from this collection are apparently those illustrated by Brotherus when he described the species in Herzog

(1916: tbl. 7). Another specimen mentioned by Brotherus in the protologue of *P. bolivianum* (syntype: *Herzog* 4435 NY) has longer capsules (2.0–2.5 mm), even though they are somewhat immature, that are more typical of *H. cylindricarpa*. The other morphological features of the type specimens of *P. bolivianum* are typical of *Herzogiella cylindricarpa*.

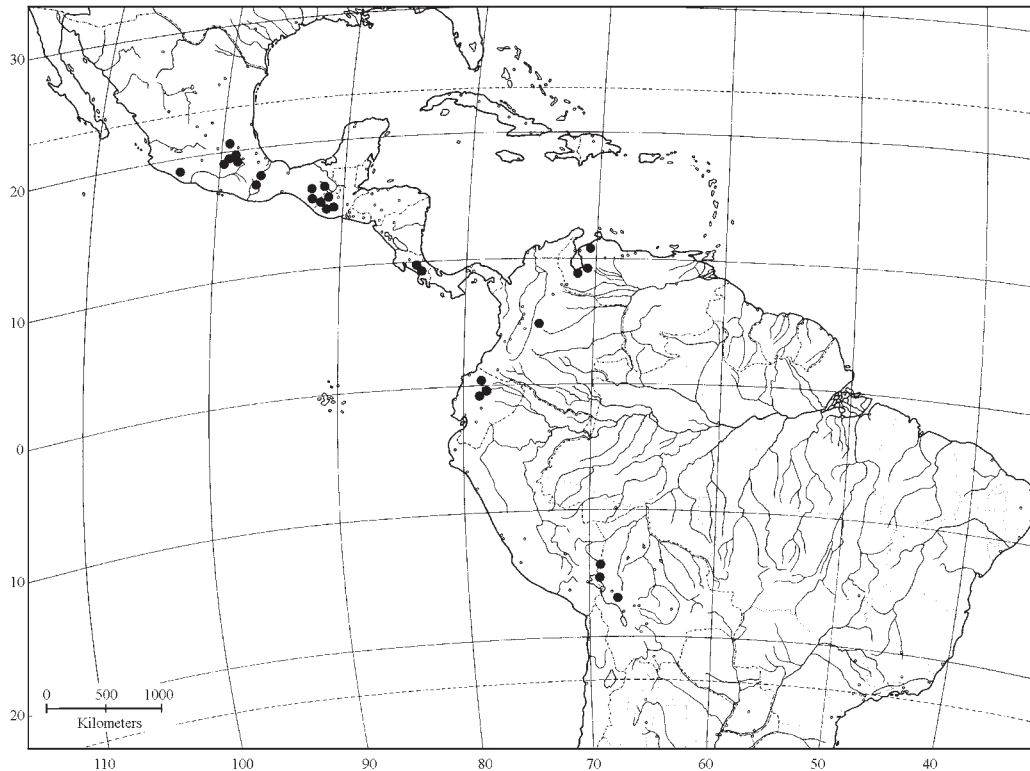


FIGURE 4. Distribution of *Herzogiella cylindricarpa* in Latin America.

Specimens examined: **MEXICO.** **Chiapas:** Cerro Mozotal, 29 km NW of Motozintla, 2880 m, *Cárdenas* 4252 (MEXU); Cima del Cerro Tzontehuitz, close to Tenejapa, 2870 m, *Cárdenas* 4276 (MEXU, MO, NY); near Las Casas, 2682 m, *Sharp* 3481 (CANM, MEXU, MICH, TENN). **Distrito Federal:** Desierto de los Leones, *Lyonnet* 1623 (MEXU); El Zarco, 3200 m, *Sánchez & Herrera* 51 (MEXU). **Hidalgo:** 10 km N of Pachuca, Mineral del Monte, 2810 m, *Castillo* 33 (MEXU); 2 km N of Presa Jaramillo, El Chico, 2920 m, *Alfaro & Castillo* 112 (MEXU). **México:** Mpio. de Tlalmanalco, 3 km E of San Rafael, 2750–2900 m, *Cisneros* 1666 (CANM); Cañada en la Vertiente NW of Iztaccíhuatl, 2690–2980 m, 19°12'N, 98°43'W, *Cárdenas* 3973 (NY). Popocatepetl, 11 km E of Amecameca, 3000 m, *Held & van Rhijn* HM 11 (CANM). **Michoacán:** Along Federal Hwy. 15, ~50 km W of Cd. Hidalgo, *Sharp et al.* 2301 (CANM); ~46 km W of Cd. Hidalgo, 2700 m, *Sharp et al.* 2286b (CANM, TENN). **Oaxaca:** Above Llano de las Flores in Sierra Juárez on Hwy. 175 between Tuxtepec and Oaxaca, 2400 m, *Sharp et al.* 132 (MEXU, MICH, MO, NY), 140a, 2332 (CANM, TENN), 2341 (CANM, F, MEXU, TENN); N of Oaxaca, along road N of Llano

de Las Flores, *Iwatsuki & Sharp* 532a (CANM). **Tlaxcala:** Mpio. de Tlaxco, Ex-Hacienda de Tlacotla, 2950 m, *Reyna s.n.* (MEXU, U). **GUATEMALA.** **Chimaltenango:** Cerro de Tecpan, region of Santa Elena, 2400–2700 m, *Standley* 60966 (FH, MICH); slopes of Volcán de Acatenango, above Las Calderas, 2400–2700 m, *Standley* 61923 (F, FH). **Huehuetenango:** Sierra de los Cuchumatenes, along road beyond La Pradera, km 32, ~3300 m, *Standley* 81813 (FH); above San Mateo Ixtatán, 3048 m, *Sharp* 4962a (CANM, TENN). **Quezaltenango:** Volcán Santa María, upper NE facing slopes to summit of volcano, 3000–4200 m, *Steyermark* 34086, 34105 (DUKE, F, FH, MICH), 34121 (F, FH, MICH); above Los Vahos, Cerro Quemado, 2900–3000 m, *Standley* 86103 (F, FH, MICH); above Chiquival, 2621 m, *Sharp* 2160 (TENN); Cerro de Sija, 3048 m, *Sharp* 5033 (CANM, DUKE, F, FH, MICH, TENN); Getena area N of Sija, 3002 m, *Sharp* 2287 (MEXU, TENN). **Totonicapán:** Pacajá region of Desconsuelo, mountains above Totonicapán, 3100–3200 m, *Standley* 84534 (F, FH, MICH); E of Totonicapán, 3200 m, *Sharp* 2619 (DUKE, FH, TENN). **COSTA RICA.** **San José:** ~12 km NE of Canáan, on trail to Cerro Chirripó, 2940–3120 m, *Bowers* 914-G, 916-I

(TENN, USJ), 919-I (TENN); Cerros de las Vueltas, 2700–3000 m, *Standley & Valerio 43761b* (FH); southern slope of Volcán de Turrialba, 2000–2400 m, *Standley 35013* (FH, NY), 35015, 35159, 35217 (FH). **COLOMBIA. Cundinamarca:** Mpio. de Subachoque and Supata, “El Tablazo,” 3500 m, *Ireland 23374* (CANM, COL, MO, NY), *Lewis 88-1234* (CANM, LPB), *Lewis 88-1222* (LPB). **VENEZUELA. Mérida:** Páramo de Los Granates, 3000–3100 m, *Griffin PV-942* (CANM). **Trujillo:** Above Mpio. Las Piedras, Páramo de Guirigay, 3200 m, *Griffin & López PV-1536* (CANM); Páramo El Jabón, al SE y arriba de Carache, 2900–3300 m, *Griffin & López PV-1452* (NY). **ECUADOR. Imbabura:** Lago San Marcos, Cayambe Mountain, 3414 m, *Cazalet & Pennington 68* (MICH, NY). **Napo:** At Km 45 on road from Salcedo to Napo, 3800 m, *Laegaard 54158CC* (NY); 3600 m, *54159M* (NY); N side of Laguna Verdecocha, 2 km E of the peak of Cerro Quilindaña, Cord. Oriental, 4100 m, 78°21'W, 0°47'S, *Løjtnant & Molau 11679* (NY). **Pichincha:** Road Olmedo–Laguna San Marcos, W of the pass, 3600 m, *Ølgaard et al. 34341* (CANM, MO, NY). **PERU. Amazonas:** Prov. Chachapoyas, Chachapoyas-Cajamarca road, ~3 km above Leymebamba, 2700 m, *Philippi 2334a* (NY). **BOLIVIA. La Paz:** Prov. Saavedra, mountain side directly N of river, beneath Niño Karine, NNW of Chuma, 3250 m, *Lewis 79-1044* (CANM, F, NY), *79-1045A* (CANM, F). Prov. Franz Tamayo, along trail between Pelechuco and Pata, 3050 m, *Lewis 88-1852 d-1* (CANM). Prov. Inquisivi, Río Glorieta, ~8 km NW of Quime, 3200–3400 m, *Lewis 87570* (MO).

4. *Homomallium* (Schimp.) Loeske

Homomallium (Schimp.) Loeske, *Hedwigia* 46: 314. 1907; *Hypnum* subg. *Homomallium* Schimp., *Syn.* 616. 1860; *Stereodon* sect. *Homomallium* (Schimp.) C. E. O. Jensen, *Danm. Moss.* 2: 115. 1923. Type: *Hypnum incurvatum* Brid.

Plants small to medium-sized, in flat mats, shiny, soft, yellow-green to dark green. Stems creeping, regularly to

irregularly pinnately branched, not or weakly complanate-foliate; stems in cross section dorsiventrally flattened, without a hyalodermis, with medium-sized thick-walled cells surrounding larger thinner-walled cells, central strand small; pseudoparaphyllia filamentous; axillary hairs with a single short brown basal cell and 1–2 elongate hyaline apical cells. Stem and branch leaves similar or somewhat differentiated, not or weakly complanate, erect-spreading to ± homomallous, concave, not or slightly plicate, ovate-lanceolate to lanceolate, short- to long-acuminate, short-decurrent; margins subentire to weakly serrulate above, plane or recurved below; costa short and double; cells oblong- to linear-rhomboidal, smooth or (extralimitally) prorulose, shorter in the acumen; alar cells relatively numerous, subquadrate to oblate, with a single decurrent cell. Asexual propagula not seen. Autoicous. Perichaetial leaves erect, oblong-lanceolate, short- to long-acuminate, not or scarcely plicate; margins entire to serrulate; costa none or short and double. Setae elongate, smooth, reddish; capsules inclined to horizontal, arcuate, asymmetric, cylindrical, constricted below the mouth when dry and empty; exothecial cells rounded-hexagonal to short-rectangular, ± thick-walled; annulus differentiated; operculum conic-apiculate to obliquely short-rostrate; peristome double, exostome teeth pale yellow, shouldered, bordered, on the front surface with a zigzag median line, not furrowed, cross-striolate below, papillose above, trabeculate at back; endostome with a high basal membrane, segments keeled, perforate, smooth or papillose, cilia in groups of 1–3, nodulose. Spores spherical, nearly smooth to finely papillose. Calyptrae cucullate, naked, smooth.

Discussion: *Homomallium* is somewhat intermediate between the erect-capsuled, epiphytic Hypnaceae genera, like *Pylaisia* or *Platygyrium*, and more typical terrestrial members of the family. It is characterized by relatively short apical leaf cells, numerous quadrate alar cells and curved, asymmetric capsules with a perfect peristome (Ando, 1964). The genus barely makes it into the Neotropics, with one species in northern Mexico and adjacent United States and the other a little-collected Mexican endemic.

KEY TO THE SPECIES OF *HOMOMALLIUM*

1. Branches usually homomallous-foliate; stem and branch leaves scarcely differentiated, relatively short-acuminate; margins usually recurved below; branch leaf alar cells extending up the margins 20–30 cells 1. *H. mexicanum*
1. Branches not homomallous-foliate; stem and branch leaves differentiated, relatively long-acuminate; margins erect to narrowly incurved; branch leaf alar cells extending up the margins 8–13 cells 2. *H. sharpii*

1. *Homomallium mexicanum*

Homomallium mexicanum Cardot, Rev. Bryol. 37: 53. 1910. Type: Mexico. Hidalgo: Cuyamaloya Station, 17 Sept 1908, Pringle, *Plantae Mexicanae* 10631 (syntypes: NY-3!, US!), 15250 (syntype: specimen not seen).

Plants medium-sized, in flat mats, shiny, soft, pale green to dark green. Stems to 4 cm long, creeping, elongate, irregularly pinnately branched; branches erect-ascending, somewhat curved, 2–7 mm long, rarely flagelliform; in cross section with 1–2 rows of medium-sized, thick-walled cells surrounding abruptly larger firm-walled cells, central strand of small, very thin-walled cells; pseudoparaphyllia filamentous; axillary hairs of 1 short brown basal cell and 1–2 elongate hyaline apical cells. Stem and branch leaves similar, 1–1.4 mm long, homomallous, strongly concave, ovate-lanceolate, broadly long-acuminate; margins subentire to serrulate above, entire below, usually narrowly recurved below, plane above; costa short and double; cells long-hexagonal, flexuose, 40–70 μm long at midleaf, mostly 5–6 μm wide, as short as 20 μm long in the acumen, smooth; alar cells subquadrate to oblate (especially along the margins) in 6–8 rows, extending up the margins by 20–30 cells. Perichaetial leaves erect, oblong-lanceolate, convolute, gradually narrow-acuminate; margins subentire. Setae 0.5–1.5 cm long, reddish; capsules 1.3–1.5 mm long, suberect to inclined, cylindrical; annulus of 1 row of thick-walled cells; operculum ~0.4 mm long, mostly obliquely short-rostrate; exostome teeth cross-striolate below, coarsely papillose above, trabeculate at back; endostome yellowish, papillose throughout, with a high basal membrane, segments keeled, perforate, cilia mostly in pairs. Spores 15–20 μm in diameter. Calyptrae cucullate, naked, smooth.

Distribution and ecology: Northern Mexico; also in southwestern United States; growing on bases of hardwood trees, logs, and rocks, mostly at (1500–)2000–2700 m.

Illustrations in publications: Fig. 755 in Ando (1994: 1016).

Discussion: When sterile, the plants might be confused with *Pylaisia* because of the numerous alar cells. However, the shorter apical laminal cells are decidedly different than those in that genus. When sporophytes are present (frequent), the inclined, asymmetric capsules separate it from the erect, symmetric capsules of *Pylaisia*. *Homomallium mexicanum* differs from *H. adnatum* (Hedw.) Broth., of eastern North America, by its larger size (leaves greater than 1 mm long), longer apical laminal cells, and recurved lower leaf margins.

Specimens examined: MEXICO. Durango: Along Hwy. 40, W of Durango, near Km 103, 23°48'N, 105°23'W, ~2355 m, King & Garvey B311 (MO, NY). Guanajuato: Sierra de Pénjamo, 24 km SW de Cuerámaro, 20°35'N, 101°45'W, Delgadillo 5825 (MEXU, NY). Hidalgo: Only the type seen.

2. *Homomallium sharpii*

Homomallium sharpii Ando & Higuchi, Bryologist 86: 374. 1983 [1984]. Type: Mexico. Tamaulipas: La Perra (El Porvenir), Rancho del Cielo above Gómez Farias, 6300 ft, Sharp 5641a (holotype: TENN!; isotypes: HIRO, MICH!).

Plants medium-sized, in flat mats, shiny, soft, yellow-green to yellow-brown. Stems to 4 cm long, creeping, elongate, irregularly pinnately branched; branches erect-ascending, somewhat curved, to 1 cm long; stems in cross section with 2–4 rows of small, thick-walled cells surrounding abruptly larger firm-walled cells, central strand of small, very thin-walled cells; pseudoparaphyllia filamentous; axillary hairs of 1 short brown basal cell and 1 elongate hyaline apical cell. Stem and branch leaves somewhat differentiated; stem leaves 0.9–1.1 \times 0.4–0.6 mm, \pm homomallous, \pm falcate, concave, broadly ovate-lanceolate, long-acuminate; branch leaves not homomallous, 1–1.3 \times 0.3–0.5 mm, ovate-lanceolate, long-acuminate; margins subentire to serrulate above, entire below, usually erect above, plane below; costa short and double; cells long-hexagonal, flexuose, (30–)40–60 μm long at midleaf, mostly 3–5 μm wide, as short as 25 μm long in the acumen, smooth; alar cells subquadrate to oblate (especially along the margins) in 6–8 rows, extending up the margins by 8–13 cells. Perichaetial leaves erect, oblong-lanceolate, convolute, gradually narrow-acuminate; margins subentire. Setae 1–1.8 cm long, reddish; capsules 1.3–2 mm long, suberect to inclined, cylindrical; annulus of 1 row of thick-walled cells; operculum ~0.4 mm long, mostly conic-apiculate; exostome teeth cross-striolate below, coarsely papillose above, trabeculate at back; endostome yellowish, papillose throughout, with a high basal membrane, segments keeled, perforate, cilia in groups of 2–3. Spores 13–15 μm in diameter. Calyptrae cucullate, naked, smooth.

Distribution and ecology: Northeast Mexico; endemic; growing on limestone, at 1900–2500 m.

Illustrations in publications: Fig. 756 in Ando (1994: 1018).

Discussion: This species differs from *H. mexicanum* in the nonhomomallous branch leaves with longer acumina and fewer alar cells. The stem and branch leaves are differentiated much more so than in *H. mexicanum*. The spores are smaller and the peristomial cilia are in groups of 2–3.

Specimens examined: MEXICO. San Luis Potosí: Just E of San Francisco, 45 km E of San Luis Potosí, at Km 218 along Hwy. 70, 2166 m, *Magill 2591a*, 2593 (HIRO, TENN); on hillsides along Hwy. 70 near Km 226, 37 km E of San Luis Potosí, 2318 m, *Magill 2577* (HIRO, TENN). **Tamaulipas:** Only the type seen.

5. *Irelandia* W. R. Buck

Irelandia W. R. Buck, *Brittonia* 36: 179. 1984b.

This is a monospecific genus with the characters of the species.

Irelandia robusticaulis

FIGURE 5

Irelandia robusticaulis (E. B. Bartram) W. R. Buck, *Brittonia* 36: 179. 1984b.

Isopterygium robusticaule E. B. Bartram, *Bryologist* 49: 122. 1946; *Taxiphyllum robusticaule* (E. B. Bartram) Ireland, *Bryologist* 87: 360. 1984 (1985). Type: Guatemala, Dept. Alta Verapaz, Montaña Yxocubvain, 2 ½ mi. W of Cubilgüitz, alt. 300–500 m, *Steyermark 44970a* (holotype: FH!; isotypes: FI, TENN!, US!); Cerro de Agua Tortuga (Sahacoc), vicinity of Cubilgüitz, alt. 350–450 m, *Steyermark 44584* (paratypes: FH!, MICH!).

Isopterygium guatemalense E. B. Bartram, *Bryologist* 49: 123. 1946. Type: Guatemala, Dept. Chimaltenango, between Chimaltenango and San Martín Jilotepeque, *Standley 80937* (holotype: FH!; isotypes: FI, MICH!), 64364 (paratype: FH!).

Plants in thin, loose mats, glossy, dark green to yellow-green. Stems to 4.5 cm long, 1.5–2.5 mm wide, subjulaceous, simple or irregularly branched; stems in cross section with 1–3 rows of small thick-walled cells surrounding larger somewhat thinner-walled cells, central strand small, consisting of thin-walled cells; pseudoparaphyllia foliose; axillary hairs with 1–3 short brown basal cells and a single elongate hyaline distal cell. Stem and branch leaves similar, 1.5–2.0(–2.5) mm long, 0.5–0.8 mm wide, rigid, imbricate or erect-spreading, concave, smooth, ovate-lanceolate, symmetric, acuminate; margins entire to serrulate or serrate above, serrulate or entire below, broadly recurved

above, somewhat incurved below; costa short and double or lacking; median cells 47–94 × 5–9 µm, smooth or rarely minutely prurulose at upper ends on dorsal surface; alar cells strongly differentiated, quadrate to rectangular, in 1 to several rows with 5–15 cells in the margin. Asexual propagula none. Dioicous; rarely producing sporophytes. Setae 1.2 cm long, brown to reddish, flexuose; capsules 1.5 mm long, inclined, subarcuate, yellowish brown, oblong-ovoid, somewhat contracted below mouth when dry; operculum unknown; annulus present, persistent, of 2 rows of cells; 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 or approximately the same length as the segments, in groups of 1–3. Spores 9–19 µm in diameter. Calyptrae not seen.

Distribution and ecology: Rare or seldom collected; Mexico, Guatemala, Honduras, Jamaica, and Haiti (Figure 6); occurring on limestone bluffs, on shaded banks, or on bark of trees in forests, 250–1800 m.

Discussion: This monospecific genus and its distinctive species are characterized by its stiff, dark green to yellow-green, subjulaceous plants, imbricate or erect-spreading, concave, ovate-lanceolate, acuminate leaves with margins broadly recurved above, and strongly differentiated alar regions of 1 to several rows of quadrate to rectangular cells with 5–15 differentiated cells along the margin.

Buck (1984b), who described this monospecific genus in honor of the senior author, distinguished it from *Taxiphyllum* primarily on the basis of its stiff plants with erect-spreading leaves, noncomplanate foliate branches, and leaves more or less abruptly long-acuminate with a much better developed alar region with numerous rectangular cells along the leaf margins. In addition to these characters, the plants have conspicuous broadly recurved leaf margins near their apices.

The senior author (Ireland, 1984) placed this species, which was originally described as an *Isopterygium* by Bartram (1946), in the genus *Taxiphyllum* because it has foliose pseudoparaphyllia, a julaceous habit, and a large number of quadrate to rectangular alar cells on the leaf margins. These features also occur in *Taxiphyllum cuspidifolium* (Cardot) Z. Iwats. from the southern United States. However, the rigid stems and the strongly recurved distal leaf margins of *T. robusticaule* do not occur in *T. cuspidatum* or any other species of *Taxiphyllum* and seem to place the genus *Irelandia* apart from *Taxiphyllum*. These distinctions, however, may not be strong enough to support establishment of a new genus. Future DNA studies may be helpful in deciding if *Irelandia* is truly worth recognizing.

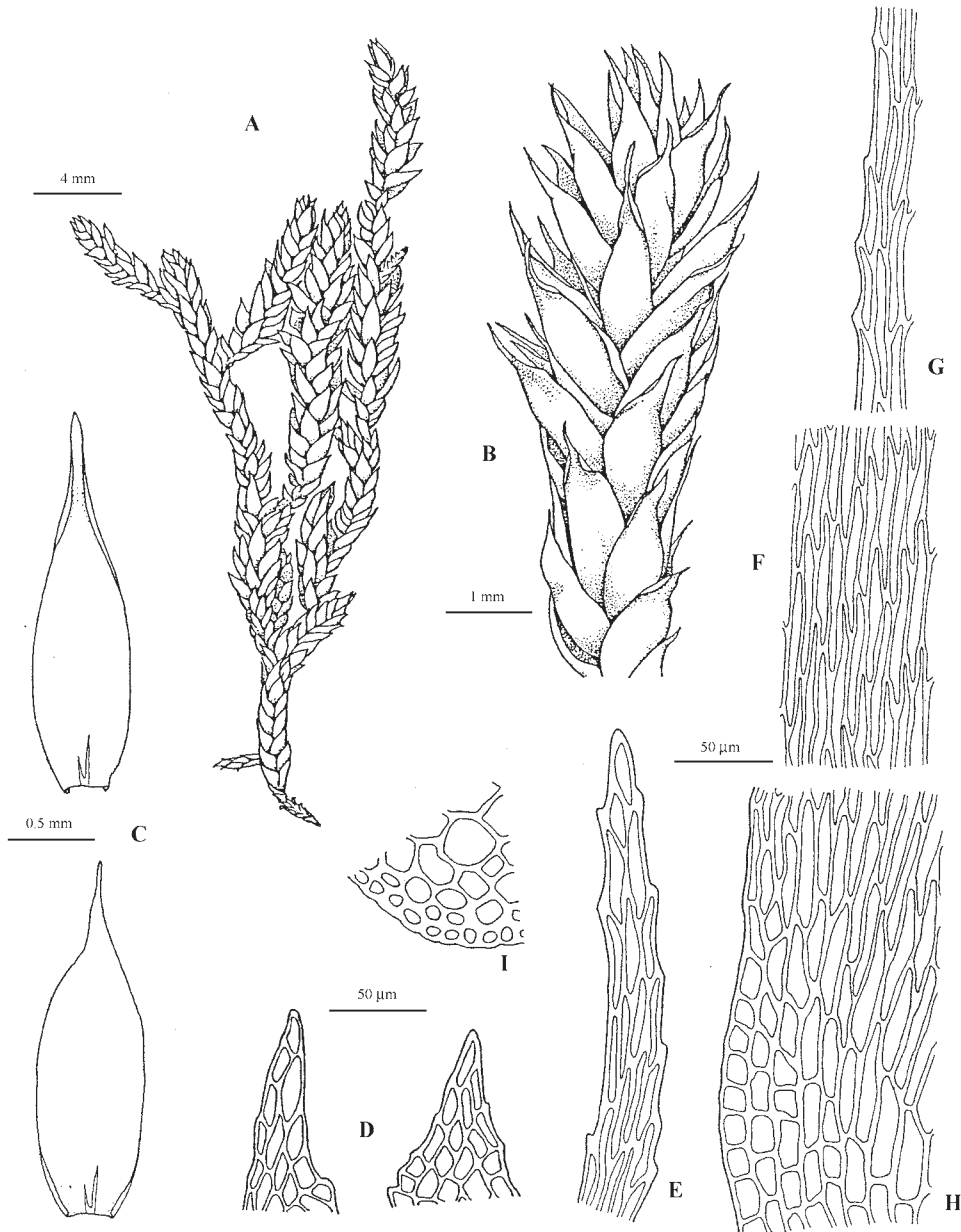


FIGURE 5. *Irelandia robusticaulis*. A. Habit. B. Enlargement of stem. C. Leaves (leaf above, view of dorsal surface; leaf below, view of ventral surface). D. Pseudoparaphyllia. E. Apical leaf cells. F. Median leaf cells. G. Marginal leaf cells. H. Alar cells. I. Portion of stem cross section. All illustrations drawn from *Sharp 1378a* (TENN).

Buck (1984b) did not include *Isopterygium guatemalense* E. B. Bartram in the synonymy of *Irelandia* at the time he described the genus. Buck (1998: 323) later stated that he was unconvinced that it belongs in the genus because it is “a much softer plant that has more or less plicate leaves and shorter acumina.” However, since the senior author (Ireland, 1984) included it in the synonymy

of *Taxiphyllum robusticaule*, it has been included here in the synonymy of the species until a more detailed study of the important characters of the two taxa can be made.

Specimens examined: MEXICO. Puebla: El Cerro de Cuhuatepec, 1140 m, *Sharp 1378a* (TENN, US). GUATEMALA. Alta Verapaz: Near Río Icvolay, near Hacienda Yaxcabnal, 8 km NW of Cubilgüitz, 250–300 m,

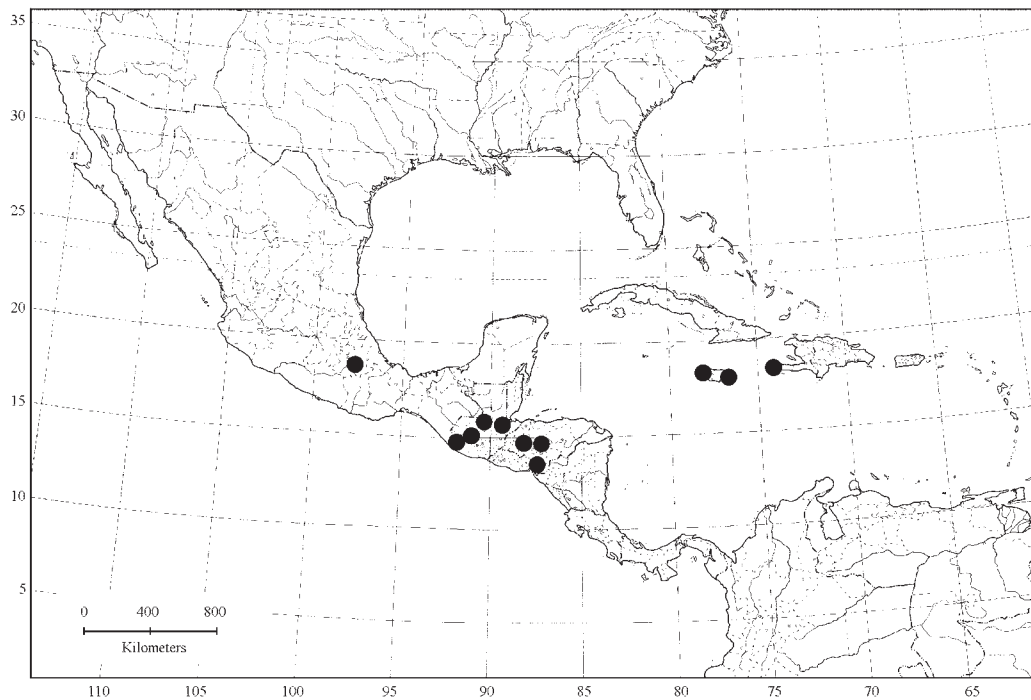


FIGURE 6. Distribution of *Irelandia robusticaulis* in Latin America.

Steyermark 44702 (F, FH). **Baja Verapaz:** Patal, 1615 m, *Sharp* 2827 (MEXU, US). **Chimaltenango:** Near Río Pixcayó, between Chimaltenango and San Martín Jilotepeque, 1650–1800 m, *Standley* 64364 (F, FH). **Retalhuleu:** Dept. Quezaltenango, near Chivolandia, along road to San Felipe, 650 m, *Standley* 87209a (FH). **Zacapa:** Upper reaches of Río Sitio Nuevo, between Santa Rosalía and first waterfall, 1200–1500 m, *Steyermark* 42208 (F, FH). **HONDURAS.** **Comayagua:** Vicinity of Siguatepeque, ~1050 m, *Standley & Chacón* 6704 (F). **Choluteca:** Creek flowing to Río Choluteca, near La Vesto PM, *Olson* 83-2 (CANM, MO). **Lempira:** Montana de Celaque, along Río Arquegual, 7.5 km SW of Gracias, 14°34'N, 88°39'W, *Allen* 11152, 11166 (MO). **JAMAICA.** **Portland:** ~3.2 km SW of Ecclesdown, 686 m, *Farr* 1358 (CANM). **Trelawny:** Cockpit Co., just N of Wilson's Run, 9 km N of bridge at Troy, *Buck* 5899 (NY), *Crosby* 13878 (NY). **HAITI.** Rivière Glace, Morne la Hotte, 800–1000 m, *Holdridge* 3090 (CANM, NY).

6. *Isopterygiopsis* Z. Iwats.

Isopterygiopsis Z. Iwats., J. Hattori Bot. Lab. 33: 379. 1970. Type: *Plagiothecium muellerianum* Schimp., Syn. Musc. Eur. 584. 1860.

Plants small, in thin to dense mats, glossy, light green to yellowish green. Stems sometimes complanate-foliate, creeping, simple or sparingly and irregularly branched, hyalodermis distinct with large cells or somewhat indistinct with small cells, central strand absent or sometimes present and indistinct; rhizoids papillose, in clusters in leaf axils; pseudoparaphyllia lacking; axillary hairs consisting of 1 short to slightly long, brown basal cell and 1–3 elongate, hyaline distal cells. Asexual reproductive bodies 30–90 μm long, sometimes present in clusters in leaf axils on stems and branches, cylindrical or fusiform, composed of 2–6 smooth cells. Stem and branch leaves similar, somewhat rigid, crowded and imbricate, erect-spreading, occasionally secund, smooth, flat or somewhat concave, symmetric, nondecurent, lanceolate or ovate- to oblong-lanceolate, long-acuminate to abruptly acuminate; margins entire to minutely serrulate, plane to erect; costa lacking or short and double; median cells often flexuose, firm-walled, linear-fusiform, smooth or prorulose at upper ends on dorsal leaf surface, with walls not pitted; alar cells not differentiated or sometimes with 1–3 quadrate to short-rectangular cells on margins. Autoicous or dioicous; perigonia and perichaetia clumped at base of stems and branches, bracts small, lanceolate to ovate, acuminate to

abruptly filiform-acuminate; margins plane. Setae smooth, elongate, straight to somewhat curved, twisted, red to reddish brown; capsules erect to cernuous, straight to subarcuate, yellow to orange-brown, oblong to ovoid, smooth, contracted below mouth and wrinkled at neck when dry; operculum conic to obliquely rostrate, shorter than the urn; annulus present, deciduous, of 2–3 rows of cells; 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, in groups of 1–3, sometimes absent. Spores spherical to ovoid, smooth or minutely papillose. Calyptra cucullate, smooth, naked.

Distribution: The genus *Isopterygiopsis* has only three species in the world, two of which occur in Latin America. The species occupy terrestrial habitats in the Arc-

tic, in boreal and temperate woods, or at high altitudes and latitudes in Latin America.

Discussion: *Isopterygiopsis* was described by Iwatsuki (1970) as a segregate of the genus *Isopterygium*. Seventeen years later, he further refined the generic characteristics of *Isopterygiopsis* while separating another genus, *Pseudotaxiphyllum*, which also lacks pseudoparaphyllia like *Isopterygiopsis*, from *Isopterygium*, which has filamentous pseudoparaphyllia (Iwatsuki, 1987). *Isopterygiopsis* is now distinguished by its small, scarcely branched, glossy plants; large to small hyalodermis cells; papillose rhizoids in the leaf axils; absence of pseudoparaphyllia; nondecurent, entire or minutely serrulate leaves; 2–6 celled, smooth, cylindrical or fusiform propagula in clusters in the leaf axils; autoicous or dioicous sexual condition; and the presence of an annulus.

KEY TO THE SPECIES OF ISOPTERYGIOPSIS

1. Stems complanate-foliate, appearing ventrally concave because of curvature of upturned leaves; leaves often abruptly acuminate, cells smooth or dorsally prorulose 1. *I. muelleriana*
1. Stems not complanate-foliate, leaves erect-spreading, occasionally secund; leaves gradually acuminate, cells smooth 2. *I. pulchella*

1. *Isopterygiopsis muelleriana*

FIGURE 7

Isopterygiopsis muelleriana (Schimp.) Z. Iwats., J. Hattori Bot. Lab. 33: 379. 1970. *Plagiothecium muellerianum* Schimp., Syn. Musc. Eur. 584. 1860; *Isopterygium muellerianum* (Schimp.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 441. 1878. Type: Austria?, 30 Sep 1851, J. Müller (holotype: BM!).

Plants in thin mats, glossy, yellowish green. Stems to 2 cm long, 0.8–2.0 mm wide, complanate-foliate, appearing ventrally concave because of curvature of upturned leaves, simple or irregularly branched; hyalodermis of large epidermal cells, enclosing 1 to several layers of small, thick-walled cortical cells and several large, thin-walled cells in the center. Asexual reproductive bodies not seen on Latin American plants, known on plants from elsewhere as axillary clusters of 2–6 celled, smooth, cylindrical or fusiform, green to yellowish green brood bodies in leaf axils on stems and branches. Leaves 0.5–1.0 mm long, 0.2–0.3 mm wide, somewhat rigid, crowded and overlapping, erect-spreading and rigidly complanate, smooth, ovate- to oblong-lanceolate, symmetric, acuminate, often abruptly so; margins plane, entire or minutely serrulate; costa

none or short and double; median cells 50–80 × 2–5 μm, smooth or prorulose at upper ends on dorsal leaf surface; alar cells not differentiated or sometimes with 1–3 short-rectangular cells on margins. Sex organs and sporophytes not seen on Latin American plants, known to be dioicous from regions where it is fertile and possesses sporophytes. Setae 0.6–1.2 cm long, brown to reddish brown; capsules 0.5–1.5 mm long, erect or rarely ± cernuous, straight, ellipsoid to ovoid, contracted below the mouth when dry; operculum conic to obliquely rostrate; annulus present, deciduous, of 2–3 rows of cells. Spores 8–12 μm in diameter.

Distribution and ecology: Rare; known only from a single Mexican collection (Figure 8); occurring on a bluff at 3139 m.

Discussion: *Isopterygiopsis muelleriana* is a species that is rare or rarely collected in Latin America. It is best recognized by its plants that are complanate-foliate, appearing concave on the upper surface because of the upturned leaves, and by the stems that have a hyalodermis with large, thin-walled cells (best seen in cross section) with papillose rhizoids clustered in the leaf axils. Other helpful features distinguishing the species, are the ovate- to oblong-lanceolate, nondecurent leaves, often abruptly acuminate with margins that are entire or minutely serrulate, the median leaf cells that are 50–80 × 2–5 μm, often prorulose at the distal ends on the dorsal leaf surface, the few differentiated alar

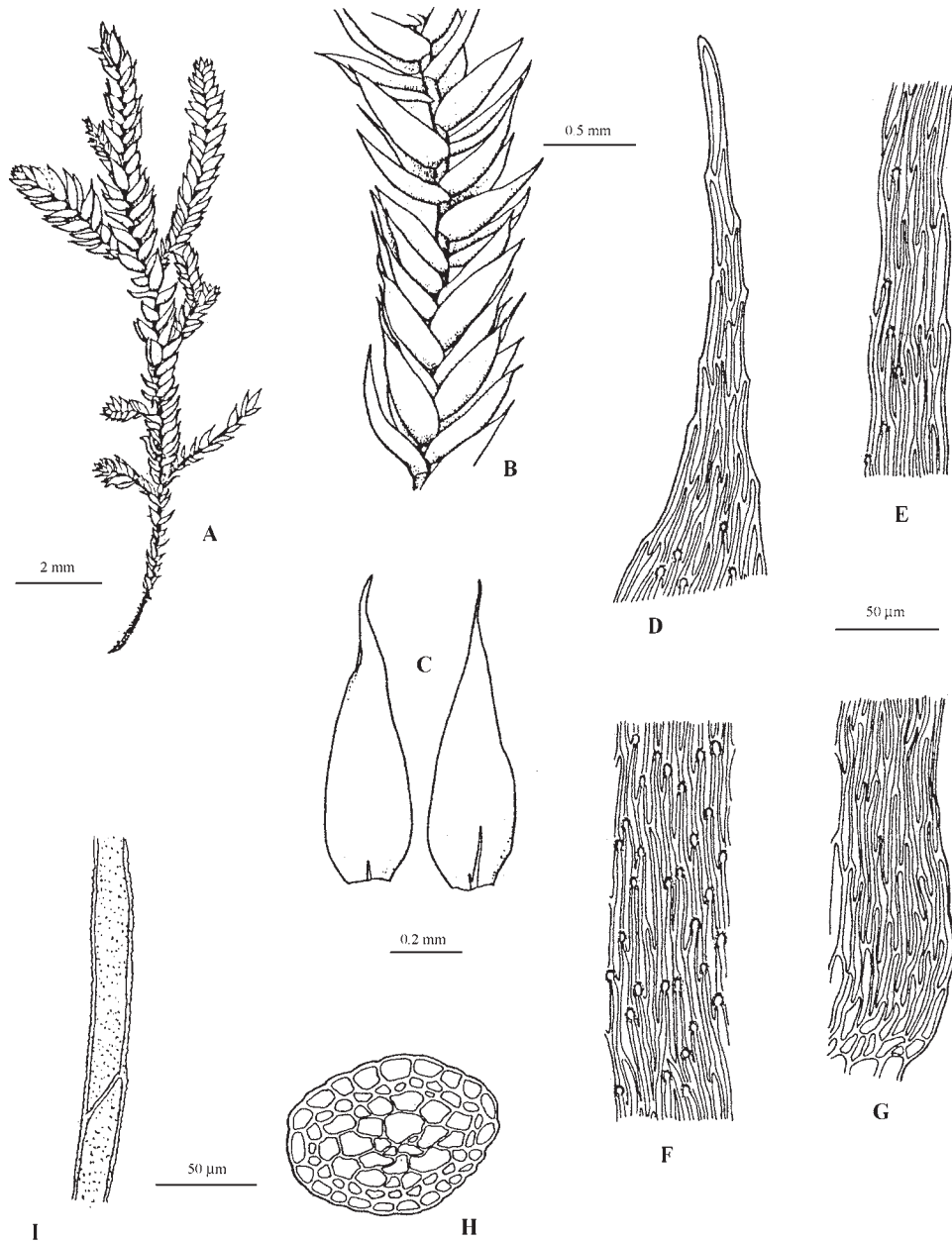


FIGURE 7. *Isopterygiopsis muelleriana*. A. Habit. B. Enlargement of portion of stem. C. Leaves. D. Apical leaf cells. E. Median-marginal leaf cells. F. Median leaf cells. G. Alar cells. H. Stem cross section. I. Portion of rhizoid. All illustrations drawn from Sharp 64 (CANM).

cells, with 1–3 short-rectangular ones on the margins. In addition, the plants are dioicous, and they sometimes possess smooth, cylindrical or fusiform brood bodies clustered in leaf axils on the stems and branches.

Specimen examined: MEXICO. Distrito Federal: Desierto de los Leones near Mexico City, 3139 m, Sharp 64 (CANM, MEXU, MICH, TENN).

2. *Isopterygiopsis pulchella*

FIGURE 9

Isopterygiopsis pulchella (Hedw.) Z. Iwats., J. Hattori Bot. Lab. 63: 450. 1987. *Leskea pulchella* Hedw., Spec. Musc. Frond. 220. 1801; *Isopterygium pulchellum*

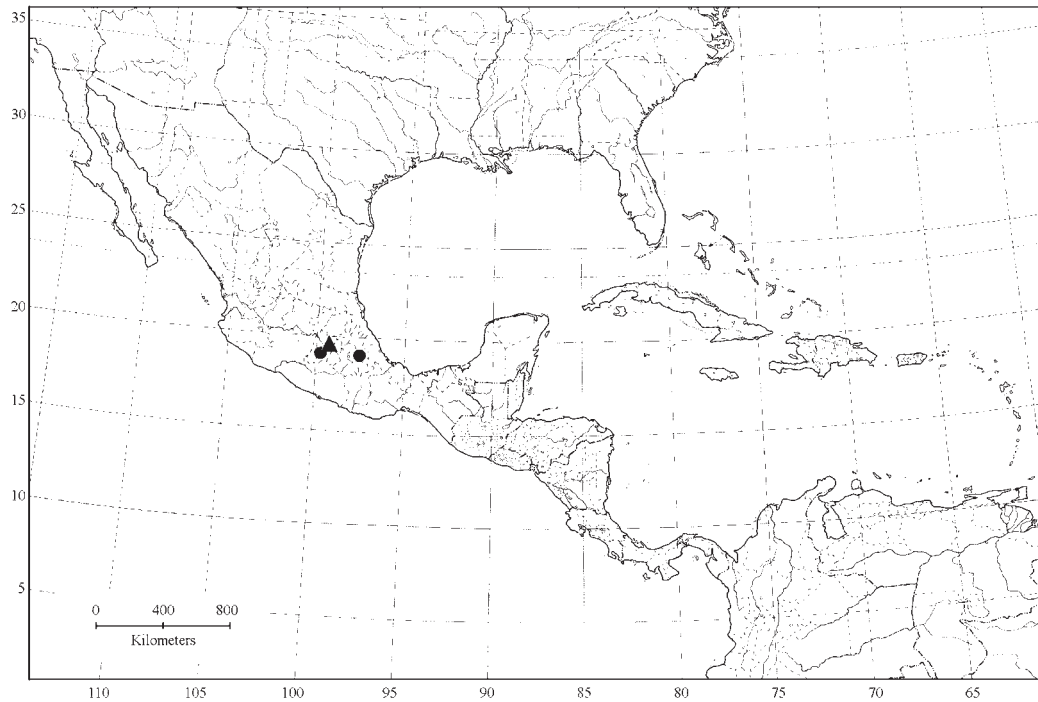


FIGURE 8. Distribution of *Isopterygiopsis muelleriana* (▲) and *I. pulchella* (●) in Mexico.

(Hedw.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876-77: 441. 1878. Type: Scotland, no collector cited (holotype: G!).

Hypnum magellanicum Müll. Hal., Flora 68: 425. 1885, *hom. illeg.*; *Isopterygium fuegianum* Besch., Miss. Sci. Cape Horn, Bot. 5: 301. 1889 (new name for *Hypnum magellanicum*); *Plagiothecium magellanicum* (Besch.) Paris, Index Bryol. 963. 1896. Type: Chile, Clarence Is., S. Holl Bay, *Hariot* 63 (holotype: BM!; isotype?: H!). *Syn. nov.*

Plagiothecium leptoplumosum Dusén, Rep. Princeton Univ. Exp. Patagonia, Botany 8: 100. 1903; *Isopterygium leptoplumosum* (Dusén) Cardot, Wiss. Erb. Schwed. Südpolar-Exp. 4(8): 178. 1908. Type: Chile, Patagonia, Río Chico, *Hatcher s.n.* (holotype: S!; isotype: NY!). *Syn. nov.*

Plants in thin to dense mats, glossy, light green to yellowish green. Stems to 2 cm long, 1–2 mm wide, simple or irregularly branched; hyalodermis present but somewhat indistinct from the 1 to several layers of inner thick-walled cortical cells. Asexual reproductive bodies 30–60 μm long, rarely present, cylindrical or fusiform, clustered in leaf axils on stems and branches, green to yellowish green, composed of 2–5 smooth cells. Leaves 0.5–1.5 mm long, 0.2–0.4 mm wide, flaccid, close or

sometimes distant, erect-spreading, occasionally secund, often appearing distichous, subconcave, smooth, lanceolate to slenderly ovate-lanceolate, symmetric, gradually long-acuminate; margins plane to erect throughout, entire or sometimes minutely serrulate, often with 1–2 cells distinctly serrulate in alar region; costa none or short and double; median cells 47–122 \times 5–7 μm , smooth; alar cells differentiated only on margins, 1–3 quadrate to short-rectangular cells, sometimes lacking. Autoicous. Setae 1–2 cm long, red to reddish brown; capsules 0.5–2.5 mm long, subcernuous to cernuous, rarely erect, straight to subarcuate, oblong to ovoid, contracted below the mouth when dry; operculum conic to conic-apiculate; annulus present, deciduous, of 2–3 rows of cells. Spores 9–14 μm in diameter.

Distribution and ecology: Infrequent; Mexico, Chile, and Argentina (Figures 8, 10); on soil, in crevices of rock cliffs, and on rotting tree trunks at 150–3650 m and sometimes higher.

Discussion: *Isopterygium fuegianum* Besch. and *I. leptoplumosum* (Dusén) Cardot are considered here as new synonyms of *I. pulchella*. No important differences could be found for maintaining either species as separate taxa from *I. pulchella*. Even Dusén and Bescherelle stated

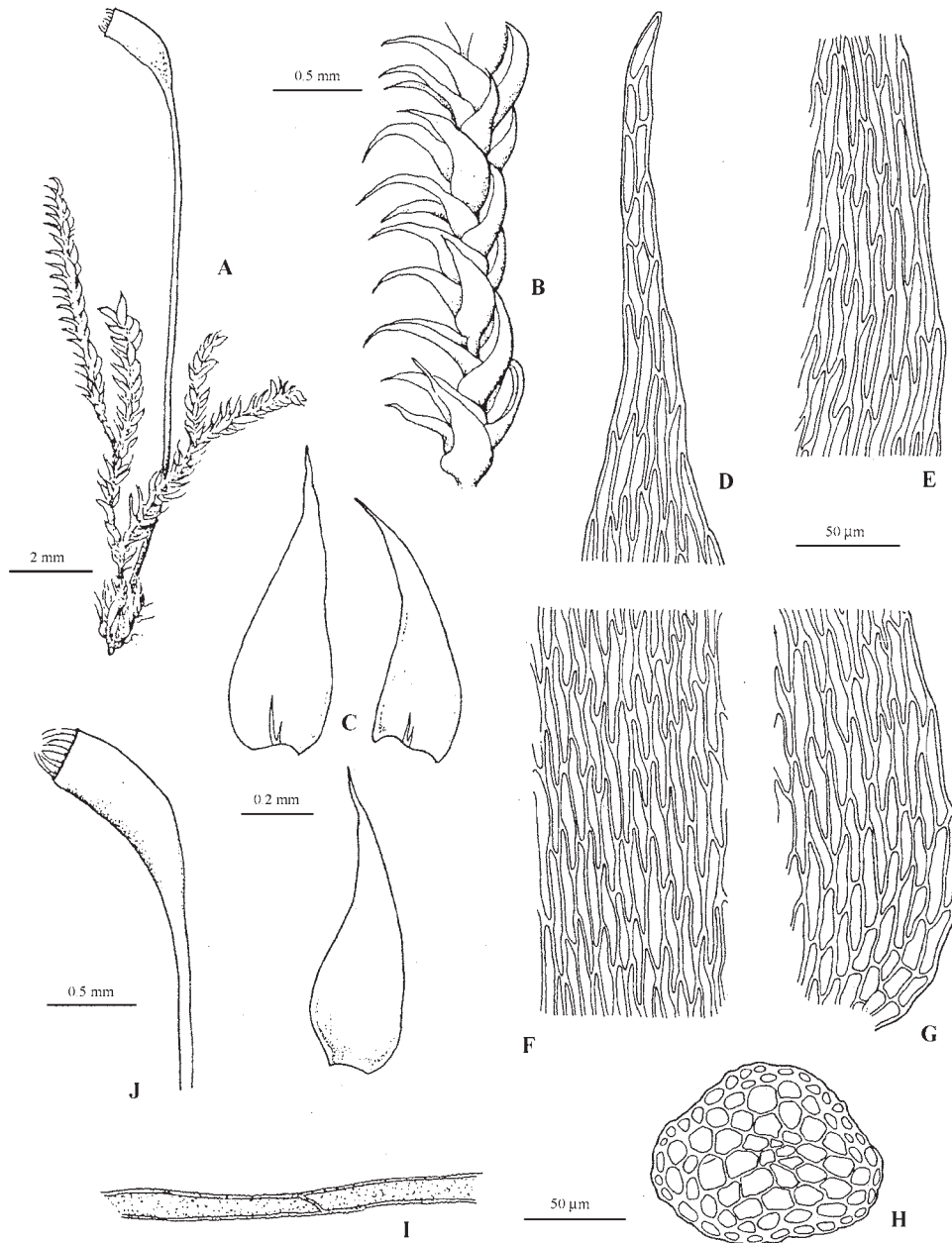


FIGURE 9. *Isopterygiopsis pulchella*. A. Habit. B. Enlargement of portion of stem. C. Leaves. D. Apical leaf cells. E. Median-marginal leaf cells. F. Median leaf cells. G. Alar cells. H. Stem cross section. I. Portion of rhizoid. J. Capsule (wet). Illustrations A, B drawn from *Dusén* 22 Feb 1897 (M); C–J from *Hatcher*, holotype of *Plagiothecium leptoplumosum* (S).

that their new species were very similar to *I. pulchella* when they described them.

Isopterygiopsis pulchella is recognized by the erect-spreading, sometimes secund, lanceolate to slenderly ovate-lanceolate, gradually acuminate, nondecurent leaves with entire or minutely serrulate margins, the long

(47–122 μm) and narrow (5–7 μm), smooth, median leaf cells, the alar regions undifferentiated or sometimes with 1–3 short-rectangular to quadrate cells on the margins, the occasional presence of cylindrical to fusiform, 2–5-celled brood bodies clustered in the leaf axils and the autoicous sexual condition.

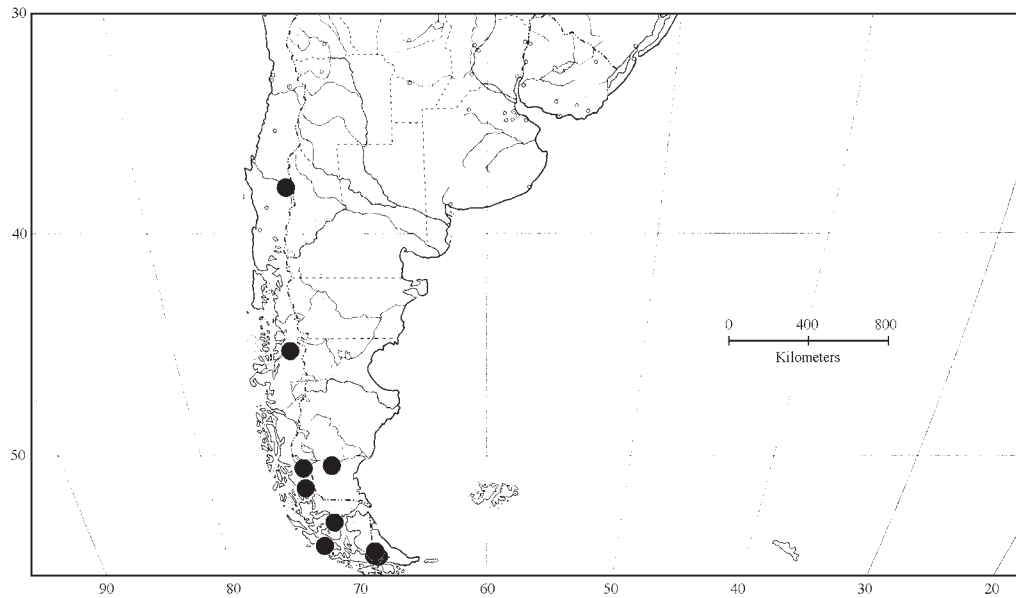


FIGURE 10. Distribution of *Isopterygiopsis pulchella* in South America.

Bryologists may sometimes have difficulty placing *I. pulchella* into *Isopterygiopsis* because the stem hyalodermis cells of *I. pulchella* are not as distinctly enlarged and thin-walled as those of the type species of the genus, *I. muelleriana*. However, the other important features distinguishing the genus *Isopterygiopsis* and placing *I. pulchella* within it are present, i.e., lack of pseudoparaphyllia, presence of cylindrical or fusiform propagula, and papillose rhizoids in the leaf axils.

Specimens examined: MEXICO. Mpio. Toluca, Parque Nacional Nevado de Toluca, NW slopes of Nevado de Toluca volcano, 3650 m, 19°08'N, 99°47'W, *Buck* 28203 (NY); Mt. Orizaba, Sep 1908, *Purpus s.n.* (FH). CHILE. Bío-Bío Region: Bío-Bío Prov., National Park Lake Laja, Los Barros Military Base, 1500 m, 37°27'S, 71°09'W, *Ireland & Bellolio* 34124 (CONC, MO, US). Magellanes Region: Antártica Chilena Prov., Communa Cabo de Hornos, Parque Nacional Alberto de Agostini, E end of Isla Gordon, S side of Punta Divide on Brazo Sudoeste of Beagle Channel, 54°58'S, 69°08'W, *Buck* 47943 (NY); Clarence Is., *Hariot* 63 (BM); Patagonia, Río Chico, *Hatcher s.n.* (NY, S); Patagonia, Aysén, *Dusén* 584 (FH, H, M, NY); Río Aysén, 22 Feb 1897, *Dusén s.n.* (M); Punta Arenas, *Thaxter* 161 (FH), *Dusén* 63 (H); ~35 km from Puerto Natales, inside Cueva de Milodon, *Kuc* 117 (CANM). ARGENTINA. Dept. Ushuaia, Camino de ascenso al Glaciar Le Martial, ~900–1200 m, 54°46'S, 68°29'W, *Schiavone &*

Ochyra 6908, *Musci Fuegiani Exsiccati* 48, (MO); Tierra del Fuego australis, Valle del Río Pipo, 300 m, 54°46'S, 68°20'W, *Roivainen* 1352 (NY); Arroyo Grande, 150 m, 54°47'S, 68°17'W, *Roivainen* 2095 (MO, NY); E Glaciar Martial, *Kuc* 107 (CANM); Santa Cruz, in valley above Río Santa Cruz, Jan 1905, *Dusén s.n.* (H); Lago Argentino, *Dusén* 5684 (NY).

7. *Isopterygium* Mitt.

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

Plants small to medium-sized, in thin to dense mats, glossy, light green to yellow-green. Stems complanate-foliolate, 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; axillary hairs consisting of 1 moderately long, brown basal cell and 1–3 elongate, hyaline distal cells. 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, sometimes contorted when dry, smooth, flat or somewhat concave, symmetric or asymmetric, nondecurrent or rarely with 1–2 decurrent cells, 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, occasionally lacking; median 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, cylindrical, ellipsoid or ovoid, smooth or sometimes wrinkled at neck and 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, in groups of 1–3, sometimes absent. Spores spherical to ovoid, smooth or minutely papillose. Calyptra cucullate, smooth, naked.

Distribution: *Isopterygium* is a genus of approximately 40–50 species worldwide that in the subtropics and tropics occur predominantly in terrestrial habitats at low elevations.

Discussion: *Isopterygium* has been considered a taxonomically difficult genus since it was described by Mitten (1869). The taxonomic characters Mitten used to establish *Isopterygium* were not distinct enough to distinguish it from many other genera, and this has caused a great amount of confusion. Mitten placed his new genus in the tribe Stereodontae, on the basis of its long setae, short, double-leaf costae, and short, dense alar cells. The tribe contained an assemblage of genera, many of which are not considered very closely related today, such as *Plagiothecium* Bruch & Schimp. in Bruch, Schimp. & W. Gümbel, *Ctenidium* (Schimp.) Mitt., *Heterocladium* Bruch & Schimp. in Bruch, Schimp. & W. Gümbel, *Leucomium* Mitt., *Ectropothecium* Mitt., *Entodon* Müll. Hal., *Pleurozium* Mitt., *Acrocladium* Mitt., and *Ptychomnion* (Hook. & Wilson) Mitt. Some bryologists (Brotherus, 1923; Corley et al., 1981; Iwatsuki,

1987; Sainsbury, 1955), placed *Isopterygium* in the family Plagiotheciaceae. While other bryologists (Crum and Anderson, 1981; Gangulee, 1978; Vitt, 1984) have placed it in the Hypnaceae. Buck and Ireland (1985), on the basis of a morphological evaluation of the Plagiotheciaceae genera, removed all genera except *Plagiothecium* from the family. *Isopterygium* is here placed in the Hypnaceae.

Mitten (1869) originally placed eight species in *Isopterygium*: *I. affusum* (Müll. Hal.) Mitt., *I. curvicolle* (Müll. Hal.) Mitt., *I. leucophyllum* (Hampe) Mitt., *I. tenerum* Mitt., *I. planissimum* Mitt., *I. tenerifolium* Mitt., *I. brachyneuron* (Müll. Hal.) Mitt., and *I. chrismarii* (Sw.) Mitt. However, the genus soon became a repository for scores of miscellaneous, complanate-foliate pleurocarpous mosses. The genus grew enormously during the next century, eventually comprising about 390 taxa, 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* M. Fleisch. (Iwatsuki, 1963), *Herzogiella* Broth. (Iwatsuki, 1965, 1970, synonyms *Dolichotheca* Lindb., *Sharpiella* Z. Iwats.), *Plagiothecium* (Iwatsuki, 1970), *Isopterygiopsis* Z. Iwats. (Iwatsuki, 1970), and *Isopterygium* Mitt. and *Pseudotaxiphyllum* Z. Iwats. (Iwatsuki, 1987) have clarified the taxa in the genera closely related to *Isopterygium*, thus making that genus more clearly defined. Studies of the North American (Ireland, 1969), Mexican (Ireland, 1984), and Latin American (Ireland, 1991a, 1992) *Isopterygium* species also have helped to understand the genus to a certain extent.

We are recognizing eight species of *Isopterygium* in the present treatment. The species are often very similar morphologically and difficult to separate even when sporophytes are present. Some of the species may be only environmental forms. However, we believe it is prudent to recognize these eight species at this time until future field and laboratory studies prove otherwise.

Isopterygium is distinguished by the complanate-foliate plants, smooth rhizoids inserted on ventral surface of stems and branches just below leaf insertions, 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, multicellular propagula with papillose cells, usually autoicous sexual condition and capsules that lack an annulus.

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, alar cells on margins mostly elongate-rectangular 5. *I. subbrevisetum*
1. Leaves ovate, ovate-lanceolate, oblong or occasionally lanceolate, mostly less than 3 times as long as broad, close or rarely distant, erect to squarrose, often curved and asymmetric, alar cells on margins mostly quadrate to short-rectangular 2
 2. Leaves with alar regions strongly differentiated, composed of quadrate to rectangular cells in several rows, 4–15 cells on margins 3
 3. Leaves short, 0.4–0.8 mm in length, acuminate; plants terrestrial 3. *I. byssobolax*
 3. Leaves long, 0.8–1.2 mm in length, acute; plants aquatic 1. *I. acutifolium*
 2. Leaves with alar regions weakly differentiated, only a small group of quadrate to short-rectangular cells present, 1–5 cells on margins 4
 4. Leaves 1–3 mm long; plants aquatic 2. *I. affusum*
 4. Leaves 0.7–1.5 mm long; plants terrestrial 5
 5. Capsules erect or rarely inclined, not or scarcely contracted below mouth when dry 4. *I. jamaicense*
 5. Capsules inclined to horizontal, rarely erect, usually strongly contracted below mouth when dry 6
 6. Capsules subglobose, about as broad as long, not contracted below mouth when dry 6. *I. subglobosum*
 6. Capsules ovoid to ellipsoid, longer than broad, strongly contracted below mouth when dry 7
 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 7. *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 8. *I. tenerum*

1. *Isopterygium acutifolium*

FIGURE 11

Isopterygium acutifolium Ireland, 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 in thin mats, light green to yellowish green. Stems up to 2.5 cm long, 1–2 mm wide, simple or sparingly and irregularly branched. Asexual reproductive bodies lacking. Leaves 0.8–1.2 mm long, 0.4–0.5 mm wide, somewhat rigid, distant, flat to slightly concave, erect-spreading, smooth, scarcely contorted when dry, 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; median cells 70–103 × 7–9 μm, smooth; alar cells strongly differentiated, quadrate to rectangular, in several rows with 4–15 cells on margins. Sex organs and sporophytes unknown.

Distribution and ecology: Known only from the type locality in Venezuela and from one locality in Guyana (Figure 12); attached to rocks near waterfalls and in running water along rapids of rivers, apparently at altitudes of ~400 m.

Discussion: Known only from sterile plants but distinguished from the other Latin American species of *Isopterygium* 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. All other *Isopterygium* species have acuminate 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 is never found on rocks in rivers.

Specimens examined: VENEZUELA. Known only from the type specimen. GUYANA. First falls of Essequibo River, Richards 359 (NY).

2. *Isopterygium affusum*

FIGURE 13

Isopterygium affusum Mitt., J. Linn. Soc., Bot. 12: 499. 1869. Type: Brazil. Taruma River, Spruce 1059 (lectotype: NY!, designated by Iwatsuki and Crosby, 1979); isolectotype: BM!); Prov. Ceara, Sierra de Araripe, Gardner 106c (synype: BM!).

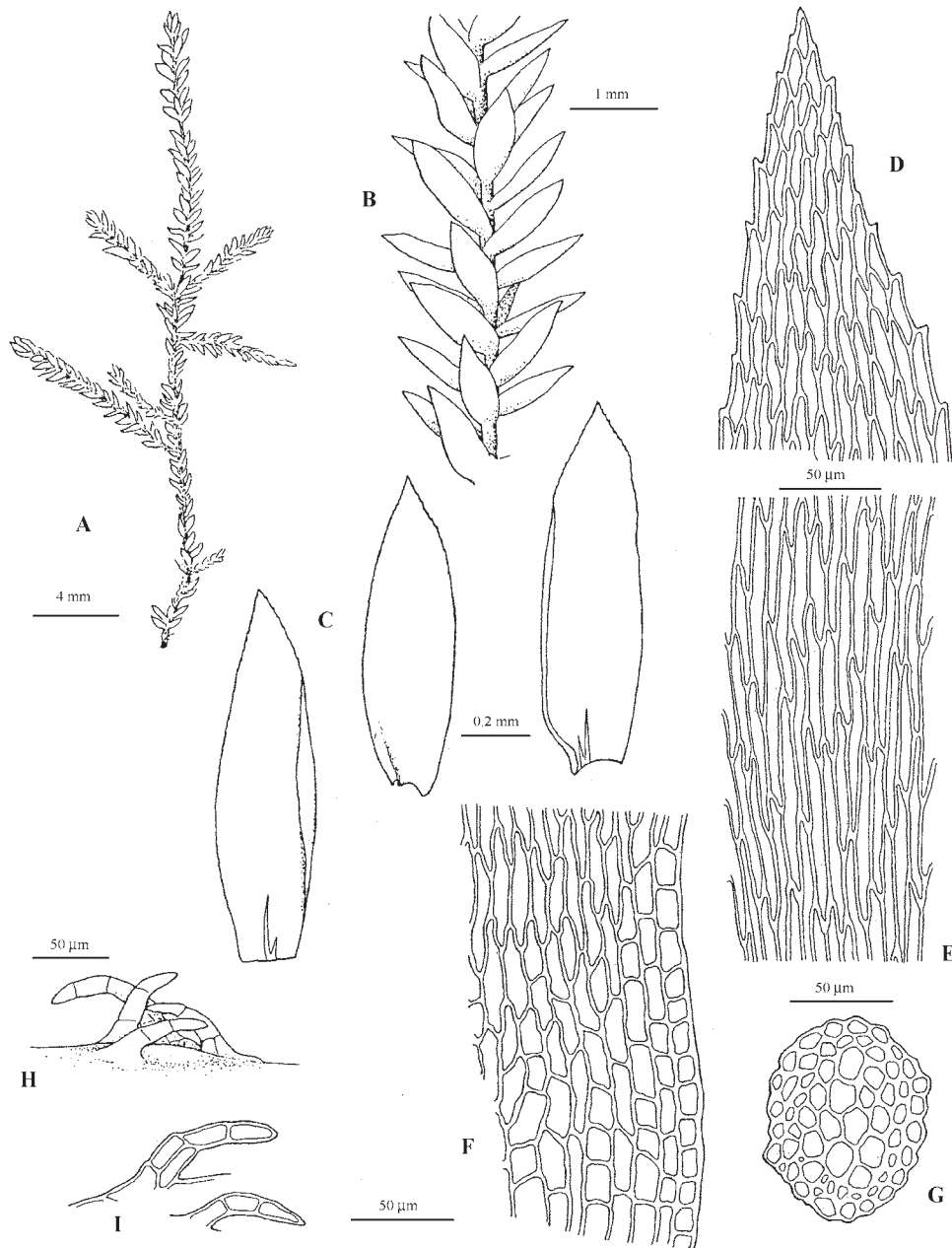


FIGURE 11. *Isopterygium acutifolium*. A. Habit. B. Enlargement of portion of stem. C. Leaves. D. Apical leaf cells. E. Median leaf cells. F. Alar cells. G. Stem cross section. H, I. Pseudoparaphyllia. All illustrations drawn from *Steyermark 97784* (US, holotype).

Isopterygium herminieri Schimp. ex Besch., Ann. Sci. Nat. Bot. sér. 6,3: 256. 1876. Type: Guadeloupe. In rivers or streams, *Herminier s.n.* (holotype: BM!; isotype: NY!).

Ectropothecium submersum Broth., Bih. Kongl. Svenska Vetensk.-Akad. Handl. 26 Afd. 3(7): 48. 1900; *Isopterygium submersum* (Broth.) Broth.,

Nat. Pflanzenfam. 1(3): 1081. 1908. Type: Brazil. Mato Grosso: Macoco River, *Lindman 502* (holotype: H!; isotype: BM!).

Plagiothecium fontigenum Müll. Hal., Hedwigia 40: 58. 1901; *Isopterygium fontigenum* (Müll. Hal.) W. R. Buck & Ireland, Fl. Neotrop. 50: 19. 1989. Type: Brazil. Santa Catarina: Serra do Oratorio, *Ule 521* (lectotype: H!, designated by Buck and Ireland, 1989).

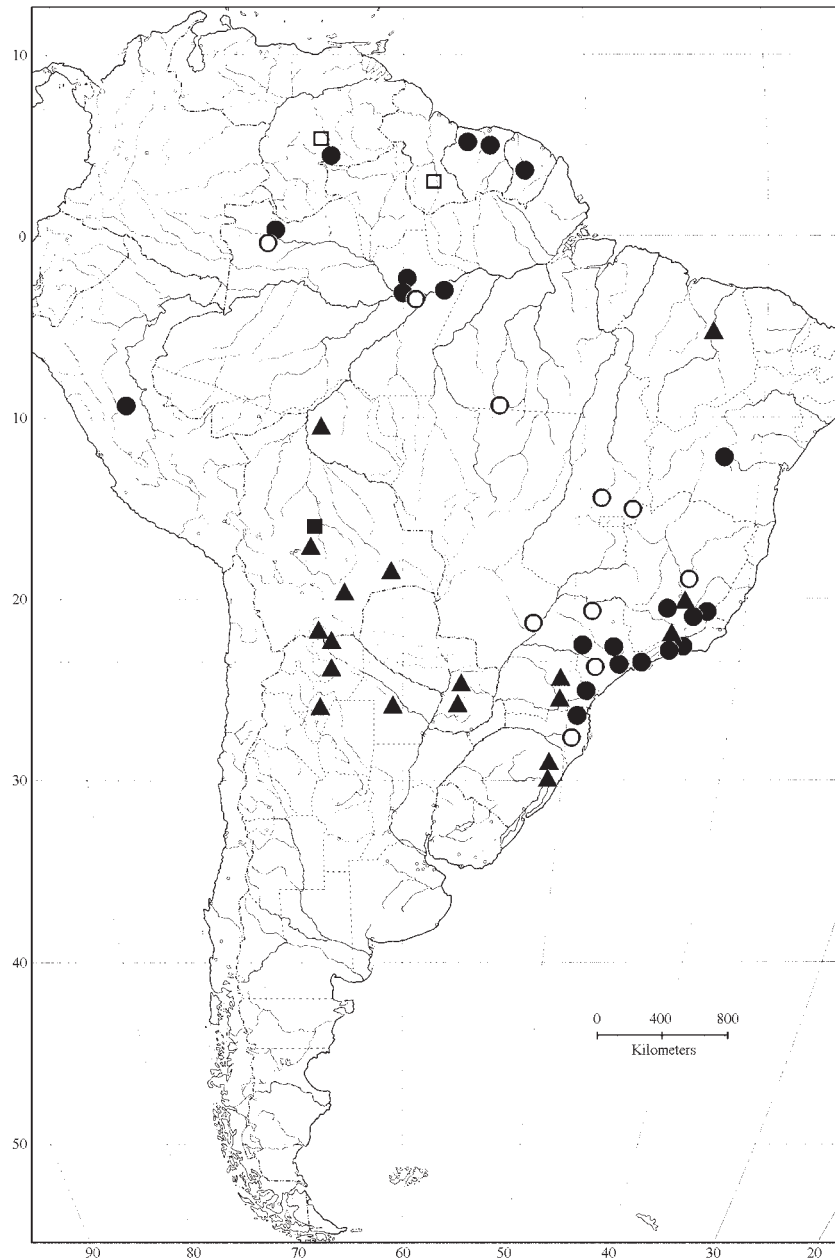


FIGURE 12. Distribution of *Isopterygium affusum* (○), *I. byssobolax* (▲), *I. subbrevisetum* (●), *I. subglobosum* (■) and *I. acutifolium* (□) in South America.

Isopterygium aquaticum H. Rob., Bryologist 67: 453. 1964, *hom. illeg., non* Dixon 1922; *Isopterygium irelandii* H. Rob., Bryologist 70: 43. 1967. Type: Honduras. Dept. Francisco Morazán, Río Agua Amarilla, NE slopes of Cerro de Uyuca, *Morton* 7566 (holotype: US!).

Plants in thin, loose masses, yellow-green to green. 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;

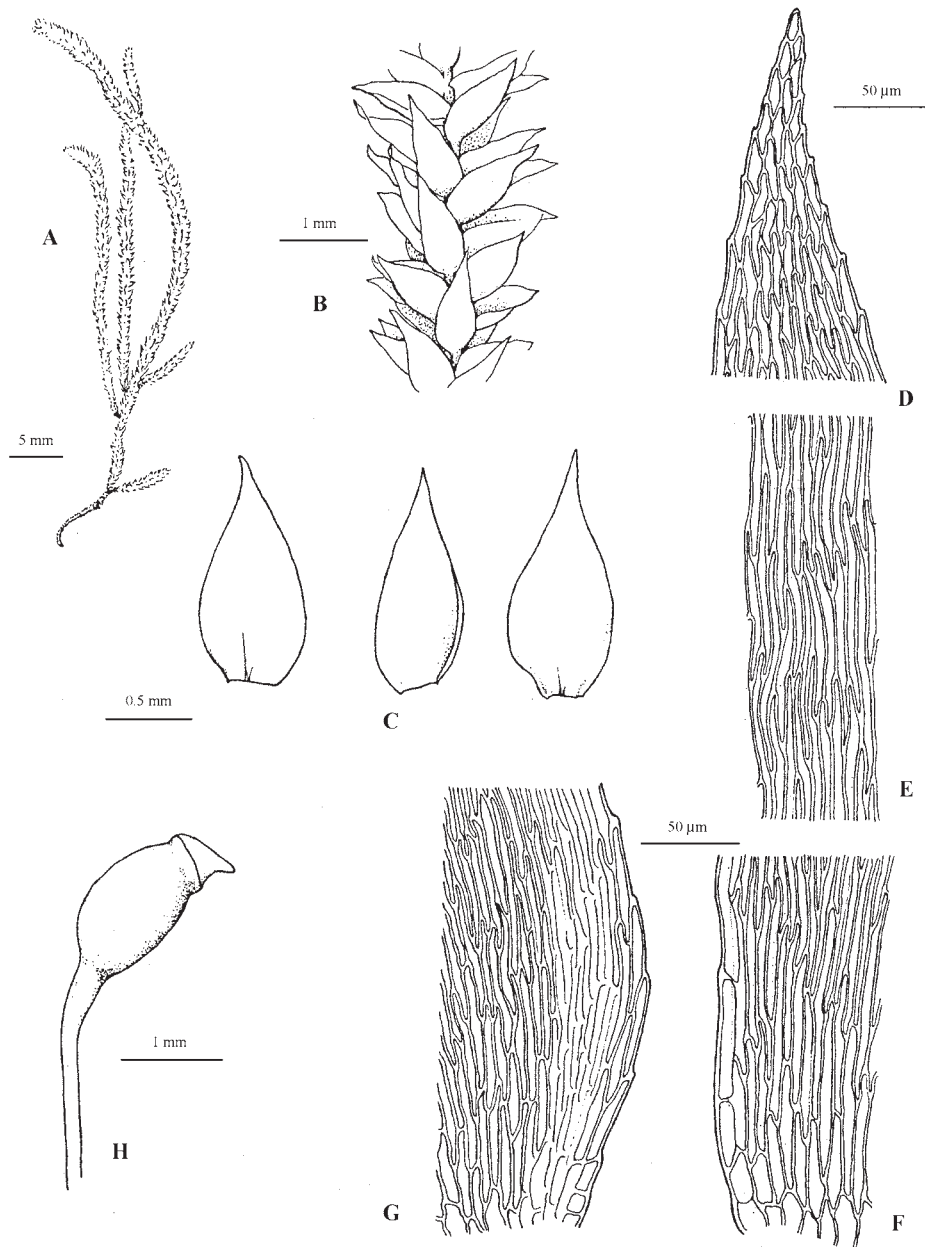


FIGURE 13. *Isopterygium affusum*. A. Habit. B. Enlargement of portion of stem. C. Leaves. D. Apical leaf cells. E. Median leaf cells. F, G. Alar cells. H. Operculate capsule (wet). Illustrations A–G drawn from *Spruce 1059* (NY, lectotype); H from *Stanley & Molina 4511* (F).

median cells smooth, $66\text{--}118 \times 5\text{--}7 \mu\text{m}$; 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; operculum obliquely short-rostrate; peristome teeth up to 0.2 mm long. Spores only seen immature.

Distribution and ecology: Honduras, Guadeloupe, Venezuela, and Brazil (Figures 12, 14, 15); an aquatic species on rocks in and beside rivers and streams, near waterfalls, or occasionally at bases of tufts of grasses and sedges in marshes, occurring at altitudes of 430–1460 m.

Discussion: The aquatic habit helps to identify this species since the other Latin American taxa, except *Isopterygium acutifolium*, are terrestrial. Its distinguishing

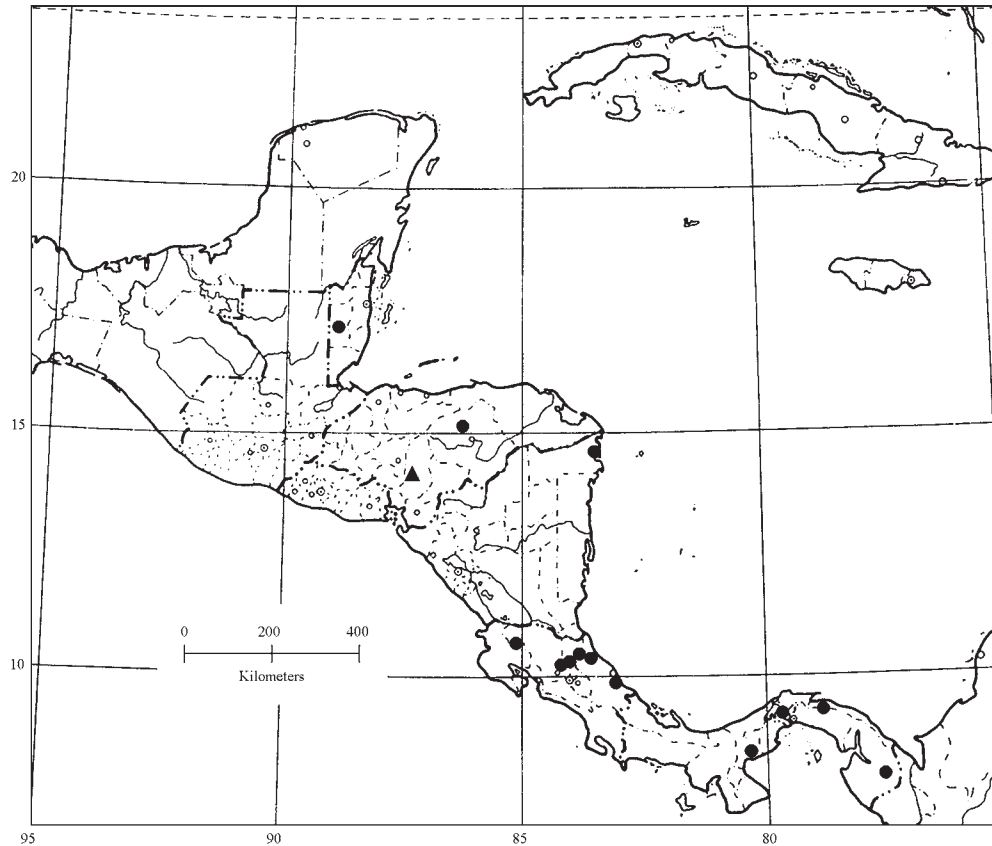


FIGURE 14. Distribution of *Isopterygium affusum* (▲) and *I. subbrevisetum* (●) in Central America.

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 quadrangle 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.

Iwatsuki and Crosby (1979) considered this species synonymous with *I. tenerifolium*. However, the aquatic habitat of *I. affusum* and its larger leaves, often up to 3 mm long, and shorter setae, 1.5–2.2 cm long, distinguish these two closely related species. The differences are rather minor, and it is possible that additional specimens of the two species may, indeed, prove that they are synonymous.

Specimens examined: **HONDURAS.** **Francisco Morazán:** El Quebracho, above El Zamorano, ~950 m, *Standley* 353 (F); region of Agua Amarilla, above El Zamorano, ~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:** 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 and Sao Gabriel, along shores of Rio Curicuriari and Igarapé Branco (Rio Cariua) from Rio Curicuriari to Cachoeira de Bôto (Cachoeira Piraiaua), 0°20'S, 66°55'W, *Buck* 2549 (CANM, NY). **Goiás:** Region of the Chapada dos Veadeiros, 4 km N of Veadeiros, *Dawson* 14745 (CANM); region of the southern Serra Dourada, 20 km E of Formoso, *Dawson* 14888 (CANM). **Mato Grosso:** Serra do Roncador, ~86 km N of Xavantina, 550 m, *Irwin et al.* 16370 (NY). **Minas Gerais:** Mpio. Santa Bárbara, Serra do Espinhaço, Parque Natural do Caraça, trail from Santuário do Caraça to Pico da Carapuça, 1300–1460 m, 20°02'S, 43°30'W, *Buck* 26686 (NY); between Serro and Datas, Diamantina, *Frahm* 1421, 1499 (MO); ~15 km SE of Datas, *Vital* 7568 (CANM); National Park Serra de Itatiaia, 1950 m, *Schäfer-Vervimp & Vervimp*

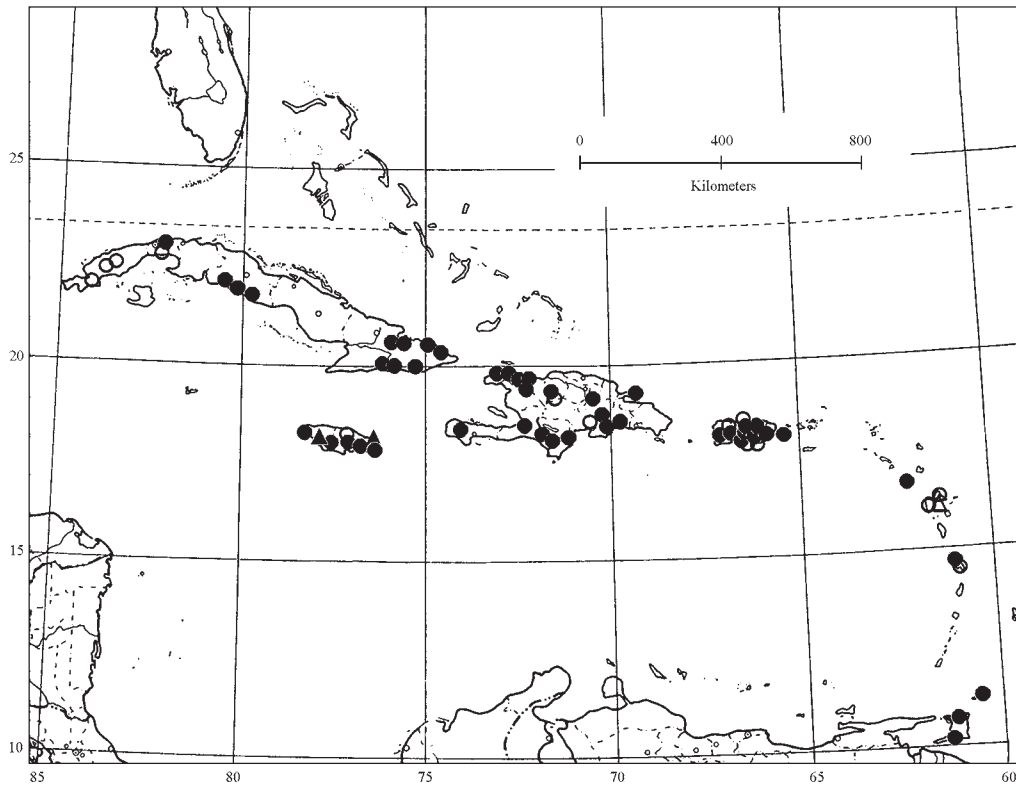


FIGURE 15. Distribution of *Isopterygium tenerifolium* (O), *I. jamaicense* (▲), *I. subbrevisetum* (●) and *I. affusum* (Δ) in the Caribbean.

9571 (NY). **Pará:** Serra do Cachimbo, Base Aérea do Cachimbo and vicinity, along bank of Rio Braço Norte, ~20 km N of border of Mato Grosso, 430–480 m, *Reese 16169* (MICH, NY, US), 16193 (MICH), 16197, 16418 (MICH, NY). **Santa Catarina:** Serra Geral, *Ule 1197* (H). **São Paulo:** Icem County, *Vital DV-1826* (CANM). **São Paulo:** Mpio. Guapiara, Serra Paranapiacaba, Fazenda Intervalles, ~800 m, ~24°16'S, 48°25'W, *Vital & Buck 20436* (NY).

3. *Isopterygium byssobolax*

FIGURE 16

Isopterygium byssobolax (Müll. Hal.) Paris, Index Bryol. Suppl. 218. 1900. *Taxicaulis byssobolax* Müll. Hal., Hedwigia 36: 114. 1897. Type: Argentina. Tucumansis, Siambón near Tucumán, Sierra de Tucumán, 1873, *Lorentz s.n.* (lectotype: JE!), designated by Ireland, 1991a); Cuesto de Siambón, *Lorentz s.n.* (syntype: JE!).

Taxicaulis pyrropus Müll. Hal., Hedwigia 36: 116. 1897; *Isopterygium pyrropum* (Müll. Hal.) Paris, Index Bryol. Suppl. 220. 1900. Type: Argen-

tina. Chaco, between Sn. Andrés and Orán, 17 Sep 1873, *Lorentz s.n.* (lectotype: MI, designated by Ireland, 1991a; isolectotypes: HI, JE!).

Taxicaulis saprophilus Müll. Hal., Hedwigia 36: 115. 1897; *Isopterygium saprophilum* (Müll. Hal.) Paris, Index Bryol. Suppl. 220. 1900. Type: Argentina. Campochico, Aug 1873, *Lorentz s.n.* (lectotype: HI, designated by Ireland, 1991a).

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

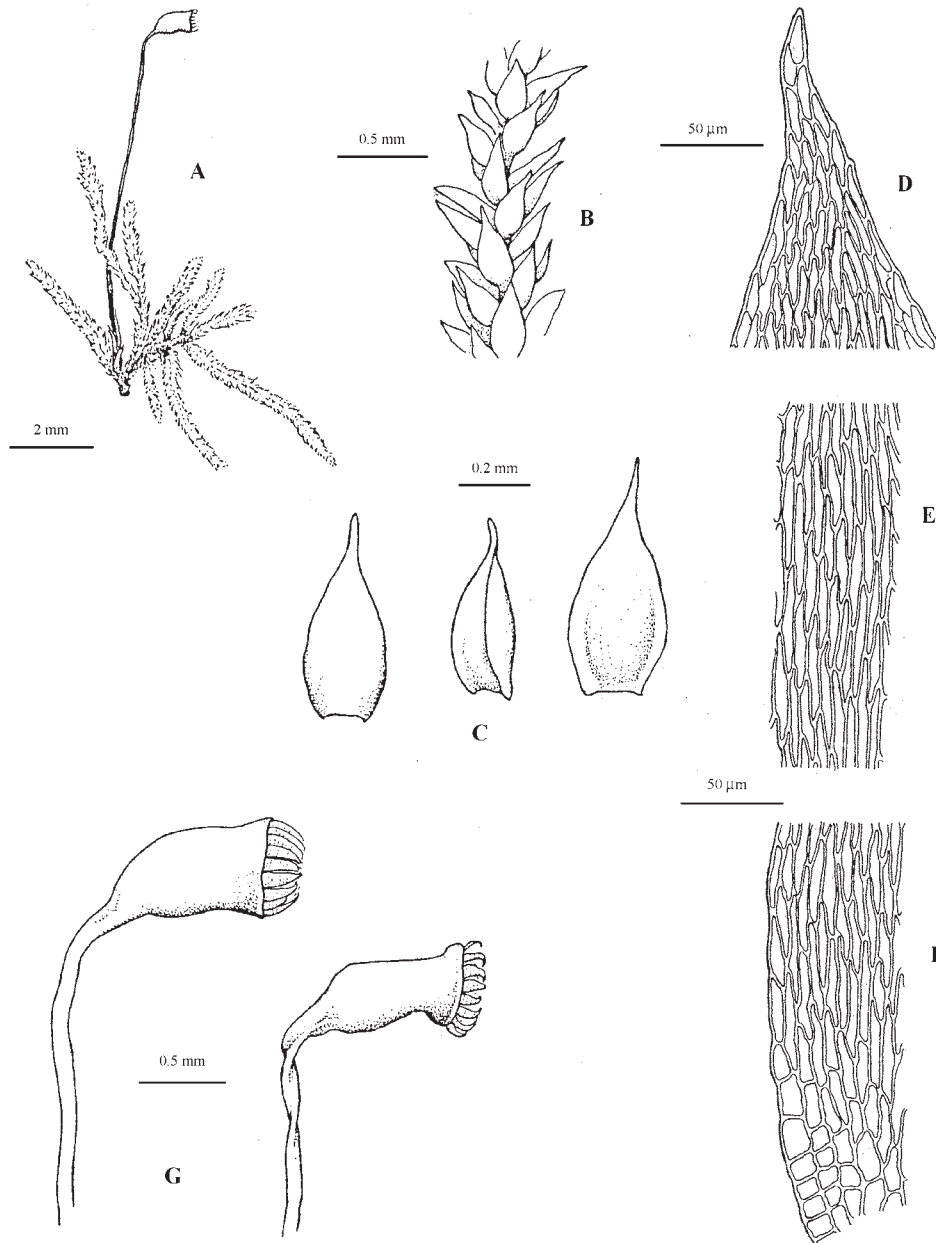


FIGURE 16. *Isopterygium byssobolax*. A. Habit. B. Enlargement of portion of stem. C. Leaves. D. Apical leaf cells. E. Median leaf cells. F. Alar cells. G. Inoperculate capsules (wet on left, dry on right). All illustrations drawn from *Lorentz s.n.* (JE, lectotype).

operculum short-rostrate; peristome teeth up to 0.2 mm long. Spores 7–9 μm in diameter.

Distribution and ecology: Brazil, Bolivia, Paraguay, and Argentina (Figure 12); usually in forests on rotten wood and tree bases, sometimes on soil and rock, at 30–1180 m.

Discussion: *Isopterygium byssobolax* is recognized in part because it is one of the smallest of the Latin Ameri-

can species (*I. subbrevisetum* is the other). 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.

Specimens examined: **BRAZIL.** Espírito Santo: Domingos Martins, Reserva Florestal Pedra Azul, 1180 m, *Schäfer-Verwimp & Verwimp 10078* (CANM). **Mato Grosso:** Palmeiras, Serra do Chapada, *Lindman B413* (BM). **Paraná:** Mpio. Ponta Grossa, Rio Tibagi, *Kummrow 02990* (NY). **Rio Grande do Sul:** São Francisco de Paula, Casuza Ferreira, 800 m, *Grazziotin et al. 3661* (NY); Vila Gonzaga, São Leopoldo, *Sehnem 77* (TENN). **Rondônia:** Ridges of Serra dos Pacaás Novos, along Rio Pacaás Novos, ~400 m, *Reese 13550, 13553* (NY). **Santa Catarina:** Mpio. de Lajes, 27°48'S, 50°21'W, *Vital 9397* (CANM, SP). **São Paulo:** Itapeirica, near Barra Mansa, ~1000 m, *Schiffner 1572* (BM); Parque Estadual das Fontes do Ipiranga, São Paulo city, *Yano 269* (MO). **BOLIVIA.** **Chuquisaca:** Prov. Luis Calvo, "Inca Huasi 2," W slope of Serrania Inca Huasi, 7 km NNE of Muyu-pampa (Vaca Guzman), 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 S and 15 km W from San José de Chiquitos, 17°53'S, 60°53'W, *Lewis 85-1139* (LPB); Prov. Cordillera, 28 km SW of Abapo, 19°06'S, 63°32'W, *Lewis 84-1173* (NY). Prov. Florida, Canton Samaipata, Laguna Volcán, above Bermejo, 1150 m, 18°07'S, 63°38'W, *Churchill et al. 20893* (MO); **Tarija:** Prov. Acre, along trail from Comunidad 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); ridge N of Tunel, 2 km E of Comunidad Emborozu, 55 km NW of Bermejo, 22°17'S, 64°31'W, *Lewis 84-2368* (LPB); headwater area of Quebrada Toro, 1 km SE of YPFB Campo Toro, 11 km N of Bermejo, 22°38'S, 64°19'W, *Lewis 84-2424* (LPB); slope of Cerro Nogal, parallel to and 0.5 km N of Quebrada Nogal, 2–5 km NW of Comunidad La Mamora, 22°09'S, 64°41'W, *Lewis 84-2169* (LPB); S 15°W of summit of Cerro La Puñalada on slopes between Río Bermejo and summit, 6 km SW of Comunidad La Mamora, 22°12'S, 64°37'W, *Lewis 84-2269* (LPB). **PARAGUAY.** **Caaguazú:** Coronel Oviedo, Barrio Azucena, 25°25'S, 56°27'W, *Bordas 238* (NY). **Paraguari:** Macizo Acahay, 500 m, 25°54'S, 57°09'W, *Zardini & Cuevas 5397* (NY); Cordillera de Ybytyruzú, Cerro Peró, 25°55'S, 56°15'W, *Zardini & Velásquez 9377* (NY). **ARGENTINA.** **Corrientes:** Dept. Mercedes: Macrosistema Iberá, Estancia Rincón del Diablo, 28°44'S, 58°02'W, *Arbo et al. 8008* (NY). **Jujuy:** Arroyo de los Matos ad Sierra Santa Barbara, *Fries 43* (H, MO). **Tucumán:** Quebrada de Lules, *Garolera 6971* (FH).

4. *Isopterygium jamaicense*

FIGURE 17

Isopterygium jamaicense (E. B. Bartram) W. R. Buck, Brittonia 36: 88. 1984a. *Platygyriella jamaicensis* E. B. Bartram, J. Wash. Acad. Sci. 26: 14. 1936. Type: Jamaica. Newmarket, *Orcutt 7263* (holotype: FH!; isotype: CANM!).

Plants in thin to dense mats, whitish green to yellow-green. Stems up to 2 cm long, 1–2 mm wide, complanate-foliate, simple or irregularly branched. Asexual reproductive bodies lacking. Leaves 0.7–1.5 mm long, 0.3–0.5 mm wide, flaccid, close, complanate, erect to erect-spreading, smooth, ovate to ovate-lanceolate, usually symmetric, acuminate; margins plane, entire or serrulate nearly to the base; costa none or rarely weak, short and double; median cells 52–85 × 5–9 μm, smooth; alar cells rectangular to quadrangle, in small groups with 2–4 cells along the margins, the cells sometimes inflated. Autoicous. Setae yellow to reddish brown, 0.5–0.8 cm long; capsules 0.5–1.3 mm long, erect to somewhat inclined, straight, cylindrical to somewhat ovoid, not or slightly contracted below the mouth when dry; operculum short-rostrate; peristome teeth up to 0.3 mm long, endostome segments linear, cilia lacking. Spores 14–24 μm in diameter.

Distribution and ecology: Mexico, Guatemala, Panama, and Jamaica (Figures 15, 18, 22); in humid forests, on bamboo stems, and on moist soil, reported once on old thatched roof, at low altitudes from near sea level to 950 m.

Discussion: This species can be 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 cylindrical, erect to inclined capsule that is not or little contracted under the mouth when dry. The gametophyte is very similar to *I. tenerum*, but that species has asymmetric leaves and sometimes has asexual reproductive bodies.

The name *Isopterygium miradoricum* (Müll. Hal.) A. Jaeger, described in 1874 from Mirador, Mexico, has been used previously for plants that seem to fit the description and type of *I. jamaicense* (Ireland, 1984). However, the type of *I. miradoricum* could not be located, and so it is impossible to be certain of the concept of *I. miradoricum*. The type description states that the capsules are inclined to nodding, which does not fit the capsules in the specimens identified as *I. miradoricum* by various bryologists that the senior author examined. If the type of *I. miradoricum* is identical to *I. jamaicense*, the former name has priority over the latter.

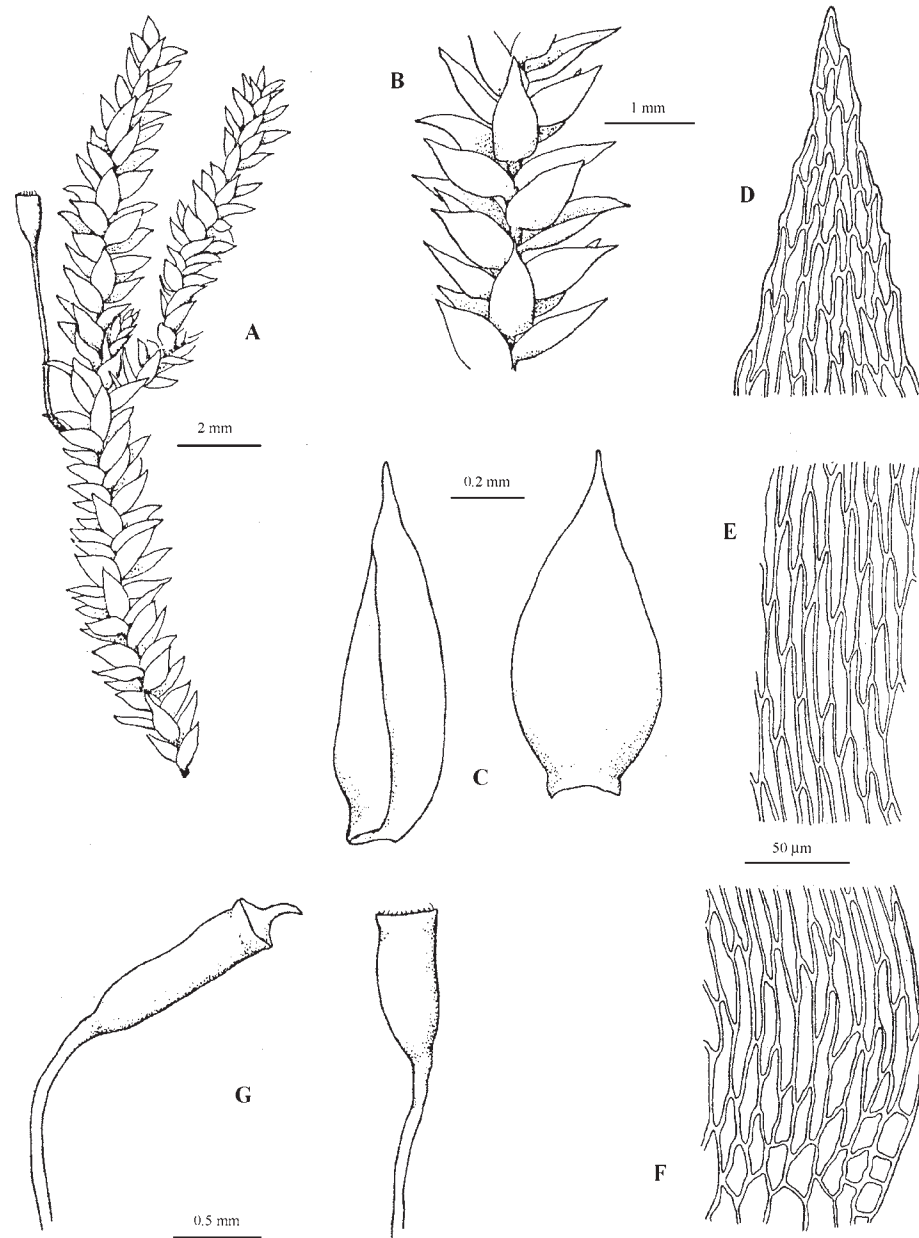


FIGURE 17. *Isopterygium jamaicense*. A. Habit. B. Enlargement of portion of stem. C. Leaves. D. Apical leaf cells. E. Median leaf cells. F. Alar cells. G. Operculate and inoperculate capsules (dry). All illustrations drawn from Santos 3854 (MICH).

Pterogonidium pulchellum (Hook.) Müll. Hal. in Broth. of the Sematophyllaceae is often confused with *Isopterygium jamaicense*. The gametophytes of the two are strikingly similar except *Pterogonidium* is a smaller plant with leaves that are seldom spreading as much as in *I. jamaicense*. Fortunately, *Pterogonidium* usually produces sporophytes, and the erect capsules, which are like

those of *I. jamaicense*, have a single rather than a double peristome like all species of *Isopterygium*.

Specimens examined: MEXICO. Oaxaca: Tuxtepec, El Cerro de Palacios, NE side of Chiltepec, Santos 3854 (CANM, F, MICH, TENN). Puebla: Río Tonta, Paseo Asihualt, 150 m, Sharp 1326a (CANM). Tabasco: (no other locality information) Gilly & Hernandez 307

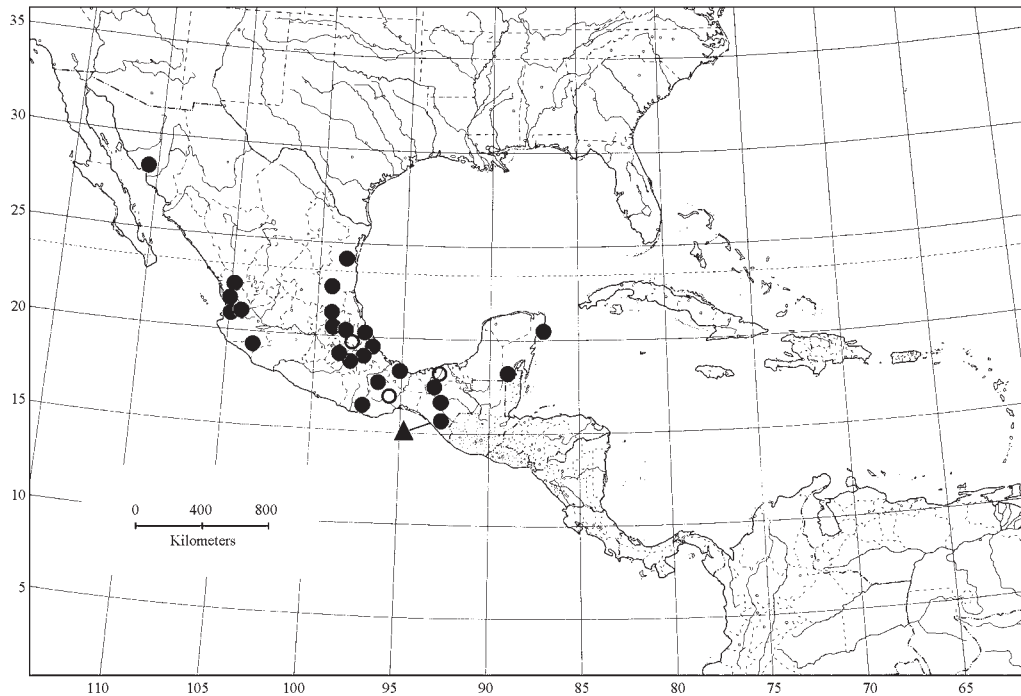


FIGURE 18. Distribution of *Isopterygium tenerifolium* (▲), *I. tenerum* (●), and *I. jamaicense* (○) in Mexico.

(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). **PANAMA.** Bocas del Toro: Vicinity of Fortuna Dam, 4.5 km from Chiriquí Grande, 850–950 m, 08°55'N, 82°08'W, *Allen* 5620 (MO). **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, NY).

5. *Isopterygium subbrevisetum*

FIGURE 19

Isopterygium subbrevisetum (Hampe) Broth., Nat. Pflanzenfam. 1(3): 1081. 1908. *Hypnum subbrevisetum* Hampe, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn ser. 3, 6: 165. 1875. Type: Brazil. Vicinity of Rio de Janeiro, *Glaziou* 6356 (holotype: BM!; isotype: H!).

Taxicaulis subtenerrimus Müll. Hal., Hedwigia 37: 253. 1895; *Isopterygium subtenerrimum* (Müll. Hal.) Paris, Index Bryol. Suppl. 221. 1900. Type: Jamaica. Bethabara, *Wulfschlägel s.n.* (isotype: NY!).

Isopterygium pusillum Renaud & Cardot, Bull. Soc. Roy. Bot. Belgique 41(1): 107. 1905. Type: Puerto Rico. 1900, *Heller* 4495 (holotype: PCI; isotype: NY!).

Isopterygium tenerrimum Renaud & Cardot, Bull. Soc. Roy. Bot. Belgique 41(1): 107. 1905. *nom. nud.*

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

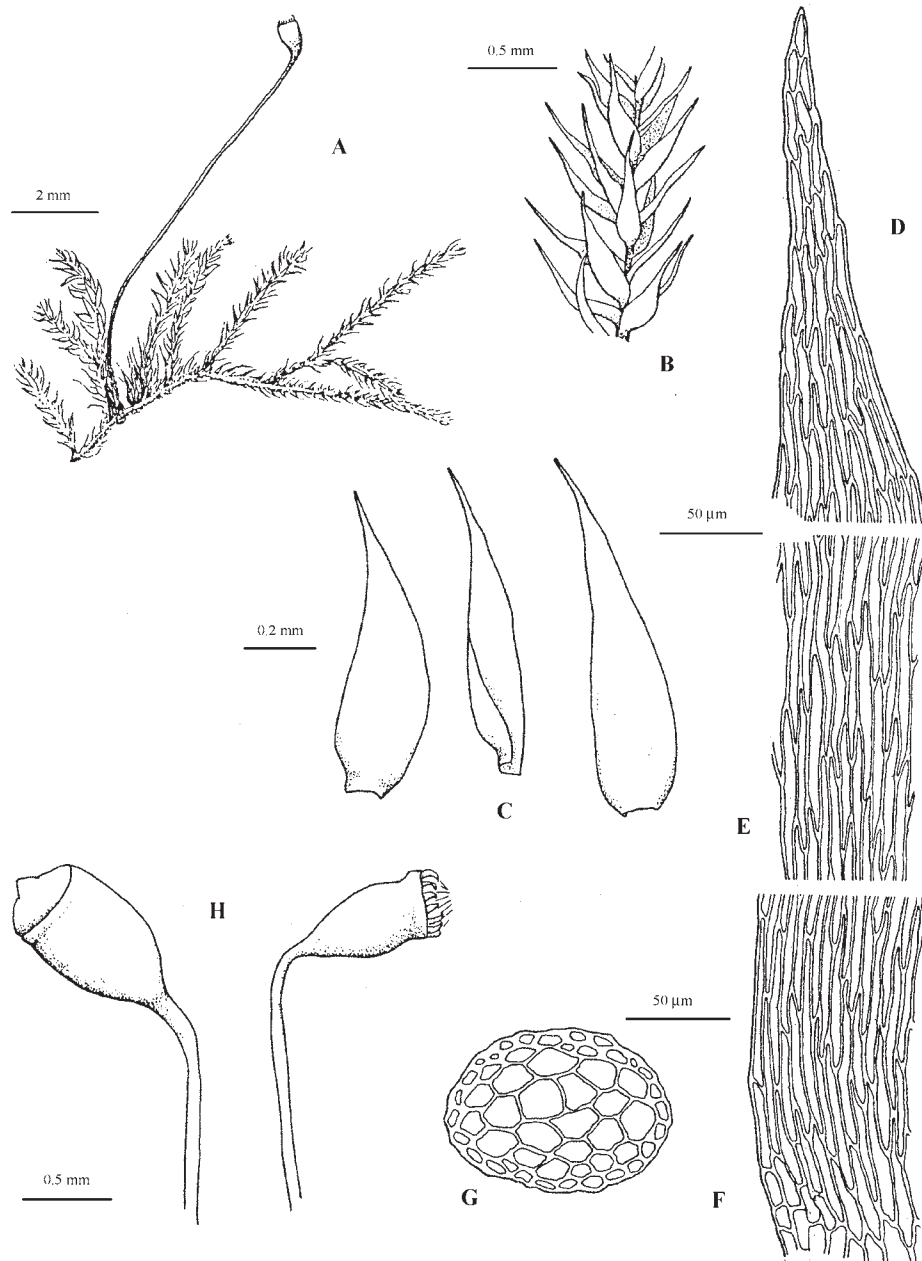


FIGURE 19. *Isopterygium subbrevisetum*. A. Habit. B. Enlargement of portion of stem. C. Leaves. D. Apical leaf cells. E. Median leaf cells. F. Alar cells. G. Cross section of stem. H. Operculate and inoperculate capsules (dry). Illustrations A, B, G, H drawn from *Steere 4602* (MO); C–F from *Glaziou 6356* (BM, holotype).

Distribution and ecology: West Indies, Belize, Honduras, Nicaragua, Costa Rica, Panama, Venezuela, Surinam, French Guiana, Ecuador, Peru, and Brazil (Figures 14, 15); on tree trunks, stumps, rotten logs, vines, humus, earth banks, and occasionally limestone and serpentine rock in humid or wet forests, occurring from 0 to 1940 m.

Discussion: The general aspect of this species is striking because of its lanceolate, slightly concave, rigid, distant, wide-spreading to squarrose leaves. The narrow, lanceolate leaves and the phyllotaxy separate *Isopterygium subbrevisetum* from the other Latin American species. The plants are otherwise most similar to *I. tenerum*, but that

species has leaves somewhat broader (0.2–0.5 mm wide) and longer (0.7–1.2 mm long).

The leaf morphology and the phyllotaxy of this species may not seem very important until one considers the North American plants of *Isopterygium tenerum*. Among the hundreds of North American plants of *Isopterygium* that the senior author studied (Ireland, 1969), none approached the distinctive leaf morphology and the phyllotaxy of *I. subbrevisetum*.

Selected specimens examined: **BELIZE.** **Cayo:** Along Raspaculo Branch above confluence with Monkey Tail Branch, 480–720 m, *Allen 18365* (MO). **HONDURAS.** **Olancho:** Río de Camote, 3 km N of La Union, 12 km below La Muralla, 800 m, 15°02'N, 86°42'W, *Allen 12890* (MO). **NICARAGUA.** (Dept. Unknown) Sandy Bay, 11 Dec 1920, *Hamilton s.n.* (NY). **COSTA RICA.** **Alajuela:** San Pedro de San Ramon, *Brenes 19, 20* (NY), 99 (FH, NY). **Heredia:** Finca La Selva, ~11 km S of Puerto Viejo, *Koch 4938* (MICH); Selva Biological Station, at confluence of Río Sarapiquí and Río Puerto Viejo, 50–100 m, 10°26'N, 84°01'W, *Grayum 9634, 9990, 9999* (MO). **Limón:** Along Río Tortuguero, ~3 km SW of village of Tortuguero, *Steere CR-180, CR-195* (NY); 0.8 km SE of Guapiles on Linnea Vieja, Diamantes Rubber Station, 150 m, *Svihla 3027a* (FH). (Dept. Unknown) Vicinity of La Palma, 1450–1550 m, *Maxon 371* (NY). **PANAMA.** **Coclé:** Near El Valle de Anton, ~550 m, *Brako 8457* (NY). **Darién:** Cerro de Garagará, Sambu basin, southern Darien, 500–974 m, *Pittier 5633* (NY). **Panamá:** Isla de Barro Colorado, *Arrocha 204* (NY), *204a* (PMA); Barro Colorado Is., Panama Canal, Gatun Lake, *Robbins 8* (CANM, FH); Quebrada Culebra, 70–75 m, *Dodge & Allen 17087* (MO); El Llano–Carti road, 16 km from Interamerican Hwy., near El Llano, 330 m, *Croat 33786* (MO). **San Blas:** 23 km from Interamerican Hwy. on El Llano–Carti Road, *Allen 4960* (H, MO, NY), *4968* (MEXU, MO); El Llano–Carti road, 19 km from Interamerican Hwy., 350 m, *de Nevers 4108* (MO). **CUBA.** **Habana:** Vicinity of Santiago de las Vegas, *Baker 691* (NY). **Las Villas:** Santa Clara, S slope of Sierra de los Helechales, Banao Mts., *León & Clement 5545* (NY); Santa Clara, Sierra de Cantu, *León & Clement 5476* (MICH, US); Santa Clara, Trinidad Mts., *Britton 4879* (CANM), *5380* (CANM, NY). **Oriente:** Sierra Maestra, Loma del Gato, *Clemente 14538* (NY); Sierra Maestra, Cordillera de la Gran Piedra, 1250 m, *López 68* (CANM); Sierra Maestra, Gran Piedra, near Santiago de Cuba, *Imshaug 25063* (CANM, MICH); Moa region, banks of the Río Yagrumaje, SW of Punta Gorda, *Webster 810* (CANM); Sierra de Nipe, foothills at the Río Guaro, ~10 km SW of Mayari, *Webster 873* (CANM); Loma San

Juan, 900 m, *Hioram 11812* (MO); Loma San Juan, 850 m, *Hioram 11618* (MICH). **Santiago:** Slopes and summit of El Yunque, near Baracoa, 305–610 m, *Pollard & Palmer 104* (MO); El Yunque Mt., Baracoa, *Underwood & Earle 1054* (CANM); base of El Yunque Mt., Baracoa, *Underwood & Earle 320* (CANM), *1289* (CANM, NY); 1–2 km W of La Gran Piedra, *Shaw 5261* (NY). La Prenda, Guantanamo, *Hioram 18173* (MO). **JAMAICA.** **Manchester:** Marshall's Pen, 4.8 km WNW of Mandeville, 700 m, *Crosby 13816* (NY); 4.3 km N of Plowden Hill, 500 m, *Crosby 13847* (NY); 1.6 km from Balaclava, *Orcutt 816* (MICH); 0.8 km NE of Spur Tree, 790 m, *Webster 5257a* (CANM); Shooters Hill, 2.4–3.2 km S of Mizpah, 430 m, *Farr 831, 832* (CANM). **Portland:** E slope of John Crow Mts., ~2.4 km SW of Ecclesdown, 460 m, *Webster 5179* (CANM); John Crow Mts., ~2 km SW of Ecclesdown, 460–610 m, *Webster 5588* (CANM); John Crow Mts., SW of Ecclesdown, 305–610 m, *Welch 17542, 17707* (CANM); between 0.8 and 2.4 km SW of Ecclesdown, *Powell & Welch 514* (CANM). **St. Ann:** Reynolds Mines area, near Lydford, *Howard & Proctor 14032* (CANM). **St. Andrew:** Summit of Coopers Hill, 775 m, *Farr 1441* (CANM); near Hermitage Dam, ~610 m, *Proctor 17409* (CANM); Second Breakfast Spring, near Mt. Airy, ~915 m, *Farr 724* (CANM). **St. Thomas:** Mountain trail between House Hill and Cuna Cuna Gap, 550–725 m, *Maxon 8901* (BM); Cuna Cuna area, 610–760 m, *Farr 1566* (CANM); Farm Hill, 1220 m, *Proctor 9679* (CANM); N side of Cuna Cuna Gap, *Britton 968* (MICH, NY); Cuna Cuna Gap, 610 m, *Britton 1251* (NY); Bath Fountain, ~150 m, *Farr 1320* (CANM); Corn Puss Gap and vicinity, ~14 km N of Bath, on trail to Port Antonio, 550 m, *Crosby 13653* (NY); Bath, trail N from Bath Fountain Hotel along Sulphur River, ~90 m, *Crosby 13615* (NY). **Trelawny:** Windsor estate, ~120 m, *Powell 335* (CANM); Blue Mts., Hampstead, ~1115 m, *Jäderholm 118* (H). **HAITI.** Canape Verte, above Port-au-Prince, *Mackness 285* (MICH). Dept. de la Grand'anse, Massif de la Hotte, along small stream entering Rivière Glace at junction of road from Beaumont to Camp Perrin, 41 km S of Roseaux, 710 m, *Buck 9060* (NY); Guimbi Galata, Mornes des Commissaires, 1800 m, *Holdridge 1800* (MICH). **Nord:** Vicinity of Pilate, ~325 m, *Leonard 9594* (CANM, FH, US). **Ouest:** Above road NW of Forêt des Pins, *Imshaug & Wetmore 22888* (CANM, MSC). **Sud'est:** Massif de la Selle, 5 km E of Seguin on road to Mare Rouge, 1780 m, *Buck 9478* (NY); Osman, Morne la Selle, 1650 m, *Holdridge 3008a, 3009, 3014* (MICH). **DOMINICAN REPUBLIC.** **Independencia:** Sierra de Baoruco, 30.5 km S of Puerto Escondito, 1940 m, *Buck 14661* (NY). **Santo**

Domingo: Vicinity of Colonia Ramfis, 400–500 m, *Allard 16290* (NY, US); vicinity of Ciudad Trujillo, 0–25 m, *Allard 16116* (NY). **Pedernales:** Las Abejas, ~40 km N along road from Cabo Rojo from junction of road from Oviedo to Pedernales, 1190 m, *Reese 14959* (NY); 55 km N of port of Cabo Rojo on Alcoa road, 1100 m, *Steere 22854* (NY). **La Vega:** La Culata, 9 km NNW of Constanza, 1280 m, *Buck 5356* (NY); La Cumbra, road between Constanza and Jarabacoa, 1220 m, *Allard 16508a* (NY); Loma Compana, ~1036 m, *Allard 18654* (NY); vicinity of Piedra Blanca, 200–500 m, *Allard 18000d* (NY); between Loma La Sal and Loma La Golondrina, 945 m, *Zanoni et al. 19938A, 19938M* (MO). **Dajabon:** Cañada Tirolis, 1 km S of Villa Anacaona, 400 m, *Buck 4837* (NY); along road at Los Amaceyes, 565 m, *Imshaug & Wetmore 3401* (MSC, NY). **PUERTO RICO.** Sierra de Yabucoa, 500 m, *Britton et al. 6313* (NY). Ponce Dist., above Villalba, Doña Juana Recreation Area, 800–1000 m, *Buck 15984* (NY); Guaraguao, *Pagán 66* (MICH, MO). Mountain between Guayama and Cayey, 700–900 m, *Britton et al. 6590* (NY). Near Mayagüez, *Heller 4495* (F, MICH). Western end of Laguna Tortuguero, *Britton & Brown 6855* (MO, NY). Vicinity of Mayagüez, *Britton & Marble 610* (NY). Santa Rosa, Jayuya, *Pagán 299* (MICH, MO). La Torre-cilla, Barranquitas, *Steere 4546* (FH, MICH, MO), 4588, 4602, 4625, 4648 (MICH, MO), 4664, 4667 (MICH). Ridge above Jajome Alto, Cayey–Guayama Road, *Steere 5115* (MICH, MO). Ridge at Km 15, Maricao-Sabana Grande Road, *Steere 5778* (MICH, MO). Just E of Cidra, *Steere 6347* (MICH), 6379 (MICH, MO). Above Toro Negro Reservoir, S of Jayuya, *Steere 6878* (MICH, MO). Mt. Guilarte, W of Adjuntae, *Steere 7191* (MICH, MO). Guavate Purchase Unit, Sierra de Cayey, *Steere 4820* (FH, MICH), 4838, 4858 (MICH), 6754 (MICH, MO), 6762 (MICH). Mt. Cenote, *Pagán 1* (MO), 91, 124 (MICH). Arroyo de los Corchos, between Adjuntas and Jajuya, 800–900 m, *Britton 5334a* (MICH). Monte Torrecilla, 900–1100 m, *Britton et al. 5696* (NY), 5566 (MICH). Río Juan Diego, N slope of Sierra de Luquillo, *Steere 6957* (MICH). NW slopes of Sierra de Luquillo, above Verde, *Steere 4987* (MICH). Between Cayey and Caguas, *Britton 5704* (NY). Cerro de la Punta, S of Jayuya, *Steere 6229* (MICH, NY). Mt. El Toro, trail to Ciénaga Alta, Sierra de Luquillo, *Steere 6461* (MICH). Toro Negro Unit, Río Doña Juana, N of Villalba, *Steere 6015* (MICH, NY, US). 22.5 km S of San Juan, *Heller 696* (MICH). Río Sabana, Sierra de Luquillo, S from Luquillo, *Steere 5190* (MICH). Above upper Río de Marcao, *Steere 5666* (MICH). Vi-ques Is., *Pagán 101* (MICH). **LEEWARD ISLANDS.** **Montserrat:** Chausers Mtn., 610–760 m, *Shafer 806* (CANM, NY); Gags Mtn., 460–760 m, *Shafer 825* (CANM, NY). **Tortola:** N side of Tortola, *Allen & Harter 3332* (MO). **WINDWARD ISLANDS.** **Martinique:** Bois de la Capote, *Stebble 4002* (NY). **Grenada:** Grand Etang, 760 m, *Howard 264* (FH). **COLOMBIA.** **Nariño:** Mpio. Tumaco, Resguardo Indígena de El Hojal, Alrededores, 245 m, 01°19'N, 78°30'W, *Ramírez P. et al. 9808* (MO). **VENEZUELA.** **Bolívar:** Cerro Sarisariñama, Sima Mayor, 1020 m, *Buck & Brewer 15602A, 15619B* (NY). **TRINIDAD AND TOBAGO.** **Trinidad:** Caura R. Valley, *Britton et al. 1224* (NY). Siparia, 30 m, *Simmonds 517* (CANM). **Tobago:** Murray's Land, Cardiff Road, *Broadway 4292* (CANM). **SURINAM.** **Brokopondo:** Brownsberg, near trail to Witt Creek, ~500 m, *Florschütz-de Waard & Zielman 5036A* (U); Brownsberg, 450 m, *Gradstein 4670* (U). **Sipaliwini:** Blanche Marie Valley, 04°44'N, 56°53'W, 100 m, *Muñoz 98-26b* (MO). **FRENCH GUIANA.** Commune de Saül, Mont Galbao, summit NW peak, ~700 m, 03°36'N, 53°16'W, *Buck 33294, 33306* (NY); NE of Saül, summit S of Pic Matécho, 13 km N of Saut Nais, 590 m, *Cremers 6291* (U). **ECUADOR.** Galapagos Iss., 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 Maria, *Morrow 9584* (FH). **BRAZIL.** **Acre:** Mpio. Sena Madureira, Basin of Rio Purus, Rio Macanã, Colocação Castanheira, 09°42'S, 69°07'W, *Daly et al. 8134* (NY). **Amazonas:** Along the Rio Negro, along BR 307, N from São Gabriel de Cachoeira to Cucuí, at Km 41, *Buck 2598* (NY); vicinity of Manaus, along BR 174 at Km 30, *Buck et al. 1751* (CANM, NY); along the Rio Uatumã, along road to Balbina Dam project from Manaus-Caracari Road (BR 174), *Buck 2662* (CANM, NY). **Bahia:** Mpio. Ilhéus, Centro de Pesquisas do Cacau, Km 22 on BR 415 between Ilhéus and Itabuna, 50 m, ~14°50'S, 39°13'W, *Vital & Buck 20190* (NY); Serra da Agua de Rega, ~24 km N of Seabra, road to Agua de Rega, 1000 m, *Irwin et al. 31095* (CANM). **Minas Gerais:** Parque Nacional do Caparaó, Vale Verde, ~1200 m, 20°30'S, 41°40'W, *Buck 26942* (NY); Vicosia, *Mexia 4499-a* (FH); Fazenda Bom Destino, *Bandeira 277* (NY). **Paraná:** Mpio. Foz do Iguaçu, Parque Nacional do Iguaçu, 100–200 m, 25°40'S, 54°25'W, *Vital & Buck 11960* (NY). **Rio de Janeiro:** Parque Nacional do Itatiaia, vicinity of Pousada do Elefante, ~22°25'S, 44°36'W, *Vital & Buck 20040* (NY); Petropolis, Pedreira da Quitandinha, *Bandeira 191* (NY). **Roraima:** Bonfim, *Santiago 14332* (NY). **Santa Catarina:** Without locality, *Ule 970* (H); Matta Hoffman, Brusque, 50 m, *Reitz 3144* (NY). **São Paulo:** Mpio. Guapiara, Serra Paranapiacaba, Fazenda Intervalles, slopes of Morro do

Mirante, 800–1000 m, ~24°16'S, 48°25'W, *Vital & Buck* 20495 (NY); Mpio. Santo André, slopes of Paranapiacaba, ~850 m, 23°47'S, 47°17'W, *Vital & Buck* 20609 (NY); Sierra de São Pedro, São Pedro, 680 m, *Schäfer-Verwimp & Verwimp* 9526 (NY); near Alto da Serra, May 1901, 900 m, *Schiffner* (BM); Mairinque, ~75 km W of São Paulo, Porta do Sol, *Schäfer-Verwimp* 8268 (CANM); Bauru, *Vital* 11125 (CANM).

6. *Isopterygium subglobosum*

FIGURE 20

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

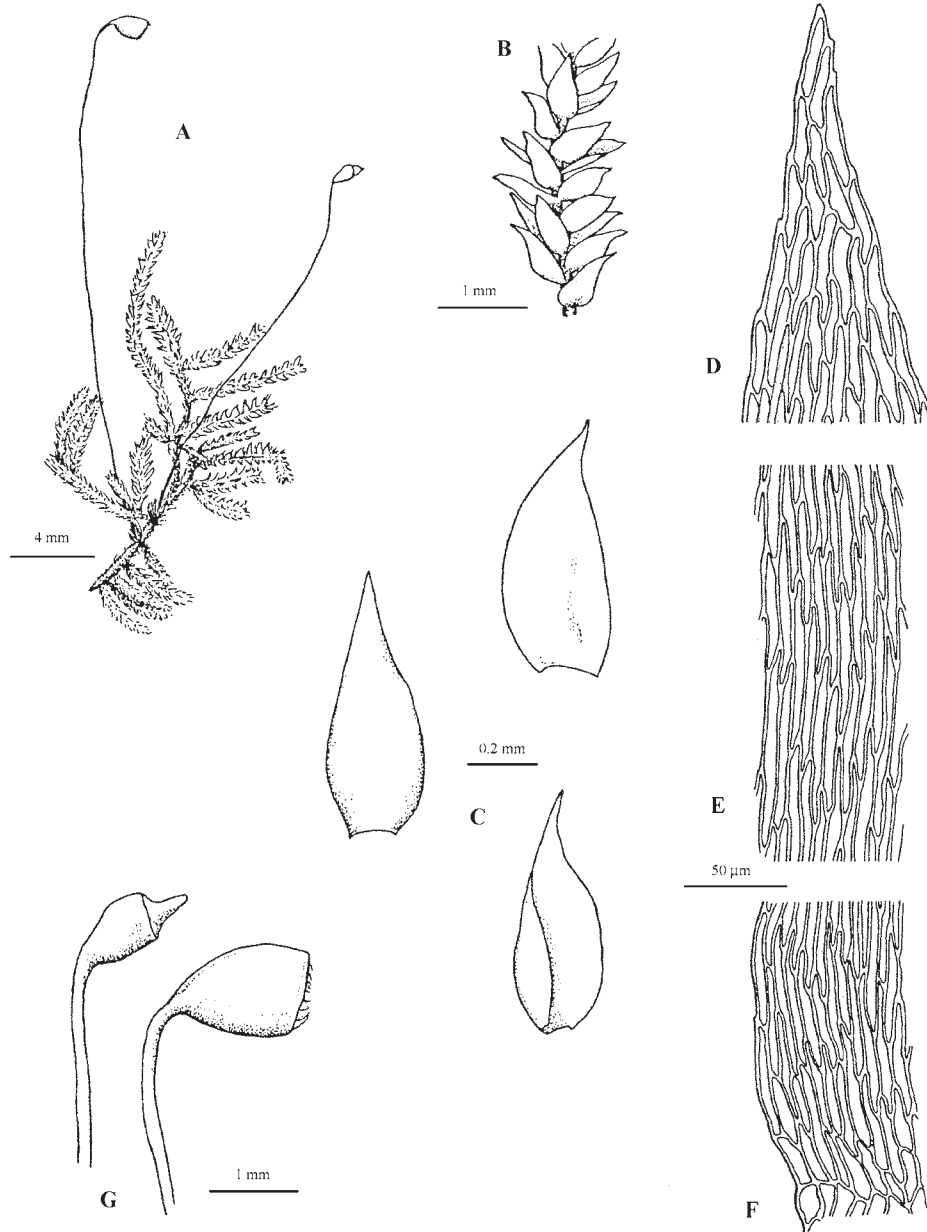


FIGURE 20. *Isopterygium subglobosum*. A. Habit. B. Enlargement of portion of stem. C. Leaves. D. Apical leaf cells. E. Median leaf cells. F. Alar cells. G. Operculate and inoperculate capsules (dry). All illustrations drawn from *Herzog* 2738 (JE, holotype).

Plants in thin to dense mats, light green to yellowish green. 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 0.7–1.0 mm long, 0.3–0.5 mm wide, flaccid, close, concave, wide-spreading to squarrose, smooth, somewhat contorted when dry, ovate to ovate-lanceolate, often curved and asymmetric, short- to long-acuminate; margins erect, serrulate above, entire or nearly so below; costa none; median cells 52–108 × 7–9 μm, smooth; alar cells rectangular, in small groups with 1–2 cells on margins. Autoicous. Setae 1.4–2.2 cm long, yellowish red to reddish; capsules 0.5–1.2 mm long, inclined, subglobose, not contracted below the mouth when dry; operculum high-conic to short-rostrate; peristome teeth up to 0.3 mm long. Spores 9–12 μm in diameter.

Distribution and ecology: Known from only the type locality in Bolivia (Figure 12), occurring on decaying leaves at margin of creek at ~1700 m.

Discussion: This species, like the previous one, is impossible to distinguish from several of the other Latin American *Isopterygium* 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 only an environmental response to light, moisture, etc., with no genetic basis. We have elected to retain *Isopterygium subglobosum* as a separate species until more collections become available for comparison. The gametophytes of this species are very similar to *I. tenerum*.

Specimen examined: BOLIVIA. Only the type specimens seen.

7. *Isopterygium tenerifolium*

FIGURE 21

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. 16. 1867. *nom. nud.*

Ectropothecium longisetum Schimp. ex Besch., Ann. Sci. Nat., Bot. sér. 6, 3: 258. 1876; *Isopterygium longisetum* (Schimp. ex Besch.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908, *hom. illeg., non* Broth. 1895; *Isopterygium altisetum* H. A. Crum & Steere, Bryologist 59: 254. 1956, *nom. nov.* Type: Guadeloupe. Chemin de la Soufrière, *Husnot exsiccata no. 169* (holotype: BM!; isotypes: M!, NY!).

Plagiothecium villae-ricae Besch., Mem. Soc. Sci. Nat. Cherbourg 21: 271. 1877. Type: Paraguay. Guaira, Villa Rica, *Balansa 1210* (isotype: NY!).

Isopterygium longisetum Broth., Bih. Kongl. Svenska Vetensk.-Akad. Handl. 21 Afd. 3(3): 55. 1895; *I. mosenii* Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908, *nom. illeg.* Type: Brazil. Minas Gerais: Caldas, *Mosén 471* (lectotype: H!, designated by Ireland, 1991a); near Capivary, *Mosén 439* (syntype: H!); Serra de Caldas, *Mosén 469* (syntype: H!); São Paulo, between Campinas and Serra de Caracol, *Mosén 470* (syntype: H!).

Taxicaulis stigmocarpus Müll. Hal., Nuovo Giorn. Bot. Ital. 4: 150. 1897; *Isopterygium stigmocarpum* (Müll. Hal.) Paris, Index Bryol. Suppl. 220. 1900. Type: Bolivia. Province Cochambamba, near Choquecamata, *Germain 1173b* (lectotype: M!, designated by Ireland, 1991a; isolectotype: H!).

Taxicaulis excelsipes Müll. Hal., Hedwigia 37: 253. 1898; *Isopterygium excelsipes* (Müll. Hal.) Paris, Index Bryol. Suppl. 219. 1900. Type: Jamaica. Near Kingston, 1897, *Hansen s.n.* (isotype: H!).

Plagiothecium meteoriaceum Müll. Hal., Bull. Herb. Boissier 6: 120. 1898; *Isopterygium meteoriaceum* (Müll. Hal.) Paris, Index Bryol. Suppl. 220. 1900. Type: Brazil. Serra Itatiaia, *Ule 1884* (isotype: H!).

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

Plagiothecium paludigenum Müll. Hal., Hedwigia 40: 58. 1901; *Isopterygium paludigenum* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908. Type: Brazil. Santa Catarina: Tubarão, *Ule 912* (lectotype: H!, designated by Ireland, 1991a).

Plagiothecium lonchopelmatum Müll. Hal., Hedwigia 40: 59. 1901; *Isopterygium lonchopelmatum* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908. Type: Brazil. San Francisco Island, Province Santa Catarina, *Ule 511* (lectotype: H!, designated by Ireland, 1991a); *Ule 509, 513* (syntypes, H!).

Plagiothecium restingae Müll. Hal., Hedwigia 40: 60. 1901; *Isopterygium restingae* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908. Type: Brazil. Rio de Janeiro: Restinga de Maua, *Ule 2144* (lectotype: H!, designated by Ireland, 1991a; isolectotypes: FH!, M!).

Plagiothecium restingae var. *tenue* Müll. Hal., Hedwigia 40: 60. 1901. Type: Brazil. Nova Friburgo, in Capoeira, *Ule, Bryotheca brasiliensis 233* (lectotype: H!, here designated; isolectotypes, BM!, NY!).

Plagiothecium jamaicense Müll. Hal., Hedwigia 40: 61. 1901. Type: Jamaica. 1897, *Hansen s.n.* (isotype: NY!).

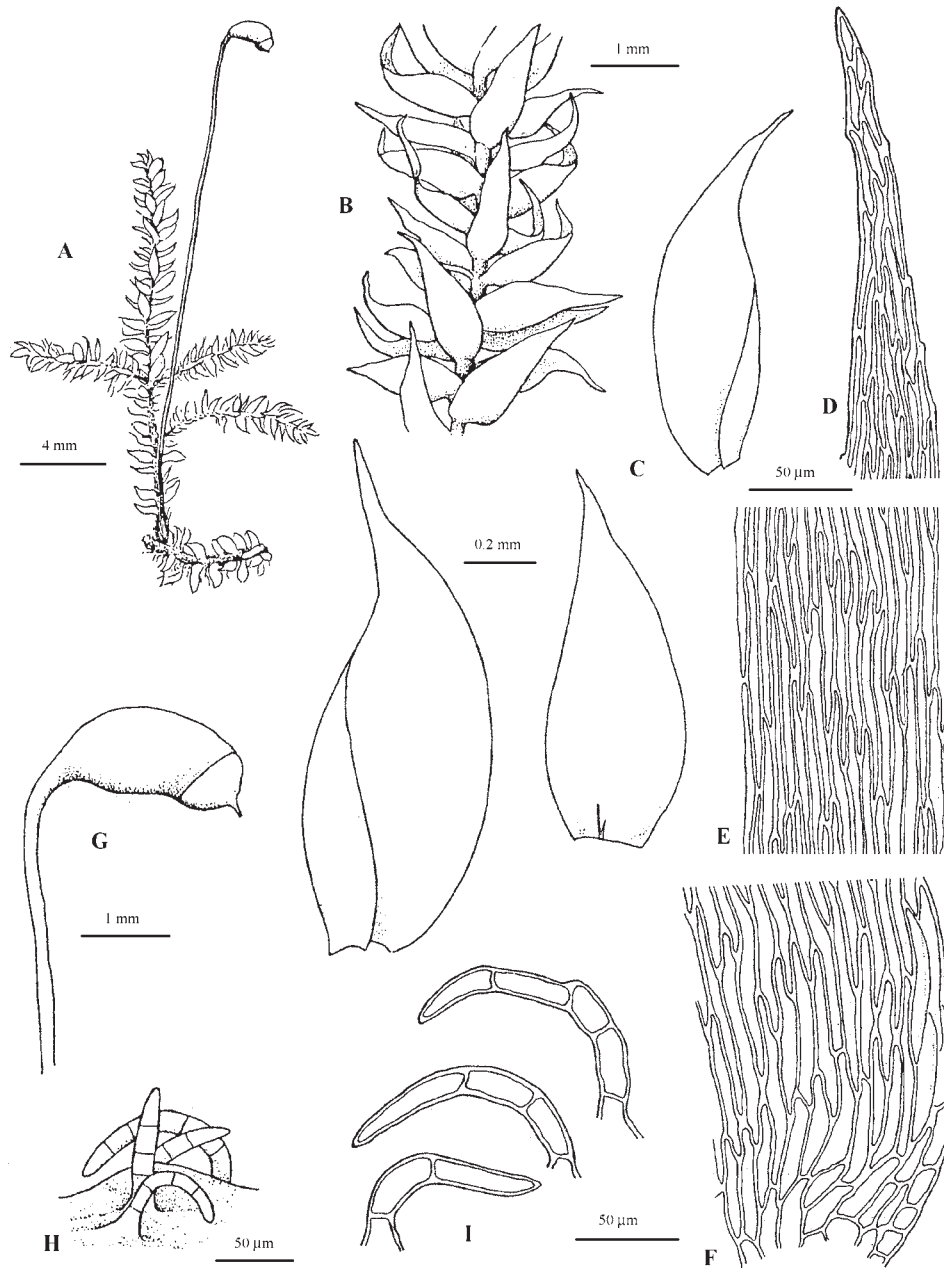


FIGURE 21. *Isopterygium tenerifolium*. A. Habit. B. Enlargement of portion of stem. C. Leaves. D. Apical leaf cells. E. Median leaf cells. F. Alar cells. G. Operculate capsule (wet). H, I. Pseudoparaphyllia. Illustrations A, B, G drawn from *Stevens et al. 25048* (MO); C–F, H, I from *Spruce 1060* (NY, holotype).

Isopterygium fecundum Renauld & Cardot, Bull. Soc. Roy. Bot. Belgique 41(1): 140. 1905. Type: Costa Rica. Potrero del Alto, volcán de Poás, *Pittier & Durand, Plantae costaricensis exsiccatae 5735* (isotypes: FHI!, US!).

Isopterygium manaosense Broth., Hedwigia 45: 286. 1906. Type: Brazil. Estado de Amazonas, Manaus, Rio Negro, *Ule, Bryotheca brasiliensis 280* (lectotype: H!, designated by Ireland, 1991a); *Ule 2331* (syntypes, BM!, H!).

Isopterygium vagans Herzog, Biblioth. Bot. 87: 152. 1916. Type: Bolivia. An Wegrändern bei San Miguelito, *Herzog 2765* (holotype: JE!; isotype: H!).

Plants in thin, loose mats, yellow-green to green. Stems up to 4 cm long, 2–3 mm wide, complanate-foliate, simple or irregularly and freely branched. Asexual reproductive bodies lacking. Leaves 1.0–1.5 mm long, 0.4–0.7 mm

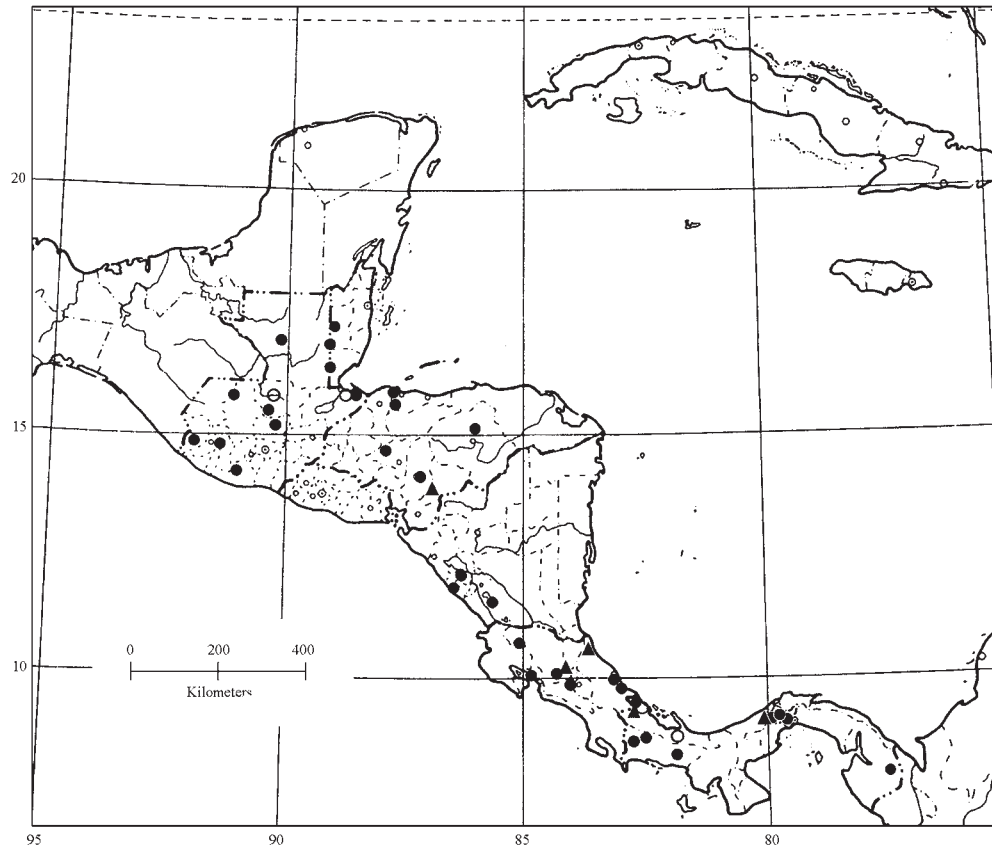


FIGURE 22. Distribution of *Isopterygium tenerum* (●), *I. tenerifolium* (▲), and *I. jamaicense* (○) in Central America.

wide, flaccid, close, complanate, wide-spreading to squarrose, smooth when wet, usually wrinkled and contorted when dry, 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; median cells $71\text{--}141 \times 5\text{--}7 \mu\text{m}$, smooth; alar cells short-rectangular to quadrate, in small groups with 1–2 cells on margins. Autoicous. Setae (1.5–) 2–3(–4) cm long, brown to reddish brown; capsules 1.0–1.5 mm long, horizontal to pendulous, rarely erect, ovoid to ellipsoid, contracted below the mouth when dry; operculum obliquely short-rostrate; peristome teeth up to 0.2 mm long. Spores 9–14 μm in diameter.

Distribution and ecology: West Indies, southern Mexico to Panama, and from Colombia and Venezuela to northern Argentina (Figures 15, 18, 22, 23), also from the southeastern United States; 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 160 to 3000 m.

Discussion: *Isopterygium tenerifolium* is best recognized by its large plants with stems to 4 cm long, 2–3 mm wide, and leaves 1.0–1.5 mm long, ovate-lanceolate to ovate, often curved and asymmetric, acuminate, flaccid, close, complanate, usually wrinkled and contorted when dry, 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 plant's large size and especially the long setae, longer than any of the other Latin American species of *Isopterygium*, are obvious features that help identify this species.

Selected specimens examined: MEXICO. Chiapas: Mpio. Angel Albino Corzo, 9 km S de Finca Liquidambar, $15^{\circ}42'N$, $92^{\circ}45'W$, Delgadillo M. 4676, 4678, 4679b, 4726, 4728a (MEXU); Cárdenas 4163, 4189 (MEXU). HONDURAS. Cortés: Cusuco Natl. Park, along Río Cusuco, ~22 km W of San Pedro Sula and 16 km S of Cuyamel, $15^{\circ}30'N$, $88^{\circ}14'W$, 1840–1900 m, Allen 14392 (MO). El

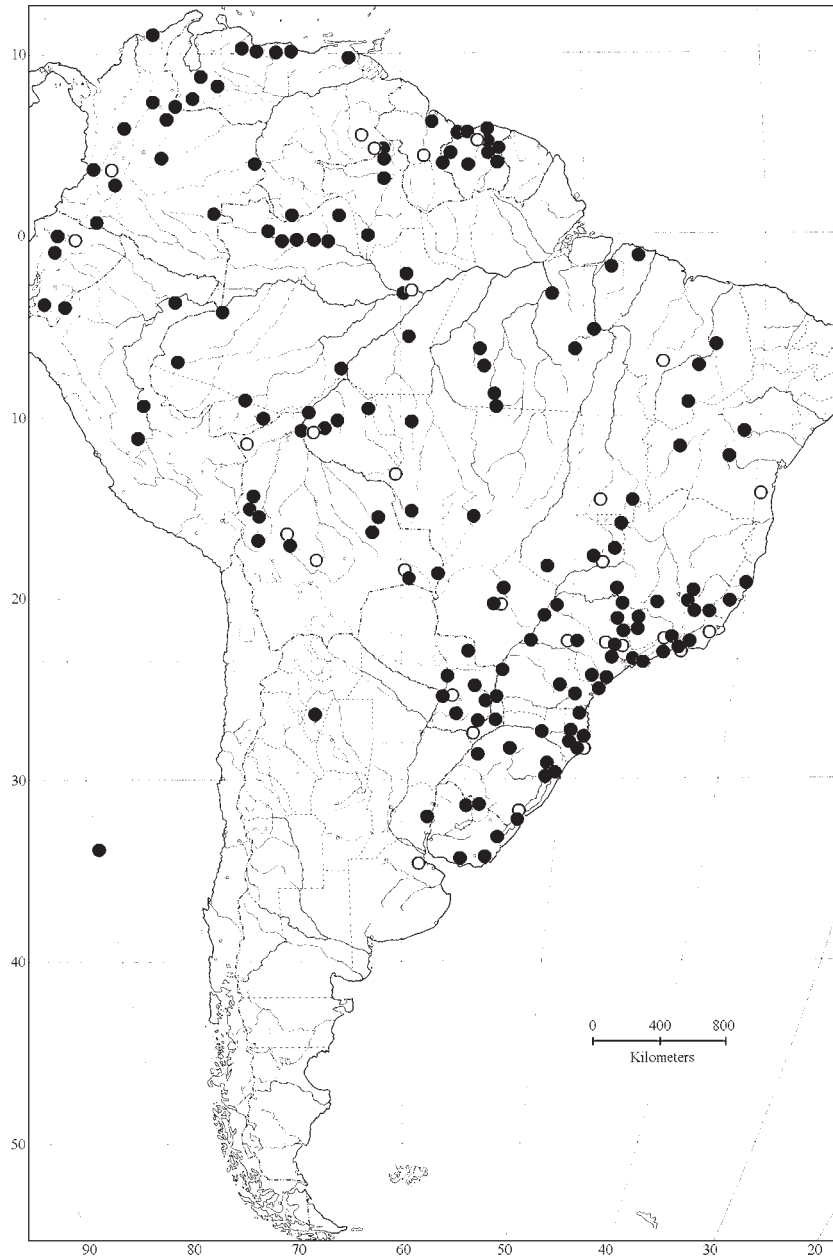


FIGURE 23. Distribution of *Isopterygium tenerum* (●) and *I. tenerifolium* (○) in South America.

Paraíso: Between Las Mesas and Ojo de Agua, 700 m, *Morton* 6981, 6982 (US). **Francisco Morazán:** Region of Agua Amarilla, above El Zamorano, 900–1100 m, *Standley et al.* 5050 (FH). **COSTA RICA.** **Alajuela:** Volcán Poás, 2500 m, *Valerio* 285 (FH). **Limón:** ~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). **Canal Area:** Barro Colorado Is., Jan–Feb 1938, *Willis s.n.* (MICH). **CUBA.** **Habana:** Batabano, *Baker & Wilson* 2391 (H). **Pinar del Río:** Herradura, *Ekman* 10749 (BM, NY). 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.** **Dajabón:** 14.7 km desde el Parque Central del Pueblo de

Loma de Cabrera en el camino a Capotillo y Loma de Alto de la Paloma, 490 m, *Zanoni & Mejía 17989A* (NY). **Pera-
via:** La Nevera area, 47 km S of Constanza, 2070–2100
m, *Buck 5247* (NY). **PUERTO RICO.** Vicinity of Utuado,
Britton 5139a (NY). Cerro de la Punta, Cordillera Cen-
tral, S of Jayuya, *Steere 6212* (MICH, MO, NY, US), 6238
(MICH, MO). South shore of Laguna Tortuguero, near
Manati, *Steere 6777* (MICH, NY, US). Vega Baha, *Heller
1338* (NY). **WINDWARD ISLANDS. Guadeloupe:** With-
out 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. Valle:** La Cumbre,
1800–2200 m, *Killip & Smith 16026* (NY). **Santander:** Vicinity of Las
Vegas, 2600–3000 m, *Killip & Smith 16026* (NY). **VEN-
EZUELA. Bolívar:** Dist. Roscio, 13 km al Noreste de Santa
Elena de Uairén, 900 m, *Steyermark & Liesner 127566*
(MO); vicinity of Canaima and the Río Carrao, *A. J. &
E. B. Sharp F-7629* (TENN). **Tachira:** 12 km SW of Punta
de Piedra, toward Sacramento, 175 m, *Steyermark & Rabe
96615* (US). **Yaracuy:** Dept. Bruzual, Mpio. Campoelias,
1300–1550 m, *Trujillo 16461* (MO). **GUYANA.** Without
locality, *Parker s.n.* (NY). **SURINAM.** Sabanpassie, *Teunis-
sen & Wildschut 11931* (U). **FRENCH GUIANA.** Canton
de Approuague-Kaw, ~1.5 km SSW of Pic Matécho, 160 m,
03°44'N, 53°02'W, *Buck 37938* (NY). **ECUADOR. Ori-
ente:** Without locality, Jun 1910, 1800 m, *Allioni s.n.* (H).
BRAZIL. Amazonas: Manaus, Rio Negro, May 1902, *Ule
s.n.* (M); Taruma-Fälle, in Quellmulden, ~60 m, 02°53'S,
60°06'W, *Schäfer-Verwimp 9803* (NY). **Bahia:** Mpio. Rio
de Contas, Pico das Almas, 1120 m, 13°00'S, 14°53'W,
Harley et al. 25965 (NY). Salvador, Bairro of Itapua, vicin-
ity of airport, *Boom et al. 886, 895* (NY); between Ibirapi-
tanga and Ubaitaba, 200 m, *Schäfer-Verwimp & Verwimp
8753* (NY). **Goiás:** Region of southern Serra Dourada,
Dawson 14888 (FH). **Minas Gerais:** Serra da Mantiqueira,
Delfim Moreira, in Quellmoor, 1330 m, 22°33'S, 45°15'W,
1330 m, *Schäfer-Verwimp & Verwimp 14946* (NY); Serra
de Caldas, 15 Sep 1873, *Mosén s.n.* (H). Parque Nacional
do Itatiaia, vicinity of Brajo da Lapa, at Km 8 along entry
road near border of Rio de Janeiro, 2120 m, ~22°22'S,
44°45'W, *Vital & Buck 19660* (NY). **Pará:** Ponta Grossa,
Rio Tapajas, *Swallen 6936* (FH, US). **Rio Grande do Sul:**
Vieira, nearly opposite Rio Grande, *Lindman B130* (H,
NY). **Rondônia:** Along Rio Pacaás Novos, between its con-
fluence with Rio Mamoré and the first rapids, *Reese 13294*
(NY); Vilhena-Colorado road, 13 km N of Vilhena on BR-
364, *Nelson 358* (NY). **Santa Catarina:** Tubarão, *Ule 982*
(H). **São Paulo:** Near Cerqueira-Cesar, 500 m, *Kryptoga-
mae exsiccatae 2898, Schiffner* (H, M, US); near Campo

Grande on São Paulo Railway, 700 m, *Schiffner 650* (FH,
H). **BOLIVIA. Santa Cruz:** Prov. Chiquitos, “Cerro Tata-
raqui,” 13 km NE of Roboré, 18°16'S, 59°39'W, *Lewis
85-1307* (LPB); Prov. Manuel M. Caballero, Serranía de
Siberia, ~15 km E de Siberia, carretera a Comparapa, 2460
m, 17°49'S, 64°40'W, *Churchill 22482* (MO, NY). Also
known from type collections of *I. stigmocarpum* & *I. va-
gans*. **PARAGUAY.** Santo Antonio, Colonia “Elis,” *Lind-
man B231* (NY). **ARGENTINA. Corrientes:** Dept. Santo
Tome: Laguna Luna, 28°02'S, 56°49'W, *Arbo et al. 8476*
(NY). Posados, Misiones, *Eckman 2096* (FH).

8. *Isopterygium tenerum*

FIGURE 24

Isopterygium tenerum (Sw.) Mitt., J. Linn. Soc., Bot. 12:
499. 1869. *Hypnum tenerum* Sw., Fl. Ind. Occid. 3:
1817. 1806; *Isothecium tenerum* (Sw.) Brid., Bryol.
Univ. 2: 385. 1827. Type: Jamaica. *Swartz 2719* (holo-
type: S!; isotypes: BM!, C!).

Hypnum micans Sw., Adnot. Bot. 175. 1829; *Rhynchostegium micans*
(Sw.) Austin, Bot. Gaz. (Crawfordville) 1: 30. 1875; *Isopterygium micans*
(Sw.) Kindb., Enum. Bryin. Exot. 21. 1888; *Plagiothecium micans* (Sw.)
Paris, Index Bryol. 963. 1896. Type: North America [Pennsylvania, Lan-
caster Co.]. *Muhlenberg 166* (lectotype, selected here, PH!; no material
found at S).

Hypnum splendidulum Hornsch., Fl. Bras. 1(2): 77. 1840; *Isopterygium
splendidulum* (Hornsch.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3):
1081. 1908. Type: Brazil. In Serra dos Orgãos, Feb, *Beyrich s.n.* (lectotype:
BM!, designated by Ireland, 1991a).

Hypnum fulvum Hook. & Wilson in Drumm., *Musci Amer., S. States 110*.
1841, *hom. illeg.*; *Plagiothecium fulvum* A. Jaeger, Ber. Thätigk. St. Gal-
lischen Naturwiss. Ges. 1876–77: 450. 1878 (new name); *Isopterygium ful-
vum* (A. Jaeger) Kindb., Canad. Rec. Sci. 6(2): 72. 1894; *Plagiothecium mi-
cans* var. *fulvum* (A. Jaeger) Paris, Index Bryol. 963. 1896. Type: Louisiana.
Drummond, Musci Amer., S. States 110 (isotypes: NY!, WTU!).

Hypnum brachyneuron Müll. Hal., Bot. Zeitung (Berlin) 3: 109. 1845; *Iso-
pterygium brachyneuron* (Müll. Hal.) Mitt., J. Linn. Soc., Bot. 12: 498. 1869.
Type: Brazil. Santa Catarina: Sep–Oct 1864, *Pabst s.n.* (isotype: H!)

Hypnum curvicolle Müll. Hal., Syn. Musc. Frond. 2: 684. 1851, “*curvicol-
lum*”; *Isopterygium curvicolle* (Müll. Hal.) Mitt., J. Linn. Soc., Bot. 12: 498.
1869; *Isopterygium curvicolle* var. *majus* Broth. in E. Bauer, Verh. Zool.-Bot.
Ges. Wien 55: 576, 578. 1905, Rev. Bryol. 32: 11. 1905. *nom. nud.* Type:
Brazil. Santa Catarina: Apr and May 1847, *Pabst s.n.* (isotypes: H!, JE!).

Hypnum leucophyllum Hampe in Müll. Hal., Syn. Musc. Frond. 2: 280. 1851; *Isopterygium leucophyllum* (Hampe) Mitt., J. Linn. Soc., Bot. 12: 499. 1869. Type: Chile. On trees, without specific locality and collector (holotype: BM!).

Hypnum hospitans Hampe, Ann. Sci. Nat., Bot. sér. 5, 5: 313. 1866; *Isopterygium hospitans* (Hampe) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 434. 1878. Type: Colombia. Tequendama, Aug 1863, *Lindig s.n.* (holotype: BM!; isotype: M!).

Hypnum cordovense Müll. Hal., Linnaea 38: 652. 1874; *Isopterygium cordovense* (Müll. Hal.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 436. 1878. Type: Mexico. Cordova, Sep 1857, *Mohr s.n.* (isotypes: NY!, US!).

Hypnum leptomiton Müll. Hal., Linnaea 38: 652. 1874; *Isopterygium leptomiton* (Müll. Hal.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 436. 1878. Type: Guatemala. *Bernoulli s.n.* (isotypes: BM!, H!).

Hypnum laxum Hampe, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn ser. 3, 6: 166. 1875, *hom. illeg. non* P. Beauv. 1805; *Ectropothecium laxum* A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1877–78: 266. 1880 (new name); *Isopterygium laxum* (A. Jaeger) Broth., Bih. Kongl. Svenska Vetensk.-Akad. Handl. 21 Afd. 3(3): 56. 1895. Type: Brazil. Vicinity of Rio de Janeiro, *Glaziou 7197* (holotype: BM!; isotypes: H!, JE!).

Hypnum divaricatum Müll. Hal. ex Hampe, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn ser. 3, 6: 167. 1875; *Isopterygium divaricatum* (Hampe) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1081. 1908. Type: Brazil. Vicinity of Rio de Janeiro, *Glaziou 5611* (holotype: BM!; isotypes: H!, JE!, NY!).

Hypnum lamprophyllum Hampe, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn ser. 3, 6: 167. 1875, *hom. illeg. non* (Mitt.) Müll. Hal. 1874; *Ectropothecium lamprophyllum* A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1877–78: 266. 1880 (new name); *Isopterygium lamprophyllum* (A. Jaeger) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1081. 1908. Type: Brazil. Vicinity of Rio de Janeiro, *Glaziou 6357* (holotype: BM!; isotype: H!).

Ectropothecium clandestinum Ångstr., Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 33(4): 43. 1876; *Isopterygium clandestinum* (Ångstr.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1081. 1908. Type: Brazil. Caldas, Jun 1854, *G.A. Lindberg s.n.* (isotypes: BM!, H!).

Isopterygium streptopodium Besch., Ann. Sci. Nat., Bot. sér. 6, 3: 257. 1876. Type: Guadeloupe. Chemin de la Soufrière, *Husnot, exsiccata no. 184* (holotype: BM!).

Hypnum brachystelium Hampe, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn ser. 4, 1: 139. 1879; *Isopterygium brachystelium* (Hampe) Kindb., Enum. Bryin. Exot. 100. 1891. Type: Brazil. Near Novo Friburgo, *Beyrich s.n.* (holotype: BM!).

Hypnum citrinum Hampe, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn ser. 4, 1: 142. 1879; *Isopterygium citrinum* (Hampe) Kindb., Enum. Bryin. Exot. 100. 1891. Type: Brazil. Serra dos Orgãos, collector *Beyrich?* (holotype: BM!).

Hypnum cacti Müll. Hal., Linnaea 42: 437. 1879; *Isopterygium cacti* (Müll. Hal.) Kindb., Enum. Bryin. Exot. 20. 1888. Type: Argentina. Concepción del Uruguay, Quinta del Colegio, Apr 1876, *Lorentz s.n.* (isotypes: H!, JE!).

Hypnum eutrypherum Müll. Hal., Linnaea 42: 497. 1879; *Isopterygium eutrypherum* (Müll. Hal.) Paris, Index Bryol. 707. 1897. Type: Venezuela. Near Colonian Tovar, *Fendler 153* (isotypes: BM!, H!).

Hypnum restitutum Hampe, Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn ser. 4, 1: 141. 1879; *Isopterygium restitutum* (Hampe) Kindb., Enum. Bryin. Exot. 100. 1891. Type: Brazil. Vicinity of Rio de Janeiro, *Glaziou 7163* (lectotype: BM!, designated by Ireland, 1991a); *Glaziou 7455* (syntype: H!).

Hypnum chlorosum Hampe, Flora 64: 414. 1881; *Isopterygium chlorosum* (Hampe) Paris, Index Bryol. 706. 1897. Type: Brazil. Near Rio de Janeiro, *Glaziou 11733* (holotype: BM!; isotype: H!).

Isopterygium subtenerum Besch., J. Bot. 5: 348. 1891. Type: Paraguay. Cordillère de Péribébui, *Balansa 3690* (holotype: BM!; isotype: MICH!).

Isopterygium guarapense Besch., J. Bot. 5: 349. 1891. Type: Paraguay. Guarapi, *Balansa 3619* (possible holotype: BM!; isotype: H!).

Plagiothecium radisetum Müll. Hal., Malpighia 10: 515. 1896; *Isopterygium radisetum* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908. Type: Guyana. Georgetown, near Marshall Falls on the Mazaruni River, 1895, *Quelch s.n.* (isotype: BM!).

Taxicaulis adflatus Müll. Hal., Hedwigia 36: 115. 1897; *Isopterygium adflatum* (Müll. Hal.) Paris, Index Bryol. Suppl. 217. 1900. Type: Argentina. Tucumanensis, near Tucumán, Mar 1872, *Lorentz s.n.* (isotype: H!).

Taxicaulis cylindraceus Müll. Hal., Nuovo Giorn. Bot. Ital. n.s. 4: 151. 1897; *Isopterygium cylindraceum* (Müll. Hal.) Paris, Index Bryol. Suppl. 218. 1900. Type: Bolivia. Cochabamba, near Choquecamata, Jun 1889, *Germain s.n.* (isotype: H!).

Taxicaulis trichopelma Müll. Hal., Bull. Herb. Boissier 5: 210. 1897; *Isopterygium trichopelma* (Müll. Hal.) Paris, Index Bryol. Suppl. 221. 1900. Type:

Guatemala. Alta Vera Paz, Pansanala, Dec 1887, *von Türckheim s.n.* (holotype: BM!).

Taxicaulis weigeltii Müll. Hal., Hedwigia 37: 252. 1898, “*weigeltii*”; *Isopterygium weigeltii* (Müll. Hal.) Broth., Nat. Pflanzenfam. 1(3): 1081. 1908. Type: Surinam. *Weigelt s.n.* (possible isotype: H!).

Taxicaulis rufisetulus Müll. Hal., Hedwigia 37: 253. 1898; *Isopterygium rufisetulum* (Müll. Hal.) Paris, Index Bryol. Suppl. 220. 1900. Type: Cuba. *Wright, coll. III, no. 96* (possible isotype: H!).

Taxicaulis araneosetus Müll. Hal., Hedwigia 37: 255. 1898; *Isopterygium araneosetum* (Müll. Hal.) Paris, Index Bryol. Suppl. 218. 1900, “*arauco-setum*.” Type: Trinidad. Near Maroval, Jul 1847, *Crüger s.n.* (possible isotype: H!).

Isopterygium callochlorum Broth., Bih. Kongl. Svensk. Vetensk.-Akad. Handl. 26 Afd. 3(7): 46. 1900. Type: Paraguay. Santo Antonio, colonia “Elisa,” *Lindman 231b* (holotype: H!).

Microthamnium angustirete Broth., Bih. Kongl. Svensk. Vetensk.-Akad. Handl. 26 Afd. 3(7): 48. 1900; *Isopterygium angustirete* (Broth.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908. Type: Brazil. Rio Grande do Sul: S. Leopoldo, *Lindman 115* (holotype: H!).

Plagiothecium bromeliophilum Müll. Hal., Hedwigia 40: 59. 1901; *Isopterygium bromeliophilum* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908. Type: Brazil. Santa Catarina: Tubarão, near Conconhaz, *Ule 769* (isotype: H!).

Plagiothecium aurantiacum Müll. Hal., Hedwigia 40: 60. 1901; *Isopterygium aurantiacum* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908. Type: Brazil. Rio de Janeiro: Restinga de Maua, *Ule 2145* (isotypes: FH!, H!).

Plagiothecium flaviusculum Müll. Hal., Hedwigia 40: 59. 1901; *Isopterygium flaviusculum* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908. Type: Brazil. Rio de Janeiro: Restinga de Maua, *Ule 1941* (isotypes: BM!, JE!, MO!).

Taxicaulis bahiense Müll. Hal., Hedwigia 40: 59. 1901; *Isopterygium bahiense* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1081. 1908. Type: Brazil. Bahia: *Salzmann s.n.* (possible isotype: H!).

Taxicaulis afflictus Müll. Hal., Hedwigia 40: 68. 1901; *Isopterygium afflictum* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1083. 1908. Type: Brazil. Goyaz, near Mossamedes, *Ule 1616* (isotype: US!).

Taxicaulis ammophilus Müll. Hal., Hedwigia 40: 66. 1901; *Isopterygium ammophilum* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3):

1081. 1908. Type: Brazil. Santa Catarina: Campo de Jaguarone, Laguna, *Ule 780* (isotypes: H!, M!).

Taxicaulis fabroniiformis Müll. Hal., Hedwigia 40: 69. 1901; *Isopterygium fabroniiforme* (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1083. 1908, “*fabroniaeforme*.” Type: Brazil. Goyaz, near Mossamedes, *Ule 1617* (isotypes: NY!, US!).

Plagiothecium pseudotenerum Broth. & Kindb. ex Kindb., Rev. Bryol. 28: 54. 1901; *Isopterygium pseudotenerum* (Broth. & Kindb.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1082. 1908. Type: Colombia. Near Bonda, vicinity of Santa Marta, Dec 1898, *Baker s.n.* (holotype: S!; isotype: MO!).

Isopterygium peruvianum Broth., Bot. Jahrb. Syst. 56 (Beibl. 123): 21. 1920. Type: Peru. Sandia Province, Churchusmayo, 7 Jul 1902, *Weberbauer s.n.* (holotype: H!).

Isopterygium fernandezianum Broth. in Skottsberg, Nat. Hist. Juan Fernandez 2(12): 440. 1924. Type: Juan Fernandez Islands, Mas a Tierra, C. & I. *Skottsberg 479* (holotype: H!).

Isopterygium fernandezianum var. *longisetum* Broth. in Skottsberg, Nat. Hist. Juan Fernandez 2(12): 440. 1924. Type: Juan Fernandez Islands, Mas a Tierra, Valle Colonial, Quebrada seca, C. & I. *Skottsberg 487* (lectotype: H!, designated by Ireland, 1991a); Cordon Salsipuedes, C. & I. *Skottsberg 480* (syntype, H!); Valle Anson, near Plazoleta, C. & I. *Skottsberg 491* (syntype: H!).

Isopterygium brachyneuroides Broth., Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. 83: 327. 1926. Type: Brazil. São Paulo: On island “Ilha Comprida,” near Iguape, *Schiffner 362* (holotype: H!; isotype: BM!).

Isopterygium diminutivum E. B. Bartram, J. Wash. Acad. Sci. 18: 581. 1928, “*dimunitivum*.” Type: Mexico. State of Jalisco, Tuxpan, *Mexia 1028a* (holotype: US!; isotype: FH!).

Plants in thin to dense mats, whitish green to yellow-green. Stems 1–2 cm long, rarely 3 cm, 0.5–1.5(–3) mm wide, often 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 0.7–1.2 mm long, 0.2–0.5 mm wide, flaccid, close, complanate, erect-spreading, often secund at the tips, smooth, 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; median cells 38–132 × 5–12 μm, smooth; alar cells short-rectangular to quadrate or transversely elongate, in small groups

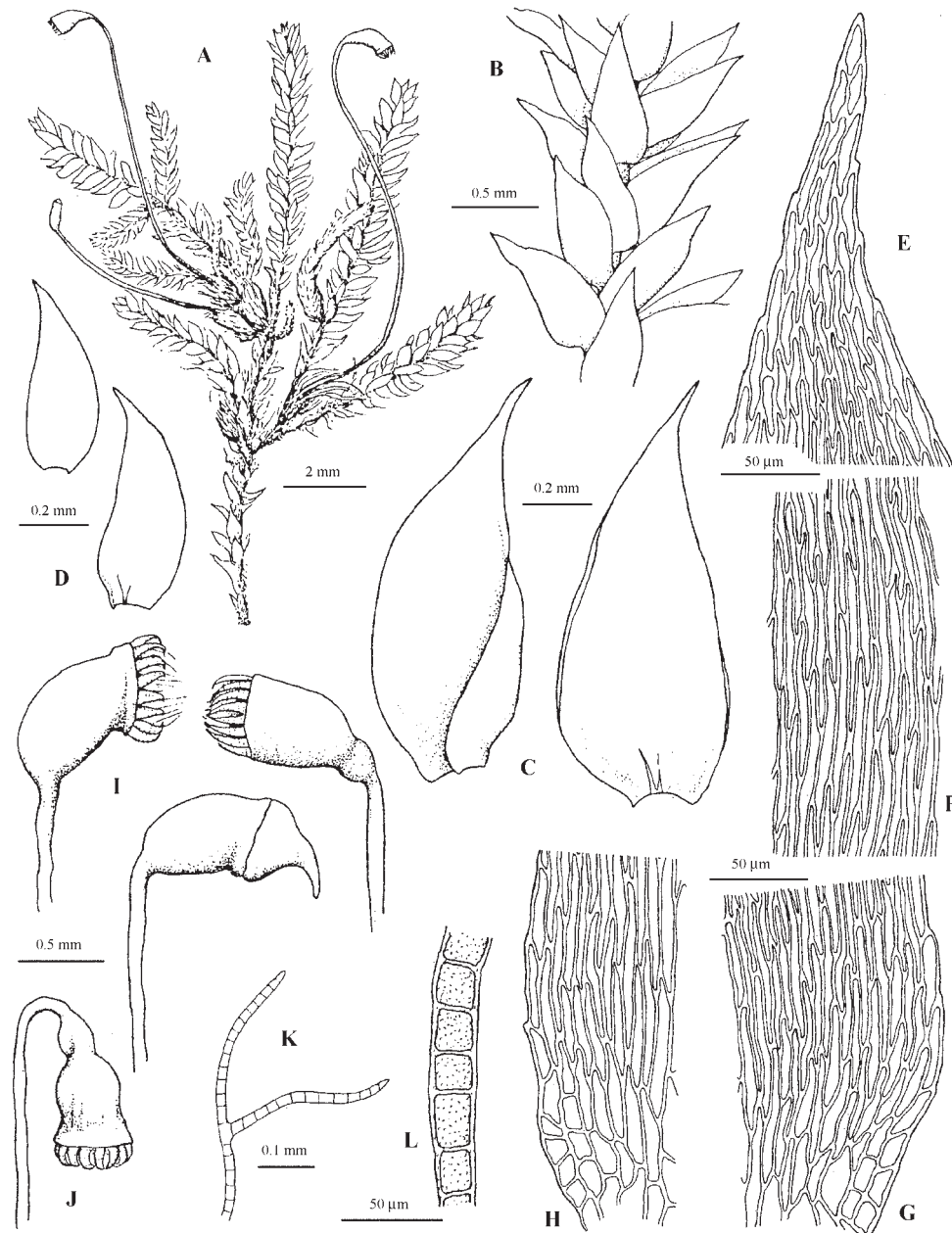


FIGURE 24. *Isopterygium tenerum*. A. Habit. B. Enlargement of portion of stem. C, D. Leaves. E. Apical leaf cells. F. Median leaf cells. G, H. Alar cells. I. Inoperculate and operculate capsules (dry). J. Inoperculate capsule (wet). K. Asexual reproductive body. L. Cells of asexual reproductive body. Illustrations A, B, J drawn from *Mexia* 4841 (NY); C, E–G from *Schiffner* 362 (H, holotype of *I. brachyneuroides*); D from *Vital* 7826 (MO); H from *Pabst s.n.* (H, isotype of *Hypnum curvicolleum*); I from *Mexia* 5348a (NY); K, L from *Santos* 3965 (CANM).

with 1–5 cells on margins. Autoicous. Setae (0.3–)0.5–1.2 (–2.2) cm long, yellow to reddish brown; capsules 0.5–1.5 mm long, cernuous or rarely erect, curved or sometimes straight, ovoid to ellipsoid, usually strongly contracted below the mouth when dry; operculum conic-apiculate

to obliquely short-rostrate; peristome teeth up to 0.2 mm long. Spores 9–14 µm in diameter.

Distribution and ecology: Throughout the West Indies and from Mexico to northern Argentina and Uruguay (Figures 18, 22, 23, 25); also known from eastern North

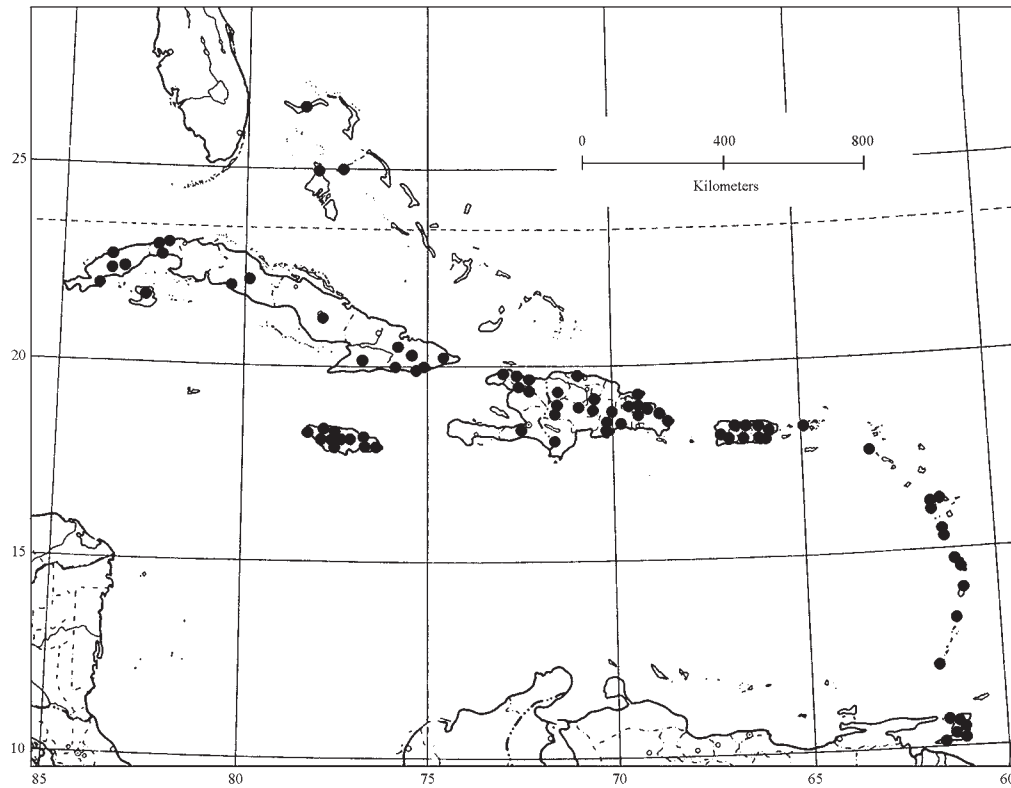


FIGURE 25. Distribution of *Isopterygium tenerum* in the Caribbean.

America and recently reported from South Africa (Ochyra and Ireland, 2004). Recently, Matteri and Schiavone (2002) reported the species from the southern part of Argentina in the Tierra del Fuego region. An extremely common species often occurring 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.

Discussion: *Isopterygium tenerum* is not only the most common species of *Isopterygium* in Latin America, as it is throughout the world, but it is also the most variable. Its polymorphism undoubtedly explains the large number of taxa that have been included here in its synonymy. Carl Müller alone described 21 of the 45 taxa the senior author has recognized as synonyms from various Latin America localities.

In its typical form, the species is best distinguished by the usually complanate, medium-sized plants with stems 1–2 cm long, 0.5–1.5 mm wide, leaves 0.7–1.2 mm long, ovate-lanceolate, asymmetric, acuminate, close, erect-

spreading, 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 0.5–1.5 mm long, ovoid to ellipsoid, inclined to horizontal, usually strongly contracted below the mouth when dry.

Pterogonidium pulchellum (Hook.) Müll. Hal. in Broth. (Sematophyllaceae) often grows intermixed with *I. tenerum*. The gametophytes of the two species are superficially somewhat similar except the leaves of *Pterogonidium* are usually narrowly lanceolate, symmetric, and more erect than the usually wider, ovate to lanceolate, asymmetric, and spreading leaves of *I. tenerum*. Fortunately, *Pterogonidium* usually produces sporophytes and the capsules are erect, cylindrical, not contracted under the mouth when dry and have a single peristome. In contrast, the capsules of *I. tenerum* are inclined to horizontal, ovoid to ellipsoid, have a double peristome, and are usually strongly contracted under the mouth when dry.

We have taken a broad view of *Isopterygium tenerum*, and some names synonymized here, with more study,

might be recognized. For example, Buck (1998) recognized *I. brachyneuron* on the basis of its more asymmetric leaves, stronger costa, and fewer alar cells. Material identified as *I. fernandezianum* might also be distinct at the species level on the basis of its strongly asymmetric leaves, strongly serrate leaf apices, and fewer alar cells.

Selected specimens examined: **MEXICO.** Chiapas: Town of Tenejapa, 1768 m, *Breedlove 14778* (MICH); Santa Elena, 650 m, 16°53'N, 91°35'W, *Delgadillo M. 6308* (MO). Colima: Laguna María, Parque Nacional El Jabalí, *Arreguín 790e* (MEXU); Alzada, *Orcutt 4645* (FH, MICH, NY). Hidalgo: Above Tianguistengo on Hwy. 105, 3 km from Zacualtipan, ~2100 m, *Sharp et al. 102* (CANM, MICH, TENN). Jalisco: Known from type locality of *I. diminutivum*. Nayarit: 14.5 km N of Compostela, *Koelz 34043* (MICH). Oaxaca: Sierra Juárez, above Valle Nacional along road from Tuxtepec to Oaxaca, 600 m, *Richards & Sharp 7051b* (CANM, MICH, TENN). Puebla: At and near the summit of El Cerro de Cuhuapetl, Tehuacan, 945–1160 m, *Santos 3693* (MICH). Quintana Roo: Laguna Ciega, Isla de Cozumel, 5 m, ~20°36'N, 86°44'W, *Delgadillo M. 4401, 4403, Cárdenas 1311, 1312, 1313* (MEXU), *4402* (MEXU, MICH, MO). San Luis Potosí: W of Xilitla, 1035 m, *Sharp 5935* (CANM, MEXU, MICH, TENN). Sinaloa: Along Hwy. 40, ~9.7 km W of Las Palmitas, ~2285 m, *Norris et al. 20425* (MICH). Tabasco: Along trail between Teapa and Cerro de Azufre, 6 km from Teapa, *Gilly & Hernandez 308c* (MICH); Cerro del Madrigal, *Zamudio 1342b* (MEXU). Tamaulipas: Edge of Casa de Piedra, near Rancho del Cielo above Gómez Farias, *Sharp 8736* (CANM, F, MEXU, TENN); 32 km SW of Tuxpan, road to Poza Rica, ~1000 m, *Pursell 5138* (MO). Veracruz: 10 km SE of Campo Experimental de Hule, El Palmar, Zongolica, *Santos 3965* (CANM, MICH, NY); ~11.2 km NW of Tuxpan on road to Tampico, 15 m, *Pursell 5067* (MO). GUATEMALA. Izabal: ~11 km S of Puerto Barrios, 50 m, *Croat 41799* (MO). Petén: La Libertad, *Lundell 3384* (MICH). Quezaltenango: Vicinity of Fuentes Georginas, slopes of Volcán de Zunil, 2500–2800 m, *Standley 85946* (F, FH, MICH, NY). (Dept. Unknown) Finca El Naranjo, near Chicacoa, *Svihla 2883* (FH). BELIZE. Cayo: San Agustín, *Mains 3999* (MICH), *4084* (F, FH, MICH, NY); Retiro, *Mains 3698* (MICH), *3706* (FH, MICH). HONDURAS. Atlántida: Lancetilla Valley, near Tela, 20–600 m, *Standley 55796* (F, FH, US), *55803* (F, FH, NY, US); vicinity of San Alejo, base of hills S of San Alejo near Río San Alejo, 150–270 m, *Standley 7662* (F). Comayagua: Vicinity of Siguatopeque, 1080–1400 m, *Standley 56053* (F, FH, US). Francisco Morazán: Piedra Herrada, lower slopes of Cerro de Uyuca, 1500–1650 m,

Standley 11903 (F, FH). Olancho: Slopes of Montana Pena Blanca, 11.5 km S of Gualaco, 980–1000 m, 14°57'N, 86°08'W, *Allen 12905* (MO). NICARAGUA. Sierra de Managua, 600–900 m, *Garnier 715* (NY). Río Siquia, 6 Jan 1941, *LaRue* (NY). COSTA RICA. Alajuela: Viento Fresco, 1600–1900 m, *Standley & Torres 47877a* (FH); Volcán Poás, 2500 m, *Valerio 285* (US). Limón: Near Carmen Station on Indiana Branch, ~30 m, *Standley & Valerio 48390* (FH, US). Heredia: Isla Bonita near Vara Blanca, ~1675 m, *Svihla 3067* (FH). Puntarenas: Coto Brus Canton, 1000–1200 m, 08°47'N, 83°02'W, *Dauphin 1953* (MO); Cocos Is., Chatham Bay, *Howell 120* (FH). Vicinity of Coliblanco, ~1950 m, *Maxon 250* (NY). PANAMA. Bocas del Toro: Cerro Colorado, 6.9 km above Chami Camp, 1700 m, *Allen 5335* (MO). Chiriquí: Boquete, 1100–1525 m, *Svihla 2711* (MICH); El Volcán, *Chickering 32a, 50* (CANM, NY); Santa Marta, Bugaba, *Vinda 1521* (PMA); Cerro Colorado, 5.1 km from Escopeta, 800–1000 m, *Folsom 4920* (MO). Canal Area: Barro Colorado Is., *Willis 11* (FH, MO), *49* (MO); along Río Masambi Grande between Gaillard Hwy., 1.5 km NW of Summit Gardens, 70 m, *Nee 6935* (MO); summit Experimental Garden, near Gamboa, *Welch 20162, 20163, 20164, 20167, 20168* (NY). Darién: Above Cana, leading to Pirre Massif, 800–900 m, *Allen 8982* (MO). BERMUDA. Paget Marsh, *Britton 44* (NY, US), *1855* (MICH, MO, NY, TENN). BAHAMAS. Andros Is.: Coppice, near Nicholl's Town, *Small & Carter 8968* (NY, US). Great Bahama Is.: *Britton & Millsbaugh 2628* (NY). New Providence Is.: Prospect Ridge, *Degener 19095* (NY). CUBA. Habana: Batabano, *Baker & Wilson 2391* (MO). Oriente: Baracoa Region, Altos de Farola, 35 km S of Baracoa, 685 m, *Webster 894* (CANM). Pinar del Río: Río Guao, *Britton et al. 10142, 10127a* (CANM, NY). Santiago: Slopes and summit of El Yunque, near Baracoa, 305–610 m, *Pollard & Palmer 104* (NY), *110* (BM, NY, US). Isle of Pines, Siguaná, *Britton et al. 14373* (MICH, NY), *14932* (NY). Ingenio Esperanza near Pinar del Río, *Wright 206* (CANM, MICH, NY, TENN, US). JAMAICA. Clarendon: Mason R. Savanna, ~4.4 km NW of Kellits, 700 m, *Crosby 3118* (CANM, MO, NY). Hanover: E slope of Dolphin Head, 365–460 m, *Proctor 10434* (CANM). Manchester: 1.6 km from Balaclava, *Orcutt 816* (MICH). Portland: Murdock's Gap, 1740 m, *Crosby 3536* (CANM, MEXU, MO, NY). St. Andrew: Cinchona, 1450 m, *Farr 949* (CANM). St. Ann: 11 km NE of Moneague, 380 m, *Farr 194* (CANM). St. James: 6 km NE of Maroon Town on road to Spring Vale, 150 m, *Crosby 13956* (MO). St. Thomas: S slope of Winchester Peak, 1.8 km NW of Wheelerfield, S end of John Crow Mts., 350 m, *Buck 5590*

(NY); Whitfield Hall, *Hegewald & Hegewald* 7960 (MO). **Trelawny:** Windsor Estate, 120–180 m, *Proctor* 10522 (CANM). **Westmoreland:** 4 km NE of Negril, near sea level, *Proctor* 35534 (NY). **HAITI. Nord:** Vicinity of Dondon, ~400 m, *Leonard* 8578 (CANM). **Sud'est:** Massif de la Selle, 19 km S of Kenscoff on road from Port-au-Prince, 1600 m, *Buck* 8997 (NY); Bayeux, at mouth of Rivière de Port Margot, north coast, between Cap Haitien and Le Borgne, near sea level, *Bartlett* 17758a (MICH), 17756 (CANM, MICH, MO), 17765 (CANM, MICH); Valley of Rivière de Plaisance from Plaisance to Pilate, *Bartlett* 17749 (MICH). **DOMINICAN REPUBLIC. El Seibo:** 19 km N of Hato Mayor on road to El Valle, 300 m, *Mejía et al.* 10259 (MO, NY). **La Vega:** Vicinity of Piedra Blanca, 200–500 m, *Allard* 17816 (NY). **Pedernales:** ~6 km S of El Aguacate on road to Pedernales, 1525 m, *Reese* 15286 (NY). **San Cristobal:** Mano Matuey, 12 km from Cambito Garabito on road to El Cacao, 550 m, *Buck* 5166 (NY). **La Altagracia:** 6 km SE of Otra Banda on road to Punta Cana, ~30 m, *Buck* 5097 (NY). **La Estrelleta:** Along Río Limpio at Colonia Río Limpio, 670 m, *Reese* 15398 (NY). **Puerto Plata:** Pico El Murazo, 1083 m, *Buck* 4839 (NY). **Samaná:** Loma Pan de Azúcar, 6.8 km N of road to El Valle, 60 m, *Zanoni et al.* 20758L (U). **PUERTO RICO.** Along Río la Coca, Sierra de Luquillo, S of Mameyes, *Steere* 7048 (MICH). Río Sabana, Sierra de Luquillo, S from Luquillo, *Steere* 5172 (MICH, MO). Mpio. de Maricao, in mountains ~1.6 km outside Maricao, *Stimson* 3299 (MO, NY). Villalba, *Pagán* 55 (MO), 54 (FH, MICH, MO), 60, 65 (MICH, MO). Los Picachos de Jayuya, 915 m, *Pagán* 328 (MO). E of Cidra, *Masters* 442 (M), 456 (M, MO). La Torrecilla, Barranquitas, *Steere* 4689 (MICH, MO). Guate Purchase Unit, Sierra de Cayey, *Steere* 4747 (FH, MICH, MO), 4804, 4849 (MICH, MO), 4858 (MO). Dist. de Arecibo, Mpio. de Utuado, *Stimson* 3582 (NY). Mount Morales, near Utuado, *Britton & Marblef* 478, 1175 (NY), 1187 (MO, NY). La Juanita, near Las Marias, *Britton* 3999 (NY). Cerro de Las Pinas, near Las Cruces, 600–720 m, *Britton* 6905 (NY). **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, *Stebbé* 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). **NETHERLANDS ANTILLES. Saba:** Mt. Scenery, trail from parking area at SW end of mountain, 530–814 m, 17°37'N, 63°14'W, *Buck* 50633 (NY). **COLOMBIA. An-**

tioquia: San José de la Montana, 13 km S of San José, road to la Labores, near Estación La Oculta, ~2600 m, *Thiers* 4188-b (NY); Mpio. Anorí, Vereda El Carmen, Kms 18–20.5 N of Anorí, 820–910 m, 07°15'N, 75°12'W, *Callejas et al.* 8831 (NY); Mpio. Domingo, Corregimiento de Santiago, sector “La Negra,” ~6 km W de Santiago, 1100–1165 m, ~06°30'N, 75°10'W, *Churchill et al.* 14706 (NY). **Arauca:** Mpio. de Fortul, Vereda Palmarito, 200 m, 06°44'N, 71°43'W, *Churchill et al.* 18939 (NY). **Cauca:** Guapi, Parque Nacional Natural Isla Gorgona, Isla Gorgonilla, cerca al Faro, *Rudas & Aguirre* 287 (COL); Mpio. de Piendamó, Corregimiento de El Mango, Reserva Natural El Guayabo, Km 93–94, 1640 m, ~02°46'N, 76°33'W, *Churchill & Franco* 16536, 16562 (NY). **Magdalena:** Santa Marta, near Bonda, *Baker* 6563 (H). **Meta:** Outskirts of Villavicencio, 500 m, 04°09'N, 73°39'W, *Schultes* 11097 (H, MO, TENN, US), 11110 (BM, CANM, COL, F, MICH, MO, NY). **Nariño:** Mpio. de Albán, Veredas Bellavista–El Cebadero, 1800–2000 m, 01°26'N, 77°05'W, *Ramírez P.* 5910 (NY); Mpio. Tumaco, road to La Turbia, 245 m, 01°18'N, 78°30'W, *Ramírez P. et al.* 9901 (MO). **Putumayo:** 15 km NW of Puerto Asís, 305 m, *King & Guevara* C-1122 (US). **Santander:** Mesa de los Santos, 1500 m, *Killip & Smith* 15329 (NY). **Vaupés:** Río Vaupés, Mitú and surroundings, ~250 m, *Schultes & Cabrera* 13953 (CANM). **Valle:** Costa del Pacífico, Río Cajambre, 5–80 m, *Cuatrecasas* 17383-B (US). **VENEZUELA. Amazonas:** Dept. Río Negro, along Río Mawarinuma, just outside Cañon Grande, vicinity of Neblina base camp, ~140 m, *Buck* 11227, 11352 (NY). **Aragua:** Parque Nacional Henry Pittier, Las Locas, ~2000 m, *Sharp* C-7610A (TENN). **Barinas:** Along Hwy. 5, 2 km W of Río Acequia, SW of junction of road to Ciudad Bolivia, 175 m, *Steyermark & Rabe* 96510 (US). **Bolívar:** Dist. Roscio, Río Uairén, 9 km NE of Santa Elena de Uairén, 900 m, *Steyermark & Liesner* 127350 (MO). **Carabobo:** Between Los Tanques and La Toma, at the head of Río San Gián, 750 m, *Steyermark & Steyermark* 95588 (MO, US). **Delta Amacuro:** Dept. Pedernales, boundary with Dept. Tucupita, Caño Simoina, W of Isla Cocuina, S of Barra de Cocuina, 50 m, 09°45'N, 61°53'W, *Steyermark et al.* 114365 (MO). **Distrito Federal:** Around Caracas, 800–1000 m, *Pittier* 11108 (FH, NY, US). **Lara:** Dist. Palavecino, 20 km from Cabudare, 1200–1300 m, *Steyermark et al.* 103335 (MO, US). **Mérida:** Foot of Sierra Nevada, near Mérida, 1850 m, *Alston* 6759a (BM). **Miranda:** Providencia, 1200 m, *Medina* 981, 991 (CANM). **Monagas:** Bajo Guarapiche, Maturin, *Medina* 986 (CANM). **TRINIDAD AND TOBAGO. Trinidad:** Vicinity of Tabaquite, *Britton* 2615 (FH, NY, US); North Range, *Welch* 21272 (NY). **Tobago:** Arnos

Vale Bay, Arnos Vale Hotel, 11°13'N, 60°45'W, *Djan-Chékar 95-13* (NY). **GUYANA. Demerara-Mahaica Region:** Along Linden-Soesdyke Hwy., ~1.6 km E of Soesdyke, 1–50 m, *Pipoly 9286A, 9295* (NY). **SURINAM. Brokoppo:** Phedra, along Surinam R., 67 km SE of Paramaribo, 20 m, 05°20'N, 55°05'W, *Allen 19342* (MO). **Nickerie:** Kabalebo Dam project, 0–50 m, *Florschütz-de Waard & Zielman 5496, 5687, 5712* (U). **Paramaribo:** Cultuurtuin, *Florschütz & Florschütz 607, 611* (U). **Sipaliwini:** Blanche Marie valley, 100 m, 04°44'N, 56°53'W, *Muñoz 98-26b* (MO); Talfelberg Natl. Park, vicinity of Rudy Kappel airstrip, 325 m, 03°48'N, 56°08'W, *Allen 20306, 20320* (MO); White Sand Savanna, 32 km NE of Apura, 55 m, 05°10'N, 57°00'W, *Allen 19287* (MO). Brownsberg, trail to Leo Falls, 29 Jan 1976, 500 m, *Sang & van der Wiel s.n.* (U). Marowijne River, Armina Falls, 29 Sep 1952, *Geijskes s.n.* (MEXU, U). Blanche-Marieval, vicinity of waterfall between Van Edenal and Granietsoela, 21–24 Aug 1982, *Kuc s.n.* (CANM). **FRENCH GUIANA. Approuague-Kaw:** Pic Matécho, summit of waterfall on N side of peak, ~500 m, 03°45'N, 53°02'W, *Buck 37830* (NY); Commune de Régina, Kaw Mts. Trail up Montagne Favard from Savane de Kaw, 0–100 m, 04°30'N, 52°03'W, *Buck 32939* (MO); **St.-Laurent-du-Maroni:** Canton de Maripasoula, Commune de Säül, ~6 km N or Säül along road to Bélizon, vicinity of Eau Claire, ~200 m, 03°37'N, 53°12'W, *Buck 18690* (NY). **ECUADOR. Azuay:** Gualaquiza, *Allioni 8300, 8362, 8379* (H). **Cotopaxi:** Las Juntas on road El Corazón–Quevedo, 200 m, *Anderson 1010* (U). **El Oro:** ~17 km above Zaracay on road to Catacocha, 700 m, *Anderson 1005* (U). **Loja:** Road Celica-Alamor, Km 11–16, 1600–1700 m, *Anderson 944* (U). **Pichincha:** ~18 km NW of San Miguel de los Bancos, 800 m, *Buck 10326* (NY). **Santiago-Zamora:** Méndez, 700 m, *Harling 2217* (CANM). Galapagos Is., Isla Santa Cruz, trail from Bella Vista to Media Luna, 550 m, *Sipman M-234* (U). **PERU. Junín:** E of Quimiri Bridge, near La Merced, 800–1300 m, *Killip & Smith 24038* (CANM, NY). **Loreto:** Maynas Prov., ~135 km NE of Iquitos, ~2 km N of Río Sucasari, 03°30'S, 72°55'W, *Timme 14349, 14351, 14352, 14359* (MO); Iquitos, ~100 m, *Killip & Smith 26942* (CANM, NY); Middle and upper part of Río Maniti, E of Iquitos, 20 Jan 1981, *Kuc s.n.* (CANM). **BRAZIL. Acre:** 15 km E of Rio Branco along road to Abuna, *Reese & McPherson 13195* (CANM, NY). **Amazonas:** Ilha Acarabu, along the Rio Negro between Manaus and São Gabriel at the mouth of the Rio Marié, *Buck 2347* (CANM, NY); estrada Manaus-Itacoatiara, Km 26, reserva florestal Ducke, *Lisbôa 57, 63, 70* (MG). **Bahia:** ~10 km W of Barreiras, 500 m, *Irwin et al.*

31332 (CANM, F, NY). **Distrito Federal:** Rio Sobradinho, immediately W of Sobradinho, 1100 m, *Irwin et al. 33235* (CANM, NY). **Goiás:** Mpio. de Formosa, *Vital 8275* (MO); Mpio. de Caldas Novas, *Vital 8501* (CANM, SP); Mineiros, Galeriewald nahe der Grenze zu Mato Grosso, 680 m, *Schäfer-Verwimp & Verwimp 8554* (NY). **Minas Gerais:** Vicosa Agricultural College lands, Horticultural Hill, 670 m, *Mexia 4841* (BM, FH, F, MICH, MO, NY, U); Vicosa Agricultural College lands, E boundary to reservoir, *Mexia 5348a* (BM, FH, MO, NY); Corrigo Riberro, 675 m, *Mexia 4884* (BM, F, FH, MICH, MO, NY, U, US), 4888 (F, FH, MO, US). **Mato Grosso:** Palmeiras, *Lindman 413* (H). **Pará:** Belém, Reserva Mocambo, *Lisbôa et al. 706* (MG); Serra do Cachimbo, Base Aérea do Cachimbo and vicinity, Km 780–820 on Cuiabá–Santaré Hwy. (BR 163), ~20 km N of border of Mato Grosso, along Rio Braço Norte, 430–480 m, *Reese 16169, 16418* (MO), 16170, 16209 (MICH, MO), 16142, 16171, 16175, 16178, 16185, 16190, 16192, 16195, 16210, 16218, 16237, 16238, 16239, 16256, 16428 (NY), 16223 (MICH, MO, US). **Paraná:** Mpio. Foz do Iguaçu, Parque Nacional do Iguaçu, along Rio Iguaçu, 100–200 m, *Vital & Buck 12097* (NY). **Rio Grande do Sul:** S. Francisco de Paula, 900 m, *Sehnm 4645* (FH). **Rio de Janeiro:** Mpio. de Resende, Itatiaia Natl. Park, S face of Mt. Itatiaia, 1780 m, *Eiten & Eiten 7654, 7656* (US). **Rondônia:** Ridges of Serra dos Pacaás Novos along the river, ~400 m, *Reese 13320, 13556, 13616, 13623* (NY); Guajará-Mirim, estrada do Bom Sossego, Km 25, *Lisbôa et al. 491* (MG); Guajará-Mirim, 6 km NE of Guajara Mirim, 2 km E of gravel road, 175 m, 10°43'S, 65°15'W, *Nee 34688* (NY). **Roraima:** Rio Uraricoeira, vicinity of Uaicá airstrip, *Prance et al. 19953, 19954, 19956* (CANM, NY). **Santa Catarina:** Tubarão, *Ule 87* (FH, H, NY, SP, US), 91 (BM, F, FH, H, NY, US). **São Paulo:** Mpio. Guapiara, Serra Paranapiaacaba, Fazenda Intervalles, ~800–1000 m, ~24°16'S, 48°25'W, *Vital & Buck 20430, 20449, 20458, 20475* (NY); Mpio. Teodoro Sampaio, Reserva Florestal de Teodoro Sampaio, *Vital 7826* (CANM, MO); Mpio. Rancharia, along Raposo Tavares road, between Presidente Prudente to Assis, *Vital 2584* (MO). **BOLIVIA. Beni:** Prov. Ballivian, Beni Biological Station, near Porvenir, ~60 km E of San Borja, 200–250 m, ~14°30'S, 66°30'W, *Lewis 89-018 d-3* (MO); vicinity of Guayaramerín, *Reese 12739, 12753, 12775, 12794, 12798, 12803* (CANM, NY). **Cochabamba:** Prov. Carrasco, Municipio Pojo, Estación Experimental Sacta, 250 m, 17°05'S, 64°46'W, *Churchill & Arroyo P. 21634* (US); Prov. Chaparé, road to Corani, 3200 m, *Hermann 24671* (US). **La Paz:** Prov. Nor Yungas, “Alto Coro Coro,” 7 km N of Caranavi, 15°46'S, 67°32'W, *Lewis 84-066*

(LPB); Prov. Inquisivi, “Río Pichincha Grande,” along Río Pichincha Grande from its mouth at the Río Cañamina to its headwaters above Rancho Pichincha, ~7 km SE of Miguillas, 16°35'S, 67°17'W, *Lewis* 86-1462 (LPB). **Santa Cruz:** Prov. Nuflo de Chavez, “Doloresa,” along San Javier–Concepción road, ~1 km past turnoff for Esstancia Doloresa, approximately half way between San Javier and Concepción, 16°14'S, 62°25'W, *Lewis* 85-925A (LPB); Prov. Chiquitos, “Río Roboré,” base of Serrania Santiago in canyon along the Río Roboré, 18°18'S, 59°44'W, *Lewis* 85-1212 (LPB); Prov. Velasco, Natl. Park Noel Kempff Mercado, 250 m, 14°32'S, 60°48'W, *Churchill & Churchill* 20505 (MO); near Aten, *Williams* 2070 (F, FH, MICH, NY, TENN, US). Tumupasa, *Williams* 2059 (F, FH, MICH, TENN). Apolo, *Williams* 2091 (BM, F, FH, MICH, NY, US). New Brazil, *Williams* 2094 (MICH, NY, US). **CHILE.** Juan Fernandez Iss., Mas a Tierra, Valle Colonial, 435 m, *Skottsberg & Skottsberg* 484 (NY); trail to Portezuelo de Villagra, 427–549 m, *Hatcher & Engel* 14 (US); Valle Anson, 400–500 m, Skottsberg M40 (H). **PARAGUAY.** **Amambay:** Parque Nacional Cerro Corá, trail up Cerro Muralla, ~300 m, ~22°40'S, 56°00'W, *Buck* 12518 (NY). **Caaguazú:** Coronel Oviedo, Barrio Azucena, *Bordas* 114A (NY). **Canendiyú:** 2.5 km E of Río Corrientes, road from Salto del Guairá, ~200 m, ~24°35'S, 55°55'W, *Buck* 12446A (NY). **Central:** San Lorenzo, Ciudad Universitaria, 25°30'S, 57°30'W, *Bordas* 61B (NY). **Cordillera:** Chololó, Km 80 S of Piribebuy, 100–200 m, 25°33'S, 57°02'W, *Churchill* 20248 (MO, NY). **Guairá:** Villarrica, 25°45'S, 56°26'W, *Bordas* 65 (NY). **Itapúa:** Centro de Desarrollo Forestal (CEDEFO) at Km 428 on Ruta 6, just W of Arroyo Pirapó, ~100 m, ~26°55'S, 55°29'W, *Buck* 12171 (NY). **Paraguari:** Parque Nacional Ybycuí, trail along Arroyo Mina, ~200 m, ~26°05'S, 56°53'W, *Buck* 12107, 12141 (NY); El Chaco, Rosario, *Lindman* 324 (H); Mazono Acahay, 500 m, 25°54'S, 57°09'W, *Zardini & Cuevas* 5397 (MO). **ARGENTINA.** Lago Encondido, *Matteri* 799 (BA). Buenos Aires, Santa Catalina, 7 Aug 1973, *Oleksy s.n.* (BA). San Miguel de Tucuman, *Lorentz s.n.* (FH). Parque Nacional, Iguazú, 4 Jan 1984, *Kuc s.n.* (CANM). **URUGUAY.** Canelones, Banado del Negro, cerca de Arroyo Pando, *Castellanos* 8582 (FH). Curticeiras Rivera, Ruta 5, *Zorrón* 2098 (US). Prov. Rocha, Parque Nacional Sta. Teresa, 5 Mar 1984, *Kuc s.n.* (CANM).

***Isopterygium* Excluded Taxa**

Isopterygium alstonii E. B. Bartram, *Bryologist* 56: 168. 1953. Type: Venezuela: Federal Dist., Pico de El Avila, alt. 2000 m, 17 Dec 1938, *Alston* 5574c (holotype: FH!;

isotypes: BM!, US!). = *Wijkia alstonii* (E. B. Bartram) Ireland, *Caldasia* 16(76): 267. 1991.

Isopterygium semicostatum Renaud & Cardot, *Bull. Soc. Roy. Bot. Belgique* 41(1): 143. 1904 [1905]. Type: Costa Rica: Forêts de General, Feb 1891, *Pittier & Tonduz* 5817 in *Pittier & Durand, Plantae costaricensis exsiccatae* (isotype: US!). = *Lepyrodon tomentosus* (Hook.) Mitt. according to H. Robinson in *The Mosses of Juan Fernandez Islands*, *Smithsonian Contr. Bot.* 27: 52. 1975.

Isopterygium subtrichopelma Renaud & Cardot, *Bull. Soc. Roy. Bot. Belgique* 41(1): 142. 1904 [1905]. Type: Costa Rica: Forêts du Barba, 31 Aug. 1889, *Pittier & Tonduz* 5790 (isotype: FH!). = *Mittenothamnium* sp.

***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. Pflanzenfam.* 1(3): 1081. 1908; *Hypnum brevisetum* Hornsch., *Fl. Bras.* 1(2): 78. 1840. Type: Brazil. Near Rio de Janeiro, Jul and Aug, *Merkel s.n.* Type apparently not in BM.

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

Isopterygium exiguum Kindb., *Enum. Bryin. Exot.* 100. 1891 (new name); *Hypnum exiguum* Geh. & Hampe in Hampe, *Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn ser. 4, 1:* 140. 1879, *hom. illeg.* Type: Brazil. Near Apiahy, Jun 1877, *Puiggari s.n.* Type apparently not in BM.

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

Isopterygium fruticola (Müll. Hal.) Paris, *Index Bryol. Suppl.* 219. 1900; *Taxicaulis fruticola* Müll. Hal., *Hedwigia* 37: 252. 1898, “*fruticolus*.” Type: Surinam. Near Paramaribo, Aug 1844, *Kegel s.n.*

Isopterygium gracillimum (Hornsch.) Broth. in Engl. & Prantl, *Nat. Pflanzenfam.* 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 (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1083. 1908; *Taxicaulis hookeriophilus* Müll. Hal., Hedwigia 40: 67. 1901. Type: Brazil. São Paulo, 1891, *Wohltmann s.n.*

Isopterygium microplumosum (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1083. 1908; *Taxicaulis microplumosus* Müll. Hal., Hedwigia 40: 68. 1901. Type: Brazil. Minas Gerais: Serra Ouro Preto, *Ule 1486*.

Isopterygium miradoricum (Müll. Hal.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 436. 1878; *Hypnum miradoricum* Müll. Hal., Linnaea 38: 650. 1874. Type: Mexico. Mirador, Apr 1873, *Sartorius s.n.*

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

Isopterygium pygmaeocarpum (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1081. 1908; *Taxicaulis pygmaeocarpus* Müll. Hal., Hedwigia 40: 66. 1901. Type: Brazil. Santa Catarina: Tubarão, *Ule 973*.

Isopterygium sapricola (Müll. Hal.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 1083. 1908; *Taxicaulis sapricola* Müll. Hal., Hedwigia 40: 67. 1901. Type: Brazil. Rio de Janeiro, Monte Corcovado, *Ule 165*.

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

Isopterygium subcurvicolle (Müll. Hal.) Paris, Index Bryol. ed. 2, 3: 125. 1905, “*subcurvicollum*”; *Taxicaulis subcurvicollis* Müll. Hal., Hedwigia 40: 65. 1901. Types: Brazil. Santa Catarina, Apr 1888, *Ule s.n.*; Tubarao, *Ule 640, 783*; Serra Geral, *Ule 1202*.

Isopterygium subsplendidulum (Müll. Hal.) Paris, Index Bryol. Suppl. 221. 1900; *Taxicaulis subsplendidulus* Müll. Hal., Bull. Herb. Boissier 5: 210. 1897. Types: Guatemala. Mazatenango, *Bernoulli & Cario 75, 84*.

8. *Phyllodon* Bruch & Schimp. in Bruch, Schimp. & W. Gümbel

Phyllodon Bruch & Schimp. in Bruch, Schimp. & W. Gümbel, Bryol. Eur. 5 (fasc. 46–47, Monogr. *Hookeria* 4): 60. 1851. Type: *Hookeria retusa* Wilson, *nom. nud.* = *Phyllodon truncatulus* (Müll. Hal.) W. R. Buck.

Glossadelphus M. Fleisch., Musci Buitenzorg 4: 1351. 1923. Lectotype: *Hypnum truncatulum* Müll. Hal. (designated by Robinson, 1974) = *Phyllodon truncatulus* (Müll. Hal.) W. R. Buck.

Plants small to medium-sized, in dull, soft to ± stiff, flat mats, green to yellow-green. Stems creeping, subpinately branched, complanate-foliate; stems in cross section without a hyalodermis, with small, thick-walled cells surrounding larger thin-walled cells, central strand present; pseudoparaphyllia foliose; axillary hairs consisting of a single short brown basal cell and 1–4 elongate hyaline distal cells. Stem and branch leaves similar but dorsal and ventral leaves differentiated from lateral leaves, complanate, erect- to wide-spreading, often asymmetric, oblong to ligulate, dorsal and ventral leaves narrower than lateral leaves, obtuse to acute, lateral leaves very concave; margins serrate above, the teeth sometimes bifid, plane; costa short and double or absent; cells linear-flexuose, prorulose and/or seriatly papillose, thin- to firm-walled; alar cells not or scarcely differentiated. Asexual propagula not seen. Dioicous, autoicous, or synoicous. Perichaetial leaves often crispate, lanceolate to ovate, acuminate to acute or obtuse; margins serrate, plane; costa usually none; cells linear-flexuose, prorulose and/or papillose, becoming laxly rectangular and smooth toward the insertion; alar cells not differentiated. Setae elongate, smooth or roughened above, reddish; capsules inclined, arcuate, asymmetric, ovoid; exothecial cells quadrate to short-rectangular, firm-walled, not collenchymatous but sometimes with the horizontal walls thinner than the vertical walls; annulus differentiated; operculum high-conic; peristome double, exostome teeth yellow-brown, shouldered, bordered, on the front surface with a zigzag median line, not furrowed, cross-striolate below, coarsely papillose above, trabeculate at back; endostome with a high basal membrane, segments keeled, perforate, nearly as long as the exostome, cilia mostly single. Spores spherical, papillose. Calyptrae cucullate, naked, smooth, falling early.

Discussion: We have one species of *Phyllodon* in the New World; the remainder of the species are Asian and African. The genus is characterized by ligulate leaves, often conspicuously toothed at the apex, with laminal cells

strongly prorulose and/or seriatly papillose. The alar cells are scarcely differentiated. The genus probably has a relationship with *Taxiphyllum* rather than to the Sematophyllaceae, where *Phyllodon* (as *Glossadelphus*) has often been placed. Indeed, species like *Taxiphyllum laevifolium* and *T. ligulaefolium* seem to bridge the gap between the two genera. Tentatively, though, we are not merging the genera (with *Phyllodon* as the older name) but keeping them separate on the basis of cells sometimes papillose over the lumina and the almost total lack of alar differentiation in *Phyllodon*. This relationship was first hinted at by Buck (1987) when he suggested the use of the name *Phyllodon* rather than *Glossadelphus*.

Phyllodon truncatulus

Phyllodon truncatulus (Müll. Hal.) W. R. Buck, Mem. New York Bot. Gard. 45: 521. 1987. *Hypnum truncatulum* Müll. Hal., Syn. Musc. Frond. 2: 263. 1851; *Ectropothecium truncatulum* (Müll. Hal.) Mitt., J. Linn. Soc., Bot. 12: 517. 1869; *Trichosteleum truncatulum* (Müll. Hal.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 415. 1878; *Glossadelphus truncatulus* (Müll. Hal.) M. Fleisch., Musci Buitenzorg 4: 1352. 1923. Type: Peru. Pöppig (BM!).

Hookeriopsis cocoensis R. S. Williams, Bryologist 27: 40. 1924; *Glossadelphus cocoensis* (R. S. Williams) E. B. Bartram, Proc. Calif. Acad. Sci. IV, 21: 86. 1933. Type: Cocos Island, 1905–1906, A. Stewart 1432a (holotype: NY!).

Glossadelphus longisetus E. B. Bartram, Contr. U.S. Natl. Herb. 26(3): 109. 1928. Type: Costa Rica. Limón: vicinity of Guapiles, 300–500 m, 12–13 Mar 1924, Standley 37280 (holotype: FH!; isotype: US!).

Plants somewhat small, in dull, ± stiff, flat mats, green to yellow-green. Stems to ~3 cm, creeping, elongate, sub-pinnately branched, the branches numerous, elongate, complanate-foliate; stems in cross section with 2–3 rows of small thick-walled cells surrounding abruptly larger thin-walled cells, central strand of small, very thin-walled cells; pseudoparaphyllia foliose; axillary hairs consisting of 1 short, brown basal cell and 2 elongate, hyaline distal cells. Stem and branch leaves similar but dorsal and ventral leaves differentiated from lateral leaves, 0.75–1.0 mm long, complanate, erect- to wide-spreading, often asymmetric, broadly ligulate, dorsal and ventral leaves narrower than lateral leaves, broadly rounded to emarginate, lateral leaves very concave; margins sharply serrate above, the teeth bifid, serrulate below, plane; costa short and double

or absent; cells linear-flexuose, prorulose and/or seriatly papillose, the papillae lower in basal half of leaf, thin-walled; alar cells scarcely differentiated, with a few sub-square, concolorous cells in basal angles and across the insertion. Asexual propagula none. Synoicous. Perichaetial leaves 0.6–1.25 mm long, ovate to oblong-ovate, obtuse to short-acuminate; margins singly to doubly serrate above, entire below, plane; costa none; cells linear-flexuose, spiculate, the “papillae” to 30 µm tall, thick-walled, shorter and smooth toward the insertion; alar cells not differentiated. Setae 1.5–2.5 cm long, elongate, smooth, reddish; capsules ~1.25 mm long, inclined, arcuate, asymmetric, ovoid; exothecial cells oval to short-rectangular, firm-walled, not colenchymatous; annulus of 1–2 rows of thick-walled cells; operculum ~0.8 mm long, high-conic; exostome teeth yellow-brown, shouldered, bordered, on the front surface cross-striolate below, coarsely papillose above, trabeculate at back; endostome yellowish, with a high, smooth basal membrane, segments finely papillose, keeled, perforate, nearly as long as the exostome, cilia finely papillose, single, broad, 2–3-seriate below, sometimes split in two above. Spores 13–17 µm in diameter, spherical, finely papillose. Calyptrae cucullate, naked, smooth, falling early.

Distribution and ecology: Costa Rica, Panama, Colombia, Ecuador, Peru, Brazil, French Guiana, Jamaica, Hispaniola (Haiti and Dominican Republic), Puerto Rico, and St. Vincent; growing mostly on moist rocks but also on tree trunks, in humid forests, at 200–600(–1200) m.

Illustrations in publications: Fig. 174 in Florschütz-de-Waard and Veling (1996: 455); Pl. 129 in Buck (1998: 327); Fig. 142 in Buck (2003: 160).

Discussion: *Phyllodon truncatulus* is an extraordinary species not likely to be confused with any other due to the ligulate leaves with broadly rounded apices and strongly prorulose and/or papillose cells. The marginal bifid serrations are particularly striking. The species seems close to the Angolan *P. truncatus* (Welw. & Duby) W. R. Buck but differs, among other features, by the smooth rather than strongly roughened seta.

Selected specimens examined: COSTA RICA. **Cartago:** Vicinity of Pejivalle, 900 m, Standley & Valerio 47141 (NY). **Guanacaste:** Slopes of Miravalles, above Bijaagua, 1500 m, Gomez et al. 19105 (MO, NY). **Puntarenas:** Near Monteverde, 1373 m, 20 Feb 1972, W. James s.n. (NY). PANAMA. **Panamá:** 5.5 km N of Cerro Azul, 763 m, Tyson et al. 2483 (NY). JAMAICA. **Portland Parish:** Hardwar Gap Falls, ~1220 m, Welch 17594A (NY). **St. Andrew Parish:** Trail from Hardwar Gap to Mt. Caledonia (Old England Trail), 1.4–2.8 km NNW of Hardwar Gap, 18°06'N, 76°44'W, 1342–1403 m, Crosby 3210 (DUKE,

NY). **St. Thomas Parish:** Corn Puss Gap and vicinity, ~12.4 km N of Bath on trail to Port Antonio, 18°00'N, 76°21'W, 550 m, *Buck 5542, 5586* (NY). **DOMINICAN REPUBLIC.** **La Vega:** Vicinity of Piedra Blanca, near Goodrich Rubber grove, 200–500 m, *Allard 18812* (NY). **ST. VINCENT.** Below 305 m, *Smith 1490a* (NY). **BRAZIL.** **Amazonas:** Along the Rio Negro, slopes and summit of Serra Curicuriari, from Igarapé Arabú of the Rio Curicuriari to the summit, 0°20'S, 66°50'W, 450 m, *Buck 2477* (INPA, NY). **Mato Grosso:** Chapada dos Guimaraes, Wasserfall Véu da Neuva, 500 m, *Schäfer-Verwimp 8626* (NY). **Minas Gerais:** Mpio. São Roque de Minas, Parque Nacional da Serra da Canastra, Caachoeira Casca D'Anta, 20°18'S, 46°31'W, 1000 m, *Vital & Buck 11936* (NY, SP). **Rio de Janeiro:** Parque Nacional do Itatiaia, along trail to Véu de Noiva and Itaporani, ~13.5 km N of town of Itatiaia, 22°25'S, 44°36'W, 1100 m, *Vital & Buck 19976* (NY, SP). **Santa Catarina:** Blumenau, Park Floresta Negra, 200 m, *Schäfer-Verwimp 8240* (NY). **São Paulo:** São Paulo, Pico do Jaragua, 810 m, *Schäfer-Verwimp & Verwimp 9026* (NY). **COLOMBIA.** **Antioquia:** Mpio. Santo Domingo, Corregimiento de Santiago, sector "La Negra," ~6 km O [W] de Santiago, 06°30'N, 75°10'W, 1100–1165 m, *Churchill et al. 14851* (NY). **Caquetá:** Transecto Neiva–San Vicente del Caguán, Quebrada Chorreras, entre Guayabel y Los Andes, 02°30'–33'N, 74°30'–75°00'W, 1300 m, *Churchill & Betancur 16864-B* (NY). **Magdalena:** Parque Nacional de la Sierra Nevada de Santa Marta, Vertiente oriental del Río Buritaca, 700 m, *Griffin et al. 1137* (FLAS, NY). **ECUADOR.** **Napo:** Añangu, S shore of Río Napo, ~75 km E of Puerto Francisco de Orellana, "Coca," 0°32'S, 76°23'W, 245–325 m, *Churchill & Sastre-De-Jesús 13820* (AAU, NY). **Pastaza:** ~5 km SE of Puyo on road to Macas, 01°31'S, 77°55'W, 1000 m, *Churchill & Sastre-De-Jesús 13688* (AAU, NY). **FRENCH GUIANA.** **St-Laurent-du-Maroni:** Canton de Maripasoula, Commune de Saül, ~6 km N of Saül along road to Bélizon, vicinity of Eaux Claires, 03°37'N, 53°12'W, 200 m, *Buck 18508* (NY). **PERU.** **San Martín:** Prov. Lamas, Strasse Yurimaguas–Tarpoto, Km 112, 900 m, *Frahm et al. 1472* (B, NY).

9. *Platygyriella* Cardot

Platygyriella Cardot, Rev. Bryol. 37: 9. 1910. Type *P. helicodontioides* Cardot *Bryosedgwickia* Cardot & Dixon in Dixon, J. Bot. 50: 154. 1912. Type: *B. kirtikarii* Cardot & Dixon in Dixon.

Plants in slender to medium-sized mats, mostly golden, shiny or dull. Stems creeping, irregularly pinnate

with relatively short branches; stems in section without a hyalodermis, with 2–4 outer layers of small, thick-walled cells surrounding ± thin-walled, large cells, central strand absent; pseudoparaphyllia filamentous; axillary hairs with 1–2 short, brown basal cells and 3–5 elongate, hyaline apical cells. Stem and branch leaves only slightly differentiated, the stem leaves somewhat larger and occasionally with recurved margins and laxer cells across the insertion. Branch leaves erect-spreading to imbricate, lanceolate to ovate, acute to narrowly acuminate, slightly or (in broader leaves) distinctly concave, short-decurrent; margins plane or reflexed, entire to serrulate near the apex or commonly almost to the base, the marginal cells somewhat broader and forming an indistinct border; costa short and double, rarely absent; upper cells linear-rhomboidal, smooth, straight to indistinctly flexuose; basal cells lax, thin-walled and porose; alar cells quadrate to oblate in sizable triangular groups usually not reaching the costa, the walls distinctly thicker than those of the upper cells, decurrent in 1–3 rows with the cells in the decurrencies conspicuously enlarged. Dioicous or autoicous. Perichaeial leaves oblong-lanceolate, acuminate, serrulate above, ecostate; upper cells linear and lower cells ± rhomboidal-rectangular, large, lax. Setae reddish, slightly twisted, smooth; capsules erect, symmetric, cylindrical, red-brown; exothecial cells thin- to thick-walled, oblong to square; annulus none; operculum conic to short-rostrate, straight to oblique, the cells usually thick-walled; peristome attached slightly below the mouth, double; exostome teeth lanceolate, strongly bordered, on the outer surface with a zigzag median line and ± broad plates, irregularly striolate-papillose to cross-striolate below (or sometimes the basal plates smooth and with strongly thickened walls), becoming papillose to obliquely striolate at the middle and ± smooth above, on the inner surface with ± narrow, non-projecting trabeculae, smooth or coarsely papillose, occasionally perforate; endostome with a fairly high basal membrane, papillose to granulose, segments narrow, flat to slightly keeled, not perforate, papillose below, smooth above, nearly as long as the teeth, cilia none or rarely rudimentary. Spores finely papillose, 12–35 µm in diameter. Calyptrae cucullate, naked, smooth.

Discussion: *Platygyriella* (and its synonym, *Bryosedgwickia* [Buck, 1984a]) was traditionally placed near the Entodontaceae, especially *Erythrodontium*, because of the numerous alar cells and the erect capsules (Buck, 1980). However, the relationships are more with the Hypnaceae because of the exostome ornamentation. The genus is characterized by its lanceolate to ovate leaves that are mostly acuminate, a short, double costa, and numerous

oblate to quadrate alar cells. Gametophytically, the best character by which to recognize the genus is the enlarged cells of the decurrencies that usually remain attached to the stem on dissection. In this respect it is like *Ectropothecium*, but in that genus there is but a single enlarged cell in the decurrencies, rather than several. The capsule

is erect and symmetric, with a reduced endostome having a relatively high basal membrane, narrow, mostly flat segments, and no cilia or only rudimentary ones. In the two American species the basal membrane is almost always coarsely granular. In addition, there are two African and three Asian species of *Platygyriella*.

KEY TO THE SPECIES OF *PLATYGYRIELLA*

1. Leaves erect-spreading, lanceolate to lanceolate-ovate, gradually acuminate, 0.35–0.8 mm long 1. *P. densa*
 1. Leaves imbricate, broadly ovate, abruptly acuminate, 0.9–1.2 mm long 2. *P. pringlei*

1. *Platygyriella densa*

Platygyriella densa (Hook. in Kunth) W. R. Buck, Brittonia 36: 86. 1984a; *Leskea densa* Hook. in Kunth, Syn. Pl. 1: 61. 1822; *Entodon densus* (Hook. in Kunth) Mitt., J. Linn. Soc., Bot. 12: 531. 1869; *Erythrodontium densum* (Hook. in Kunth) Paris, Index Bryol. ed. 2, 2: 158. 1904; *Bryosedgwickia densa* (Hook. in Kunth) Bizot & P. de la Varde, Rev. Bryol. Lichénol. 20: 246. 1951. Type: Mexico. [Michoacán:] Between Pazcuaro and Ario, 1828–2111 m, *Humboldt & Bonpland s.n.* (holotype: BM!; isotype: NY!).

Platygyrium guatemaliense Schimp. ex A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 276. 1878, *nom. nud.*

Entodon pallidissimus Müll. Hal., Linnaea 42: 494. 1879; *Erythrodontium pallidissimus* (Müll. Hal.) Paris, Index Bryol. 437. 1896; *Bryosedgwickia pallidissima* (Müll. Hal.) Bizot & P. de la Varde, Rev. Bryol. Lichénol. 21: 10. 1952. Type: Venezuela. Prope Coloniam Tovar, 1854–5, *A. Fendler 96* (lectotype: NY!, designated by Buck, 1984a).

Platygyriella helicodontioides Cardot, Rev. Bryol. 37: 9. 1910. Type: Mexico. México: Amecameca, 1908, *Pringle 15256* (lectotype: PCI; isolectotypes: NY!, US!, both types designated by Buck, 1984a).

Erythrodontium subdensum Broth. & Thér. in Thér., Recueil Publ. Soc. Havraise Études Diverses 88: 313. 1921; *Bryosedgwickia subdensa* (Broth. & Thér.) Bizot & P. de la Varde, Rev. Bryol. Lichénol. 21: 10. 1952. Type: Costa Rica. Alajuela, 900 m, Jan 1910, *O. Jiménez s.n.* (holotype: HI!; isotype: PC!).

Plants small and slender, in mats, dull green to golden. Stems to ~4 cm long, mostly shorter, irregularly branched, the branches prostrate, short; stems in cross section with 2–4 rows of small, thick-walled cells surrounding abruptly larger, thinner walled cells, central strand lacking; pseudoparaphyllia filamentous; axillary hairs with 1(–2) short,

brown basal cell(s) and 3–5 elongate, hyaline apical cells. Asexual reproduction sometimes by flagellate branches. Leaves 0.35–0.8 mm long, erect-spreading wet or dry, lanceolate to lanceolate-ovate, concave, gradually acuminate; margins entire or more often minutely serrulate almost throughout, plane or sometimes reflexed; costa short and double; cells linear, rarely shorter at the apex; alar cells quadrate to oblate, usually extending to the costa, the decurrencies usually of 1–2 greatly enlarged cells. Dioicous. Setae 1.2–1.5 cm long; capsules ~2 mm long; operculum short- to high-conic; exostome teeth orange, striolate to papillose below, smooth or faintly papillose above; endostome with a moderately high basal membrane, with walls sometimes very thickened, often coarsely papillose, and narrow, flat, finely to coarsely papillose segments, cilia none. Spores 13–20 µm in diameter.

Distribution and ecology: Mexico (where it is common and weedy), Costa Rica, Venezuela, Bolivia, Brazil, Paraguay, and Peru; mistakenly reported from Haiti (Buck and Steere, 1983); commonly on bark of deciduous tree trunks, sometimes on rocks, in mesic to dry forests, at (200–)400–1700(–2400) m.

Illustrations in publications: Fig. 161F–H in Bartram (1949: 363); Pl. 757 in Buck (1994: 1020).

Discussion: This moss is often found in mixtures with other mosses, often on tree trunks. When by itself, it is frequently small, sterile, and weatherworn. It is distinctive by its small size, ovate-lanceolate, gradually acuminate leaves, short-double costa, and one or two greatly enlarged cells of the decurrencies (that typically remain attached to the stems upon dissection). The moderately high basal membrane of the endostome, which is coarsely papillose and often has strikingly thick walls, and narrow, flat segments are unmistakable. There is little chance of confusion with *P. pringlei*, which has much larger, imbricate, and more or less abruptly tapered leaves and usually more than two enlarged cells in the decurrencies, as well as a rupestral habit.

Specimens examined: **MEXICO.** **Chiapas:** Mpio. Angel Albino Corzo, 9 km S of Finca Liquidambar, 15°42'N, 92°45'W, 2000–2150 m, *Delgadillo* 4707 (MEXU, NY). **Distrito Federal:** La Venta, San Miguel, 3469–3965 m, 17 Oct 1926, *Antipovich s.n.* (MO, NY). **Guerrero:** Mpio. Chilpancingo de los Bravos, Ixtamalco, 18 km W of Chilpancingo on road to Olmitemi, 1500 m, *Thomas & Contreras* 3728 (NY). **Jalisco:** Etzaltan, *Pringle, Plantae Mexicanae* 10617 (US); Río Blanco, Guadalajara, *Pringle* 15235 (US); N slope of La Cumbre, 16 km SW of Autlán on La Resolana road, 1464 m, *Crum* 481 (MICH, NY). **México:** Barranca de Malinaltenango, 18°46'N, 99°42'W, 1450–1600 m, *Buck* 18174 (NY); Santa Fé, *Pringle* 15653 (US); Canada, *Pringle* 15113 (US). **Michoacán:** Vicinity of Morelia, Cerro Azul, 2300 m, *Arsène* 4534, 4546, 4551, 4795, 4796 (US); Jesús del Monte, 2000 m, *Arsène* 7614 (US); Campanario, 2200 m, *Arsène* 7450, 7525 (US); on Federal Hwy. 15, 41 km W of Cd. Hidalgo, *Sharp et al.* 2191 (NY, TENN). **Morelos:** At Mirador, near Km 67 on Cuernavaca–Mexico City toll road, Hwy. 95D, 1952 km, *Magill* 2510 (NY, TENN). **Nayarit:** Mpio. Acaponeta, La Ciénaga, ~16 km NW of Mesa del Nayar, 2593 m, *Norris & Taranto* 14421a (NY, TENN). **Oaxaca:** Dist. Putla, ~19 km S of Putla de Guerrero on road to Pinotepa Nacional, *Norris & Taranto* 15876 (NY, TENN). **Puebla:** Vicinity of Puebla, Hacienda Santa Bárbara, 2160 m, *Arsène* 4516 (US). Durango, el Oro, *Rangel & Arsène* 4881 (US). **Sinaloa:** Along Hwy. 40, ~10 km W of Las Palmas, 2288 m, *Norris* 20448 (NY, TENN). **GUATEMALA.** **Baja Verapaz:** Near Patal, 1585 m, *Sharp* 2906 (US); **Chimaltenango:** Along Río Guacalate, SE of Chimaltenango, ~1700 m, *Standley* 80038 (NY); **Quezaltenango:** Region of Las Nubes, S of San Martín, Chile Verde, ~2250 m, *Standley* 83644 (NY); **Suchitepéquez:** S slope of Volcán Santa Clara, 1219 m, July 1948, *Holdridge s.n.* (NY). **HONDURAS.** **Lempira:** Montana de Celaque, along Río Arquegual, 7.5 km SW of Gracias, 14° 34'N, 88°39'W, 1400 m, *Allen* 11160 (MO, NY). **EL SALVADOR.** **La Libertad:** Cafetale de Miguel Eduardo Araujo, 13°39'N, 89°22'W, 1000 m, *Monro et al.* 2320 (MO); **Santa Ana:** Cerro Verde National Park, 13°29'N, 88°32'W, 2365 m, *Sidwell et al.* 455 (MO). **NICARAGUA.** **Jinotega:** ~3.2 km NW of Jinotega, road to San Rafael del Norte, 1000 m, *Croat* 43029 (MO); **Madriz:** Cerro Quisuca, 13°31'N, 86°31'W, 1100–1250 m, *Stevens* 16139 (MO); **Managua:** Sierra de Managua, 600–900 m, *Garnier* 707 (US). **COSTA RICA.** **Alajuela:** Carrillos de Poas, cerca de Río Poas, *Brenes* 17401 (NY); **San José:** Santa María de Dota, 1600 m, *Standley* 43172 (NY). **PANAMA.** **Chiriquí:** Cerro Colorado, Chami Camp, 8°35'N, 81°44'W, 1050 m, *Allen* 5006A (MO); **Coclé:** El

Valle, *Tyson* 2477 (MO); **Los Santos:** Trail between Jobero and headwaters of Río Pedregal, 500–780 m, *Croat* 34535 (MO). **BOLIVIA.** **Tajira:** Prov. Arce, slope of Cerro Nogal, 0.5 km N of Quebrada Nogal, 2–5 km NW of Comunidad La Mamora, 22°09'S, 64°41'W, 1230 m, *Lewis* 84-2157 (F, NY). **BRAZIL.** **Goiás:** Alto Paraíso, Chapada dos Veadeiros, am Rio São Miguel westlich des Nationalparks, 800 m, *Schäfer-Verwimp* 9857 (NY). **PARAGUAY.** **Cordillera:** Cerro Ybitú Silla, 1 km S of Tobatí, 25°12'S, 57°07'W, 297 m, *Zardini* 6024 (MO, NY). **PERU.** Above San Miguel, 1830 m, *Foot* 25 (NY).

2. *Platygyriella pringlei*

Platygyriella pringlei (Cardot) W. R. Buck, *Brittonia* 36: 87. 1984a; *Erythrodonium pringlei* Cardot, *Rev. Bryol.* 37: 11. 1910; *Bryosedgwickia pringlei* (Cardot) Bizot & P. de la Varde, *Rev. Bryol. Lichénol.* 21: 10. 1952. Type: Mexico. Michoacán: Coru, 1907, *Pringle* 10438 *p.p.* (lectotype: PC!; isolectotypes: CANM!, FH!, US!, both types designated by Buck, 1984a).

Erythrodonium densum var. *brevifolium* Cardot, *Rev. Bryol.* 37: 12. 1910; *Bryosedgwickia densa* var. *brevifolia* (Cardot) Bizot & P. de la Varde, *Rev. Bryol. Lichénol.* 21: 10. 1952. Type: Mexico. Michoacán: Coru, 1907, *Pringle* 10438 *p.p.* (holotype: PC!; isotypes CANM!, FH!, NY!, US!).

Erythrodonium imbricatifolium R. S. Williams ex Cardot, *Rev. Bryol.* 37: 12. 1926; *Platygyriella imbricatifolia* (Cardot) Thér., *Smithsonian Misc. Collect.* 78(2): 27. 1926. Type: Mexico. Jalisco: Barranca de Guadalajara, *Pringle* 709 (holotype: PC; isotypes: FH!, NY!).

Plants moderately robust in mostly dense mats, brownish, rather shiny. Stems to ~10 cm but usually about half that, irregularly branched; stems in cross section with (2–)3–5 rows of small, thick-walled cells surrounding abruptly larger, thinner-walled cells, central strand lacking; branches prostrate, slightly curved, terete; pseudo-paraphyllia filamentous; axillary hairs with 1(–2) short, brown basal cell(s) and 4–5 elongate, hyaline apical cells. Asexual reproduction rarely by flagellate branches with greatly reduced leaves. Leaves 0.9–1.2 mm long, imbricate, concave, ovate, abruptly acuminate; margins entire to minutely serrulate, erect; costa short and double; cells linear, not shorter in the apex; alar cells quadrate to oblate, rarely reaching the costa; the decurrencies of mostly 3–6 somewhat enlarged cells in 1–2 rows. Dioicous. Setae ~2 cm long, red; capsules 3–4 mm long; operculum short-rostrate; cells at mouth of urn rarely tardily deciduous (not forming a true annulus); exostome teeth light yellow,

cross-striolate below, smooth to faintly papillose at the extreme apex; endostome with a moderately high basal membrane; segments narrow, \pm keeled, smooth to lightly papillose, cilia none. Spores 14–19 μ m in diameter.

Distribution and ecology: Mexico (where it is relatively common) and Guatemala; usually occurring on sunny rocks, less often on trunks of deciduous trees, commonly in oak-pine forests, above 2000 m.

Illustrations in publications: Fig. 162A, B in Bartram (1949: 365); Pl. 758 in Buck (1994: 1021).

Discussion: This is a very attractive moss, with a beautiful brownish coloration. It can be distinguished from *P. densa* by its rupestral habitat, greater stature, imbricate and abruptly tapered leaves, and larger decurrencies with less markedly differentiated cells. There are peristomial features separating the two as well, but neither is commonly found fertile. Confusion is more likely with *Erythrodon-tium longisetum* (Hook.) Paris. However, in *Erythrodon-tium longisetum* the leaves are oblong rather than ovate, the decurrencies are quite broad, the inflorescences are autoicous, and the setae are yellow rather than red. *Erythrodon-tium densum* var. *brevifolia*, characterized only by flagellate branches, is a rare and unimportant expression of the species.

Selected specimens examined: **MEXICO. Chihuahua:** N of Barranco de Batopilas between Divisadero and Quirire, *Bye 6346d* (COLO, NY). **Durango:** Below Salto, 2532 m, *Sharp 1826* (NY, TENN). **Guerrero:** Near Taxaco, *Welch 20364* (MICH, NY). **Jalisco:** Guadalajara, *Pringle, Plantae Mexicanae 15074* (US); 14 km al W de Cuautla, por la brecha Ayutla–Mascota, *Guzmán 912* (MEXU, NY). **México:** Mpio. Ocuilán, Barranca de Mexicapa, Km 14 on road from Sta. Mónica de Ocuilán to Cuernavaca, 18°58'N, 99°20'W, 2200–2350 m, *Buck 28137* (NY). **Michoacán:** 6 km NE of Zinapécuaro, 19°54'N, 100°47'W, 2020 m, *Delgadillo 4980* (MEXU, NY); vicinity of Morelia, Jesús del Monte, 2000 m, *Arsène 7602, 7603, 7606, 7618, 7624* (US); Carrindapaz, 2100 m, *Arsène 7702, 7953* (US); Cerro San Miguel, 2200 m, *Arsène 5101* (US); Bosque San Pedro, 1950 m, *Arsène 4584* (US). **Morelos:** oberh. D. neuen Autobahn zw. Cuernavaca u. Mexico City, 2050–2100 m, *Düill 199* (MICH, NY). **Oaxaca:** 22.4 km N on Hwy. 175 from jct. with Hwy. 190, near La Punte, NE of Oaxaca, 17°12'N, 96°05'W, 2532 m, *Vitt 17624* (ALTA, NY). **Puebla:** Honey Station, *Pringle 15128* (US); Zacatlán, *Orcutt 1262* (NY). **San Luis Potosí:** Above Xilitl, 763 m, *Sharp 5906* (NY, TENN). **Sinaloa:** Along Hwy. 40, ~3 km E of Las Palmitas, 2288 m, *Norris 20598* (NY, TENN). **GUATEMALA. Quetzaltenango:** Mpio. Zunil, road to Fuentes Georginas, 4 km S of Zunil, NW slopes

of Volcán Zunil, 14°45'N, 91°29'W, 2442 m, *Quedensley 2140* (BIGU, NY).

10. *Platygyrium* Schimp. in Bruch, Schimp. & W. Gümbel

Platygyrium Schimp. in Bruch, Schimp. & W. Gümbel, Bryol. Eur. 5(46–47): 95.1851, *nom. cons.* Type: *P. repens* (Brid.) Schimp.

Plants small to medium-sized, in creeping mats, glossy, yellowish green to brownish green or darker. Stems subpin-nately branched; branches short to elongate, erect to prostrate, straight to curved at tips, loosely foliate to julaceous, in cross section without a hyalodermis, central strand lacking; pseudoparaphyllia filamentous to narrowly foliose; axillary hairs composed of 1–2 short, brown basal cells and 1–5 elongate, hyaline apical cells. Stem and branch leaves similar, ovate, imbricate to homomalous, acute to acuminate, flat to somewhat plicate, concave; margins mostly entire, rarely subserrulate apically, somewhat to strongly recurved, especially below; costa short and double to absent; cells elongate, smooth; alar cells numerous, quadrate, thick-walled. Asexual reproduction by flagellate branchlets at branch apices. Dioicous, but often fertile. Perichaetia small, inconspicuous. Setae straight, elongate, smooth, twisted when dry. Capsules erect, long-exserted, cylindrical to subcylindrical, symmetric or slightly asymmetric; exothecial cells oblong-rectangular, stomata phaneroporous, few, confined to base of urn; annulus differentiated in 1–3 rows of cells; operculum obliquely rostrate; peristome double, exostome pale, yellow-orange, teeth finely papillose to papillose-striolate on outer surface, bordered, smooth at tips, weakly trabeculate at back; endostome segments nearly as long as teeth, brown, narrowly linear, perforate or not, sometimes adherent to teeth, cilia rudimentary to lacking. Spores green, spherical. Calyptra cucullate, naked.

Discussion: *Platygyrium* is a genus of about eight species, mostly distributed in Asia. In North America there is the common and widespread *P. repens* (Brid.) Schimp., but it does not reach into our flora area. Only a single species is in our region. The genus is similar to and often confused with *Homomallium* and *Pylaisia*. Fertile specimens of *Homomallium* are easily distinguished because they have arcuate, asymmetric capsules, whereas *Platygyrium* and *Pylaisia* have erect, symmetric capsules. *Pylaisia* can be distinguished from *Platygyrium* by the smooth exostome teeth and the shorter operculum. In *Platygyrium* the long, obliquely rostrate operculum is in striking contrast to that of *Pylaisia*, which has a conic operculum with only a short,

straight rostrum. These three genera have more or less homomallous leaves and numerous alar cells. The epiphytic habitat and axillary brood branchlets distinguish *Platygyrium* from *Pylaisia*, as well as from *Homomallium*.

Platygyrium fuscoluteum

Platygyrium fuscoluteum Cardot, Rev. Bryol. 37: 49. 1910. Type: Mexico. Chihuahua: environs de Madera, 1908, *Palmer 445 p.p.* (holotype: NY!).

Regmatodon fusco-luteus Schimp. ex Besch., Mém. Soc. Sci. Nat. Cherbourg 16: 232. 1872; *Platygyrium fuscoluteum* (Besch.) Cardot, Rev. Bryol. 38: 40. 1911, *hom. illeg., non* Cardot, 1910. Type: Mexico. Orizaba, *F. Müller* (holotype: BM!).

Plants in relatively robust mats, yellowish brown. Stems to ~5 cm long, irregularly to regularly 1–2-pinnately branched, in cross section without a hyalodermis, central strand lacking; branches 3–10 mm long, rarely longer, straight to curved; axillary brood branchlets occasionally near branch tips. Leaves mostly 1.3–1.6 mm long, 0.3–0.4 mm wide, oblong-lanceolate, acuminate, usually homomallous but sometimes straight, slightly plicate; margins entire, conspicuously recurved in lower half, sometimes almost to leaf apex; median cells mostly 50–75 × 4–6 μm, slenderly elongate; alar cells 5–12 up the margins, subquadrate, sometimes colored. Perichaetial leaves oblong-lanceolate, acuminate, ± plicate; margins serrulate above. Setae 8–20 mm long, reddish. Capsules 2–2.5 mm long, pale yellow-brown, cylindrical, nearly symmetric; operculum slenderly and mostly obliquely long-rostrate. Annulus of 1–2 rows of cells. Exostome teeth cross-striolate below, smooth to lightly roughened above, strongly trabeculate at back; endostome segments brownish, smooth; cilia rudimentary, single. Spores 15–20 μm in diameter, finely granular. Calyptra 2.0–2.5 mm long.

Distribution and ecology: Mexico; also in the southwestern United States; occurring on tree trunks and logs, rarely on soil in coniferous and deciduous forests at altitudes of 2200–2800 m.

Illustrations in publications: Pl. 751 in Ando (1994: 1011).

Discussion: This species is confined to Mexico and the southwestern United States (Arizona, New Mexico, and Texas). It mostly occurs at higher elevations on tree trunks and logs in hardwood and mixed conifer-hardwood forests at 1300–2500 m. The glossy yellowish brown plants with homomallous leaves and long, slender apices on elongate branches are characteristic. The strongly recurved leaf margins and somewhat plicate leaves, coupled

with subquadrate alar cells, make the species distinctive. The axillary brood branchlets are less conspicuous and less common than in the more northerly *P. repens*, but they are usually present.

Homomallium mexicanum Cardot is similar to *P. fuscoluteum*. As mentioned above, the capsules (if the plants are fertile) in *Homomallium* are curved. Vegetatively, the two may be separated by the brood branchlets in *Platygyrium* and by the homomallous leaves in *Homomallium*. From *Pylaisia*, *Platygyrium fuscoluteum* can be separated by the straight branches and straight to mildly homomallous leaves, in addition to the brood branchlets; some *Pylaisia* species have curved branches and strongly homomallous to falcate leaves.

Specimens examined: MEXICO. Coahuila: Maderas del Carmen, 2500 m, *Riskind 1990a* (NY). Michoacan: Between Chilchota and Zacapu, 2135 m, *Weber & Charette B-9854* (NY). Veracruz: Just S of the city of Xalapa, Rancho Guadeloupe, 1300 m, *Buck 35323* (NY). Zacatecas: Sierra de los Morones, 37 km W de Jalpa, *Cárdenas 845* (MEXU, NY).

11. *Pseudotaxiphyllum* Z. Iwats.

Pseudotaxiphyllum Z. Iwats., J. Hattori Bot. Lab. 63: 448. 1987. Type: *Isothecium elegans* Brid., Bryol. Univ. 2: 356. 1827.

Plants in medium-sized, often complanate-foliate, thin to dense mats, dull to glossy, light green to yellowish green. Stems creeping, simple or often sparingly and irregularly branched, cortical cells small, thick-walled, central strand sometimes present; rhizoids smooth, in clusters below leaf insertions; pseudoparaphyllia lacking; axillary hairs with a single short-rectangular, light brown basal cell and 2–3, elongate, hyaline distal cells. Asexual reproductive bodies sometimes present in clusters at stem apices or below in leaf axils, 0.1–0.5 mm long, elongate, multicellular, smooth-celled, twisted-vermiform, with 1–5 acute teeth, or resembling the parent plant but smaller, 0.8–1.2 mm long, bearing reduced leaves from apex to base of propagula. Stem and branch leaves similar, somewhat rigid, crowded and imbricate, erect-spreading to squarrose, sometimes upturned-homomallous, occasionally complanate, smooth or undulate, flat or concave, symmetric to asymmetric, nondecurrent, lanceolate, ovate, ovate-lanceolate or oblong-lanceolate, acute, sometimes abruptly so, to acuminate; margins plane to erect, serrate to serrulate; costa lacking or short and double; cells often flexuose, firm-walled, linear-fusiform, smooth or apical

cells sometimes prurlose at upper ends on dorsal surface, walls not pitted; alar regions not or distinctly differentiated with numerous quadrate to short-rectangular cells. Dioicous or sometimes autoicous, usually sterile; perigonia along stems; perichaetia at base of stems, bracts small, lanceolate to ovate, acuminate to abruptly filiform-acuminate; margins plane. Setae smooth, elongate, straight or sometimes curved, twisted, red to reddish brown; capsules cernuous to pendulous, straight to subarcuate, dark brown to dark red, smooth to wrinkled, contracted below mouth and wrinkled at neck when dry; operculum conic to short-rostrate, shorter than urn; annulus present, deciduous, of 2–3 rows of cells; peristome double, exostome teeth cross-triolate below, papillose above, bordered, trabeculate at back; endostome with a high to low basal membrane, keeled segments, and cilia shorter than the segments, in

groups of 1–3. Spores spherical to ovoid, minutely papillose. Calyptra cucullate, smooth, naked.

Distribution: *Pseudotaxiphyllum* is a genus of 11 species occurring in terrestrial habitats in temperate, subtropical, and tropical regions.

Discussion: *Pseudotaxiphyllum* is a segregate of the genus *Isopterygium* described by Iwatsuki (1987). The genus is distinguished by the medium-sized, simple or sparingly branched, dull to glossy plants, the small, thick-walled cortical stem cells, the smooth rhizoids below the leaf insertions, the absence of pseudoparaphyllia, the nondecurent, serrate to serrulate leaves, the occasional presence of asexual reproductive bodies, the dioicous or sometimes autoicous sexual condition, and the presence of an annulus. Sex organs and sporophytes have never been seen on plants of three of the four species present in Latin America.

KEY TO THE SPECIES OF *PSEUDOTAXIPHYLLUM*

1. Median leaf cells broad, 5–9 μm wide; propagula lacking 2
 2. Leaves long-acuminate, upturned-homomallous; leaf margins plane when dry; alar regions poorly differentiated, a few short-rectangular cells present 3. *P. homomallifolium*
 2. Leaves acute to short-acuminate, not upturned-homomallous; leaf margins involute when dry; alar regions distinctly differentiated, numerous quadrate cells present 4. *P. richardsii*
1. Median leaf cells narrow, usually 4–7 μm wide; propagula usually present 3
 3. Leaves asymmetric, often cultriform; propagula clustered at stem apices and in upper leaf axils, elongate, twisted-vermiform, with 1–5 acute teeth at apices 1. *P. distichaceum*
 3. Leaves symmetric, never cultriform; propagula usually clustered in leaf axils below stem apices, resembling parent plant but smaller, bearing reduced leaves from apex to base of propagula 2. *P. elegans*

1. *Pseudotaxiphyllum distichaceum*

FIGURE 26

Pseudotaxiphyllum distichaceum (Mitt.) Z. Iwats., J. Hattori Bot. Lab. 63: 449. 1987. *Stereodon distichaceus* Mitt., J. Proc. Linn. Soc., Bot., Suppl. 1: 105. 1859; *Isopterygium distichaceum* (Mitt.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 439. 1878. Type: Nepal, India, Wallich *s.n.* (lectotype: NY!, here designated).

Plagiothecium subfalcatum Austin, Musci Appalach. 366. 1870; *Isopterygium subfalcatum* (Austin) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 438. 1878. Type: Mountains of New Jersey and New York, Austin's, Musci Appalach. 366 (isotypes: CANM!, DUKE!, NY!, US!).

Isopterygium poasense Renaud & Cardot, Bull. Soc. Roy. Bot. Belgique 41(1): 141. 1904 [1905]. Type: Costa Rica, Potrero del Alto, volcán de Poás, 2463 m, Pittier 5791 (isotypes: FH!, US!).

Taxiphyllum howellianum H. A. Crum & L. E. Anderson, J. Elisha Mitchell Sci. Soc. 74: 38. 1958. Type: North Carolina, Jackson Co., W of Cashiers, below Cowee Gap, Howell Tract, 1158 m, Anderson 11071 (isotype: CANM!).

Plants in thin to loose mats, glossy, light green to yellowish green. Stems to 2 cm long, 1.0–3.5 mm wide, complanate-foliate, simple or irregularly branched. Asexual reproductive bodies often present, 0.1–0.5 mm long, clustered in leaf axils at or near stem apices, yellowish green, elongate, twisted-vermiform, composed of 2–4 layers of smooth cells, with 1–5 acute, erect teeth at apex. Leaves 1.0–1.8 mm long, 0.3–0.6 mm wide, semiflaccid to rigid, distant, squarrose, complanate, smooth, ovate- or oblong-lanceolate, often cultriform, asymmetric, acuminate; margins plane or narrowly recurved at base, serrate to serrulate above, serrulate to entire below; costa usually strong, short and double; median cells 56–120 \times 4–7 μm , smooth; apical cells sometimes prurlose at upper ends

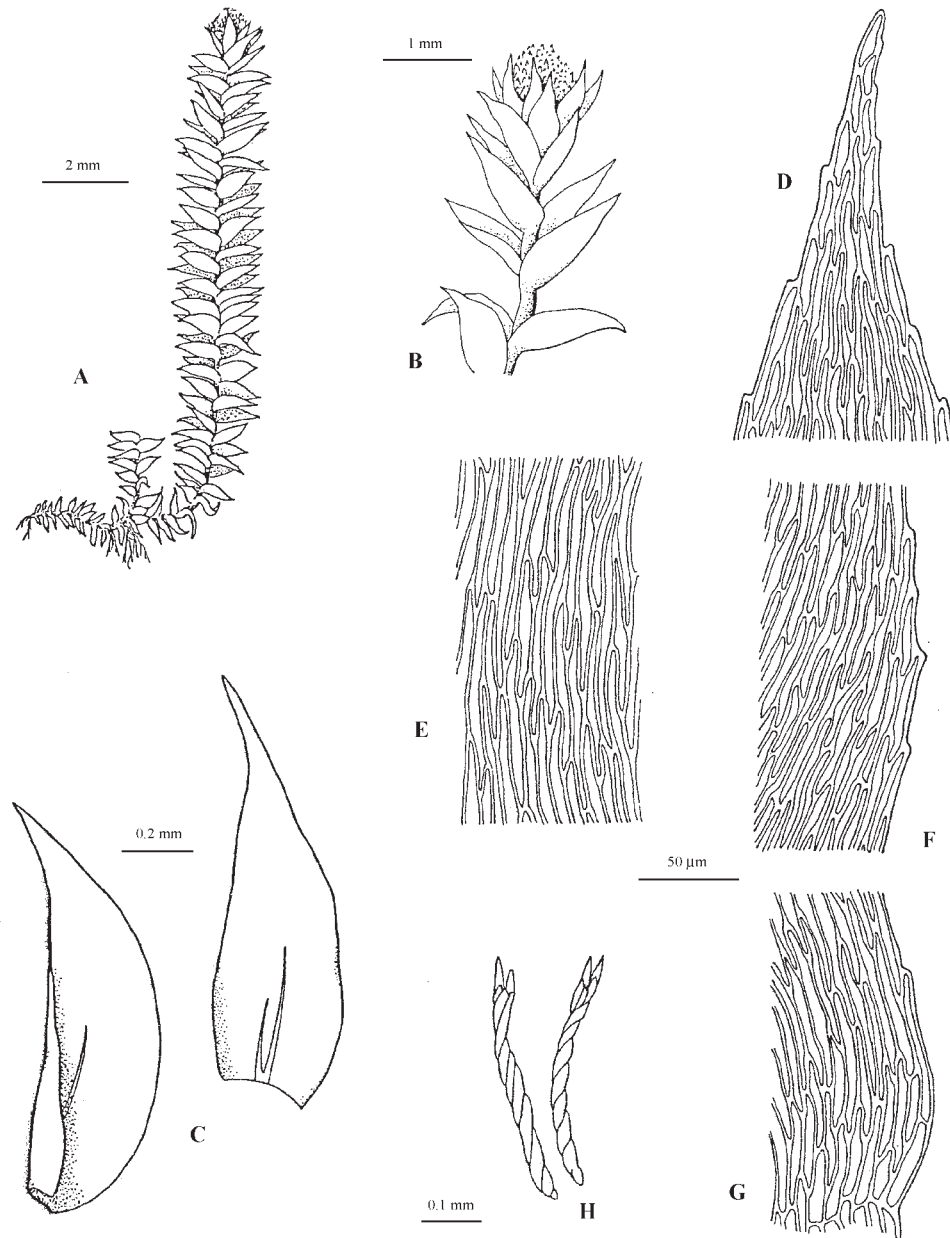


FIGURE 26. *Pseudotaxiphyllum distichaceum*. A. Habit. B. Enlargement of stem apex showing asexual reproductive bodies. C. Leaves. D. Apical leaf cells. E. Median leaf cells. F. Marginal leaf cells. G. Cells of alar region. H. Asexual reproductive bodies. All illustrations drawn from Juárez G. 1630 (CANM).

on dorsal surface; alar cells undifferentiated or 1–3 marginal cells quadrate to rectangular. Sex organs and sporophytes not seen on Latin American plants. Reported from India (Buck, 1998) to be dioicous? (no perigonia seen) or monoicous (Gangulee, 1980). Buck also reported setae ~1.5 cm long, reddish, curved just below the urn; capsules ~1.1–1.5 mm long, horizontal, symmetric, broadly cylin-

dric with a distinct neck; operculum conic. Crum and Anderson (1981) report spores 8–10 μm in diameter, minutely roughened.

Distribution and ecology: Rare or seldom collected; known from Mexico, Guatemala, Honduras, Costa Rica, Dominican Republic, Colombia, Venezuela, Ecuador and Brazil (Figure 27); also known from southeastern

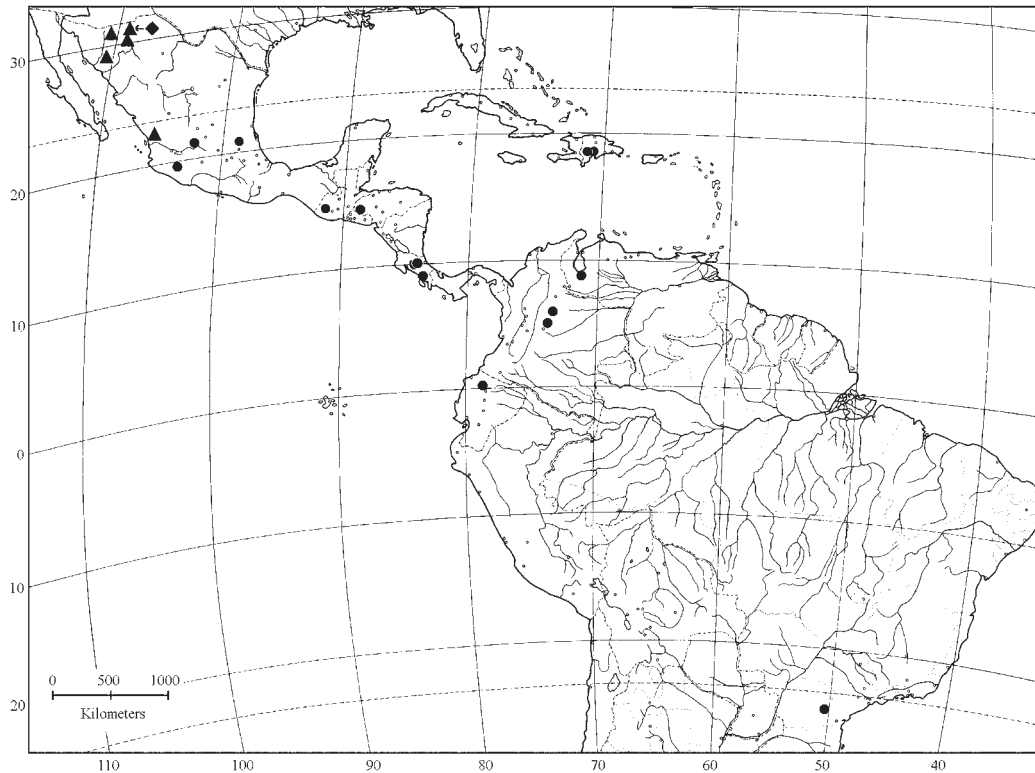


FIGURE 27. Distribution of *Pseudotaxiphyllum distichaceum* (●), *P. homomallifolium* (◆), and *P. richardsii* (▲) in Latin America.

Canada, eastern United States, Asia, and Australia; occurring on shaded, moist to somewhat dry soil or soil over rocks and boulders, limestone cliffs, often on humid, steep ravines, 0–4040 m.

Discussion: *Pseudotaxiphyllum distichaceum* is best recognized by the distant, squarrose, complanate, ovate- or oblong-lanceolate, often cultriform, asymmetric, acuminate leaves with serrate to serrulate margins, the narrow median leaf cells, the poorly differentiated alar cells, sometimes 1–3 quadrate to rectangular cells on the margins, and the usual presence of clusters of elongate, twisted-vermiform propagula with 1–5 acute teeth at apices in the upper leaf axils. The Mexican plants studied often lacked the characteristic propagula that occur clustered in the upper leaf axils and, when present, make this one of the easiest plants to recognize. Most of the plants seen elsewhere in Latin America, however, have propagula.

Pseudotaxiphyllum distichaceum is easily confused with *P. elegans*, especially when propagula are not present. The asymmetric, often cultriform leaves of *P. distichaceum* will distinguish it from *P. elegans*, which has symmetric leaves that are never cultriform. When propa-

gula are present, their location on the stems as well as their morphology are distinctly different in the two species. *Pseudotaxiphyllum distichaceum* has propagula that are elongate, twisted-vermiform with 1–5 acute teeth at the apices, and they occur in the leaf axils at or near the stem apices. On the other hand, *P. elegans* has propagula in the leaf axils that always occur below the stem apices and they resemble the parent plant, being much smaller, possessing small leaf-like structures along their length.

Specimens examined: **MEXICO.** Jalisco: Nevado de Colima, 3940–3970 m, *De Luna 509a* (CANM). Veracruz: 10 km NE of outskirts of Huayacocotla, *Juárez G. 1630* (CANM). Zacatecas: Cerro de la Bufa, 2700 m, *Cárdenas 339* (CANM, MEXU). **GUATEMALA.** Quezaltenango: Canyon above Baños Georginas, 8 km above Zunil, ~2470 m, ~14°46'N, 91°28'W, *Gereau & Martin 1876* (NY). **HONDURAS.** Lempira: Montana de Celaque, Cerro Mojon, 13 km SW of Gracias, 14°32'N, 88°41'W, *Allen 12271* (MO). **COSTA RICA.** Cartago: ~97 km S of Cartago, behind Hotel La Georgina on Interamerican Hwy., 2900 m, *Bowers 830-1A* (TENN). San José: Cerro de Zurqui, N of San Luis Norte, 17 km NNE of San

José, 10°03'N, 84°01'W, Crosby 9686 (MO). Parque Nacional Volcán Poás, Morales 538 (CANM). **DOMINICAN REPUBLIC.** La Vega: Vicinity of pyramids, 13.8 km S of Valle Nuevo, 44.7 km S of Constanza, 2256 m, Shaw 5642 (NY). **San Juan–Santiago:** Parque Nacional J. Armando Bermúdez, on the Loma La Pelona, 3100–3200 m, Zannoni *et al.* 42050 (NY). **COLOMBIA.** Boyacá: Mpio. de Duitama, around Páramo “La Rusia,” 2620 m, Ireland 23602 (CANM, COL). **Cundinamarca:** Mpio. de Subachoque and Supata, N of Bogota, “El Tablazo,” 3500 m, Ireland 23422 (CANM); Páramo de Palacio, between Mina de Cal and Río Chuza, Páramo Seco, Florschütz 3883 (U). **Santander:** La Sierra, along road between Párama de la Rusia and Virolin, ~2600 m, Lewis 88-1350 (CANM, LPB). **VENEZUELA.** Mérida: Páramo de los Conejos, Sierra del Norte, 3300 m, Griffin & Lopez PV-611 (CANM). **ECUADOR.** Imbabura: E side of Cerro Imbabura above La Esperanza, ENE of Otavalo, 4040 m, Lewis 78-2969B (F). **BRAZIL.** Paraná: Ponta Grossa, Park Vila Velha, 900 m, Schäfer-Verwimp & Verwimp 9201 (CANM).

2. *Pseudotaxiphyllum elegans*

FIGURE 28

Pseudotaxiphyllum elegans (Brid.) Z. Iwats., J. Hattori Bot. Lab. 63: 449. 1987. *Hypnum elegans* Hook., Musci Exot. 1: Pl. 9. 1818, *hom. illeg.*; *Isothecium elegans* Brid., Bryol. Univ. 2: 356. 1827; *Isopterygium elegans* (Brid.) Lindb., Not. Sällsk. Fauna Fl. Fenn. Förh. 13: 416. 1874; *Plagiothecium elegans* (Brid.) Schimp., Syn. Musc. Eur. ed. 2, 698. 1876. Type: Canada, British Columbia, Vancouver Is., Nootka, Menzies 35 (holotype: BM!; isotype: NY!).

Plants in thin to dense mats, glossy, dark green to yellowish green. Stems to 1 cm long, 1–2 mm wide, simple or irregularly branched. Asexual reproductive bodies usually present, clustered in leaf axils below stem apices, 0.8–1.2 mm long, yellow to green, smooth-celled, resembling the parent plant but smaller, bearing reduced leaves from apex to base of propagula. Leaves 0.5–1.2 mm long, 0.2–0.6 mm wide, semiflaccid to rigid, close to somewhat distant, erect-spreading, somewhat concave, smooth, lanceolate, ovate- or oblong-lanceolate, symmetric, acuminate; margins plane, serrulate to strongly serrate above, serrulate to entire below; costa usually strong, short and double; median cells 48–100 × 4–7 μm, smooth; apical cells sometimes minutely prurulose at upper ends on dorsal surface; alar cells undifferentiated or 1–3 quadrate to rectangular cells on margins. Sex organs and sporophytes

not seen on Latin American plants. North American plants reported (Ireland, 1969) to be dioicous. Setae 1.0–2.5 cm long, dark red; capsules 1–2 mm long, cernuous to pendulous, straight or subarcuate, oblong-ovoid to ovoid, wrinkled and contracted below mouth when dry; operculum conic to short-rostrate, 0.4–0.7 mm long; annulus present. Crum and Anderson (1981) reported spores 7–10 μm in diameter, minutely roughened.

Distribution and ecology: Very rare; known from one locality on the Falkland Islands, Argentina, where it occurred on rocks, and from one in Chile, where it occurred on a limestone cliff, both localities apparently at sea level (Figure 29); known elsewhere from Canada, United States, Europe, and Iceland; reported from Asia and Africa (van der Wijk *et al.*, 1964).

Discussion: This species is recognized by the close to somewhat distant, erect-spreading, lanceolate, ovate- or oblong-lanceolate, asymmetric, acuminate leaves with serrulate to strongly serrate margins, the narrow median leaf cells, the poorly differentiated alar cells, 1–3 marginal cells quadrate to rectangular, and the usual presence of clusters of propagula in the leaf axils below stem apices, the propagula resembling the parent plant but smaller, bearing reduced leaves from apex to base. *Pseudotaxiphyllum elegans* is morphologically close to *P. distichaceum*. For distinctions see the discussion under that species.

The Halle and Skottsberg 873 (UPS) specimen from the Falkland Islands has been reported as *Isopterygium elegans* var. *nanum* (Jur. in Milde) A. Jaeger (Cardot and Brotherus, 1923; Matteri, 1986; Matteri and Schiavone, 2002), but an examination of the specimen fits our concept of *P. elegans* var. *elegans*. The type of the var. *nanum* has not been examined, but judging from Juratzka's (1864) description of the type (as *Plagiothecium nanum* Jur. in Milde), it falls within the range of variation that we associate with *P. elegans* var. *elegans*. Therefore, we are doubtful that the variety is worth taxonomic recognition, but the final decision will have to wait until the type of the var. *nanum* is examined.

Specimens examined: **CHILE:** Bío-Bío: Arauco Prov., 2 km N of Casa de Piedra Beach, a.s.l.[at sea level], 38°28'S, 73°31'W, Ireland & Bellolio 33252 (CONC, MO). **ARGENTINA:** Falkland Islands: West Falkland, Warrah River, 17 Dec 1907, Halle & Skottsberg 873 (UPS).

3. *Pseudotaxiphyllum homomallifolium*

FIGURE 30

Pseudotaxiphyllum homomallifolium (Redf.) Ireland, Caldasia 16(78): 267. 1991. *Isopterygium homomallifolium*

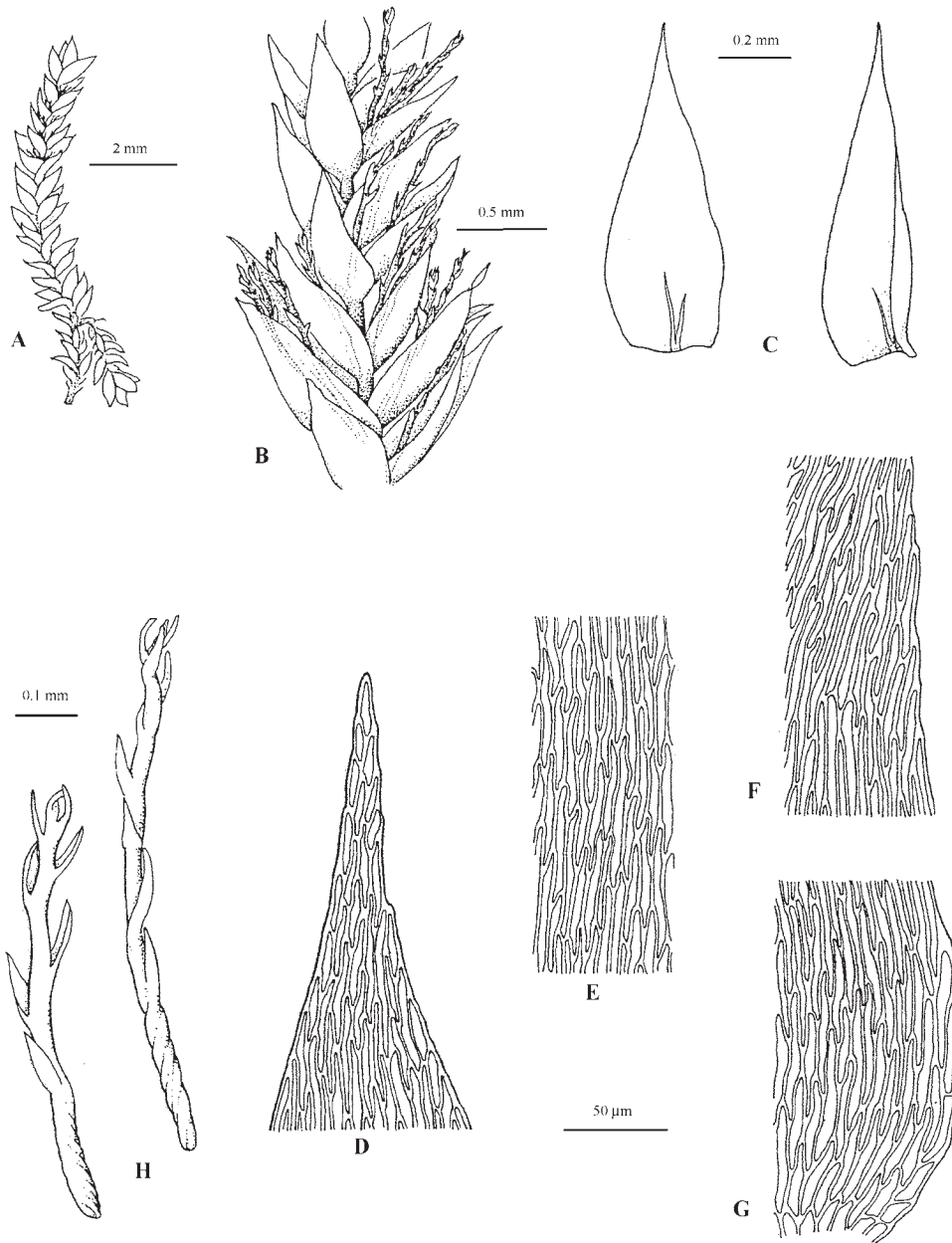


FIGURE 28. *Pseudotaxiphyllum elegans*. A. Habit. B. Enlargement of portion of stem showing asexual reproductive bodies. C. Leaves. D. Apical leaf cells. E. Median leaf cells. F. Marginal leaf cells. G. Cells of alar region. H. Asexual reproductive bodies. All illustrations drawn from Halle & Skottsberg 873 (UPS).

Redf., Bryologist 76: 440. 1973. Type: Texas, Kimble Co., along North Llano River, ~½ mi. S of Roosevelt, Redfearn 27170 (holotype: NY!; isotype: MICH!).

Plants in thin to dense mats, glossy, yellowish green. Stems to 1.5 cm long, 1–2 mm wide, simple or irregularly branched. Asexual reproductive bodies lacking. Leaves 0.8–

1.2 mm long, 0.3–0.5 mm wide, semiflaccid to rigid, distant to close and overlapping, erect-spreading, sometimes upturned-homomallous, occasionally complanate, smooth, lanceolate to ovate-lanceolate, symmetric, long-acuminate; margins plane, serrulate nearly to base; costa weak, short and double or lacking; median cells 60–120 × 5–9 μm, smooth; apical cells smooth; alar cells poorly differentiated,

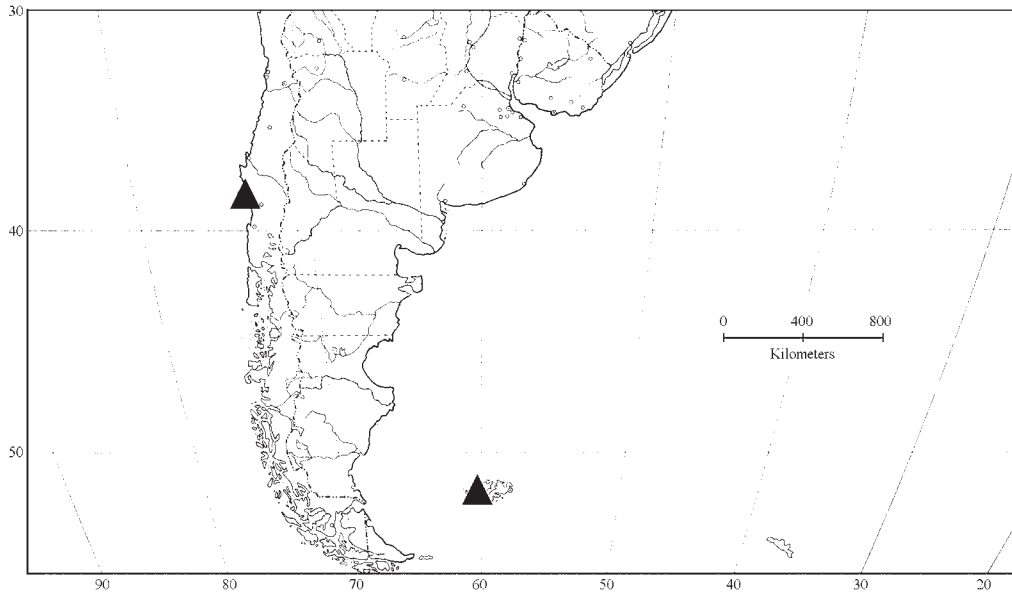


FIGURE 29. Distribution of *Pseudotaxiphyllum elegans* in Latin America.

a few short-rectangular cells often present. Sporophytes not seen on Latin American plants. North American plants reported (Ireland, In press a) to be autoicous. Setae 0.8–1.6 cm long, yellow to reddish; capsules 1.4–1.7 mm long, erect to horizontal, slightly cernuous, ellipsoid, contracted below the mouth when dry; operculum high-conic, 0.4–0.6 mm long, high-conic to short-rostrate; annulus present, deciduous, of 2–3 rows of cells. Spores 9–16 μm in diameter.

Distribution and ecology: Rare; known in Latin America only from the state of Sonora, Mexico (Figure 27); occurring on rocks and under rock ledges, 1350–1875 m; also known to occur in the southwestern United States (Arizona, New Mexico, and Texas).

Discussion: *Pseudotaxiphyllum homomallifolium* is distinctive because of its long-acuminate, upturned-homomallous leaves with serrulate margins, its broad median leaf cells, its few differentiated cells in the alar regions, and its autoicous sexual condition.

Although foliose pseudoparaphyllia were attributed to *P. homomallifolium* when Redfearn (1973) described the species, we do not believe they should be classified as such structures. The multicellular structures rarely found on the stems seem to be part of a developing branch primordium. They do not appear to be distinctly separated from the rest of the primordium, sometimes not even evident on the stems at the bases of mature branches like typical pseudoparaphyllia.

Specimens examined: MEXICO. Sonora: Loop of the Río de Bavispe, cerro del Capulin, NW of Aribabi, 1875 m, *Harvey 1704* (MICH); Cañon de Huépari, N of Aribabi, 1350 m, *Harvey 1747* (MICH).

4. *Pseudotaxiphyllum richardsii*

FIGURE 31

Pseudotaxiphyllum richardsii (E. B. Bartram) Ireland, *Caldasia* 16(78): 267. 1991. *Isopterygium richardsii* E. B. Bartram, *Bryologist* 44: 64. 1941. Type: Mexico, Sonora, Imuris, along Río de los Alisos, *Richards & Drouet 757* (holotype: F!; isotypes: DUKE!, F!, FH!, MICH!, NY!).

Plants in thin mats, somewhat glossy to dull, light green to yellowish green. Stems to 1 cm long, 1–2 mm wide, simple or irregularly branched. Asexual reproductive bodies lacking. Leaves 0.5–1.0 mm long, 0.3–0.5 mm wide, flaccid, close, erect, indistinctly complanate when dry, more noticeably so when moist, concave, smooth, ovate to ovate-lanceolate, symmetric, acute to short-acuminate; margins plane or strongly involute when dry, serrate to serrulate nearly to base; costa weak, short and double; median cells 47–75 \times 5–9 μm , smooth; apical cells smooth; alar cells distinctly differentiated, numerous

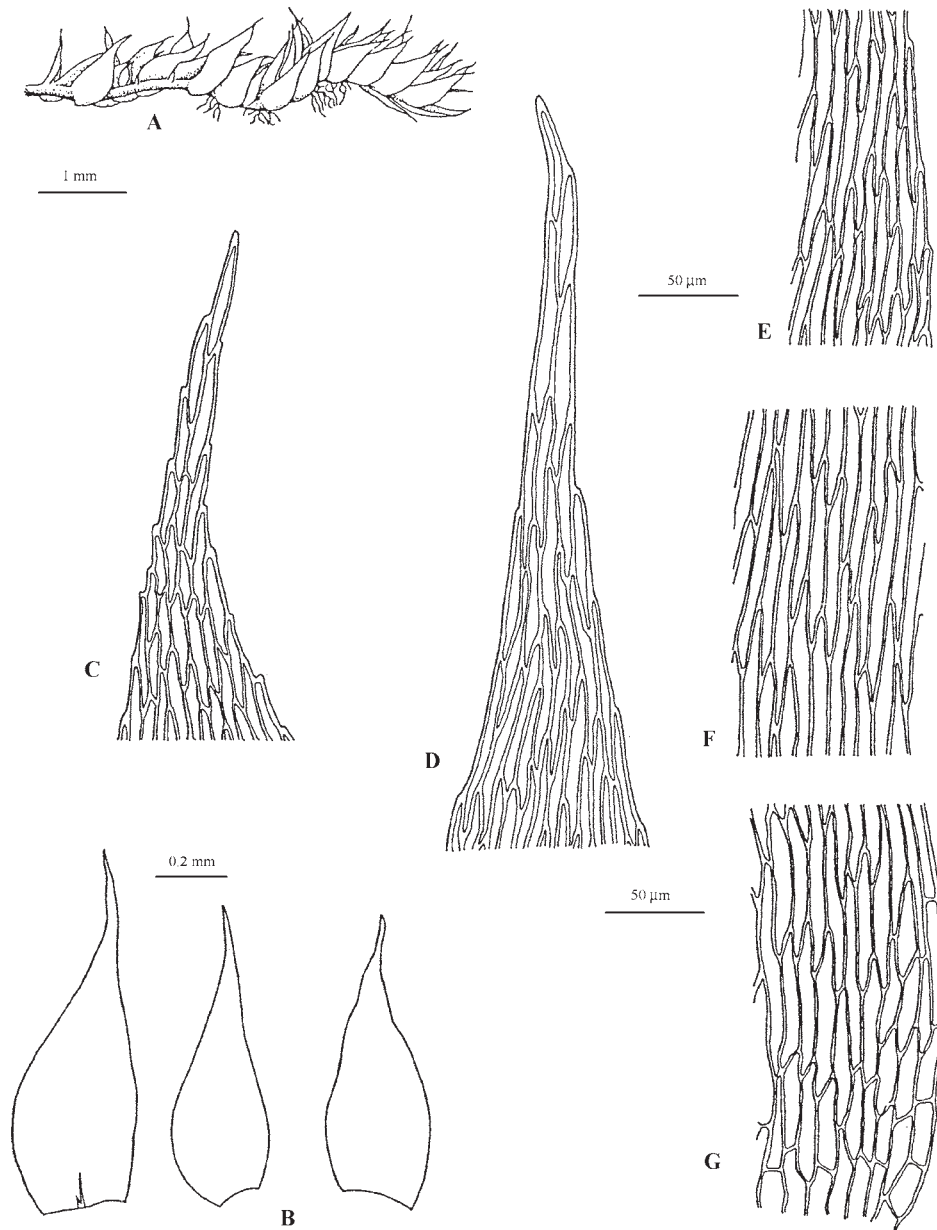


FIGURE 30. *Pseudotaxiphyllum homomallifolium*. A. Habit. B. Leaves. C, D. Apical leaf cells. E. Marginal leaf cells. F. Median leaf cells. G. Cells of alar region. All illustrations drawn from Harvey 1704 (MICH).

quadrate to short-rectangular cells present. Autoicous. Setae 0.6–0.7 cm long, reddish; capsules ~1 mm long, inclined, nearly straight, ellipsoid, not or scarcely contracted below the mouth when dry; operculum high-conic; annulus not seen. Spores and calyptra not seen.

Distribution and ecology: Rare; endemic to Mexico, where it is known only from the states of Nayarit and

Sonora (Figure 27); occurring on soil over rock in ravines and near rivers, ~1300 m.

Discussion: This species is recognized by the combination of small (0.5–1.0 mm long), ovate to ovate-lanceolate, acute to short-acuminate leaves with serrate to serrulate margins that are strongly involute when dry; broad median leaf cells; distinctly differentiated alar regions

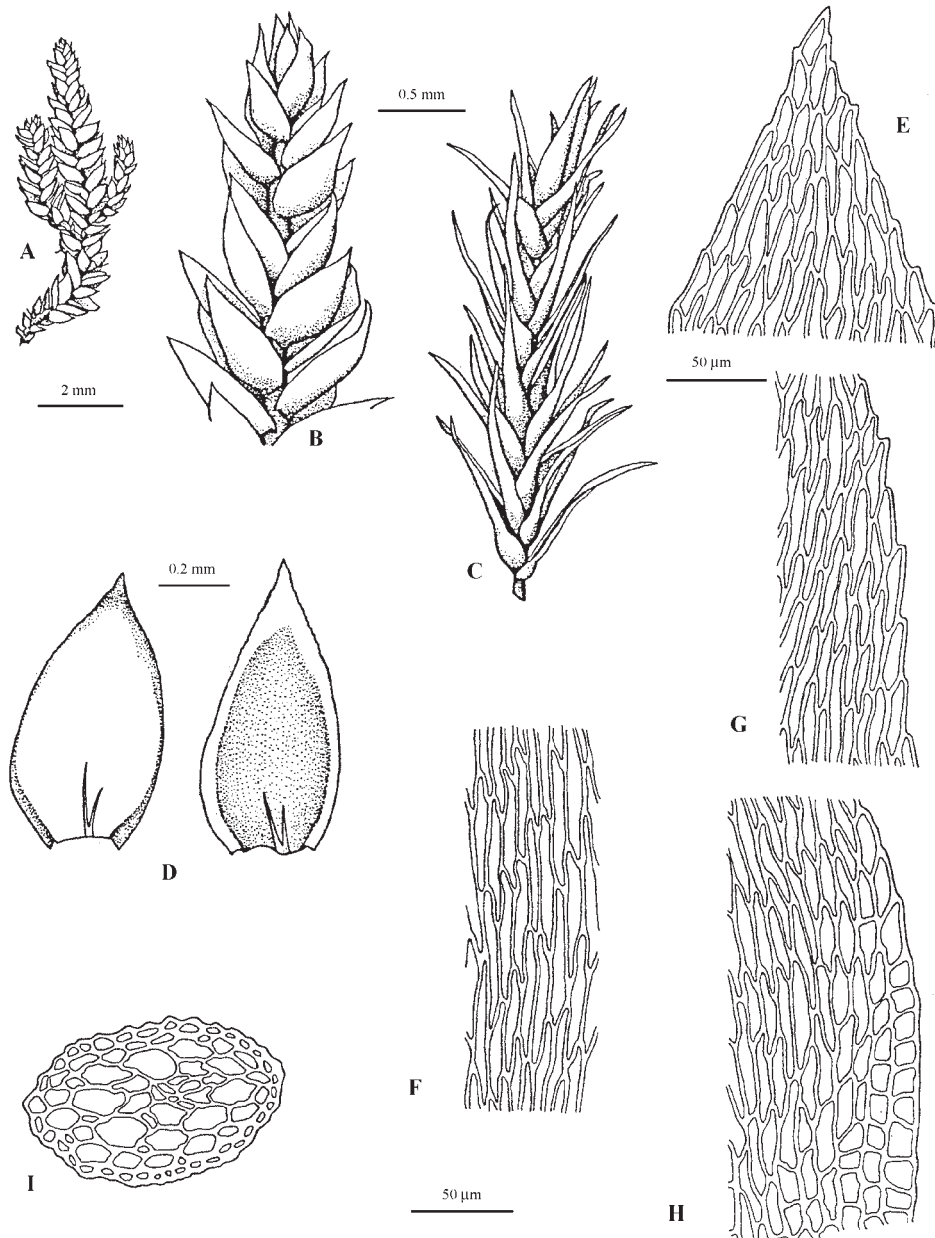


FIGURE 31. *Pseudotaxiphyllum richardsii*. A. Habit. B. Enlargement of apical portion of stem (wet). C. Enlargement of apical portion of stem (dry). D. Leaves. E. Apical leaf cells. F. Median leaf cells. G. Marginal leaf cells. H. Cells of alar region. I. Cross section of stem. A, D–I from Richards & Drouet 757 (F, holotype); B, C from Harvey 1669a (MICH).

composed of numerous quadrate to short-rectangular cells; and autoicous sexual condition.

Specimens examined: MEXICO. Nayarit: Mpio. Acaponeta, near Labra along trail W of Jesús Maria, Norris & Taranto 14132 (MICH, TENN). Sonora: 15.2 km NE of Baviácora, Richards, Drouet & Lockhart 676 (F, FH, MICH, TENN, US); canyon 24.8 km SW of Cumpas,

Richards, Drouet & Lockhart 722 (F, FH, MICH, NY, US); on side of Cerro Agua Caliente, along Río de los Alisos, near Imuris, Richards & Drouet 749 (F, FH, MICH, NY, TENN, US); on side of mountain just W of Alamos, Richards & Drouet 780 (F, MICH, US); Cañon de Huépari, N of Aribabi, 1310 m, Harvey 1669a (MICH); Cajón de la Higuera, near Moctezuma, White 349, 362,

366a, 367, 376, 390 (MICH); Río Moctezuma, Moctezuma, *White* 328, 329, 331, 348, 349 (MICH); Arroyo el Sance, near Moctezuma, *White* 318 (MICH).

***Pseudotaxiphyllum* Excluded Taxa**

Pseudotaxiphyllum machrisianum (H. A. Crum) Ireland, *Caldasia* 16(78): 267. 1991. *Taxiphyllum machrisianum* H. A. Crum, *Los Angeles County Mus. Contr. Sci.* 18: 5. 1957; *Isopterygium machrisianum* (H. A. Crum) Ireland, *Bryologist* 87: 356. 1985; *Symphyodon machrisianus* (H. A. Crum) W. R. Buck & Ireland, *Bryologist* 95: 433. 1992. Type: Brazil, 4 km N of Veadeiros, Chapada dos Veadeiros, Goiás, *Dawson* 14743a (isotypes: CANM!, FH!).

This species was sterile when it was described from a Brazilian collection as a *Taxiphyllum* by Crum (1957), who at that time expressed some doubts about its placement in the genus. All subsequent specimens examined by the authors from Mexico, Costa Rica, Nicaragua, Colombia, Venezuela, and Brazil were also sterile. However, the junior author discovered that the gametophytes of *T. machrisianum* and *Symphyodon americanus* were similar. Steere (1982) described *S. americanus* from plants with sporophytes from Colombia and sterile plants from Ecuador. The sporophytes of this species have capsules covered with single-celled spines and setae that are strongly mammillose or papillose a short distance below the capsules. These features are both typical of species of *Symphyodon* but not of the smooth capsules and setae possessed by *Taxiphyllum*, *Pseudotaxiphyllum*, or *Isopterygium*, where *T. machrisianum* had been placed at one time or another (see list of synonyms above). Because the specific name of the *Taxiphyllum* antedated that of the *Symphyodon*, it necessitated a new combination, *S. machrisianus* (H. A. Crum) W. R. Buck & Ireland (Buck and Ireland, 1992). However, only two years later, Churchill (1994) discovered that the species was synonymous with *S. imbricatifolius* (Mitt.) S. P. Churchill from the West Indies and Central and South America.

12. *Puiggariopsis* Menzel

Puiggariopsis Menzel, *J. Hattori Bot. Lab.* 71: 239. 1992, *nom. nov.*; *Puiggariella* Broth. in Engl. & Prantl, *Nat. Pflanzenfam.* 1(3): 1046. 1908, *hom. illeg., non* Speg., *Anales Soc. Ci. Argent.* 12: 99. 1881 (= *Strigula* Fr., *Strigulaceae*). Type: *Puiggariella aurifolia* (Mitt.) Broth.

This is a monospecific genus with the characters of the species.

Puiggariopsis aurifolia

Puiggariopsis aurifolia (Mitt.) Menzel, *J. Hattori Bot. Lab.* 71: 239. 1992; *Ctenidium aurifolium* Mitt., *J. Linn. Soc., Bot.* 12: 509. 1869; *Puiggariella aurifolia* (Mitt.) Broth. in Engl. & Prantl, *Nat. Pflanzenfam.* 1(3): 1047. 1908. Type: Brasilia tropica, *Burchell* 2275 (holotype: NY!; isotype: BM!).

Pilotrichum disciflorum Geh. & Hampe, *Flora* 64: 403. 1881; *Puiggariella disciflora* (Geh. & Hampe) Broth. in Engl. & Prantl, *Nat. Pflanzenfam.* 1(3): 1047. 1908. Type: Brazil. *Apiahy*, Apr 1879, *Puiggari* 618 (holotype: BM!; isotype: H!).

Papillaria rutenbergiacea Müll. Hal., *Hedwigia* 40: 90. 1901. Type: Brazil. Rio de Janeiro, ad truncos arborum montis Tijuca, Nov 1893, *Ule* 1697 (isotypes: H!, US!).

Plants in medium-sized to robust mats, yellowish green. Stems 2–3(–5) cm long, ascending to arching, rarely creeping, subpinnately branched, sometimes becoming flagelliform; stems in cross section lacking a hyalodermis, with a few rows of small, thick-walled cells and large, thin-walled cells in center, central strand present; rhizoids finely papillose, reddish brown, on ventral side of stem; paraphyllia present, narrowly lanceolate; pseudoparaphyllia foliose; axillary hairs reddish brown, consisting of 2–4, short basal cells and (1–)2–3(–5) elongate, distal cells. Asexual reproductive bodies lacking. Branch and stem leaves differentiated; stem leaves 1.9–2.2 mm long, 0.9–1.3 mm wide, imbricate, julaceous, erect to spreading, weakly secund, ovate, gradually acuminate with the acumen twisted, plicate, shortly decurrent; margins plane, serrulate throughout; costa double, separated at base, to $\frac{1}{4}$ the leaf length; median cells (30–)45–55 (–65) \times \sim 2.5 μ m (lumen; \sim 5 μ m including walls), linear, thick-walled, porose, upper cells prorulose at upper ends on abaxial surface, becoming shorter, broader, thicker-walled and smooth toward the insertion; alar cells deeply excavate, weakly differentiated, rectangular, thick-walled, porose. Branch leaves 1.3–1.9 mm long, 0.6–0.8 mm wide, smaller and narrower than stem leaves. Dioicous. Perichaetial leaves erect, oblong-obovate, abruptly acuminate, not plicate; margins weakly serrulate above. Setae 15–18 mm long, smooth, reddish brown; capsules 1.0–1.5 mm long, 0.8–1.0 mm wide, inclined to horizontal, ovoid, strongly constricted below the mouth when dry; operculum \sim 1.2 mm long, obliquely conic-rostrate; exostome teeth yellowish, with a zigzag center line, on front surface cross-striolate with overlying papillae below, irregularly striolate with overlying papillae toward middle, papillose

above; endostome almost smooth, with a low basal membrane, nearly as high as exostome teeth, keeled, narrowly perforate, cilia 1–2, rudimentary or absent. Spores too few to accurately determine size, appearing spherical, finely papillose. Calyptrae cucullate, densely hairy.

Distribution and ecology: Known from Mexico to Nicaragua, southern Brazil, Venezuela, and Peru; usually growing on tree trunks and branches, less often on rocks or soil, at (200–)700–1000(–1800) m.

Illustrations in publications: Fig. 780 (as *Puiggariella aurifolia* (Mitt.) Broth.) in Nishimura and Ando (1994: 1052); Fig. 182E–H (as *Puiggariella aurifolia* (Mitt.) Broth.) in Bartram (1949: 412).

Discussion: This distinctive moss is recognized by its differentiated branch and stem leaves with prorulose laminal cells. The leaves are plicate and short-decurrent, with strongly excavate but otherwise weakly differentiated alar cells. The genus is unique among the Latin American Hypnaceae by the presence of paraphyllia. The densely hairy calyptra is also distinctive. Although Nishimura et al. (1984) defined the Hypnaceae as lacking paraphyllia, he (Nishimura, 1989) appears to make an exception for this genus.

The description of the spore shape and ornamentation was taken from Nishimura (1989), who saw only 2–3 spores in a scanning electron microscope study of the peristome. However, the few spores that he observed were not enough to determine their size (N. Nishimura, Okayama University of Science, Japan, personal communication).

Selected specimens examined: **MEXICO. Oaxaca:** 59 km NE de Llano de las Flores, *Delgadillo 854* (MEXU, NY). **Puebla:** El Cerro de Cuhuatepetl, Tehuacan, *Santos 3329* (FH, MICH, NY). **Veracruz:** El Esquilón, 1300 m, *Buck 35534* (NY). **GUATEMALA. Alta Verapaz:** Near Chirriacté, *Standley 91604* (FH). **Baja Verapaz:** Civija, *Sharp 5193* (FH, MICH, NICH). **NICARAGUA.** Without locality, *Garnier 5053* (FH, MICH). **BRAZIL. Paraná:** Banhado, *Dusén 12177* (BM, FH, MICH, NY). **Rio de Janeiro:** Type of *Papillaria rutenbergiacea*. **Rio Grande do Sul:** Bom Jesús, *Sehnem 211* (FH, NY). **Santa Catarina:** Nova Venezia, *E. Ule 1186* (H). **São Paulo:** Mpio. Eldorado Paulista, *Vital & Buck 12543* (NY, SP).

13. *Pylaisia* Schimp. in Bruch, Schimp. & W. Gümbel

Pylaisia Schimp. in Bruch, Schimp. & W. Gümbel, Bryol. Eur. 5: 87. 1851, *nom. cons.*; *Isothecium* subg. *Pylaisia* (Schimp.) Boulay, Musc. France 146. 1884; *Pylaisiella* Kindb. ex Grout, Bull. Torrey Bot. Club 23: 228. 1896. Type: *Pylaisia polyantha* (Hedw.) Schimp.

Thedenia Schimp. in Bruch, Schimp. & W. Gümbel, Bryol. Eur. 5: 83. 1852, *hom. illeg.* Type: *Thedenia suecica* Schimp. in Bruch, Schimp. & W. Gümbel.

Giraldiella Müll. Hal., Nuovo Giorn. Bot. Ital. n.s. 5: 192. 1898. Type: *Giraldiella levieri* Müll. Hal.

Plants small to large, in often extensive mats, yellowish green to dark green. Stems creeping, regularly or irregularly pinnately branched; stems in cross section lacking a hyalodermis, with small, thick-walled cells around large, thin-walled cells, central strand small; rhizoids smooth, reddish, emerging from dorsal surface of stem in rows at leaf bases; paraphyllia none; pseudoparaphyllia foliose; axillary hairs with 1 short, brown basal cell and (1–)2–3 elongate, hyaline apical cell(s). Asexual reproductive bodies only known from protonematal buds. Stem and branch leaves differentiated or not; stem leaves straight to falcate, narrowly oblong-lanceolate to ovate, acuminate, not or somewhat plicate, not decurrent; margins plane or recurved, subentire to serrulate above; costa short and double or none; cells linear or linear-rhomboidal, smooth, firm-walled; alar cells well-differentiated, mostly numerous, subquadrate to short-rectangular. Autoicous. Perichaetial leaves erect, oblong-lanceolate, acuminate, margins serrulate at shoulders. Setae smooth, twisted; capsules erect, ovoid to oblong-cylindrical, not constricted below the mouth when dry; annulus differentiated or lacking; operculum conic to obliquely rostrate; exostome erect when moist, incurved when dry, on front surface smooth below, sometimes papillose above, scarcely trabeculate at back; endostome free or fused to exostome teeth, mostly papillose, with a high to low basal membrane, segments keeled, perforate or not, cilia rudimentary. Spores spherical, papillose. Calyptrae cucullate, smooth, naked.

Distribution: *Pylaisia* is a genus of 15 species, primarily distributed in eastern Asia, but with a handful of species being circumboreal. Two of these extend into Mexico. *Pylaisia falcata* is the only species extending into the Southern Hemisphere. The species are almost all exclusively tree trunk epiphytes, although they may persist on fallen trees.

Discussion: *Pylaisia* has long been known in North America under the name *Pylaisiella* because of paronymy of the name. However, *Pylaisia* was recently conserved. The genus is characterized by epiphytic pleurocarps with erect capsules. The branches are often curved when dry, and the leaves are somewhat falcate with often well developed alar regions. *Pylaisia* is uniquely characterized among its near relatives, *Platygyrium* and *Platygyriella*, by

the autoicous sexual condition, foliose pseudoparaphyllia, and exostome teeth smooth on the front surface.

Arikawa (2004) recently revised *Pylaisia* for the world.

KEY TO THE SPECIES OF PYLAISIA

1. Alar regions extending up the margins by more than 15 cells 3. *P. selwynii*
 1. Alar regions extending up the margins by less than 15 cells 2
 2. Endostome segments perforate; spores 25–40 µm in diameter; alar regions extending up the margins by only 2–6 cells. . . .
 1. *P. falcata*
 2. Endostome segments not perforate; spores 11–14 µm in diameter; alar regions extending up the margins by 8–10 cells. . . .
 2. *P. polyantha*

1. *Pylaisia falcata*

Pylaisia falcata Schimp. in Bruch, Schimp. & W. Gümbel, Bryol. Eur. 5: 89. 1851; *Stereodon falcatus* (Schimp.) M. Fleisch. ex Broth. in Engl., Nat. Pflanzenfam. ed. 2, 11: 452. 1925, *hom. illeg., non* Dozy & Molk.; *Pylaisiella falcata* (Schimp.) Ando, Phyta 1: 14. 1978. Type: Mexico. Orizaba, *Liebmann* (holotype: BM!; isotypes: H, PC).

Pylaisia subfalcata Schimp. in Bruch, Schimp. & W. Gümbel, Bryol. Eur. 5: 89. 1851; *Stereodon subfalcatus* (Schimp.) M. Fleisch. ex Broth. in Engl., Nat. Pflanzenfam. ed. 2, 11: 452. 1925; *Stereodon falcatus* var. *subfalcatus* (Schimp.) Thér., Rev. Bryol. Lichénol. 5: 110. 1933. Type: Mexico. *Liebmann 9/42* (lectotype: BM, designated by Arikawa, 2004).

Stereodon hamatus Mitt., J. Linn. Soc., Bot. 12: 533. 1869; *Hypnum hamatum* (Mitt.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1877–78: 312. 1880, *hom. illeg., non* Dozy & Molk.; *Pylaisia hamata* (Mitt.) Cardot, Rev. Bryol. Lichénol. 38: 103. 1911; *Hypnum mittenohamatum* B. C. Tan, Mem. New York Bot. Gard. 68: 5. 1992. Type: Ecuador. Andes Quitenses, in montibus Chimborazo, *Jameson* (lectotype: NY!, designated by Arikawa, 2004); Colombia. Andes Bogotenses, ad viam inter Tipaquirá et Pacho, *Weir 265* (syntype: NY!); Ecuador. Pichincha, *Spruce 1046* (syntype: NY!).

Pylaisia macrotis Cardot, Rev. Bryol. 37: 10. 1910. Type: Mexico. Las Chipans, district de San Cristobal, 23 Dec 1907, *Münch s.n.* (holotype: PC).

Pylaisia panduraefolia Herzog, Biblioth. Bot. 87: 126. 1916; *Stereodon pandurifolius* (Herzog) Broth. in Engl., Nat. Pflanzenfam. ed. 2, 11: 452. 1925. Type: Bolivia. In Hochland von Totorá, *Herzog 5123* (holotype: JE; isotypes: L, M, S).

Pylaisia falcata var. *intermedia* Thér., Smithsonian Misc. Collect. 78(2): 28. 1926; *Stereodon falcatus* var. *intermedius* (Thér.) Thér., Rev. Bryol. Lichénol. 5: 110. 1933. Type: Mexico. Vicinity of Puebla, Esperanza, *Arsène 4667* (lectotype: PC, designated by Arikawa, 2004).

Plants large, in mats, glossy, yellow-green. Stems to 5 cm long, creeping, regularly to irregularly pinnately branched, the branches 5–10 mm long, usually creeping, rarely ascending and curved. Leaves falcate-secund, ovate to narrowly oblong-ovate, ± gradually long-acuminate, stem leaves 1.6–2.2 mm long, 0.6–0.9 mm wide, branch leaves 1.6–1.9 mm long, 0.4–0.6 mm wide, concave, not plicate; margins plane, subentire to serrulate above; costa short and double or none; median cells 50–70 × 3–4 µm, linear; alar cells subquadrate, extending up the margins by 2–6 cells, in 6–10 rows across the insertion. Perichaetial leaves to 2.3 mm long, oblong-ovate, convolute, gradually long-acuminate; margins serrulate at shoulders. Setae 15–25 mm long, red-brown, sinistrorsely twisted in lower 2/3 and dextrorsely twisted in upper 1/3 when dry; capsules 1.5–2.5 mm long, cylindrical, yellowish to reddish brown; operculum obliquely short-rostrate; exostome teeth ~250 µm long, smooth below, finely papillose above; endostome free or somewhat adherent to the exostome teeth below, with a low, smooth, basal membrane, endostome longer than the exostome teeth, densely papillose-spiculose, keeled, perforate, sometimes bifid, cilia rudimentary. Spores 25–40 µm in diameter, papillose.

Distribution and ecology: Known from Mexico to Bolivia; also in eastern Asia (China and Nepal); growing on tree trunks and logs at 2000–4000 m.

Illustrations in publications: Pl. 753 (as *Pylaisiella falcata* (Bruch, Schimp. & W. Gümbel) Ando) in Ando (1994: 1014); Fig. 25 in Arikawa (2004: 110); Fig. 175H–J (as *Stereodon falcatus* (Schimp.) M. Fleisch.) in Bartram (1949: 397).

Discussion: *Pylaisia falcata* is the most common Latin American species of the genus and also the one with the largest plants. It is characterized by its large size, falcate-secund leaves, narrow laminal cells, relatively few quadrate alar cells, papillose-spiculose endostomial segments, and large spores.

Selected specimens examined: **MEXICO.** Chiapas: Cima del Cerro Mozotal, 30 km NW of Motzintla, *Delgado* M. 4771 (MEXU, NY). **Distrito Federal:** Cima, *Pringle* 10521 (MO, NY). **Durango:** 30 km W of El Salto, *Sharp* 1846 (NY). **Hidalgo:** Cerro Xihuingo, al N de Tepeapulco, 2750 m, *Cárdenas* S. 1730 (MEXU, NY); above Real de Monte, 2852 m, *Sharp* 506 (US). **Jalisco:** El Cuartón, above Manantlán, *Crum* 1199 (MICH, NY). **México:** Mpio. San Martín de las Pirámidas, Cerro Gordo, *Buck* 21486 (NY). **Michoacán:** Hills of Patzcuaro, *Pringle* 749b (NY). **Oaxaca:** Summit of Cerro Yucuyacua, ~12 km S of Tlaxiaco, *Hallberg* 1085 (NY). **Puebla:** Esperanza, *Purpus* 4290 (MO, NY). **Veracruz:** Slope of Mt. Orizaba, 3050 m, *Smith* 15 p.p. (NY). **GUATEMALA.** Huehuetanango: Sierra de los Cuchumatanes, along road beyond La Pradera, Km 32, *Standley* 81795 (NY). **Sololá:** Sierra Madre Mountains, Cerro María Tecum, *Williams et al.* 41755B (MO). **Totonicapán:** Along road between San Francisco El Alto and Momostenango, *Standley* 84028 (NY). **COSTA RICA.** **Cartago:** S slope of Volcán Irazu, on highway about 5 km NE of Finca Robert, *Holm & Iltis* 1176 (G). **San José:** Cerro de la Muerte, ~4.1 km NW of Villa Mills, *Koch* 5083 (NY). **PANAMA.** **Chiriquí:** Along road from gatehouse to summit of Volcán Baru, *Allen* 9149 (MO, NY). **COLOMBIA.** **Antioquia:** Mpio. de Sonsón, 10.7 km E de Sonsón hacia Nariño/Argelia, *Churchill & Sastre-De Jesús* 13013 (NY). **Boyacá:** Mpio. de Duitama, al lado de páramo Rusia, *Churchill et al.* 19061 (NY). **Caldas:** Mpio. de Vállamaria, cerca de Km 214, carretera a Nevado del Ruíz, *Churchill & Betancur* 17934-B (NY). **Cauca:** Mpio. de Coconuco, ~18 km E de Puracé, *Churchill & Rengifo* M. 17287 (NY). **Cundinamarca:** Along trail NE from Bogotá (via La Calera) to Mundo Nuevo, 2593–3050 m, *Steere* 7725 (NY). **Nariño:** Mpio. de Pasto, 3 km E de Dolores, *Ramírez* P. 3612 (NY). **VENEZUELA.** **Mérida:** Páramo de Los Granates, al rededor de El Chimborazo, un sector del páramo do Los Granates, *Griffin III & López F.* PV-1092 (NY); Distr. Rivas Davila, páramo La Negra, above town of Bailadores, *Griffin III et al.* 1992 (NY). **ECUADOR.** **Azuay:** 0–2 km W of Laguna Llaviucu, ~10 km WNW of Sayausí, 3200 m, *Løjtnant et al.* 14761 (NY). **Carchi:** Tulcán–El Angel road, 34 km S of Las Juntas, 3550 m, *Balslev* 901 (NY). **Chimborazo:** 11 km E of Alao, 3526 m, *Dorr & Barnett* 6224 (NY). **Imbabura:** Cotocachi–Apuela road, 3111 m, *Steere* 26636 (NY). **Napo:** 6 km E of Papallacta, 2880 m, *Buck* 9968 (NY). **Pichincha:** Road Chillogallo–Chiriboga, 3000 m, *Holm-Nielsen* 18658 (NY). **PERU.** **Cajamaraca:** Prov. Celendin, östlich des Passes zwischen Celendin und Balas, *Hegewald & Hegewald* 6659 (NY). **BOLIVIA.** See type of *Pylaisia panduraefolia* Herzog.

2. *Pylaisia polyantha*

Pylaisia polyantha (Hedw.) Schimp. in Bruch, Schimp. & W. Gümbel, Bryol. Eur. 5: 89. 1851; *Leskea polyantha* Hedw., Sp. Musc. Frond. 229. 1801; *Hypnum polyanthum* (Hedw.) Dicks., Fasc. Pl. Crypt. Brit. 4: 17. 1801; *Pterogonium polyanthos* (Hedw.) Muhl., Cat. Pl. Amer. Septentrionalis 98. 1813; *Isothecium polyanthum* (Hedw.) Spruce, Musci Pyren. 79. 1847; *Streodon polyanthos* (Hedw.) Mitt., J. Proc. Linn. Soc., Bot., Suppl. 1: 94. 1859; *Pylaisiella polyantha* (Hedw.) Grout, Bull. Torrey Bot. Club 23: 229. 1896. Type: Ad truncos arborum annosarum, maxime salicum remotius ab earum basi in Germania, Anglia (lectotype: G, designated by Geissler in Margadant and Geissler, 1995).

See Arikawa (2004) for additional synonymy based on non-Latin American types.

Plants rather small, in low mats, glossy, yellow-green to bright green. Stems to 2 cm long, prostrate, regularly pinnately branched, the branches to 1 cm long, usually creeping, rarely ascending and curved. Leaves mostly straight, ovate-lanceolate, gradually long-acuminate, stem leaves 1.3–2.0 mm long, 0.4–0.5 mm wide, branch leaves 1.1–1.4 mm long, 0.3–0.5 mm wide, concave, slightly plicate; margins plane or slightly involute above, serrulate above; costa short and double; median cells 50–80 × 4–5 µm, linear; alar cells subquadrate to short-rectangular, extending up the margins by 8–10 cells, in 5–8 rows across the insertion. Perichaetial leaves to 1.4 mm long, oblong-lanceolate, abruptly short-acuminate; margins serrulate at shoulders. Setae 10–18 mm long, yellow- to red-brown, sinistrorsely twisted in lower 3/4 to 4/5 and dextrorsely twisted in upper 1/4 to 1/5 when dry; capsules 1.6–2.2 mm long, long-cylindrical, reddish brown; operculum obliquely conic; exostome teeth ~200 µm long, smooth below, finely papillose above; endostome free, with a well-developed, smooth, basal membrane, endostome longer than the exostome teeth, papillose, keeled, not perforate, cilia single, rudimentary. Spores 11–14 µm in diameter, finely papillose.

Distribution and ecology: Pan North Temperate, extending into eastern Mexico (Nuevo León, San Luis Potosí, Veracruz); occurring throughout North America, also in Europe, northern and central Asia, China, Japan, and Africa; growing on tree trunks at 2500–3600 m.

Illustrations in publications: Pl. 754 (as *Pylaisiella polyantha* (Hedw.) Grout) in Ando (1994: 1015); Fig. 16 in Arikawa (2004: 94); Fig. 560A–G in Crum and Anderson (1981: 1137); Pl. 343 in Ireland (1982: 600).

Discussion: This North Temperate species just barely makes it into the Neotropics. It is characterized by a moderate number of alar cells (intermediate number between *P. selwynii* and *P. falcata*), a free endostome with nonperforate segments, and small spores. Its branches are not ascending and curved as in *P. selwynii*, and the leaves are not falcate as in *P. falcata*.

Specimen examined: Mexico. Nuevo León: Main road up Cerro Potosi, just below summit, ~17 km NW of Galeana, 3600 m, 26 Jul 1985, *Whittemore 2721* (MO).

3. *Pylaisia selwynii*

Pylaisia selwynii Kindb., Ottawa Naturalist 2: 156. 1889; *Pylaisiella selwynii* (Kindb.) H. A. Crum, Steere & L. E. Anderson, Bryologist 67: 164. 1964. Type: Canada. Ottawa, Richmond Road, 15 May 1885, *Macoun s.n.* (holotype: S!; isotype: CANM!).

Plants small, in mats, glossy, yellow-green to dark green. Stems to 2 cm long, creeping, regularly pinnately branched, branches to 3 mm long, ascending and curved when dry. Leaves straight to secund, ovate, abruptly short-acuminate, stem leaves 0.9–1.2 mm long, 0.5–0.6 mm wide, branch leaves 0.7–0.9 mm long, 0.25–0.3 mm wide, not concave, not plicate; margins plane or slightly incurved above, serrulate above; costa short and double; median cells 25–45 × 4.3–7 µm, linear; alar cells oblate to short-rectangular, extending up the margins by 20–25 cells, in 6–10 rows across the insertion. Perichaetial leaves to 1.6 mm long, oblong-lanceolate, gradually long-acuminate; margins subserrulate above. Setae 10–15 mm long, yellow- to red-brown, sinistrorsely twisted in lower ½ and dextrorsely twisted in upper ½ when dry; capsules 1.0–1.6 mm long, cylindrical, reddish brown; operculum obliquely conic; exostome teeth ~150–200 µm long, smooth below, finely papillose above; endostome adherent to exostome teeth below, free above, with a well developed, smooth, basal membrane, segments extending beyond the exostome teeth, papillose, keeled, bifid with ½ of segment plus cilium united and adherent below to exostome teeth. Spores 16–25 µm in diameter, finely papillose.

Distribution and ecology: Reaching its southern limit in western and southern Mexico (Chiapas, Chihuahua, and Oaxaca in addition to those cited below); commonly occurring in eastern North America; and also known from eastern Asia, extending into central European Russia; growing on tree trunks.

Illustrations in publications: Pl. 752 (as *Pylaisiella selwynii* (Kindb.) Crum, Steere & L. E. Anderson) in Ando (1994: 1013); Fig. 31 in Arikawa (2004: 120); Fig. 558

in Crum and Anderson (1981: 1134); Pl. 341 in Ireland (1982: 598).

Discussion: This North Temperate species creeps into the Neotropics in western Mexico. It is characterized by ascending and curved branches, relatively short-acuminate leaves, relatively short laminal cells, numerous alar cells, an endostome adherent to the exostome teeth, and spores intermediate in size between *P. falcata* and *P. polyantha*.

Specimens examined: Mexico. Sonora: E of El Tigre, Cañon de Santa Rosa, *White 559* (UBC); Río de Bavispe, La Nacha, *White 4013* (S). Sinaloa: ~2.8 km E of Las Palmitas, along Hwy. 40, *Norris 20579* (UBC).

14. *Rhacopilopsis* Renaud & Cardot

Rhacopilopsis Renaud & Cardot, Rev. Bryol. 27: 47. 1900. Type: *Rhacopilopsis dupuisii* (Renaud & Cardot) Renaud & Cardot.

Hypnum sect. *Dimorphella* Müll. Hal., Flora 69: 523. 1886; *Dimorphella* (Müll. Hal.) Renaud & Cardot, Bull. Soc. Roy. Bot. Belgique 41(1): 101. 1904 [1905]. Type: *Hypnum pechuelii* Müll. Hal.

Acanthocradiella M. Fleisch., Musci Buitenzorg 4: 1381. 1923. Type: *Acanthocradiella flexilis* (Renaud & Cardot) M. Fleisch.

Plants in thin mats, often lustrous, soft, green to pale green. Stems creeping, irregularly to regularly pinnate, the branches complanate-foliate; stems in cross section without a hyalodermis, with small thick-walled cells surrounding larger thinner walled cells, central strand none; paraphyllia none; pseudoparaphyllia filamentous, but often 2–5-seriate at base, or rarely foliose; axillary hairs consisting of 1–2 short, brown basal cell(s) and 2–3 elongate, hyaline distal cells. Asexual reproductive bodies lacking. Stem and branch leaves somewhat differentiated, ventral, dorsal and lateral stem leaves sometimes differentiated, when differentiated the ventral ones symmetric, oblong-ovate, with a wide insertion, gradually long-acuminate, the dorsal ones somewhat asymmetric, ovate, gradually acuminate, concave, the lateral ones strongly asymmetric, ovate-oblong, ± abruptly acuminate, concave; stem leaf margins subentire to distantly subserrulate throughout, plane to recurved; costa short and double; cells long-hexagonal to linear, smooth but with thickened cell end walls giving the impression of prorulae, firm-walled, not porose; alar cells differentiated in extreme basal angles, not reaching the costa, 2–4 cells enlarged and inflated, ± oblong, sometimes colored, with a small group of subquadrate to short-rectangular cells directly above them, in lateral leaves

the enlarged cells sometimes only on one side of the costa. Branch leaves with dorsal and lateral leaves sometimes differentiated, when differentiated, the dorsal ones erect-spreading, symmetric, lanceolate, gradually acuminate, the lateral ones wide-spreading, asymmetric, oblong-ovate, gradually or ± abruptly acuminate, somewhat concave; all branch leaves with margins subentire to serrate throughout, the lateral leaves more strongly toothed, plane to narrowly recurved, especially above; costa short and double; cells linear to linear-flexuose, smooth, firm-walled, not porose, sometimes becoming shorter in the acumen; alar cells differentiated in extreme basal angles, only rarely reaching the costa, colored, 2–4 cells enlarged with a small group of rhomboidal to subquadrate cells directly above them. Dioicous. Perichaetial leaves erect, lanceolate-ovate, abruptly acuminate, margins sometimes strongly toothed above. Setae smooth, red or orange; capsules inclined to horizontal, ovoid to short-cylindrical, constricted below the mouth when dry; operculum conic, mammillate to short-rostrate; exostome teeth on front surface cross-striolate below, papillose above; endostome finely papillose, about as long as the teeth, with a high basal membrane, segments keeled, perforate, cilia in pairs, about as long as the teeth. Spores spherical, finely papillose. Calyptrae unknown.

Distribution: Of the two species of *Rhacopilopsis* (Watling and O'Shea, 2000), one occurs in Latin America and Africa, while the other is strictly African; usually at low elevations.

Discussion: Although not obvious, once the differentiated dorsal and lateral branch leaves are noticed, *Rhacopilopsis* is unlikely to be confused with few genera. The often whitish green plants with complanate-foliate branches are also helpful characters for recognition. However, this generic definition only holds up for the single Latin American one, and not the African endemic *R. variegatum* (Welw. & Duby) Watling & O'Shea.

We have seen no sporophytes, and the descriptions provided here are adapted from that provided by Watling and O'Shea (2000). Bartram (1949: 414) described the setae as 1–2 cm long, the capsules small (~1 mm long) and nodding, the endostomial segments arising from a high basal membrane, and the spores 7–8 µm in diameter. Crum (1994b) reported the spores to be ~17 µm in Mexican plants.

According to Dixon (1922), the genus is monospecific and the American and African material is inseparable. However, Buck (1993) merged *Rhacopilopsis* with the African *Acanthocladiella*, resulting in a more speciose genus. The nonfalcate, mostly toothed leaves with a few inflated alar cells also hold the genus together. A recent mono-

graph (Watling and O'Shea, 2000) has reduced the number of species to two.

Rhacopilopsis trinitensis

Rhacopilopsis trinitensis (Müll. Hal.) E. Britton & Dixon in Dixon, J. Bot. 60: 88. 1922. *Hypnum trinitense* Müll. Hal., Syn. Musc. Frond. 2: 284. 1851; *Ectropo-thecium trinitense* (Müll. Hal.) Mitt., J. Linn. Soc., Bot. 12: 514. 1869. Type: Trinidad. Ad Maraccas, Arima et montem Touche, Aug et Dec 1844 et 1847, *Crüger* (syntype: BM!).

Dimorphella brasiliensis Broth. & Herzog in Herzog, Arch. Bot. Est. São Paulo 1: 86. 1925. Type: Brazil. Minas Gerais: Serra da Caraça, 22 Jan 1921, *Hoehne 8283 (173)* (isotype: BM!).

See Watling and O'Shea (2000) for additional synonymy based on African types.

Plants slender to medium-sized, in ± thin mats, lustrous, soft, mostly pale green. Stems to 10 cm long, long-creeping, often regularly pinnate, the branches complanate-foliate, less than 1 cm long; stems in cross section with 2–4 rows of small thick-walled cells surrounding larger thinner walled cells, central strand none; pseudoparaphyllia filamentous; axillary hairs consisting of 1 relatively long or 2 short, brown basal cell(s) and 2–3 elongate, hyaline distal cells. Stem and branch leaves somewhat differentiated, ventral, dorsal and lateral stem leaves strongly differentiated, the ventral ones 0.65–0.95 mm long, symmetric, oblong-ovate, gradually long-acuminate, the dorsal ones 1.0–1.3 mm long, somewhat asymmetric, ovate, gradually acuminate, concave, the lateral ones 0.85–1.2 mm long, strongly asymmetric, often cultriform, ovate-oblong, ± abruptly acuminate, concave; all stem leaves with margins distantly subserrulate throughout, plane; costa short and double; median cells long-hexagonal to linear, 8–20:1, smooth but with thickened cell end walls, giving the impression of prorulae, firm-walled, becoming thicker-walled and somewhat porose toward the insertion; alar cells mostly yellow, 2–4 cells enlarged in extreme basal angles, oblong, to 55 µm long, sometimes absent on one side of lateral leaves, with 5–12 rhomboidal to subquadrate cells directly above the enlarged ones. Branch leaves with dorsal and lateral leaves differentiated, the dorsal ones 0.8–1.1 mm long, half as many as the lateral ones, symmetric, erect-spreading, lanceolate, gradually acuminate, the lateral ones 1.1–1.3 mm long, somewhat asymmetric, wide-spreading, sometimes subfalcate, oblong-ovate, gradually or ± abruptly acuminate, somewhat concave; branch

leaf margins subentire to serrulate throughout, the lateral leaves more strongly toothed, plane or narrowly recurved above; costa short and double, rarely lacking; cells linear to linear-flexuose, 10–20:1, smooth, firm-walled, sometimes becoming shorter in the acumen, becoming thicker walled and somewhat porose toward the insertion; alar cells yellow, 3–5 cells enlarged in extreme basal angles, oblong, to 55 μm long, rarely absent on one side of lateral leaves, with 4–12 rhomboidal to subquadrate cells directly above the enlarged ones. Asexual propagula not seen. Dioicous. Perichaetial leaves long-attenuate; margins strongly toothed. Setae 17–30 mm long; capsules 1.8–2.5 mm long.

Distribution and ecology: Guatemala to Panama, northern South America, Brazil, Trinidad; elsewhere in central Africa and Madagascar; growing on tree trunks, especially at the bases, occasionally on logs, mostly in moist forests, at 400–900 m.

Illustrations in publications: Fig. 779 in Crum (1994b: 1051); Fig. 175 in Florschütz-de Waard and Veling (1996: 457); Pl. 121 in Buck (1998: 309); Fig. 143 in Buck (2003: 161); Fig. 183A–D in Bartram (1949: 415).

Discussion: The heterophyllous leaves with yellowed insertions are distinctive. The species is decidedly rare in the West Indies, although it is not uncommon in Trinidad, Central America, the Guianas, and northern Andean South America.

Although we have not critically evaluated Cardot's (1909: 50) two varieties—*Dimorphella pechuelii* ("i") (Müll. Hal.) Renauld & Cardot var. *acuminata* Cardot and *D. pechuelii* ("i") (Müll. Hal.) Renauld & Cardot var. *gracilis* Cardot—that were described from Africa but which have also been reported from the New World (Dixon, 1922), we are unconvinced for this treatment that they deserve taxonomic recognition.

Selected specimens examined: **GUATEMALA.** **Izabal:** Valley of tributary of Río San Francisco del Mar, 3.2 km NE of Hopi, 19.3 km E of Entre Ríos, 10–20 m, *Steyermark* 39779 (F). **HONDURAS.** **Yoro:** Cordillera Nombre de Dios, N slope, ridge between Río Guán Guán and Quebrada Aguacatal, *Allen* 13599 (MO, NY). **COSTA RICA.** **Alajuela:** Río Jesús (Santiago) de San Ramón, *Brenes* 20420 (NY). **Limón:** Up to 4 km inland from Green Turtle Station and village of Tortuguero, *Steere* CR-5 (NY). **San José:** Vicinity of El General, *Skutch* 2694 (MO, NY). **Puntarenas:** Cocos Island, without locality, *Holdridge* 5194 (NY). **PANAMA.** **Canal Area:** Pipeline road leading NW from Gamboa, *Crosby* 10800 (MO). **Chiriquí:** Cerro Colorado, Chami Camp vicinity Cerro Colorado Mine, *Allen* 5000 (MO, NY). **Colón:** Along Santa Rita Ridge, ~12.4 km NE from Boyd–Roosevelt Hwy., *Crosby* 4468 (MO).

Darién: Pirre Massif just W of Cana, *Allen* 8889 (MO). **Panamá:** 6.5 km by road N of Lago Cerro Azul, *Nee* 9325 (MO, NY). **Veraguas:** 0.3 km beyond fork in road at Escuela Agrícola Alto Piedra, *Croat & Folsom* 33939 (MO). **Isla Bahía Honda:** Without locality, *Taylor* 1110 (NY). **DOMINICA.** Syndicate Estate, ~8 km S of Portsmouth, 605 m, *Townsend* 91/296 (NY). **GUADELOUPE.** Vicinity of Grand Etang, 400 m, *Crosby & Crosby* 4800 (MO, NY). **MARTINIQUE.** Without locality, 1899, *Duss* 86 (NY). **TRINIDAD AND TOBAGO.** **Trinidad:** Morne Bleu, *Britton* 2301 (NY). **COLOMBIA.** **Arauca:** Mpio. de Tame, S de Tame, entre San Lope, 485 m, *Churchill et al.* 18941 (NY). **Boyacá:** Mpio. de Cubara, ~5 km E de Cubara, 300 m, *Churchill et al.* 18933 (NY); Casanare, Tauramena, 600 m, *Uribe* 4292(US). **Caquetá:** Transecto Neiva–San Vicente del Caguán, 1200–1300 m, *Churchill & Betancur* 16897 (NY). **Meta:** Cordillera La Macarena, *Schultes* 11157 (NY, US); 20 km SE of Villavicencio, 480 m, *Alston* 7581 (US). **Putumayo:** ~40 km NW of Puerto Asís, ~305 m, *King & Guevara* C-1136 (US). **Santander:** E of Hacienda El Playón, NW of Bucaramanga, 1220–1373 m, *Steere* 7638 (NY). **VENEZUELA.** **Amazonas:** Along Río Mawarinuma, just outside Cañon Grande of Cerro de la Neblina, 140 m, *Buck* 12933 (NY). **Apure:** Reserva Forestal San Camilo, 250–280 m, *Steyermark et al.* 101723 (NY,US), 101730, 101850 (US); Quebrada La Azulita, 280 m, *Steyermark et al.* 101607 (US); 4.5–5 km N of San Camilo, 280 m, *Steyermark et al.* 101789 (US). **Barinas:** Distr. Pedraza, trail from Mesa de Canagua to Cerro de Filón, 600–880 m, *Dorr et al.* 7842 (NY). **Bolívar:** Gran Sabana, San Ignacio de Yuruaní, 850 m, *Liesner* 24230 (MO, NY). **Sucre:** Peninsula de Paria, entre Manacal y Los Pocitos de Santa Isabel, 700–900 m, *Dumont et al.* VE-7496 (NY); Cerro de Río Arriba, vecindad de “Los Positos,” 700 m, *Steyermark & Rabe* 96298 (US). **Tachira:** Oeste de Ayari, 200 m, *Steyermark & Rabe* 96644 (US). **Yaracuy:** Quebrada Honda, 17.3 km del pueblo de Aroa, 1100 m, *Steyermark* 105405 (NY, US). **Zulia:** Sierra de Perija, valley of the Río Socuy, 2400–2800 m, *Griffin III* 161 (NY). Hato La Vergareña, ~75 km S of Cd. Piar, *Pursell* 8050 (US). **GUYANA.** **Upper Mazaruni Dist.:** Right bank of Mazaruni River, 05°52'N, 60°34'W, 473–641 m, *Robinson* 85-0081 (US). Kamakusa, along the upper Mazaruni River, *Leng* 4 (NY); NW portion of Kanuku Mountains, Mt. Iramaikpang, 850 m, *Smith* 3618 (NY, US); Essequibo River, Moraballi Creek, near Bartica, near sea level, *Richards* 241 (NY). **Potaro-Siparuni Region:** Kaieteur Natl. Park, 400 m, *Pipoly* 9904 (NY). **SURINAM.** **Sipaliwini:** Tafelberg, *Maguire* 24339 M₃ (NY), *Allen* 20549 (MO, NY). **FRENCH GUIANA.** **Approuague-Kaw:** Pic Matécho, 590 m, *Buck* 37969 (NY),

l'Inini Region: Mont Atachi Bacca, 03°33'N, 53°55'W, 670 m, *Cremers et al.* 10444 (US). **Maripasoula:** Commune de Saül, vicinity of Eaux Claires, 200 m, *Buck* 18354 (NY). **Roura:** Kaw Mountains, Trésor Réserve Naturelle, 300 m, *Buck* 37769 (NY). **ECUADOR. Napo:** 6 km along Río Pano, 0°58'S, 77°52'W, 600 m, *Holm-Nielsen & Jeppesen* 702a (US). **Pastaza:** Lorocachi, 2 km del Río Curaray, 200 m, *Jaramillo et al.* 30715 (NY). **Pichincha:** ~18 km NW of San Miguel de los Bancos, forest reserve of ENDESA, 800 m, *Buck* 10365 (NY). **PERU. Madre de Dios:** Los Amigos Biological Station, 250–320 m, *Majestyk* 4169 (NY). Near Pucallpa, Aug 1962, *Worthley s.n.* (US). **BOLIVIA. La Paz:** Franz Tamayo, Parque Nacional Madidi, 700–900 m, *Fuentes et al.* 4441 (MO, NY). **BRAZIL. Amapá:** Mpio. de Oiapoque, BR156 between Calçoene and Oiapoque, *Mori & Cardoso* 17108 (NY). **Mato Grosso:** Chapada dos Guimarães, Wasserfall Veú da Noiva, 500 m, *Schäfer-Verwimp & Verwimp* 8628 (NY). **Pará:** Serra do Cachimbo, Rio Jamanxím and vicinity, 300 m, *Reese* 16677 (NY, US); Serra Maze and vicinity, ~05°55'S, 55°40'W, ~100–200 m, *Reese* 16826 (US). **Roraima:** Pacaraima, 226 km N of Boa Vista, 1000 m, *Buck et al.* 1944 (NY).

15. *Syringothecium* Mitt.

Syringothecium Mitt., J. Linn. Soc., Bot. 12: 497. 1869.

Type: *Syringothecium sprucei* Mitt.

Plants small to medium-sized, in lax to dense mats, yellow-green. Stems creeping, irregularly but freely branched; stems in cross section lacking a hyalodermis, with a couple of rows of small, thick-walled cells and large, thin-walled cells in center, central strand absent; rhizoids smooth to slightly roughened, in clusters just below the leaf insertions; paraphyllia absent; pseudoparaphyllia filamentous; axillary hairs consisting of 1 short, brown basal cell and 2 elongate, hyaline distal cells. Asexual reproductive bodies lacking. Stem and branch leaves similar, soft, imbricate,

erect-spreading, lanceolate to ovate, acuminate, concave, nondecurent; margins plane or erect, sometimes recurved below, subentire to serrulate above, subentire below; costa short and double; cells linear, smooth, thin- to firm-walled, not porose; alar cells abruptly differentiated, few, quadrate, extending up the margin by a few cells. Autoicous. Perichaetial leaves erect, triangular-lanceolate, acuminate; margins plane. Setae smooth, straight, sometimes twisted, orange to reddish; capsules erect to suberect, cylindrical, not at all contracted below mouth; annulus poorly developed or not differentiated; operculum high-conic, bluntly rostrate; exostome teeth erect when dry, incurved when moist, bordered, on front surface at extreme base cross-striolate, finely papillose-spiculose above, scarcely projecting at back; endostome densely and finely papillose throughout from a medium high basal membrane, segments keeled, not or narrowly perforate, sometimes as tall but not taller than teeth, cilia none to single. Spores spherical, finely papillose or roughened. Calyptrae cucullate, smooth, naked.

Distribution: The two species of *Syringothecium* occur in terrestrial or epiphytic habitats at moderate elevations in South America.

Discussion: *Syringothecium* is distinguished by the endostome being as well developed or more so than the exostome. The endostome segments are very long, straight, erect and extend beyond the exostome teeth. In all the Latin American *Isopterygium* spp. the endostome segments are scarcely evident. The rhizoids are smooth to sometimes slightly roughened compared to the consistently smooth rhizoids of *Isopterygium*. Although traditionally placed in the Sematophyllaceae, the genus seems to be a segregate from *Isopterygium*. In fact, Buck (1989) synonymized the genus with *Isopterygium*. Although we suspect that the genus truly is derived from within *Isopterygium* (and thus making that genus paraphyletic), we are tentatively recognizing it here. Both species seem to be rare, and recent collections are unavailable for DNA sequencing. It seems to differ only from *Isopterygium* by the peristomial features upon which it was described.

KEY TO THE SPECIES OF SYRINGOTHECIUM

1. Leaves lanceolate, gradually long-acuminate, with erect or narrowly recurved margins; spores 8–10 µm in diameter 1. *S. brasiliense*
1. Leaves lanceolate-ovate to ovate, short-acuminate, with plane margins; spores 14–17 µm in diameter 2. *S. sprucei*

1. *Syringothecium brasiliense*

Syringothecium brasiliense Broth., Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 83: 338. 1926; *Isopterygium brasiliense* (Broth.) W. R. Buck, Bryologist 92: 531. 1989. Type: Brazil. Paraná: Serra do Mar, Ypi-

rango, ~800 m, in culmis Chusquearum, 17 Feb 1904, *Dusén* 3895 (lectotype: H!, designated by Buck, 1989; isolectotype: H!); *Dusén* 3894 (syntype: H!).

Plants in lax mats, yellowish green. Stems ~2 cm long, creeping, irregularly but freely branched, somewhat

complanate-foliate; stems in cross section with 1–2 rows of epidermal cells. Leaves 1.1–1.4 mm long, spreading to wide-spreading, somewhat contorted when dry, lanceolate, long-acuminate, concave; margins erect, sometimes narrowly recurved below, entire or subserrulate above, subentire below; costa short and double, rarely to 1/5 the leaf length; cells 5.5–6.5 μm wide, linear, mostly thin-walled, somewhat broader, to 9 μm in the acumen but not much shorter, shorter and broader in a single row across the insertion; alar cells few, rectangular to subquadrate, extending up the margin by 3–4 cells. Autoicous. Perichaetial leaves 1.4–2.0 mm long, erect, triangular-lanceolate, gradually long-acuminate; margins mostly erect, subentire to serrulate above. Setae 10–13 mm long, orange, straight, twisted; capsules 1–1.3 mm long, erect to suberect, cylindrical, not at all contracted below mouth; annulus apparently not differentiated; operculum ~0.75 mm long, high-conic, bluntly rostrate; exostome teeth ~600 μm tall, orange, lanceolate, strongly bordered, not shouldered, on front surface at extreme base cross-striolate, directly above that papillose-striolate, often in irregular patterns, finely papillose-spiculose above, scarcely trabeculate at back; endostome with a basal membrane of medium height, segments not perforate, extending to the height of the teeth but appearing taller in dry material, cilia usually single and short, sometimes rudimentary. Spores 8–10 μm in diameter, finely roughened.

Distribution and ecology: Known only from the type specimens in southeastern Brazil; growing on culms of bamboo.

Illustrations in publications: Figs. 9–15 in Buck (1989: 530).

Specimen examined: BRAZIL. Paraná. Seen only from the type collection.

2. *Syringothecium sprucei*

Syringothecium sprucei Mitt., J. Linn. Soc., Bot. 12: 497. 1869; *Isopterygium sprucei* (Mitt.) W. R. Buck, Bryologist 92: 529. 1989. Type: Ecuador. Andes Quitenses, Montaña de Canelos, 3000 ft., in forest, *Spruce 1517* (holotype: NY!; isotypes: NY-2!).

Syringothecium nemodontium Herzog, Hedwigia 67: 267. 1927. Type: Bolivia. Hacienda Simaco am Weg nach Tipuani, ~1400 m, Oct 1920, *Buchtien 121* (holotype: JE; isotypes: HI, BR!, US!).

Plants in dense mats, yellowish green. Stems ~3 cm long, creeping, irregularly but freely branched, somewhat complanate-foliate; stems in cross section with 1–2(–3) rows of epidermal cells. Leaves 0.8–1.2 mm long, erect-

spreading, little altered when dry, lanceolate-ovate to ovate, short-acuminate, concave; margins plane, subentire to serrulate above, subentire below; costa short and double, sometimes to 1/4 the leaf length; cells 4–6 μm wide, linear, becoming shorter in the acumen and across the sometimes yellowed insertion; alar cells few, quadrate, extending up the margin by 2–3 cells. Autoicous. Perichaetial leaves 1.4–1.9 mm long, erect, triangular-lanceolate, gradually long-acuminate; margins plane to erect, entire or laxly serrulate at apex; costa none; cells linear, firm-walled, becoming shorter and broader across the yellowed insertion. Setae 11–19 mm long, reddish; capsules ~1.5 mm long, erect to suberect, cylindrical, not at all contracted below mouth; annulus poorly developed, of 1–2 rows of small, quadrate cells, sometimes adhering to operculum; operculum ~0.8 mm long, high-conic, bluntly rostrate; exostome teeth ~430 μm high, reddish but becoming yellowish soon after operculum falls, lanceolate, strongly bordered, not shouldered, on front surface at extreme base cross-striolate, finely papillose-spiculose above, trabeculate at back; endostome with basal membrane of medium height, segments not or narrowly perforate only toward base, usually extending more than ~20 μm above the teeth, cilia none. Spores 14–17 μm in diameter, finely papillose.

Distribution and ecology: Rare and so far known only from Colombia, Ecuador, and Bolivia; usually growing on twigs and rotten wood at 1000–2100 m.

Illustrations in publications: Figs. 1–8 in Buck (1989: 530).

Specimens examined: COLOMBIA. Antioquia: Mpio. Guatapé, Finca Montepinar, ~15 km NNE de Guatapé, 06°18'N, 75°09'W, 1810–1840 m, *Churchill 16405* (NY); Mpio. Frontino, corregimiento Nutlbara, coenca alta del Río Cuevas, Finca “La Peña de la India,” 1880, *Sánchez et al. 698* (NY). Nariño: Mpio. Barbacoas, Corregimiento Altaquer, Vereda El Barro, Reserva Natural Río Nambí, 01°18'N, 78°08'W, *Giraldo et al. 1973* (NY). ECUADOR. Napo: Summit of Sierra de Guayamacas, new road between Tena and Baeza, 2100 m, on rotting log along road, 12 Jan 1982, *Steere E-131* (NY). BOLIVIA. Known only from the type locality of *S. nemodontium*.

16. *Taxiphyllum M. Fleisch.*

Taxiphyllum M. Fleisch., Musci Buitenzorg 4: 1434. 1922. Type: *Hypnum deplanatum* Schimp. ex Müll. Hal., Syn. Musc. Frond. 2: 260. 1851.

Plants medium- to large-sized, in thin to dense mats, glossy, light green to dark green or yellow-green. Stems complanate-foliate or sometimes terete, creeping, simple

or sparingly and irregularly branched, cortical cells small, thick-walled, central strand sometimes present; rhizoids smooth, in clusters below leaf insertion usually on ventral surface of stems; pseudoparaphyllia large to small, foliose; axillary hairs consisting of 1–3 short, brown basal cell(s) and 1 elongate, hyaline distal cell. Asexual reproductive bodies unknown. Stem and branch leaves similar, rigid or occasionally somewhat flaccid, crowded and imbricate to distant, erect, erect-spreading or wide-spreading, often complanate, rarely secund at the subjulaceous, tips, sometimes smooth or occasionally plicate, plane to concave, symmetric or nearly so, nondecurrent, ovate, ovate-lanceolate, oblong-lanceolate, oblong-ovate or linear-oblong, acute to subobtusate; margins plane or recurved, serrate to serrulate above, sometimes the serrations are bifid at the leaf apices (only in *T. laevifolium*), serrulate to entire below; costa lacking or short and double; cells firm-walled, linear-flexuose, rhomboidal near leaf apices, smooth or prorulose at upper ends on dorsal leaf surface, with walls not pitted; alar regions distinctly differentiated with 1 to several rows of quadrate to rectangular cells, or not to nearly undifferentiated. Dioicous or rarely synoicous, usually sterile; perigonia and perichaetia at base of stems and branches; perigonial bracts small, ovate; perichaetial bracts lanceolate to ovate, slenderly acuminate, spreading from an erect base; margins plane. Setae smooth, elongate, straight or somewhat flexuose, dark red to brown; capsules inclined to cernuous, straight to subarcuate, yellowish brown to reddish brown, smooth, oblong-ovoid, somewhat contracted below mouth and wrinkled at neck when dry; operculum obliquely rostrate, often shorter than urn; annulus present, persistent, of 2 rows of cells; 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 or approximately the same length as the segments, in groups of 1–3. Spores 7–28 μm in diameter, globose to ovoid, smooth to minutely papillose. Calyptra cucullate, smooth, naked.

Distribution: *Taxiphyllum* is a genus of approximately 30–35 species occurring in terrestrial habitats, primarily on calcareous substrates, in temperate, subtropical, or tropical regions.

Discussion: This is an easy genus of hypnaceous mosses to recognize because of the distinctive fish scale appearance of the leaves, especially evident at magnifications of $\sim 25\text{--}50\times$. Other more important distinguishing characters are the medium- to large-sized, simple or sparingly branched, complanate or subjulaceous, glossy plants, the small, thick-walled cortical stem cells, the smooth rhizoids on the stems below the leaf insertions, the presence of foliose pseudoparaphyllia, the nondecurrent, serrate to serrulate leaves, the lack of asexual reproductive bodies, the dioicous or rarely synoicous sexual condition, and the presence of an annulus.

Iwatsuki (1963) clarified the taxonomy of *Taxiphyllum*, while Ireland (1969) revised the genus in Canada and the United States and later published a synopsis (Ireland, 1986) of the North American taxa. Buck (1998) published a treatment of the genus for the West Indies and provided excellent illustrations for the four species that occur there. However, one species that he places in the genus, namely, *T. scapellifolium* (Müll. Hal.) Broth. in Engl., the senior author considers better placed in the genus *Mittenothamnium* (see Excluded Taxa).

KEY TO THE SPECIES OF TAXIPHYLLUM

1. Alar regions strongly differentiated with a large region of quadrate to short-rectangular cells, 3–9 differentiated cells extending up margins 1. *T. deplanatum*
1. Alar regions undifferentiated or weakly differentiated with only a few quadrate to short-rectangular cells, 1–5 differentiated cells extending up margins 2
 2. Leaves usually remote, wide-spreading to squarrose, acute to acuminate, rarely subobtusate; margins narrowly and indistinctly recurved 4. *T. taxirameum*
 2. Leaves usually close, erect-spreading, acute to obtuse, margins plane 3
 3. Leaves ovate- to oblong-lanceolate, apices broad, often irregularly notched with cells ending at different levels, 0.8–1.5 mm long, 0.4–0.7 mm wide 2. *T. laevifolium*
 3. Leaves linear-oblong, apices narrow, ending in a single or a few terminal cells, 0.9–2.5 mm long, 0.2–0.3 mm wide 3. *T. ligulaefolium*

1. *Taxiphyllum deplanatum*

FIGURE 32

Taxiphyllum deplanatum (Schimp. ex Müll. Hal.)
M. Fleisch., Musci Buitenzorg 4:1435. 1923. *Hypnum*

deplanatum Schimp. ex Müll. Hal., Syn. Musc. Frond. 2: 260. 1851; *Isopterygium deplanatum* (Schimp. ex Müll. Hal.) Mitt., J. Linn. Soc., Bot. 12: 498. 1869; *Plagiothecium deplanatum* (Schimp. ex Müll. Hal.) Spruce, J. Bot. 18: 289. 1880. Type: United States, *Sullivan*,

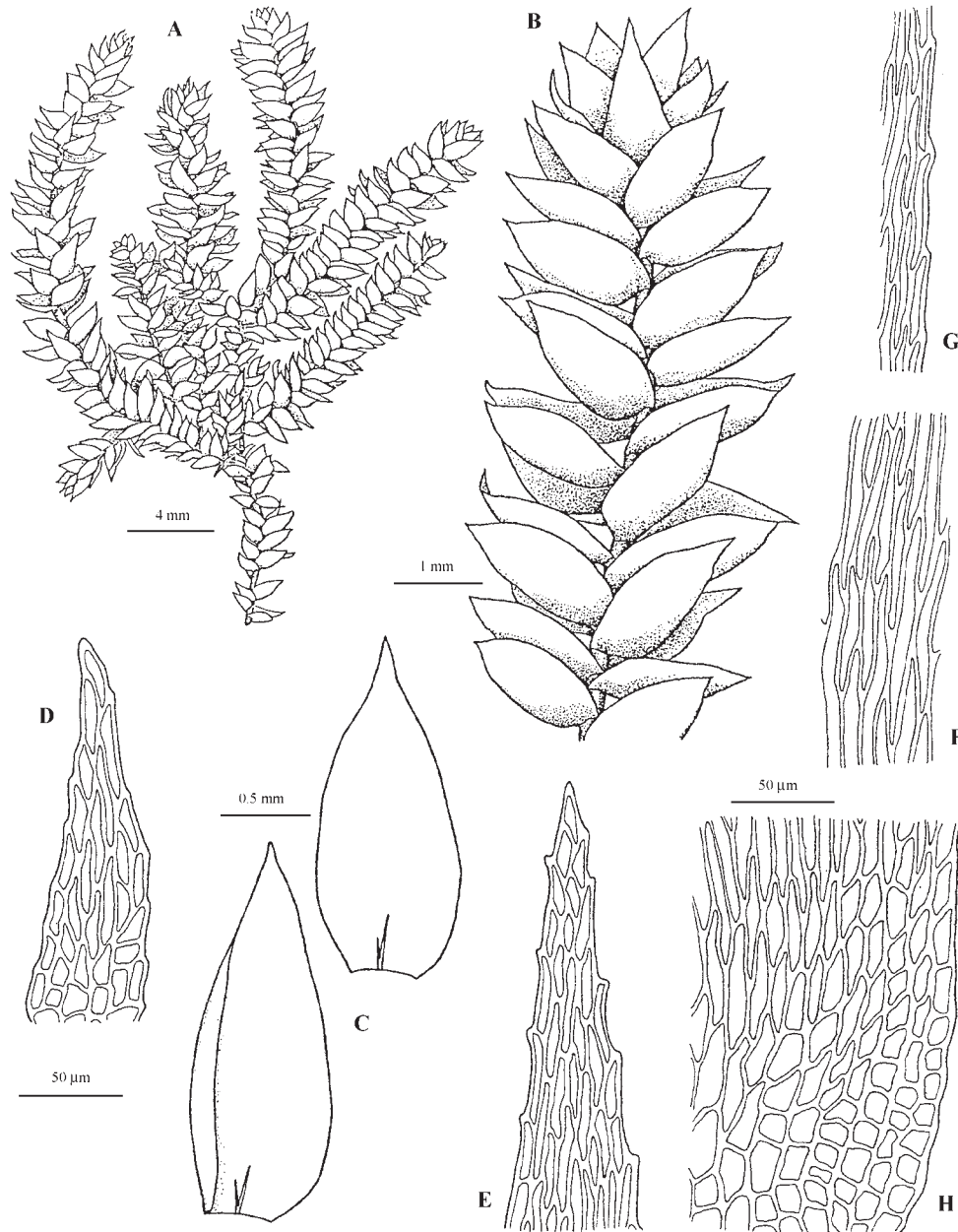


FIGURE 32. *Taxiphyllum deplanatum*. A. Habit. B. Enlargement of stem. C. Leaves. D. Pseudoparaphyllium. E. Apical leaf cells. F. Median leaf cells. G. Marginal leaf cells. H. Alar cells. Illustrations A, B drawn from *Sharp 3939* (TENN); C–H from *Sharp 8728b* (TENN).

Musci Allegh. 50 (lectotype: NY!, designated by Ireland, 1969); isolectotype: US!).

Isopterygium planissimum var. *laxirete* Thér., *Smithsonian Misc. Collect.* 85 (4): 43. 1931. Type: Mexico, Michoacán, vicinity of Morelia, Loma Santa María, 2000 m, *Arséne 4877* (isotypes: FH!, US!).

Plagiothecium deplanatum f. *ovatum* Grout, *Moss Fl. N. Amer.* 3(3): 161. 1932. Type: Arizona, Pima Co., Santa Catalina Mts., Mt. Lemmon, Up-

per Sabino Canyon, 2743 m, *Bartram, Mosses S. Arizona 161* (isotypes: CANM!, DUKE!, NY!, US!, WTU!).

Plants in thin to dense mats, glossy, light green to yellow-green. Stems to 2.5 cm long, 1–3 mm wide, complanate-foliate, simple or irregularly branched. Leaves 1.0–2.5 mm long, 0.4–1.0 mm wide, flaccid, usually crowded, imbricate, erect- to wide-spreading, somewhat concave or flat, smooth, ovate to ovate-lanceolate, symmetric to

somewhat asymmetric, acute or acuminate, somewhat contorted when dry; margins plane, serrate to serrulate above, serrulate below; costa very short and double or lacking; median cells $47\text{--}136 \times 5\text{--}9 \mu\text{m}$, smooth; alar cells strongly differentiated, quadrate to short-rectangular, in 1 to several rows with 3–9 cells in the marginal row. Sex organs and sporophytes not seen on Latin American plants. North American plants reported (Ireland, In press b) to be dioicous; perigonia unknown; perichaetia small, numerous, the bracts lanceolate to ovate-lanceolate, acuminate. Setae 0.7–1.0 cm long, yellowish brown to red, flexuose; capsules 0.8–1.5 mm long, cernuous, straight or arcuate, yellowish brown to light brown, oblong or ovoid, contracted below mouth and tapered to a wrinkled neck when dry; operculum 0.3–0.5 mm, obliquely rostrate; annulus present, persistent. Spores 11–13 μm in diameter.

Distribution and ecology: Rare or seldom collected; Mexico and Honduras (Figure 33); also in eastern and southwestern North America; on shaded soil or limestone boulders and cliffs, sometimes on bases of trees and exposed tree roots, at 1000–2600 m.

Discussion: *Taxiphyllum deplanatum* is recognized by the flaccid, light to yellow-green, complanate-

foliate plants, the imbricate, erect to wide-spreading, slightly concave or flat, ovate to ovate-lanceolate, acute or acuminate leaves with plane margins, and the noticeably differentiated alar regions of 1 to several rows of quadrate to short-rectangular cells with 3–9 differentiated cells in the marginal rows.

The Latin American plants of *T. deplanatum* are noticeably different from their North American counterparts in that the leaves are more distant, wide-spreading and they are somewhat contorted when dry. Microscopically, the plants were observed to be similar to the North American ones.

Specimens examined: **MEXICO.** **Durango:** ~14.5 km W of La Ciudad, 2637 m, *Bowers et al. 5083c* (CANM, TENN). **Hidalgo:** Above Tianguistengo, 3.2 km from Zacualtipan, 2100 m, *Sharp et al. 1825a* (CANM, TENN), 1837 (CANM, F, MEXU, TENN). **Morelos:** ~11 km above Cuernavaca, 2200 m, *Dürl 2/276* (MICH). **San Luis Potosí:** Just E of San Francisco, ~45 km E of San Luis Potosí at K[m]-218 along Hwy. 70, 4260 m, *Magill 2609* (MO, NY). **Tamaulipas:** Edge of Casa de Piedra, near Rancho del Cielo above Gómez Farias, *Sharp 8728b* (TENN); trail to Indian Spring, Rancho del Cielo above Gómez Farias, 1100–1200 m, *Iwatsuki & Sharp 4845* (TENN). **Veracruz:** Txolo Falls,

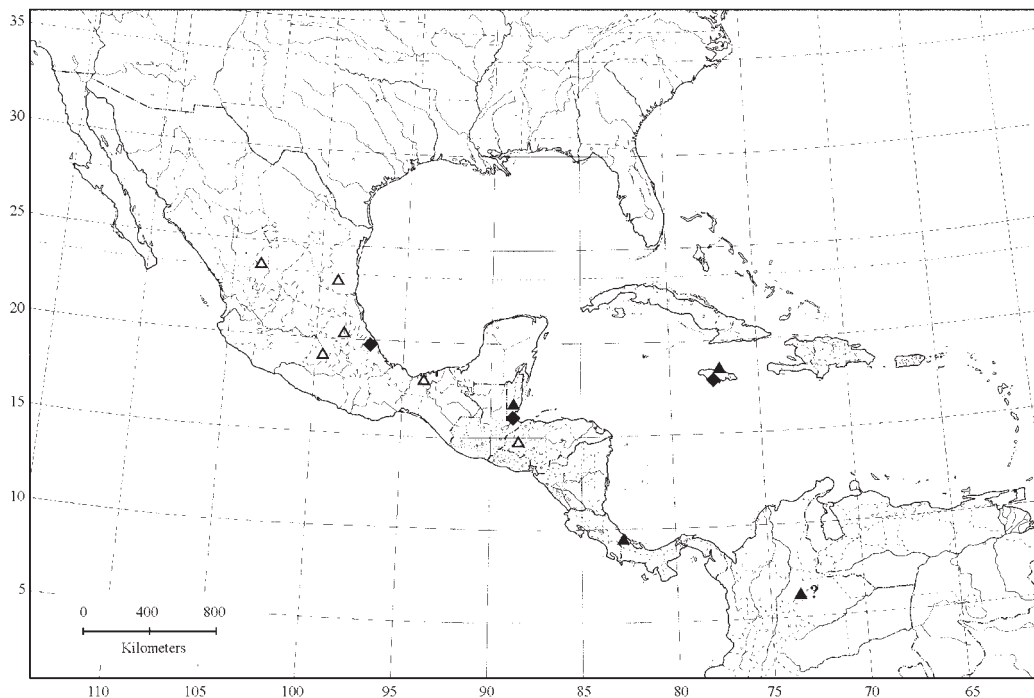


FIGURE 33. Distribution of *Taxiphyllum deplanatum* (Δ), *T. laevifolium* (\blacktriangle), and *T. ligulaefolium* (\blacklozenge) in Latin America. Colombia locality of *T. laevifolium* uncertain.

near Jalapa, 1006 m, *Sharp 3939* (MICH, TENN). HONDURAS. *Comayagua*: Vicinity of Siguatepeque, ~1050 m, *Standley & Chacón 6151* (F, FH).

2. *Taxiphyllum laevifolium*

FIGURE 34

Taxiphyllum laevifolium (Mitt.) W. R. Buck, Mem. New York Bot. Gard. 45: 521. 1987. *Ectropothecium laevifolium* Mitt., J. Linn. Soc., Bot. 12: 517. 1869. Type: Colombia, Andes Bogotenses, *Weir 425* (holotype: NY!).

Glossadelphus laevifolius (Mitt.) E. B. Bartram, Bull. Brit. Mus. (Nat. Hist.), Bot. 2: 49. 1955.

Plants in thin to dense mats, glossy, light green to yellow-green. Stems usually ~2 cm long, rarely to 7 cm, 1.5–2.0 mm wide, complanate-foliate, usually irregularly branched. Leaves 0.8–1.5 mm long, 0.4–0.7 mm wide, rigid, imbricate, erect to erect-spreading, slightly concave, smooth, ovate- to oblong-lanceolate, symmetric, or somewhat asymmetric, acute to obtuse, the apices broad, irregularly notched with the cells ending at different levels; margins plane, serrate to serrulate above, sometimes the serrations bifid at leaf apices, serrulate to entire below; costa lacking or weak, short and double; median cells 38–80 × 5–6 μm, smooth or often prulose at upper ends on dorsal surface; alar cells poorly differentiated, long- to short-rectangular or rarely quadrate, in a few rows with 1–4 cells in the marginal rows. Synoicous. Setae 1.2–1.5 cm long, red, flexuose; capsules 0.7–1.0 mm long, inclined, straight or nearly so, ovoid, often contracted below mouth when dry; operculum unknown; annulus present, persistent. Spores 23–28 μm in diameter.

Distribution and ecology: Rare or seldom collected; Mexico, Panama, Jamaica and Colombia (Figure 33); occurring on lava boulders, rocks in woods, beside streams and near waterfalls or on trunks of fallen trees, at ~700–1300 m. Also reported from Costa Rica, Galápagos Iss., Cocos Iss., and Dominica (Crum, 1994a, as *Glossadelphus laevifolius*).

Discussion: This species is distinguished by the rigid, light to yellow-green, complanate-foliate plants, the imbricate leaves that are erect to erect-spreading, slightly concave, ovate- to oblong-lanceolate with plane margins, acute to obtuse apices that are often irregularly notched with the cells ending at different levels, the serrate leaf margins at apices sometimes bifid and the poorly differentiated alar regions of a few rows of short-rectangular or rarely quadrate cells with 1–4 differentiated cells in the marginal rows.

The leaf margins in this species sometimes have bifid serrations on the apical leaf cells which is very unusual and it was only observed in the single collection from Veracruz, Mexico. This morphological feature was noted by H. A. Crum (1994a), who placed the species in the genus *Glossadelphus*. However, the illustration in Crum (1994a: fig. 747e) does not show the bifid teeth; they are instead shown for *G. ligulaefolius* (Crum, 1994a: fig. 747b). This is undoubtedly an error in the illustration of the species since the description states that *G. laevifolius* has “serrations often minutely bifid.” However, the Mexican plants may have much larger bifid serrations than shown in the illustration (see collection from Veracruz, Mexico, at TENN). No other species of *Taxiphyllum* is known to have bifid serrations from Latin America or, as far as we know, from anywhere else in the world. This could be a reason for placing this species in another genus, but further study is necessary to decide whether it belongs in *Glossadelphus* or another genus. Also, although Crum indicates that *G. laevifolius* does not have prulae on cells on the dorsal surface of the leaf, we have found that they are often present.

Although the type collection (NY) from Colombia was described as monoicous, the senior author was unable to find any antheridia on plants with sporophytes when the specimen was examined. The only Jamaican collection contained plants with synoicous inflorescences but with no sporophytes. Synoicous pleurocarpous mosses are usually rare, with the exception of members of the Hookeriales, and only a very small number of species in other orders are known with this sexual condition.

Specimens examined: MEXICO. Veracruz: Road to Bastonal, above Tebanca, 700 m, *Richards, A.J. & E.B. Sharp 5863b* (TENN). PANAMA. Bocas del Toro: Vicinity of Fortuna Dam, along ridge below Continental Divide on Chiriqui Grande road, 800 m, 08°55'N, 82°08'W, *Allen 5831* (MO). JAMAICA. Portland: Forest Reserve Area W of Hardwar Gap, 1219–1295 m, *Crosby 2923* (DUKE). COLOMBIA. Known only from the type locality.

3. *Taxiphyllum ligulaefolium*

FIGURE 35

Taxiphyllum ligulaefolium (E. B. Bartram) W. R. Buck, Trop. Bryol. 2: 42. 1990. *Glossadelphus ligulaefolius* E. B. Bartram, Bryologist 49: 123. 1946. Type: Guatemala, Dept. Izabal, jungle between Escobas and waterfall, across bay from Puerto Barrios, 20–25 m, *Steyermark 39846* (holotype: FH!).

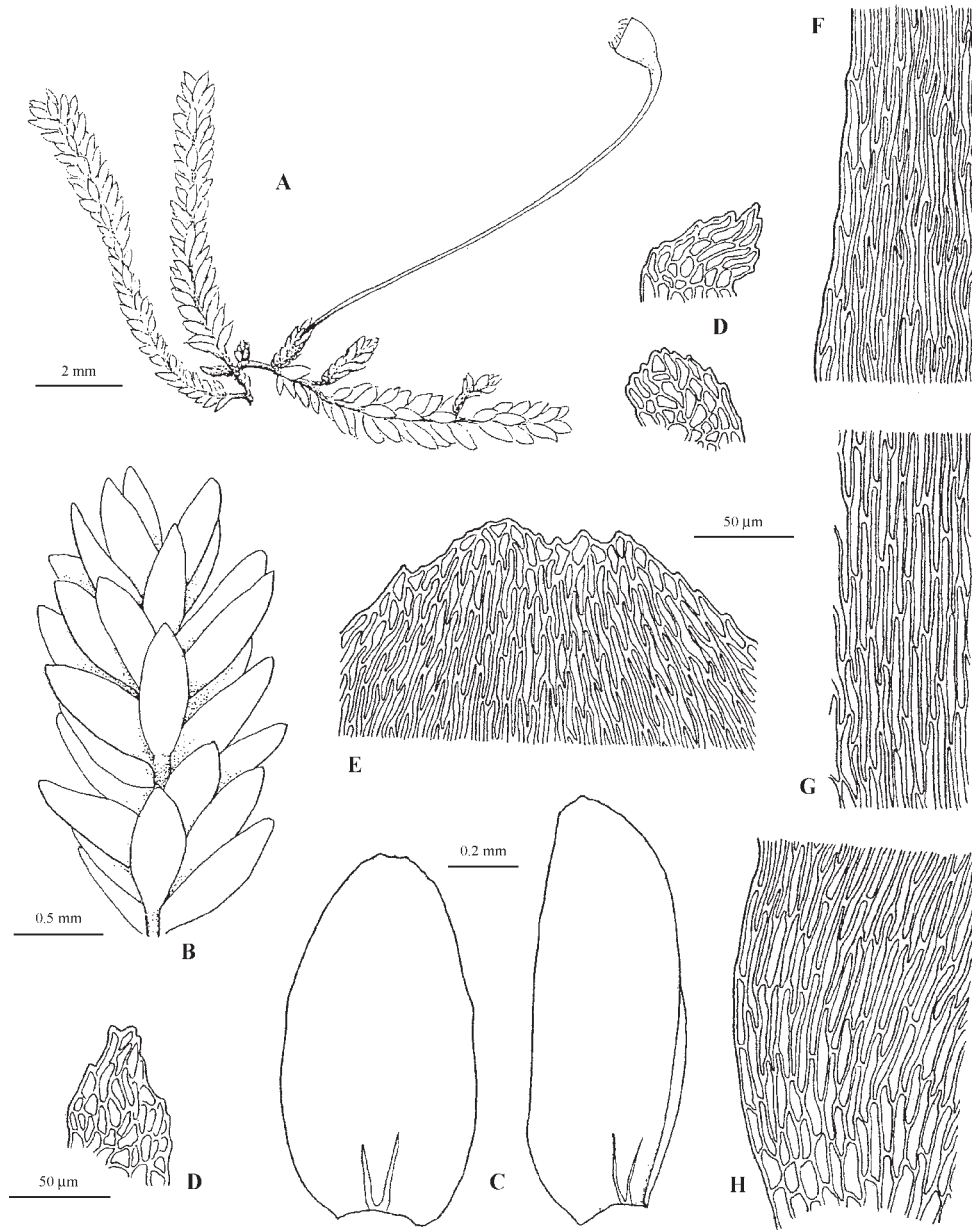


FIGURE 34. *Taxiphyllum laevifolium*. A. Habit. B. Enlargement of stem. C. Leaves. D. Pseudoparaphyllia. E. Apical leaf cells. F. Marginal leaf cells. G. Median leaf cells. H. Alar cells. Illustrations A–D drawn from Weir 425 (NY); E–H from Crosby 2923 (DUKE).

Taxiphyllum gallorum W. R. Buck, Brittonia 36 (2): 178. 1984b. Type: Jamaica, Trelawny Parish, Cockpit Co., just N of Wilson's Run, 5.8 mi. N of bridge at Troy, 500 m, 18°16'N, 77°40'W, Buck 5888 (holotype: NY!).

Plants in thin mats, glossy, yellowish green. Stems to 1 cm long, 2–3 mm wide, complanate, simple or irregularly branched. Leaves 0.9–2.5 mm long, 0.2–0.3 mm wide,

rigid, close, erect-spreading, complanate, slightly concave at base, smooth, linear-oblong, symmetric, abruptly acute to subobtusate, ending in a single or a few terminal cells; margins plane, sometimes erect below, serrate to serrulate above, serrulate to subentire below; costa usually weak, short and double, sometimes lacking; median cells 47–94 × 4–5 μm, smooth or prorulose at upper ends on

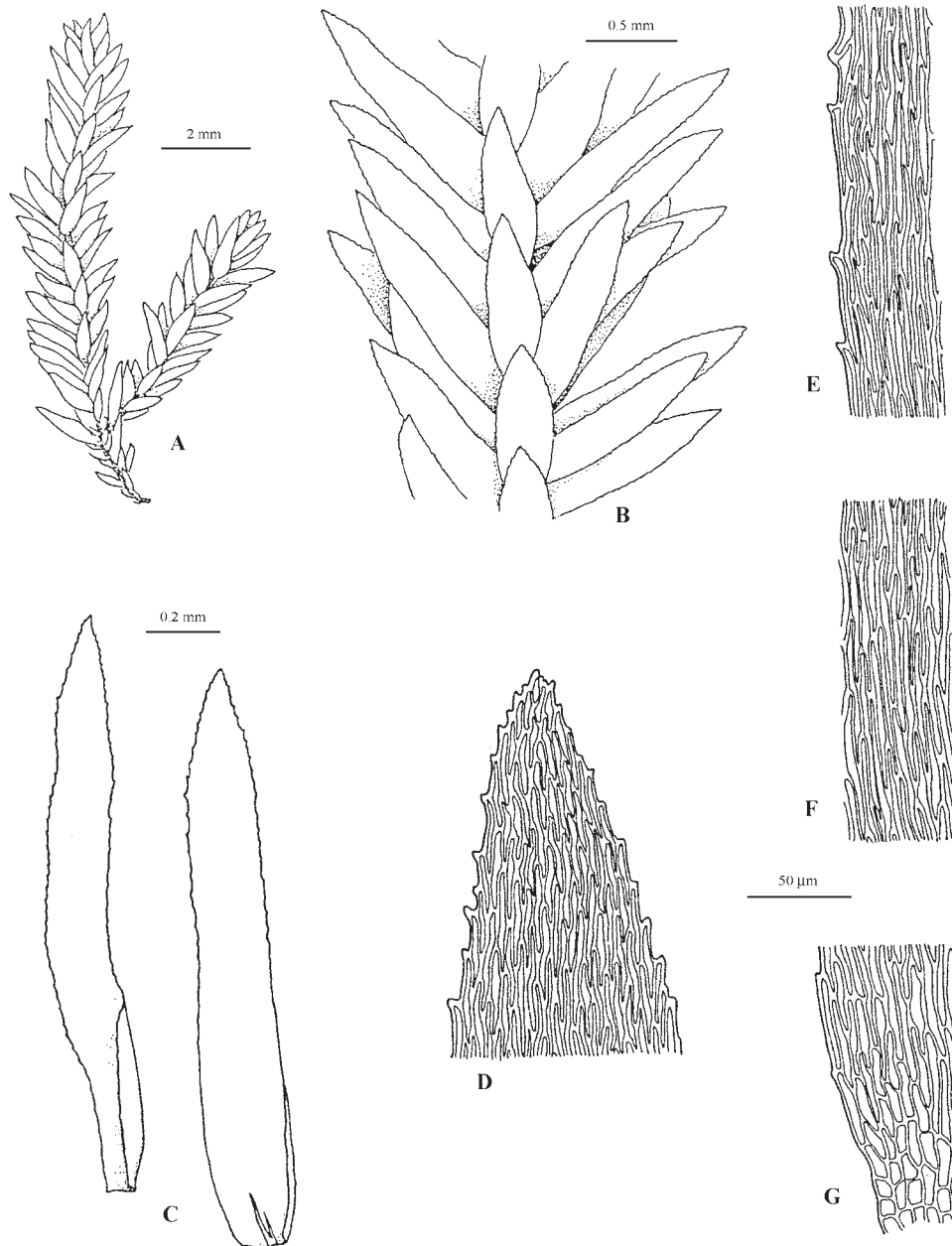


FIGURE 35. *Taxiphyllum ligulaefolium*. A. Habit. B. Enlargement of stem. C. Leaves. D. Apical leaf cells. E. Marginal leaf cells. F. Median leaf cells. G. Alar cells. All drawn from Crosby 13875 (NY).

dorsal surface; alar cells usually differentiated, quadrate to short-rectangular, 2–4 extending up margins. Sex organs and sporophytes unknown.

Distribution and ecology: Very rare or seldom collected; known only from Mexico, Guatemala, Belize, and Jamaica (Figure 33); occurring on limestone in humid forests, sometimes near waterfalls, up to 1158 m.

Discussion: *Taxiphyllum ligulaefolium* is a very distinctive species that is easily recognized by the leaves that are close, erect-spreading, linear-oblong, with abruptly acute to subobtuse apices usually ending in a single terminal cell, the serrate to serrulate margins, the narrow median leaf cells, and the small region of differentiated alar cells, 2–4 quadrate to short-rectangular cells on margins.

It is of interest to note that the serrations on the margins near the leaf apex of the only Mexican plant (Puebla, Santos 3694 MICH) known from the country thus far are described as simple in the *Glossadelphus* key (Crum, 1994a: 1002) and description (Crum, 1994a: 1003), which we consider a synonym of this species (as *G. ligulaefolius* E. B. Bartram), but illustrated as minutely bifid (Crum, 1994a: 1004, fig. 747b). However, no such minute bifid serrations were observed in any of the Mexican plants from the same collection (seen at FH but not at MICH) or any of the plants from elsewhere that the authors studied.

This species can be confused with a *Pseudotaxiphyllum* because of the few foliose pseudoparaphyllia present on its stems.

Specimens examined: MEXICO. Puebla: Near summit of El Cerro de Cuhuatepetl, Tehuacan, 945–1158 m, Santos 3694 (FH). GUATEMALA. Known only from type locality. BELIZE. Toledo, Columbia River Forest Reserve, Union Camp, 680 m, 16°23'N, 89°08'W, Allen 18552 (MO). JAMAICA. Same locality as type of *Taxiphyllum gallorum*, Crosby 13875 (NY).

4. *Taxiphyllum taxirameum*

FIGURE 36

Taxiphyllum taxirameum (Mitt.) M. Fleisch., Musci Buitenzorg 4: 1435. 1923. *Stereodon taxirameus* Mitt., J. Linn. Soc., Bot., Suppl. 1: 105. 1859; *Isopterygium taxirameum* (Mitt.) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 439. 1878. Type: In[di]a, Himalayae reg. temp., Simla et Kumaon, Thomson 1023 (lectotype: NY!, designated by Iwatsuki and Crosby (1979: 393); 1023b cited by Mitten in the type description is apparently an error; Ceylon, Gardner s.n. (syntype: NY!).

Isopterygium planissimum Mitt., J. Linn. Soc., Bot. 12: 498. 1869; *Taxiphyllum planissimum* (Mitt.) Broth. in Engl., Nat. Pflanzenfam. ed. 2, 11: 463. 1925; *Plagiothecium planissimum* (Mitt.) E. B. Bartram, Bryologist 49(4): 122. 1946. Type. Jamaica, Wilson 675 (lectotype: NY!, here designated).

Isopterygium cavernicola Cardot, Rev. Bryol. 37: 56. 1910; *Taxiphyllum cavernicola* (Cardot) Thér., Rev. Bryol. Lichénol. 5: 109. 1932. Type: Mexico, Morelos, near Cuernavaca, Pringle, *Plantae Mexicanae* 15179 (isotypes: H!, NY!).

Plants in thin to dense mats, glossy, dark green to yellow-green. Stems to 5 cm long, 2–4 mm wide, complanate, simple or irregularly branched. Leaves 1–2 mm long,

0.3–0.6 mm wide, rigid, usually distant, wide-spreading, flat or somewhat concave, smooth or plicate, ovate- to oblong-lanceolate, symmetric or nearly so, acuminate or abruptly narrowed to an acute or rarely subobtusate apex; margins very narrowly recurved almost to apex, serrulate to serrate throughout; costa lacking or short and double; median cells 66–120 × 3–7 μm, smooth or prorulose at upper ends on dorsal leaf surface; alar cells poorly differentiated, long- to short-rectangular or rarely quadrate, in 1–3 rows with 1–5 cells in the marginal rows. Sex organs and sporophytes not seen on Latin American plants. Reported and observed to be dioicous; perigonia small, bracts ovate, acute; perichaetia small, bracts lanceolate to ovate-lanceolate, acuminate. Setae 0.7–1.2 cm long; capsules 1.0–1.5 mm long, reddish brown. Spores 11–13 μm in diameter.

Distribution and ecology: Common; West Indies, Mexico to Costa Rica, Colombia, Surinam, Ecuador, Brazil, and Bolivia (Figure 37); also known from eastern North America and eastern Asia; usually on moist, shaded limestone rocks and cliffs in woods, sometimes on soil banks beside streams and along roadsides, rarely on logs and bases of trees, at 40–2500 m.

Discussion: This is a distinctive species recognized by the dark green to yellow-green, rigid, complanate-foliate plants, the distant, wide-spreading, flat or somewhat concave, ovate- to oblong-lanceolate, acuminate or acute to rarely subobtusate, sometimes plicate leaves with very narrowly recurved margins, and the poorly differentiated alar regions of 1–3 rows of quadrate to rectangular cells with 1–5 cells in the marginal rows. It is the most common species of *Taxiphyllum* in Latin America, and it is especially prevalent in parts of Mexico and the West Indies.

Selected specimens examined: MEXICO. Chiapas: Rancho Monte Armenio, Ejido Chintul, Tecpatán, 300 m, Zamudio & Rodríguez 1499 (MEXU); Santa Elena, 650 m, 16°53'N, 91°35'S, Delgadillo M. 6324 (MO); above Paval N of Mapastepec, 1524 m, Sharp 4443 (MICH, TENN). Chihuahua: At bridge Puerto de Río Urique, 61 km S of Creel, 1707 m, Bowers et al. 5356 (CANM, MEXU, TENN), 5330-b, 5332-c, 5362b (TENN). Durango: Near Palos Colorados, W of Durango, 2499 m, Sharp 1499c (TENN). Hidalgo: 82.2 km SW of Tempoal on Molango Hwy., Spessard 696a (TENN); ~26 km S of Tamazunchale, Bowers et al. 5049-a (TENN). Jalisco: Puente San Pedro, 8 km SW of Tecalitlán, ~1200 m, 22 Sep 1958, McVaugh s.n. (MICH, NY); Arroyo de La Resolana, near Sapotillo, 305 m, Crum 643 (MICH, NY, TENN); near summit of La Cumbre, 16 km SW of Autlán, 1524 m, Crum 1345 (MICH, TENN, US); 27 km W of Ameca on road to Los Volcanes,

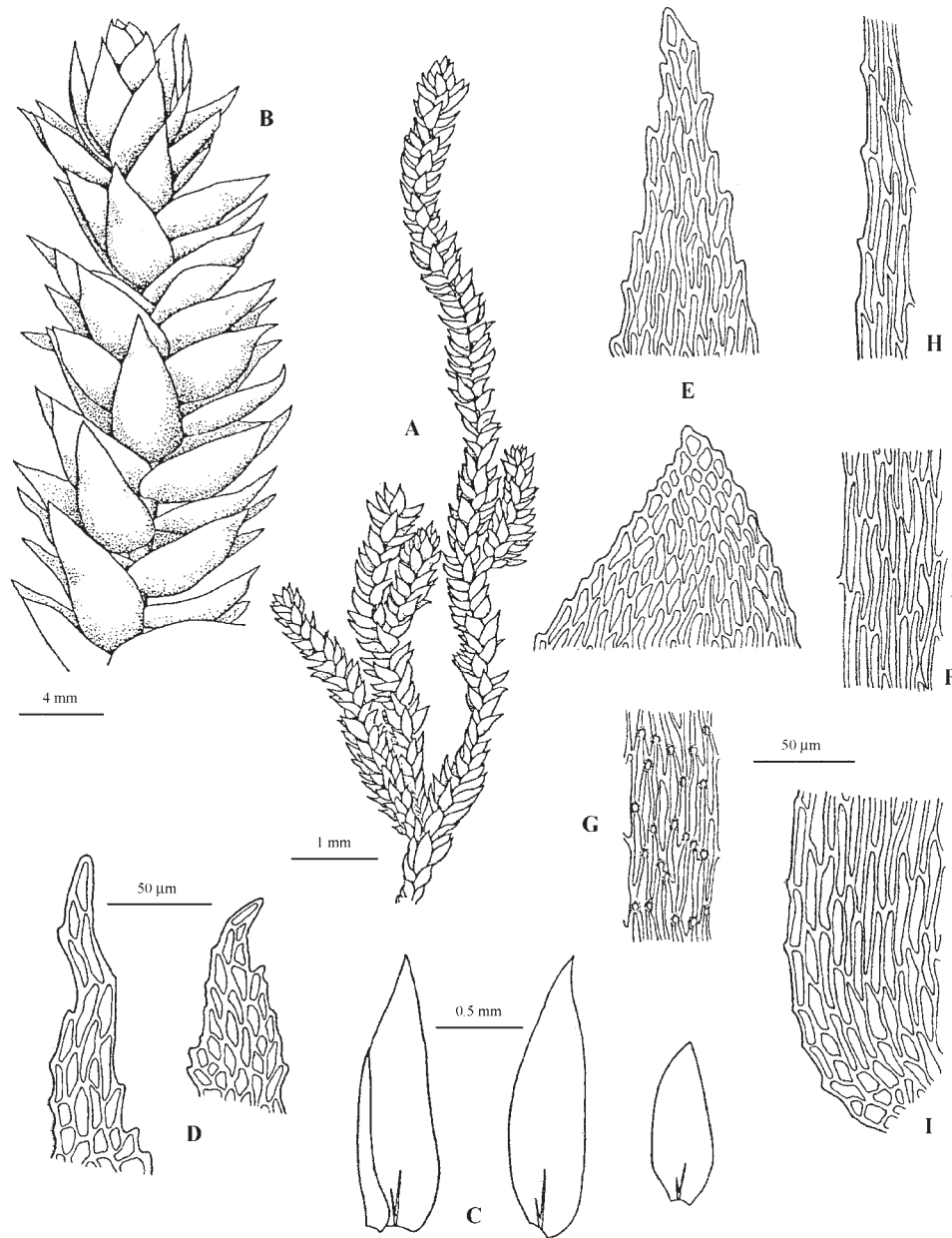


FIGURE 36. *Taxiphyllum taxirameum*. A. Habit. B. Enlargement of stem. C. Leaves. D. Pseudoparaphyllia. E. Apical leaf cells. F. Median leaf cells (smooth). G. Median leaf cells (prorulose). H. Marginal leaf cells. I. Alar cells. Illustrations A, B drawn from *Magill 2609* (TENN); C (two on left), D (left), E (top), F, H, I from *Sharp 4240* (CANM); C (one on right), D (right), E (bottom), G from *Smith & Sharp 114* (CANM).

1500 m, 20°34'N, 104°15'W, *Whittemore 2107* (MO). **México:** Hacienda Lanzarote, municipio de Villa Nicolás Romero, 2350 m, *Cárdenas 3820a* (MEXU). **Michoacán:** Morelos Natl. Park, near Morelia, *Norris & Taranto 15528* (CANM, TENN); Cascade de Caradacuan in Río Cupatzio, *Patrick 615* (FH). **Nayarit:** ~6 km from Compostela on road to San Pedro Jagunilla, *Norris & Taranto 15079*

(CANM, TENN); ~3 km W of Compostela on road to Puerto Vallarta, *Norris & Taranto 15161* (CANM, TENN); 50 km E of Ruiz, 10.7 km E of San Pedro Ixcátán on road to Mesa de Nayar, 109 m, 22°02'N, 104°50'W, *Whittemore 3227* (MO). **Nuevo León:** Cañon de San Francisco near Monterrey, *Spessard 95* (CANM, TENN); Río Valle Alto, *Spessard 436, 441* (TENN); Chipinque, Sierra Madre

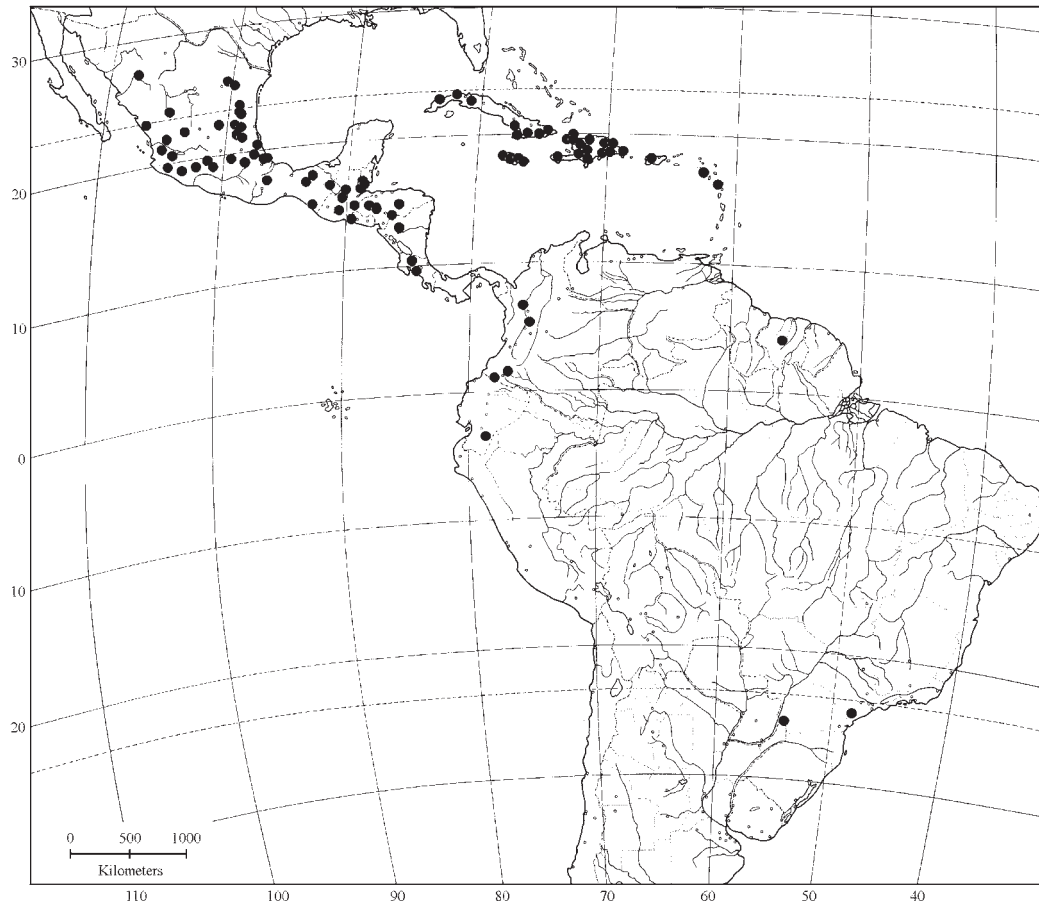


FIGURE 37. Distribution of *Taxiphyllum taxirameum* in Latin America.

Oriental, ~14 km NW of Monterrey, 1158 m, *Hermann* 26039 (CANM), 26039*b* (US); Sierra Madre, near Monterrey, *Pringle* 15103 (NY). **Oaxaca:** Sierra Juárez above Río Valle Nacional, 20 Dec 1962, *Robinson s.n.* (MEXU, NY, US); below Tamazulapam Mixe, ~70 km E of Oaxaca, *Smith et al.* 2994 (CANM, MEXU, TENN), 3001 (CANM, TENN). **Puebla:** Below Zacapoaxtla, near Xalacapa, 1524 m, *Sharp* 4240 (CANM, MICH, TENN); vicinity of Puebla, 2200 m, *Arsène* 584 (US). **San Luis Potosí:** W of Xilitia, 838 m, *Sharp* 5915 (MEXU, MICH, TENN, US); above Xilitla, 762 m, *Sharp* 5856 (MEXU, MICH, TENN, US); just E of San Francisco, 45 km E of San Luis Potosí, 2164 m, *Magill* 2609 (TENN); 49 km S of Antigua Morelos, road to Huizache, *Pursell* 5367 (MO). **Sinaloa:** 45 km NE of Mazatlan, 152 m, *Bowers et al.* 5127 (CANM, F, MEXU, TENN). **Tamaulipas:** 14 km above San Antonio on Hwy. 101, 1773 m, *Sharp et al.* 1002-*b* (TENN); ~16 km from Victoria on road to San Luis Potosí, 914 m, *Smith & Sharp* 112, 114 (CANM, TENN), 116 (TENN); ~16 km N

of Villa Aldama, *Pursell* 5458 (MO); South Mt., near Rancho del Cielo, Gómez Farias, 1037 m, 23°15'N, 99°12'W, *Manuel* 396 (MO); roadside of Hwy. 101, 37 km SW of Victoria, 1098 m, *Bowers et al.* 2776 (NY); Paso de las Calabazas, along Río Sabinas, near Gómez Farias, *Sharp* 8763 (CANM); just E of San Francisco, 45 km E of San Luis Potosí, 2164 m, *Magill* 2609 (TENN). **Tlaxcala:** Near falls of Río Zahuapan, near Amaxac, *Sharp* 401 (MEXU, TENN). **Veracruz:** Sierra de Chiconquiaco, between Santa Rita and Bella Luz, ~40 km NW of Xalapa, 1750 m, *Hermann* 28844 (CANM, TENN); above Poza Rica on Hwy. 130, 1000 m, *Sharp et al.* 1280 (CANM, TENN), 4858 (CANM, F, MEXU, TENN); El Esquilón, ~1300 m, 19°37'N, 96°56'W, *Buck* 35518 (NY); La Concha, along Carretera La Concha a San Antonio, ~1000 m, 19°36'N, 96°53'W, *Buck* 35406, 35416 (NY); just S of city of Xalapa on road to Coatepec, Instituto de Ecología, Rancho Guadeloupe, ~1300 m, 19°31'N, 96°56'W, *Buck* 35380 (NY). **Zacatcas:** 7 km S of Laguna Grande, N of Monte

Escobedo, 2030 m, *Cárdenas 3057b* (MEXU), 3028 (MEXU, NY); 8 km E of Monte Escobedo, 2030 m, *Cárdenas 3070* (MEXU, NY). **GUATEMALA. Alta Verapaz:** Cerro Chinajá, between Finca Yalpemech and Chinajá, 150–700 m, *Steyermark 45564* (F, FH); 3 km N of Coban, 1341 m, *Sharp 2994* (FH). **Baja Verapaz:** Patal, 1615 m, *Sharp 2827* (FH, TENN). **Chimaltenango:** Quisaché, 1800 m, *Standley 62310* (F, FH). **Quezaltenango:** Above Santa María de Jesús, ~1650 m, *Standley 67279* (F, FH). **Retalhuleu:** Near Chivolandia (Dept. Quezaltenango) along road to San Felipe, ~650 m, *Standley 87209a* (F), 87213 (DUKE, F, FH, MICH, NY). **Sacatepéquez:** Above Pastores, ~1680 m, *Standley 60768* (F, FH, MICH, NY, US). **Zacapa:** Trail between Río Hondo and waterfall, 250–400 m, *Steyermark 29413* (F, FH, MICH). **BELIZE. Cayo:** S side of Rapaculo Branch, 16°49'N, 88°56'W, *Allen 18458, 18474* (MO). **Toledo:** Solomon Camp, vicinity of junction of Richardson creek and Bladen Branch, foothills of the Maya Mts., 80–420 m, *Davidse & Brant 32073B* (MO); Upper Bladen Branch, Bladen Nature Reserve, 16°54'N, 88°55'W, *Whittemore 5800* (MO, NY); Gabriel Camp-Edwards Central Camp, *Boutin & Schlosser 5155* (MO); Columbia River Forest Reserve, 16°22'N, 89°07'W, *Allen 18678* (MO). **HONDURAS. Comayagua:** Vicinity of Siguatequeque, ~1050 m, *Standley & Chacón 6599* (F); Quebrada Agua Helado, above San José del los Planes, ~15 km E of Lago Yojoa, cerro Meámbar, 14°47'N, 87°51'W, *Allen 13717* (MO). **Cortés:** Along Río Lindo, N of Lake Yojoa, 500–600 m, *Morton 7875, 7876* (US); near Jaral, 600 m, *Standley 7021* (F); Nacimiento del Río Lindo, near Jaral, ~600 m, *Standley 7075* (F). **El Paraíso:** Vicinity of Danlí, 700–800 m, *Standley 16394* (F). **Olancho:** Slopes of Montaña Pena Blanca, 11.5 km S of Gualaco on road from San Francisco de La Paz to Gualaco, 980–1000 m, 14°57'N, 86°08'W, *Allen 12405, 12426* (MO). **EL SALVADOR. Ahuachapán,** near Ataco, 1200–1400 m, *Standley & Padilla 2689, 2694, 2701* (F). **NICARAGUA. Jinotega:** Between Las Camelias and La Salvadora, along tributary of Río Jiguina, ~13°05'–06'N, 85°53'–54'W, *Stevens & Grijalva 15359* (MO). **COSTA RICA. Cartago:** Río Macho, 1100 m, *Morales et al. 963* (USJ). **Puntarenas:** ~2 km SE of Monteverde, 1500–1550 m, *Gentry & Burger 2755D* (MO). Aserri, 1400 m, *Alfaro 70b* (FH). **BERMUDA. Tucker's Town,** Church Cave, *Britton 418* (NY). **CUBA. Guantánamo:** Loma Lagunato, ESE of El Ramón, 300–400 m, *Reyes 9193B* (NY). **Oriente:** Loma del Gato, *Hioram 12044* (F). **Pinar del Río:** Sierra la Buirá, *Leon 4710* (NY). **Santo Domingo:** Barrabos, 400 m, 1887, *von Eggers s.n.* (H). **Santiago de Cuba:** La Gran Piedra, 1000 m, *Buck 7609, Shaw 5098, 5153* (NY). **Seibo:** Azui, *Taylor 278b* (NY). **Sierra Maestra:** “El Peru,” in the valley of the Río Yara, *Pócs 9073c* (NY). **Trinidad Mtns., Santa Clara, León 14149** (NY). **JAMAICA. Manchester:** Marshall's Pen, 5 km WNN of Mandeville, 701 m, *Crosby 13825* (NY); 4 km N of Plowden Hill, 500 m, *Crosby 13848* (MO, NY). **St. Andrew:** Newcastle road, between 16 & 17 mile posts, 762–1069 m, *Farr 104* (CANM). **St. Catherine:** Byndloss Gully, 1.6 km N of Linstead, 91 m, *Farr 106* (CANM). **St. Thomas:** Corn Puss Gap and vicinity, ~14 km N of Bath, 550 m, *Buck 5561* (NY); Bath, along Sulphur River, 91 m, *Crosby 13631* (MO, NY). **Trelawny:** Vicinity of Windsor Cave, 140 m, *Buck 5932* (NY); Cockpit Country, just N of Wilson's Run, 9 km N of bridge at Troy, 500 m, *Crosby 13879* (MO, NY). **HAITI. Vicinity of St. Louis du Nord,** Morne Colombot, *Leonard & Leonard 14249* (NY, US), 14319 (F, FH, NY, US). Vicinity of Port au Prince, Pétionville, *Leonard & Leonard 15792* (FH, NY, US). **Nord:** vicinity of Marmelade, 800 m, *Leonard 8139* (CANM, FH, NY, US). **Sud'est:** Massif de la Selle, 19 km S of Kenscoff, 1600 m, *Buck 9015* (NY). Vicinity of Bombardopolis, 610 m, *Leonard & Leonard 13560* (FH, US). Les Trois Sources, between Chambellan and Cayaba, 442 m, *Bartlett 17792* (DUKE, MICH). **DOMINICAN REPUBLIC. La Altagracia:** Between Higüey and Miches, ~20 km N of Otra Banda, *Jones & Norris 1403A, 1405A* (NY). **Dajabón:** Cañada Tirolis, 1 km S of Villa Anacaona, 396 m, *Reese 15386, 15390* (NY). **La Estrella:** Sierra de Neiba, from 8 to 15 km N of Angel Félix, 1402–1829 m, *Buck 4605* (NY). **La Vega:** Vicinity of Piedra Blanca, 200–500 m, *Allard 16886, 16941d, 16962* (NY, US). **Pedernales:** 4 km E of Mencia, 457 m, *Reese 15073* (NY). **Samaná:** Parque Nacional Los Haitises, S of Naranjo, *Smith 10416* (NY); Hacienda Nydia, 3.5 km E of Las Terrenas, 122 m, *Steere 23193* (NY). **San Cristóbal:** Mano Matuey, 12 km from Cambito Garabito, 549 m, *Buck 5159, 5197, Reese 15608, 15622, 15628* (NY). **Sánchez Ramírez:** Loma La Guacara, N of Comedor Arriba, ~5 km S of Fantino, 100–240 m, *Zanoni & Peláez 16185* (MO, NY, U). **PUERTO RICO. Arecibo,** between Manati and Morovis, ~300 m, *Buck 16149* (DUKE, MO, NY). ~6 km SSW of Florida, just S of junction with Río Yúnes, *Reese 14434* (NY). Cordillera Central, 13 km S of Utuado, 6 km N of Adjuntas, *Reese 14511, Buck 3759, 3763* (NY). Cordillera Central, above Villalba, Dona Juana Recreation Area, 800–900 m, *Allen 6390* (MO). Between Arecibo and Utuado, *Britton 2077* (F, FH, MICH, NY). **LEEWARD ISLANDS. Nevis:** St. George Gingerland Parish, Golden Rock Estate, Golden Rock Nature Trail, ~300 m, 17°08'N, 62°34'W, *Buck 29538* (NY). **WINDWARD ISLANDS. Guadeloupe:** Rivière Beaugendre, *LeGallo 651* (CANM), 705 (MICH). **COLOMBIA. Antioquia:** Mpio. Liborina, N of Liborina en la carretera a Sabanalarga, 910–1030 m, *Churchill et al. 14653* (NY); Mpio. Dabeiba,

2–3 km NE of Dabeiba, 460 m, *Churchill et al.* 17048 (CANM, NY). **Caldas:** Mpio. of Río Sucio, on the Río Sucio, Vereda el Tabor, 1900–2080 m, *Churchill & Arbeláez* 15646 (NY). **Huila:** Transecto Neiva, San Vicente del Caguán, Río Las Ceibas, 680 m, *Churchill & Betancur* 16767 (CANM, NY). **Nariño:** Mpio. Alban, Campo Bello, 01°28'N, 77°04'W, *Ramírez P.* 5868 (MO); Mpio. de Barbacoas, km 1 El Mirador–Junín, 1500 m, 01°08'N, 78°09'W *Ramírez P.* 3631 (NY); Mpio. de Sandoná, 1900 m, *Ramírez* 5678 (NY). **SURINAM.** Without locality, *Korthals s.n.* (H). **ECUADOR.** **Azuay:** Gualaquiza, Jun 1909, *Allioni* 8343 (H). **BRAZIL.** **Paraná:** Mpio. Foz do Iguaçu, Parque Nacional do Iguaçu, forest along Rio Iguaçu, 100–200 m, ~25°40'S, 54°25'W, *Vital & Buck* 12074 (NY). **São Paulo:** Serra de Paranapiacaba, Eldorado, Caverna do Diabo, 500 m, *Schäfer-Verwimp & Verwimp* 11082 (CANM). **BOLIVIA.** **Santa Cruz:** Aneres Ibanes, Espejillas, 20 km W of San José, 17°56'S, 63°26'W, *Fuentes* 140A (MO).

***Taxiphyllum* Excluded Taxa**

Taxiphyllum scapellifolium (Müll. Hal.) Broth. in Engl., Nat. Pflanzenfam. ed. 2, 11: 462. 1925.

The senior author agrees with Crum (1968) that this species belongs in the genus *Mittenothamnium*, as *M. scapellifolium* (Müll. Hal.) H. A. Crum, primarily because of the different type of branching pattern that has never been seen to occur in other taxa of the genus *Taxiphyllum*. The main stems are creeping, wiry, with small, spreading, ovate-lanceolate, acuminate leaves that differ strikingly from the complanate, oblong to ovate-oblong, abruptly short-acuminate to mucronate leaves of the secondary stems. This type of branching pattern with dimorphic leaves does not occur in the genus *Taxiphyllum*. Although the complanate secondary leaves are unlike those of any species known in the genus *Mittenothamnium*, the wiry creeping stems giving rise to secondary stems do occur in the genus. Crum placed it in the genus *Mittenothamnium* because of the stipitate growth habit. He also mentions the prorulose leaf cells as a reason for placing it in the genus, although prorulose leaf cells are also known in species of *Taxiphyllum*. In spite of this the senior author considers further studies to be necessary before it is prudent to place the species in *Taxiphyllum*. Buck (1998: 326) is “not completely convinced of a relationship within *Taxiphyllum*,” but he has left it in the genus for lack of a better one in which to place it.

Acknowledgments

We are very grateful to the following curators for the loan of specimens: J. Aguirre C. (COL); B. H. Allen, M. R. Crosby, and R. E. Magill (MO); H. A. Crum[†] (MICH); C. Delgadillo M. (MEXU); A. Eddy[†] and A. Newton (BM); J. J. Engel (F); T.-B. Engelmark (S); P. Geisler[†] (G); M. F. Goncalves-Carralves and G. G. Hassel de Menéndez (BA); S. R. Gradstein (U); H. Hertel (M); H. A. Imshaug (MSC); P. Isoviita (H); E. Lawton[†] (WTU); M. Lewis (LPB); R.C. L. Lisbôa (MG); F. K. Meyer (JE); B. D. Mishler (DUKE); R. Moberg (UPS); G. S. Mogensen (C); M. I. Morales (USJ); D. H. Pfister (FH); H. E. Robinson (US); N. Salazar A. (PMA); A. J. Sharp[†] and D. K. Smith (TENN); and D. M. Vital (SP). We also thank M. Kuc, Ottawa, Canada, for allowing us to examine his South American collections and A. Schäfer-Verwimp, Museum für Naturkunde Stuttgart, Germany, for the many Brazilian specimens he sent. We thank Bruce Allen (MO) for his valuable time in correcting mistakes and adding comments to the manuscript, as well as aiding in preparing the illustrations and maps. We appreciate the assistance of Linda M. Ley (CANM) for her comments on the manuscript and for her technical expertise, particularly for the tedious and time-consuming job of preparing the illustrations as well as for her help with the maps. Halina Bednarek-Ochyra (Institute of Botany, Polish Academy of Sciences, Kraków, Poland) did the illustrations of *Elmeriobryum* for the junior author, and we are very grateful for her excellent work. We thank Marjorie Knowles, formerly a Research Assistant at the Smithsonian Institution, for her assistance with revising the maps with the computer, for correcting mistakes in the manuscript, and for her computer skills in various other aspects of preparing this paper. We are indebted to Joe Ireland for revising the maps and illustrations for publication and for his help with numerous computer problems. Wilf Schofield[†] (UBC) contributed his time in correcting mistakes in the manuscript, for which we are grateful. Also, to Harold Robinson, Smithsonian Institution, the senior author owes a debt of gratitude for providing space, equipment, and assistance to finish the studies for this paper. We thank Paul Peterson of the Smithsonian Institution for his help with the review process of the manuscript; and we also acknowledge the excellent work by the Smithsonian Scholarly Press, especially Meredith McQuoid

and Tshawna Byerly, for seeing this paper through to publication. Finally, we are grateful to A. Stewart, J.-G. Brisson, and other library staff of the Canadian Museum

of Nature (Ottawa, Canada) as well as Ruth Schallert, Smithsonian Botany Library, for their help in obtaining many literature references for this study.

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