

REGINA YOSHIE HIRAI

**Taxonomia e Filogenia Molecular das
Espécies Neotropicais de *Micropolypodium*
Hayata (Polypodiaceae)**

Tese apresentada ao Instituto de Botânica da Secretaria do Meio Ambiente, como parte dos requisitos exigidos para a obtenção do título de DOUTOR em BIODIVERSIDADE VEGETAL E MEIO AMBIENTE, na Área de Concentração de Plantas Vasculares em Análises Ambientais.

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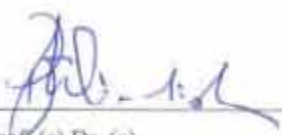
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RESUMO

As análises moleculares combinadas de três marcadores plastidiais, *atpB*, *rbcL* e *trnL-trnF*, corroboraram que *Micropolypodium s.l.* não é um grupo monofilético. Foram utilizadas na filogenia duas espécies asiáticas (*Micropolypodium okuboi* (Yatabe) Hayata e *M. sikkimense* (Hieron.) X.C. Zhang) e 21 espécies Neotropicais de *Micropolypodium*. O clado Neotropical de *Micropolypodium* é fortemente sustentado no método de Máxima Parcimônia e na análise Bayesiana (*bootstrap* = 94%, probabilidade *a posteriori* = 1.0, respectivamente). Este clado Neotropical é distinto do outro clado Paleotropical de *Micropolypodium* (*bootstrap* = 78%, probabilidade *a posteriori* = 1.0, respectivamente) formado pelas espécies que ocorrem ao leste da Ásia. Consequentemente, neste trabalho o uso do nome genérico *Micropolypodium* está restrito apenas às espécies do Velho Mundo. Não há nenhum nome genérico disponível para o clado Neotropical, e por isso, um novo nome, *Moranopteris*, foi proposto. A sinapomorfia morfológica das espécies de *Moranopteris* é a presença de pequenos tricomas levemente catenados, ramificados (com ou sem ramos setiformes) e às vezes com tricomas simples, ocorrendo juntos sobre o pecíolo, costa e tecido laminar abaxialmente, enquanto que *Micropolypodium s. str.* apresenta somente pequenos tricomas catenados e simples nas mesmas partes das frondes. *Moranopteris* está sendo descrito no presente estudo, seguido de 26 novas combinações para as espécies, bem como a combinação de um híbrido. Além disso, duas espécies novas estão sendo descritas para o gênero (*M. simplex* R.Y. Hirai & J. Prado e *M. rupicola* R.Y. Hirai & J. Prado). São apresentadas as árvores filogenéticas obtidas nas análises moleculares, bem como uma chave de identificação para as espécies, tipificações, descrições, distribuição geográfica, comentários e ilustrações.

ABSTRACT

The phylogenetic analyses combined of three plastid sequences, *atpB*, *rbcL* e *trnL-trnF*, corroborated that *Micropolypodium s.l.* is not a monophyletic group. In the phylogeny was used two Asian species (*Micropolypodium okuboi* (Yatabe) Hayata and *M. sikkimense* (Hieron.) X.C. Zhang) and 21 Neotropical species of *Micropolypodium*. The Neotropical clade of *Micropolypodium* is strongly supported by Maximum Parsimony and Bayesian Inference (*bootstrap* = 94%, posterior probability = 1.0, respectively). This Neotropical clade is distinct from the other Paleotropical clade of *Micropolypodium* (*bootstrap* = 78%, posterior probability = 1.0, respectively) formed by Asian species. Consequently, in this paper, we restrict the application of *Micropolypodium* to a group of Old World species. There is no available generic name for this Neotropical clade, and then, a new name, *Moranopteris*, is being proposed. A morphological synapomorphy for the species of *Moranopteris* is the presence of minute and slightly catenate branched hairs (with or without a setiform branch) and sometimes unbranched hairs occurring together on the stipe, costa, and laminar tissue abaxially. In contrast, *Micropolypodium s. str.* has only minute, catenate, and unbranched hairs borne on the same parts of the leaves. *Moranopteris* is described and combinations are made for the 26 species and one hybrid known to belong to it. Moreover, two new species (*M. simplex* R. Y. Hirai & J. Prado and *M. rupicola* R. Y. Hirai & J. Prado) are also presented. Phylogenetic trees generated in molecular analysis, as well as identification keys for species, typifications, descriptions, geographical distribution, comments, and illustrations are presented.

INTRODUÇÃO GERAL



Moranopteris taenifolia (Jerzman) R. Y. Hirai & J. Prado (Foto: R. C. Moran, 2004)

INTRODUÇÃO GERAL

O gênero *Micropolypodium s.l.* Hayata apresenta cerca de 30 espécies, a maioria Neotropical (com apenas algumas espécies ocorrendo no leste da Ásia), e pertence ao grupo das gramitidóides dentro da família Polypodiaceae J. Presl. Esta família, atualmente, apresenta cerca de 1.200 espécies distribuídas em 56 gêneros (Smith *et al.* 2006, 2008).

Os representantes deste gênero, até pouco tempo atrás, eram considerados como um grupo pertencente à Grammitidaceae (C. Presl) Ching (por exemplo, em Parris 1986; Labiak & Prado 2003, 2005a, b, c), e anteriormente, já pertenciam a Polypodiaceae *s.l.* (por exemplo, em Baker 1870; Copeland 1947). Somente com os estudos filogenéticos (Schneider *et al.* 2004, Smith *et al.* 2006, 2008) foi possível corroborar que Polypodiaceae *s. str.* (por exemplo, em Hennipman *et al.* 1990), como frequentemente reconhecido, era parafilético, uma vez que excluía Grammitidaceae.

Atualmente “Grammitidaceae” é conhecido como um grupo chamado de gramitidóides, uma vez que não constitui mais uma família. Este grupo é constituído de 24 gêneros com ca. de 750 espécies, sendo que aproximadamente 250 spp. ocorrem no Neotrópico e 500 spp. no Paleotrópico (Parris 2009). Levando-se em conta os diversos trabalhos que tem sido realizados por diferentes autores, sejam eles estudos florísticos, revisões taxonômicas e/ou estudos filogenéticos (por exemplo, Copeland 1947; Murillo & Smith 2003; Parris 1990, 1997a, b, 2003, 2007; Smith *et al.* 2006; Labiak *et al.* 2010a, b, 2011; Kessler *et al.* 2011; Sundue 2011), as gramitidóides, atualmente, constituem um grupo com ca. 29 gêneros, no entanto esses gêneros ainda necessitam de re-circunscrições para melhor delimitá-los, principalmente aqueles que ocorrem no Velho Mundo.

Dentre os principais trabalhos taxonômicos com as gramitidóides destacam-se os de Bishop (1974, 1977, 1978, 1988, 1989a, b), Parris (1983, 1984, 1986, 1990, 1995, 1997a, b, 1998, 2002, 2003, 2007), Smith *et al.* (1991), Bishop & Smith (1992), Parris *et al.* (1992), Smith & Moran (1992), Smith (1992, 1993a, b, 1995b), Labiak (2000, 2003) e Lehnert (2008) os quais tem proposto a criação de novos táxons nesse grupo, bem como apresentam tratamentos taxonômicos para alguns gêneros.

Além desses trabalhos, ainda existem aqueles referentes às floras neotropicais que abordam as gramitidóides, bem como o gênero *Micropolypodium s.l.* como os de: Sota (1960) para a Argentina; Sota *et al.* (2000) para a Argentina e Chile; Morton (1967) para o Equador; Vareschi (1969) para a Venezuela; Stolze (1981) para a Guatemala; Proctor (1977, 1985, 1989) para as Pequenas Antilhas, Jamaica e Porto Rico, respectivamente; Mickel & Beitel (1988) para Oaxaca, México; Lellinger (1989) para a Costa Rica, Panamá e Chocó na Colômbia; Tryon & Stolze (1993) para o Peru; Bishop & Smith (1995) para a Venezuela;

Smith (1995a) para a região Mesoamericana, Mickel & Smith (2004) para o México e Labiak & Prado (2003, 2005a, b, c) para o Brasil.

Os estudos realizados por Smith (1992) revelaram que *Micropolypodium s.l.*, gênero descrito em 1928 para o Japão, e que apresenta poucas espécies no leste da Ásia (três espécies), deveria abranger as espécies neotropicais, que anteriormente haviam sido reconhecidas nos gêneros: *Polypodium* L. por Maxon (1916), *Xiphopteris* Kaulf. por Copeland (1952) e *Grammitis* Sw. por Morton (1967).

Dessa forma, Smith (1992) se tornou o trabalho mais relevante de *Micropolypodium s.l.* por ter realizado as combinações das espécies que estavam nos gêneros mencionados acima para dentro do gênero. Essa revisão inicial com as novas combinações totalizou 22 espécies neotropicais e duas espécies paleotropicais. Além desse, destaca-se também Smith (1995b) na Flora Mesoamericana, no qual foram estudadas 11 espécies do gênero, apresentando descrições, comentários, uma chave de identificação e distribuição geográfica.

As publicações de Labiak & Prado (2003, 2005a, b, c) são trabalhos de revisão taxonômica da família “Grammitidaceae” no Brasil. Neles são apresentadas descrições, comentários, chaves de identificações, ilustrações e distribuição geográfica dos gêneros *Ceradenia* L.E. Bishop, *Cochlidium* Kaulf., *Grammitis* Sw., *Melpomene* A.R. Sm. & R.C. Moran, *Micropolypodium*, *Lellingeria* A.R. Sm. & R.C. Moran, *Terpsichore* A.R. Sm. e *Zygophlebia* L.E. Bishop.

Alguns trabalhos recentemente publicados envolvendo filogenia de samambaias, embora não tratem especificamente do grupo em questão, apresentam dados relevantes que auxiliaram no entendimento das relações dos gêneros de gramitidóides com outras famílias próximas. Como por exemplo, Pryer *et al.* (1995) que apresentaram um estudo preliminar a partir da análise filogenética baseada em caracteres morfológicos e moleculares (*rbcL*) para diversos grupos de samambaias. Na análise de máxima parcimônia utilizando-se apenas os caracteres morfológicos, Grammitidaceae (representada por *Micropolypodium*) aparece relacionada aos gêneros *Vittaria* Sm. (Vittariaceae) e *Loxogramme* (Blume) C. Presl (Polypodiaceae), formando um grupo parafilético com Polypodiaceae (representada por *Polypodium s. str.*). E na análise de máxima parcimônia, baseada apenas nos caracteres moleculares, o gênero *Micropolypodium* aparece no mesmo clado de *Polypodium*, formando assim um grupo monofilético.

Mais especificamente com as gramitidóides, existem três trabalhos relevantes de estudos filogenéticos, a saber:

Schneider *et al.* (2004) que trabalharam com 98 espécies selecionadas de Polypodiaceae *s. str.* e Grammitidaceae (poligramóides). A filogenia foi inferida a partir de três sequências

gênicas do cloroplasto (*rbcl*, *rps4* e o espaçador intergênico *rps4-trnS*). Os autores detectaram quatro importantes linhagens monofiléticas: os loxogramóides (*Anarthropteris* Copel. e *Loxogramme* (Blume) C. Presl.); dois clados paleotropicais: um clado com as drinarióides (*Drynaria* (Bory) J. Sm. e *Aglaomorpha* Schott) e seligueóides (*Arthromeris* (T. Moore) J. Sm., *Gymnogrammitis* Ching ex Tardieu & C. Chr., *Polypodiopteris* C.F. Reed e *Selliguea* Bory); e outro clado com os platiceróides (*Platyterium* Desv. e *Pyrrosia* Mirbel), lepisoróides (*Belvisia* Mirbel, *Drymotaenium* Makino, *Lemmaphyllum* C. Presl, *Lepisorus* (J. Sm.) Ching, *Neocheiropteris* H. Christ e *Neolepisorus* Ching), microsoróides (*Leptochilus* Kaulf., *Colysis* C. Presl, *Paraleptochilus* Copel. e *Microsorium* Link) e seus parentes; e por último, um clado, em grande parte, neotropical (incluindo as Grammitidaceae pantropicais). Os gêneros *Microsorium* e *Polypodium*, como tradicionalmente definidos, apareceram como polifiléticos.

Ranker *et al.* (2003) conduziram uma análise filogenética molecular com o gênero endêmico havaiano *Adenophorus* Gaudish. (gramitidóide), empregando também três sequências gênicas do cloroplasto: *rbcl*, *atpB* e o espaçador intergênico *trnL-trnF* (IGS). Uma análise cladística com os dados moleculares mostrou que *Adenophorus* é monofilético; o subgênero *Oligadenus* L.E. Bishop é parafilético; *Grammitis tenella* Kaulf., uma espécie havaiana endêmica foi fortemente sustentada como táxon irmão de *Adenophorus*. Ainda como conclusão deste trabalho, sugere-se que a lâmina das frondes muito dividida é uma característica derivada no grupo, enquanto que a presença de folhas simples é um caráter plesiomórfico.

Ranker *et al.* (2004) realizaram uma análise filogenética abrangendo 73 espécies de gramitidóides utilizando dados morfológicos e moleculares (*atpB* e *rbcl*). O gênero *Adenophorus*, *Ceradenia*, *Calymmodon* C. Presl, *Cochlidium*, *Enterosora* Baker e *Melpomene* foram fortemente sustentados como grupos monofiléticos, enquanto outros gêneros, como *Ctenopteris* Blume, *Grammitis*, *Lellingeria*, *Micropolypodium*, *Prosaptia* C. Presl e *Terpsichore* não foram sustentados como grupos monofiléticos.

Recentemente, estudos filogenéticos e revisões taxonômicas de alguns desses gêneros já estão em andamento. *Melpomene* está sendo estudado por Marcus Lehnert (Göttingen, Alemanha), parte de *Terpsichore s.l.* por Michael Sundue (Nova Iorque, EUA), *Lellingeria* por Paulo H. Labiak (Paraná, Brasil), e parte de *Terpsichore s.l.* por Michael Kessler e colaboradores (Universidade de Zurique, Suíça).

Lehnert (2008) publicou um trabalho com 11 espécies novas de *Melpomene*; Sundue & Kessler (2008) publicaram cinco espécies novas e um registro novo de *Terpsichore s.l.* para a Bolívia. Sundue (2011), a partir de estudos moleculares e morfológicos (Sundue *et al.* 2010,

Sundue 2010), descreveu um novo gênero chamado de *Ascogrammitis*, um grupo segregado de *Terpsichore s.l.* Labiak (2010c, 2011) descreveu dois novos gêneros *Leucotrichum* e *Stenogrammitis* que foram segregados de *Lellingeria s.l.* Kessler *et al.* (2011) também segregaram de *Terpsichore s.l.* um novo gênero, chamado de *Alansmia*, homenageando o Dr. Alan R. Smith (Universidade da Califórnia, Berkeley, EUA).

Ranker *et al.* (2004) verificaram que a homoplasia para os caracteres morfológicos foi consideravelmente maior do que para os caracteres moleculares. Muitos dos caracteres que exibiram altos níveis de convergência e paralelismo através da filogenia são características geralmente usadas para circunscrever gêneros neste grupo, como por exemplo: divisão da lâmina da fronde (simples, pinatífida, pinatissecta, 1-pinada, pinado-pinatífida ou mais dividida), várias características relacionadas às escamas do rizoma (como a cor), hidatódios (presença ou ausência) e paráfises glandulares. E alguns dos caracteres que exibiram relativamente baixos níveis de homoplasia não são considerados como tendo um valor taxonômico ou então são ignorados (p. ex., inserção da raiz (dorsal e ventral ou somente ventral), brilho nas escamas do rizoma (fosco à brilhante), etc. (Ranker *et al.* 2004).

Além disso, nesse trabalho de Ranker *et al.* (2004), o posicionamento de *Chrysogrammitis musgraviana* (Baker) Parris (que ocorre na Ásia e Oceania) aparece como grupo irmão do clado IVa (*Micropolypodium* + *Terpsichore longisetosa* + *T. achilleifolia*), porém com pouquíssima sustentação de *bootstrap* e probabilidade *a posteriori*, assim como em Schuettpelz & Pryer (2007, 2008) no trabalho de filogenia molecular de 400 espécies de samambaias leptosporangiadas com três genes plastidiais (*rbcL*, *atpB* e *atpA*).

Todas as três espécies de *Micropolypodium s.l.* (*M. hyalinum*, *M. taenifolium* e *M. zurquinum*) estudadas por Ranker *et al.* (2004) apareceram juntamente com outras duas espécies de *Terpsichore s.l.* – *T. achilleifolia* (Kaulf.) A.R. Sm. (uma coleta proveniente do Brasil) e *T. longisetosa* (Hook.) A.R. Sm. oriunda da Costa Rica – formando assim um grupo parafilético.

Smith (1993a) considerou cinco grupos de espécies no gênero *Terpsichore s.l.* e estas duas espécies utilizadas no trabalho de Ranker *et al.* (2004), juntamente com *T. gradata* (Baker) A.R. Sm., pertencem ao grupo *T. achilleifolia*. Todas as três espécies são diferentes das outras espécies incluídas em *Terpsichore s.l.* por apresentarem escamas do rizoma estramíneas a castanho-claras, semelhantes àquelas encontradas em muitas espécies de *Micropolypodium s.l.*, diferente das escamas mais escuras dos outros grupos de *Terpsichore s.l.* Uma característica importante nas espécies de *Micropolypodium s.l.* é a presença de soros na base das pínulas, com as margens dos soros maduros sobre ou justapostas às nervuras. As espécies de *Terpsichore s.l.* do grupo de *T. achilleifolia* (Smith 1993a) também apresentam

esta característica e a localização dos soros em outras espécies de *Terpsichore* não é desta forma.

Smith (1993a) e Labiak & Prado (2005c) afirmam que este grupo de *Terpsichore s.l.* pode, na verdade, pertencer ao grupo de *Micropolypodium s.l.* devido a tais características, no entanto ponderaram que mais dados eram necessários para se estabelecer esta relação.

A partir da descoberta de um novo híbrido de *Micropolypodium s.l.*, resultado do cruzamento entre *M. setosum* e *Terpsichore achilleifolia* (*Micropolypodium* x *bradei* Labiak & F. B. Matos), Labiak & Matos (2007), com base nos caracteres morfológicos e moleculares, transferiram *T. achilleifolia* e *T. gradata* para *M. achilleifolium* (Kaulf.) Labiak & F. B. Matos e *M. gradatum* (Baker) Labiak & F. B. Matos.

Além disso, os dados moleculares preliminares das espécies neotropicais de *Micropolypodium s.l.* indicaram que as espécies asiáticas, incluindo a espécie-tipo (*M. okuboi* (Yatabe) Hayata), podem não ser congêneras com as espécies do grupo de *Micropolypodium s.l.* (Ranker *et al.* 2004). Caso isso viesse a ser comprovado, esses resultados teriam grandes implicações na classificação de *Micropolypodium s.l.*, bem como para *Terpsichore s.l.* (Mickel & Smith 2004).

Este é um dos principais motivos pelo qual o gênero *Micropolypodium s.l.* foi escolhido para ser estudado. Além disso, muitas dúvidas taxonômicas ainda persistem quando se trata do estabelecimento dos gêneros e das espécies dentro de gramitidóides, consequentemente, vários gêneros novos tem sido segregados dentro deste grupo.

Os principais objetivos deste trabalho consistiam em apresentar uma revisão taxonômica para as espécies neotropicais de *Micropolypodium s.l.*; realizar um amplo estudo sobre a morfologia das espécies e realizar um estudo de filogenia molecular, colaborando para elucidar alguns problemas taxonômicos no grupo das samambaias gramitidóides, e na delimitação do próprio gênero *Micropolypodium*. Além disso, ao final, foi apresentada uma chave de identificação para todas as espécies neotropicais de *Micropolypodium s.l.*, bem como descrições detalhadas, distribuições geográficas e ilustrações para todos os táxons, bem como as árvores filogenéticas obtidas nas análises.

Esta tese está sendo apresentada na forma de capítulos, uma vez que esses já estão no formato de publicação. No capítulo 1 é apresentada a filogenia molecular de *Micropolypodium s.l.* com todos os resultados obtidos nas análises filogenéticas que implicaram basicamente na criação de um novo gênero Neotropical denominado *Moranopteris*, bem como nas combinações novas para as espécies e as descrições de duas espécies novas no gênero. O capítulo 2 refere-se a todo o tratamento taxonômico das espécies de *Moranopteris*, que anteriormente eram reconhecidas como *Micropolypodium s.l.* Nesse

último capítulo, os cabeçalhos taxonômicos das espécies e em alguns lugares na introdução do capítulo há citações incompletas (indicados por 20XX), uma vez que a referência completa depende da publicação do primeiro capítulo que será submetido à revista *Taxon*. O segundo artigo será submetido à publicação no *American Fern Journal*.

Referências Bibliográficas

- Baker, J.G.** 1870. Cyatheaceae et Polypodiaceae. *In*: C.F. P. Martius & A.G. Eichler (eds.). Flora Brasiliensis. Fleischer, Leipzig, v. 1. part. 2, pp. 307–334.
- Bishop, L.E.** 1974. Revision of the genus *Adenophorus* (Grammitidaceae). *Brittonia* 26: 217–240.
- Bishop, L.E.** 1977. The American species of *Grammitis* sect. *Grammitis*. *American Fern Journal* 67: 101–106.
- Bishop, L.E.** 1978. A revision of the genus *Cochlidium* (Grammitidaceae). *American Fern Journal* 68: 76–94.
- Bishop, L.E.** 1988. *Ceradenia*, a new genus of Grammitidaceae. *American Fern Journal* 78: 1–5.
- Bishop, L.E.** 1989a. *Zygophlebia*, a new genus of Grammitidaceae. *American Fern Journal* 79: 103–118.
- Bishop, L.E.** 1989b. New species of *Ceradenia* subg. *Ceradenia*. *American Fern Journal* 79: 14–25.
- Bishop, L.E. & Smith, A.R.** 1992. Revision of the genus *Enterosora* (Grammitidaceae) in the New World. *Systematic Botany* 17: 345–362.
- Bishop, L.E. & Smith, A.R.** 1995. Grammitidaceae. *In*: P.E. Berry, B.K. Holst & Yatskievych (eds.). Pteridophytes, Spermatophytes: Acanthaceae-Araceae. *In*: J.A. Steyermark, P.E. Berry & B.K. Holst (eds.). Flora of the Venezuelan Guayana. Timber Press, Portland, v. 2, pp. 135–158.
- Copeland, E.B.** 1947. Genera filicum. *Chronica Botanica Co.* Waltham, Massachusetts. 247 p.
- Copeland, E.B.** 1952. The American Species of *Xiphopteris*. *American Fern Journal* 42: 41–52; 93-110.
- Hennipmann, E., Veldhoen, P., Kramer, K.U. & Price, M.G.** 1990. Polypodiaceae. *In*: K.U. Kramer & P.S. Green (eds.). The families and genera of vascular plants, vol. I. Pteridophytes and Gymnosperms. Springer-Verlag, Berlin. pp. 203–230.
- Kessler, M., Velázquez, A.M., Sundue, M. & Labiak, P.H.** 2011. *Alansmia*, a new genus of grammitid ferns (Polypodiaceae) segregated from *Terpsichore*. *Brittonia* (no prelo).

- Labiak, P.H.** 2000. New species and new combinations in neotropical Grammitidaceae (Pteridophyta). *Brittonia* 52: 246–255.
- Labiak, P.H.** 2003. A new combination in the fern genus *Ceradenia* (Grammitidaceae). *Kew Bulletin* 58: 991–994.
- Labiak, P.H. & Matos, F.B.** 2007. A new hybrid and two new combinations in neotropical grammitid ferns. *Brittonia* 59: 182–185.
- Labiak, P. H. & Prado, J.** 2003. Grammitidaceae (Pteridophyta) no Brasil com ênfase nos gêneros *Ceradenia*, *Cochlidium* e *Grammitis*. *Hoehnea* 30: 243–283.
- Labiak, P.H. & Prado, J.** 2005a. As espécies de *Lellingeria* A.R. Sm. & R.C. Moran (Grammitidaceae – Pteridophyta) do Brasil. *Revista Brasileira de Botânica* 28: 1–22.
- Labiak, P.H. & Prado, J.** 2005b. As espécies de *Melpomene* e *Micropolypodium* (Grammitidaceae – Pteridophyta) no Brasil. *Boletim de Botânica da Universidade de São Paulo* 23: 51–69.
- Labiak, P.H. & Prado, J.** 2005c. As espécies de *Terpsichore* A.R. Sm. e *Zygophlebia* L.E. Bishop (Grammitidaceae) do Brasil. *Acta Botânica Brasilica* 19: 867–887.
- Labiak, P.H., Rouhan, G. & Sundue, M.** 2010a. Phylogeny and taxonomy of *Leucotrichum* (Polypodiaceae): A new genus of grammitid ferns from the Neotropics. *Taxon* 59: 911–921.
- Labiak, P.H., Sundue, M. & Rouhan, G.** 2010b. Molecular phylogeny, character evolution, and biogeography of the grammitid fern genus *Lellingeria* (Polypodiaceae). *American Journal of Botany* 97: 1354–1364.
- Labiak, P.H.** 2010c. *Leucotrichum*. In: P.H. Labiak, M. Sundue & G. Rouhan. Phylogeny and taxonomy of *Leucotrichum* (Polypodiaceae): A new genus of grammitid ferns from the Neotropics. *Taxon* 59: 911–921.
- Labiak, P.H.** 2011. *Stenogrammitis*, a new genus of grammitid ferns segregated from *Lellingeria* (Polypodiaceae). *Brittonia* (no prelo).
- Lellinger, D.B.** 1989. The ferns and fern-allies of Costa Rica, Panamá, and the Chocó (Part 1: Psilotaceae through Dicksoniaceae). *Pteridologia* 2A: 1–364.
- Lehnert, M.** 2008. Eleven new species in the grammitid fern genus *Melpomene* (Polypodiaceae). *American Fern Journal* 98: 214–250.
- Maxon, W.R.** 1916. Studies of Tropical American Ferns n^o. 6. Contributions from the United States National Herbarium 17: 541–557.
- Mickel, J.T. & Beitel, J.M.** 1988. Pteridophyte flora of Oaxaca, Mexico. *Memoirs of the New York Botanical Garden* 46: 1–568.

- Mickel, J.T. & Smith, A.R.** 2004. The Pteridophytes of Mexico. *Memoirs of the New York Botanical Garden* 88: 1–1054.
- Morton, C.V.** 1967. The genus *Grammitis* in Ecuador. *Contributions from the United States National Herbarium* 38: 85–123.
- Murillo, M.T. & Smith, A.R.** 2003. *Luisma*, a new genus of Grammitidaceae (Pteridophyta) from Colombia. *Novon* 13: 313–317.
- Parris, B.S.** 1983. A taxonomic revision of the genus *Grammitis* Sw. (Grammitidaceae: Filicales) in New Guinea. *Blumea* 29: 13–222.
- Parris, B.S.** 1984. Another intergeneric hybrid in Grammitidaceae: *Ctenopteris longiceps* × *Grammitis sumatrana*. *Fern Gazette* 12: 337–340.
- Parris, B.S.** 1986. Grammitidaceae of peninsular Malaysia and Singapore. *Kew Bulletin* 41: 491–517.
- Parris, B.S.** 1990. Noteworthy species of Grammitidaceae from South-east Asia. *Hooker's Icone Plantarum* 40: 1–129.
- Parris, B.S.** 1995. New combinations in *Prosaptia* (Grammitidaceae: Pteridophyta). *Kew Bulletin* 50: 165–167.
- Parris, B.S.** 1997a. *Themelium*, a new genus of Grammitidaceae (Filicales). *Kew Bulletin* 52: 737–741.
- Parris, B.S.** 1997b. Receptacular paraphyses in Asian, Australasian and Pacific Islands taxa private of Grammitidaceae (Filicales). *In*: R.J. Johns (ed.). *Holtum Memorial Volume*. Royal Botanic Gardens, Kew. pp.81–90
- Parris, B.S.** 1998. *Chrysogrammitis*, a new genus of Grammitidaceae (Filicales). *Kew Bulletin* 53: 909–918.
- Parris, B.S.** 2002. New species and new combinations in African Grammitidaceae (Filicales). *Kew Bull.* 57: 423–434.
- Parris, B.S.** 2003. Distribution of Grammitidaceae inside and outside Malesia. *Telopea* 10: 451–466.
- Parris, B.S.** 2007. Five new genera and three new species of Grammitidaceae (Filicales) and the re-establishment of *Oreogrammitis*. *Gardens' Bulletin, Singapore* 58: 233–274.
- Parris, B.S.** 2009. New genera of Malesian Grammitidaceae (Monilophyta). *Blumea* 54: 217–219.
- Parris, B.S., Beaman, R.S. & Beaman, J.H.** 1992. The plants of Mount Kinabalu: 1. Ferns and ferns allies. Royal Botanic Gardens, Kew. 165p.

- Pryer, K.M., Smith, A.R. & Skog, J.E.** 1995. Phylogenetic relationships of extant ferns based on evidence from morphology and *rbcL* sequences. *American Fern Journal* 85: 205–282.
- Proctor, G.R.** 1977. Pteridophyta. *In*: R. A. Howard (ed.). *Flora of the Lesser Antilles*. Harvard University, Cambridge, v. 2, 414p.
- Proctor, G.R.** 1985. Ferns of Jamaica. British Museum of Natural History, London, 631p.
- Proctor, G.R.** 1989. Ferns of Puerto Rico and Virgin Islands. *Memoirs of the New York Botanical Garden* 53: 1–389.
- Ranker, T.A., Geiger, J.M.O., Kennedy, S.C., Smith, A.R., Haufler, C.H. & Parris, B.S.** 2003. Molecular phylogenetics and evolution of the endemic Hawaiian genus *Adenophorus* (Grammitidaceae). *Molecular phylogenetics and evolution* 26: 337–347.
- Ranker, T.A., Smith, A.R., Parris, B.S., Geiger, J.M.O., Haufler, C.H., Straub, S.C.K. & Schneider, H.** 2004. Phylogeny and evolution of grammitid ferns (Grammitidaceae): A case of rampant morphological homoplasy. *Taxon* 53: 415–428.
- Schneider, H., Smith, A.R., Cranfill, R., Hildebrand, T.J., Haufler, C.H. & Ranker, T.A.** 2004. Unraveling the phylogeny of polygrammoid ferns (Polypodiaceae and Grammitidaceae): Exploring aspects of the diversification of epiphytic plants. *Molecular Phylogenetics and Evolution* 31: 1041–1063.
- Schuettpelez, E. & Pryer, K.M.** 2007. Fern phylogeny inferred from 400 leptosporangiate species and three plastid genes. *Taxon* 56: 1037–1050.
- Schuettpelez, E. & Pryer, K.M.** 2008. Fern phylogeny. *In*: T.A. Ranker & C.H. Haufler (eds.). *Biology and evolution of ferns and lycophytes*. Cambridge: Cambridge University Press. pp. 395–416.
- Smith, A.R.** 1992. A review of the fern genus *Micropolypodium* (Grammitidaceae). *Novon* 2: 419–425.
- Smith, A.R.** 1993a. *Terpsichore*, a new genus of Grammitidaceae (Pteridophyta). *Novon* 3: 478–489.
- Smith, A.R.** 1993b. New species and combinations in *Ceradenia* (Grammitidaceae). *Novon* 3: 182–185.
- Smith, A.R.** 1995a. Grammitidaceae. *In*: R.C. Moran & R. Riba (eds.). *Psilotaceae a Salviniaceae*. *In*: G. Davidse, M.S. Sousa & S. Knapp (eds.). *Flora Mesoamericana*. Universidad Nacional Autónoma de México, Ciudad de México, v. 1. pp. 366–367.
- Smith, A.R.** 1995b. *Micropolypodium*. *In*: R.C. Moran & R. Riba (eds.). *Psilotaceae a Salviniaceae*. *In*: G. Davidse, M.S. Sousa & S. Knapp (eds.). *Flora Mesoamericana*. Universidad Nacional Autónoma de México, Ciudad de México, v. 1. pp. 383–385.

- Smith, A.R.** 1995b. New combinations in Neotropical Grammitidaceae (Pteridophyta). *Novon* 5: 21–22.
- Smith, A.R. & Moran, R.C.** 1992. *Melpomene*, a new genus of Grammitidaceae (Pteridophyta). *Novon* 2: 426–432.
- Smith, A.R., Moran, R.C. & Bishop, L.E.** 1991. *Lellingeria*, a new genus of Grammitidaceae. *American Fern Journal* 81: 76–88.
- Smith, A.R., Pryer, K.M., Schuettpelz, E., Korall, P., Schneider, H. & Wolf, P.G.** 2006. A classification for extant ferns. *Taxon* 55: 705–731.
- Smith, A.R., Pryer, K.M., Schuettpelz, E., Korall, P., Schneider, H. & Wolf, P.G.** 2008. Fern classification. *In*: T.A. Ranker & C.H. Haufler (eds.). *Biology and evolution of ferns and lycophytes*. Cambridge University Press, Cambridge. pp. 417–467.
- Sota, E.R. de la.** 1960. Polypodiaceae y Grammitidaceae Argentinas. *Opera Lilloana* 5: 1–229.
- Sota, E.R. de la, Cassá de Pazos, L.A. & Ponce, M.M.** 2000. Grammitidaceae (Pteridophyta) de Argentina y Chile. *Darwiniana* 38: 299–306.
- Stolze, R.G.** 1981. Fern and fern allies of Guatemala, part 2: Polypodiaceae. *Fieldiana, Botany* 6: 1–522.
- Sundue, M.** 2010. A morphological cladistic analysis of *Terpsichore* (Polypodiaceae). *Systematic Botany* 35: 716–729.
- Sundue, M.** 2011. A monograph of *Ascogrammitis*, a new genus of grammitid ferns (Polypodiaceae). *Brittonia* 62: 357–399..
- Sundue, M. & Kessler, M.** 2008. New species and new records of the fern genus *Terpsichore* (Polypodiopsida: Polypodiaceae) from Bolivia. *Organisms, Diversity & Evolution* 8: 163e1–163e10.
- Sundue, M.A., Islam, M.B. & Ranker, T.A.** 2010. Systematics of grammitid ferns (Polypodiaceae): Using morphology and plastid sequence data to resolve the circumscription of *Melpomene* and the polyphyletic genera *Lellingeria* and *Terpsichore*. *Systematic Botany* 35: 701–715.
- Tryon, R.M. & Stolze, R.G.** 1993. Pteridophyta of Peru part V, 18. Aspleniaceae – 21. Polypodiaceae. *Fieldiana, Botany, new series* 32: 1–190.
- Vareschi, V.** 1969. Helechos. *In*: T. Lasser (ed.). *Flora de Venezuela*. Instituto Botánico, Caracas, v. 1, tomo 2, pp. 473–1033.

CAPÍTULO 1



Moranopteris taenifolia (Jerman) R. Y. Hirai & J. Prado (Foto: R. C. Moran, 2004)

**Molecular phylogeny reveals a new genus of
grammitid ferns (Polypodiaceae) from the
Neotropics**

Molecular phylogeny reveals a new genus of grammitid ferns (Polypodiaceae) from the Neotropics

Abstract *Moranopteris*, a new genus of grammitid ferns is described and combinations are made for the 26 species and one hybrid known to belong to it. Moreover, two new species are presented here. *Moranopteris* was segregated from *Micropolypodium s.l.* on the basis of molecular analyses, morphological characters, and geographical distribution. The phylogeny was based on three cpDNA markers, *atpB*, *rbcL*, and *trnL-trnF*, showing the relationships between *Moranopteris* and other genera of grammitid ferns. A morphological synapomorphy of the new genus is the presence of minute and slightly catenate branched and unbranched hairs occurring together. Some hairs have a setiform branch and are mostly found on the stipe, costa, and laminar tissue abaxially. On the other hand, *Micropolypodium s. str.* has just minute catenate unbranched hairs borne on the same parts of the leaf. The new genus comprises 28 species and one hybrid restricted to Neotropics.

Keywords cpDNA; *Micropolypodium*; *Moranopteris*; Neotropical region; Paleotropical region; taxonomy

INTRODUCTION

Hasebe & al. (1995) and Pryer & al. (1995) made the first approaches about fern phylogeny based on *rbcL* and morphology plus *rbcL*, respectively. In the first paper, Polypodiaceae, Grammitidaceae, and *Pleurosoriopsis* formed a monophyletic group. This clade showed a first insight that Polypodiaceae was paraphyletic, because Grammitidaceae appeared into it. Grammitidaceae was represented by *Micropolypodium s. str.* (*M. okuboi* (Yatabe) Hayata, the type-species).

Similar result was encountered by Schneider & al. (2004), which recovered Grammitidaceae as monophyletic, and also nested within Polypodiaceae *s. str.* Schneider's studies used 98 selected species of polygrammoid ferns (Polypodiaceae *s. str.* and grammitids) and three gene sequences of chloroplast (*rbcL*, *rps4*, and the *rps4-trnS* intergenic spacer). This group of ferns has been informally called as grammitid ferns, which constitute a monophyletic group, nested within a large clade corresponding to the Polypodiaceae. Based on these findings, Smith & al. (2006, 2008), in their classification for the leptosporangiate ferns, included all genera formerly treated as Grammitidaceae (e.g., Parris, 1990; Smith,

1995) into Polypodiaceae, which, according to this circumscription, would comprise ca. 1200 species and 56 genera.

Ranker & al. (2003) were the first study using molecular phylogenetic analysis to focus on a grammitid fern genus. They used three markers (*rbcL*, *atpB*, and *trnL-trnF*) to study *Adenophorus*, an endemic Hawaiian genus. However, the first worldwide phylogenetic study focusing on the grammitid ferns was conducted by Ranker & al. (2004). They realized a phylogenetic analysis based on 73 species of grammitid ferns using molecular (*atpB*, *rbcL*) and morphological data. These papers were the starting point for other molecular studies within the group, because many of the genera traditionally recognized were not recovered as monophyletic. For example, none of the genera *Ctenopteris* Blume, *Grammitis* Sw., *Lellingeria* A.R. Sm. & R.C. Moran, *Prosaptia* C. Presl, and *Terpsichore* A.R. Sm. were supported as monophyletic.

Thereafter, other phylogenetic studies were performed focusing on specific clades within the grammitid ferns, such as Lehnert & al. (2009) on *Melpomene*, Labiak & al. (2010a, 2010b) on *Lellingeria s.l.*, Sundue & al. (2010) and Kessler & al. (2011) on *Terpsichore*, and Ranker & al. (2010), on the *Lellingeria myosuroides* clade.

Concerning *Micropolypodium*, the analysis performed by Ranker & al. (2004), was the first study to show that *Micropolypodium s.l.* was paraphyletic, with two species of *Terpsichore* (*T. achilleifolia* (Kaulf.) A.R. Sm. and *T. longisetosa* (Hook.) A.R. Sm.) nested within it. In this analysis, however, no species from Asia (from where the type of the genus originated) were included, just three Neotropical species were analyzed (*Micropolypodium taenifolium* (Jenman) A.R. Sm., *M. zurquinum* (Copel.) A.R. Sm., and *M. hyalinum* (Maxon) A.R. Sm.).

Noteworthy is that Mickel & Smith (2004) mentioned that preliminary molecular data on Neotropical species of *Micropolypodium s.l.* indicated that the Asian species (and the type specimen) of *Micropolypodium s. str.* would not be congeneric with Neotropical species.

According to the results presented by Ranker & al. (2004), the Neotropical species of *Micropolypodium s.l.* formed a well supported clade that included also the species of the *Terpsichore achilleifolia* group (as considered by Smith, 1993). The species of this group are similar to *Micropolypodium*, because of the orangish to golden scales on the rhizome, fronds with determinate growth, hydathodes visible conspicuously on the adaxial lamina surface, and dark red-brown unbranched setae on laminar tissue. Based on these results, Labiak & Matos (2007) described a new hybrid from Rio de Janeiro (Brazil) – *Micropolypodium* × *bradei* Labiak & F.B. Matos, and also combined *T. achilleifolia* and *T. gradata* into

Micropolypodium (= *M. achilleifolium* (Kaulf.) Labiak & F.B. Matos, and *M. gradatum* (Baker) Labiak & F.B. Matos).

As the analysis performed by Ranker & al. (2004) did not include any Paleotropical species of *Micropolypodium* and considering the high levels of homoplasy among the Neotropical and Paleotropical species, we have based our studies in a much broader sampling among the species considered within *Micropolypodium s.l.*, with the aim to: a) test the monophyly of *Micropolypodium s.l.* b) confirm the monophyly of the Neotropical species of *Micropolypodium s.l.*, as suggested by previous studies, and c) to present a taxonomic revision of the Neotropical species of this group.

In the present paper we are presenting the results of the two first objectives listed above and only a conspectus of the genus. A complete revision of the genus will be presented in a separated paper.

MATERIAL AND METHODS

Taxonomic sampling. – Based on the studies by Schneider & al. (2004), we have chosen the following outgroups: *Polypodium vulgare* L., *Pectuma eurybasis* (C. Chr.) M.G. Price, *Microgramma bifrons* (Hook.) Lellinger, *Microgramma percussa* (Cav.) de la Sota, and *Serpocaulon triseriale* (Sw.) A.R. Sm.

To test the monophyly of *Micropolypodium s.l.*, and also to access which groups are most closely related to it, we have included samples of most of the grammitid fern genera from Neotropics and Old World making a screening, i.e., they represent the major clades in the grammitids previously recognized in the molecular phylogenetic study by Ranker & al. (2004).

The sequences of outgroups and the majority of grammitid fern genera cited above were obtained at GenBank.

In this study, 21 species in total were sampled in the clade IVa of Ranker & al. (2004). This clade corresponds to Neotropical species of *Micropolypodium s.l.* plus *Terpsichore achilleifolia* and *T. longisetosa*. Additionally, two Asian species of *Micropolypodium s.l.* were included in our molecular analysis. The final matrix includes 75 terminals, corresponding to 62 species and 25 grammitid fern genera.

Voucher information and GenBank accession numbers are listed in Appendix 1.

DNA extraction. – Genomic DNA was isolated from either field-collected, silica gel-dried fronds or from herbarium specimens. Total genomic DNA was performed using the Qiagen DNEasy Plant Mini Kit (Valencia, California, U.S.A.), following the manufacturer's

protocol, but with an additional proteinase K digestion during the lysis step: 30 μ L of proteinase K (20 mg/mL), and 30 μ L of β -mercaptoethanol (98%) added per tube, with the tubes incubated on a tipping plate at 42°C for 12 hours.

Amplifications and sequencing. – The three chloroplast DNA markers, *atpB*, *rbcL*, and the *trnL-trnF* spacer, were amplified by PCR, following standard protocols. For *atpB* was used the primers ESATPB172F and ESATPE45R (Schuettpelz & Pryer, 2007), for *rbcL* the primers ESRBCL1F and ESRBCL1361R (Schuettpelz & Pryer, 2007), and for *trnL-trnF* spacers the primers “e” (Taberlet & al., 1991) and “f” (Taberlet & al., 1991). The first two genes were typically amplified using a program beginning with one initial denaturation step of 5 min at 94°C, followed by 35 cycles of 1 min at 94°C, 1 min at 50°C, 2.5 min at 72°C, and a final extension period of 10 min at 72°C. For spacer *trnL-trnF* was used a program beginning with one initial denaturation step of 5 min at 94°C, followed by 35 cycles of 1 min at 94°C, 30 s at 50°C, 1 min at 72°C, and a final extension period of 7 min at 72°C. The PCR products were sequenced using the amplification primers plus the internal primers 493F and 910R for *atpB* (Schuettpelz & Pryer, 2007), ESRBCL628F and ESRBCL654R for *rbcL* (Schuettpelz & Pryer, 2007). PCR products were sequenced by the High-Throughput Genomics Unit at the University of Washington (<http://www.htseq.org/index.html>). All the 31 newly obtained consensus sequences were subsequently submitted to GenBank (Appendix 1).

Alignment and phylogenetic analyses. – Forward and reverse sequences obtained for all species were edited and assembled using Sequencher v.4 (Gene Codes Corporation, Ann Arbor, Michigan). Consensus sequences were then automatically aligned using the program Muscle v.3.6 using the default parameters (Edgar, 2004), and the resulting alignments were manually checked and revised maximizing the similarity between sequences using the MUST package (Philippe, 1993). Thus, many indels were necessary to achieve an aligned matrix for *trnL-trnF*.

Data matrices were constructed using TaxonDNA v.1.6.2. (Meier & al., 2006) and analyzed using equally weighted maximum parsimony (MP), and Bayesian inference (BI). Gaps resulting from the alignment for the *trnL-trnF* region were scored with SeqState v.1.4.1 (Müller, 2005). As suggested by Simmons & al. (2007), the modified complex indel coding model (MCIC; Müller, 2006) and the simple indel coding model (SIC; Simmons & Ochoterena, 2000) outperform treating gaps as missing data or excluding gapped positions. Consequently, the MCIC model was used in parsimony-based analyses, and the SIC model in Bayesian analyses.

Maximum parsimony analyses (MP) were performed using the program PAUP* v.4.0b10 (Swofford, 2002). For all MP analyses, heuristic searches were performed with

10,000 random-sequence addition replicates, tree bisection-reconnection (TBR), branch swapping, and the Multrees options were on. The robustness of each node was assessed by a non-parametric bootstrap analysis (BS; Felsenstein, 1985), with 1000 replicates of similar heuristic searches (but each replicate with 3 random-sequence addition replicates). Because all characters are equally sampled, parsimony-uninformative characters can have a significant effect on robustness that is neither logical nor desirable (Desalle & al., 2002). Therefore, parsimony-uninformative characters were removed before the bootstrap procedure.

Bayesian analyses (BI) were performed using the program MrBayes v3.1.2 (Huelsenbeck & Ronquist, 2001; Ronquist & Huelsenbeck, 2003). Each molecular partition was assigned its own model of nucleotide substitution (GTR+ Γ +I for the three regions), each being suggested as best fit to the data under the Akaike information criterion (AIC; Akaike, 1973), as implemented in the program jModelTest v.0.1.1 (Posada, 2008). The coded gap characters (in the *trnL-trnF* sequences) were included and analyzed separately from the rest of the sequence data, being set to follow the model implemented in MrBayes for binary data: “lset coding = variable”. The partition strategy included the models for each marker, separate codon positions for *atpB* and *rbcL*, and the binary model for the coded gap characters. Two independent but parallel analyses were carried out using flat priors, starting from random trees and consisting of four chains each. The analyses were run for 5 million generations, sampling every 100 generations. Following completion of the analyses, the output parameter estimates through time was explored in order to recognize the point of convergence to the stationary distribution, using Tracer v.1.5 (Rambaut & Drummond, 2004). This was reached after approximately 150,000 generations and the first 500,000 generations (5,000 trees) of one of the runs were conservatively excluded as the ‘burn-in’. We pooled the post burn-in trees (45,000 total trees) and computed a majority consensus with average branch lengths and posterior probability estimates for all nodes.

Taxonomic treatment. – A new genus is described, and combinations are made for the species currently known as belonging to it. Based on morphology, two new species are also described.

Scanning electron micrograph of spores and lamina tissues showing the base of the seta were obtained from herbarium specimens (NY, UC). With dissecting needles the spores and laminar tissue were transferred from the specimens to aluminum scanning electron microscope (SEM) stubs coated with an adhesive tape. The stubs were then coated with gold-palladium in a sputter coater for 30 to 40 seconds and imaged digitally with an SEM.

RESULTS

In Table 1 are summarized the results for each analysis and for each marker, including the number of characters and taxa included, percentages of variable and informative sites, number of MP trees, tree length, consistency indice(CI), retention indice (RI), and substitution models used in BI.

Table 1. Number of taxa and characters, evolutionary models used in BI, and tree statistics for the MP analyses.

Data set	<i>atpB</i>	<i>rbcL</i>	<i>trnL-trnF</i>	Combined
Total number of taxa / ingroup only	69 / 31	71 / 33	57 / 32	75 / 36
Included characters	1357	1311	404	3072
Variable characters (%)	359 (26)	346 (26)	259 (64)	964 (31)
Parsimony informative characters (%)	254 (19)	236 (18)	192 (47)	682 (22)
Consistency Index (CI)	0.45	0.43	0.50	0.44
Retention Index (RI)	0.65	0.65	0.70	0.64
Number of MP trees	156	56243	458	12
MP tree length	979	987	845	2938
BI substitution model	GTR+ Γ + I	GTR+ Γ + I	GTR+ Γ + I	GTR+ Γ + I

The analyses performed for each marker and the combined dataset produced a nearly identical topology, according to the analytical methods described above. Thus, only the results from the combined dataset using MP (Fig 1) and BI analyses (Fig 2) are discussed here.

The results of these analyses show clearly that *Micropolypodium s.l.* is a paraphyletic genus. The Neotropical species of *Micropolypodium s.l.* form a clade that is strongly supported in both MP and BI analyses (Fig. 1 and 2; bootstrap support (BS) = 94%; posterior probability (PP) = 1, respectively). The results also support the monophyly of the Asian species of *Micropolypodium s.l.* (BS = 78%; PP = 1).

In the MP analyses, a basal polytomy in the *Moranopteris* clade precludes the assessment of the relationships among the species. Although this polytomy is resolved in BI,

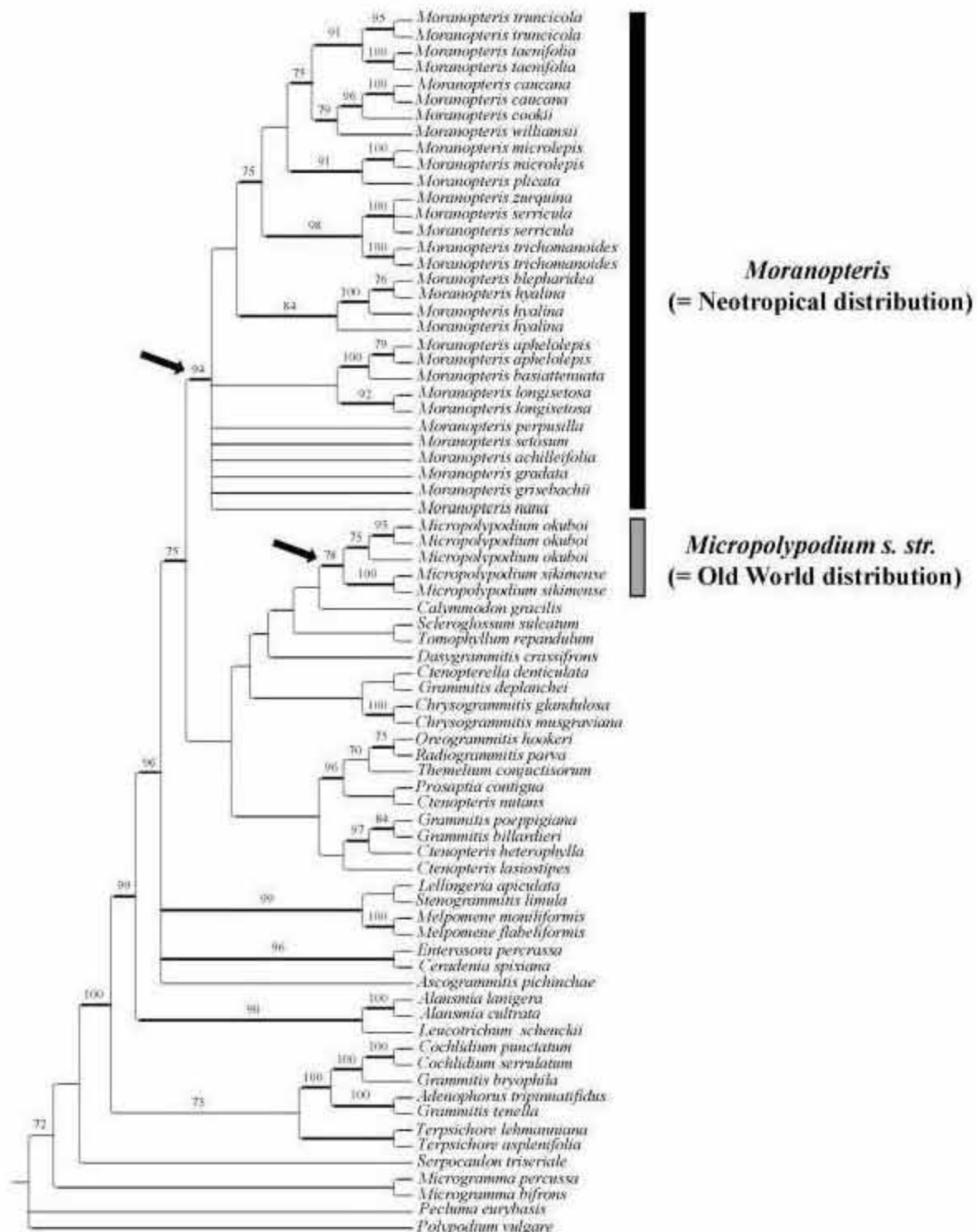


Fig. 1. Strict consensus tree of 12 most parsimonious trees obtained in a maximum parsimony analysis of the combined dataset (*atpB* + *rbcL* + *trnL-trnF*). Bootstrap values >70% are given above branches. Branches in bold represent clades with $\geq 75\%$ bootstrap support. Arrows indicate two main clades: Neotropical and Old World species of *Micropolypodium s. l.*

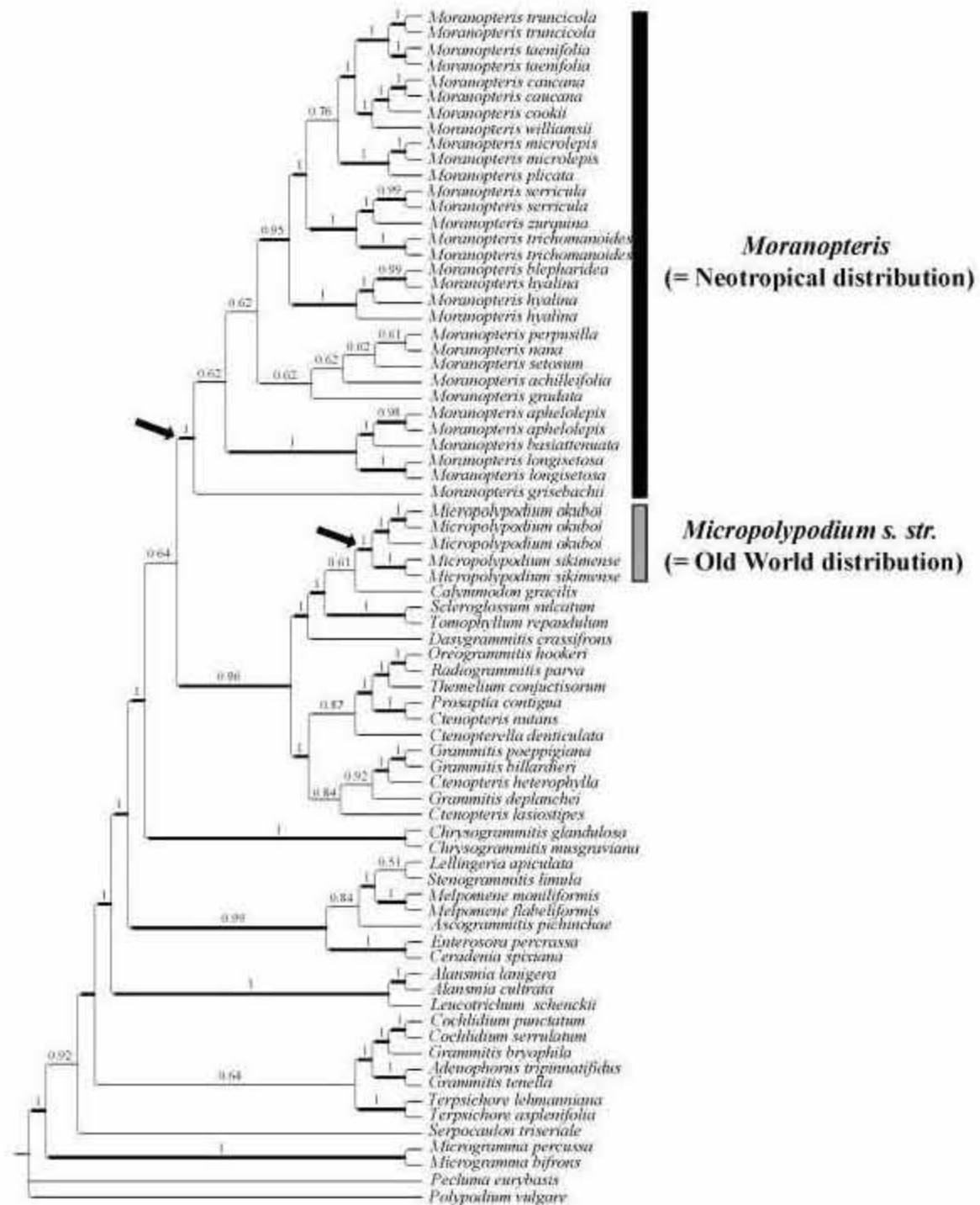


Fig. 2. Majority-rule consensus tree from the Bayesian analysis. Numbers above branches indicate values of posterior probability >0.5 . Branches in bold represent clades with ≥ 0.95 posterior probability support. Arrows indicate two main clades: Neotropical and Old World species of *Micropolypodium s.l.*

the relationships are poorly supported (PP = 0.62).

Within *Moranopteris*, two clades are strongly supported in both analysis (MP and BI). One of them comprises a basal clade formed by *M. blepharidea* plus *M. hyalina* (BS = 84%, PP = 1), which is sister to the other large clade that consists of *M. truncicola* to *M. trichomanoides* (with 16 terminals, BS = 75%, PP = 1).

The entirely Neotropical clade of *Micropolypodium s.l.* is closely related to other Old World genera (*Calymmodon* C. Presl, *Scleroglossum* Alderw., *Tomophyllum* (E. Fourn.) Parris, *Dasygrammitis* Parris, *Ctenopterella* Parris, *Grammitis*, *Chrysogrammitis* Parris, *Oreogrammitis* Copel., *Radiogrammitis* Parris, *Themelium* (T. Moore) Parris, *Prosaptia*, *Ctenopteris*) and not to Neotropical ones (*Melpomene*, *Leucotrichum* Labiak, *Enterosora*, *Ceradenia* L.E. Bishop, *Cochlidium*, *Terpsichore*, etc.).

The MP analyses show a large clade (BS = 75%) formed by primarily Old World species of grammitid genera (including *Micropolypodium s. str.* and *Chrysogrammitis*) as sister to Neotropical clade of *Micropolypodium s.l.* In the Bayesian Inference, *Chrysogrammitis* (from SE Asia through Malesia to Melanesia) is recovered as sister to this large clade (PP = 1) comprised by the Neotropical clade of *Micropolypodium s.l.* plus other Old World genera.

The relationships among Old World genera remain unclear in both analysis (MP and BI). *Calymmodon* is weakly supported (BS <70% and PP = 0.61) as sister to *Micropolypodium s. str.* clade. Additionally, *Scleroglossum* and *Tomophyllum* form a clade that is closely related to *Micropolypodium s. str.* plus *Calymmodon*. These relationships are strongly supported by the Bayesian analysis (PP = 1), but not by the MP analysis (BS <70%).

DISCUSSION

The results presented here support two distinct clades of *Micropolypodium s.l.* One of them is formed by Neotropical species and the other by Old World species, as previously suggested by Mickel & Smith (2004).

The Neotropical species of *Micropolypodium s.l.* differs of Old World species of *Micropolypodium s.l.* especially in the morphology of the hairs, which slightly catenate unbranched and branched hairs on stipe, rachis or costa and laminar tissue, mainly abaxially vs. only catenate unbranched hairs. Probably, there are other characters that are exclusive to the Neotropical clade of *Micropolypodium s.l.*, but additional ontogenetic studies among these Neotropical and Old Word species are still necessary to address this assumption.

Our results also corroborate the recognition of a monophyletic group formed by Neotropical species of *Micropolypodium s.l.* that includes also the species considered in the *Terpsichore achilleifolia* group by Smith (1993), as first suggested by Ranker & al. (2004). Besides the phylogenetic results, the *Terpsichore achilleifolia* group is morphologically more similar to *Micropolypodium s.l.* than to the remaining groups of *Terpsichore s.l.*, from which it differs by having orangish to golden rhizome scales and red-brown unbranched setae (Smith, 1993).

Parris (2009) recognized *Micropolypodium s. str.* from Malesia having radial rhizome with stipes in whorls, pale to medium brown non-clathrate glabrous rhizome scales, laminae deeply pinnately divided to pinnate, one sorus per lobe or pinna, medium to dark brown simple hairs present and branched hairs absent, hydathodes present and glabrous sporangia. Comparing the Neotropical species of *Micropolypodium s.l.* with this description they overlap the Old World species except by the hairs and geographic distribution.

According to Smith (1993), there is an interesting point of view about certain species of *Terpsichore taxifolia* group that resemble *Pechuma* (Polypodiaceae) by having pectinate laminae. He also pointed out that: “it seems likely that the resemblance is the result of convergent evolution and is not an indication of any close affinity between the two genera”.

This idea can be extended to hairs, for instance, *Oleandra* Cav. (Moran, pers. comm.) and *Pechuma* M.G. Price (illustrated by Price, 1983) have similar hairs when compared with Neotropical species of *Micropolypodium s.l.* and other grammitid genera, and it does not mean that they are closely related. By the way, *Pechuma* is more closely related with *Polypodium*, *Pleopeltis*, and *Phlebodium* clade (Schuettpelez & Pryer, 2007, 2008). Oleandraceae and Davalliaceae are sisters to Polygrammoids (Schuettpelez & Pryer, 2007, 2008), but *Davallia* Sm. does not have this type of hairs.

Labiak & al. (2010a) commented that hairs are homoplastic having evolved multiple times in the grammitid clade. These hairs can be explained as convergent evolution and used sometimes to characterize genus and groups within them.

The relationships inside of *Moranopteris* clade need more investigations. The results here presented are not enough to conclude the evolution within *Moranopteris*. It is necessary to have more data, including more fresh dried samples in silica gel of *Moranopteris* species mainly from Caribbean, because the present molecular study results were based only on old herbaria collections. Maybe, also other molecular markers will be important to establish the placement of the basal and derived species and besides, the evolution of morphological characters of the genus. Additionally, more *Moranopteris* species need to be included in

subsequent analysis, for example: *M. nimbata* and *M. knowltoniorum*. Unfortunately, any materials from these species were obtained for the molecular studies.

Calymmodon is putatively sister to Old World species of *Micropolypodium s.l.* Furthermore, *Scleroglossum* plus *Tomophyllum* form a monophyletic group, sister to Old World species of *Micropolypodium s.l.* plus *Calymmodon*; however these relationships were not clearly established here. The results were not conclusive in the present study, but Ranker & al. (2004) found similar topology as well (clade III).

Moreover, *Chrysogrammitis* clade is placement as sister to Old World grammitid genera plus Neotropical clade of *Micropolypodium s.l.* and *T. achilleifolia* group and they are strongly supported in BI analyses, however this placement is not found in MP analyses. In MP analyses, *Chrysogrammitis* clade appeared into the Old World grammitid species, sister to *Ctenopteris* and *Grammitis*, but is weakly supported (BS). In Ranker's studies (Ranker & al., 2004) the placement of *Chrysogrammitis musgraviana* (Baker) Parris as sister to Old World taxa plus Neotropical species of *Micropolypodium s.l.* plus *Terpsichore achilleifolia* group plus Old World taxa were unresolved. A recent study based on 400 leptosporangiate species using three plastid genes (*rbcL*, *atpB*, and *atpA*), *Chrysogrammitis musgraviana* (an Old World species) were placement as sister to *Micropolypodium s.l.* (*M. hyalinum* and *M. taenifolium*), but it was not strongly supported too (Schuettpelz & Pryer, 2007).

All results have showed insufficient conclusions about the relationships among Old World genera of grammitid ferns, therefore several questions yet remain unresolved. To resolve these questions is necessary to increase the number of molecular and morphological data of Old World taxa in the further analyses.

Based on phylogenetic evidence and its geographic distribution, as well as morphological characters, the Neotropical species of *Micropolypodium s.l.* are here segregated from *Micropolypodium s. str.* Our studies corroborate *Micropolypodium* as a name restrict to a group of Asian species, therefore a new generic name to this Neotropical clade is provided.

Moranopteris R.Y. Hirai & J. Prado, **gen. nov.** – Type: *Moranopteris basiattenuata* (Jenman) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium basiattenuatum* Jenman, Bull. Bot. Dept. Jamaica, n.s. 4: 114. 1897.

Diagnosis. – Primo aspectu ad *Micropolypodio* valde accedit, sed distributio neotropica (non veteri-mundi), frondibus cum pilis leviter catenulatis ramosis et non-ramosis, pilis ramosis cum ramis setaceis et non-setaceis (non frondibus solum cum pilis non-ramosis) distincta.

Description. – Plants epiphytic, rarely epipetric or terrestrial. *Rhizome* short-creeping, decumbent to ascending, generally weakly dorsiventral to radially symmetric, with scales, golden to castaneous, often lustrous, nonclathrate, entire, or with small lateral projections, or with glanduliform or setiform projections on the margins, setiform projections mostly red-brown, rarely hyaline, other projections hyaline, with or without apical or subapical gland-like cells, cells of body often turgid. *Fronde* monomorphic, caespitose, erect to pendent, determinate, or rarely \pm indeterminate, short-stipitate, sometimes the stipe almost absent, not articulate to the rhizome; *laminae* mostly linear, sometimes lanceolate, pinnatifid, pinnatisect, bipinnatisect, pinnatisect-pinnatifid, or pinnate-pinnatifid, sometimes pinnate at base, gradually tapering proximally to a lateral narrow wing or not, mostly chartaceous, sometimes membranaceous; *costa* obscured by laminar tissue or visible with dark sclerenchyma abaxially and adaxially; *segments* ascending to patent, alternate to opposite, with an acroscopic hump (gibbous) or not, when present, especially in fertile segments, symmetric or asymmetric, linear, oblong, or rounded, pinnatisect or pinnatifid, slightly decurrent at base or not, margins plane or slightly revolute, with or without hyaline cells, basicopic side not folded over sorus; *veins* simple, furcate or pinnate, inconspicuous, obscured by laminar tissue or visible with dark sclerenchyma at the base of the segment, *hydathodes* present, mostly 1 or 2 (rarely > 2) hydathodes per segment or pinna, the hydathodes visible adaxially, elliptic, rounded, or linear; *setae* dark red-brown, on both surfaces of the stipe, rachis or costa, and laminar tissue or rarely absent, ring of cells at base conspicuous to inconspicuous; *hairs* present on the stipe, rachis or costa, and laminar tissue (mainly near to costa abaxially), slightly catenate, hyaline, slightly red-brown on the cross walls, mostly branched, or unbranched and branched. *Sori* superficial, usually at base of the costa/costule or on the acroscopic veinlet, mostly 1 (rarely > 2) per segment or pinna, rounded or elliptic, exindusiate; soral paraphyses absent; *sporangia* glabrous; *spores* tetrahedral-globose, papillate to tuberculate with globules; $x=37$ (Smith, 1992).

Distribution. – *Moranopteris* is a Neotropical genus, with 28 species and one hybrid. It occurs in Mexico, Central America, Antilles, Andes, Guyanas, and Brazil. Andes and Central America are centers of diversity of the genus, with 14 and 12 species, respectively. In these centers five species that occur in Andes (*M. aphelolepis*, *M. blepharidea*, *M. killipii*, *M. simplex*, and *M. williamsii*) and sole one species in Central America are endemic (*M. zurquina*). Moreover, there are three species and one hybrid endemic to Brazil (*M. gradata*, *M. perpusilla*, *M. setosa*, and *M. x bradei*) and two species endemic to Caribbean (*M. knowltoniorum* and *M. sherringii*).

Distinctive morphological characters. – *Moranopteris* differs from *Micropolypodium s. str.* in having slightly catenate unbranched and branched hairs (Fig. 3L–P) vs. only catenate unbranched hairs (similar Fig. 3L).

The rhizome scales are nonclathrate and the cells of the scale body are often turgid. The margins of rhizome scales are mostly entire, or with small lateral projections, or with setiform or glanduliform projections (Fig. 3G–K).

The segments sometimes are gibbous, visible mainly on fertile segments (Fig. 3F). The number of hydathodes and veins can vary mostly from 1 or 2 (Fig. 3E–F), sometimes with more than two per segment in *Moranopteris achilleifolia* Fig. 3D, *M. gradata* Fig. 3C, and *M. longisetosa*.

Setae are commonly present on the stipe, costa or rachis, and laminar tissue, rarely absent in *Moranopteris grisebachii* and *M. perpusilla*. As commented by Smith (1992), setae in *Micropolypodium s.l.* appear to differ from those setae of many other grammitid ferns. He described the seta bearing a ring of cells at base. These cells are different from the adjacent surrounding epidermal cells, like in *Moranopteris basiattenuata* (Fig. 4A) and in several other species examined. Moreover, Smith (pers. comm.) observed that *Micropolypodium s. str.* does not present this ring of cells such as in *Micropolypodium okuboi* (Fig. 4B). This ring of cells at base of the seta can be observed in many specimens of *Moranopteris*, but it is inconspicuous in some plants and it is a difficult character to be used for distinguishes *Moranopteris* promptly.

Hairs are often branched (1–4-branched), sometimes there are unbranched hairs and branched hairs on the same plant (Fig. 3L–P). The branched hairs can seldom have 1 (Fig. 3P) or 2 setiform branch(es). Some species (e.g., *Moranopteris blepharidea* and *M. killipii*) can be recognized by 1-branched hairs that have a typical longer branch: \geq twice longer than the main branch (Fig. 3M).

At first view, the spores of *Moranopteris* appear different from *Micropolypodium s. str.* Tryon & Lugardon (1990) described the spores of *Micropolypodium knowltoniorum* (= *Moranopteris knowltoniorum*) being tuberculate. The spores of *Moranopteris basiattenuata* have also tuberculate surface with globules (Fig. 4C, D), whereas *Micropolypodium okuboi* papillate surface with dense globules (Fig. 4E, F) and it is strongly depressed or the surface has only low papillae in *Micropolypodium sikkimense* (Fig. 4G, H). These spores' characters seem to be very tenuous between the *Moranopteris* and *Micropolypodium s. str.*

Therefore, the presence of ring of cells at base of the seta and spores morphology was not used as distinctive morphological characters for the new genus.

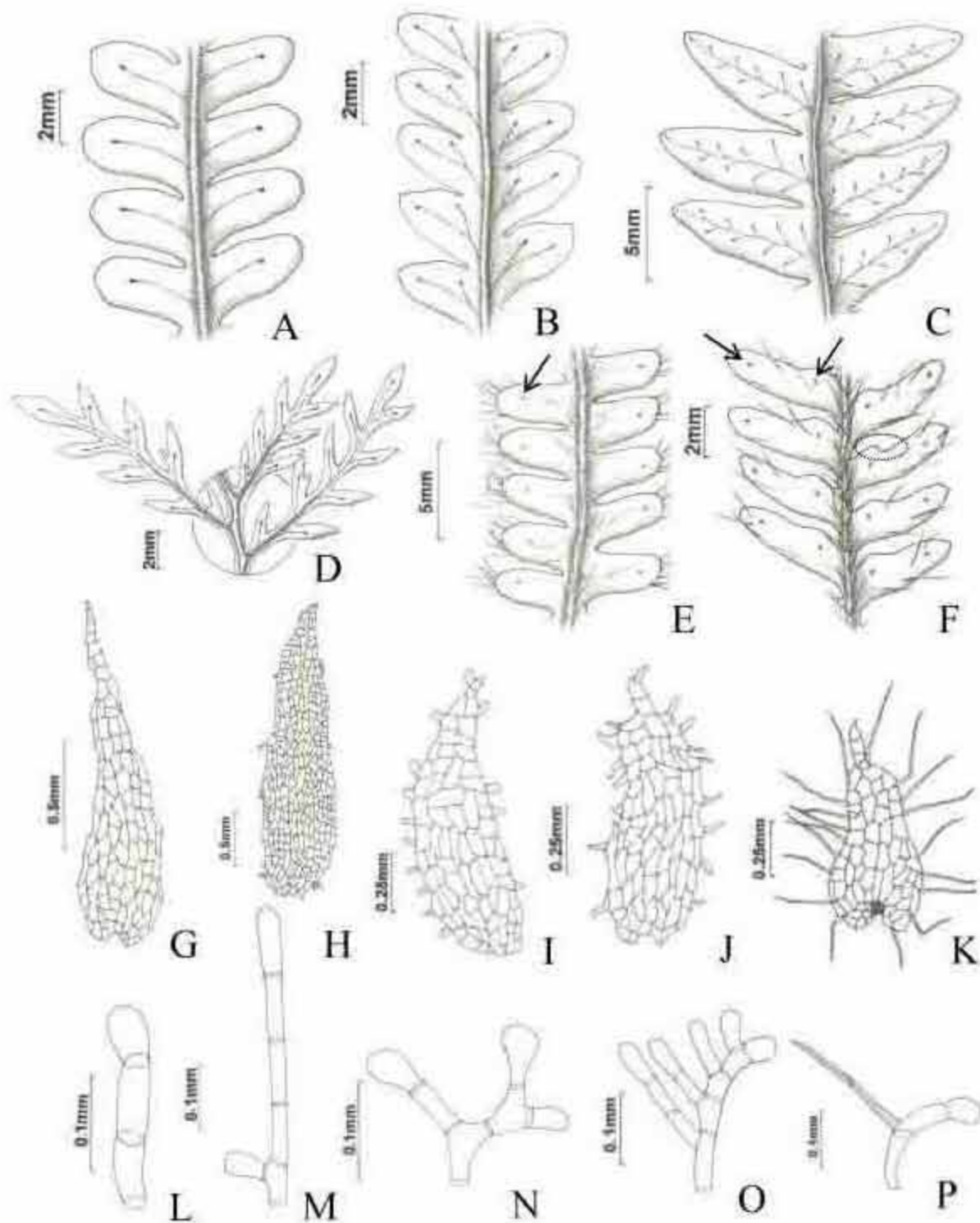


Fig. 3. Morphology of some species of *Moranopteris*. A–D, venation patterns (cleared leaf): A, simple veins, *M. cookii* (Sunder & al. 1764, NY); B, furcate veins, *M. aphelolepis* (Boeke & Jaramillo 2701, NY); C, pinnate veins, *M. gradata* (Hirai & al. 564, SP); D, pinnate veins, *M. longisetosa* (Rojas 3209, NY); E–F, segments: E, not gibbous segments (pointed by arrow is the hydathode adaxially), *M. cookii* (Sunder & al. 1764, NY); F, gibbous segments at circle (pointed by arrow are the hydathodes adaxially), *M. liesneri* (Cowan & Wurdack 31415, NY); G–K, rhizome scale types: G, entire margins, *M. cookii* (Sunder & al. 1764, NY); H, margins with small lateral projections, *M. basiattenuata* (Breedlove & Thorne 30160, NY); I, margins with glanduliform projections, *M. longisetosa* (Rojas 3209, NY); J, margins with short setiform projections, *M. killipii* (Lehmann 7655, K); K, margins with setiform projections, *M. microlepis* (Rojas 3603, NY); L–P, some hair types: L, unbranched hairs, *M. liesneri* (Cowan & Wurdack 31415, NY); M, 1-branched, *M. blepharidea* (Kessler & al. 11973, UPCEB); N, 2-branched, *M. longisetosa* (Rojas 3209, NY); O, 4-branched, *M. setosa* (Hirai & al. 598, SP); P, 1-branched with one setiform branch, *M. taenifolia* (Graville 3557, CAY).

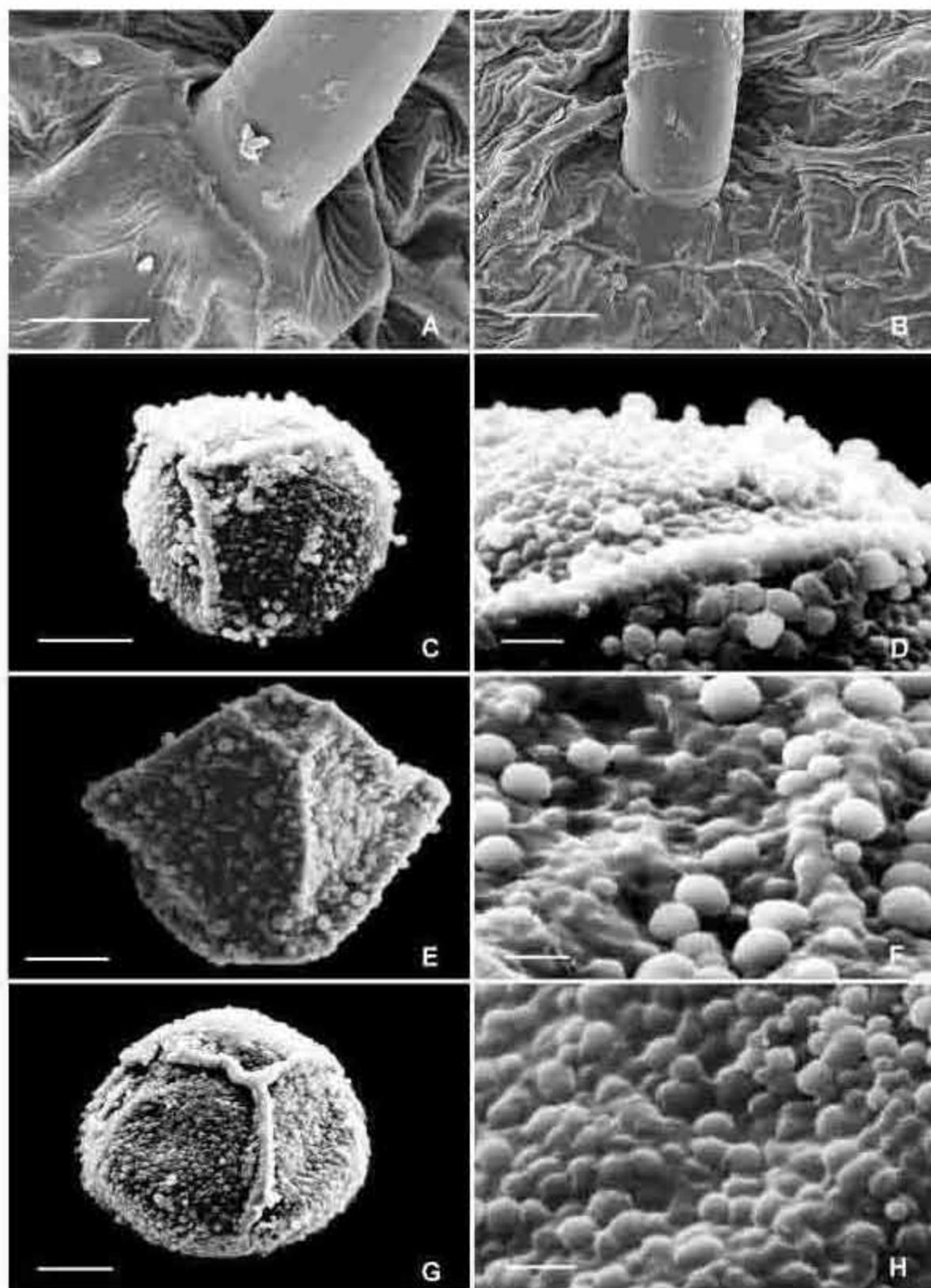


Fig. 4. **A**, base of a seta showing a ring of cells in *Moranopteris basiattenuata* (Maxon 9858, NY); **B**, base of a seta without a ring of cells in *Micropolypodium okuboi* (Togashi s.n., UC); **C–D**, spores of *M. basiattenuata* (Breedlove & Thorne 30160, NY): **C**, proximal face with globules; **D**, detail of tuberculate surface; **E–F**, spores of *M. okuboi* (Togashi s.n., UC): **E**, proximal face strongly depressed and densely globulose; **F**, detail of globules on an irregular surface; **G–H**, spores of *Micropolypodium sikkimense* (Miehe 93-32, UC): **G**, proximal face; **H**, detail of low papillae on the surface. (A–C, E, G: scale bars = 10 μ m; D, F, H: scale bars = 2 μ m).

New combinations:

1. *Moranopteris achilleifolia* (Kaulf.) R.Y. Hirai & J. Prado, **comb. nov.** \equiv *Polypodium achilleifolium* Kaulf., Enum. Fil. 116. 1824. *Ctenopteris achilleifolia* (Kaulf.) J. Sm., Hist. fil. 185. 1875. *Grammitis achilleifolia* (Kaulf.) R.M. Tryon & A.F. Tryon in Rhodora 84: 128. 1982. *Terpsichore achilleifolia* (Kaulf.) A.R. Sm. in Novon 3: 486. 1993. *Micropolypodium achilleifolium* (Kaulf.) Labiak & F.B. Matos in Brittonia 59: 184. 2007. – Distribution: Coastal Brazil.

2. *Moranopteris aphelolepis* (C.V. Morton) R.Y. Hirai & J. Prado, **comb. nov.** \equiv *Grammitis aphelolepis* C.V. Morton in Contr. U.S. Natl. Herb. 38: 97. 1967. *Xiphopteris aphelolepis* (C.V. Morton) Pic.Serm. in Webbia 28: 472. 1973. *Micropolypodium aphelolepis* (C.V. Morton) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Colombia, Ecuador, and Bolivia.

3. *Moranopteris basiattenuata* (Jenman) R.Y. Hirai & J. Prado, **comb. nov.** \equiv *Polypodium basiattenuatum* Jenman in Bull. Bot. Dept. Jamaica, n.s. 4: 114. 1897. *Xiphopteris basiattenuata* (Jenman) Copel. in Amer. Fern J. 42: 104. 1952. *Grammitis basiattenuata* (Jenman) Proctor in Bull. Inst. Jamaica, Sci. Ser. 5: 32. 1953. *Micropolypodium basiattenuatum* (Jenman) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Mexico, Guatemala, Honduras, El Salvador, Costa Rica, Jamaica, Dominican Republic, Guyana, Venezuela, Colombia, and Ecuador.

4. *Moranopteris blepharidea* (Copel.) R.Y. Hirai & J. Prado, **comb. nov.** \equiv *Polypodium blepharideum* Copel. in Univ. Calif. Publ. Bot. 19: 304. pl. 64. 1941. *Xiphopteris blepharidea* (Copel.) Copel. in Amer. Fern J. 42: 99. 1952. *Micropolypodium blepharideum* (Copel.) A.R. Sm. in Novon 2: 422. 1992. *Grammitis blepharidea* (Copel.) Stolze in Fieldiana, Bot. n.s., 32: 112. 1993. – Distribution: Colombia, Peru, and Bolivia.

5. *Moranopteris caucana* (Hieron.) R.Y. Hirai & J. Prado, **comb. nov.** \equiv *Polypodium caucanum* Hieron. in Bot. Jahrb. Syst. 34: 503. 1904. *Xiphopteris caucana* (Hieron.) Copel. in Amer. Fern J. 42: 98. 1952. *Grammitis caucana* (Hieron.) C.V. Morton in Contr. U.S. Natl. Herb. 38: 96. 1967. *Micropolypodium caucanum* (Hieron.) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Nicaragua, Costa Rica, Panama, Guyana, Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil.

6. *Moranopteris cookii* (Underw. & Maxon) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium cookii* Underw. & Maxon in Contr. U.S. Natl. Herb. 17: 408. 1914. *Xiphopteris cookii* (Underw. & Maxon) Copel. in Amer. Fern J. 42: 98. 1952. *Grammitis cookii* (Underw. & Maxon) F. Seym. in Phytologia 31: 173. 1975. *Micropolypodium cookii* (Underw. & Maxon) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Guatemala, Costa Rica, Panama, and Ecuador.
7. *Moranopteris gradata* (Baker) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium gradatum* Baker, Fl. Bras. 1(2): 513. 1870. *Polypodium hirsutulium* Fée, Crypt. vasc. Br. 1: 87. 1869, *nom. illeg., non* Forst (1786). *Ctenopteris gradata* (Baker) Copel. in Philippi. J. Sci. 84: 437. 1955. *Grammitis gradata* (Baker) R.M. Tryon & A.F. Tryon in Rhodora 84: 128. 1982. *Terpsichore gradata* (Baker) A.R. Sm. in Novon 3: 486. 1993. *Micropolypodium gradatum* (Baker) Labiak & F.B. Matos in Brittonia 59: 184. 2007. – Distribution: Endemic to Coastal Brazil.
8. *Moranopteris grisebachii* (Underw. ex C. Chr.) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium grisebachii* Underw. ex C. Chr., Index Filic. 531. 1906, based on *P. exiguum* Griseb., *non* Heward (1838). *Polypodium exiguum* Griseb, Fl. Br. W. Ind. 701. 1864, *nom. illeg., non* Heward (1838). *Xiphopteris grisebachii* (Underw. ex C. Chr.) Copel. in Amer. Fern J. 42: 95. 1952. *Grammitis grisebachii* (Underw. ex C. Chr.) Proctor in Bull. Inst. Jamaica Sci. Ser. 5: 33. t. 2(7-8). 1953. *Micropolypodium grisebachii* (Underw. ex C. Chr.) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Endemic to Caribbean.
9. *Moranopteris hyalina* (Maxon) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium hyalinum* Maxon in Contr. U.S. Natl. Herb. 17: 406. 1914. *Xiphopteris hyalina* (Maxon) Copel. in Amer. Fern J. 42: 107. 1952. *Grammitis hyalina* (Maxon) F. Seym. in Phytologia 31: 174. 1975. *Micropolypodium hyalinum* (Maxon) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Costa Rica, Colombia, Ecuador, and Peru.
10. *Moranopteris killipii* (Copel.) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Xiphopteris killipii* Copel. in Amer. Fern J. 42: 105. t. 10. 1952. *Grammitis killipii* (Copel.) Lellinger in Amer. Fern J. 74: 58. 1984. – Distribution: Endemic to Andes from Colombia and Ecuador.

11. *Moranopteris knowltoniorum* (Hodge) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium knowltoniorum* Hodge in Amer. Fern J. 31: 105. p. 1, f. 4–6. 1941. *Xiphopteris knowltoniorum* (Hodge) Copel. in Amer. Fern J. 42: 108. 1952. *Grammitis knowltoniorum* (Hodge) Proctor in Rhodora 63: 35. 1961. *Micropolypodium knowltoniorum* (Hodge) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Endemic to Lesser Antilles.
12. *Moranopteris liesneri* (A.R. Sm.) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Grammitis liesneri* A.R. Sm. in Ann. Missouri Bot. Gard. 77: 257. 1990. *Micropolypodium liesneri* (A.R. Sm.) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Endemic to Venezuela.
13. *Moranopteris longisetosa* (Hook.) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium longisetosum* Hook. in Sp. Fil. 4: 225. t. 278 A. 1864. *Terpsichore longisetosa* (Hook.) A.R. Sm. in Novon 3: 487. 1993. – Distribution: Costa Rica, Venezuela, Colombia, Ecuador, Peru, and Bolivia.
14. *Moranopteris microlepis* (Rosenst.) R.Y. Hirai & J. Prado, **comb. nov. & stat. nov.** ≡ *Polypodium blepharodes* Maxon var. *microlepis* Rosenst. in Repert. Spec. Nov. Regni Veg. 22: 14. 1925. – Distribution: Costa Rica, Panama, Jamaica, and Guadeloupe.
15. *Moranopteris nana* (Fée) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium nanum* Fée in Gen. Filic. 5: 238. 1852. *Xiphopteris nana* (Fée) Copel. in Amer. Fern J. 42: 107. 1952. *Micropolypodium nanum* (Fée) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Costa Rica, Panama, Trinidad and Tobago, French Guiana, Suriname, Guyana, Venezuela, Colombia, Peru, and Brazil.
16. *Moranopteris nimbata* (Jenman) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium nimbatum* Jenman in J. Bot. 24: 271. 1886. *Xiphopteris nimbata* (Jenman) Copel. in Amer. Fern J. 42: 108. 1952. *Grammitis nimbata* (Jenman) Proctor in Bull. Inst. Jamaica Sci. Ser. 5: 34. 1953. *Micropolypodium nimbatum* (Jenman) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Greater Antilles.
17. *Moranopteris perpusilla* (Maxon) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium perpusillum* Maxon in Contr. U.S. Natl. Herb. 17: 409. pl. 13-A. 1913. *Xiphopteris perpusilla* (Maxon) Copel. in Amer. Fern J. 42: 95. 1952. *Micropolypodium*

- perpusillum* (Maxon) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Endemic to Southeast Brazil.
- 18. *Moranopteris plicata*** (A.R. Sm.) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Grammitis plicata* A.R. Sm. in Ann. Missouri Bot. Gard. 77: 258. 1990. *Micropolypodium plicatum* (A.R. Sm.) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Costa Rica, Venezuela, Colombia, Ecuador, Peru, and Brazil.
- 19. *Moranopteris serricula*** (Fée) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium serricula* Fée, Gen. Filic. 238. 1852. *Xiphopteris serricula* (Fée) Copel in Amer. Fern J. 42: 101. 1952. *Grammitis serricula* (Fée) Proctor in Rhodora 63: 35. 1961. *Micropolypodium serricula* (Fée) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Dominica, Guadeloupe, Martinique, Trinidad and Tobago, and Venezuela.
- 20. *Moranopteris setosa*** (Kaulf.) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Xiphopteris setosa* Kaulf., Enum. Filic. 275. 1824. *Grammitis setosa* (Kaulf.) C. Presl, Tent. 208. 1836, *nom. illeg., non* Blume (1828). *Polypodium micropteris* C. Chr., Index Filic. 545. 1906, *nom. nov.* for *X. setosa* Kaulf. *Grammitis micropteris* (C. Chr.) Brade in Sellowia 18: 81. 1966. *Micropolypodium setosum* (Kaulf.) A.R. Sm. in Novon 2: 422. 1992. – Distribution: Endemic to Coastal Brazil.
- 21. *Moranopteris sherringii*** (Baker) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium sherringii* Baker in J. Bot. 20: 26. 1882. *Xiphopteris sherringii* (Baker) Copel. in Amer. Fern J. 42: 104. 1952. *Grammitis sherringii* (Baker) Proctor in Bull. Inst. Jamaica Sci. Ser. 5: 35. 1953. *Micropolypodium sherringii* (Baker) A.R. Sm. in Novon 2: 423. 1992. – Distribution: Endemic to Greater Antilles.
- 22. *Moranopteris taenifolia*** (Jenman) R.Y. Hirai & J. Prado, **comb. nov.** ≡ *Polypodium taenifolium* Jenman in Bull. Bot. Dept. Jamaica, n.s. 4: 114. 1897. *Xiphopteris taenifolia* (Jenman) Copel. in Amer. Fern J. 42: 109. 1952. *Grammitis taenifolia* (Jenman) Proctor in Bull. Inst. Jamaica Sci. Ser. 5: 35. 1953. *Micropolypodium taenifolium* (Jenman) A.R. Sm. in Novon 2: 423. 1992. – Distribution: Mexico, Belize, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Jamaica, Haiti, Dominican Republic, Puerto Rico, Saint Kitts and Nevis, Guadeloupe, Martinique,

Trinidad and Tobago, French Guiana, Suriname, Guyana, Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil.

- 23. *Moranopteris trichomanoides*** (Sw.) R.Y. Hirai & J. Prado, **comb. nov.** \equiv *Polypodium trichomanoides* Sw., Prodr. 131. 1788. *Grammitis trichomanoides* (Sw.) Ching in Bull. Fan Mem. Inst. Biol. 10: 16. 1940. *Xiphopteris trichomanoides* (Sw.) Copel., Gen. Fil. 215. 1947. *Micropolypodium trichomanoides* (Sw.) A.R. Sm. in Novon 2: 423. 1992. – Distribution: Mexico, Guatemala, Honduras, Cuba, Jamaica, Haiti, and Dominican Republic.
- 24. *Moranopteris truncicola*** (Klotzsch) R.Y. Hirai & J. Prado, **comb. nov.** \equiv *Polypodium truncicola* Klotzsch var. *major* Klotzsch in Linnaea 20: 374. 1847. *Xiphopteris truncicola* (Klotzsch) Copel. in Amer. Fern J. 42: 101. 1952. *Grammitis truncicola* (Klotzsch) C.V. Morton in Contr. U.S. Natl. Herb. 38: 98. 1967. *Micropolypodium truncicola* (Klotzsch) A.R. Sm. in Novon 2: 423. 1992. – Distribution: Costa Rica, Guyana, Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil.
- 25. *Moranopteris williamsii*** (Maxon) R.Y. Hirai & J. Prado, **comb. nov.** \equiv *Polypodium williamsii* Maxon in Contr. U.S. Natl. Herb. 17: 547, pl. 34. 1916. *Xiphopteris williamsii* (Maxon) Copel. in Amer. Fern J. 42: 101. 1952. *Grammitis williamsii* (Maxon) Lellinger in Amer. Fern J. 74: 59. 1984. *Micropolypodium williamsii* (Maxon) A.R. Sm. in Novon 2: 423. 1992. – Distribution: Endemic to Bolivia.
- 26. *Moranopteris zurquina*** (Copel.) R.Y. Hirai & J. Prado, **comb. nov.** \equiv *Xiphopteris zurquina* Copel. in Amer. Fern J. 42: 99. 1952. *Grammitis zurquina* (Copel.) F. Seym. in Phytologia 31: 175. 1975. *Micropolypodium zurquinum* (Copel.) A.R. Sm. in Novon 2: 423. 1992. – Distribution: Endemic to Costa Rica.
- 27. *Moranopteris* x *bradei*** (Labiak & F.B. Matos) R.Y. Hirai & J. Prado, **comb. nov.** \equiv *Micropolypodium* x *bradei* Labiak & F.B. Matos in Brittonia 59: 182. 2007. – Distribution: Endemic to the state of Rio de Janeiro, southeastern Brazil.

New species:

1. *Moranopteris rupicola* R.Y. Hirai & J. Prado, **sp. nov.** – Type: Guyana. Mazaruni-Potaro, Roraima, summit, La Proa Camp, east of border, near Lake Gladys, 2800 m, 05°15'36"N, 60°13'W, 14 Apr 1988, *R.L. Liesner 23289* (holotype: MO; isotypes: UC, VEN). Figure 5A–G.

Diagnosis. – *Moranopteris rupicola* similis *Moranopteridi taenifoliae* sed a qua habitu rupicolous et pilis ramosis cum 1 vel 2 ramis (vs. habitu epiphyticus, pilis non-ramosis et pilis ramosis cum 1 vel 2 ramis setaceis) differt.

Plants epipetric. *Rhizome* erect with scales, the scales 2.1–2.7 mm × 0.3–0.4 mm, yellow-brown, lanceolate, base slightly cordate, apex acute, mostly with apical or subapical gland-like cells, margins with long setiform projections, or also with small lateral projections, rarely setiform projections occurring on the scale surface, setiform projections red-brown, 0.15–0.30 mm long. *Fronde* erect to arcuate, determinate, 5.5–13.0 cm × 4.5–10.0 mm, sparsely setose; *stipe* 0.5–1.0 cm long, yellow-brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costa* visible or slightly visible with dark sclerenchyma abaxially, slightly visible with dark sclerenchyma adaxially; *segments* slightly ascending, 60–80° to costa, 17–36 pairs, spaced (0.4–)0.6–1.8 mm, subopposite, gibbous, asymmetric, 2.8–4.9 × 1.9–2.9 mm, oblong, decurrent at base, apex rounded to slightly acute, margins plane, without hyaline cells, or inconspicuous; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, obovate or linear; *setae* 1.6–2.4 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the costa and laminar tissue, rarely on the margins (mainly near to costa abaxially), hyaline, slightly red-brown, branched or rarely unbranched, the branched hairs mostly 1 or 2-branched, the main branch 2 or 3-celled, 0.15–0.25 mm long, 1st branch 1 or 2-celled, or sometimes 2-celled in the same insertion point, (<–)0.10–0.15 mm long, 2nd branch, if present, 1-celled, < 0.1 mm long, the unbranched if present, 1-celled, < 0.1 mm long. *Sori* one per segment, rounded, 1.5–1.8 mm diam.

Additional specimens examined. – VENEZUELA. Bolívar, Cumbre del Ptari-tepui, al norte de la Misión de Santa Teresita de Kavanayén, 2360–2420 m, 05°45'N, 61°45'W, 23 Feb 1978, *Steyermark et al. 115650* (GH, UC, VEN).

Distribution. – Guyana, Venezuela, and probably Brazil; 2360–2800 m.

Discussion. – *Moranopteris rupicola* has rhizome scales with red-brown long setiform projections on the margins, sparsely setose fronds, gibbous segments, furcate veins, two hydathodes per segment, and mostly branched hairs mainly near and on the costa (Fig. 5A–

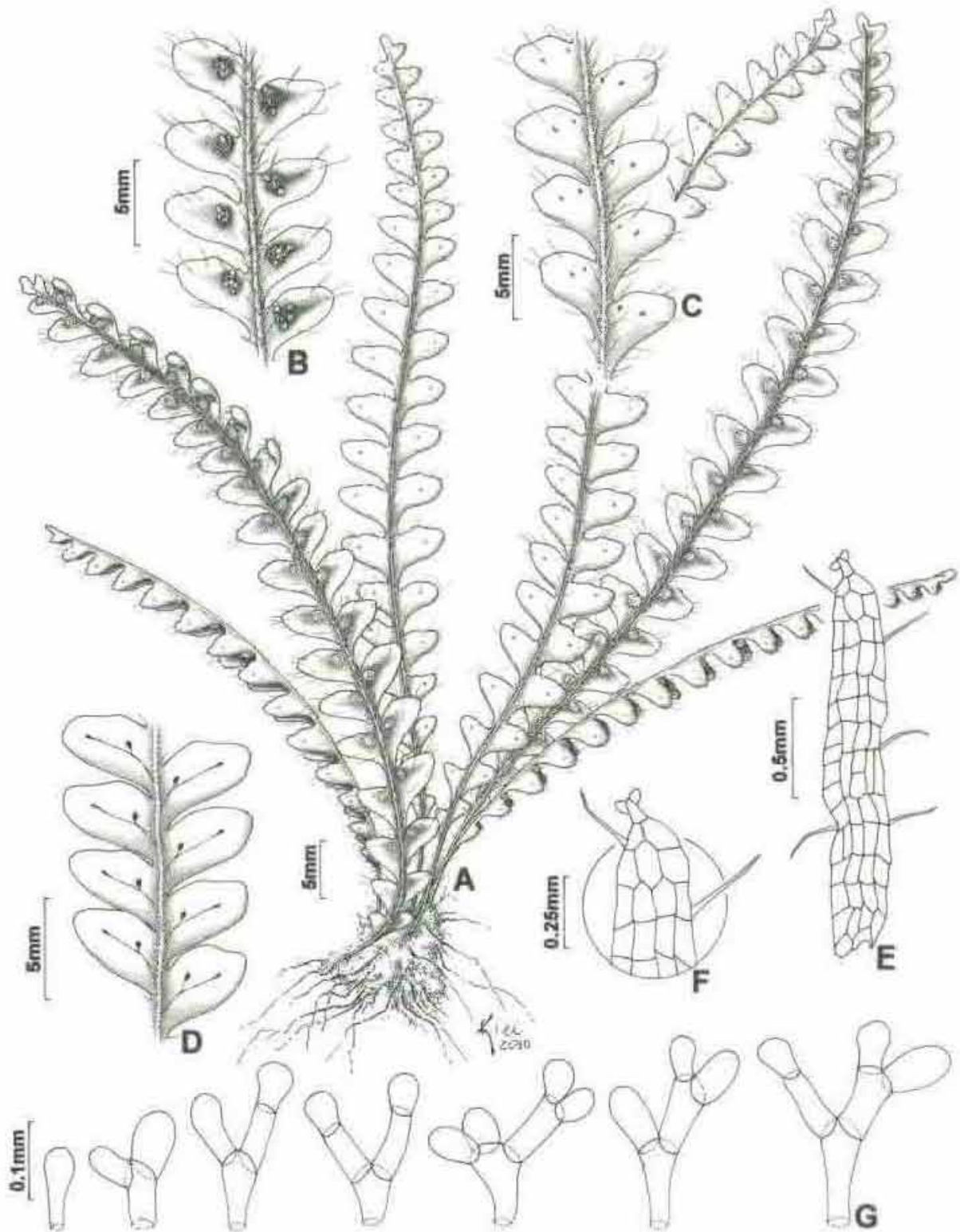


Fig. 5. A–G, *Moranopteris rupicola*. A, habit; B, detail of the fertile segments showing sori and setae abaxially; C, detail of the segments showing setae and hydathodes adaxially; D, detail of the venation (cleared leaf); E, stem scale; F, detail of the apex of the rhizome scale; G, unbranched and branched hairs from the costa. (A–C, E, F: Liesner 23289 [MO]; D, G: Steyermark et al. 115650 [UC]).

G). The specific epithet refers to the habitat where this species grows on rocks of the Venezuelan tepuis.

Moranopteris rupicola resembles *M. taenifolia*, but they are easily distinguished by the hairs that occur mostly near and on the costa abaxially. *Moranopteris taenifolia* differs in having unbranched hairs and branched hairs with a setiform branch.

2. *Moranopteris simplex* R.Y. Hirai & J. Prado, **sp. nov.** – Type: Venezuela. Aragua: Maracay, Choroní-Passes, 1600 m, 28 Feb 1958, K. Mägdefrau 464 (holotype: B-200077185). Figure 6A–F.

Diagnosis. – Species quam maxime affinis *Moranopteridi trichomanoidea*, sed plerumque pilis non-ramosis et pilis furcatis sparsis in lamina abaxialiter (vs. pilis ramosis cum 2–4-ramis, approximatis et in costa abaxialiter) differt.

Plants epiphytic. *Rhizome* erect with scales, the scales 2.0–2.2 × 0.20–0.25 mm, yellow-brown, lanceolate to slightly linear, base slightly cordate, apex acute, with apical or subapical gland-like cells, margins entire, or with also small lateral projections, these projections sometimes furcate. *Fronde* erect to arcuate, determinate, 3.5–7.6 cm × 5.0–7.5 mm, moderately setose; stipes almost absent, brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, sometimes deeply pinnatifid, gradually tapering proximally to a narrow wing, chartaceous; *costa* obscured by laminar tissue abaxially and adaxially, sometimes slightly visible with dark sclerenchyma abaxially; *segments* slightly ascending, ca. 60–80° to costa, 18–35 pairs, spaced ca. 1.1–1.7 mm, subopposite, gibbous, asymmetric, 2.5–3.8 × 1.1–1.6 mm, oblong to oblong-lanceolate, deltate toward base, decurrent at base, apex rounded to slightly acute, margins slightly revolute, without hyaline cells; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, rarely 3 hydathodes, the hydathodes visible adaxially, elliptic or obovate, sometimes rounded; *setae* 1.1–2.7 mm long, dark red-brown, on both surfaces of the costa and laminar tissue; hairs scattered throughout the costa, laminar tissue abaxially, and margins, hyaline to yellowish, slightly red-brown, unbranched and branched, the unbranched hairs 2-celled, 0.05–0.15 mm long, the branched hairs 1 or 2-branched, mostly 1-branched, the main branch 2 or 3-celled, (<–)0.1(–0.2) mm long, 1st branch 1 or 2-celled, 0.10–0.15 mm long, 2nd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, rounded, 1.4–1.8 mm diam.

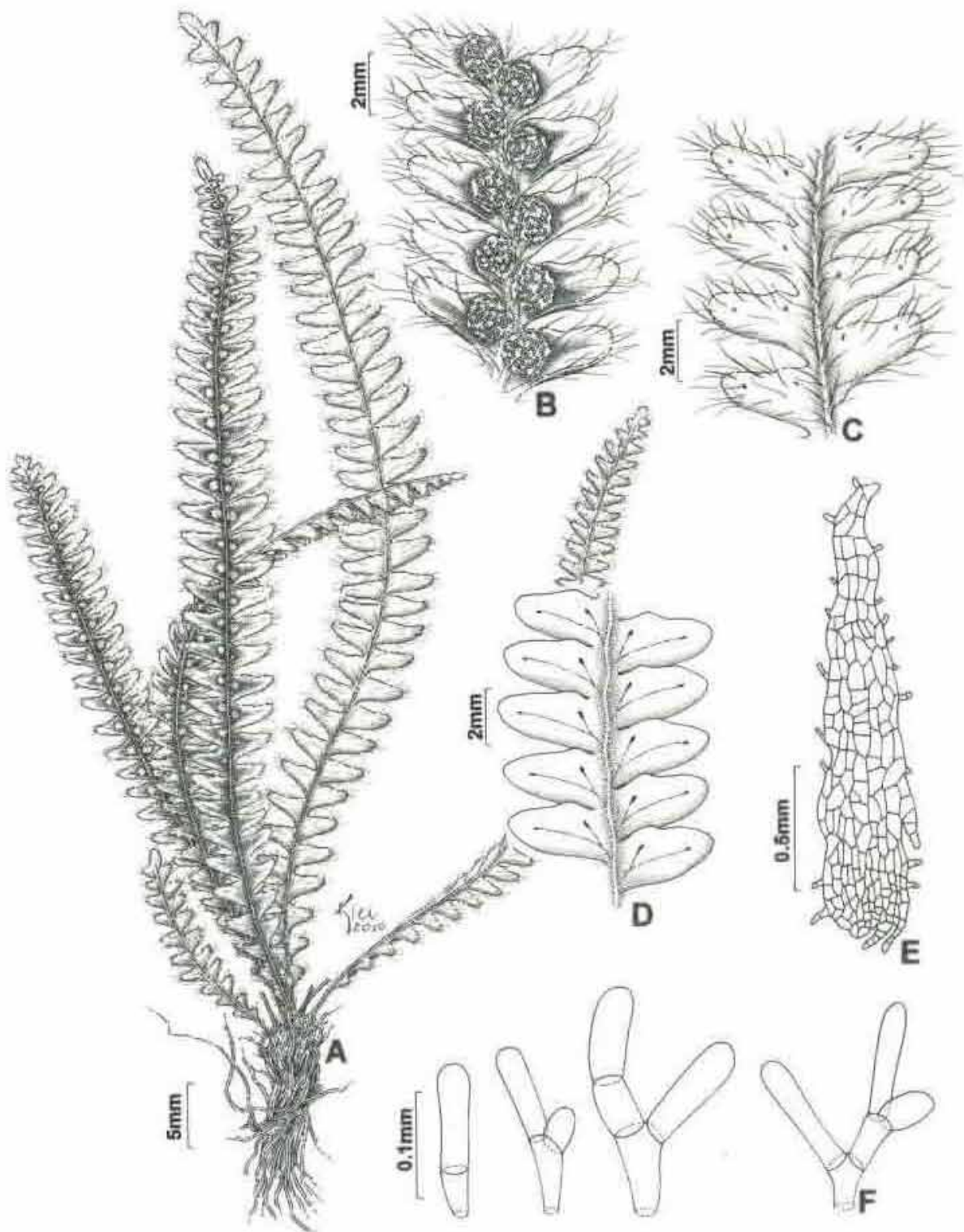


Fig. 6. A–F, *Moranopteris simplex*. A, habit; B, detail of the fertile segments showing sori and setae abaxially; C, detail of the segments showing setae and hydathodes adaxially; D, detail of the venation (cleared leaf); E, stem scale; F, unbranched and branched hairs from the costa. (A–C, E: Mägdefrau 464 [B]; D, F: Quijada 4 [VEN]).

Additional specimens examined. – VENEZUELA. Aragua, Colonia Tovar, s.d., *Moritz s.n.* p.p. (P-637667, P-696244); Distrito Federal, Caracas, Monte Grappa, 18 Aug 1985, *Quijada 4* (VEN); El Junquito, 1925 m, 26 Mar 1943, *Killip & Rohl 37170* (US).

Distribution. – Endemic to Venezuela; 1600–1925 m.

Discussion. – *Moranopteris simplex* is easily distinguished by the hairs. These hairs are mostly yellowish unbranched and up to 2-branched. On the whole, they differ because occur scattered abaxially on the laminar tissue (Fig. 6A–F).

The most similar species is *Moranopteris trichomanoides*, which occurs in Greater Antilles and Central America. It differs by having branched hairs, mostly 2–4-branched, near and on the costa abaxially, without unbranched and rarely 1-branched hairs.

The specific epithet refers to the hairs which are less branched when compared to the hairs of the most similar species (*Moranopteris trichomanoides*).

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LITERATURE CITED

- Akaike, H.** 1973. Information theory as an extension of the maximum likelihood principle. Pp. 267–281 in: Petrov, B.N. & Csaki, F. (eds.), *Second International Symposium on Information Theory*. Budapest: Akademiai Kiado.
- Desalle, R., Giribert, G. & Wheeler, W.** 2002. *Techniques in molecular systematics and evolution*. Basel: Birkhauser Verlag.
- Edgar, R.C.** 2004. Muscle: Multiple sequence alignment with high accuracy and high throughput. *Nucleic Acids Res.* 32: 1792–1797.
- Felsenstein, J.** 1985. Confidence limits on phylogenies: An approach using the bootstrap. *Evolution* 39: 783–791.
- Hasebe, M., Wolf, P.G., Pryer, K.M., Ueda, K., Ito, M., Sano, R., Gastony, G.J., Yokoyama, J., Manhart, J.R., Murakami, N., Crane, E.H., Hafler, C.H. & Hauk,**

- W.D.** 1995. Fern phylogeny based on *rbcl* nucleotide sequences. *Amer. Fern J.* 85: 134–181.
- Huelsenbeck, J.P. & Ronquist, F.** 2001. MrBayes: Bayesian inference of phylogenetic trees. *Bioinformatics* 17: 754–755.
- Kessler, M., Velázquez, A.M., Sundue, M. & Labiak, P.H.** 2011. *Alansmia*, a new genus of grammitid ferns (Polypodiaceae) segregated from *Terpsichore*. *Brittonia* (no prelo).
- Labiak, P.H. & Matos, F.B.** 2007. A new hybrid and two new combinations in neotropical grammitid ferns. *Brittonia* 59: 182–185.
- Labiak, P.H., Rouhan, G. & Sundue, M.** 2010a. Phylogeny and taxonomy of *Leucotrichum* (Polypodiaceae): A new genus of grammitid ferns from the Neotropics. *Taxon* 59: 911–921.
- Labiak, P.H., Sundue, M. & Rouhan, G.** 2010b. Molecular phylogeny, character evolution, and biogeography of the grammitid fern genus *Lellingeria* (Polypodiaceae). *Am. J. Bot.* 97: 1354–1364.
- Lehnert, M., Kessler, M., Schmidt-Lebuhn, A.N., Klimas, S.A., Fehlberg, S.D. & Ranker, T.A.** 2009. Phylogeny of the fern genus *Melpomene* (Polypodiaceae) inferred from morphology and chloroplast DNA analysis. *Syst. Bot.* 34: 17–27.
- Meier, R., Kwong, S., Vaidya, G. & Ng, P.K.L.** 2006. DNA barcoding and taxonomy in Diptera: a tale of high intraspecific variability and low identification success. *Syst. Biol.* 55: 715–728.
- Mickel, J.T. & Smith, A.R.** 2004. The pteridophytes of Mexico. *Mem. New York Bot. Gard.* 88: 1–1054.
- Müller, K.** 2005. SeqState primer design and sequence statistics for phylogenetic DNA data sets. *Appl. Bioinformatics* 4: 65–69.
- Müller, K.** 2006. Incorporating information from length-mutational events into phylogenetic analysis. *Mol. Phylogenet. Evol.* 38: 667–676.
- Parris, B.S.** 1990. Grammitidaceae. Pp. 153–157 in: Kramer, K.U. & Green, P.S. (eds.), *The families and genera of vascular plants, vol. I. Pteridophytes and Gymnosperms*. Berlin: Springer-Verlag.
- Parris, B.S.** 2009. New genera of Malesian Grammitidaceae (Monilophyta). *Blumea* 54: 217–219.
- Philippe, H.** 1993. MUST, a computer package of management utilities for sequences and trees. *Nucleic Acids Res.* 21: 5264–5272.
- Posada, D.** 2008. jModelTest: Phylogenetic model averaging. *Molec. Biol. Evol.* 25: 1253–1256.

- Price, M.G.** 1983. *Pechuma*, a new tropical American fern genus. *Amer. Fern J.* 73: 109-116.
- Pryer, K.M., Smith, A.R. & Skog, J.E.** 1995. Phylogenetic relationships of extant ferns based on evidence from morphology and *rbcL* sequences. *Amer. Fern J.* 85: 205–282.
- Rambaut, A & Drummond, A.J.** 2004. *Tracer*. Oxford: University of Oxford.
- Ranker, T.A., Geiger, J.M., Kennedy, S.C., Smith, A.R., Haufler, C.H. & Parris, B.S.** 2003. Molecular phylogenetics and evolution of the endemic Hawaiian genus *Adenophorus* (Grammitidaceae). *Molec. Phylogenet. Evol.* 26: 337–347.
- Ranker, T.A., Smith, A.R. Parris, B.S., Geiger, J.M.O., Haufler, C.H., Straub, S.C.K. & Schneider, H.** 2004. Phylogeny and evolution of grammitid ferns (Grammitidaceae): A case of rampant morphological homoplasy. *Taxon* 53: 415–428.
- Ranker, T.A., Sundue, M., Labiak, P.H., Parris, B. & Rouhan, G.** 2010. New insights into the phylogeny and historical biogeography of the *Lellingeria myosuroides* clade (Polypodiaceae). <http://knol.google.com/k/tom-a-ranker/new-insights-into-the-phylogeny-and/uggrdrq3hh35/4?collectionId=28qm4w0q65e4w.46#> (accessed 29 Nov 2010).
- Ronquist, F. & Huelsenbeck, J.P.** 2003. MrBayes 3: Bayesian phylogenetic inference under mixed models. *Bioinformatics* 19: 1572–1574.
- Schneider, H., Smith, A.R., Cranfill, R., Hildebrand, T.J., Haufler, C.H. & Ranker, T.A.** 2004. Unraveling the phylogeny of polygrammoid ferns (Polypodiaceae and Grammitidaceae): Exploring aspects of the diversification of epiphytic plants. *Molec. Phylogenet. Evol.* 31: 1041-1063.
- Schuettpelez, E. & Pryer, K.M.** 2007. Fern phylogeny inferred from 400 leptosporangiate species and three plastid genes. *Taxon* 56: 1037–1050.
- Schuettpelez, E. & Pryer, K.M.** 2008. Fern phylogeny. Pp. 395–416 in: Ranker, T.A. & Haufler, C.H. (eds.), *Biology and evolution of ferns and lycophytes*. Cambridge: Cambridge University Press.
- Simmons, M.P., Müller, K. & Norton, A.P.** 2007. The relative performance of indel-coding methods in simulations. *Molec. Phylog. Evol.* 44: 724–740.
- Simmons, M.P. & Ochoterena, H.** 2000. Gaps as characters in sequence-based phylogenetic analyses. *Syst. Biol.* 49: 369–381.
- Smith, A.R.** 1992. A review of the fern genus *Micropolypodium* (Grammitidaceae). *Novon* 2: 419–425.
- Smith, A.R.** 1993. *Terpsichore*, a new genus of Grammitidaceae (Pteridophyta). *Novon* 3: 478-489.

- Smith, A.R.** 1995. Grammitidaceae. Pp. 366–367 in: Moran, R.C. & Riba, R. (eds.), Psilotaceae a Salviniaceae in: Davidse, G., Sousa, M.S. & Knapp, S. (eds.), *Flora Mesoamericana*. Ciudad de México: Universidad Nacional Autónoma de México.
- Smith, A.R., Pryer, K.M., Schuettpelz, E., Korall, P., Schneider, H. & Wolf, P.G.** 2006. A classification for extant ferns. *Taxon* 55: 705–731.
- Smith, A.R., Pryer, K.M., Schuettpelz, E., Korall, P., Schneider, H. & Wolf, P.G.** 2008. Fern classification. Pp. 417–467 in: Ranker, T.A. & Haufler, C.H. (eds.), *Biology and evolution of ferns and lycophytes*. Cambridge: Cambridge University Press.
- Sundue, M.A., Islam, M.B. & Ranker, T.A.** 2010. Systematics of grammitid ferns (Polypodiaceae): Using morphology and plastid sequence data to resolve the circumscription of *Melpomene* and the polyphyletic genera *Lellingeria* and *Terpsichore*. *Syst. Bot.* 35: 701–715.
- Swofford, D.L.** 2002. *PAUP* Phylogenetic analyses using parsimony (* and other methods), Version 4*. Sunderland, Massachusetts: Sinauer Associates.
- Taberlet, P., Gielly, L., Pautou, G. & Bouvert, J.** 1991. Universal primers for amplification of three non-coding regions of chloroplast DNA. *Pl. Molec. Biol.* 17: 1105–1109.
- Tryon, A.F. & Lugardon, B.** 1990. *Spores of the Pteridophyta*. New York: Springer-Verlag.

Appendix 1. Species, vouchers (collector, collector number, and Herbarium), locality, and GenBank accession numbers of the DNA sequences used in this paper (*rbcL*, *atpB*, and *trnL-trnF*). Missing data: –. Asterisks indicate newly obtained sequences. X=GenBank accession number to be obtained.

Taxon	Collector's collections's (herbarium)	name, number	Origin	<i>rbcL</i>	<i>atpB</i>	<i>trnL-trnF</i>
<i>Adenophorus tripinnatifidus</i>	Ranker 1102 (COLO)		Hawaiian Islands, USA	AF468207	AF469783	AF469796
<i>Alansmia cultrata</i>	Dassler 94-7-19-1 (ILLS)		Colombia	AY460669	AY459502	–
<i>Alansmia lanigera</i>	Léon 3647 (USM,UC)		Peru	AY460672	AY459505	GU476718
<i>Ascogrammitis pichinchae</i>	Dassler 94-7-13-1 (ILLS)		Colombia	AY459508	AY460675	X
<i>Calymmodon gracilis</i>	Chiou 97-09-12-01 (COLO,TAIF,UC)		Taiwan	AY362341	AY459451	GU476618
<i>Ceradenia spixiana</i>	Salino 3008 (UC)		Brazil	AY460623	AY459457	–
<i>Chrysogrammitis glandulosa*</i>	Ranker 2195 (BORH, SAN, SNP, COLO)		Malaysia	X	X	X
<i>Chrysogrammitis musgraviana</i>	Kessler 12570 (UC)		Sabah, Malaysia	AY460624	AY459458	GU476630
<i>Cochlidium serrulatum*</i>	Hirai & Schwartsburd 541 (SP)		Brazil	X	X	X
<i>Cochlidium punctatum*</i>	Silva 3914 (UC)		Brazil	X	X	X
<i>Ctenopterella denticulata*</i>	Ranker 2113 (BORH, SAN, SNP, COLO)		Malaysia	X	X	X
<i>Ctenopteris heterophylla</i>	Parris 12419 (AK)		New Zealand	AY460629	AY459462	–
<i>Ctenopteris lasiostipes</i>	Hodel 1448 (UC)		New Caledonia	AY460630	AY459463	–
<i>Ctenopteris nutans</i>	Ranker & Trapp 1765 (COLO, UC)		Papua New Guinea	AY460631	AY459464	–

<i>Dasygrammitis crassifrons</i> *	<i>Game 95-80</i> (UC)	Fiji	X	X	X
<i>Enterosora percrassa</i>	<i>Moraga & Rojas 508</i> (UC)	Costa Rica	AY460635	AY459468	GU476636
<i>Grammitis billardierei</i>	<i>Parris 12421</i> (AK)	New Zealand	AY460637	AY459469	X*
<i>Grammitis bryophila</i>	<i>Rojas & al. 3240</i> (UC)	Costa Rica	AF468208	AF469784	AF469797
<i>Grammitis deplanchei</i>	<i>Hodel 1450</i> (UC)	New Caledonia	AY460639	AY459471	–
<i>Grammitis poeppigiana</i>	<i>Taylor 6072</i> (UC)	Chile		AY459479	–
<i>Grammitis poeppigiana</i>	<i>Weber 13772</i> (COLO)	Australia	AY460647		–
<i>Grammitis tenella</i>	<i>Ranker 1352</i> (COLO)	Hawaiian Islands, USA	AF468198	AF469773	AF469786
<i>Lellingeria apiculata</i>	<i>Salino 3009</i> (UC)	Brazil	AY362343	AY459480	GU476642
<i>Leucotrichum schenckii</i>	<i>Salino 4547 = 4538</i> (UC,BHCB)	Brazil	AY460651	AY459483	GU476657
<i>Melpomene flabelliformis</i>	<i>Sanchez 183</i> (UC)	Colombia	AY460656	AY459488	–
<i>Melpomene moniliformis</i>	<i>Moraga & Rojas 446</i> (INB)	Costa Rica	AY460654	AY459486	GU476664
<i>Microgramma bifrons</i>	<i>van der Werff 18062</i> (UC)	Peru		EF463499	DQ642224
<i>Microgramma bifrons</i>	<i>Neill & al. 8309</i> (UC)	Ecuador	AY362582		
<i>Microgramma percussa</i>	<i>Smith 1357</i> (UC)	Venezuela	AY362574	AY459516	GU476669
<i>Micropolypodium okubo</i> *	<i>Parris 12154</i> (AK)	Japan	X	X	X
<i>Micropolypodium okubo</i> *	<i>Kanebira & Sasaki 21672</i> (UC)	Formosa	X	–	–
<i>Micropolypodium okubo</i> *	<i>Wilson 2387</i> (UC)	Japan	X	X	X
<i>Micropolypodium sikkimense</i> *	<i>Miehe 00-093-32</i> (UC)	Bhutan	X	X	X

<i>Micropolypodium sikkimense</i> *	<i>Xian & al. s.n.</i> (UC)	China	X	X	X
<i>Moranopteris achilleifolia</i>	<i>Cordeiro & Ribas 1398</i> (MBM, UC)	Brazil	AY460666	AY459499	–
<i>Moranopteris aphelolepis</i> *	<i>Borke & Jaramillo 2701</i> (NY)	Ecuador	–	–	X
<i>Moranopteris aphelolepis</i> *	<i>Jiménez & Vidarri 557</i> (UC)	Bolivia	X	X	X
<i>Moranopteris basiattenuata</i> *	<i>Breedlove & Thorne 30160</i> (NY)	Mexico	X	X	X
<i>Moranopteris blepharidea</i> *	<i>Jiménez 708</i> (GOET)	Bolivia	X	X	X
<i>Moranopteris caucana</i> *	<i>van der Werff & al. 13445</i> (UC)	Ecuador	X	X	X
<i>Moranopteris caucana</i> *	<i>Lehnert 182</i> (GOET)	Ecuador	X	X	X
<i>Moranopteris cookii</i> *	<i>Sundue & al. 1771</i> (NY)	Costa Rica	X	X	X
<i>Moranopteris gradata</i> *	<i>Hirai & al. 537</i> (SP)	Brazil	X	X	X
<i>Moranopteris grisebachii</i> *	<i>Maxon 9961</i> (NY)	Jamaica	–	X	X
<i>Moranopteris hyalina</i>	<i>Rojas & al. 3210</i> (CR, INB, MO, UC)	Costa Rica	AY362344	AY459490	GU476670
<i>Moranopteris hyalina</i> *	<i>Lehnert 1426</i> (GOET)	Ecuador	X	X	X
<i>Moranopteris hyalina</i> *	<i>Sundue 1148</i> (NY)	Ecuador	X	X	X
<i>Moranopteris longisetosa</i>	<i>Rojas & al. 3209</i> (CR, INB, MO, UC)	Costa Rica	AY460674	AY459507	–
<i>Moranopteris longisetosa</i> *	<i>Lehnert 596</i> (GOET)	X	X	X	X
<i>Moranopteris microlepis</i> *	<i>Smith 2584</i> (UC)	Costa Rica	X	X	X
<i>Moranopteris microlepis</i> *	<i>Kluge 2003</i> (UC)	Costa Rica	X	X	X
<i>Moranopteris nana</i> *	<i>Diaz & al. 4747</i> (NY)	Venezuela	X	–	–

<i>Moranopteris perpusilla</i> *	<i>Hirai & al. 574</i> (SP)	Brazil	X	X	X
<i>Moranopteris plicata</i> *	<i>Lehnert 929</i> (GOET, UC)	Ecuador	X	X	X
<i>Moranopteris serricula</i> *	<i>Feldmann s.n.</i> (P)	Guadeloupe	–	–	X
<i>Moranopteris serricula</i> *	<i>Wilbur & al. 8084</i> (NY)	Dominica	X	X	X
<i>Moranopteris setosa</i> *	<i>Hirai & al. 599</i> (SP)	Brazil	X	X	X
<i>Moranopteris taenifolia</i> *	<i>Rothfels 08-116</i> (DUKE)	Costa Rica	–	X	X
<i>Moranopteris taenifolia</i> *	<i>Triano-Moreno s.n.</i> (SP)	Costa Rica	X	X	X
<i>Moranopteris trichomanoides</i> *	<i>Gomez 114</i> (NY)	Honduras	X	X	X
<i>Moranopteris trichomanoides</i> *	<i>Zanoni & al. 45973</i> (NY)	Dominica	–	–	X
<i>Moranopteris truncicola</i> *	<i>Lehnert 862</i> (GOET)	Ecuador	X	X	X
<i>Moranopteris truncicola</i> *	<i>Vasco & Sundue 626</i> (NY)	Colombia	X	X	X
<i>Moranopteris williamsii</i> *	<i>Kessler & al. 7173</i> (UC)	Bolivia	X	X	X
<i>Moranopteris zurquina</i>	<i>Rojas & Mata 3021</i> (UC)	Costa Rica	AY460659	AY459492	–
<i>Oreogrammitis hookeri</i>	<i>Ranker 1116</i> (COLO)	Hawaii, USA	AY460642	AY459473	EF178655
<i>Pecluma eurybasis</i>	<i>Danton s.n.</i> (GOET)	Bolivia	EF463255	EF463504	
<i>Pecluma eurybasis</i>	<i>Kessler s.n.</i> (GOET)				FJ825691
<i>Polypodium vulgare</i>	<i>Schneider s.n.</i> (GOET)	Germany	EF551065	EF463510	EF551119
<i>Prosaptia contigua</i>	<i>Chiou 97-09-12-05</i> (TAIF, COLO, UC)	Taiwan	AY362345	AY459494	EF178663
<i>Radiogrammitis parva</i>	<i>Ranker 1763a</i> (COLO, UC)	Papua New Guinea	AY460644	AY459476	–

<i>Scleroglossum sulcatum</i>	<i>Bowden-Kerby in Raulerson</i> 24182b (GUAM, UC)	Pohnpei	AY460665	AY459498	X*
<i>Serpocaulon triseriale</i>	<i>Jiménez 1994</i> (UC)	Bolivia	DQ151926	EF463516	DQ151980
<i>Stenogrammitis limula</i>	<i>Sundue 1736</i> (INB, NY, UC, UPCB)	Costa Rica	GU476903	GU476765	GU476651
<i>Terpsichore asplenifolia</i> *	<i>Moraga & Rojas 506</i> (INB)	Costa Rica	X	X	–
<i>Terpsichore lehmanniana</i>	<i>Wilson 2589</i> (UC)	Ecuador	AY460673	AY459506	–
<i>Themelium conjunctisorum</i>	<i>Ranker & Trapp</i> 1758 (COLO, UC)	Papua New Guinea	AY460680	AY459514	–
<i>Tomophyllum repandulum</i>	<i>Ranker & Trapp</i> 1767 (COLO, UC)	Papua New Guinea	AY460633	AY459466	–

CAPÍTULO 2



Moranopteris taenifolia (Jerman) R. Y. Hirai & J. Prado (Foto: R. C. Moran, 2004)

Monograph of *Moranopteris* (Polypodiaceae)

Monograph of *Moranopteris* (Polypodiaceae)

ABSTRACT.—Twenty eight species and one hybrid are here recognized for *Moranopteris*, a grammitid fern genus endemic to the Neotropics. An identification key is given and for each species a description is provided, as well as full synonymy, discussion, illustration, distribution map, and a list of specimens examined. The Andean and Central American regions are primary centers of diversity of *Moranopteris* with 14 and 12 species, respectively. The mountains of Coastal Brazil are an important secondary center of endemism and diversity for the genus.

KEY WORDS.—Ferns, floristic, Grammitidaceae, *Micropolypodium*, systematic, taxonomy

Moranopteris is a genus of grammitid ferns endemic from the neotropics described by Hirai et al. (20XX). It comprises 28 species and one hybrid. Previously, this grammitid group was considered as belonging to *Micropolypodium s.l.*, but molecular analysis showed that *Micropolypodium s. str.* is a genus restricted to eastern Asia (Hirai et al. 20XX).

The majority of species nowadays included in *Moranopteris* was recognized in other genera, for example: in *Polypodium* by Maxon (1916), *Xiphopteris* by Copeland (1952), *Grammitis* by Morton (1967), and *Micropolypodium s.l.* by Smith (1992). Few species of *Moranopteris* were placed in *Ctenopteris* (e.g., Copeland 1952) and *Terpsichore* (Smith 1993).

In general, floristic accounts treated species of *Moranopteris* for different geographic regions. Such as the studies for Mexican and Central American: Chiapas, Mexico (Smith 1981); Guatemala (Stolze 1981); Oaxaca, Mexico (Mickel and Beitel 1988); Costa Rica, Panama, and Chocó (Lellinger 1989); Mesoamerica (Smith 1995), Mexico (Mickel and Smith 2004), Nicaragua (Gómez and Arbeláez 2009); Greater Antilles: Jamaica (Proctor 1985); Puerto Rico and the Virgin Islands (Proctor 1989); Lesser Antilles: Proctor (1977); Andes: Ecuador (Morton 1967); Peru (Tryon and Stolze 1993); Venezuelan Guayana (Smith 1990, Bishop and Smith 1995), French Guiana (Cremers 1997); and Southeast Brazilian (Labiak and Prado 2003, 2005a, b, c).

Smith (1992) published a review of the genus *Micropolypodium s.l.* comprising about 30 species. For the Neotropical region he listed 22 species and to the other localities (eastern Asia) two species. Parris (2009) mentioned in her studies that *Micropolypodium s.l.* presented a total of 25 species.

Micropolypodium s.l., according to Smith (1992) has radially symmetric erect rhizomes, often golden brown nonclathrate rhizome scales, linear

fronds, usually less than 10 mm wide and often less than 6 mm wide, segments (pinnae) with a single unbranched vein or with only an acroscopic branch, often gibbous, prominent adaxial hydathodes, with long, dark red-brown unbranched setae, and unisoriolate segments.

Smith (1993) recognized five groups in *Terpsichore s.l.* One of them, the *T. achilleifolia* group with only three species, is distinct from the other groups by having orangish to golden scales on the rhizome, fronds with determinate growth, hydathodes on the adaxial lamina surface, and dark red-brown unbranched setae on laminar tissue.

Labiak and Matos (2007) described a new hybrid from Rio de Janeiro (Brazil) and it was called of *Micropolypodium* X *bradei* Labiak & F. B. Matos. Its parents are *M. setosum* (Kaulf.) A. R. Sm. and *T. achilleifolia* (Kaulf.) A. R. Sm. Consequently, these authors (based on morphological evidences and preliminary molecular studies by Ranker *et al.* 2004) also decided to combine *T. achilleifolia* and *T. gradata* (Baker) A. R. Sm. to *Micropolypodium*.

The phylogenetic analysis conducted by Hirai *et al.* (20XX) confirmed that the *Terpsichore achilleifolia* group by Smith (1993, including *T. achilleifolia*, *T. gradata*, and *T. longisetosa* (Hook.) A. R. Sm.) belongs to *Moranopteris* too.

In brief, *Moranopteris* has all morphological features described by Smith (1992) and additionally it has species with pinnate lamina and veins, with more than one sorus per segment or pinna. More details about the morphological characters are presented under the results and discussion in the present paper.

The purpose of the present study is to review the species of *Moranopteris* and provide an up-to-date taxonomic treatment for the genus.

MATERIAL AND METHODS

Herbarium specimens were borrowed from 37 herbaria worldwide (see Acknowledgements).

The recognition of species in *Moranopteris* was based on morphological characters such as: rhizome scales, setae, lamina division, segments, hydathodes, veins, and hairs (see details in the topic on morphology).

To produce the distribution maps, the geographic coordinates were estimated for many specimens because this information was not provided on the specimen labels. For the Selected Specimens Examined, only one specimen was cited per state or province, or department, except when there were few specimens for the species. The dot distribution maps were based on all specimens studied and they were generated with DIVA-GIS (version 7.1) and ArcView 8.3.

The altitudes given in feet were converted to meters and appearing in the topic Selected specimens examined and in some type locality. They also have been used to prepare the figure 1 that shows the altitudinal ranges for *Moranopteris*.

Leaf tissue clearings were made of almost all species using Strittmatter method adapted (1973, *apud* Kraus and Arduin 1997). These leaves were drawn to show the patterns of venation and hairs in the genus. Hairs were measured on plants from Herbarium specimens.

The figure 3 shows some aspects of the morphology of *Moranopteris* and it can be used to follow the key.

RESULTS AND DISCUSSIONS

ECOLOGY.—*Moranopteris* inhabits wet and tropical forests. In general, this genus grows in cloud forests at high elevations, consequently reflecting in its geographic distribution (Fig. 1). The genus rarely occurs in disturbed forests. The altitudinal range of *Moranopteris* is from almost sea level to 3850 m, with most plants collected above 1000 m (Fig. 2). There are few species that can be found in lower elevations (0-300 m) such as *M. nana*, *M. setosa*, and *M. taenifolia*.

GEOGRAPHY.—The distribution of species of *Moranopteris* is given according to the main regional centers, as defined by Tryon (1972).

Andean and Central American regions are primary centers of diversity of *Moranopteris* with 14 and 12 species, respectively. Andean is the most important region where 50% of species of *Moranopteris* occur, five them are endemic (Tab. 1). Costa Rica, Venezuela, and Colombia contain the richest *Moranopteris* flora with 11 species in each country, followed by Ecuador with 10 species (Tab. 2). One must considerer that part of Venezuela belongs to Guianan region. Guianan and Central America regions are secondary centers of diversity for *Moranopteris*.

The Mountains of Serra do Mar, covered by the Atlantic Forest, in the Southeastern Brazilian region is also another important secondary center of diversity because has three species (*Moranopteris gradata*, *M. setosa*, and *M. perpusilla*) and one hybrid (*M. X bradei*), and all of them are endemic (Tab. 1). In the Andean region there are five endemic species (36% of total in the region), followed by Guianan with two species (25% of total in the region, respectively), and Central American, Greater Antilles, Lesser Antilles, and Guianan each one with one endemic species (Tab. 1). The interesting point about *Moranopteris grisebachii* is its endemic distribution to Caribbean, but it not appears in tab. 1 because Caribbean was separated in Greater and Lesser Antilles considering that they are

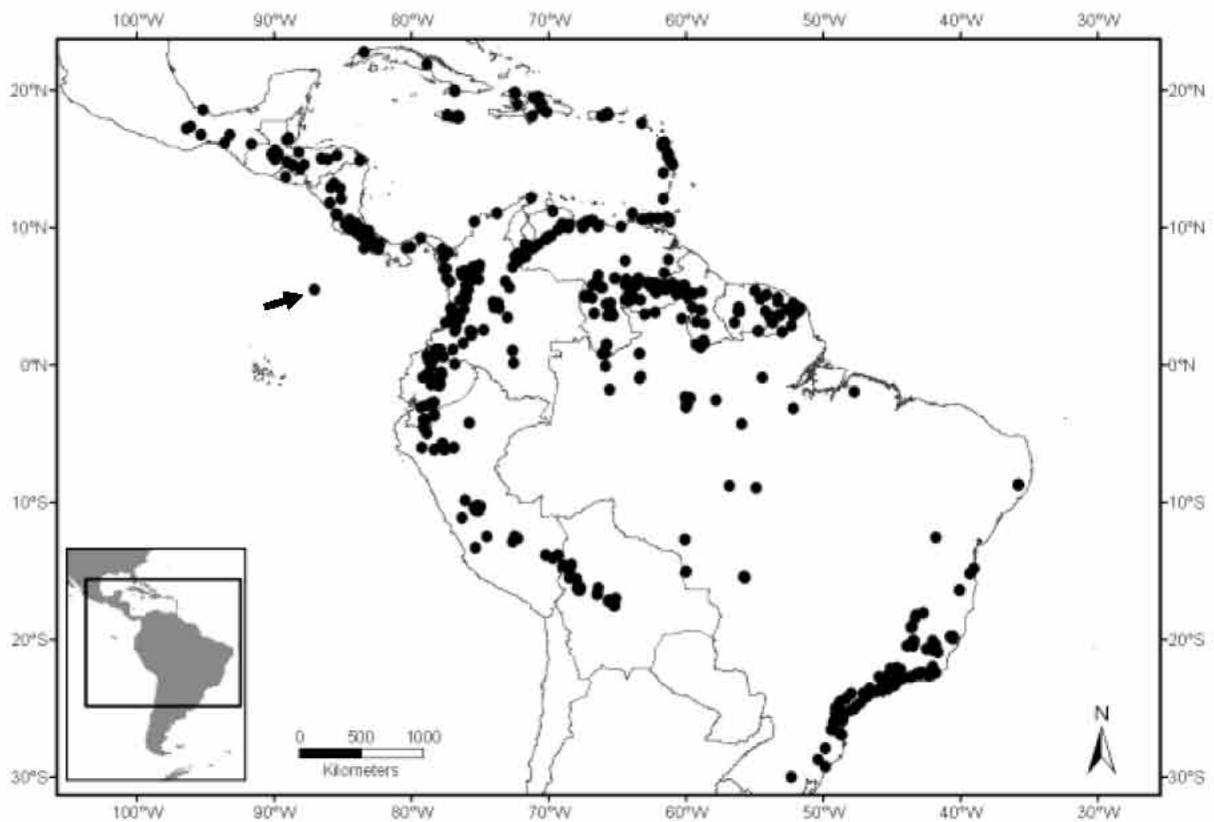


Fig. 1. Distribution of *Moranopteris*. The arrow point to Cocos Island.

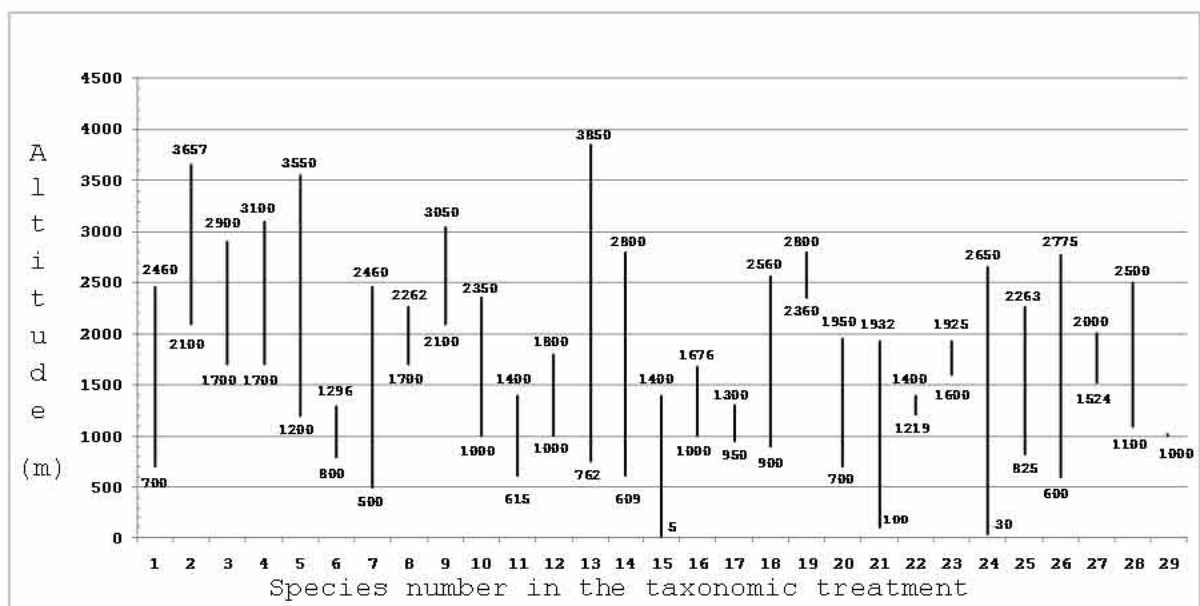


Fig. 2. Altitudinal ranges (in meters) of Neotropical species of *Moranopteris*. The numbers at horizontal axis correspond to the species number assigned in the taxonomic treatment.

primary and secondary centers of diversity of *Moranopteris*, respectively.

A similar pattern of distribution was already reported for other fern genera and primarily in grammitid ferns such as: *Melpomene*, *Terpsichore*, and *Lellingeria* (Mickel and Smith 2004). For instance, *Lellingeria* is an entirely Neotropical group such as *Moranopteris*. The Andes are the center of diversity for *Lellingeria s. str.* (Labiak *et al.* 2010b). It comprises about 50 species (Labiak, unpublished manuscript), of which about 30 species occur in the Andes (60% of the total), and approximately 24 species of them are endemic (80% of the total) to the area. Outside of the Andes, *Lellingeria s. str.* includes 11 species in Central America (six endemic), eight species in the West Indies (four endemic), 10 species in the Guyana/Venezuelan Shield (six endemic), and six species in southeastern Brazil (three endemic) (Labiak *et al.* 2010b).

Tab. 1. Geographic regions and their species of *Moranopteris*. Endemic species are in boldface.

Main geographic regions (based on Tryon 1972)	Species (numbers correspond to those in the taxonomic treatment)	Number of species per Region (% of total species in the genus)	Number of endemic species per Region (%)
Mexican	3, 24, 25	3 (11%)	0
Central American	3, 5, 6, 9, 13, 14, 15, 18, 24, 25, 26, 28	12 (43%)	1 (8%)
Greater Antilles	3, 8, 14, 16, 22 , 24, 25	7 (25%)	1 (14%)
Lesser Antilles	8, 11 , 14, 15, 20, 24, 25	7 (25%)	1 (14%)
Andean	2 , 3, 4 , 5, 6, 9, 10 , 13, 15, 18, 23 , 24, 26, 27	14 (50%)	5 (36%)
Guianan	3, 5, 12 , 15, 19 , 20, 24, 26	8 (28%)	2 (25%)
Southeastern Brazil	1, 7 , 17 , 21 , 29	4 (14%) + 1 hybrid	3 (75%) + 1 hybrid

Tab. 2. Distribution of *Moranopteris* by country in the Neotropic. Endemic species are in boldface.

Country	Numbers of species	Endemic or no endemic	Species
MEXICO	3	no endemic	<i>M. basiattenuata</i> , <i>M. taenifolia</i> , <i>M. trichomanoides</i>
BELIZE	1	no endemic	<i>M. taenifolia</i>
GUATEMALA	4	no endemic	<i>M. basiattenuata</i> , <i>M. cookii</i> , <i>M. taenifolia</i> , <i>M. trichomanoides</i>
HONDURAS	3	no endemic	<i>M. basiattenuata</i> , <i>M. taenifolia</i> , <i>M. trichomanoides</i>
EL SALVADOR	1	no endemic	<i>M. basiattenuata</i>
NICARAGUA	2	no endemic	<i>M. caucana</i> , <i>M. taenifolia</i>
COSTA RICA	11	1 endemic	<i>M. basiattenuata</i> , <i>M. caucana</i> , <i>M. cookii</i> , <i>M. hyalina</i> , <i>M. longisetosa</i> , <i>M. microlepis</i> , <i>M. nana</i> , <i>M. plicata</i> , <i>M. taenifolia</i> , <i>M. truncicola</i> , <i>M. zurquina</i>
PANAMA	5	no endemic	<i>M. caucana</i> , <i>M. cookii</i> , <i>M. microlepis</i> , <i>M. nana</i> , <i>M. taenifolia</i>
CUBA	3	no endemic	<i>M. nimbata</i> , <i>M. sherringii</i> , <i>M. trichomanoides</i>
JAMAICA	7	no endemic	<i>M. basiattenuata</i> , <i>M. grisebachii</i> , <i>M. microlepis</i> , <i>M. nimbata</i> , <i>M. sherringii</i> , <i>M. taenifolia</i> , <i>M. trichomanoides</i>
HAITI	2	no endemic	<i>M. taenifolia</i> , <i>M. trichomanoides</i>
DOMINICAN REPUBLIC	4	no endemic	<i>M. basiattenuata</i> , <i>M. nimbata</i> , <i>M. taenifolia</i> , <i>M. trichomanoides</i>
PUERTO RICO	2	no endemic	<i>M. sherringii</i> , <i>M. taenifolia</i>

SAINT KITTS AND NEVIS	1	no endemic	<i>M. taenifolia</i>
DOMINICA	2	no endemic	<i>M. knowltoniorum, M. serricula</i>
GUADELOUPE	6	no endemic	<i>M. grisebachii, M. knowltoniorum, M. microlepis, M. serricula, M. taenifolia, M. trichomanoides</i>
MARTINIQUE	3	no endemic	<i>M. grisebachii, M. serricula, M. taenifolia</i>
TRINIDAD AND TOBAGO	3	no endemic	<i>M. nana, M. serricula, M. taenifolia</i>
FRENCH GUIANA	2	no endemic	<i>M. nana, M. taenifolia</i>
SURINAM	2	no endemic	<i>M. nana, M. taenifolia</i>
GUYANA	6	no endemic	<i>M. basiattenuata, M. caucana, M. nana, M. rupicola, M. taenifolia, M. truncicola</i>
VENEZUELA	11	2 endemics	<i>M. basiattenuata, M. caucana, M. liesneri, M. longisetosa, M. nana, M. plicata, M. rupicola, M. serricula, M. simplex, M. taenifolia, M. truncicola</i>
COLOMBIA	11	no endemic	<i>M. aphelolepis, M. basiattenuata, M. blepharidea, M. caucana, M. hyalina, M. killipii, M. longisetosa, M. nana, M. plicata, M. taenifolia, M. truncicola</i>
ECUADOR	10	no endemic	<i>M. aphelolepis, M. basiattenuata, M. caucana, M. cookii, M. hyalina, M. killipii, M. longisetosa, M. plicata, M. taenifolia, M. truncicola</i>
PERU	8	no endemic	<i>M. blepharidea, M. caucana, M. hyalina, M. longisetosa, M. nana, M. plicata, M. taenifolia, M. truncicola</i>

BOLIVIA	7	1 endemic	<i>M. aphelelepis</i> , <i>M. blepharidea</i> , <i>M. caucana</i> , <i>M. longisetosa</i> , <i>M. taenifolia</i> , <i>M. truncicola</i> , <i>M. williamsii</i>
BRAZIL	9 + 1 hybrid	4 endemics	<i>M. achilleifolia</i> , <i>M. caucana</i> , <i>M. gradata</i> , <i>M. nana</i> , <i>M. perpusilla</i> , <i>M. plicata</i> , <i>M. setosa</i> , <i>M. taenifolia</i> , <i>M. truncicola</i> , <i>M. x bradei</i>

MORPHOLOGY (Figs. 3-37).—As stated by Smith *et al.* (1991), genera of grammitid ferns, including *Micropolypodium s.l.* (= *Moranopteris*), are each held together by combinations of characteristics of their hairs, scales, sori, paraphyses, and hydathodes. Additionally, this combination of essential characters can be extended to the species level. The main information on the morphology of *Moranopteris* is commented, as follows: rhizome scales, segments, hydathodes, veins, and hair types. They have been extremely useful to recognize species and used by different authors, for instance, Maxon (1916), Copeland (1952), Smith (1992), Ranker *et al.* (2004), Lehnert (2008), Labiak *et al.* (2010a), etc.

RHIZOME SCALES.—It is the first character that should be analyzed to recognize a species of *Moranopteris*, because rhizome scales in fact are distinctive in some species or it can lead one to a group of species. Thus is very important to leave the scales visible on the sheet, i.e., removing mosses on the rhizome and do not put scotch tape on them.

The most important character on the rhizome scales are their margins. Three basic types of margins can be found on the rhizome scales of *Moranopteris*. One of them has red-brown or hyaline mostly long setiform projections (e.g., *M. truncicola* and *M. hyalina*, Figs. 35E, 15E respectively); another type has entire margins (e.g., *M. williamsii*, Fig. 36E), and the last has glanduliform projections (e.g., *M. longisetosa*, Fig. 19E). All of them can vary and show a few small lateral projections.

Color of the rhizomes scales can vary from golden to castaneous. In general, the cells of rhizome scales are turgid. Sometimes these cells are red-brown-tinged toward the tip. Mickel and Smith (2004) used the character color on the tip of the rhizome scales plus other ones to recognize *Moranopteris taenifolia*, but the color sometimes is not present in all specimens. *Moranopteris microlepis* is another species where the scales may vary in color (the entire body of the scales can vary from red-brown to only the cell-walls red-brown).

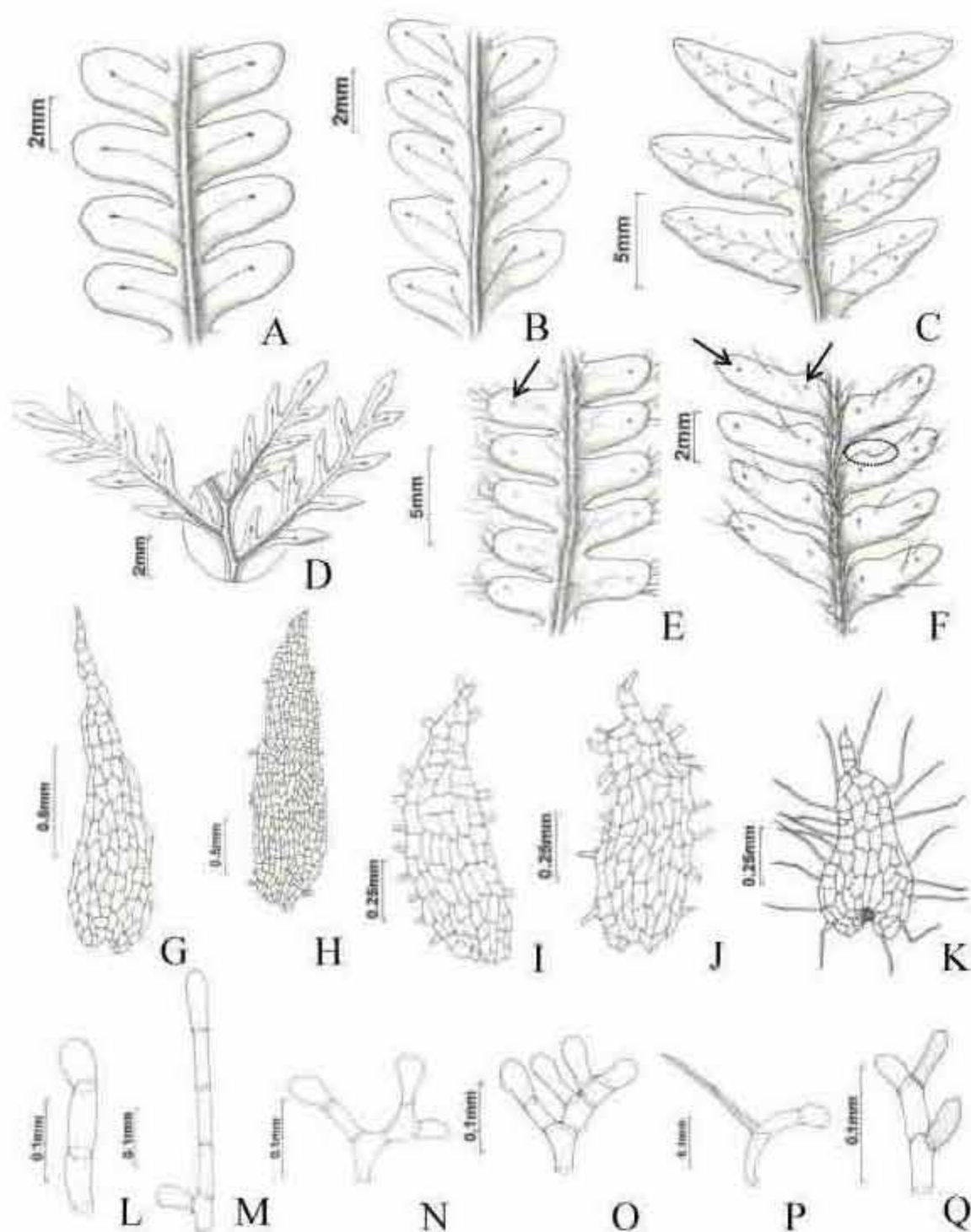


FIG. 3. Morphology of some species of *Moranopteris*. A-D: venation patterns (cleared leaf). A. simple veins, *M. cookii* (Saxdæ & al. 1764, NY). B. furcate veins, *M. aphelolepis* (Boeke & Jaramillo 2701, NY). C. pinnate veins, *M. gradata* (Hirai & al. 564, SP). D. pinnate veins, *M. longisetosa* (Rojas 3209, NY). E-F: segments. E. not gibbous segments (pointed by arrow is the hydathode adaxially), *M. cookii* (Saxdæ & al. 1764, NY). F. gibbous segments at circle (pointed by arrow are the hydathodes adaxially), *M. liesneri* (Cowan & Wurdack 31415, NY). G-K: rhizome scale types. G. entire margins, *M. cookii* (Saxdæ & al. 1764, NY). H. margins with small lateral projections, *M. basiattenuata* (Breedlove & Thorne 30160, NY). I. margins with glanduliform projections, *M. longisetosa* (Rojas 3209, NY). J. margins with short setiform projections, *M. killipii* (Lehmann 7655, K). K. margins with setiform projections, *M. microlepis* (Rojas 3609, NY). L-P: some hair types. L. unbranched hairs, *M. liesneri* (Cowan & Wurdack 31415, NY). M. 1-branched, *M. blepharidea* (Kessler & al. 11973, UPCE). N. 2-branched, *M. longisetosa* (Rojas 3209, NY). O. 3-branched, *M. serricula* (Feldmann s.n., P). P. 1-branched with one setiform branch, *M. taenifolia* (Graville 3557, CAY). Q. 2-branched, branches tinged of red-brown (Clement 1007, P).

Many authors have used "glandular apical cells" as a helpful character to recognize species in the *Moranopteris*. Morton (1967) utilized this feature plus other ones to distinguish *Grammitis aphelolepis* (= *Moranopteris aphelolepis*) from *G. truncicola* (= *M. truncicola*), and *G. taenifolium* (= *M. taenifolia*). However, this feature also appears in other genera like *Adenophorus*, *Ceradenia*, and *Melpomene* (Ranker et al. 2004) and it is not exclusively of *Moranopteris* (e.g., Fig. 37F). These apical cells seem to be easily detached by a slight touch, becoming difficult to use as a diagnostic feature in *Moranopteris*. Sundue (2010) used the term "apical or subapical gland-like cells" and commented that these cells are very small and easily overlooked. Among the studied species *Moranopteris aphelolepis* and *M. truncicola* have or not these apical cells on the rhizome scales, but in *M. taenifolia* they are absent (Fig. 32E).

The terms apical or subapical gland-like cells in *Moranopteris* was used as in Sundue (2010). These cells refer to the margins of apex of the rhizome scale. In general these cells have thinner walls and are smaller than those from the scale body. *Moranopteris grisebachii* sometimes has apical cells similar to *Stenogrammitis* Labiak that was named of "apical cillium" by Labiak (2011); therefore in *M. grisebachii*, it is called of apical cillium-like cell.

SEGMENTS.—The segments sometimes have an acroscopic hump at base, i.e., a lobe on acroscopic margin of each segment which is known as gibbous segment. It is especially visible on fertile segments (Fig. 32C). This feature has being used to distinguish species in *Moranopteris*. In general, this character can be helpful, for example, Mickel and Smith (2004) used this and other features to recognize *Micropolypodium trichomanoides* (= *Moranopteris trichomanoides*) (Figs. 34C, D).

HYDATHODES.—Sota et al. (2000) commented about the "hydathodes" found in grammitid ferns. According to these authors, these structures are immersed adaxially and located at the tip of the veins. They have a different epidermis from laminar tissue, which allow the observation by transparency of an ensemble of short tracheids with the expanded distal portion, which Bower (1928) called "storage tracheids". They differ from hydathodes *s. str.* because they would be soral area and receptacle's area that did not arise sporangia, and in some cases could exude water and salts (vs. areas with stomata opened all the time that are responsible for gutation). In this study we use the term hydathodes *s.l.* such as other authors (e.g., Proctor 1985, Smith 1992).

The number of hydathodes, visible on the lamina adaxially, is directly related to the number of veins. Basically, three groups of hydathodes can be recognized in *Moranopteris*: 1) one hydathode per segment (e.g., *M. cookii*, Fig. 11C), 2) two hydathodes per segment, at least, in fertile segments or sometimes one in sterile segments (e.g., *M. aphelolepis*, Fig.

6C), and 3) commonly more than two hydathodes per segment (e.g., *M. achilleifolia*, Fig. 4C).

VEINS.—The veins are another helpful identification feature. As mentioned before, three types of free veins are found in *Moranopteris*: 1) simple veins (e.g., *M. cookii*, Fig. 11D), 2) furcate veins, at least, in fertile segments or sometimes simple in sterile ones (e.g., *M. aphelolepis*, Fig. 6D), and 3) pinnate veins (e.g., *M. achilleifolia*, Fig. 4D).

In the past, the species with pinnate veins (*Moranopteris achilleifolia*, *M. gradata*, and *M. longisetosa*) were classified under other genus (i.e., *Terpsichore achilleifolia* group by Smith 1993). Ranker *et al.* (2004) pointed out that in grammitids the venation patterns and blade dissection are homoplastic characters and are false indicator of affinities. These same results were finding by Hirai *et al.* (2011).

SETAE.—Setae are usually stiff, straight, terete, and often dark red-brown hairs (Smith 1992, Lellinger 2002). They are uniseriate and the oblique cell walls are not visible. The setae are present in most of species of *Moranopteris* on both surfaces of the stipe, costa, and laminar tissue. Among the studied species there are only two species having no setae: *Moranopteris grisebachii* and *M. perpusilla* (Figs. 14A–C, 25A–C, respectively). As commented by Smith (1992), setae in *Micropolypodium* (= *Moranopteris*) also appear to differ from those setae of many other grammitid ferns. He described the seta with a ring of cells at base. These cells are different from the adjacent surrounding epidermal cells, like in *M. basiattenuata* and in several other species examined. In the Neotropical species of *Moranopteris* these cells can be conspicuous or inconspicuous.

HAIRS.—According to Sota (1966), hairs are good characters to distinguish grammitid ferns at species level by their diversity and constancy. He classified the hairs in three basic types: 1) unbranched hairs, 2) branched hairs, and 3) mixed hairs (with setiform branches).

For *Lellingeria* Smith *et al.* (1991) described the hairs as mostly presenting a short basal cell that forks producing two cells: one short, lateral, and apparently glandular, the other usually longer, oblique, and acicular. Rarely, the short lateral cell bears a second long-acicular cell. Although mostly species of *Lellingeria* produce forked hairs, several species also have hairs that (apparently) are not branched (unbranched).

Smith (1995) described the species of *Micropolypodium s.l.* with simple, glandular branched, or only branched hairs. He applied the term glandular branched to *Moranopteris trichomanoides*, *M. truncicola*, and *M. zurquina* (Figs. 34G, 35F, 37G, respectively).

Lehnert (2008) attributed to *Melpomene* only the term clavate hairs for the minute, simple and branched, pluricellular hairs that are pale in color and bear clavate cells at their apices or along their length, because he did not observe a secretive nature in the hairs of *Melpomene*.

Labiak *et al.* (2010a) described the genus *Leucotrichum* based on the same concept presented by Smith (1992) for the hairs with a slight difference: the shorter cell is glandular. The hair presented in Fig. 2F3 (Labiak *et al.* 2010a) of *Leucotrichum* corresponds to a branched hair with setiform branch also found in *Moranopteris taenifolia* (Fig. 3P). Smith *et al.* (1991) originally segregated *Lellingeria s.l.* from *Grammitis* based in part upon the presence of distinctive three-celled, once- to twice-furcate hairs that bear hyaline acicular branch cells. According to Labiak *et al.* (2010a), this hair type should in fact be interpreted as homoplastic, having evolved multiple times in the grammitid clade.

For the present study, the classification by Sota (1966) was adopted with little modifications, because his concept seems to be clearer than others to describe the hair types, as follows:

1) *Unbranched hairs*: uniseriate, hyaline, slightly catenate (mostly red-brown on the cross walls), 1–6-celled, with a rounded or clavate apical cell. This apical cell can be glandular or not (Fig. 18F).

2) *Branched hairs*: 1–4-branched, hyaline, slightly catenate (mostly red-brown on the cross walls), these branches mostly have rounded or clavate terminal cells or the branch itself is setiform (Fig. 30H), rarely slightly acicular (*M. grisebachii*, Fig. 14F). The terminal cells can be glandular or not. Some 1-branched hairs have a typical longer branch: \geq twice longer than the main branch, like in *M. cookii*, *M. hyalina*, etc. (Figs. 11F, 15G, respectively). Sometimes the hairs can have the branches tinged of red-brown such as in *Moranopteris nimbata* (Fig. 24F); however it is not a rule.

The variation on the morphology of the hairs revealed to be more useful feature to recognize species in *Moranopteris*, especially for the group of species with rhizome scales with setiform projections on the margins.

TAXONOMIC TREATMENT.—Twenty eight species and one hybrid are here recognized for the Neotropical region. The species may be separated by the key.

Moranopteris R. Y. Hirai & J. Prado, Taxon 20XX. Type.—***Moranopteris basiattenuata*** (Jenman) R. Y. Hirai & J. Prado, Taxon 20XX. *Polypodium basiattenuatum* Jenman, Bull. Bot. Dept. Jamaica, n.s. 4: 114. 1897.

Plants epiphytic, rarely epipetric or terrestrial. *Rhizome* short-creeping, decumbent to ascending, generally weakly dorsiventral to radially symmetric, with scales, golden to castaneous, often lustrous, nonclathrate, that are entire, or with small lateral projections, or with glanduliform or setiform projections on the margins, setiform projections are mostly red-brown, rarely hyaline, other projections are hyaline, with apical or subapical gland-like cells or not, cells of body often turgid. *Fronds*

monomorphic, caespitose, erect to pendent, determinate, or rarely \pm indeterminate, short-stipitate, sometimes the stipe almost absent, not articulate to the rhizome; *laminae* mostly linear, sometimes lanceolate, pinnatifid, pinnatisect, bipinnatisect, pinnatisect-pinnatifid, or pinnate-pinnatifid, sometimes pinnate at base, gradually tapering proximally to a lateral narrow wing or not, mostly chartaceous, sometimes membranaceous; *costa* obscured by laminar tissue or visible with dark sclerenchyma abaxially and adaxially; *segments* ascending to patent, alternate to opposite, with an acroscopic hump (gibbous) or not, when present, especially in fertile segments, symmetric or asymmetric, linear, oblong, or rounded, pinnatisect or pinnatifid, slightly decurrent at base or not, margins plane or slightly revolute, with or without hyaline cells, basiscopic side not folded over sorus; *veins* simple, furcate or pinnate, inconspicuous, obscured by laminar tissue or visible with dark sclerenchyma at the base of the segment, *hydathodes* present, mostly 1 or 2 (rarely > 2) hydathodes per segment or pinna, the hydathodes visible adaxially, elliptic, rounded, or linear; *setae* dark red-brown, on both surfaces of the stipe, rachis or costa, and laminar tissue or rarely absent, ring of cells at base conspicuous to inconspicuous; *hairs* present on the stipe, rachis or costa, and laminar tissue (mainly near to costa abaxially), slightly catenate, hyaline, slightly red-brown on the cross walls, mostly branched, or unbranched and branched. *Sori* superficial, usually at base of the costa/costule or on the acroscopic veinlet, mostly 1 (rarely > 2) per segment or pinna, rounded or elliptic, exindusiate; soral paraphyses absent; *sporangia* glabrous; *spores* tetrahedral-globose, papillate to tuberculate with globules; $x=37$ (Smith 1992).

KEY TO THE SPECIES OF *MORANOPTERIS*

1. Veins pinnate (Fig. 3C, D); sori more than 2 per segment
 2. Rhizome scales with glanduliform projections on the margins (Fig. 3I); *laminae* pinnate-pinnatisect, sometimes pinnate-pinnatifid
..... **13. M. longisetosa**
 2. Rhizome scales with entire margins (Fig. 3G) or with small lateral projections (Fig. 3H); *laminae* pinnatisect (Fig. 3C) or pinnatisect-pinnatifid, or bi-pinnatisect (Fig. 3D)
 3. Segments pinnatisect (Fig. 3D) or pinnatifid, linear
..... **1. M. achilleifolia**
 3. Segments entire (Fig. 3C), deltate to deltate-lanceolate
..... **7. M. gradata**
1. Veins simple (Fig. 3A) or furcate (Fig. 3B); sori 1 per segment
 4. Rhizome scales with short (Fig. 3J) or long (Fig. 3K) setiform projections on the margins, hyaline to yellowish or red-brown

5. Rhizome scales with hyaline or yellowish setiform projections on the margins **9. M. hyalina**
5. Rhizome scales with red-brown setiform projections on the margins
6. Veins simple (Fig. 3A) and with 1 hydathode (Fig. 3E) per segment in fertile segments visible adaxially
7. Hairs 1-branched absent, hairs branched mostly 2 or 3-branched (Fig. 3N, O) on the rachis or costa abaxially **18. M. plicata**
7. Hairs 1-branched with a branch $\geq 2X$ longer than the main branch (Fig. 3M) on the rachis or costa abaxially
8. Fronds determinate; segments oblong, 27-45 pairs **6. M. cookii**
8. Fronds \pm indeterminate; segments deltate, 48-69 pairs **5. M. caucana**
6. Veins furcate (Fig. 3B) and with mostly 2 hydathodes (Fig. 3F) per segment in fertile segments visible adaxially
9. Rhizome scales with short setiform projections (Fig. 3J); hairs 1-branched with a branch $\geq 2X$ longer than the main branch (Fig. 3M) on the rachis or costa abaxially **10. M. killipii**
9. Rhizome scales with long setiform projections (Fig. 3K); 1-branched hairs without a branch $\geq 2X$ longer than the main branch or with setiform branch, or with or 2(3)-branched hairs (Fig. 3N, O), or unbranched hairs (Fig. 3L) on the rachis or costa abaxially
10. Rachis or costa with only unbranched hairs (Fig. 3L) and/or 1-branched hairs with setiform branch (Fig. 3P) abaxially
11. Segments linear, ascending mostly $40-45^\circ$ to rachis or costa; plants endemic to Venezuela **12. M. liesneri**
11. Segments oblong to lanceolate, patent $80-90^\circ$ to costa; plants widely distributed in Neotropic **24. M. taenifolia**
10. Rachis or costa with mostly branched hairs (Fig. 3N, O) abaxially
12. Costa slightly visible with dark sclerenchyma adaxially **19. M. rupicola**
12. Costa obscured by laminar tissue adaxially
13. Segments mostly gibbous (Fig. 3F)
14. Fronds mostly sparsely setose; segments ovate; rhizome scales with setiform projections mostly on the $1/3$ of distal portion, setiform projections 0.1-0.2 mm long (rarely 0.3 mm long) **15. M. nana**

14. Fronds mostly densely setose; segments oblong; rhizome scales with setiform projections along margins, setiform projections 0.3-0.5 mm long **14. M. microlepis**
13. Segments mostly not gibbous (Fig. 3E) (rarely gibbous in *M. plicata*)
15. Hairs branched mostly with branches tinged of red-brown (Fig. 3Q) on the costa abaxially; plants endemic to Greater Antilles (Cuba, Dominican Republic, and Jamaica) . **16. M. nimbata**
15. Hairs branched mostly hyaline or slightly red-brown on the cross walls on the costa abaxially; plants from Central and South America
16. Segments ascending ca. 65-80° to costa; 30-61(-70) pairs **26. M. truncicola**
16. Segments ascending ca. 45-60° to costa; 10-29 pairs **18. M. plicata**
4. Rhizome scales with entire margins (Fig. 3G) or small lateral projections (Fig. 3H)
17. Fronds without setae
18. Roots proliferous; laminae membranaceous; segments gibbous; plants endemic to Caribbean **8. M. grisebachii**
18. Roots not proliferous; laminae chartaceous; segments not gibbous; plants endemic to SE Brazil **17. M. perpusilla**
17. Fronds with setae
19. Veins simple; 1 hydathode per segment
20. Segments patent ca. 80-90° to costa; hairs 1-branched with a branch $\geq 2X$ longer than the main branch on the rachis or costa abaxially **6. M. cookii**
20. Segments ascending ca. 40-60°(-70); hairs 1-branched without a branch $\geq 2X$ longer than the main branch or with hairs 2 or 3-branched (Fig. 3N, O) on the rachis or costa abaxially
21. Rhizome scales ovate to oblong; segments mostly gibbous; plants endemic to Bolivia **27. M. williamsii**
21. Rhizome scales lanceolate to slightly linear; segments not gibbous; plants endemic to Costa Rica **28. M. zurquina**
19. Veins furcate; mostly 2 hydathodes per segment
22. Segments gibbous, rarely inconspicuous
23. Stipes (0.7-)1.3-3.5 cm long; fronds densely setose **2. M. aphelolepis**
23. Stipes 0.05-0.35 cm long; fronds moderately setose

24. Hairs scattered throughout the costa and laminar tissue abaxially and margins; plants endemic to Venezuela **23. M. simplex**
24. Hairs mostly confined near to costa abaxially; plants from Mexico, Central America, and Caribbean
25. Laminae membranaceous; hairs 1 or 2-branched, the 1st branch mostly $\geq 2X$ longer than the main branch (Fig. 3M) .. **11. M. knowltoniorum**
25. Laminae chartaceous; hairs (1 or) 2 or 3 (or 4)-branched (Fig. N, O), the 1st branch not $\geq 2X$ longer than the main branch
..... **25. M. trichomanoides**
22. Segments not gibbous or, if present, inconspicuous
26. Hairs 1-branched with a branch $\geq 2X$ longer than the main branch on the rachis or costa abaxially
27. Segments oblong to oblong-lanceolate, apex slightly rounded to truncate **3. M. basiattenuata**
27. Segments mostly deltate-lanceolate, apex mostly acute **4. M. blepharidea**
26. Hairs 1-branched without a branch $\geq 2X$ longer than the main branch or mostly 2 or 3-branched hairs on the rachis or costa abaxially
28. Segments ascending ca. 20°-35° to costa; plants endemic to Brazil **21. M. setosa**
28. Segments ascending ca. 45°-60° to costa; plants from Caribbean and Guianan
29. Fronds 7.5-18.5 cm long; with 18-63 pairs of segments, deltate **20. M. serricula**
29. Fronds 3.5-4.5 cm long; with 6-12 pairs of segments, oblong **22. M. sherringii**

1. **Moranopteris achilleifolia** (Kaulf.) R. Y. Hirai & J. Prado, *Taxon* 20XX.
Polypodium achilleifolium Kaulf., *Enum. Fil.* 116. 1824. *Ctenopteris achilleifolia* (Kaulf.) J. Sm., *Hist. fil.* 185. 1875. *Grammitis achilleifolia* (Kaulf.) R. M. Tryon & A. F. Tryon, *Rhodora* 84: 128. 1982. *Terpsichore achilleifolia* (Kaulf.) A. R. Sm., *Novon* 3: 486. 1993. *Micropolypodium achilleifolium* (Kaulf.) Labiak & F. B. Matos, *Brittonia* 59: 184. 2007. TYPE.—BRAZIL. "Habitat in Brasilia, Otto communicaviti", s.d., collector unknown (holotype: probably at B-n.v.). **Figs. 4A–F.**

Plants epiphytic, epipetric, rarely terrestrial. *Rhizome* short-creeping with scales, the scales 1.5–2.2 X 0.2–0.4 mm, golden, sometimes castaneous, linear to linear-lanceolate, base truncate or slightly cordate, apex attenuate, margins entire, or sometimes with also small lateral projections. *Fronde*s erect to arcuate, determinate, 4.8–17.5 X 1.0–3.4 cm, sparsely setose; *stipes* 0.5–3.2 cm long, yellowish or sometimes slightly dark-brown at the base, wings absent; *laminae* lanceolate, pinnatisect-pinnatifid to bipinnatisect, sometimes pinnate at base, gradually tapering proximally, chartaceous; costa obscured by laminar tissue abaxially and adaxially, sometimes slightly visible with dark sclerenchyma abaxially; *segments* ascending, (30–)50–70° to costa, 10–27 pairs, spaced ca. 1.0–3.0 mm, alternate, not gibbous, symmetric, 4.0–18.0 X 0.9–4.0 mm, linear, pinnatisect or pinnatifid, slightly decurrent at base, apex rounded, margins plane or slightly revolute, without hyaline cells; *veins* pinnate, inconspicuous, > 2 hydathodes per segment, the hydathodes visible adaxially, elliptic or rounded, sometimes linear; *setae* 0.3–0.9 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; *hairs* present on the stipe, costa, veins, and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, unbranched and branched, the unbranched hairs (1 or) 2 or 3-celled, ca. 0.2 mm long, the branched hairs (1 or) 2 or 3-branched, mostly 2-branched, the main branch (2 or) 3(or 4)-celled, ca. 0.2 mm long, 1st and 2nd branches 1 or 2(or 3)-celled, < 0.1 mm long. *Sori* > 2 per segment, rounded or elliptic, 0.7–1.5 mm diam.

Distribution.—Coastal of Brazil (Bahia, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Santa Catarina, and Rio Grande do Sul States), probably also in Argentina (Misiones); 700–2460 m (Figs. 5A, 2).

SELECTED SPECIMENS EXAMINED.—BRAZIL. **Bahia:** Arataca, Serra do Peito de Moça, estrada que liga Arataca à Una, ramal ca. 22,4 km de Arataca com entrada no Assentamento Santo Antônio, RPPN "Caminho das Pedras", 900 m, 15°10'25"S, 39°20'30"W, 6 Aug 2006, Labiak et al. 3642 (NY). **Minas Gerais:** Araponga,

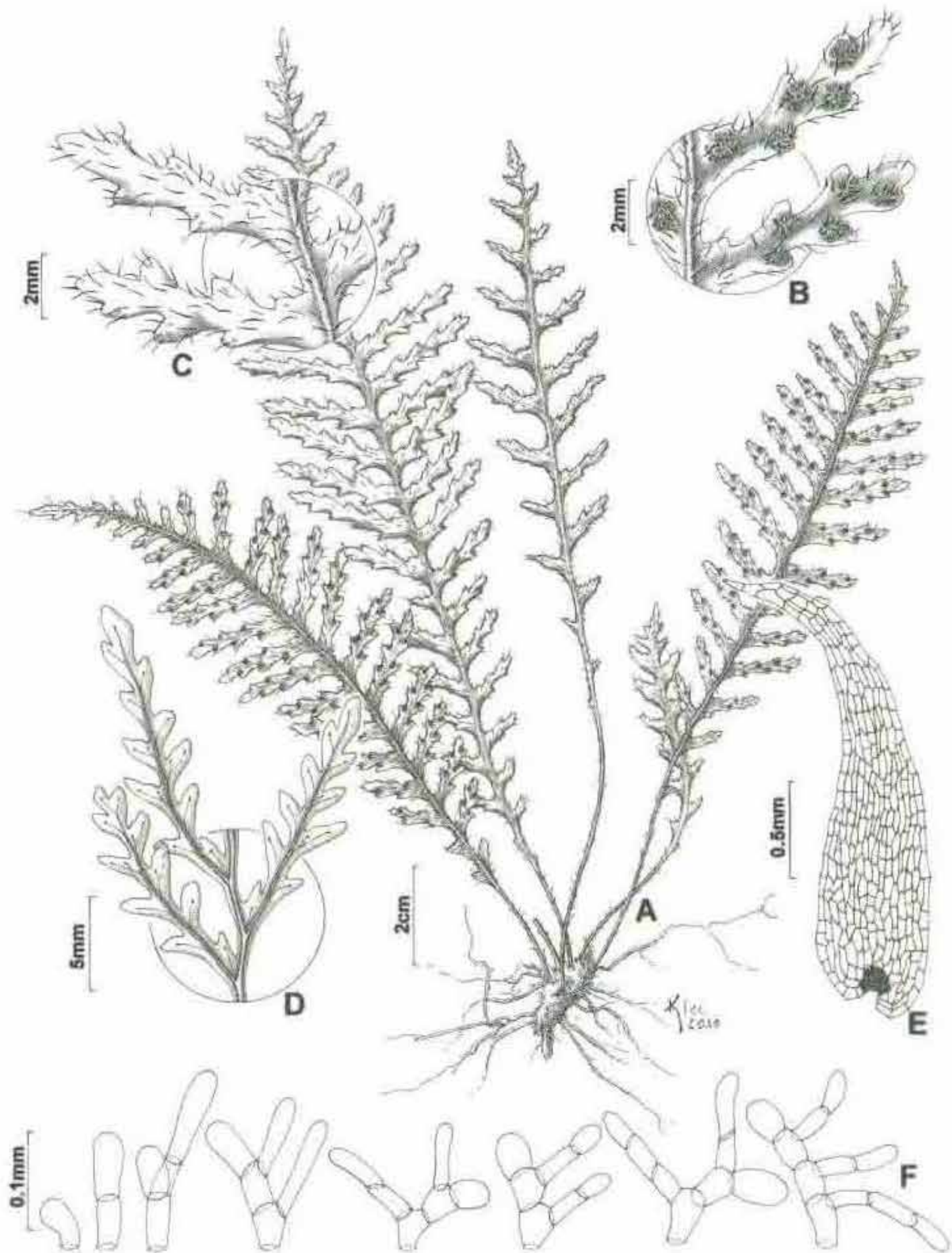


FIG. 4. *Moranopteris achilleifolia*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments adaxially showing setae and hydathodes. D. Detail of the venation (cleared leaf). E. Stem scale. F. Unbranched and branched hairs from the costa. A-C: Hirai & Schwartsburd 608 (SP). D-F: Hirai et al. 601 (SP).

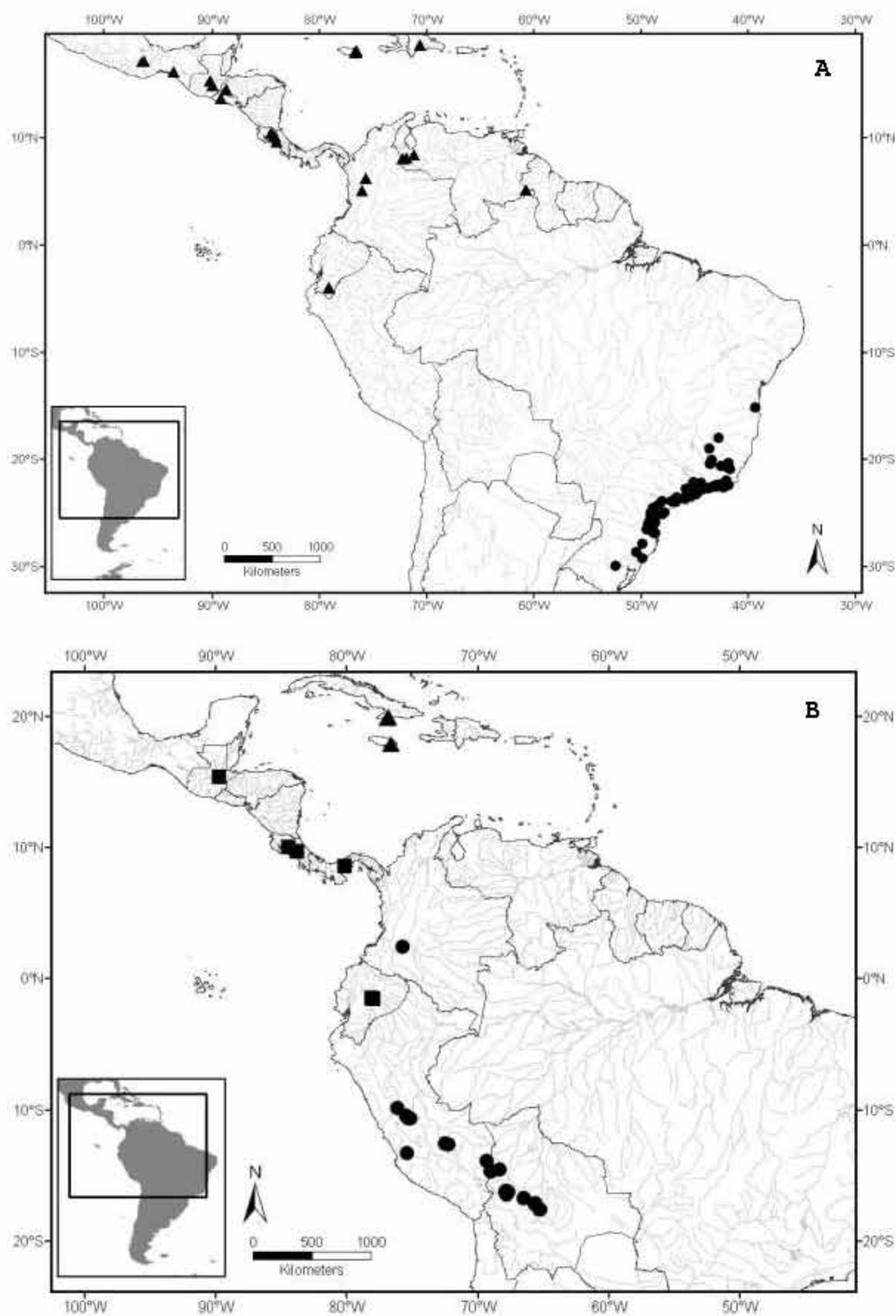


FIG. 5. A. Distribution of *Moranopteris achilleifolia* (●) and *M. basiattenuata* (▲). B. Distribution of *M. blepharidea* (●), *M. cookii* (■), and *M. sherringii* (▲).

Parque Estadual da Serra do Brigadeiro, trilha para o Pico do Boné, 26 May 2000, *Salino et al.* 5514 (BHCB, SP). **Espírito Santo:** Castelo, Forno Grande, 1500 m, 15 May 1949, *Brade* 19980 (RB). **Rio de Janeiro:** Itatiaia, Parque Nacional do Itatiaia, trilha para o morro Três Picos, Jun 2000, *Labiak et al.* 1249 (MBM, UPCB). **São Paulo:** Campos do Jordão, Parque Estadual de Campos do Jordão, trilha para a cachoeira, 1565 m, 22°41'53"S, 45°27'89"W, 3 Jan 2009, *Hirai & Prado* 616 (NY, SP). **Paraná:** Campina Grande do Sul, Serra do Capivari, subida para a estação da Embratel, 1400 m, 25°08'S, 48°49'W, 26 Dec 2008, *Hirai & Schwartsburd* 608 (SP). **Santa Catarina:** Campo Alegre, Serra Quiriri, próximo à torre de rádio, 1400 m, 28 Dec 1999, *Cordeiro et al.* 1725 (MBM). **Rio Grande do Sul:** Aparados da Serra, 1000 m, 3 Feb 1953, *Sehnem* 6276 (B).

Moranopteris achilleifolia is characterized by short-creeping rhizome, rhizome scales with entire margins, pinnatisect-pinnatifid to bipinnatisect laminae, pinnate veins ending in hydathodes, and more than 2 sori per segment (Figs. 4A–E).

The most similar species is *Moranopteris longisetosa*, which differs in having margins of the rhizome scales with glanduliform projections and pinnate-pinnatisect laminae, sometimes pinnate-pinnatifid. Moreover, *M. longisetosa* has the widest distribution range occurring in Costa Rica, Venezuela, Colombia, Ecuador, Peru, and Bolivia.

Sehnem (1970) and Ponce (2008) reported this species to Misiones (Argentina), but the vouchers cited by both authors were not localized at HBR and PACA herbaria. Any specimen from Argentina was found.

2. *Moranopteris aphelolepis* (C. V. Morton) R. Y. Hirai & J. Prado, *Taxon* 20XX. *Grammitis aphelolepis* C. V. Morton, *Contr. U.S. Natl. Herb.* 38: 97. 1967. *Xiphopteris aphelolepis* (C. V. Morton) Pichi-Serm., *Webbia* 28: 472. 1973. *Micropolypodium aphelolepis* (C. V. Morton) A. R. Sm., *Novon* 2: 422. 1992. TYPE.—ECUADOR. **Azuay:** Oriente border, Páramo del Castillo, crest of the eastern cordillera on the trail between Sevilla de Oro and Mendez, 29 Aug 1945, *W. H. Camp E-5107* (holotype: US-2080287; isotype: NY-144934). **Figs. 6A–G.**

Plants epiphytic. *Rhizome* erect with scales, the scales 1.6–3.2 X 0.4–0.7 mm, yellow-brown to castaneous, lanceolate to ovate-lanceolate, base cordate or slightly cordate, apex acute, usually with apical or subapical gland-like cells, margins entire, or with also small lateral projections, these projections sometimes furcate, rarely occurring on the scale surface. *Fronde*s erect to pendent, determinate, (5.0–)7.0–18.5 cm X (4.0–)5.0–11.0 mm, densely setose; *stipes* (0.7–)1.3–3.5 cm long, brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, sometimes deeply pinnatifid,

gradually tapering proximally to a narrow wing, chartaceous to membranaceous; *costa* visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* slightly ascending, ca. (45–)60–75°(–80) to *costa*, 21–55 pairs, spaced ca. 0.5–1.4 mm, subopposite, mostly gibbous, asymmetric, (2.1–)2.5–5.5 X (1.3–)1.5–3.2 mm, oblong, deltate toward base, decurrent at base, apex rounded, sometimes acute, margins plane, with hyaline cells inconspicuous or absent; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2(–4) hydathodes per segment, the hydathodes visible adaxially, elliptic; *setae* 1.4–2.7 mm long, dark red-brown, on both surfaces of the stipe, *costa*, and laminar tissue; hairs present on the stipe, *costa*, and laminar tissue, sometimes on the margins (mainly near to *costa* abaxially), hyaline to yellowish, slightly red-brown, mostly 2–4-branched, the main branch 3–5-celled, 0.10–0.25 mm long, 1st branch (1 or)2–5-celled, 0.15–0.25 mm long, 2nd and 3rd branches, mostly 2–4-celled, the 2nd branch 0.15–0.25 mm long, the 3rd branch < 0.1 mm long, 4th branch, if present, 1 or 2-celled, < 0.1 mm long. *Sori* one per segment, rounded, 0.9–1.7 mm diam.

Distribution.—Colombia, Ecuador, and Bolivia; 2100–3657 m (Figs. 7A, 2).

SELECTED SPECIMENS EXAMINED.—COLOMBIA. **Antioquia**: Ciudad Bolívar, Corregimiento San Bernardo de los Farallones, Farallones del Citará, sector La Peña, base del cerro Cabeza de Índio, 2750–3220 m, 5°46′19″N, 76°03′13″W, 10 Nov 2004, *Rodríguez et al.* 4685 (HUA, NY). **Huila**: Cordillera Central, Cordillera del Buey, hike from Finca Loyola over the páramo down to San Antonio, 2100–3000 m, 14 Dec 1972, *Bishop* 1972 (UC). **Putumayo**: Santiago, Vereda de San Antonio de Bellavista, Páramo del Bordoncillo, 3200–3400 m, 4–5 Apr 1992, *Ramírez* 4726 (US). ECUADOR. **Azuay**: Between Huagrarancha and Loma de Galápagos, 3140–3505 m, 9 Jul 1943, *Steyermark* 53464 (NY, US). **Carchi**: Estación Biológica La Guandera, 3310 m, 00°35′N, 77°42′W, 18 Feb 2004, *Moran et al.* 6870 (MO, NY). **Imbabura**: Ridge about 10 km, south of Las Toldadas, easterly from Cayambe Peak, 3246 m, 15 Jul 1944, *Wiggins* 10402 (US). **Napo**: Playon de San Francisco, El Mirador, 16 Aug 1978, *Boeke & Jaramillo* 2701 (NY). **Sucumbíos**: Cerro "El Mirador", 4 km al SW de la población de "Cocha Seca", subiendo por el sector de "Chozas Viejas", 3300–3500 m, 29 Feb 1992, *Gavilanes & Funk* 838 (US). **Zamora-Chinchiipe**: Estación Científica San Francisco, above refuge, along trail T1, 2550 m, 03°59′33″S, 79°04′15″W, 29–30 Sep 2003, *Lehnert* 935 p.p. (UC). BOLIVIA: **La Paz**: Cotapata, Sud Yungas, north on trail on side of mountain, 3200 m, 16°15′S, 67°50′W, 8 Aug 1989, *Fay & Fay* 2602 (LPB, MO).

Moranopteris aphelelepis can be recognized by an assemblage of morphological characters: rhizome scales with entire margins, densely

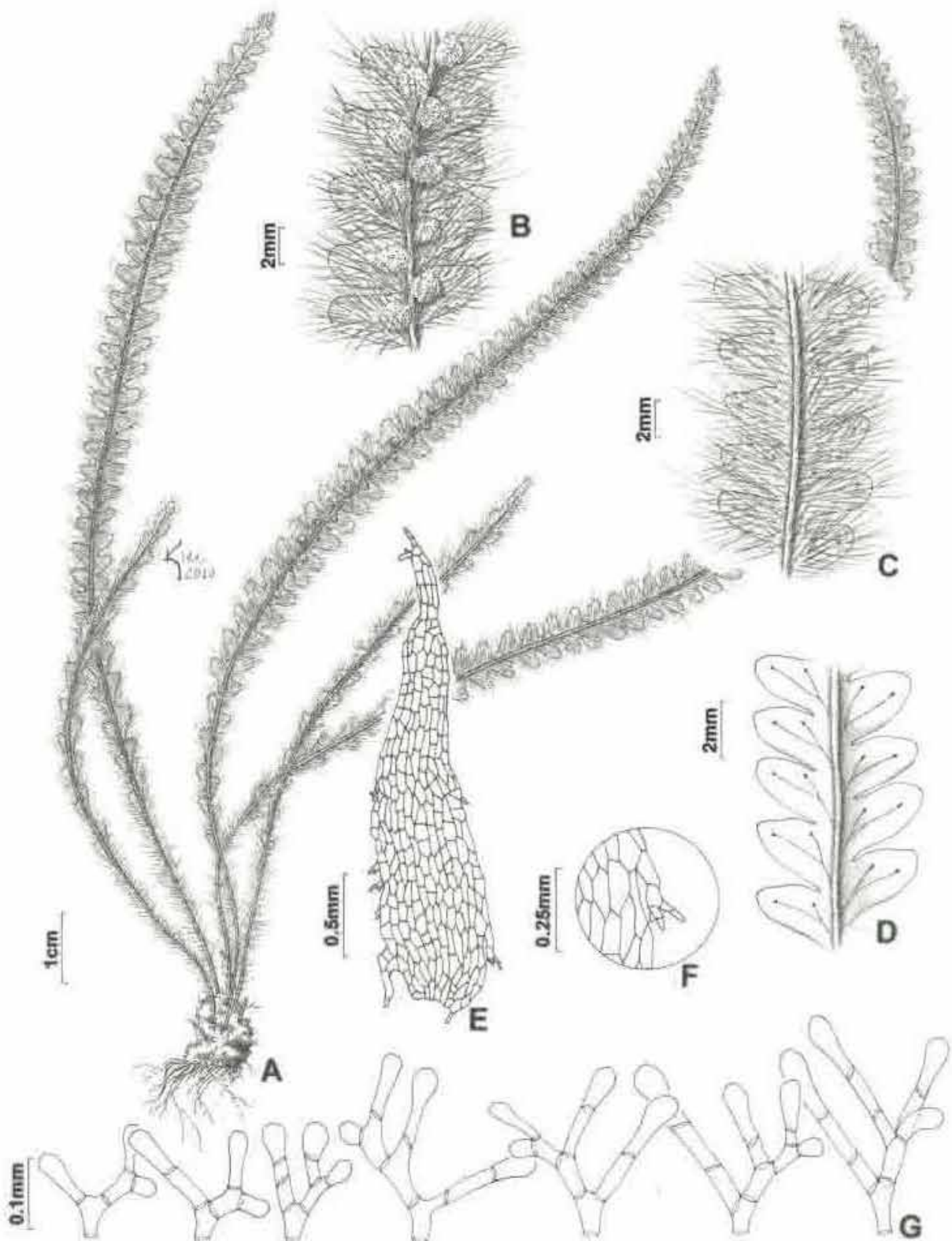


FIG. 6. *Moranopteris aphelolepis*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Detail of the margin of the rhizome scale. G. Branched hairs from the costa. A-C: Rodriguez et al. 4723 (HUA). D, G: Boeke & Jaramillo 2701 (NY). E, F: Moran et al. 6870 (NY).

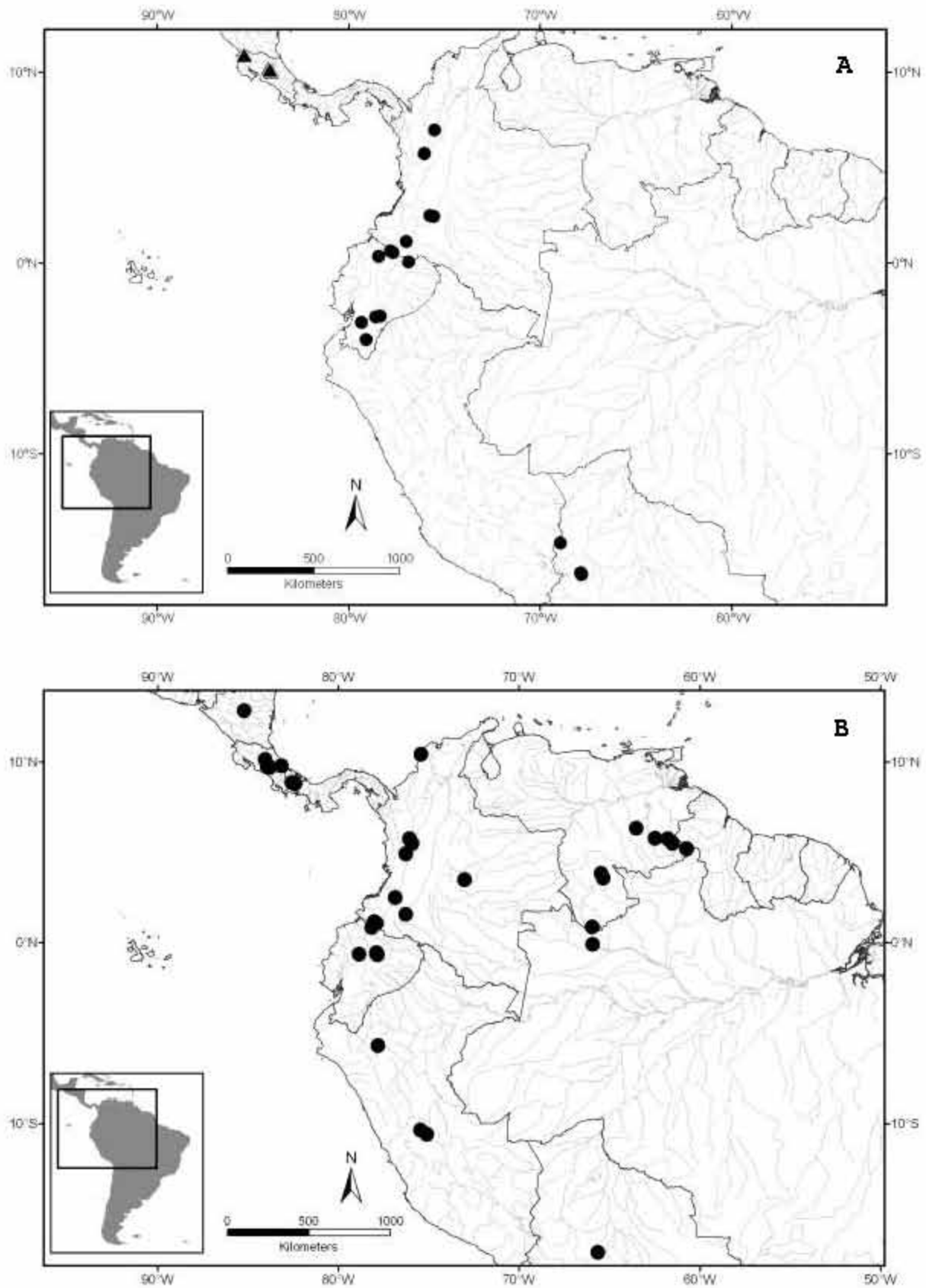


FIG. 7. A. Distribution of *Moranopteris aphelolepis* (●) and *M. zurquina* (▲). B. Distribution of *M. caucana* (●).

setose fronds, usually furcate veins, gibbous segments, two hydathodes per segment, and branched hairs (Figs. 6A–G). Some specimens from Colombia are densely setulose that resembles a caterpillar.

Gavilanes & Funk 838 (US) and *Jameson 371* (P) are a little bit atypical specimens by having 3 or 4 hydathodes per segment, but on the other features match perfectly with *Moranopteris aphelolepis*.

Moranopteris knowltoniorum is similar in the general aspect of the frond, but differs by branched hairs near and on the costa abaxially (Fig. 17G). These branched hairs have mostly a 1st branch \geq twice longer than the main branch. It also occurs only in Lesser Antilles (Guadeloupe and Dominica).

3. *Moranopteris basiattenuata* (Jenman) R. Y. Hirai & J. Prado, *Taxon* 20XX.

Polypodium basiattenuatum Jenman, *Bull. Bot. Dept. Jamaica*, n.s. 4: 114. 1897. *Xiphopteris basiattenuata* (Jenman) Copel., *Amer. Fern J.* 42: 104. 1952. *Grammitis basiattenuata* (Jenman) Proctor, *Bull. Inst. Jamaica, Sci. Ser.* 5: 32. 1953. *Micropolypodium basiattenuatum* (Jenman) A. R. Sm., *Novon* 2: 422. 1992. LECTOTYPE.—first step selected by Smith (1995) and second step (here designated).—JAMAICA. Without exact locality, s.d., *G. S. Jenman s.n.* (NY-127117, duplicate: NY-s.n.; photo GH-n.v.). **Figs. 8A–G.**

Grammitis basiattenuata (Jenman) Proctor var. *valens* Mickel & Beitel, *Mem. New York Bot. Gard.* 46: 197. 1988. TYPE.—MEXICO. **Oaxaca:** Distrito Ixtlán, 2 km E of Natividad, on lower part of trail from San Pedro Nolasco to the Llano Verde, 1828–2072 m, 4 Oct 1969, *J. T. Mickel & R. L. Hellwig 3824* (holotype: NY-144937).

Plants epiphytic. *Rhizome* erect with scales, the scales 1.2–2.3 mm X 0.2–0.4 mm, orangish-brown to castaneous, lanceolate, base slightly cordate to truncate, apex acute, usually with apical cells, margins with small lateral projections, sometimes these projections furcate. *Fronds* erect to arcuate, determinate, 4.0–15.5(–21.0) cm X 4.5–9.0 mm, moderately to densely setose; *stipe* 0.5–1.2 cm long, brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, sometimes deeply pinnatifid in small plants (ca. 5 cm long), gradually tapering proximally to a narrow wing, chartaceous; *costa* visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, ca. 45–60° to costa, 17–52 pairs, spaced ca. 0.4–1.1 mm, subopposite, not gibbous, symmetric, 1.9–5.1 X 1.1–2.3 mm, oblong to oblong-lanceolate, deltate toward base, decurrent at base, apex slightly rounded to truncate, margins plane, without hyaline cells; *veins* usually furcate, at least in fertile segments, or sometimes

simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic or obovate; *setae* 1.3–3.0 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs scattered on the stipe, costa, laminar tissue abaxially, and margins, hyaline, slightly red-brown, 1 or 2(or 3)-branched, the main branch 2 or 3(or 4)-celled, (<–)0.10(–0.25) mm long, the 1-branched hairs have a branch $\geq 2X$ longer than the main branch, 1st branch (1 or) 2 or 3(or 4)-celled, (0.15–)0.20–0.25 mm long, 2nd branch 1–3-celled, ca. 0.15 mm long, 3rd branch, if present, 2-celled, ca. 0.15 mm long. *Sori* one per segment, rounded, 1.1–1.4 mm diam.

Distribution.— Mexico, Guatemala, Honduras, El Salvador, Costa Rica, Jamaica, Dominican Republic, Guyana, Venezuela, Colombia, and Ecuador; 1700–2900 m (Figs. 5A, 2).

SELECTED SPECIMENS EXAMINED.— MEXICO. **Chiapas:** On the southeast side of Cerro Tres Picos and the ridges near summit, 2100–2500 m, 11 Dec 1972, *Breedlove & Thorne 30160* (NY). GUATEMALA. **Alta Verapaz:** San Juan Chamelco, Montaña Caquipec, 2100–2200 m, 15°23'52"N, 90°11'47"W, 10 Apr 1998, *Förther et al. 10135a* (MSB). **El Progreso:** Chilasco San Agustín Acasaguastlán, Sierra de las Minas, microcuenca del Río El Naranjo, laderas del Pinalón, 1900–2800 m, Apr 1997, *Vargas 695* (UC). HONDURAS. **Lempira:** Celaque National Park, along Río Arcágual, upstream from base camp 2, 10.5 km WSW of the town of Gracias, 2500 m, 14°34'05"N, 88°41'05"W, 16 Nov 1991, *Moran 5580* (NY, UC). EL SALVADOR. Bosque Montecrato, 2300 m, 7 Apr 1979, *Serler 1135* (NY). COSTA RICA. **Alajuela:** Volcán Poas summit area and lake, 2500–2650 m, 6 Jul 1967, *Bishop 811* (UC). **Heredia:** Vara Blanca, 2000 m, 3 Mar 1932, *Kupper 647*(M). **SAN JOSÉ:** Ca. 10 km N of San Rafael de Heredia on Volcán Barba, 1950 m, 13 Jul 1967, *Mickel 2666* (NY). JAMAICA. **Portland:** Summit of Blue Mountain Peak, 2100–2200 m, 7–9 Jul 1926, *Maxon 9858* (NY, PH, S, UC). DOMINICAN REPUBLIC: La Vega, Cordillera Central, La Nevera, 41.7–43.7 km N of central park of San José de Ocoa on the road to Constanza, 2042 m, 22 Feb 1982, *Mickel et al. 8339* (NY). GUYANA. **Cuyuni-Mazaruni:** Slopes Mount Roraima, Oct 1894, *Quelch & McConnell 49* (K). VENEZUELA. **Mérida:** Carretera de Bailadores a La Grita vía El Portachuelo, 3 km del cruce a las porqueras, 2900 m, 08°10'51"N, 71°54'16"W, 30 May 2008, *Vasco et al. 823* (NY). **Táchira:** Faldas debajo del Páramo de Tamá, cerca de la frontera Colombo-Venezolana, arriba de Betania y Tamá, cerca de la Quebrada Buena Vista, 2300–2450 m, 22–24 May 1967, *Steyermark & Dunsterville 98720* (NY). COLOMBIA. **Antioquia:** Medellín, Corregimiento San Antonio de Prado, Vereda Astilleros, Divisoria de aguas de las quebradas Doña María y Ana Díaz, 2580–2650 m, 06°15'13"N, 75°40'10"W, 3 Dec 2005, *Rodríguez et al. 5648* (HUA). **Risaralda:** Santuario, PNN Tatamá, camino que lleva al páramo de Tatamá, subiendo hacia Morro

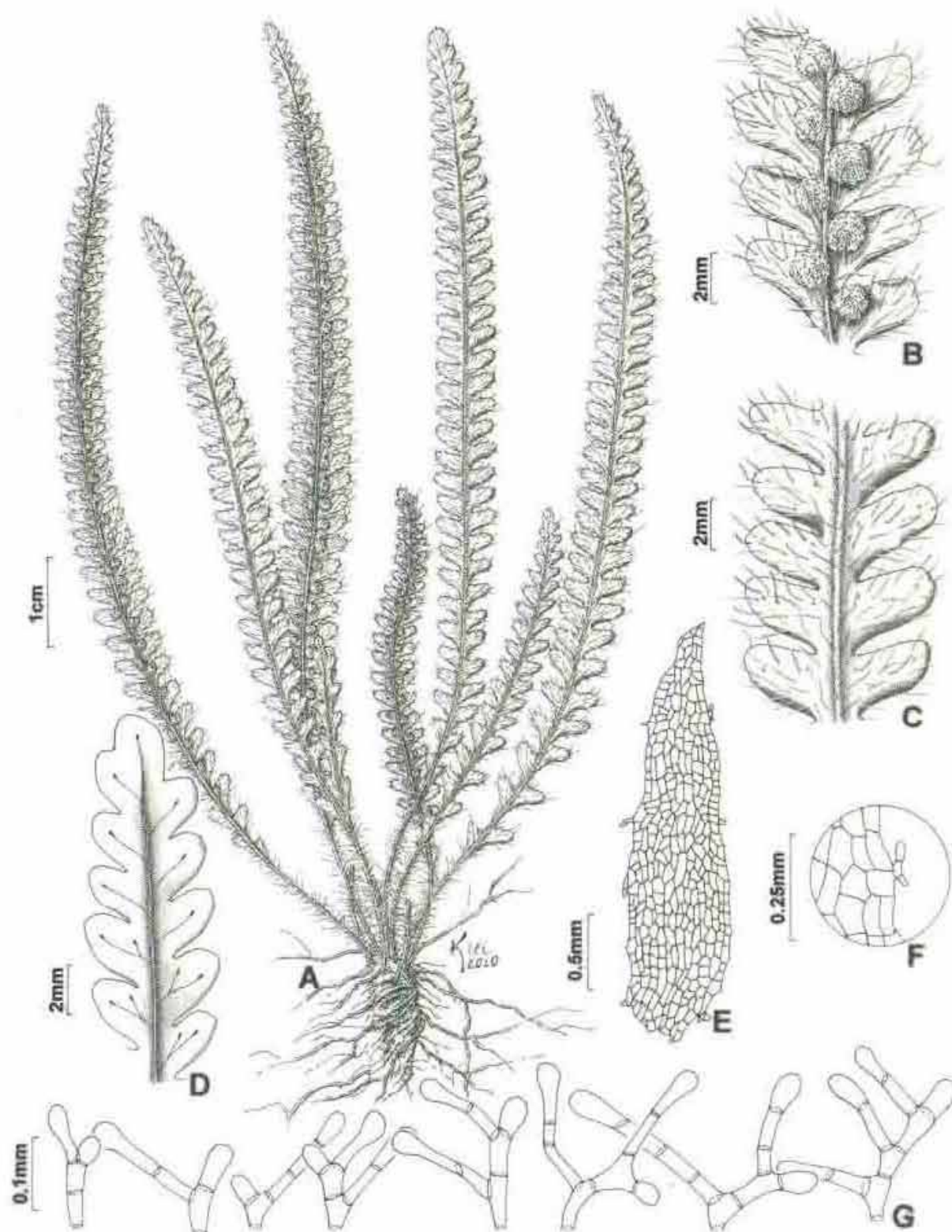


FIG. 8. *Moranopteris basiattenuata*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Detail of the margin of the rhizome scale. G. Branched hairs from the costa. A-C: Harris 7141 (NY). D-G: Breedlove & Thorne 30160 (NY).

Zancudo, 2723 m, 05°07'28"N, 76°02'30"W, 17 Apr 2007, Sundue & Vasco 1240 (NY). ECUADOR. **Zamora-Chinchi**: Area of Estación Científica San Francisco, road Loja-Zamora, ca. 35 km from Loja, 2200 m, 03°58'S, 79°04'W, 23 Mar 2004, Werner 857 (UC).

Moranopteris basiattenuata can be recognized by rhizome scales with entire margins, moderately to densely setose fronds, not gibbous segments, and usually furcate veins, and two hydathodes per segment. Another helpful distinguishing character is the branched hairs, 1-branched. In general, this kind of hair has a branch \geq twice longer than the main branch (Figs. 8A–G).

Moranopteris aphelolepis resembles *M. basiattenuata* but differs by gibbous segments and without 1-branched hairs like *M. basiattenuata*.

Some unusual specimens of *Moranopteris basiattenuata* such as Moran 5580 (NY) have somewhat gibbous segments like in some segments of the type of *Grammitis basiattenuatum* var. *valens*.

Stork 2336 (UC) cited by Smith (1995) in Flora Mesoamericana as *Micropolypodium setulosum* (Rosenst.) A. R. Sm. represents only a small plant of *Moranopteris basiattenuata*. The main morphological characters matches with *M. basiattenuata*: the 1-branched hairs near and on the costa abaxially and rhizome scales with entire margins with also small lateral projections. This specimen collected by Stork is also similar to Maxon 9955 (NY) from Jamaica.

4. *Moranopteris blepharidea* (Copel.) R. Y. Hirai & J. Prado, Taxon 20XX.

Polypodium blepharideum Copel., Univ. Calif. Publ. Bot. 19: 304. pl. 64. 1941. *Xiphopteris blepharidea* (Copel.) Copel., Amer. Fern J. 42: 99. 1952. *Micropolypodium blepharideum* (Copel.) A. R. Sm., Novon 2: 422. 1992. *Grammitis blepharidea* (Copel.) Stolze, Fieldiana, Bot. n.s., 32: 112. 1993. TYPE.—PERU. **Huánuco**: Churubamba, Crest of Santo Toribio, trail Puente Durand to Exito, 2000 m, Sep 1936, Y. Mexía 8147a (holotype: UC-595042; isotype: US-n.v.; photos F-n.v. and GH-n.v.). **Figs. 9A–G.**

Polypodium buesii Maxon, Contr. Gray Herb. 165: 72. 1947. *Xiphopteris buesii* (Maxon) Copel., Amer. Fern J. 42: 105. 1952. *Grammitis buesii* (Maxon) Lellinger, Amer. Fern J. 74: 58. 1984. TYPE.—PERU. **Cuzco**: Cerro Chuyapé, 24 Jun 1941, C. Bües A45 p.p. (holotype: US-1858604).

Plants epiphytic. Rhizome erect with scales, the scales 1.4–2.6 mm X 0.4–0.6 mm, golden to yellow-brown, sometimes castaneous, lanceolate to ovate-lanceolate, base cordate, apex acute, usually with apical or subapical gland-like cells, margins entire, or with also small lateral

projections. *Fronde*s erect to pendent, determinate, 7.5–22.5 cm x 4.0–11.5 mm, moderately setose; *stipe* (0.9–)1.2–4.0 cm long, yellow-brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, sometimes pinnate at base, gradually tapering proximally to a narrow wing, chartaceous or membranaceous; *costa* slightly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, ca. (50–)60–80° to costa, 43–78 pairs, spaced ca. 0.3–0.9 mm, subopposite, not gibbous, symmetric, (2.5–)3.0–4.5 x (0.9–)1.5–1.9 mm, mostly deltate-lanceolate, rarely oblong, deltate toward base, decurrent at base, apex mostly acute, margins plane, sometimes slightly revolute, with hyaline cells inconspicuous or absent; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic; *setae* 0.6–2.2(–4.5) mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs scattered on the stipe, costa, laminar tissue abaxially, and margins, hyaline, slightly red-brown, 1 or 2-branched, the main branch 2 or 3-celled, 0.10–0.15 mm long, the 1-branched hairs with a branch > 2X longer than the main branch, 1st branch 2–4(or 5)-celled, 0.20–0.50 mm long, 2nd branch, if present, 1–3-celled, 0.15–0.20 mm long. *Sori* one per segment, rounded, 1.3–1.6 mm diam.

Distribution.—Colombia, Peru, and Bolivia; 1700–3100 m (Figs. 5B, 2).

SELECTED SPECIMENS EXAMINED.—COLOMBIA. HUILA: Cordillera Oriental, 15 km SE of Garzón, 2225 m, 1 Feb 1945, *Little Jr.* 9349 (US). PERU. **Cuzco**: Calca, Road Quebrada-Alto Lacco, 2800 m, 12°37'22"S, 72°14'40"W, 30 Apr 2006, *van der Werff et al.* 21206 (MO, NY). Pasco: Oxapampa, Parque Nacional Yanachaga Chemillén, parte alta del Refugio el Cedro, 2450–2680 m, 10°32'S, 75°21'W, 20 Mar 2003, *Monteagudo et al.* 4737 (UC). **Puno**: Sandia, on the steep slopes east of Oconeque itself east 3 hours from Limbani, 2438–2743 m, 11 Oct 1943, *Hodge* 6087 p.p. (US). BOLIVIA. **Cochabamba**: Ayopaya, Comunidad Pampa Grande, antes de llegar al primer río que atravieza la senda desde Tunki, 2030 m, 16°40'S, 66°28'W, 11 Sep 2002, *Jiménez & Moguel* 1531 (GOET, UC). **LA PAZ**: Franz Tamayo, PN-ANMI Madidi, sendero Keara-Mojos, a media hora de caminata aproximadamente desde Tokuaqe por la senda al inciensial, 2420 m, 14°37'S, 68°57'W, 31 Oct 2001, *Jiménez & Gallegos* 708 (GOET, UC).

Moranopteris blepharidea has rhizome scales with entire margins or with also small lateral projections, mostly 1-branched hairs; these hairs have a branch \geq twice longer than the main branch (Figs. 9A–G).

Moranopteris hyalina is similar in many morphological characters. Basically it differs by the rhizome scales with hyaline long setiform projections on the margins.

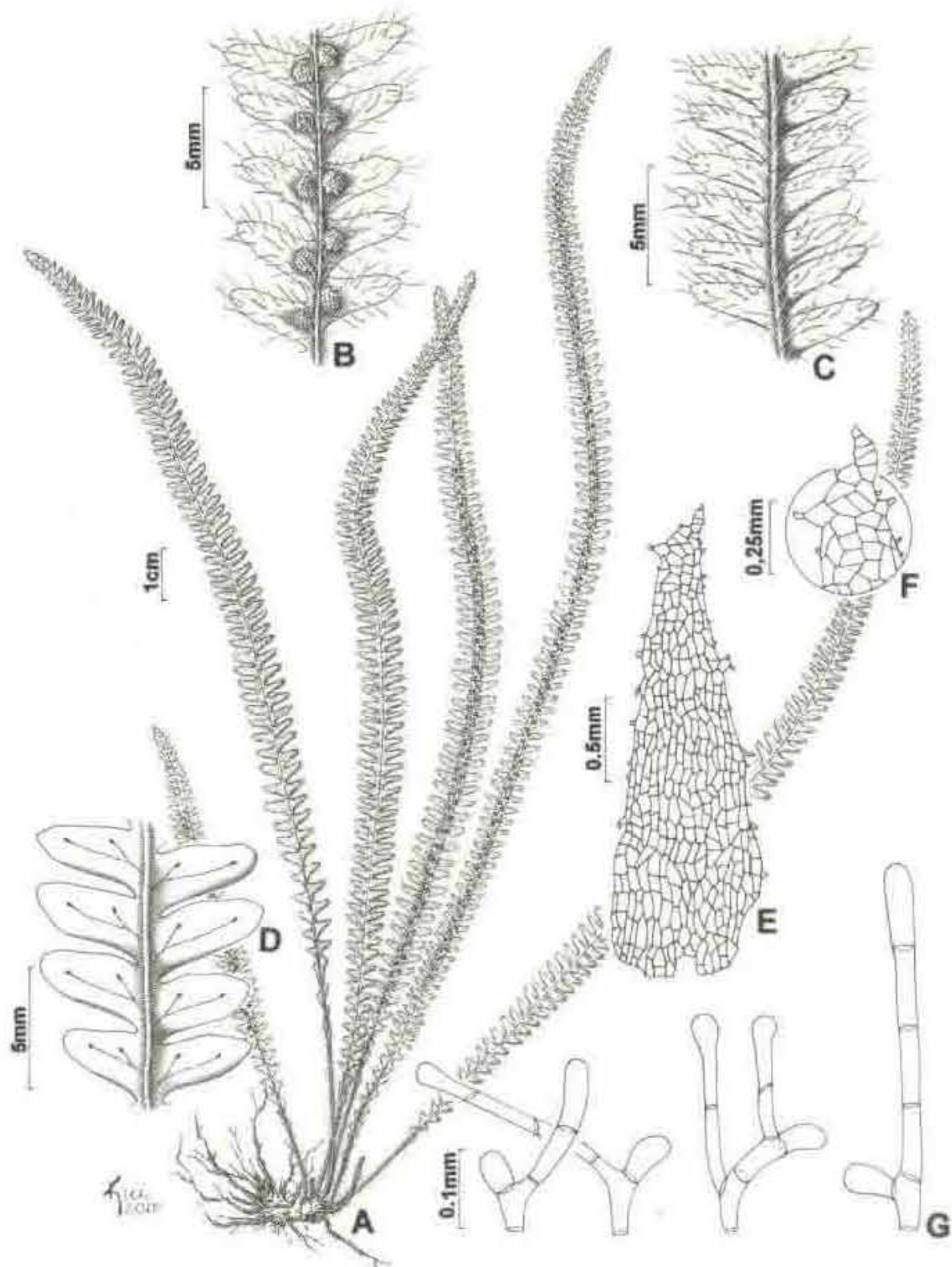


FIG. 9. *Moranopteris blepharidea*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Detail of the margin of the rhizome scale. G. Branched hairs from the costa. A-C, F: Miller & Heirichs 6173 (LPB). D, G: Kessler et al. 11973 (UPCB).

Some specimens of *Moranopteris blepharidea* like: Werff et al. 21206 (NY) and Hodge 6087 (US), Jiménez et al. 2965 (UC), Kessler et al. 7169 (UC), 7174 (UC), and Beck 17493 (UC) have rhizome scales with one hyaline setiform projection.

The type specimen of *Polypodium buesii* is mixed (pro parte) with *Moranopteris hyalina*. The specimens with 3 or 4 hyaline setiform projections on the scale margins were considered *M. hyalina* in the present paper and those with entire margins or with only few small lateral projections *Moranopteris blepharidea*. Similar decision to put *P. buesii* under *M. blepharidea* was taken by Tryon and Stolze (1993) in the flora of Peru.

Moranopteris hyalina has rhizome scales with many to few hyaline setiform projections and some small lateral projections on the margins. Based on this character, maybe *Moranopteris blepharidea* and *M. hyalina* overlapp and they might represent the same taxa. But more populational studies are necessary to solve this question. If both are considered the same taxa, *M. hyalina* has priority.

- 5. *Moranopteris caucana*** (Hieron.) R. Y. Hirai & J. Prado, Taxon 20XX.
Polypodium caucanum Hieron., Bot. Jahrb. Syst. 34: 503. 1904.
Xiphopteris caucana (Hieron.) Copel., Amer. Fern J. 42: 98. 1952.
Grammitis caucana (Hieron.) C. V. Morton, Contr. U.S. Natl. Herb. 38: 96. 1967. *Micropolypodium caucanum* (Hieron.) A. R. Sm., Novon 2: 422. 1992. LECTOTYPE (designated by Smith, 1995).—COLOMBIA. **Cauca:** Río Dagua, 2300 m, 20 Oct 1882, F. C. Lehmann 3257 (frag. B-200149305; duplicate: BM-n.v.). **Figs. 10A-F.**

Plants epiphytic or terrestrial. *Rhizome* erect with scales, the scales 1.0–1.8 mm X 0.2–0.5 mm, castaneos, lanceolate, base truncate to cordate, apex acute, usually with apical or subapical gland-like cells, margins with long setiform projections, rarely setiform projections occurring on the scale surface on the 1/3 of distal portion, setiform projections red-brown, 0.1–0.4 mm long. *Fronde*s erect to pendent, ± indeterminate, 8.0–30.0 cm X (2.5–)3.0–10.0 mm, moderately setose; *stipe* 0.7–4.0 cm long, yellow-brown to dark-brown, wings absent; *laminae* linear, pinnatisect, sometimes pinnate at base, abruptly tapering proximally, chartaceous; *costa* mostly obscured by laminar tissue abaxially, or sometimes slightly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* patent to slightly ascending, mostly 70–90° to costa, 48–69 pairs, spaced ca. 0.8–2.2 mm, subopposite, not gibbous, symmetric, (1.7–)2.8–5.0 X (0.9–)1.2–2.2 mm, mostly deltate, sometimes oblong, slightly decurrent at base, apex slightly rounded to acute, margins plane, with hyaline cells

inconspicuous or absent; veins simple, obscured, 1 hydathode per segment, very rare 2 hydathodes per segment, the hydathodes visible adaxially, elliptic to linear; setae 1.5–2.2 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs on the stipe, costa, and laminar tissue (mainly near to costa abaxially), hyaline to yellowish, slightly red-brown, unbranched and branched, the unbranched hairs commonly 3-celled, ca. 0.15 mm long, mainly with branched hairs, mostly 1-branched, sometimes 2-branched, the main branch 2(or 3)-celled, (<–)0.10–0.15 mm long, the 1-branched hairs with a branch $\geq 2X$ longer than the main branch, 1st branch (1 or) 2 or 3-celled, 0.15–0.25 mm long, 2nd branch, if present, 1 or 2-celled, 0.10–0.15 mm long. Sori one per segment, rounded, 1.1–1.7 mm diam.

Distribution.—Nicaragua, Costa Rica, Panama, Guyana, Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil; 1200–3550 m (Figs. 7B, 2).

SELECTED SPECIMENS EXAMINED.—NICARAGUA. **Without exact locality:** 1853–1856, *Wright 15* (B). COSTA RICA. **Cartago:** Along trail leading eastward into mountains from road into Tapanti Reserve ca. 1 km S of jct. of Quebrada Salto and Río Grande de Orosi, also known as "Quebrada Val Verde", 1500–1800 m, 09°43'N, 83°47'W, 1 Feb 1986, *Smith et al. 2156* (UC). **Heredia:** National Park Braulio Carrillo, transekt trail between OTS-Station La Selva and Volcán Barva, 2000 m, 10 Mar 2003, *Kluge 5624* (GOET). **Limón:** Cantón de Limón, El Progreso, siguiendo la fila a Cerro Matama, Fila Matama, Valle de La Estrella, 1600 m, 09°47'20"N, 83°07'30"W, 23 Apr 1989, *Herrera & Chacón 2726* (UC). **Puntarenas:** Monteverde, 1550 m, 25 Nov 1979, *Koptur 241* (UC). PANAMA. **Chiriquí:** Bugaba, Cerro Punta, along ridge to watershed to Bocas del Toro, along ridge to watershed to Bocas del Toro, 2200 m, 08°52'N, 82°33'W, 26 Jan 1985, *van der Werff & Herrera 6462* (NY, UC). **Chiriquí-Bocas del Toro:** Trail along continental divide to ca. 3 km E of Cerro Pate Macho, 2000–2200 m, 08°49'N, 82°23'W, 7 Feb 1986, *Smith et al. 2428* (UC). GUYANA. **Cuyuni-Mazaruni:** Upper slope Roraima, 10 Dec 1884, "im Thurn 178" (US). VENEZUELA. **Amazonas:** Atabapo, Cerro Marahuaca, cumbre, extremo noreste, 2580–2600 m, 03°50'N, 65°28'W, 30 Mar–1 Apr 1983, *Steyermark & Delascio 129279* (MO, NY, UC, VEN). **Bolívar:** Gran Sabana, Ilutepui, 2300–2600 m, 17 Mar 1952, *Maguire 33476* (NY, UC, US). COLOMBIA. **Antioquia:** Ciudad Bolívar, Corregimiento San Bernardo de los Farallones, Farallones del Citará, sector La Peña, base del cerro Cabeza de Índio, 2750–3220 m, 05°46'19"N, 76°03'13"W, 10 Nov 2004, *Rodríguez et al. 4682* (HUA, NY). **Bolívar:** Below Páramo de Chaquiro, Cordillera Occidental, 2800–3100 m, 24 Feb 1918, *Pennell 4355* (NY). **Cauca:** Río Dagua, 2300 m, 20 Oct 1882, *Vasquez et al. 28455* (NY, UC). **Chocó:** San José del Palmar, Cerro del Torrá, vertiente oriental, ca. 2500–2550 m, 14 Aug 1988, *Silverstone-Sopkin et al. 4375A* (UC). **Huila:** Cauca boundary, on and about the juncture of the

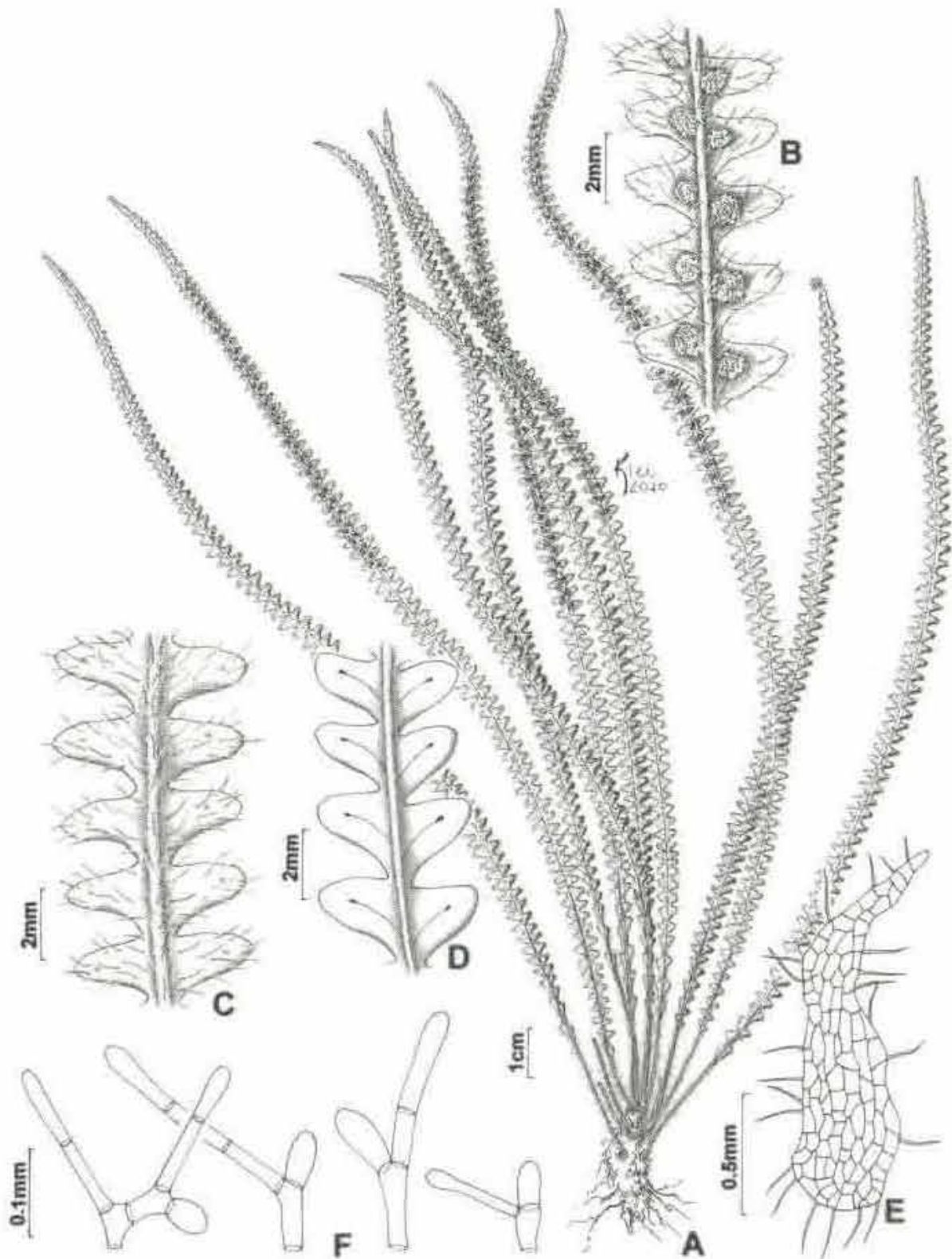


FIG. 10. *Moranopteris caucana*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Branched hairs from the costa. A-C, E: Steyermark et al. 126043 (NY). D, F: Steyermark 74948 (NY p.p.).

ridge between the drainages of the Río Guachicas with the main divide of the Cordillera Oriental at the head of Río Villalobos, SW of Pitalito, 2300 m, 01°34'N, 76°16'W, 6 Feb 1943, *Fosberg 19940* (US). **Meta:** Cordillera Oriental, upper Río Manzanares Valley, 20 km southeast of Gutiérrez, 65 km south of Bogotá, 2710 m, 7 Aug 1944, *Grant 9879* (HUA). **Nariño:** Reserva Natural La Planada, 7 km above Chucunés (on road between Tuquerres and Ricaurte), along trail to Pialapí, past entrance to La Planada Field Station, 1500–2000 m, 01°06'N, 77°53'W, 10 Mar 1990, *Croat 71244* (MO). **Valle del Cauca:** El Cairo, Cerro del Inglés, Cordillera Occidental, Serranía de los Paraguas, a 1 hora en jeep de El Cairo, 2400–2425 m, 30 Dec 1986, *Silverstone-Sopkin 2791A* (UC). ECUADOR. **Carchi:** Ridge to NE of Rafael Quindís mountain finca, 2000 m, 00°52'N, 78°08'W, 29 Nov 1987, *Hoover 2027* (MO). Napo: Along road Baeza-Tena, ca. 1200 m, 7 Mar 1994, *van der Werff et al. 13445* (MO, NY, UC). **Zamora-Chinchipe:** PERU. **Pasco:** Oxapampa, road to Chacos, 2400–2700 m, 10°35'S, 75°06'W, 17 Jul 2003, *van der Werff et al. 18573* (MO, UC). **San Martín:** Amazonas, 1950 m, 05°41'S, 77°48'W, 4 Mar 2001, *van der Werff et al. 16713* (MO, UC). BOLIVIA. **Cochabamba:** José Carrasco Torrico, 123 km antigua carretera Cochabamba-Villa Tunari, 2100 m, 17°08'S, 65°37'W, 9 Jul 1996, *Kessler et al. 7143* (GOET, LPB, UC). BRAZIL. **Amazonas:** Pico da Neblina, summit, 2438–2590 m, 3 Dec 1965, *Maguire et al. 60536 p.p.* (UC).

Moranopteris caucana is characterized by ± indeterminate fronds, deltate, not gibbous segments, with a simple vein, and usually one hydathode per segment visible adaxially (Figs. 10A–E). In addition, the best way to distinguish it is by its hairs. The most common hairs in *M. caucana* are 1-branched, with a branch \geq twice longer than the main branch (Fig. 10F). It sometimes resembles *M. taenifolia* when this species has not conspicuous gibbous segments. *Moranopteris taenifolia*, in this case, can be similar but differs by in having oblong segments, furcate vein on fertile segment, two hydathodes per segment, and mainly by the unbranched and branched hairs with a setiform branch.

Moranopteris cookii can be confused to *M. caucana*. Both have only simple veins, one hydathode per segment, and have the same kind of characteristic 1-branched hairs. *Moranopteris cookii* differs basically by rhizome scale with entire margins or with few short setiform projections (vs. conspicuous long setiform projections in *M. caucana*) and shape of the segment (oblong vs. deltate, respectively).

6. ***Moranopteris cookii*** (Underw. & Maxon) R. Y. Hirai & J. Prado, Taxon 20XX. *Polypodium cookii* Underw. & Maxon, Contr. U.S. Natl. Herb. 17: 408. 1914. *Xiphopteris cookii* (Underw. & Maxon) Copel., Amer. Fern J. 42: 98. 1952. *Grammitis cookii* (Underw. & Maxon) F. Seym., Phytologia

31: 173. 1975. *Micropolypodium cookii* (Underw. & Maxon) A. R. Sm., Novon 2: 422. 1992. TYPE.—GUATEMALA. **Alta Verapaz**: near the Finca Sepacuité, 20 Mar 1902, O. F. Cook & R. F. Griggs 80 (holotype: US-407781; isotypes: NY-144945; frag. NY-144944). **Figs. 11A–F.**

Polypodium basale Maxon, Amer. Fern J. 52: 110. 1952. *Grammitis basalis* (Maxon) Lellinger, Amer. Fern J. 74: 58. 1984. TYPE.—ECUADOR. **Napo-Pastaza**: near Puyo, 400 m, 18 Feb 1935, Y. Mexia 6930 (holotype: US-1691351).

Plants epiphytic. *Rhizome* erect with scales, the scales 1.2–1.7 mm X 0.3–0.6 mm, yellow-brown to castaneous, ovate to ovate-lanceolate, base slightly cordate, apex acute, usually with apical or subapical gland-like cells, margins mostly entire, or sometimes with also small lateral projections or short setiform projections, projections rarely occurring on the surface on the 1/3 of distal portion, setiform projections if present, few, red-brown, ca. 0.75 mm long. *Fronde*s erect to arcuate, determinate, (3.5–)6.0–16.0 cm X 4.0–8.0 mm, moderately setose; *stipe* 0.3–1.5 cm long, yellow-brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costa* obscured by laminar tissue, or sometimes slightly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* patent, ca. 80–90° to costa, 27–45 pairs, spaced ca. 0.5–1.0 mm, subopposite, not gibbous, symmetric, 2.2–4.6 X 1.2–2.2 mm, oblong, decurrent at base, apex rounded, margins slightly revolute, without hyaline cells; *veins* simple, obscured, 1 hydathode per segment, the hydathodes visible adaxially, elliptic to obovate; *setae* 0.8–2.3 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the costa, and laminar tissue, sometimes on the margins (mainly near to costa abaxially), hyaline, slightly red-brown, 1 or 2-branched, the main branch 2(or 3)-celled, 0.1–0.15(–0.2) mm long, 1-branched hairs with a branch $\geq 2X$ longer than the main branch, 1st branch (1–)3 or 4-celled, (0.10–)0.15–0.2(–0.3) mm long, 2nd branch, if present, 2 or 3-celled, ca. 0.10–0.15 mm long. *Sori* one per segment, rounded, 1.8–2.2 mm diam.

Distribution.—Guatemala, Costa Rica, Panama, and Ecuador; (400–)800–1296 m (Figs. 5A, 2).

SELECTED SPECIMENS EXAMINED.—COSTA RICA. **Alajuela**: 11 km N of San Ramón, 1000 m, 28 Jul 1967, Mickel 2929 p.p. (LP, NY). **Cartago**: P. N. Tapanti, Carretera ICE, Sendero Arboles Caidos, 1296 m, 09°44'58"N, 83°46'53"W, 4 Feb 2008, Sundue et al. 1764 (NY). PANAMA. **Coclé**: El Valle, 800–1000 m, 28 Jun 1967,

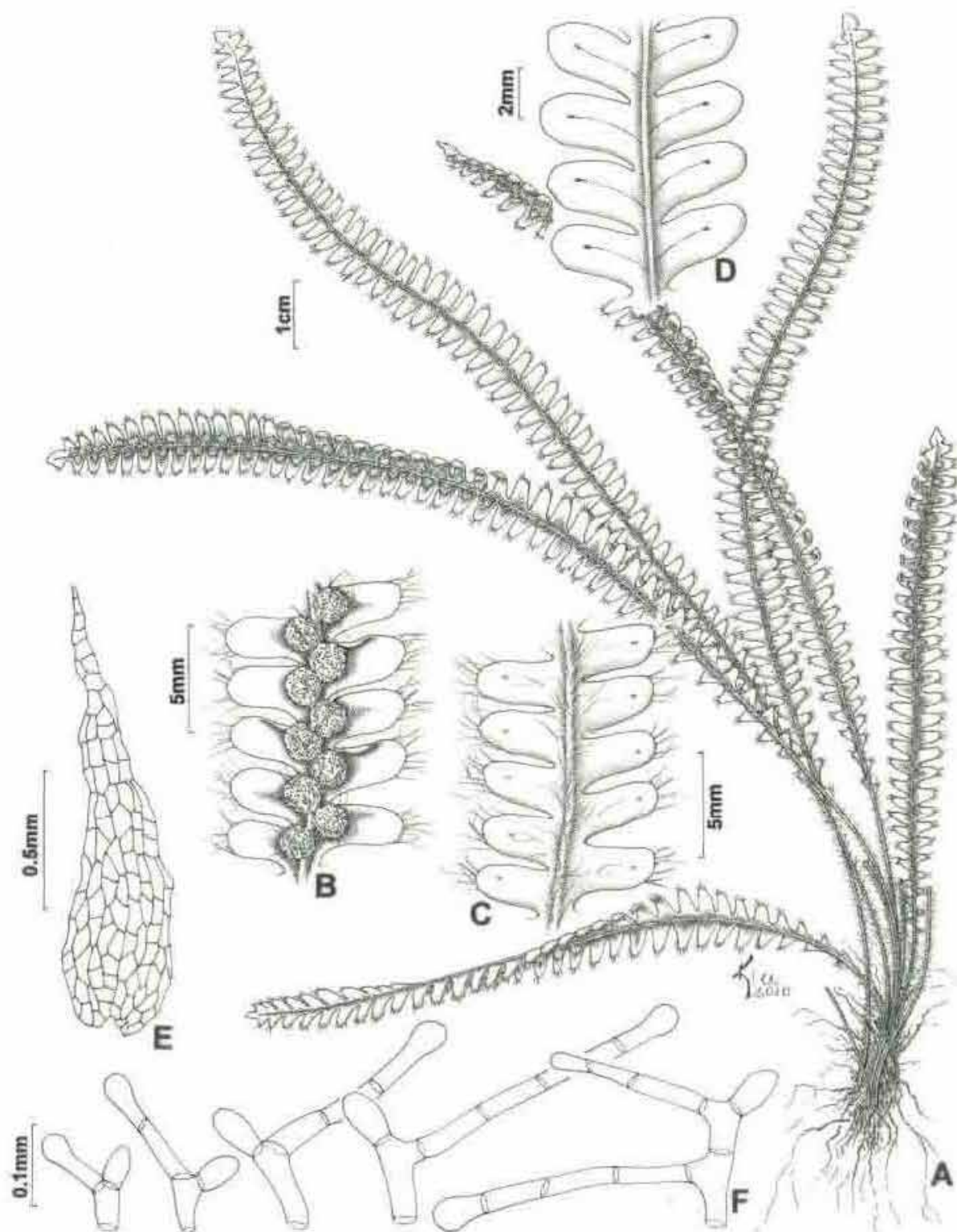


FIG. 11. *Moranopteris cookii*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Branched hairs from the costa. A-F: Sundue et al. 1764 (NY).

Duke 13219 (NY). ECUADOR. **Pastaza**: Mera Canton, 2 km northwest of Mera, at Campamento Vacacional Evangelico Mangayacu, 1250 m, 01°26'S, 78°07'W, 25 Jul 1992, Fay & Fay 3765 (MO, UC).

Moranopteris cookii can be distinguished from other species by the simple veins, one hydathode per segment, patent and not gibbous segments, also by 1-branched hairs, with a branch \geq twice longer than the main branch (Figs. 11A–F).

Moranopteris cookii is variable on the margins of the rhizome scales. Fay & Fay 3733 e 3765 (MO) have entire margins; however their duplicates at UC have few short setiform projections or entire margins, sometimes on the same rhizome.

Moranopteris basiattenuata is also a similar species but differs by the ascending segments, veins furcate in the fertile segments, and two hydathodes per segment.

7. *Moranopteris gradata* (Baker) R. Y. Hirai & J. Prado, Taxon 20XX.

Polypodium gradatum Baker, Fl. Bras. 1(2): 513. 1870. *Polypodium hirsutulum* Fée, Crypt. vasc. Br. 1: 87. 1869, *nom. illeg., non* Forst (1786). *Ctenopteris gradata* (Baker) Copel., Philipp. J. Sci. 84: 437. 1955. *Grammitis gradata* (Baker) R. M. Tryon & A. F. Tryon, Rhodora 84: 128. 1982. *Terpsichore gradata* (Baker) A. R. Sm., Novon 3: 486. 1993. *Micropolypodium gradatum* (Baker) Labiak & F. B. Matos, Brittonia 59: 184. 2007. LECTOTYPE (here designated).—BRAZIL. **Rio de Janeiro**: "Habitat prope Rio de Janeiro", s.d., A. Glaziou 2460 (P-637594; duplicates: P-632686 p.p.; BM-n.v.; foto GH-n.v.). **Figs. 12A–H.**

Polypodium schwackei Christ in Schwacke, Pl. Nov. Mineiras 2: 20. 1900.

Ctenopteris schwackei (Christ) Copel., Philipp. J. Sci. 84: 438. 1956. LECTOTYPE (here designated).—BRAZIL. **Minas Gerais**: "Habitat Serra de Ouro Preto", s.d., C. A. W. Schwacke 9488 (P; duplicate: RB).

Plants epiphytic, epipetric, rarely terrestrial. Rhizome short-creeping with scales, the scales 1.8–4.5 X 0.3–0.5 mm, golden, yellow-brown or castaneous, linear to linear-lanceolate, base cordate, apex acute, margins entire, or with also small lateral projections. Fronds erect to arcuate, determinate, 2.7–20.5 cm X 4.5–24.0 mm, sparsely setose to moderately setose adaxially; stipes 0.3–5.0 cm long, dark-brown, narrowly winged; laminae elliptic, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; costa obscured by laminar tissue, or sometimes slightly visible with dark sclerenchyma abaxially, visible with dark

sclerenchyma adaxially; *segments* slightly ascending, 40–75° to costa, 11–30 pairs, spaced ca. 1.4–1.5 mm, subopposite, not gibbous, symmetric, 2.0–13.0 X 1.7–5.0 mm, deltate to deltate-lanceolate, entire, decurrent at base, apex rounded, margins slightly revolute, without hyaline cells; *veins* pinnate, obscure or inconspicuous, > 2 hydathodes per segment, the hydathodes visible adaxially, elliptic or obovate; *setae* 0.6–2.2 mm long, dark red-brown, sometimes hyaline to yellowish (at the base of lamina and stipe), on both surfaces of the stipe, costa, and laminar tissue; *hairs* present on the stipe, costa, veins, and laminar tissue, sometimes on the margins (mainly near to costa abaxially), hyaline, slightly red-brown, 1 or 2-branched, the main branch 2 or 3-celled, 0.1–0.2 mm long, sometimes 1-branched hairs with a branch $\geq 2X$ longer than the main branch, 1st branch 1–3-celled, (<–)0.1–0.25 mm long, 2nd branch, if present, 1 or 2-celled, (<–)0.1(–0.15) mm long. *Sori* > 2 per segment, rounded, 1.0–1.7 mm diam.

Distribution.—Endemic to Coastal Brazil (Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, and Santa Catarina States); 500–2460 m (Figs. 13A, 2).

SELECTED SPECIMENS EXAMINED.—BRAZIL. **Espírito Santo**: Castelo, Braço do Sul, 6 Aug 1948, *Brade 19156* (NY, RB). **Minas Gerais**: Catas Altas, RPPN do Caraça, trilha para a Capelinha, próximo ao rio, 1300 m, 20°05'47"S, 43°29'05"W, 30 May 2008, *Hirai et al. 537* (SP). **Rio de Janeiro**: Santa Maria Madalena, Alto do Desengano, 2000 m, 3 Mar 1934, *Santos Lima & Brade 13169* (NY, RB). **São Paulo**: Campos do Jordão, Estrada para Pindamonhangaba, 1900 m, 28 Jun 1998, *Labiak 670* (SP). **Paraná**: Campina Grande do Sul, Serra do Capivari, próximo a Estação da Embratel, 1400 m, 25°08'S, 48°49'W, 26 Dec 2008, *Hirai & Schwartsburd 613* (SP). **Santa Catarina**: Joinville, Morro da Tromba, 500–600 m, 15 Sep 1901, *Schmalz 112* (NY).

Moranopteris gradata is easily recognized because it is the only species of *Moranopteris* that has pinnatisect laminae with simple segment and pinnate veins (Figs. 12A–D). Furthermore, it has more than two hydathodes and more than 2 sori per segment (Figs. 12B, C).

The most closely related species are *Moranopteris achilleifolia* and *M. longisetosa*, which have been considered to belong to *Terpichore achilleifolia* group by Smith (1993). This group was characterized in having rhizome generally weakly dorsiventral, orangish to orange-brown rhizome scales, entire to glandular to sparingly setose on margin, fronds arching, distinct stipe, determinate blade, without black clavate fungal fruiting bodies, the pinnae not reduced to base of frond, laminae with solitary setae, hydathodes lacking calcareous secretion and glabrous sporangia.

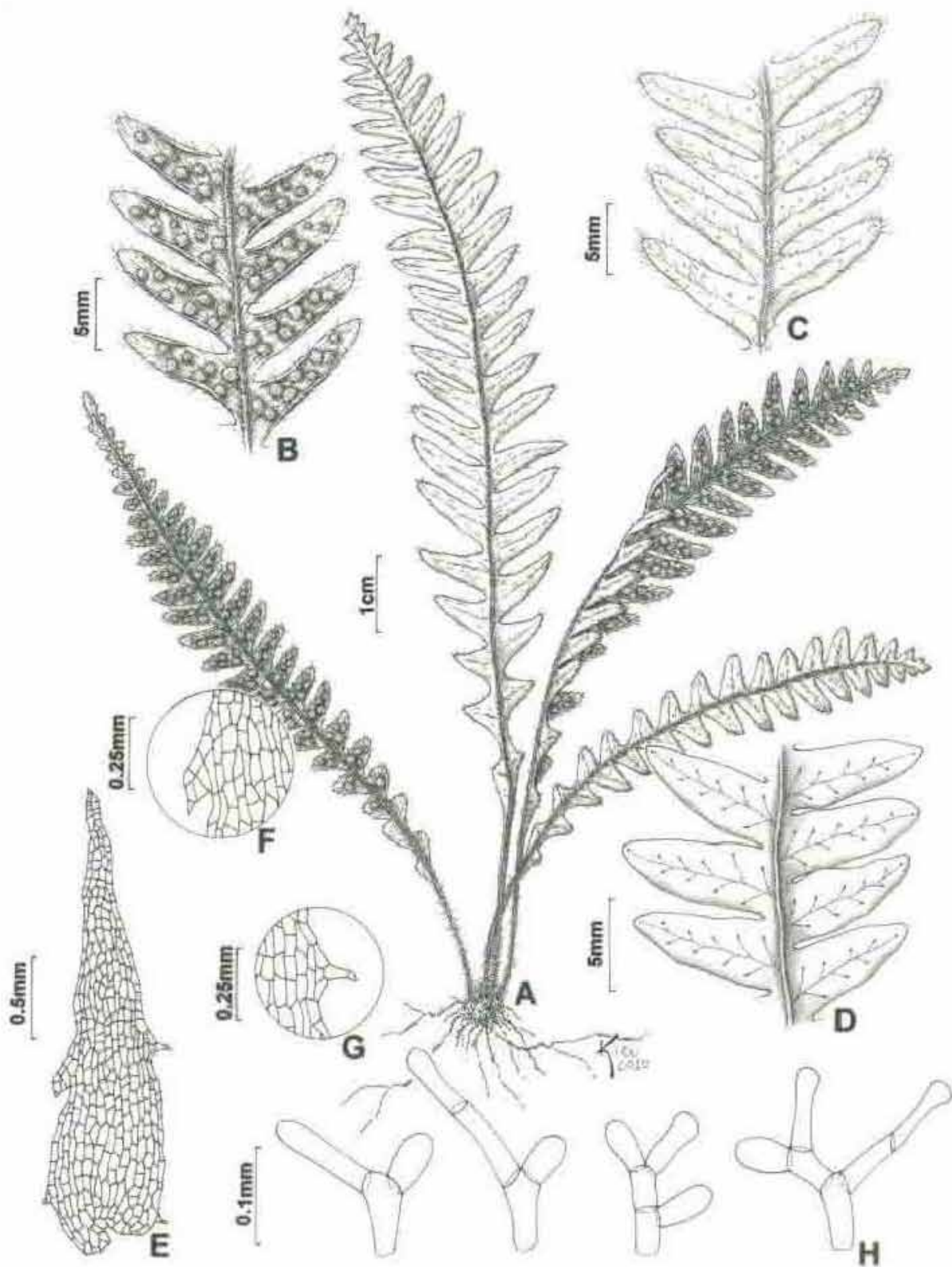


FIG. 12. *Moranopteris gradata*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F, G. Detail of the margin of the rhizome scale. H. Branched hairs from the costa. A-H: Hirai et al. 564 (SP).

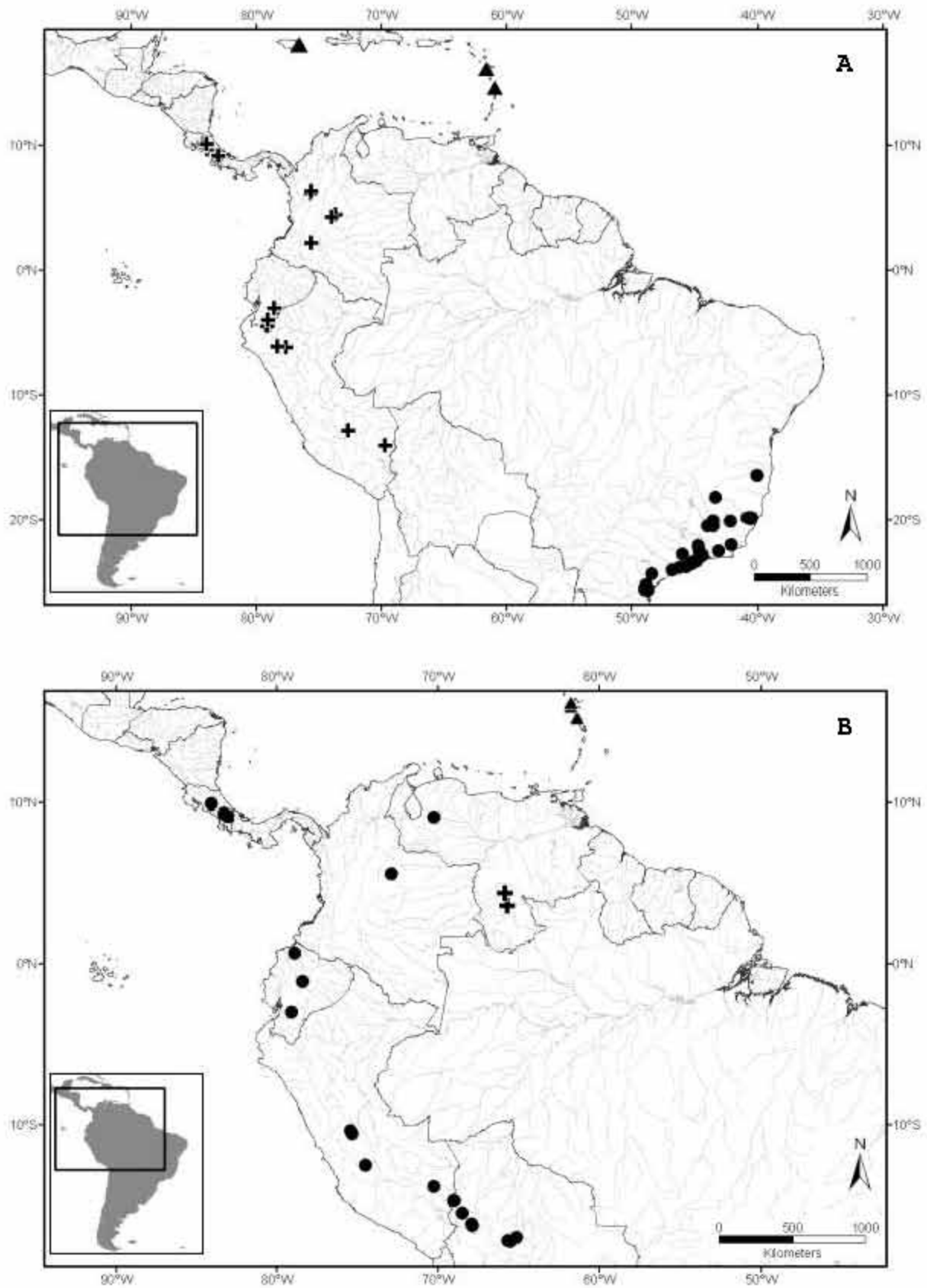


FIG. 13. A. Distribution of *Moranopteris gradata* (●), *M. grisebachii* (▲), *M. hyalina* (+). B. Distribution of *M. knowltoniorum* (▲), *M. liesneri* (+), and *M. longisetosa* (●).

8. *Moranopteris grisebachii* (Underw. ex C. Chr.) R. Y. Hirai & J. Prado, Taxon 20XX. *Polypodium grisebachii* Underw. ex C. Chr., Index Filic. 531. 1906, based on *P. exiguum* Griseb., non Heward (1838). *Polypodium exiguum* Griseb, Fl. Br. W. Ind. 701. 1864, nom. illeg., non Heward (1838). *Xiphopteris grisebachii* (Underw. ex C. Chr.) Copel., Amer. Fern J. 42: 95. 1952. *Grammitis grisebachii* (Underw. ex C. Chr.) Proctor, Bull. Inst. Jamaica Sci. Ser. 5: 33. t. 2(7-8). 1953. *Micropolypodium grisebachii* (Underw. ex C. Chr.) A. R. Sm., Novon 2: 422. 1992. TYPE.—JAMAICA. Summit of the Blue Mountain Peak, s.d., W. Purdie s.n. p.p. (holotype: K-575413). **Figs. 14A-F.**

Plants epiphytic. Roots proliferous. Rhizome erect with scales, the scales 0.4–1.2 mm X 0.15–0.25 mm, golden to yellow-brown, ovate to lanceolate, base slightly cordate, apex acute to apiculate, sometimes with apical cillium-like cell, margins entire. Fronds erect to arcuate, determinate, 2.0–6.0 cm X 2.0–4.0 mm, not setose; stipe 0.2–0.8 cm long, yellow-brown to dark-brown, narrowly winged; laminae linear, pinnatisect, gradually tapering proximally to a narrow wing, membranaceous, sometimes with a small folded arised by acroscopic laminar tissue; costa visible with dark sclerenchyma abaxially, obscured by laminar tissue and slightly visible with dark sclerenchyma at base adaxially; segments ascending, ca. 30–40° to costa, 7–21 pairs, spaced ca. 0.6–2.0 mm, alternate, gibbous, asymmetric, 1.4–2.4 X 1.0–1.4 mm, deltate to ovate-oblong, decurrent at base, apex rounded, sometimes slightly acute, margins plane, with hyaline cells; veins usually furcate, at least in fertile segments, or sometimes simple in sterile segments, mostly visible at base with dark sclerenchyma abaxially, slightly obscured by laminar tissue adaxially, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic or linear; setae absent; hairs scattered on the costa, laminar tissue abaxially, and margins, hyaline, 1 or 2-branched, sometimes branches slightly acicular, the main branch 2 or 3-celled, (<–)0.1–0.15) mm long, 1st branch 1 or 2-celled, (<–)0.1 mm long, 2nd branch, if present, 1 or 2-celled, < 0.1 mm long. Sori one per segment, rounded, 0.7–1.1 mm diam.

Distribution.—Endemic to Caribbean (Jamaica, Guadeloupe, and Martinique); (650–)1700–2262 m (Figs. 13A, 2).

SELECTED SPECIMENS EXAMINED.—JAMAICA. **Portland:** Blue Mountain Peak, 2261 m, 30 Apr 1898, *Harris 7143* (NY); *Idem*, 2232 m, 11–12 Feb 1903, *Underwood 1472* (NY); *Cinchona*, Sir John Peak, 2–10 Sep 1906, *Underwood 3174* (NY); Steep forest slope between eastern Blue Mountains Peak and Sugarloaf, 2000–2200 m, 8 Jul 1926, *Maxon 9961* (NY); Summit of Blue Mountain Peak, 2100–2200 m, 7–9 Jul 1926, *Maxon 9869* (NY); Trail to Sir Johns Peak, 7 Jun 1910, *H.H.Y.*

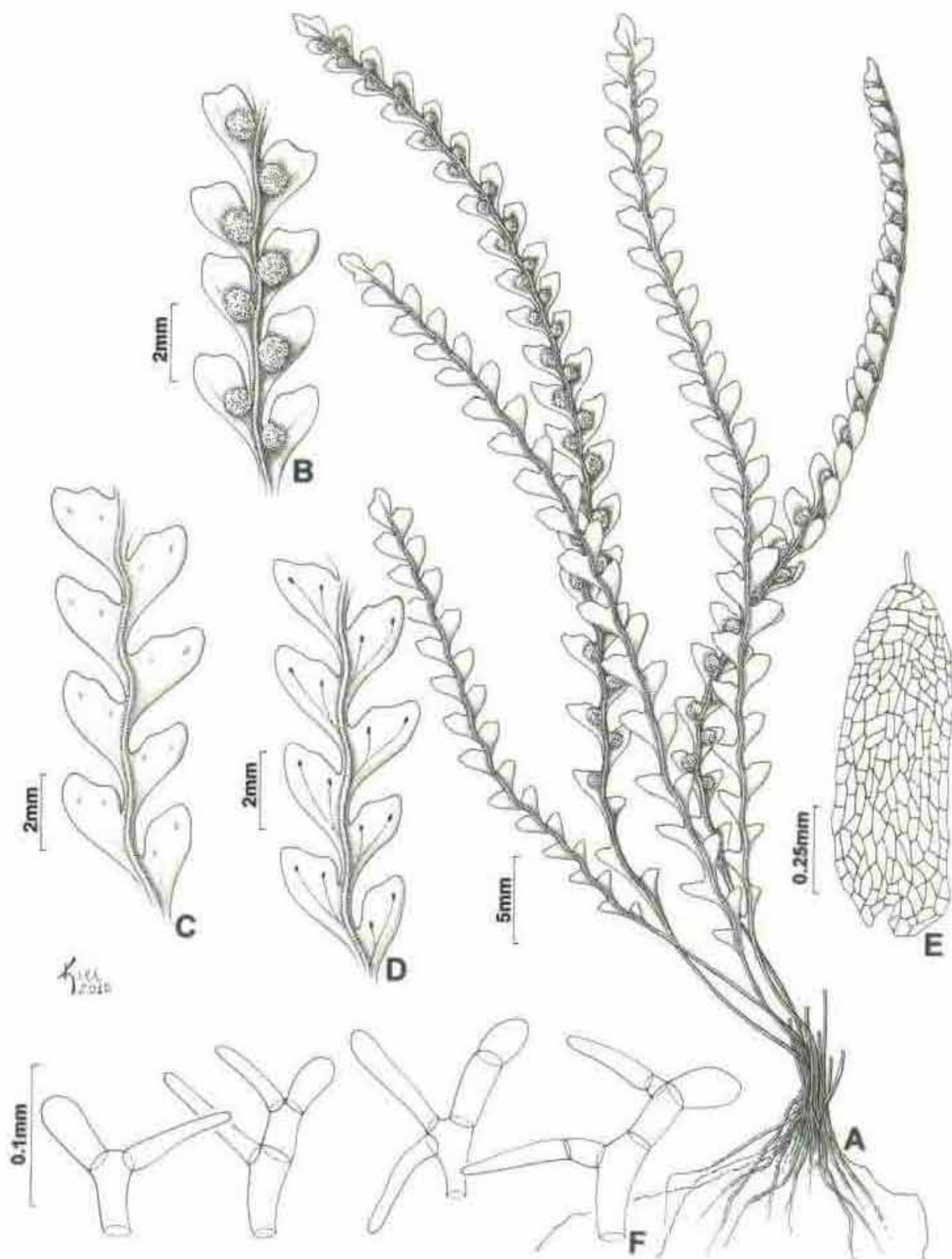


FIG. 14. *Moranopteris grisebachii*. A. Habit. B. Detail of the fertile segments showing sori abaxially. C. Detail of the segments showing hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Branched hairs from the costa. A–C: *Jerman s.n.* (NY). D–F: *Underwood 3174* (NY).

271 (PH). GUADELOUPE. 1895, *Duss 4087* (B). MARTINIQUE. 650–900 m, Sep 1883, *Duss 1655* p.p. (B, NY).

Moranopteris grisebachii is restricted to the Antilles region. It is readily recognized by rhizome scales with entire margins, furcate veins mostly visible at segment base with dark sclerenchyma abaxially, (1)2 hydathodes per segment, and hyaline margins on the segments (Figs. 14B, C). It also has proliferous roots and they were not observed in other species of *Moranopteris*.

The most similar species is *Moranopteris perpusilla*, a Brazilian endemic species, which differs in having chartaceous laminae, not gibbous segments, and veins obscured by laminar tissue abaxially (Figs. 25B, C).

Moranopteris grisebachii resembles *Lellingeria ruglesii* Proctor (= *Stenogrammitis ruglesii* (Proctor) Labiak), an endemic species from Jamaica (see details in Proctor, 1985).

Moranopteris grisebachii sometimes have segments acroscopically with a small fold, which covers partially the sorus, for instance in *Underwood 1472* (NY) and *Maxon 9869* (NY). Additionally, its branched hairs are sometimes slightly acicular.

- 9. *Moranopteris hyalina*** (Maxon) R. Y. Hirai & J. Prado, *Taxon* 20XX.
Polypodium hyalinum Maxon, *Contr. U.S. Natl. Herb.* 17: 406. 1914.
Xiphopteris hyalina (Maxon) Copel., *Amer. Fern J.* 42: 107. 1952.
Grammitis hyalina (Maxon) F. Seym., *Phytologia* 31: 174. 1975.
Micropolypodium hyalinum (Maxon) A. R. Sm., *Novon* 2: 422. 1992.
 TYPE.—COSTA RICA. Volcán de Barba, 6 Feb 1890, *H. Pittier 1928* (holotype: US-833632; isotypes: P-696178; frag. NY-144964). **Figs. 15A–G.**

Polypodium buesii Maxon, *Contr. Gray Herb.* 165: 72. 1947. *Xiphopteris buesii* (Maxon) Copel., *Amer. Fern J.* 42: 105. 1952. *Grammitis buesii* (Maxon) Lellinger, *Amer. Fern J.* 74: 58. 1984. TYPE.—PERU. **Cuzco:** Cerro Chuyapé, 24 Jun 1941, *C. Bües A45* p.p. (holotype: US-1858604).

Plants epiphytic, rarely epipetric. Rhizome erect with scales, the scales 1.1–3.5 mm x 0.2–0.6 mm, golden to yellow-brown, sometimes castaneous, lanceolate to linear, sometimes ovate-lanceolate, base cordate, apex acute, usually with apical or subapical gland-like cells, margins with many or few long setiform projections and small lateral projections, sometimes occurring on the scale surface, setiform projections hyaline to yellowish, 0.1–0.2 mm long. Fronds erect to arcuate, determinate, 7.0–24.5 cm x 5.0–11.5 mm, moderately setose; stipe 1.0–4.0 cm long, yellow-brown to

dark-brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costa* slightly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, ca. (50-)60-80° to *costa*, 25-62 pairs, spaced ca. 0.3-1.3 mm, subopposite, not gibbous, rarely slightly gibbous, symmetric, 3.6-6.0 X 1.5-3.0 mm, oblong to oblong-lanceolate, deltate toward base, decurrent at base, apex slightly rounded to acute, margins plane, sometimes slightly revolute, without hyaline cells; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic, sometimes obovate-linear; *setae* 1.2-3.2 mm long, dark red-brown, on both surfaces of the stipe, *costa*, and laminar tissue; hairs scattered on the stipe, *costa*, laminar tissue abaxially, and margins, hyaline, slightly red-brown, 1 or 2-branched, the main branch 2 or 3-celled, 0.1-0.3 mm long, the 1-branched hairs with a branch > 2X longer than the main branch, 1st branch 3-5-celled, 0.25-0.65 mm long, 2nd branch, if present, 2-4-celled, 0.15-0.55 mm long. *Sori* one per segment, rounded, 1.0-1.8 mm diam.

Distribution.—Costa Rica, Colombia, Ecuador, and Peru; 2100-3050 m (Figs 13A, 2).

SELECTED SPECIMENS EXAMINED.—COSTA RICA. **Alajuela**: Vulcan Poás, Poas Lake region, 2590 m, 6 Jun 1928, *Stork 2350* (UC). **Cartago**: Along Pan-American Hwy, km 67, 14 Jan 1999, *Smith 2583* (UC). **Heredia**: National Park Braulio Carrillo, transekt trail between OTS-Station La Selva and Volcán Barva, 2700 m, 28 Apr 2003, *Kluge 6235* (GOET). **Puntarenas**: Cantón de Buenos Aires, P. N. La Amistad, Tararia, Limon-Puntarenas, Parque Internacional La Amistad, Sendero a Cerro Kámuk, entre Cerro Kas, 2900-3050 m, 09°12'00"N, 83°03'30"W, 8 Nov 1996, *Rojas 3210* (UC). **San José**: Cerro de la Muerte, Madre Selva, Südseite der Carretera Interamericana etwa 100 m vor km 66, ca. 3 km östlich Trinidad, 2560 m, 18 May 1990, *Döbbeler 189B* (M). COLOMBIA. **Antioquia**: Bello, Corregimiento de San Félix, Alto de Las Baldías, sector Antenas de el Colombiano, 2950-3050 m, 06°20'38"N, 75°38'54"W, 1 Oct 2005, *Rodríguez et al. 5496* (HUA). **Cundinamarca**: Cordillera Oriental, North side of Quebrada San Roque, Río Blanco Valley, 10 km west of Gutiérrez, 45 km S of Bogotá, Station 42, 2725 m, 27 Jul 1944, *Grant 9702* (US). **Meta**: San Juanito, PNN Chingaza, cañón del Río Guácharo, Cordillera Oriental, 2767 m, 04°29'27"N, 73°40'58"W, 3 May 2007, *Sundue & Vasco 1305* (NY). **Huila**: Cordillera Oriental, 15 km SE of Garzón, 2346 m, 1 Feb 1945, *Little Jr. 9354a* (US). ECUADOR. **Morona-Santiago**: Vía Plan de Milagro-Gualaceo, cerca a Tinajillas, 2100-2200 m, 03°02'S, 78°33'W, 6 Feb 1989, *Palacios & van der Werff 3755* (MO). **Zamora-Chinchipec**: Reserva Tapichalaca, nearby Ventanilla, 2600 m, 04°29'S, 79°07'W, 26 Oct

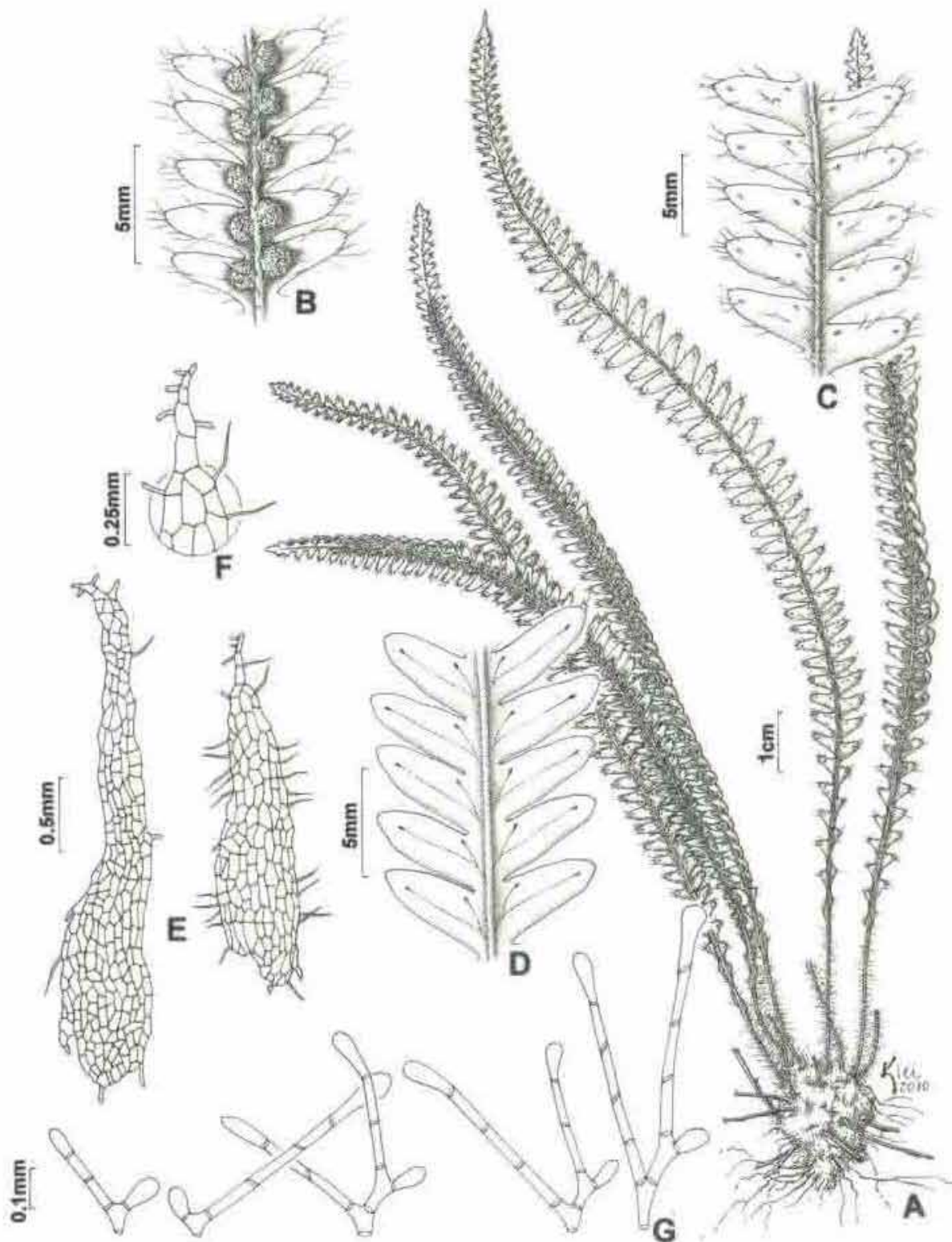


FIG. 15. *Moranopteris hyalina*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scales. F. Detail of the apex of the rhizome scale. G. Branched hairs from the costa. A-G: Rojas 3528 p.p. (NY).

2003, *Lehnert* 977 (GOET, UC). PERU. **Amazonas**: Chachapoyas, scrub forest along Río Ventilla 1-2 km, west of Molinopampa, 2350-2400 m, 23-25 Jul 1962, *Wurdack* 1511 (NY, P, S, UC, US). **Cuzco**: Cerro Chuyapi, 2400 m, 20 Jun 1941, *Bües* A38 (US). **Puno**: Sandia, on the steep slopes east of Oconeque itself east 3 hours from Limbani, 2438-2743 m, 11 Oct 1943, *Hodge* 6087 p.p. (US).

Generally *Moranopteris hyalina* is easier to recognize than other species. The best way to distinguish it is by its rhizome scales with hyaline long setiform projections on the margins. Maxon (1914) used this character to choose the epithet for this species (Fig. 15E).

Moranopteris hyalina can be confused to *M. blepharidea* by the general aspect of the frond and 1-branched hairs. See comments under that species for comparison.

- 10. *Moranopteris killipii*** (Copel.) R. Y. Hirai & J. Prado, *Taxon* 20XX.
Xiphopteris killipii Copel., *Amer. Fern J.* 42: 105. t. 10. 1952.
Grammitis killipii (Copel.) Lellinger, *Amer. Fern J.* 74: 58. 1984.
 TYPE.—COLOMBIA. **Valle**: San Antonio, west of Cali, near summit of Cordillera Occidental, 26 Feb-2 Mar 1939, *E. P. Killip & H. García* 33887 (holotype: US-1772517). **Figs. 16A-G.**

Plants epiphytic. *Rhizome* erect with scales, the scales 0.9-1.1 mm X 0.20-0.35 mm, castaneous, oval-lanceolate, base slightly cordate, apex acute, usually with apical or subapical gland-like cells, margins with short setiform projections and glanduliform projections, projections slightly red-brown. *Fronde* pendent, ± indeterminate, 10.0-26.0(-70,0) cm X 5.5-7.0 mm, moderately setose; *stipe* 1.0-2.7 cm long, yellow-brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, sometimes pinnate at base, gradually tapering proximally to a narrow wing, membranaceous; *costa* visible with dark sclerenchyma abaxially, slightly visible with dark sclerenchyma adaxially; *segments* patent to slightly ascending, mostly 70-80° to costa, 23-73 pairs, closely spaced or spaced ca. 0.1-2.2 mm, subopposite, slightly gibbous to gibbous, asymmetric, 2.1-3.6 X 1.5-2.6 mm, ovate to slightly oblong, slightly deltate at base, decurrent at base, apex rounded, margins plane, with hyaline cells; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic, obovate, sometimes rounded; *setae* 1.3-3.5 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs scattered on the stipe, costa, laminar tissue abaxially, and margins, hyaline, slightly red-

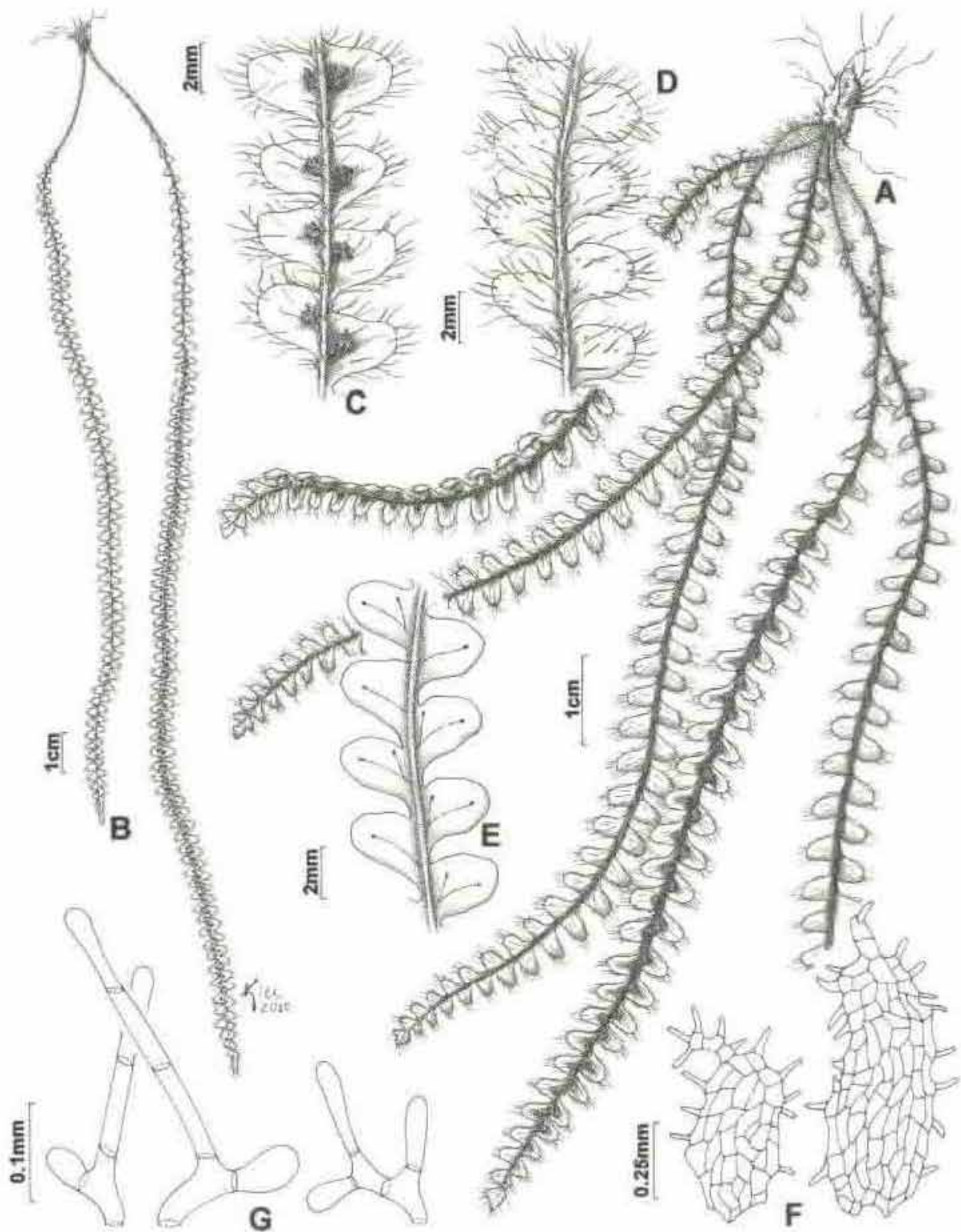


FIG. 16. *Moranopteris killipii*. A, B. Pendent habit. C. Detail of the fertile segments showing sori and setae abaxially. D. Detail of the segments showing setae and hydathodes adaxially. E. Detail of the venation (cleared leaf). F. Stem scales. G. Branched hairs from the costa. A, C-F: Lehmann 7655 (K). B: Bittner 2670 (UC).

brown, 1 or 2-branched, the main branch 2 or (3-)celled, 0.10–0.15 mm long, the 1-branched hairs with a branch > 2X longer than the main branch, 1st branch (1 or) 2 or 3-celled, 0.1–0.3 mm long, 2nd branch, if present, 1 or 2-celled, (<–)0.1–0.2 mm long. Sori one per segment, rounded, 1.2–1.4 mm diam.

Distribution.—Endemic to Andes from Colombia and Ecuador; 1000–2350 m (Figs. 21A, 2).

SPECIMENS EXAMINED.—COLOMBIA. **Nariño:** Reserva Natural La Planada Sendero "La Vieja" and "La Piña" NW of the science center, 1850 m, 01°09'37"N, 77°59'13"W, 19 Jul 1996, *Bittner 2670* (UC). ECUADOR. **Zamora-Loja:** 1000–1500 m, s.d., *Lehmann 7655* (K).

Moranopteris killipii is known only by a few collections from the Andes of Colombia and Ecuador. It is characterized by pendent fronds, with ± indeterminate growing, membranaceous lamina, segments mostly ovate, with two hydathodes, and 1-branched hairs, the hairs with a branch ≥ twice longer than the main branch (Figs. 16A–G).

Moranopteris caucana and *M. hyalina* are similar to *M. killipii* by the 1-branched hairs, but both differ by chartaceous lamina and mostly not gibbous segments. *Moranopteris caucana* also differs by the simple veins (Fig. 10D) and *M. hyalina* in having rhizome scales with hyaline setiform margins (Fig. 15E).

11. *Moranopteris knowltoniorum* (Hodge) R. Y. Hirai & J. Prado, *Taxon* 20XX.

Polypodium knowltoniorum Hodge, *Amer. Fern J.* 31: 105. p. 1, f. 4–6. 1941. *Xiphopteris knowltoniorum* (Hodge) Copel., *Amer. Fern J.* 42: 108. 1952. *Grammitis knowltoniorum* (Hodge) Proctor, *Rhodora* 63: 35. 1961. *Micropolypodium knowltoniorum* (Hodge) A. R. Sm., *Novon* 2: 422. 1992. TYPE.—DOMINICA. Morne Trois Pitons, 1400 m, 15 Aug 1938, *W. H. Hodge 54* (holotype: GH-n.v.; isotypes: US, NY). **Figs. 17A–G.**

Plants epiphytic. Rhizome erect to decumbent with scales, the scales 1.9–3.6 mm X (0.4–)0.7–0.9 mm, yellow-brown to orange-brown, lanceolate, base slightly cordate, apex acute, usually with apical or subapical gland-like cells, margins entire, or sometimes with also small lateral projections. Fronds erect to arcuate, determinate, (6.0–)8.5–13.0 cm X (5.5–)7.0–13.0 mm, moderately setose; stipe 0.1–0.2 cm long, yellow-brown to dark-brown, narrowly winged; laminae linear, pinnatisect, gradually tapering proximally to a narrow wing, membranaceous, sometimes slightly chartaceous; costa obscured by laminar tissue abaxially and adaxially, sometimes slightly visible or visible at base with dark sclerenchyma

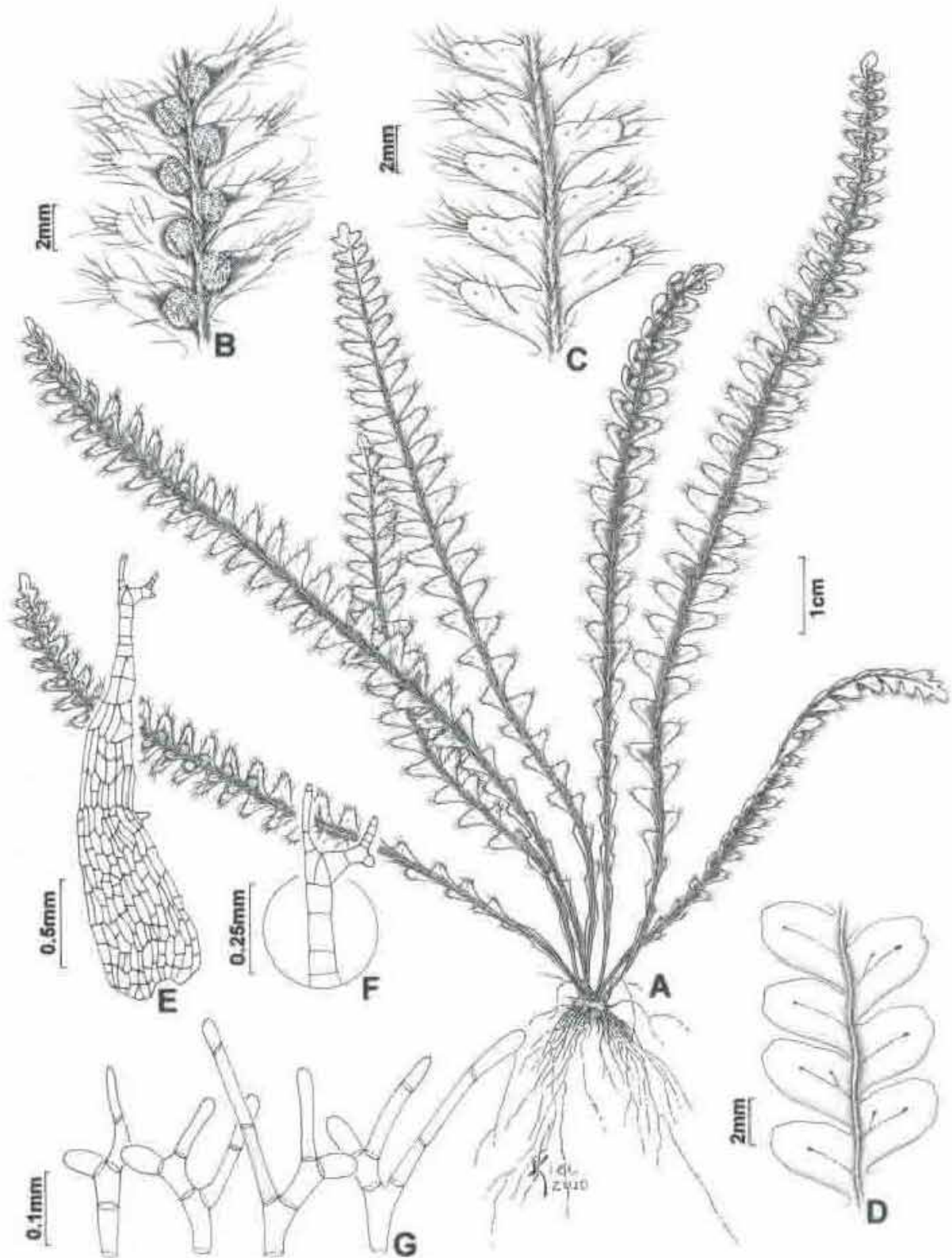


FIG. 17. *Moranopteris knowltoniorum*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf, young segments). E. Stem scale. F. Detail of the apex of the rhizome scale. G. Branched hairs from the costa. A-G: Hodge & Hodge 1431 (NY).

abaxially; *segments* slightly ascending, mostly 65–80° to costa, (20–)28–33 pairs, spaced 0.6–1.2(–2.0) mm, subopposite, gibbous, sometimes slightly gibbous, asymmetric, (3.0–)3.4–7.0 X 2.0–3.2 mm, oblong to oblong-lanceolate, sometimes deltate, mainly at base, decurrent at base, apex rounded to acute, margins plane, with hyaline or yellowish cells, sometimes inconspicuous; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, rarely 3 hydathodes, the hydathodes visible adaxially, elliptic or linear; *setae* (0.6–)1.2–2.2(–3.2) mm long, dark red-brown, on both surfaces of the costa and laminar tissue; hairs present on the costa and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, or sometimes with branches tinged of red-brown, 1 or 2-branched, the main branch 2 or 3-celled, 0.10–0.15(–0.20) mm long, 1st branch (2 or) 3–5-celled, 0.15–0.3(–0.4) mm long, this branch mostly $\geq 2X$ longer than the main branch and tinged of red-brown, 2nd branch, if present, 1 or 2-celled, (<–)0.10–0.15 mm long. *Sori* one per segment, rounded, 1.8–2.0 mm diam.

Distribution.— Endemic to Lesser Antilles (Dominica and Guadeloupe); 615–1400 m (Figs. 13B, 2).

SELECTED SPECIMENS EXAMINED.— DOMINICA. Morne Trois Pitons, 1400 m, 23 Feb 1940, Hodge 1431 (B, K, L, NY, PH, S, UC). **Saint Paul:** Trail to summit of Morne Trois Pitons SE of Pont Cass, 1066–1219 m, 15°12'30"N, 61°20'30"W, 27 May 1996, Hill 27919 p.p. (UC). GUADELOUPE. Basse Terre, comm. Petit-Bourg-Bouillante, Parc National de la Guadeloupe, route de la Traversée D23, Trace de Mamelle de Pigeon ou Déboulé, 615–768 m, 16°11'N, 61°44'W, 22 Mar 2005, Christenhusz 4208 (UC).

Moranopteris knowltoniorum can be recognized by rhizome scales with entire margins, furcate veins, 2 hydathodes per segment, mostly gibbous segments, and branched hairs, that have mostly the first branch twice longer than the main branch and with some branches tinged of red-brown (Figs. 17A–G).

Moranopteris serricula sometimes resembles *M. knowltoniorum* and both species occur in Antilles. But *M. serricula* differs in having stipe 1.1–3.5 cm long with setae (vs. 0.1–0.2 mm long without setae), mostly chartaceous laminae (vs. membranaceous), not gibbous segments (vs. conspicuously gibbous on the fertile segments), mostly ca. 45–60° to costa (vs. 65–80° to costa), and deltate (vs. mostly oblong to oblong-lanceolate) (Figs. 28A–D). Hodge (1941) used the similar characteristics to distinguish both species.

12. *Moranopteris liesneri* (A. R. Sm.) R. Y. Hirai & J. Prado, *Taxon* 20XX.

Grammitis liesneri A. R. Sm., *Ann. Missouri Bot. Gard.* 77: 257. 1990.

Micropolypodium liesneri (A. R. Sm.) A. R. Sm., Novon 2: 422. 1992.
 TYPE.—VENEZUELA. **Amazonas**: Atabapo, base of cliff and forest below it
 on slope of Huachamacarí, 03°39'N, 65°43'W, 1000–1300 m, 5 Mar 1985,
 R. L. Liesner 18241 (holotype: UC-1535652). **Figs. 18A–F.**

Plants epipetric. *Rhizome* erect to decumbent with scales, the scales
 1.0–1.6 mm X 0.3–0.5 mm, golden to slightly yellow-brown, ovate-lanceolate
 to lanceolate, base cordate, apex acute, with apical or subapical gland-
 like cells, margins with long setiform projections, or sometimes with also
 small lateral projections, rarely setiform projections occurring on the
 scale surface on the 1/3 of distal portion, setiform projections red-brown,
 0.1–0.4 mm long. *Fronds* erect to arcuate, determinate, 3.0–7.0 cm X 4.0–9.0
 mm, sparsely setose; *stipe* 0.1–0.6 cm long, yellow-brown, wings absent;
laminae linear, pinnatisect, pinnate at base, gradually tapering
 proximally, chartaceous; *rachis* or *costa* mostly visible with dark
 sclerenchyma abaxially, obscured by laminar tissue adaxially, or sometimes
 slightly visible with dark sclerenchyma adaxially; *segments* ascending,
 mostly 40–45° to rachis or costa, 16–30 pairs, spaced 1.0–1.5 mm, slightly
 alternate, gibbous, asymmetric, 3.1–5.3 X 0.9–1.7 mm, linear, slightly
 decurrent at base, apex acute to rounded, margins plane or slightly
 revolute, without hyaline cells; *veins* usually furcate, at least in fertile
 segments, or sometimes simple in sterile segments, obscured, (1)2
 hydathodes per segment, the hydathodes visible adaxially, oblong or linear;
setae 1.1–2.2 mm long, dark red-brown, on both surfaces of the stipe,
 rachis or costa, and laminar tissue; hairs present on the rachis or costa,
 and laminar tissue (mainly near to rachis or costa abaxially), hyaline,
 slightly red-brown, mostly unbranched, rarely branched hairs with a
 setiform branch, 2 or 3(or 4)-celled, 0.2–0.3 mm long, rarely 5-celled (0.5
 mm long) on the costa adaxially. *Sori* one per segment, rounded, 0.8–1.5 mm
 diam.

Distribution.—Endemic to Venezuela; 1000–1800 m (Figs. 13B, 2).

SPECIMENS EXAMINED.—VENEZUELA. **Amazonas**: Río Ventuari, Caño Asisa, Río Parú,
 Serranía Parú, 1800 m, 12 Feb 1951, Cowan & Wurdack 31415 (NY, US).

Moranopteris liesneri is characterized by having sparsely setose
 fronds, with spaced and linear segments, and also by its unbranched hairs
 on the rachis or costa, and laminar tissue abaxially (Figs. 18A–F). This
 species presents also branched hairs with a setiform branch, but they are
 rarer than unbranched hairs.

Moranopteris liesneri is known only by two collections from Venezuela.
 Consequently, the morphological concept of this species can be ampler than

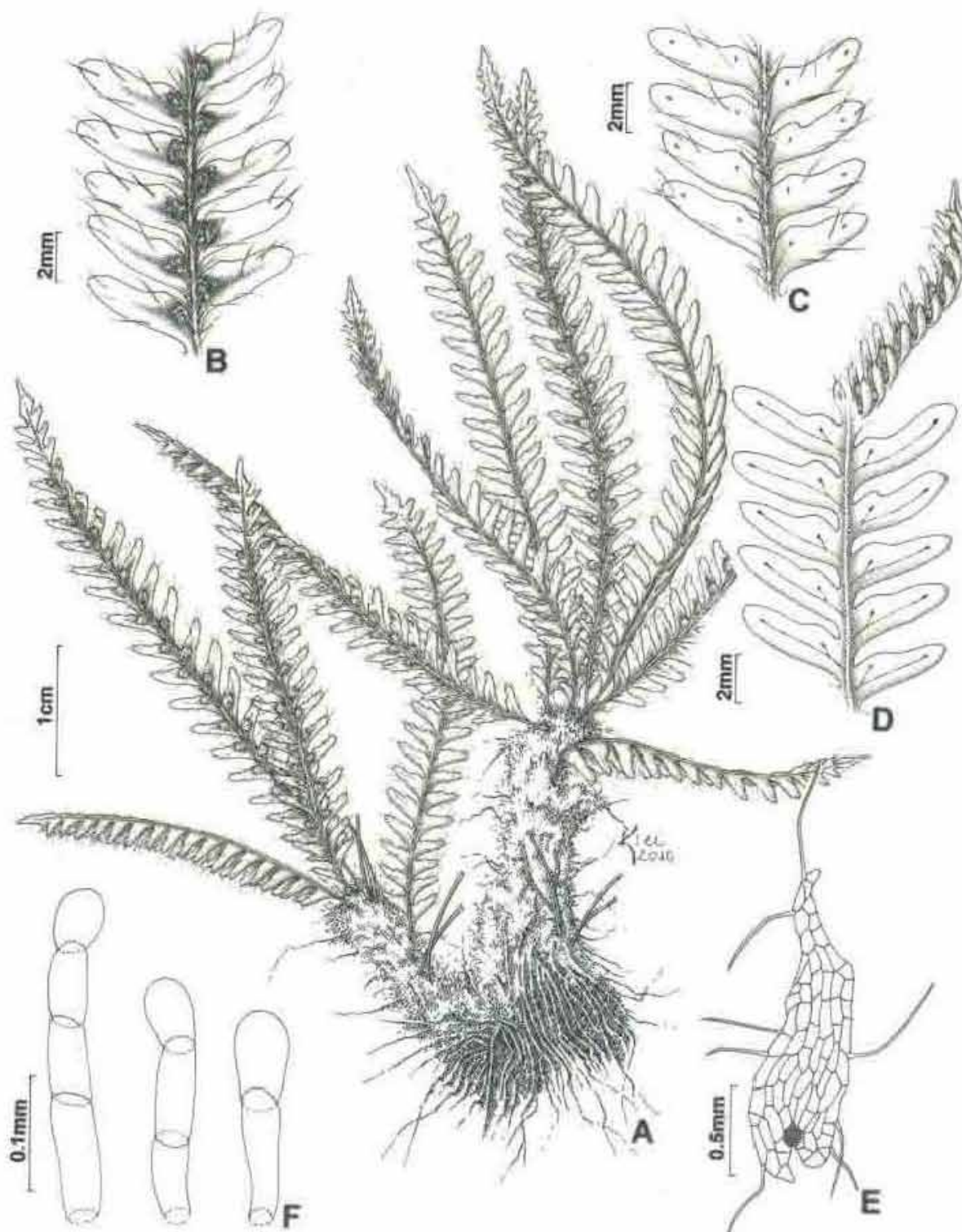


FIG. 18. *Moranopteris liesneri*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Unbranched hairs from the costa. A-F: Cowan & Wurdack 31415 (NY).

presented here. For instance, Smith (1990) described this species as having simple veins and one hydathode per segment, but the analysis of other specimen has shown that furcate veins and two hydathodes per segment are also found in this species.

- 13. *Moranopteris longisetosa*** (Hook.) R. Y. Hirai & J. Prado, *Taxon* 20XX.
Polypodium longisetosum Hook., *Sp. Fil.* 4: 225. t. 278 A. 1864.
Terpsichore longisetosa (Hook.) A. R. Sm., *Novon* 3: 487. 1993.
 LECTOTYPE (designated by Smith, 1995).—ECUADOR. Andes Quitensis,
 s.d., *W. Jameson* 79 (K-575419; duplicate: LE). **Figs. 19A–F.**

Polypodium myriophyllum Mett. ex Hook. & Baker, *Syn. Fil.* 338. 1868.
Ctenopteris myriophylla (Mett. ex Hook. & Baker) Copel., *Philipp. J. Sci.*
 84: 412. 1956. *Grammitis myriophylla* (Mett. ex Hook. & Baker) C. V.
 Morton, *Contr. U.S. Natl. Herb.* 38: 108. 1967. *Xiphopteris myriophylla*
 (Mett. ex Hook. & Baker) Crabbe, *Brit. Fern Gaz.* 9: 319. 1967. LECTOTYPE
 (here designated).—PERU. **Puno:** Tatanara, Aug 1854, *W. Lechler* 2567 (K-
 575420; duplicates: K-575421; L-795476; frag. US-2138364).

Plants epiphytic, epipetric, or terrestrial. *Rhizome* short-creeping with scales, the scales 0.6–1.4 × 0.4–0.6 mm, yellow-brown, sometimes castaneous, ovate to slightly ovate-lanceolate, base slightly cordate, apex acute, with apical or subapical gland-like cells, margins with glanduliform projections. *Fronds* erect to pendent, determinate, 12.5–35.5 × 1.5–5.4 cm, sparsely to moderately setose; *stipes* 2.8–12.0(–24.5) cm long, dark-brown, wings absent; *laminae* oblanceolate to linear-lanceolate, pinnate-pinnatisect, sometimes pinnate-pinnatifid, gradually tapering proximally, membranaceous; rachis and costa visible with dark sclerenchyma abaxially and adaxially, sometimes slightly visible with dark sclerenchyma adaxially; pinnae ascending, 30–45°(–60) to rachis, 19–40 pairs, spaced ca. 1.0–3.0 mm, alternate or subopposite in pinnate-pinnatifid laminae, not gibbous, symmetric, 6.0–70.0 × 2.0–7.5 mm, linear, pinnatisect or pinnatifid, slightly decurrent at base, apex attenuate, sometimes rounded to acute, margins plane, with hyaline cells, sometimes inconspicuous; segments (1.4–)2.0–4.2 × 0.3–0.6(–1.4) mm; *veins* pinnate, inconspicuous, > 2 hydathodes per pinnae, the hydathodes visible adaxially, linear or elliptic; *setae* 1.0–3.0 mm long, dark red-brown, sometimes yellowish, on both surfaces of the stipe, rachis, costa, and laminar tissue; *hairs* present on the stipe, rachis, costa and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, 1–3-branched, the main branch 2 or 3-celled, (<–)0.15–0.20 mm long, 1st branch 1 or 2-celled, (0.1–)0.15–0.30 mm, 2nd branch 1–

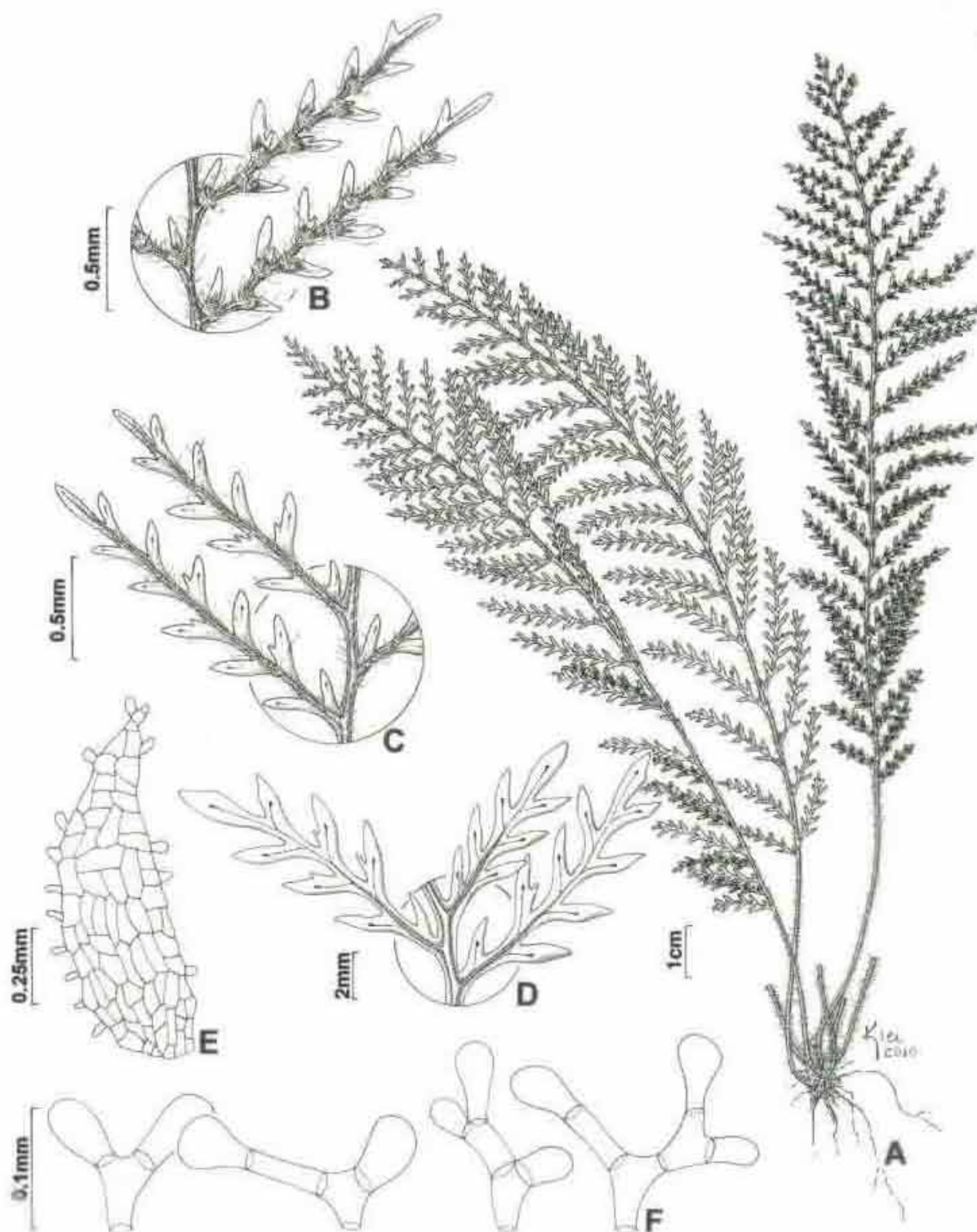


FIG. 19. *Moranopteris longisetosa*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Branched hairs from the costa. A-C: Herrera 3670 (UC). D-F: Rojas 3209 (NY).

celled, < 0.1 mm long, 3rd branch, if present, 1-celled, < 0.1 mm long. *Sori* > 2 per segment, rounded, 1.0–1.4 mm diam.

Distribution.—Costa Rica, Venezuela, Colombia, Ecuador, Peru, and Bolivia; 762–3850 m (Figs. 13B, 2).

SELECTED SPECIMENS EXAMINED.—COSTA RICA. **Limon-Puntarenas border:** Cordillera de Talamanca, Cerro Kasir, on the continental divide, 2950 m, 09°12'N, 83°03'W, 20 Sep 1984, *Davidse & Herrera 29398* (UC). **Puntarenas:** Cantón de Buenos Aires, P. N. La Amistad, Tararia, Limon-Puntarenas, Parque International La Amistad, Sendero a Cerro Kámuk, entre Cerro Kas, 2900–3050 m, 09°12'00"N, 83°03'30"W, 8 Nov 1996, *Rojas 3209* (NY). **Puntarenas-Limon border:** Cordillera de Talamanca, between Cerro Kasir and Cerro Nai, continental divide, 2900–3050 m, 09°12'13"N, 83°03'30"W, 22 Mar 1984, *Davidse et al. 25822* (L, UC). **San José:** Between Itamut and Bine peaks, Fabrega massiff, Bocas del Toro, Panama, 3200 m, 5–9 Mar 1984, *Gómez 22531* (UC). VENEZUELA. **Trujillo:** Páramo and cloud forest, Páramo de Guaramacal, 762–914 m, 3 Feb 1987, *van der Werff et al. 8800* (K, MO, UC). COLOMBIA. **Boyacá:** Arriba de la carretera Tunja-Arcabuco, en la quebrada afluyente del río Pómea, 3200 m, 17 Oct 1967, *Jaramillo et al. 3704* (GH, MO). ECUADOR. **Azuay:** Along road Gualaceo-El Limon, scrub and páramo, 3100–3500 m, 25 Aug 1989, *van der Werff & Gudiño 11456* (UC). **Carchi:** Páramo El Angel, in the pass on road El Angel-Tulcán, 3750–3850, 00°41'N, 78°54'W, 15 May 1973, *Holm-Nielsen et al. 5479* (UC). **Tungurahua:** Santiago de Pillaro, Parque Nacional Llanganates, slope above south shore of Pisayambo reservoir, near road, 3650 m, 01°04'34"S, 78°24'00"W, 26 Aug 1999, *Neill et al. 11886* (MO, UC). Peru. **Cuzco:** La Convencion, Cordillera Vilcabamba, ca. 23 km walking distance NE from the Hacienda Luisiana and the Apurimac River, 3000 m, 12°30'S, 74°30'W, 15 Jul 1968, *Dudley 11134A* (GH). **Pasco:** Oxapampa, Parque Nacional Yanachaga-Chemillén, Abra la Esperanza, 2800 m, 10°31'S, 75°20'W, 23 Mar 2003, *Monteagudo et al. 4794* (UC). BOLIVIA. **Cochabamba:** José Carrasco Torrico, 104 km antigua carretera Cochabamba-Villa Tunari, 3150 m, 17°11'S, 65°40'W, 25 Jun 1996, *Kessler et al. 6684* (NY, UC). **La Paz:** Franz Tamayo, PN-ANMI Madidi, senda Pelechuco-Mojos, localidad Tambo Quemado (lugar para acampar), bajando por el sendero, poco después del 2^o río, 3470 m, 14°41'S, 68°58'W, 29 Apr 2003, *Jiménez 1770* (MO, UC).

Moranopteris longisetosa has rhizome scales with glanduliform projections on the margins, pinnate fronds and pinnate veins (Figs. 19A–E). This species varies in the laminae division, from pinnate-pinnatisect (elsewhere) to pinnate-pinnatifid (in some specimens from Ecuador).

Moranopteris achilleifolia is the most similar species. However, it can be distinguished by its rhizome scales with entire margins (see comments in this species) (Fig. 4E).

Polypodium piligerum Hook. seems to be the same taxon as commented by Smith (1993) and Smith and Moran (1995). It was described based on a specimen from Ecuador and from the same type locality of *Polypodium longisetosum*. However, Hooker (1841) described this specimen as having rhizome scales as "nigro-fuscentibus, nitidis" and *Moranopteris* has not this kind of rhizome scales. Unfortunately, the type of *P. piligerum* was not located at K Herbarium to confirm these informations. Consequently, this name is here treated as of uncertain application.

If *Polypodium piligerum* prove to be the same species, it has priority over *Moranopteris longisetosa*.

14. *Moranopteris microlepis* (Rosenst.) R. Y. Hirai & J. Prado, Taxon 20XX.

Polypodium blepharodes Maxon var. *microlepis* Rosenst., Repert. Spec. Nov. Regni Veg. 22: 14. 1925. LECTOTYPE (designated by Lellinger, 1989).—COSTA RICA. Tablazo, 1900 m, 4 Mar 1908 [as "Feb"], A. C. Brade 80b (S-R5045; duplicate: UC-405706). **Figs. 20A-F.**

Plants epiphytic. Rhizome erect with scales, the scales 0.3–0.8 mm X 0.2–0.3 mm, castaneous, ovate, sometimes lanceolate, base slightly cordate to cordate, apex attenuate or acute, margins with long setiform projections, sometimes setiform projections occurring on the scale surface, setiform projections red-brown, 0.3–0.5 mm long, cells of scales often tinged of red-brown. Fronds erect to arcuate, determinate, 4.0–20.5 cm X 4.0–11.5 mm, moderately to densely setose; stipe 0.3–1.1 cm long, yellow-brown to dark-brown, wings absent; laminae linear, pinnatisect, sometimes pinnate at base, gradually tapering proximally, chartaceous; costa slightly visible to visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; segments slightly ascending, mostly 60–80° to costa, 22–49 pairs, spaced 0.5–1.4 mm, subopposite, gibbous, sometimes slightly gibbous, asymmetric, (1.4–)2.8–5.6 X (1.0–)1.5–2.5 mm, oblong, slightly decurrent at base, apex rounded to acute, margins plane to slightly revolute, without hyaline cells; veins usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, oblong, obovate, sometimes rounded; setae 1.0–3.9 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the costa and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, or sometimes with branches tinged of red-brown, branched or rarely unbranched, the branched hairs with (1 or) 2-branched, the main branch 2 or 3-celled, (<–)0.15 mm long, 1st branch 1 or 2 (or 3)-celled, 0.1–0.2(–0.3) mm long, 2nd branch, if present, 1 or 2-celled, (<–)0.15 mm long, the unbranched hairs, if present, 1 or 2-celled. Sori one per segment, rounded,

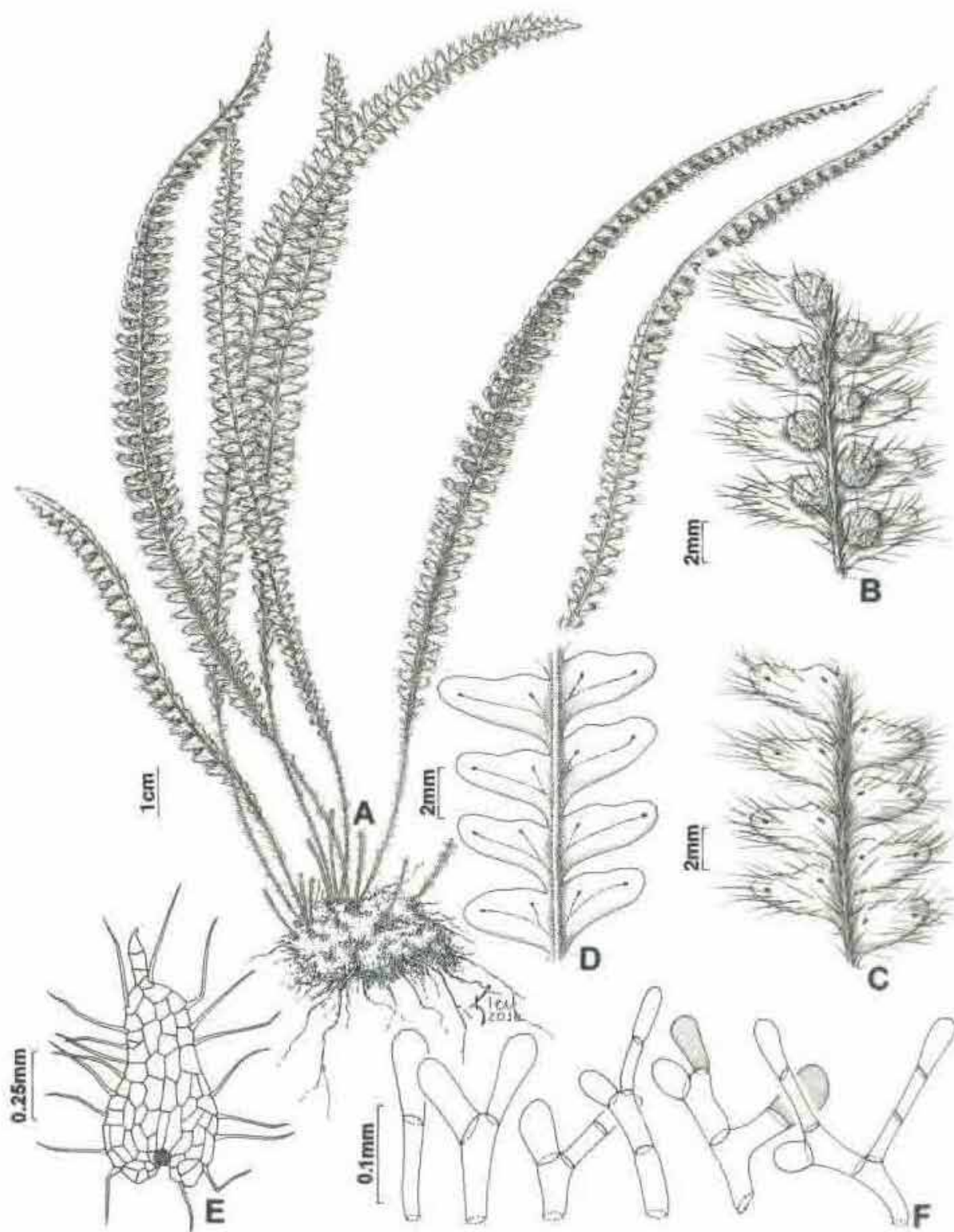


FIG. 20. *Moranopteris microlepis*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Unbranched and branched hairs from the costa. A-C: Smith 2426 (UC). D, F: Kluge 2003 (UC). E: Rojas 3603 (NY).

1.8–2.2 mm diam.

Distribution.—Costa Rica, Panama, Jamaica, and Guadeloupe; 609–2800 m (Figs. 13B, 2).

SELECTED SPECIMENS EXAMINED.—COSTA RICA. **Cartago:** Cuericí Reserve, road to the east just E of Villa Mills, 15 Jan 1999, *Smith 2584* (UC). **Heredia:** Transect trail between Volcán Barva and La Selva Biological Station, atlantic slope of Volcán Barva, 1400 m, 2003, *Kluge s.n.* (UC). **Puntarenas:** Cantón de Puntarenas, P. N. Isla del Coco, Isla del Coco, Sendero a Cerro Iglesias, entre la punta de Cerro Pelon y Cerro Iglesias, 530 m, 5°31'55"N, 87°04'45"W, 17 Jun 1997, *Rojas 3603* (NY). **San José:** About 10 km N of San Rafael de Heredia on Volcán Barva, 1950 m, 9 Jul 1967, *Bishop 833* (UC). PANAMA. **Chiriquí:** Bugaba, Santa Clara, to Cerro Pando, 08°50'N, 82°44'W, 28 Feb 1985, *van der Werff & Herrera 7295* (UC). **Chiriquí-Bocas del Toro:** trail along continental divide to ca. 3 km E of Cerro Pate Macho, 2000–2200 m, 08°49'N, 82°23'W, 7 Feb 1986, *Smith et al. 2426* (NY, UC). JAMAICA. Tweedside, 609–914 m, 10–13 Apr 1903, *Underwood 2107* (NY). GUADELOUPE. *s.d.*, *L' Herminier s.n.* (L).

Moranopteris microlepis is characterized by rhizome scales with red-brown long setiform projections on the margins, moderately to densely setose fronds, furcate veins, two hydathodes per segment, and mostly branched hairs mainly near and on the costa abaxially (Figs. 20A–F). These hairs when have branches tinged of red-brown can be helpful to recognize this species. The rhizome scales vary from ovate (e.g., specimens from Costa Rica) to lanceolate (e.g., specimens from Jamaica).

Moranopteris plicata is similar to *M. microlepis* but they can be distinguished using an assemblage of morphological characters. The differences between them can be noted even overlapping. The easiest characters which distinguish them are the fertile segments (gibbous and slightly ascending segments in *M. microlepis* vs. mostly not gibbous and ascending segments in *M. plicata*, Fig. 26C). *Moranopteris truncicola* also differs by having a large variety of laminae division (pinnatifid, deeply pinnatifid or pinnatisect), mostly membranaceous, and not gibbous segments too (Fig. 35C).

Lellinger (1989) synonymized *Polypodium blepharodes* Maxon var. *microlepis* Rosenst. under *Grammitis blepharodes* (Maxon) F. Seym. (= *Moranopteris taenifolia*). However, *M. taenifolia* differs by hairs, which are mostly unbranched and branched with setiform branches.

The lectotype of *Moranopteris microlepis* was selected by Lellinger (1989), but the specimen at S (duplicate UC) shows a different date from the protologue. It is probably only a minor error by Rosenstock (1925) when he published the variety.

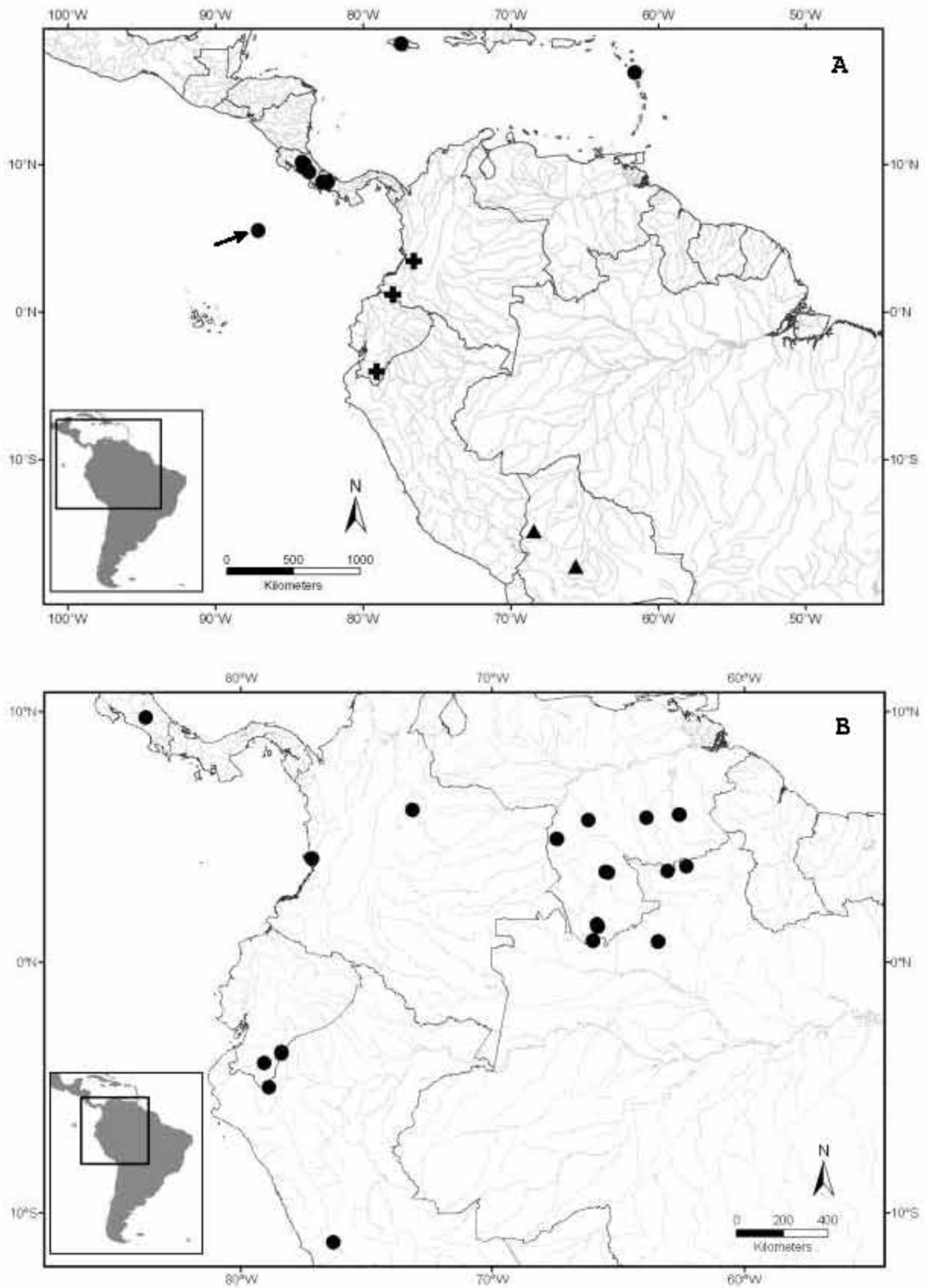


FIG. 21. A. Distribution of *Moranopteris microlepis* (●), *M. killipii* (+), and *M. williamsii* (▲). The arrow point to Cocos Island. B. Distribution of *M. plicata* (●).

15. *Moranopteris nana* (Fée) R. Y. Hirai & J. Prado, *Taxon* 20XX. *Polypodium nanum* Fée, *Gen. Filic.* 5: 238. 1852. *Xiphopteris nana* (Fée) Copel., *Amer. Fern J.* 42: 107. 1952. *Micropolypodium nanum* (Fée) A. R. Sm., *Novon* 2: 422. 1992. LECTOTYPE (here designated).—FRENCH GUIANA. Without exact locality: s.d., *F. M. R. Leprieur s.n.* ["140"] p.p. (P-696190; duplicates: P-696243, B-200142439). **Figs. 22A–F.**

Polypodium blanchetii C. Chr., *Bot. Tidsskr.* 25: 78. 1902. *Polypodium exiguum* Fée, *Crypt. Vasc. Br.* 1: 89, t. 37, f. 1. 1869, *nom illeg., non* Heward (1838), *nec* Griseb. (1864). *Grammitis exigua* (Fée) Brade, *Sellowia* 18: 79. 1966. *Grammitis blanchetii* (C. Chr.) A. R. Sm., *Ann. Missouri Bot. Gard.* 77(2): 257. 1990. LECTOTYPE (here designated).—BRAZIL. **Bahia:** 1857, *J. S. Blanchet 8* (RB; duplicate: P-n.v.).

Plants epiphytic, rarely epipetric. *Rhizome* erect with scales, the scales 0.5–1.1 mm X 0.15–0.30 mm, yellow-brown to orange-brown, ovate-lanceolate to lanceolate, base slightly cordate, apex acute, margins with long setiform projections, mostly on the 1/3 of distal portion, setiform projections red-brown, 0.1–0.2(–0.3) mm long. *Fronde*s erect to arcuate, determinate, (1.6–)5.0–8.0(–12.0) cm X (2.9–)4.0–5.5 mm, sparsely to moderately setose; *stipe* (0.1–)0.5–1.0 cm long, yellow-brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, sometimes pinnate at base, gradually tapering proximally to a narrow wing, chartaceous; *costa* slightly visible to visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* slightly ascending, mostly (45–)60–85° to costa, (7–)22–39(–50) pairs, spaced (0.2–)1.2–1.7 mm, alternate to subopposite, gibbous, asymmetric, (1.0–)1.6–3.2 X 0.9–1.7 mm, ovate to oblong, sometimes deltate, decurrent at base, apex rounded to slightly acute, margins plane to slightly revolute, without hyaline cells or inconspicuous; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic or obovate; *setae* (0.3–)0.6–1.3(–1.6) mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the costa and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, or rarely with branches tinged of red-brown, branched or rarely unbranched, sometimes these branched hairs with a setiform branch, the unbranched hairs with 2 or 3 (or 4)-celled, (<–)0.15(–2.0) mm long, the branched hairs 1 or 2-branched, the main branch 2 or 3-celled, (<–)0.2 mm long, 1st branch 1 or 2-celled, (<–)0.1(–0.35) mm long, 2nd branch, if present, 1 or 2-celled, (<–)0.10(–0.15) mm long. *Sori* one per segment, rounded, (0.5–)1.2–1.5 mm diam.

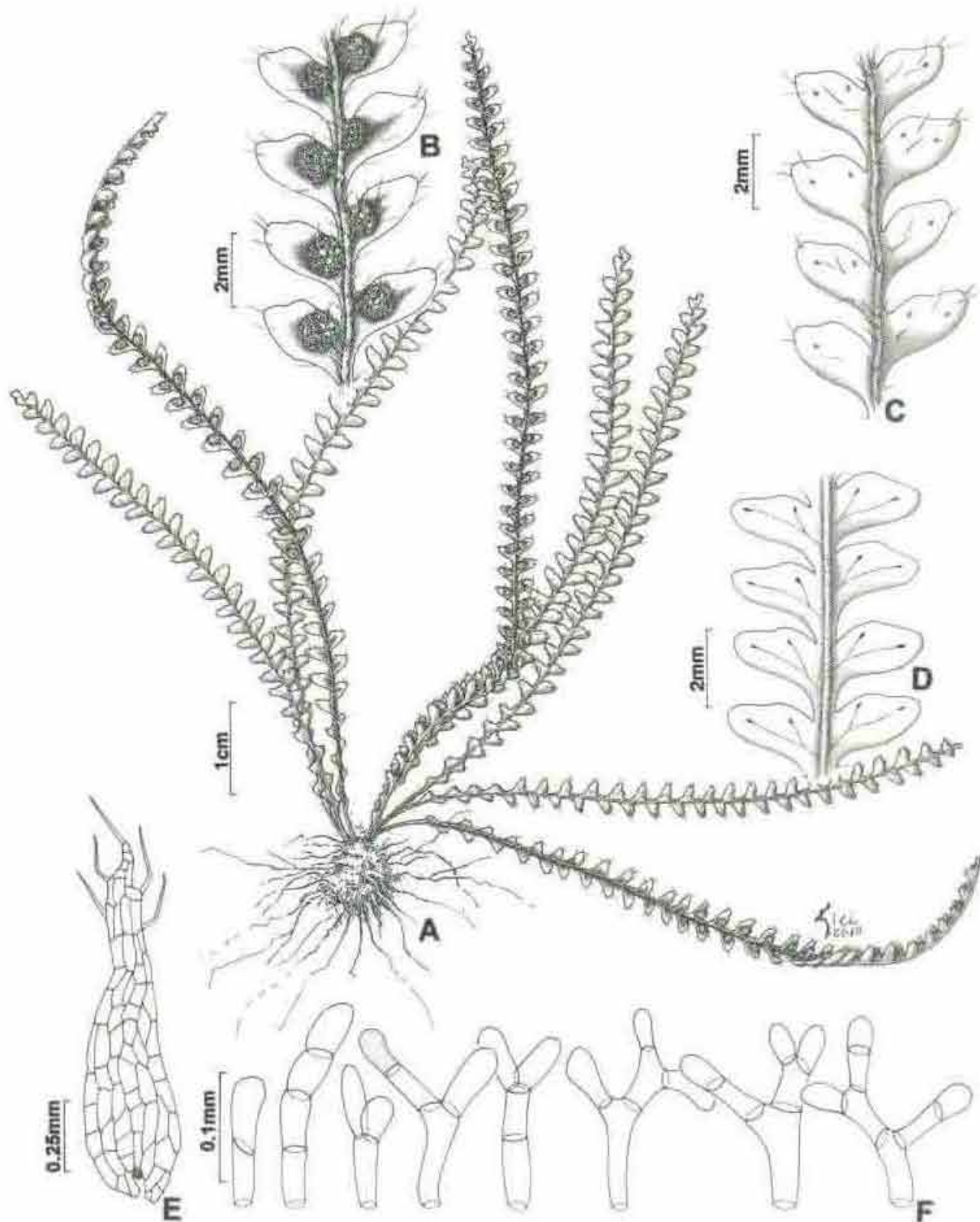


FIG. 22. *Moranopteris nana*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Unbranched and branched hairs from the costa. A-C: Cid et al. 590 (INPA). D: Lopes & Pietrobon 518 (SP). E-F: Cremers 7260 (CAY).

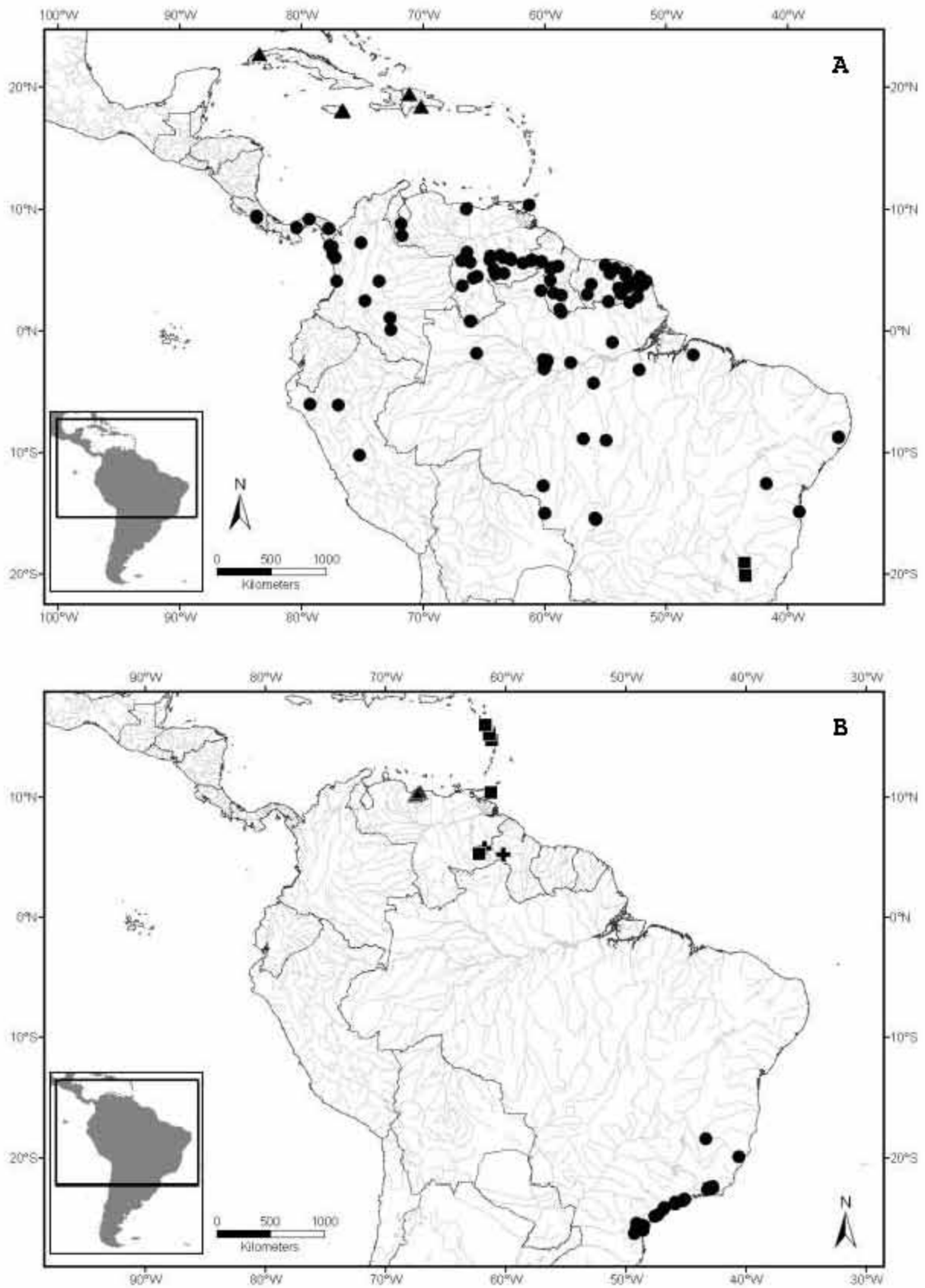


FIG. 23. A. Distribution of *Moranopteris nana* (●), *M. nimbata* (▲), *M. perpusilla* (■). B. Distribution of *M. rupicola* (+), *M. serricula* (■), *M. setosa* (●), and *M. simplex* (▲).

Distribution.—Costa Rica, Panama, Trinidad and Tobago, French Guiana, Suriname, Guyana, Venezuela, Colombia, Peru, and Brazil; 5–1400 m (Figs. 23A, 2).

SELECTED SPECIMENS EXAMINED.—COSTA RICA. **San José:** San Isidro del General, 670 m, 26 Jul 1940, *Chrysler & Roever 5246* (NY). PANAMA. **Coclé:** Bismarck, above Penonome, 609–914 m, 5–19 Mar 1908, *Williams 452* (NY). **Darién:** Tres Bocas on the Río Coasi, 1 May 1968, *Kirkbride & Duke 1380* (NY). **Panama:** Subida para Cerro Jefe, 700 m, 13 Mar 1969, *Sucre et al. 4860* (RB). TRINIDAD AND TOBAGO. **Trinidad:** Aripo road, on a tree-trunk, in a gully, near 2 mile post, 19 Mar 1926, *Broadway 6061* (K). FRENCH GUIANA. Crique Kapiri, R. N. 2, Bassin de l'Approuague, 70 m, 04°07'N, 52°05'W, 16 Jan 1991, *Cremers 11632* (CAY, P, UC, US); Crique Voltaire, Bassin du Maroni, 05°09'N, 54°10'W, 15 May 1988, *Feuillet 9844* (CAY); Face Nord de la Montagne de Kaw, 13 May 1985, *Cremers 8687* (CAY); Mont Galbao, secteur Est., 600 m, 03°36'N, 53°17'W, 14 Jan 1986, *Granville et al. 8677* p.p. (US); Mont Saint-Marcel, zone Sud-est du massif, 280 m, 02°23'00"N, 53°00'20"W, 23 Jul 2002, *Granville et al. 15439* (CAY). SURINAME. **Sipaliwini:** In montibus, qui dicuntur Nassau, on dead log, in forest near km 7.5, 11 Mar 1949, *Lanjouw & Lindeman 2592* (US). GUYANA. **Cuyuni-Mazaruni:** Paruima, 9 km W, Ararata scrub area, 800 m, 05°49'N, 61°08'W, 4 Jul 1997, *Clarke et al. 5348* (CAY, US). **U-Takutu-U. Essequibo:** Rewa River, summit of unnamed peak, 5.6 km W of camp, 400 m, 02°58'49"N, 58°38'27"W, 19 Feb 1997, *Clarke 3685* (NY, US). **Potaro-Siparuni:** Kaieteur Falls National Park, relatively moist forest along trail to Tukeit, 500 m, 05°10'N, 59°29'W, 17 Apr 1988, *Hahn et al. 4721* (US). VENEZUELA. **Amazonas:** Atabapo, Serranía del Parú (Aroko), Sabanas sobre colinas onduladas en el sector centro-nororiental de la serranía, al S del Río Parú, 710 m, 04°33'N, 65°31'W, 5–6 Oct 1979, *Huber 4353* (US). **Bolívar:** Caño Pablo, tributary of Río Caura, ca 6 km east south east Lás Pavas (Salto Para), 240 m, 06°14'N, 64°24'W, 8 May 1982, *Liesner & Morillo 13928* (VEN). **Miranda:** Parque Nacional de Guatopo, 610–710 m, 29 Nov 1961, *Steiermark 90175* (US). **Táchira:** Uribante, Empresa Las Cuevas near La Fundación, 900 m, 08°50'N, 71°47'W, 7 Jul 1983, *van der Werff & González 5005* (MO, UC). COLOMBIA. **Antioquia:** Anorí, Región Providencia, sector Aljibes-La Tirana, desembocadura de la quebrada Buenos Aires al río Anorí, 500 m, 07°17'36"N, 75°04'02"W, 18 Jan 2004, *Rodríguez et al. 4500* (HUA, NY). **Caquetá:** Sierra de Chiribiquete, Bosque más cercano a la Cueva de las Pinturas, 600 m, 01°05'N, 72°40'W, 24 Aug 1992, *Palacios et al. 2579* (MO, NY). **Chocó:** Camp Curiche, S. of Boca Curiche, 26 May 1967, *Duke 11675* (MO, US). **Meta:** about 20 km southeast of Villavicencio, 500 m, 17 Mar 1939, *Killip 34287* (US). PERU. **Pasco:** Oxapampa, Palcazu valley, Cabeza de Mono, 5–6 km west of Iscosacin, 325 m, 10°12'S, 75°14'W, 13–19 Apr 1983, *Smith 3805* (MO). BRAZIL. **Amapá:** Rio Oiapoque, near first cachoeira on Rio Iaue,

02°53'N, 52°22'W, 24 Aug 1960, *Irwin et al.* 47778 (NY, US). **Amazonas:** Manaus-Caracaraí Road, km 26, trilha subindo o Barro Branco, 02°53'S, 59°58'W, 14 Mar 1995, *Prado et al.* 590 (INPA, SP). **Pará:** Macau airstrip, 1h e meia upstream from Lageira airstrip, on Rio Maicurú, 243 m, 00°55'S, 54°26'W, 24 Jul 1981, *Strudwick et al.* 3524 (INPA, NY, US). **Roraima:** Rio Branco, Surumú, "Serra de Meivary", 1100 m, Nov 1909, *Ule 13* (B). **Rondônia:** Vilhena, Estrada que vai para Aripuanã, local Fazenda Flor da Serra, a 15 km de Vilhena, 20 May 1984, *Rosário et al.* 443 (MG). **Pernambuco:** Jaqueira, Usina Colônia, mata córrego da Guatiba, 652 m, 08°43'00"S, 35°50'25"W, 6 Dec 2001, *Lopes & Pietrobom 518* (MBM, RB, SP). **Bahia:** Ilhéus, s.d., *Riedel s.n.* (P). **Mato Grosso:** Chapada dos Guimarães, 16 Nov 1975, *Hatschbach 37625* (UC, MBM).

Moranopteris nana has sparsely setose fronds, furcate veins, two hydathodes per segment, mostly ovate, gibbous segments, and rhizome scales with setiform projections on the 1/3 of distal portion (Figs. 22A-E).

Moranopteris nana is variable in its hairs which occur near and on the costa abaxially. These hairs are branched, mostly 1 or 2-branched, or sometimes unbranched and branched hairs (Fig. 22F). The branched hairs with a setiform branch are less frequent.

Rodríguez *et al.* 4500 (HUA, NY) is an unusual specimens of *Moranopteris nana* by having segments more spaced, gibbous, and oblong-lanceolate. Maybe it might represent a new species, but we did not find other specimens to confirm this hypotheses and we prefer to interpret it here as only a variation of *M. nana*. Also, the duplicate at NY did not show segments so spaced as much as the specimen at HUA.

The most similar species is *Moranopteris taenifolia*. There is an overlapping in their kind of hairs. However, *M. taenifolia* differs by moderately setose fronds, and less spaced segments (0.4–1.0 vs. 1.2–1.7 mm).

In the protologue by Fée (1852), *Polypodium nanum* was described based on a specimen of *Leprieur s.n.* (Herb. Cl. Moug.), s.d., from "Guyana" [French Guiana]. Unfortunately, no material collected by Leprieur was found at B, NY, P, and US herbaria had a label from Herb. Cl. Moug.

Hieronymus (1905) pointed out that the specimen *Leprieur 140* was probably authentic, for this reason we choosed this material as lectotype (P). Futhermore, this specimen and their duplicates match perfectly with the protologue. There is only one divergency on the collection date can be Jun 1834 (P-696190) or only 1833 (P-696243) or undated (B-200142439).

16. ***Moranopteris nimbata*** (Jenman) R. Y. Hirai & J. Prado, *Taxon* 20XX.
Polypodium nimbatum Jenman, *J. Bot.* 24: 271. 1886. *Xiphopteris nimbata* (Jenman) Copel., *Amer. Fern J.* 42: 108. 1952. *Grammitis*

nimbata (Jenman) Proctor, Bull. Inst. Jamaica Sci. Ser. 5: 34. 1953. *Micropolypodium nimbatum* (Jenman) A. R. Sm., Novon 2: 422. 1992. LECTOTYPE (designated by Proctor, 1985).—JAMAICA. Without exact locality, s.d., collector unknown [J.P. 2067] (IJ-n.v.; duplicates: NY-127088 p.p.; US-692161; frag. NY-127087; photo IJ-n.v. and US-n.v.). **Figs. 24A-F.**

Plants epiphytic. Rhizome erect with scales, the scales 0.8–1.5 mm X 0.2–0.3 mm, castaneous, ovate-lanceolate, base slightly cordate, apex acute, sometimes with apical or subapical gland-like cells, margins with long setiform projections, or sometimes with also small lateral projections, sometimes setiform projections occurring on the scale surface, setiform projections red-brown, 0.10–0.15 mm long. Fronds erect to arcuate, determinate, 2.0–6.0(–10.0) cm X 3.0–4.5 mm, moderately to densely setose; stipe 0.3–0.5 cm long, rarely 1.0 cm, yellow-brown to dark-brown, wings absent; laminae linear, pinnatisect, sometimes deeply pinnatifid, sometimes pinnate at base, gradually tapering proximally, chartaceous; costa obscured by laminar tissue abaxially and adaxially, sometimes visible with dark sclerenchyma at base abaxially; segments ascending, 60–70° to costa, (12–)23–32(–51) pairs, spaced 0.2–0.5 mm, subopposite, not gibbous, symmetric, 1.3–2.0(–3.0) X 1.0–1.4(–2.0) mm, ovate to oblong, slightly decurrent at base, apex rounded, margins plane to slightly revolute, without hyaline cells, or sometimes inconspicuous; veins usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, rounded; setae 0.5–2.1 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the costa, and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, or sometimes with branches tinged of red-brown, (1 or) 2-branched, the main branch 2 or 3-celled, (<–)0.15 mm long, 1st branch 1 or 2-celled, (0.05–)0.1–0.2 mm long, 2nd branch, if present, 1-celled, < 0.1 mm long. Sori one per segment, rounded, 0.9–1.4 mm diam.

Distribution.—Endemic to Greater Antilles (Cuba, Jamaica, and Dominican Republic); 1000–1676 m (Figs. 23A, 2).

SELECTED SPECIMENS EXAMINED.—CUBA. Loma del Gato, 1100 m, Aug 1923, *Clement 1007* (P); Sevilla, near Santiago, Jiquarito, Mt. Sierra Maestra, 1036 m, 18 Sep 1906, *Taylor 540* (NY). JAMAICA: Base of John Crow Peak, 1524–1676 m, 18 Apr 1903, *Underwood s.n.* (NY); Cinchona, 1495 m, 19 Mar 1909, *Watt 182* (S); Rose Hill, 12 Mar 1895, *Harris 3180* (K). DOMINICAN REPUBLIC. **San Cristobal-**

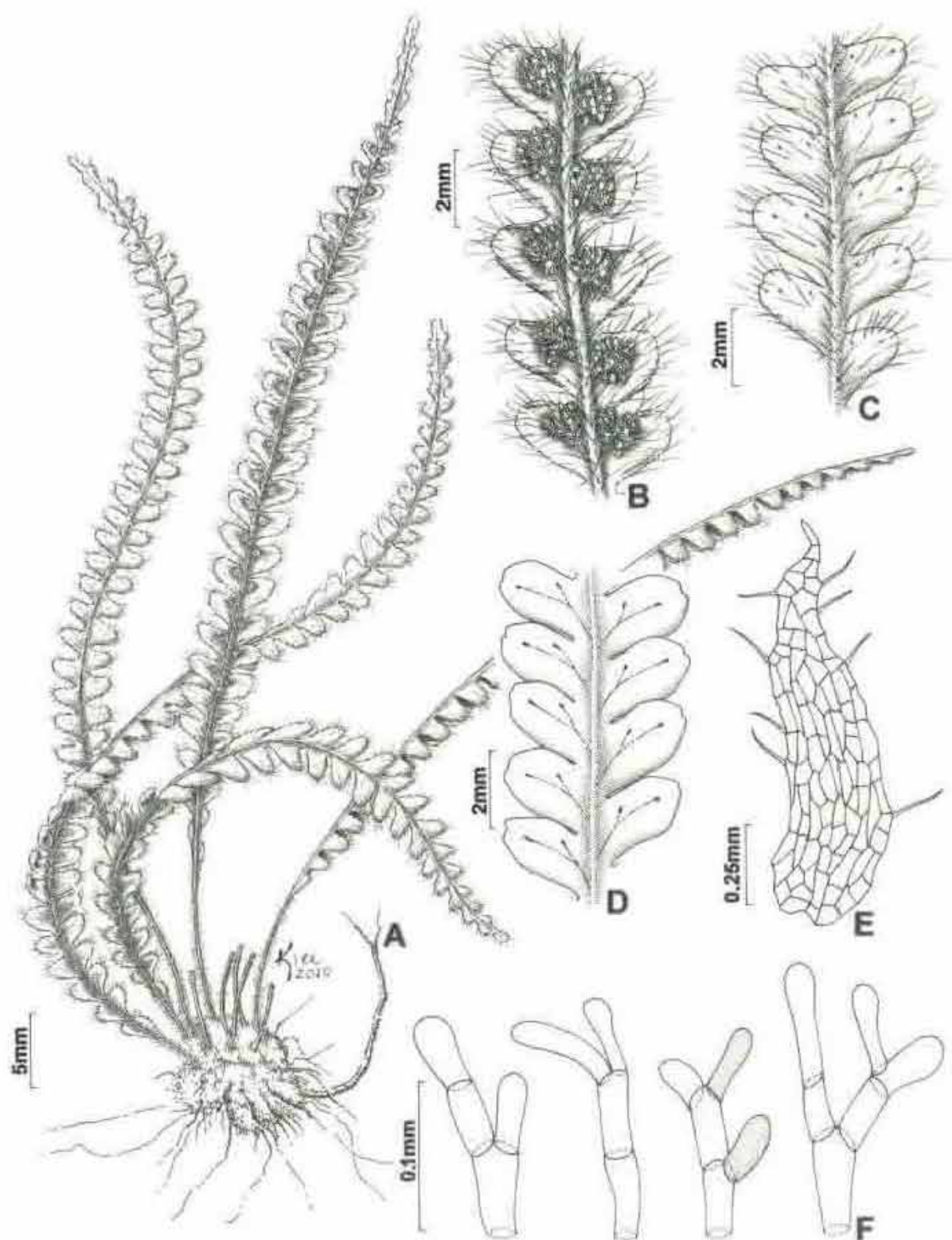


FIG. 24. *Moranopteris nimbata*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Branched hairs from the costa. A-C, E: Eggers 3685 (P). D, F: Clement 1007 (P).

Peravia border: Cordillera Central, broad-leaved forest (much cut over) along Río Mahoma, 5.3 km E of Piedra Blanca-Rancho Arriba road, from point 19 km SW of Piedra Blanca, 11.2 km NE of Rancho Arriba, 0.7 km NE of La Penita, 1000 m, 28 Feb 1983, *Mickel et al. 9050* (NY). **Santo Domingo:** Cordillera Central, prov. Monte Cristi, Monción, Lagunas de Cenabé, 1200 m, 4 Jun 1929, *Ekman 12732* (B, K, NY, S).

Moranopteris nimbata is endemic to the Greater Antilles. It is recognized by rhizome scales with red-brown long setiform projections on the margins, pinatissect or deeply pinnatifid laminae, moderately to densely setose, furcate veins, two hydathodes per segment, not gibbous segments, and branched hairs mainly near and on the costa abaxially (Figs. 24A-F). These hairs have sometimes branches tinged of red-brown and this can be helpful to recognize this species.

Eggers 3685 and *Wright 1049* (PH) are a somewhat unusual by having slightly gibbous segments, but they agree to *Moranopteris nimbata* in all other characteristics.

Moranopteris nimbata can be sometimes confused with *M. microlepis* and *M. basiattenuata*, but these two species differ by gibbous segments and entire margins of the rhizome scales, respectively.

The duplicate of type at NY-127088 is pro-parte with *Moranopteris trichomanoides*.

17. *Moranopteris perpusilla* (Maxon) R. Y. Hirai & J. Prado, *Taxon* 20XX.

Polypodium perpusillum Maxon, *Contr. U.S. Natl. Herb.* 17: 409. pl. 13-A. 1913. *Xiphopteris perpusilla* (Maxon) Copel., *Amer. Fern J.* 42: 95. 1952. *Micropolypodium perpusillum* (Maxon) A. R. Sm., *Novon* 2: 422. 1992. TYPE.—BRAZIL. **Minas Gerais:** Serra do Caraça, Mar 1892, *E. Ule s.n.* (holotype: US-534909; isotypes: P-632717, P-632718). **Figs. 25A-F.**

Plants epipetric. *Rhizome* erect with scales, the scales 1.1–2.7 mm X 0.4–0.65 mm, golden to yellow-brown, ovate-lanceolate, sometimes ovate, base cordate, apex acute, margins entire, or sometimes with also small lateral projections. *Fronde*s erect to arcuate, determinate, 1.7–4.7 cm X 2.0–3.0 mm, not setose; *stipe* 0.2–0.7 cm long, yellow-brown to dark-brown, narrowly winged; *laminae* linear, pinatissect, gradually tapering proximally to a narrow wing, chartaceous; *costa* visible with dark sclerenchyma abaxially and adaxially; *segments* ascending, ca. 30–45° to costa, 9–16 pairs, spaced ca. 0.4–0.8 mm, subopposite, alternate at base, not gibbous, symmetric, 1.1–2.0 X 0.7–1.0 mm, oblong to deltate, decurrent at base, apex rounded, margins slightly revolute, without hyaline cells; *veins* usually

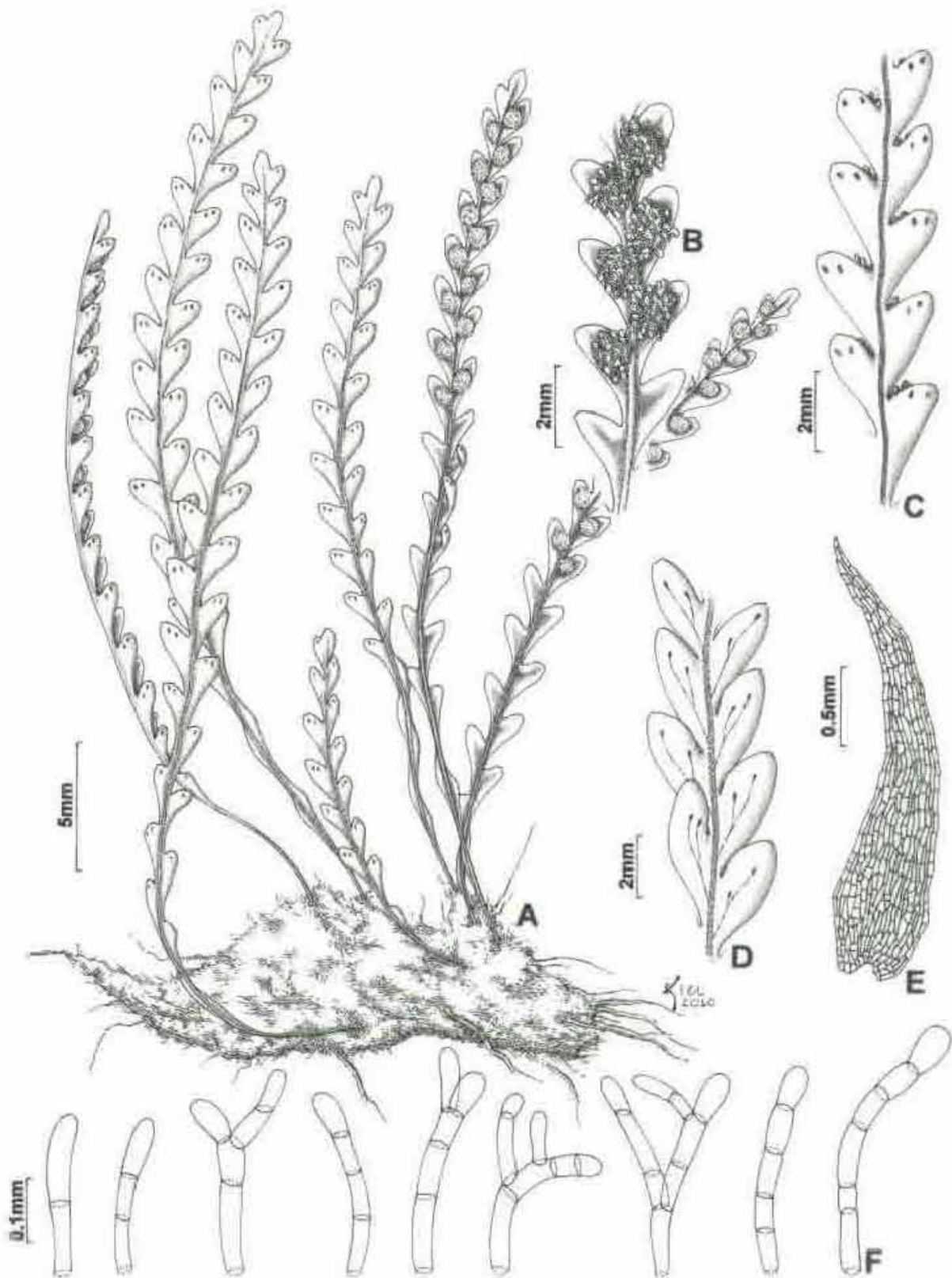


FIG. 25. *Moranopteris perpusilla*. A. Habit. B. Detail of the fertile segments showing sori abaxially. C. Detail of the segments showing hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Unbranched and branched hairs from the costa. A-F: Hiraï 574 (SP).

furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic; setae absent; hairs on the stipe, costa, and laminar tissue (mainly near to costa abaxially), yellowish, slightly red-brown, unbranched and branched, the unbranched hairs 3–5(6)-celled, 0.1–0.4 mm long, the branched hairs 1 or 2-branched, the main branch 3 or 4-celled, 0.15–0.30 mm long, 1st branch 1–3-celled, (<–)0.15–0.25 mm long, 2nd branch, if present, 1 or 2-celled, < 0.1 mm long. Sori one per segment, rounded, 0.9–1.2 mm diam.

Distribution.—Endemic to Southeast Brazil (Minas Gerais State); 950–1300 m (Figs. 23A, 2).

SELECTED SPECIMENS EXAMINED.—BRAZIL. **Minas Gerais:** Catas Altas, RPPN do Caraça, Bocaina, próximo a cachoeira, 1270 m, 20°07'25"S, 43°27'53"W, 2 Jun 2008, Hirai *et al.* 574 (SP); Conceição do Mato Dentro, Parque Natural de Ribeirão do Campo, Cachoeira do Capão Grande, 1250 m, 19°04'53"S, 43°35'22"W, 29 May 2003, Salino *et al.* 8718 (BHCB).

Moranopteris perpusilla is endemic to Southeast Brazil. It is easily recognized by rhizome scales with entire margins, pinatissect laminae, segments ca. 30–45° to costa, furcate veins, and two hydathodes per segment (Figs. 25A–E). Moreover, it has not setae on its fronds.

Labiak and Prado (2005b) pointed out that *Moranopteris perpusilla* was known only from the type-specimen collected by Ule in 1892. After 108 years it was recollected at Conceição do Mato Dentro in Minas Gerais State.

Moranopteris perpusilla seems most closely related to *M. grisebachii* (Antilles) as commented before. Another similar species, also endemic to Southeast Brazil, is *M. setosa* but differs by having setose fronds.

18. *Moranopteris plicata* (A. R. Sm.) R. Y. Hirai & J. Prado, *Taxon* 20XX.
Grammitis plicata A. R. Sm., *Ann. Missouri Bot. Gard.* 77: 258. 1990.
Micropolypodium plicatum (A. R. Sm.) A. R. Sm., *Novon* 2: 422. 1992.
 TYPE.—VENEZUELA. **Amazonas:** Serranía Parú, Caño Asísa, Río Ventuari, cumbre just south of valley head of Camp Stream, 2000 m, 2 Feb 1951, R. S. Cowan & J. J. Wurdack 31164 (holotype: UC-1526738; isotypes: NY-148605, US-2291748). **Figs. 26A–G.**

Plants epiphytic. *Rhizome* erect with scales, the scales 0.6–1.2 mm X 0.15–0.30 mm, golden to slightly yellow-brown, ovate-lanceolate to lanceolate, base slightly cordate, apex acute, sometimes with apical or subapical gland-like cells, margins with long setiform projections, especially toward the apex, sometimes setiform projections occurring on the scale surface, setiform projections red-brown, 0.1–0.2 mm long. *Fronds*

erect to pendent, determinate, 2.5–7.7(–12.5) cm x 3.0–6.0 mm, moderately to densely setose; *stipe* 0.3–0.9 cm long, dark-brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous, sometimes slightly membranaceous; *costa* visible or sometimes slightly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, 45–60° to costa, 10–29 pairs, spaced 0.6–1.0 mm, segments at base more distant 1.0–1.6 mm, subopposite, not gibbous, rarely gibbous, symmetric, 1.2–2.7 x 0.8–1.4(–1.7) mm, oblong, decurrent at base, apex rounded to slightly acute, margins plane, sometimes slightly revolute, without hyaline cells, or sometimes inconspicuous; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic; *setae* 2.0–3.4 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the stipe, costa, and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, or rarely with branches tinged of red-brown, 2 or 3-branched, the main branch 2–4-celled, 0.10–0.25 mm long, 1st branch 1–3-celled, (<–)0.10(–0.15) mm long, 2nd branch, if present, 1 or 2-celled, < 0.1 mm long, 3rd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, rounded, 0.9–1.2 mm diam.

Distribution.—Costa Rica, Venezuela, Colombia, Ecuador, Peru, and Brazil; 900–2560 m (Figs. 21B, 2).

SELECTED SPECIMENS EXAMINED.—COSTA RICA. **Cartago:** Pasture and old tree stumps to the west of Quebrada Casa Blanca, Tapantí, 1350 m, 09°47'N, 83°48'W, 1 Feb 1986, *Smith et. al.* 2200 (UC). VENEZUELA. **Amazonas:** Atabapo, Slope of Cerro de Marahuaca, Río Yameduaka arriba, 1225 m, 03°38'N, 65°28'W, 19 Feb 1985, *Liesner* 17674 (MO, UC). **Bolívar:** Heres, Cerro Marutani, cumbre, afloramiento de piedra arenisca en la altiplanicie a lo largo del Río Carla, afluente de las cabeceras del Río Paragua, 1200 m, 03°50'N, 62°15'W, 11–14 Jan 1981, *Steyermark et al.* 123952 (NY, MO, RB). BRAZIL. **Amazonas:** Platô da Serra Aracá, parte SE da Serra Norte, margem da mata de galeria, arredores da pista, 1150–1250 m, 00°51'S, 63°22'W, 18 Feb 1984, *Tavares et al.* 85 (NY). COLOMBIA. **Santander:** Charala, Virolín, 1700 m, Feb 1992, *Tohba & Barbosa* 140 (MO). **Chocó:** Hoya del Río San Juan, alrededores de Palestina, 04°10'N, 77°10'W, 26 Mar 1979, *Forero et al.* 4053 (MO, US). ECUADOR. **Zamora-Chinchipec:** In the vicinity of the mining camp at the Río Tundaime, along trail to mining site above the camp, 1100–1400 m, 03°34'44"S, 78°24'11"W, 9 Nov 2004, *van der Werff et al.* 19433 (MO, NY, UC). PERU. **Cajamarca:** San Ignacio, San José de Lourdes, Cordillera entre bajo y alto Picorana, 2550–2560 m, 04°59'S, 78°53'W, 7 Dec 1998, *Campos et al.* 5970

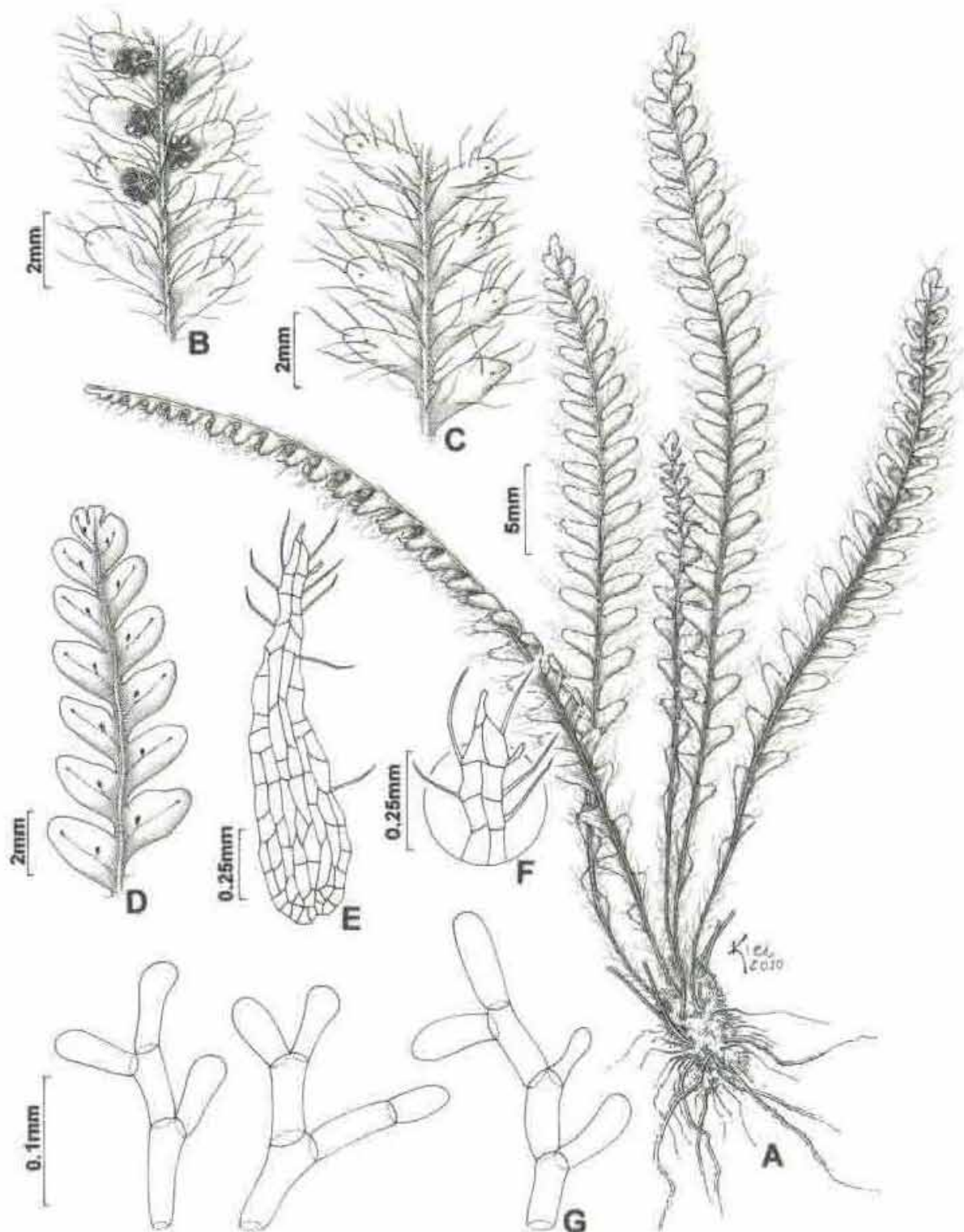


FIG. 26. *Moranopteris plicata*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Detail of the apex of the rhizome scale. G. Branched hairs from the costa. A-G: Maguire & Politi 27990 (NY).

(MO, UC). **Junín:** Schunke Hacienda, above San Ramón, 1700–1800 m, Aug–Oct 1923, *Schunke A157* (US).

Moranopteris plicata is characterized by having rhizome scales with red-brown long setiform projections on the margins, densely setose fronds, setae with 2.0–3.4 mm long, furcate veins, not gibbous segments, and branched hairs mainly near and on the costa abaxially (Figs. 26A–G).

This species was originally described with a small plant (3 to 5 mm long), usually with conduplicately folded laminae, and simple veins. After analyses of other specimens from Venezuela we concluded that the species can be larger (up to 12.5 cm long) than the specimens firstly described, also with furcate veins and two hydathodes per segment. It seems that the conduplicately folded lamina results from drying the specimen.

Steyermak et al. 123952 (a paratype) has some segments with furcate veins, two hydathodes per segment, and slightly gibbous. This material shows a little of variation in *Moranopteris plicata*, which were observed in other specimens.

Some specimens can have unusual conspicuous gibbous segments such as *Beitel* 85283 (UC), but in the same plant there are also not gibbous segments. In the other characteristics they agree with our concept of *Moranopteris plicata*.

Moranopteris nana is the most similar species but in contrast has sparsely setose fronds, smaller setae (0.6–1.3 mm long), gibbous segments, and branched-hairs mostly less branched (Figs. 22A–F). Also, *M. nana* occurs often in lower altitudes (mostly below 900 m, Fig. 2).

19. *Moranopteris rupicola* R. Y. Hirai & J. Prado, *Taxon* 20XX. TYPE.—GUYANA: Mazaruni-Potaro, Roraima, summit, La Proa Camp, east of border, near Lake Gladys, 2800 m, 05°15'36"N, 60°13'W, 14 Apr 1988, *R. L. Liesner* 23289 (holotype: MO; isotypes: UC, VEN). **Figs. 27A–G.**

Plants epipetric. *Rhizome* erect with scales, the scales 2.1–2.7 mm X 0.3–0.4 mm, yellow-brown, lanceolate, base slightly cordate, apex acute, mostly with apical or subapical gland-like cells, margins with long setiform projections, or with also small lateral projections, rarely setiform projections occurring on the scale surface, setiform projections red-brown, 0.15–0.30 mm long. *Fronds* erect to arcuate, determinate, 5.5–13.0 cm X 4.5–10.0 mm, sparsely setose; *stipe* 0.5–1.0 cm long, yellow-brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costa* visible or slightly visible with dark sclerenchyma abaxially, slightly visible with dark sclerenchyma adaxially; *segments* slightly ascending, 60–80° to

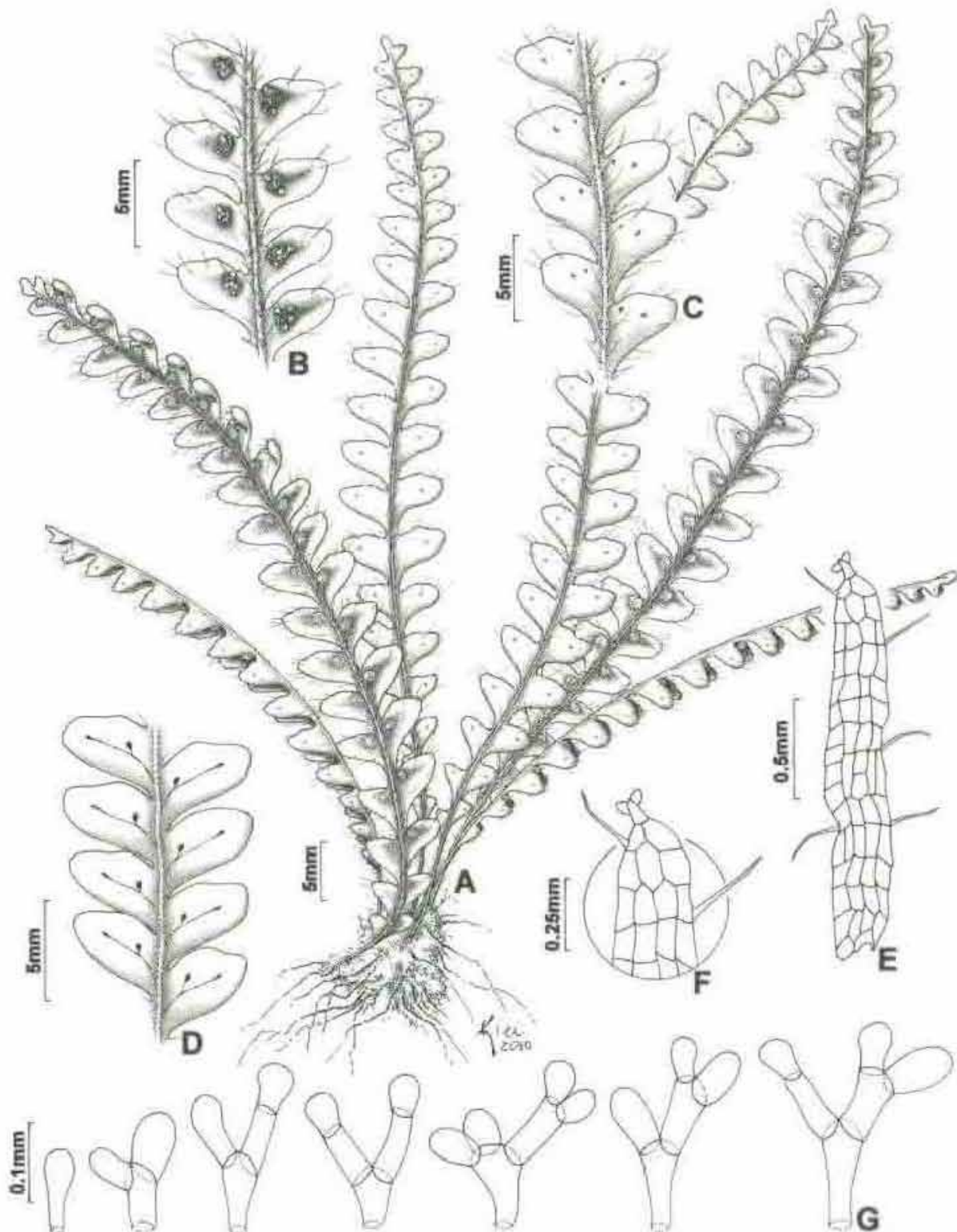


FIG. 27. *Moranopteris rupicola*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Detail of the apex of the rhizome scale. G. Unbranched and branched hairs from the costa. A-C, E, F: Liesner 23289 (MO). D, G: Steyermark et al. 115650 (UC).

costa, 17–36 pairs, spaced (0.4–)0.6–1.8 mm, subopposite, gibbous, asymmetric, 2.8–4.9 X 1.9–2.9 mm, oblong, decurrent at base, apex rounded to slightly acute, margins plane, without hyaline cells, or inconspicuous; veins usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, obovate or linear; setae, 1.6–2.4 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the costa and laminar tissue, rarely on the margins (mainly near to costa abaxially), hyaline, slightly red-brown, branched or rarely unbranched, the branched hairs mostly 1 or 2-branched, the main branch 2 or 3-celled, 0.15–0.25 mm long, 1st branch 1 or 2-celled, or sometimes 2-celled in the same insertion point, (<–)0.10(–0.15) mm long, 2nd branch, if present, 1-celled, < 0.1 mm long, the unbranched if present, 1-celled, < 0.1 mm long. Sori one per segment, rounded, 1.5–1.8 mm diam.

Distribution.—Guyana, Venezuela, and probably Brazil; 2360–2800 m (Figs. 23B, 2).

SPECIMENS EXAMINED.—VENEZUELA. **Bolívar:** Cumbre del Ptari-tepui, al norte de la Misión de Santa Teresita de Kavanayén, 2360–2420 m, 05°45'N, 61°45'W, 23 Feb 1978, Steyermark et al. 115650 (GH, UC, VEN).

Moranopteris rupicola has rhizome scales with red-brown long setiform projections on the margins, sparsely setose fronds, gibbous segments, furcate veins, two hydathodes per segment, and mostly branched hairs mainly near and on the costa (Figs. 27A–G).

The specific epithet refers to the habitat where this species grows on rocks of the Venezuelan tepuis.

Moranopteris rupicola resembles *M. taenifolia*, but they are easily distinguished by the hairs that mostly occur near and on the costa abaxially. *Moranopteris taenifolia* differs in having unbranched hairs and branched hairs with 1 or 2 setiform branch (Fig. 32F).

20. ***Moranopteris serricula*** (Fée) R. Y. Hirai & J. Prado, *Taxon* 20XX.
Polypodium serricula Fée, *Gen. Filic.* 238. 1852. *Xiphopteris serricula* (Fée) Copel, *Amer. Fern J.* 42: 101. 1952. *Grammitis serricula* (Fée) Proctor, *Rhodora* 63: 35. 1961. *Micropolypodium serricula* (Fée) A. R. Sm., *Novon* 2: 422. 1992. LECTOTYPE (here designated).—GUADELOUPE. Aux. deux Mamelles, s.d., G. S. Perrottet s.n. (B-200149328; duplicate: RB-216528 p.p.). **Figs. 28A–H.**

Plants epiphytic, rarely epipetric. *Rhizome* erect to decumbent with scales, the scales 3.2–3.7 X 0.3–1.0 mm, yellow-brown to orange-brown, lanceolate, base slightly cordate, apex acute, sometimes with apical or subapical gland-like cells, margins entire, or with also small lateral projections, these projections sometimes furcate. *Fronde*s erect to slightly pendent, determinate, 7.5–18.5 cm X 4.0–6.5(–7.0) mm, mostly sparsely setose; *stipes* 1.1–3.5 cm long, yellow-brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costa* slightly visible with dark sclerenchyma abaxially, or sometimes obscured by laminar tissue, slightly obscured by laminar tissue adaxially; *segments* ascending, ca. 45–60° to costa, 18–63 pairs, spaced ca. 0.6–1.8 mm, subopposite, mostly not gibbous, symmetric, 1.8–3.3(–3.9) X 1.1–2.0(–2.5) mm, mostly deltate, sometimes ovate-oblong or oblong, decurrent at base, apex rounded to slightly acute, margins plane, without hyaline cells; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic or obovate; *setae* 0.8–2.5(–3.7) mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the costa and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, mostly 2(or 3)-branched, the main branch (2 or) 3 or 4-celled, 0.1–0.2 mm long, 1st branch 1–3(or 4)-celled, < 0.1(–0.2) mm long, 2nd branch 1 or 2 (or 3)-celled, < 0.1(–0.15) mm long, 3rd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, rounded, 1.1–1.6 mm diam.

Distribution.—Dominica, Guadeloupe, Martinique, Trinidad and Tobago, and Venezuela; 700–1950 m (Figs. 23B, 2).

SELECTED SPECIMENS EXAMINED.—DOMINICA. **Saint George**: Morne Anglais, 763–1142 m, 3 Aug 1938, *Hodge* 53 (NY); Summit Morne Trois Pitons, 1400 m, 23 Feb 1940, *Hodge & Hodge* 3963 (B, K, L, NY, P, PH, S, UC). **Saint Peter**: Mt. Diablotin, 1903, *Llyod* 874 (NY). GUADELOUPE. Bains Chauds du Matouba, 1000 m, 2 Jan 1937, *Stehlé & Stehlé* 1469 p.p. (P); Basse Terre, comm. Basse-Terre/Capesterre, 819–1414 m, 16°03'N, 61°40'W, 6 Mar 2005, *Christenhusz & Katzer* 3930 (UC); Chemin Citerne, 1100 m, 2 Feb 1937, *Stehlé* 2413 (P); Chemin Lac Flammarion, 1100 m, 15 Aug 1936, *Stehlé* 1208 (P). MARTINIQUE. **Saint Pierre**: Colebasse Morne Paillasse, mont Pelée, 700–1000 m, May 1884, *Duss* 1654 (NY). TRINIDAD AND TOBAGO. **Trinidad**: 1896, *Hart* 204 (P). VENEZUELA. **Bolívar**: Below south-east-facing upper shoulder of Apácaratepuí, between Riscobel Ledema Camp and plateau, 1900–1950 m, 19 Jun 1953, *Steyermark* 75704 (NY, US).

Moranopteris serricula is recognized by its entire margins of the

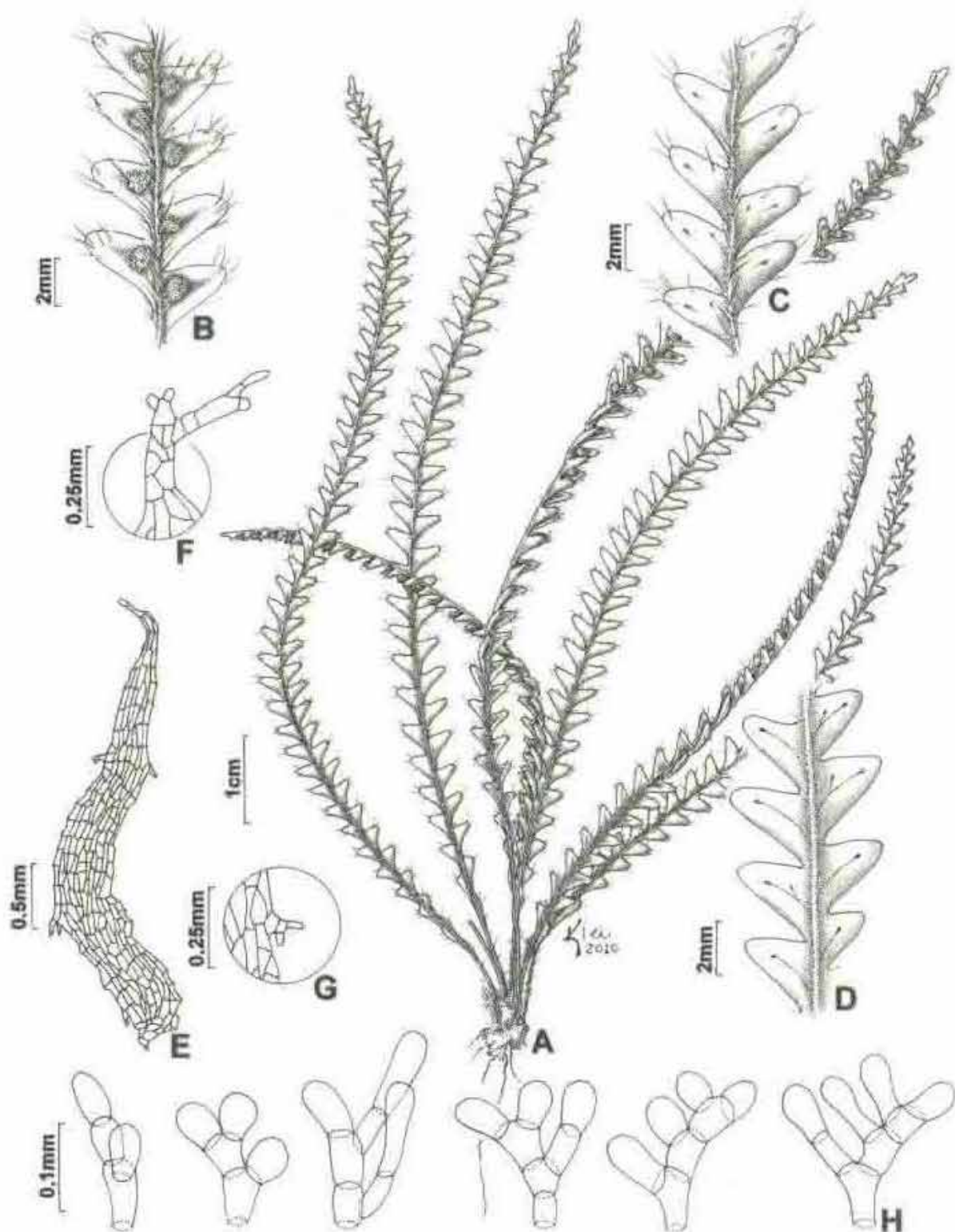


FIG. 28. *Moranopteris serricula*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Detail of the apex of the rhizome scale. G. Detail of the margin of the rhizome scale. H. Branched hairs from the costa. A-C: Duss 1654b (NY). D, H: Feldmann s.n. (P). E-G: Wilbur et al. 8084 (NY).

rhizome scales, deltate segments, ascending, ca. 40-60° to costa, mostly not gibbous segments, and with two hydathodes per segment (Figs. 28A-E). Specimens from Dominica can have a little bit more setose fronds.

Moranopteris knowltoniorum is the most similar species (see comments in this species).

During the studies of type-specimens of *Moranopteris serricula* we decided to choose *Perrottet s.n.* (B) as lectotype for this species. *L'Herminier s.n.* at RB is also pro-parte with *Stenogrammitis hartii* (Jenman) Labiak and both are mounted on the same sheet. Additionally, there are some duplicates of *L'Herminier s.n.* at B and P and they are mostly mixed with *S. hartii*.

21. ***Moranopteris setosa*** (Kaulf.) R. Y. Hirai & J. Prado, *Taxon* 20XX. *Xiphopteris setosa* Kaulf., *Enum. Filic.* 275. 1824. *Grammitis setosa* (Kaulf.) C. Presl, *Tent.*: 208. 1836, *nom. illeg., non* Blume (1828). *Polypodium micropteris* C. Chr., *Index Filic.* 545. 1906, *nom. nov.* for *X. setosa* Kaulf. *Grammitis micropteris* (C. Chr.) Brade, *Sellowia* 18: 81. 1966. *Micropolypodium setosum* (Kaulf.) A. R. Sm., *Novon* 2: 422. 1992. TYPE.—BRAZIL. "Habitat in Brasilia", s.d., L. K. A. von Chamisso s.n. (holotype: probably at B-n.v.). **Figs. 29A-F.**

Grammitis myosuroides Raddi, *Syn. Fil. Bras.* 7 (nº 44). 1819, *nom. illeg., non* Swartz (1801). TYPE.—BRAZIL. [**Rio de Janeiro**]: "Brasilia, Haec et praecedens species inveniuntur in udis rupibus torrentium, super Montes Estrellae, et ambae Musci assimilantur", s.d., G. Raddi s.n. (holotype: PI-n.v.), *ex descr.*

Plants epipetric, rarely epiphytic. Rhizome erect to short-creeping with scales, the scales 0.9-1.2 X 0.2-0.3 mm, yellow-brown, ovate, sometimes slightly lanceolate, base slightly cordate, apex acute, margins entire, rarely with also small lateral projections. Fronds slightly arcuate, determinate, 2.5-9.0 cm X 1.5-3.0 mm, sparsely setose; stipes 0.3-0.9 cm long, yellow-brown, narrowly winged; laminae linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; costa slightly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; segments ascending, ca. 20-35° to costa, 8-28 pairs, spaced ca. 1.0-1.4 mm, alternate, not gibbous, symmetric, 0.5-1.0 X 1.2-2.2 mm, deltate to deltate-linear, deltate and decurrent at base, apex acute to obtuse, margins plane or slightly revolute, without hyaline cells; veins usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic or linear; setae 0.5-0.7 mm long, dark red-

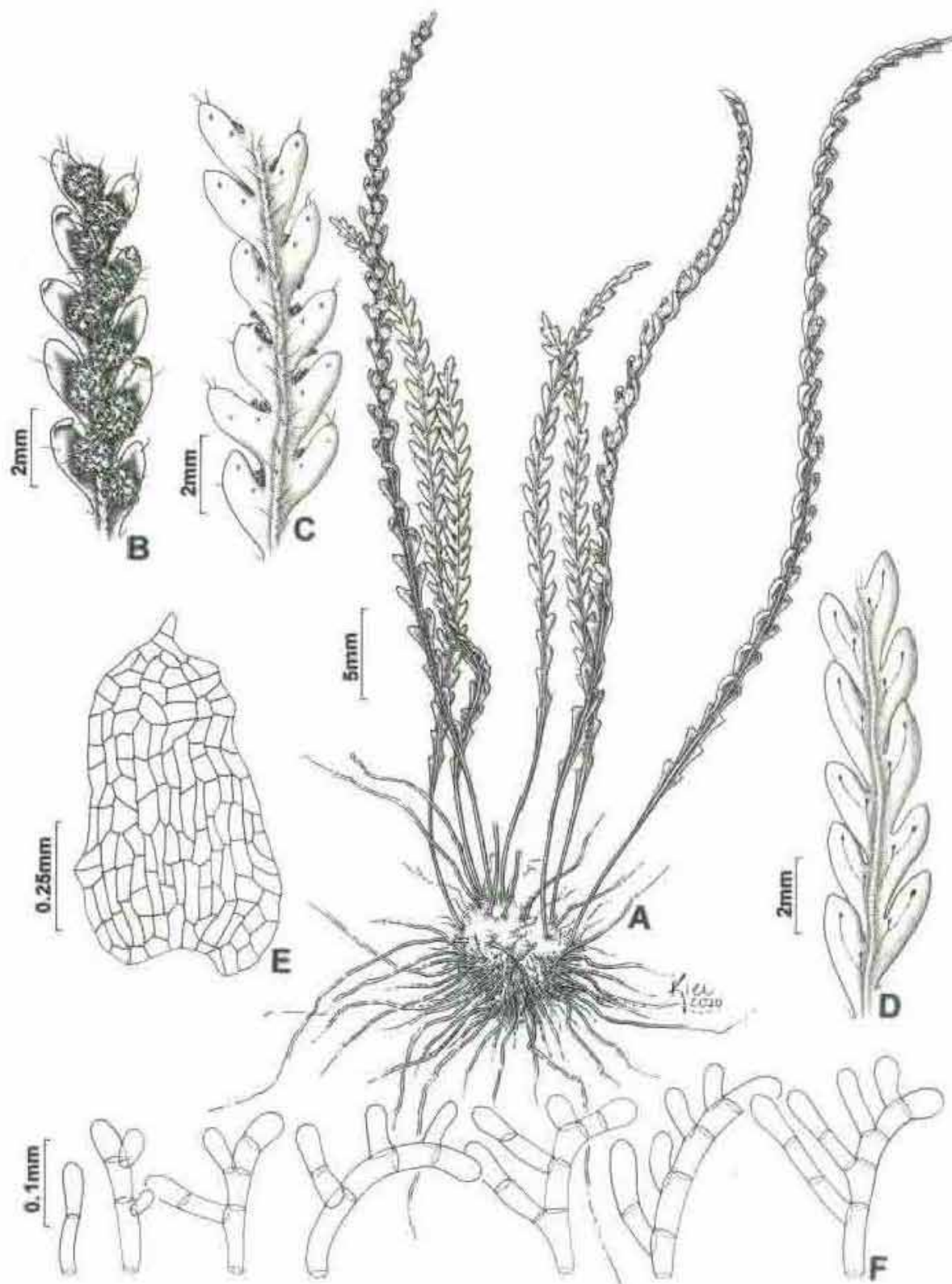


FIG. 29. *Moranopteris setosa*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Unbranched and branched hairs from the costa. A-F: Hirai et al. 598 (SP).

brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the stipe, costa, and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, branched or rarely unbranched, mostly 2 or 3(or 4)-branched, the main branch (2 or) 3 or 4(or 5)-celled, 0.15–0.30 mm long, 1st branch (1 or) 2 or 3-celled, < 0.1(–0.2) mm long, 2nd branch 1 or 2-celled, < 0.1 mm long, 3rd and 4th branch, if present, 1-celled, < 0.1(–0.15) mm long. *Sori* one per segment, rounded, 0.7–1.0 mm diam.

Distribution.—Endemic to Coastal Brazil (Espírito Santo, Rio de Janeiro, São Paulo, Paraná, and Santa Catarina States); 100–1932 m (Figs. 23B, 2).

SELECTED SPECIMENS EXAMINED.—BRAZIL. **Espírito Santo:** Santa Tereza, Jul 1976, *Barcia* 105 p.p. (R). **Rio de Janeiro:** Teresópolis, Parque Nacional da Serra dos Órgãos, Rio Beija-flor, 1100 m, 20 Oct 1977, *Maas & Martinelli* 3369 (NY, RB). **São Paulo:** Salesópolis, Estação Biológica de Boracéia, Margem do Rio Guaratuba, 800 m, 23°40'S, 45°53'W, 10 Dec 2008, *R.Y. Hirai et al.* 598 (SP); **Paraná:** Antonina, Rio Cotia, 24 Mar 1966, *Hatschbach* 14146 (MBM, UPCEB). **Santa Catarina:** Campo Alegre, Morro do Iquererim, 1300 m, 5 Feb 1958, *Reitz & Klein* 6421 (HB, MBM, NY).

Moranopteris setosa can be distinguished from other species by having ascending segments, ca. 20–35° to costa (Figs. 29A–D). It resembles *M. perpusilla* because both species are endemic from Brazil and they have similar fronds. As pointed out by Labiak and Prado (2005b), *M. perpusilla* differs by having costa obscured by laminar tissue adaxially and setae absent on the fronds (Figs. 25A–D). Also this species mostly has lanceolate rhizome scales (vs. ovate scales in *M. setosa*, Fig. 25E).

22. *Moranopteris sherringii* (Baker) R. Y. Hirai & J. Prado, *Taxon* 20XX.
Polypodium sherringii Baker, *J. Bot.* 20: 26. 1882. *Xiphopteris sherringii* (Baker) Copel., *Amer. Fern J.* 42: 104. 1952. *Grammitis sherringii* (Baker) Proctor, *Bull. Inst. Jamaica Sci. Ser.* 5: 35. 1953. *Micropolypodium sherringii* (Baker) A. R. Sm., *Novon* 2: 423. 1992. LECTOTYPE (designated by Proctor, 1985).—JAMAICA. **Newton district:** Port Royal Mountains, 1219–1371 m, 1873–1874, *R. V. Sherring s.n.* (K-575412; duplicates: NY-127080; frag. NY-127079; photos IJ-n.v., US-n.v.). **Figs. 30A–H.**

Plants epiphytic or epipetric. *Rhizome* erect with scales, the scales 1.6–3.1 × 0.3–0.5 mm, golden to yellow-brown, lanceolate, base slightly cordate, apex acute, sometimes with apical or subapical gland-like cell, margins entire, or sometimes with also small lateral projections. *Fronds*

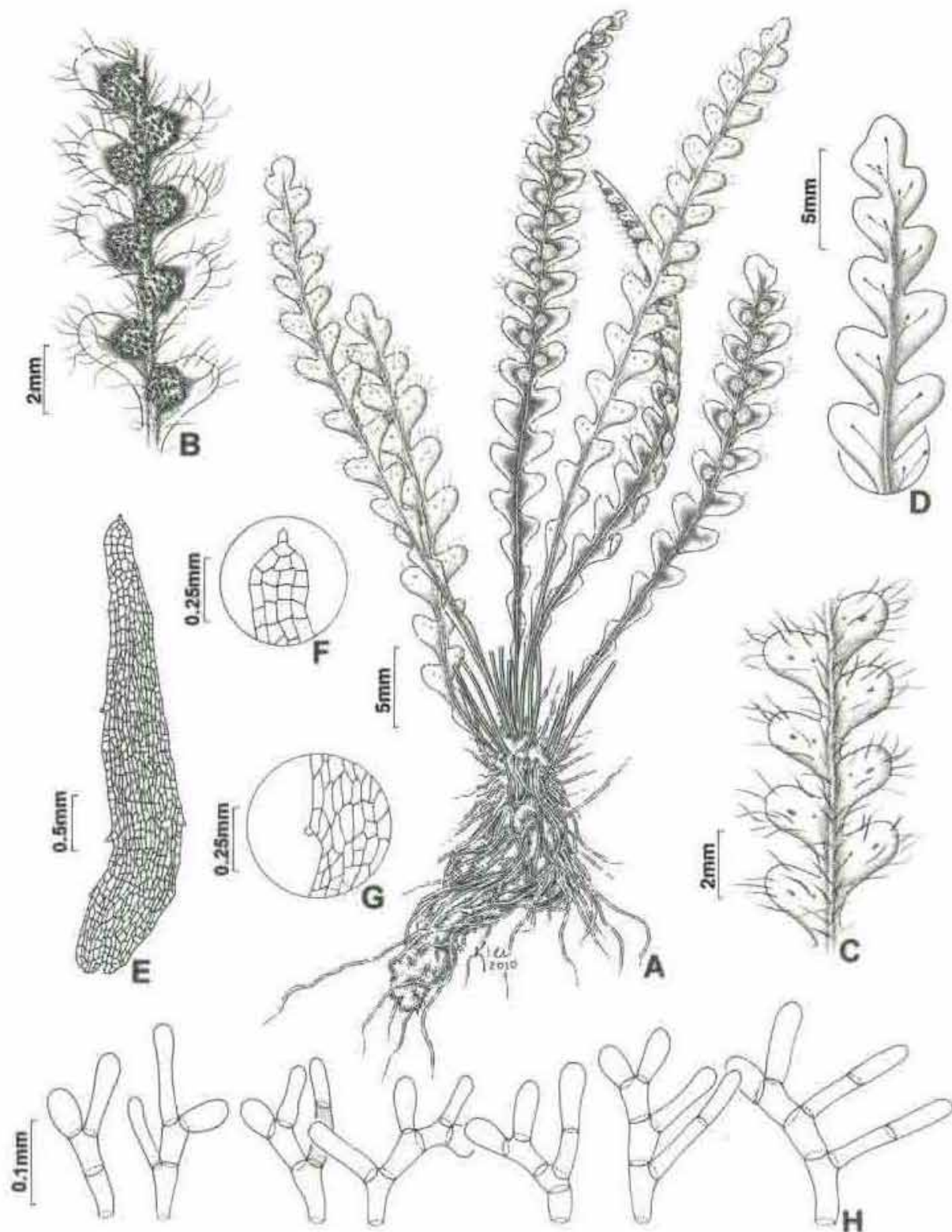


FIG. 30. *Moranopteris sherringii*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Detail of the apex of the rhizome scale. G. Detail of the margin of the rhizome scale. H. Branched hairs from the costa. A-H: Ekman 5209a (S).

erect to arcuate, determinate, 3.5–4.5 cm X 4.0–5.0 mm, sparsely setose; stipes almost absent; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous, sometimes slightly membranaceous; *costa* slightly visible with dark sclerenchyma mainly at base, sometimes slightly obscured by laminar tissue abaxially, slightly obscured by laminar tissue adaxially; *segments* ascending, ca. 50–60° to costa, 6–14 pairs, spaced ca. 0.6–1.1 mm, subopposite, not gibbous, symmetric, 2.1–2.5 X 1.5–1.8 mm, oblong, or deltate and decurrent at base, apex rounded, margins plane, without or sometimes with hyaline cells; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, elliptic or linear, or obovate; *setae* 0.6–1.2 mm long, dark red-brown, on both surfaces of the costa and laminar tissue, rarely on the margins; hairs present on the costa and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, or sometimes with branches tinged of red-brown, mostly (1 or) 2 or 3-branched, the main branch (2 or) 3 or 4 (or 5)-celled, 0.15–0.25 mm long, 1st branch 1 or 2-celled, < 0.1(–0.2) mm long, 2nd branch 1 or 2-celled, < 0.1(–0.15) mm long, 3rd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, rounded, 1.0–1.4 mm diam.

Distribution.—Endemic to Greater Antilles (Cuba, Jamaica, and Puerto Rico); 1219–1400 m (Figs. 5B, 2).

SELECTED SPECIMENS EXAMINED.—CUBA. Oriente, Sierra Maestra, Punta de Palmamocha, 1400 m, 5 Apr 1915, *Ekman 5209a* (S); Pico Turquino, Jul 1922, *Leon 11115* (NY). JAMAICA. Mar 1885, *Jenman 10* (P, frag. K).

Moranopteris sherringii are small plants (ca. 4.5 cm long), rhizome scales with entire margins, sparsely setose fronds, not gibbous segments, furcate veins, and two hydathodes per segment (Figs. 30A–D).

Proctor (1985) and other authors already pointed out that this species is very rare. Nowadays, this statement persists because all material analyzed in this study was collected between 1873–1922.

Young plants of *Moranopteris basiattenuata* sometimes can be confused with *M. sherringii*, but differs by 1-branched hairs, which has a branch \geq twice longer than the main branch. Additionally, *M. basiattenuata* is moderately to densely setose vs. sparsely setose in *M. sherringii*.

23. *Moranopteris simplex* R. Y. Hirai & J. Prado, *Taxon* 20XX. TYPE.—VENEZUELA. **Aragua:** Maracay, Choroní-Passes, 1600 m, 28 Feb 1958, K. Mägdefrau 464 (holotype: B-200077185). **Figs. 31A–F.**

Plants epiphytic. *Rhizome* erect with scales, the scales 2.0–2.2 x 0.20–0.25 mm, yellow-brown, lanceolate to slightly linear, base slightly cordate, apex acute, with apical or subapical gland-like cells, margins entire, or with also small lateral projections, these projections sometimes furcate. *Fronde*s erect to arcuate, determinate, 3.5–7.6 cm x 5.0–7.5 mm, moderately setose; stipes almost absent, brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, sometimes deeply pinnatifid, gradually tapering proximally to a narrow wing, chartaceous; *costa* obscured by laminar tissue abaxially and adaxially, sometimes slightly visible with dark sclerenchyma abaxially; *segments* slightly ascending, ca. 60–80° to costa, 18–35 pairs, spaced ca. 1.1–1.7 mm, subopposite, gibbous, asymmetric, 2.5–3.8 x 1.1–1.6 mm, oblong to oblong-lanceolate, deltate toward base, decurrent at base, apex rounded to slightly acute, margins slightly revolute, without hyaline cells; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, rarely 3 hydathodes, the hydathodes visible adaxially, elliptic or obovate, sometimes rounded; *setae* 1.1–2.7 mm long, dark red-brown, on both surfaces of the costa and laminar tissue; hairs scattered throughout the costa, laminar tissue abaxially, and margins, hyaline to yellowish, slightly red-brown, unbranched and branched, the unbranched hairs 2-celled, 0.05–0.15 mm long, the branched hairs 1 or 2-branched, mostly 1-branched, the main branch 2 or 3-celled, < 0.1(–0.2) mm long, 1st branch 1 or 2-celled, 0.10–0.15 mm long, 2nd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, rounded, 1.4–1.8 mm diam.

Distribution.—Endemic to Venezuela; 1600–1925 m (Figs. 23B, 2).

SELECTED SPECIMENS EXAMINED.—VENEZUELA. **Aragua**: Colonia Tovar, s.d., Moritz s.n. p.p. (P-637667, P-696244). **Distrito Federal**: Caracas, Monte Grappa, 18 Aug 1985, Quijada 4 (VEN); El Junquito, 1925 m, 26 Mar 1943, Killip & Rohl 37170 (US).

Moranopteris simplex is easily distinguished by the hairs. These hairs are mostly yellowish unbranched and up to 2-branched (Fig. 31F). On the whole, they differ because occur scattered throughout abaxially on the laminar tissue.

The most similar species is *Moranopteris trichomanoides*, which occurs in Greater Antilles and Central America. It differs by having branched hairs, mostly 2–4-branched (Fig. 34G), near and on the costa abaxially, without unbranched and rarely 1-branched hairs (Fig. 31F).

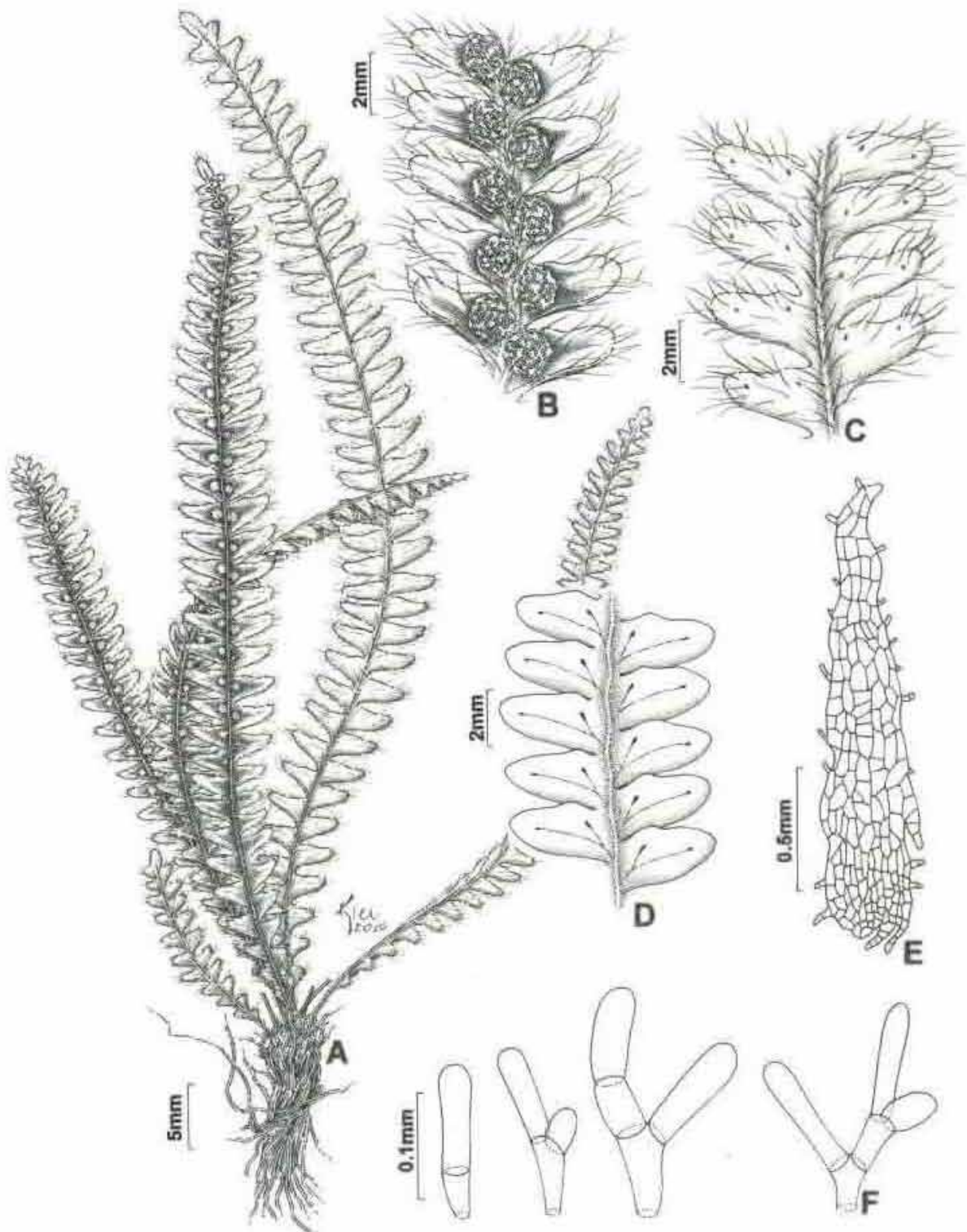


FIG. 31. *Moranopteris simplex*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Unbranched and branched hairs from the costa. A-C, E: *Mädgefrau* 464 (B). D, F: *Quijada* 4 (VEN).

The specific epithet refers to the hairs which are less branched when compared to the hairs of the most similar species (*Moranopteris trichomanoides*).

- 24. *Moranopteris taenifolia*** (Jenman) R. Y. Hirai & J. Prado, *Taxon* 20XX.
Polypodium taenifolium Jenman, *Bull. Bot. Dept. Jamaica*, n.s. 4: 114. 1897. *Xiphopteris taenifolia* (Jenman) Copel., *Amer. Fern J.* 42: 109. 1952. *Grammitis taenifolia* (Jenman) Proctor, *Bull. Inst. Jamaica Sci. Ser.* 5: 35. 1953. *Micropolypodium taenifolium* (Jenman) A. R. Sm., *Novon* 2: 423. 1992. LECTOTYPE (designated by Proctor, 1985).—JAMAICA. **Saint Andrew:** Monte Moses, near Mt. Moses, s.d., G. Syme s.n. p.p. (J.P. 197) (IJ-n.v.). **Figs. 32A–F.**

Polypodium daguense Hieron., *Bot. Jahrb. Syst.* 34: 504. 1904. *Xiphopteris daguensis* (Hieron.) Copel., *Amer. Fern J.* 42: 107. 1952. *Grammitis daguensis* (Hieron.) C. V. Morton, *Contr. U.S. Natl. Herb.* 38: 98. 1967. TYPE.—COLOMBIA. **Cauca:** Río Dagua, 20 Sep 1882, F. C. Lehmann 1951 (holotype: B-200091630; photo US-692650).

Polypodium sintenisii Hieron., *Hedwigia* 44: 101. 1905. LECTOTYPE (here designated).—PUERTO RICO. Without exact locality, Jul 1885, P. Sintenis 1796 (B-200150131; duplicates: B-200150130 p.p.; M-151279, frag. NY-127081 p.p., P-632719, P-696185, P-637692, P-637691, S-08-21047, US-833633,).

Polypodium blepharolepis C. Chr., *Index Filic.: Suppl.* 1: 58. 1913. *Polypodium gracillimum* Hieron., *Hedwigia* 48: 250, t. 12, f. 18. 1909, *nom. illeg., non* Copeland (1905). *Xiphopteris blepharolepis* (C. Chr.) Copel., *Amer. Fern J.* 42: 109. 1952. *Grammitis blepharolepis* (C. Chr.) C. V. Morton, *Contr. U.S. Natl. Herb.* 38: 98. 1967. TYPE.—ECUADOR. Excursiva von Quito norh Mindo, s.d., M. A. Stübel 747 (holotype: B-200149304).

Polypodium blepharodes Maxon, *Contr. U.S. Natl. Herb.* 17: 407. 1914. *Xiphopteris blepharodes* (Maxon) Copel., *Amer. Fern J.* 42: 109. 1952. *Grammitis blepharodes* (Maxon) F. Seym., *Phytologia* 31: 173. 1975. TYPE.—COSTA RICA. Vicinity of La Palma, 1450–1550 m, 6–8 May 1906, W. R. Maxon 406 (holotype: US-575795; isotype: NY-144938).

Plants epiphytic. Rhizome erect with scales, the scales 0.7–2.1 mm X (0.2–)0.3–0.6 mm, golden to slightly yellow-brown, mostly tinged of red-brown on the 1/3 of distal portion, ovate-lanceolate to lanceolate, base cordate to slightly truncate, apex acute, margins with long setiform

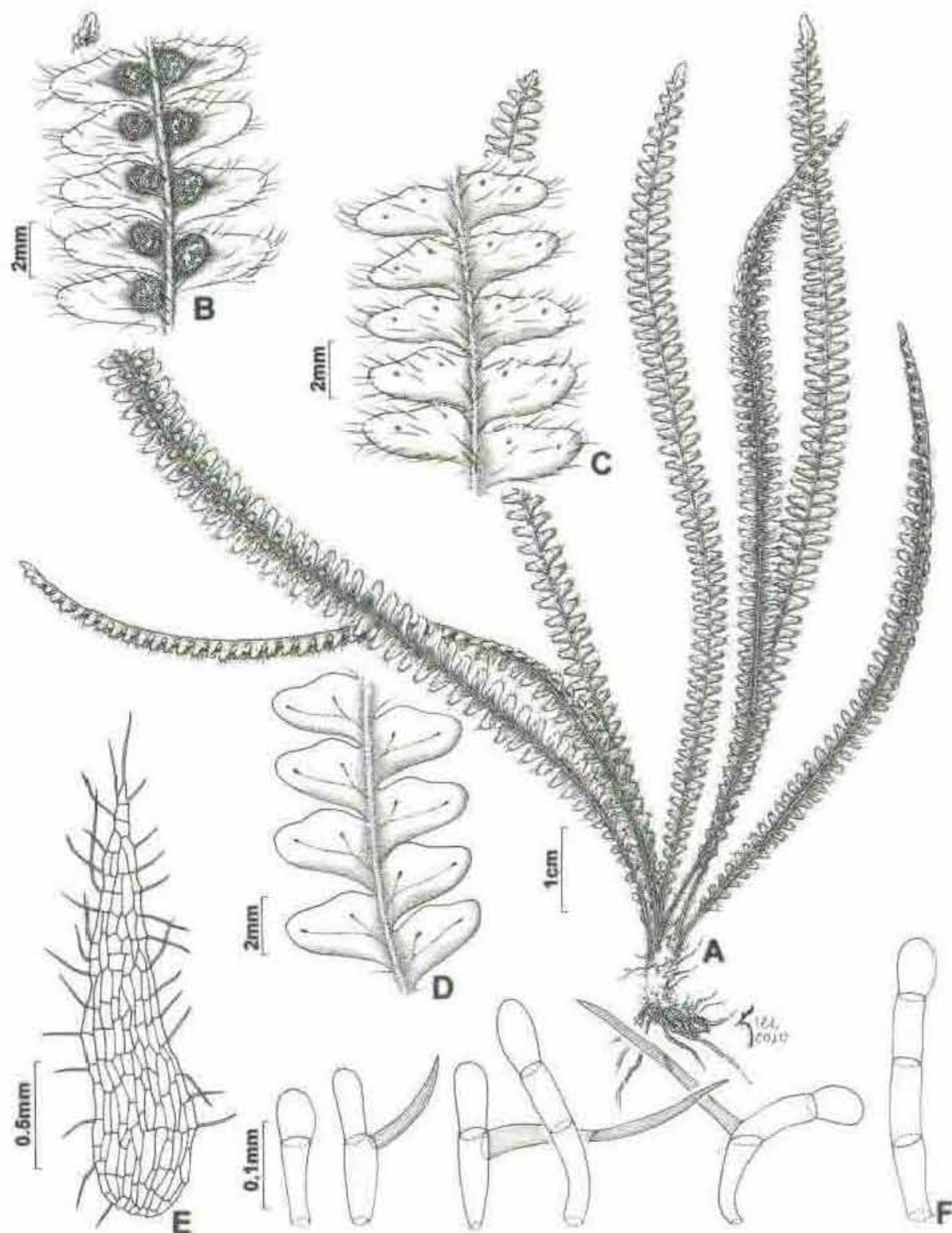


FIG. 32. *Moranopteris taenifolia*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Unbranched and branched hairs (with one setiform branch) from the costa. A-C, E: Axelrod et al. 408 (UPRRP). D, F: Granville 3557 (CAY).

projections, these projections red-brown, 0.15–0.30 mm long. *Fronde* erect to arcuate, determinate, 5.0–15.0(–36.0) cm x (2.0–)4.0–9.0 mm, moderately setose; *stipe* (0.4–)1.1–2.0 cm long, yellow-brown to dark-brown, wings absent; *laminae* linear, pinnatisect, sometimes pinnate at base, gradually tapering proximally, chartaceous; *costa* visible with dark sclerenchyma abaxially, obscured by laminar tissue or sometimes slightly visible with dark sclerenchyma adaxially; *segments* patent, 80–90° to costa, 38–62(–110) pairs, spaced 0.4–1.0 mm, alternate to subopposite, gibbous, asymmetric, (1.3–)2.3–3.9(–4.9) x (0.7–)1.0–1.9(–2.7) mm, oblong to lanceolate, slightly decurrent at base, apex acute to rounded, margins plane to slightly revolute, without hyaline cells or inconspicuous; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, the hydathodes visible adaxially, oblong or obovate; *setae* 0.3–1.1(–1.4) mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the stipe, costa, and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, unbranched and branched, these branched hairs with 1 or 2 setiform branch, the unbranched hairs mostly 2–4-celled, 0.10–0.25(–0.35) mm long, the branched hairs 1 or 2-branched, the main branch 2 or 3-celled, 0.10–0.15(–0.20) mm long, 1st branch with setiform branch, (0.15–)0.2–0.5 mm long, 2nd branch, if present, with setiform branch, (0.15–)0.2–0.3 mm long. *Sori* one per segment, rounded, 0.7–1.7 mm diam.

Distribution.—Mexico, Belize, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Jamaica, Haiti, Dominican Republic, Puerto Rico, Saint Kitts and Nevis, Guadeloupe, Martinique, Trinidad and Tobago, French Guiana, Suriname, Guyana, Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil; 30–2650 m (Figs. 33A, 2).

SELECTED SPECIMENS EXAMINED.—MEXICO. **Chiapas:** Berriozábal, 13 km north of Berriozábal near Pozo Turipache and Finca El Suspiro, 900 m, 25 Dec 1972, *Breedlove 30809* (NY). **Oaxaca:** Tehuantepec, between La Chiguzhé and Guevea de Humboldt, 1219–1371 m, 25 Jul 1972, *Hallberg 1728* (NY). BELIZE. **Toledo:** Along divide of Maya Mountains, Bladen Nature Reserve, 950–1000 m, 16°31'N, 88°57'W, 12 May 1996, *Holst et al. 5248* (UC). GUATEMALA. **Alta Verapaz:** Near Chirriacté, on the Petén highway, 900 m, 9 Apr 1941, *Standley 91702* (UC). HONDURAS. **Olancho:** Along Río Olancho, on road between San Francisco de la Paz and Gualaco, 13.6 mi SW of Gualaco, 1300 m, 15°00'N, 86°07'W, 6 Feb 1987, *Croat & Hannon 64276* (UC). NICARAGUA. **Granada:** On Mombacho Volcano, 1300 m, 5 Jan 1967, *Williams & Molina 20007* (NY). **Jinotega:** Macizos de Peñas Blancas, top and N slope of steep ridge SW of finca of Manuel Estrada (El Cielo), S of Río Gusaneras, 1200–1330 m, 13°15'N, 85°42'W, 16 Jan 1979, *Stevens & Krukoff 11523* p.p. (UC). **Matagalpa:** Disparate de Potter, Sta.

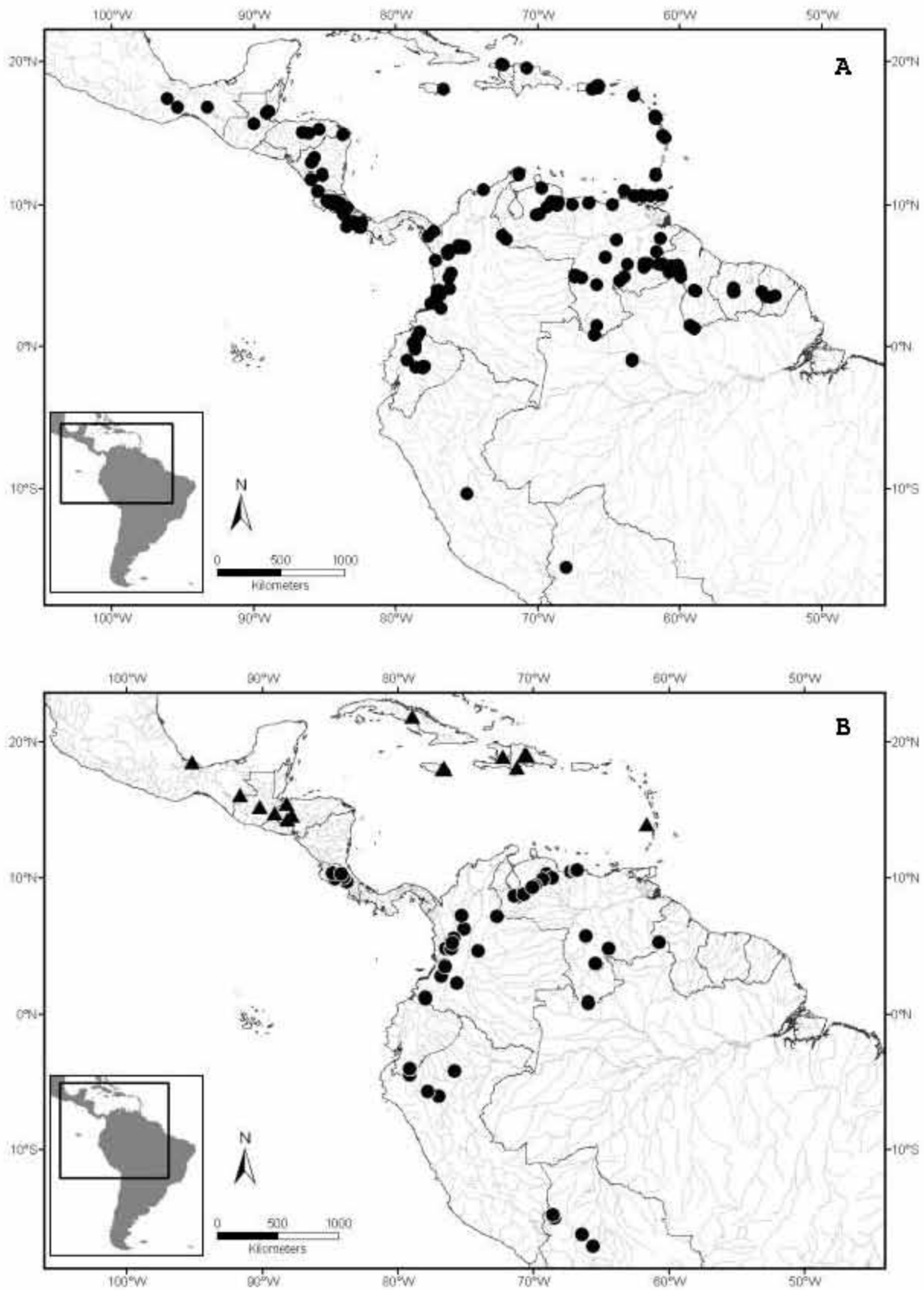


FIG. 33. A. Distribution of *Moranopteris taenifolia* (●). B. Distribution of *M. trichomanoides* (▲) and *M. truncicola* (●).

María de Ostuma, Cordillera Central de Nicaragua, 1600 m, 15 Jan 1965, *Williams et al.* 27621 (NY). COSTA RICA. **Alajuela:** Volcán Poas summit area and lake, 2500–2650 m, 6 Jul 1967, *Bishop 805* (UC). **Cartago:** ca. 22 km E of Turriaba, high ridge above Platanillo, 1200–1450 m, 22 Aug 1967, *Mickel 3396* (LP, NY, UC). **Guanacaste:** Guanacaste National Park, Estación Biológica Pitilla, 7 km SE de Santa Cecilia, east slope of Volcán Orosí, 800 m, 11°00'N, 85°30'W, 8 May 1992, *Moran & Moran 5819* (NY, UC). **Heredia:** P. N. Braulio Carrillo, entrada Quebrada Gonzales, 513 m, 10°N, 84°W, 23 Jan 2008, *Sundue 1653* (NY). **Limón:** Cantón de Pococí, Cordillera Central, forests mainly to the E of main E branch of Quebrada El Molinete, 480–520 m, 10°10'25"N, 83°55'10"W, 24 Jul 1994, *Grayum & Perry 10675* (UC). **Puntarenas:** Cantón de Golfinho, P. N. Corcovado, Península de Osa, Cerro Rincón, Nacientes del Río Tigre, 700–745 m, 08°31'N, 83°28'W, 28 Jan 1998, *Rojas et al.* 4195 (NY). **San José:** Along unnamed north fork of Río Zurquí, upstream from highway, north of tunnel, Cordillera Central, 1500–1600 m, 10°04'N, 84°01'W, 18 Jan 1986, *Smith et al.* 1649 (UC). PANAMA. **Chiriquí:** Along trail between north fork of Río Palo Alto and Cerro Pate Macho, ca. 6 km NE of Boquete, 1600–2000 m, 08°48'N, 82°23'W, 6 Feb 1986, *Smith et al.* 2417 (UC). **Darién:** Along ridge trail from Cana up the Cerro Pirre Massif, 1000–1300 m, 07°50'N, 77°40'W, 3 May 1990, *Moran 5065* (UC). JAMAICA. **Portland:** On middle western slopes of Crown Peak, John Crow Mts., 838 m, 27 May 1950, *Proctor 4586* (PH). HAITI. Massif du Nord, Bayeux, Morne Brigarest, on top of the mountain, 900–1150 m, 20–21 Dec 1924, *Ekman 2982a* (S). DOMINICAN REPUBLIC. **Santo Domingo.** Santiago, Cordillera Septentrional, Loma Diego de Ocampo, 1200 m, 4 Dec 1930, *Ekman 16311* (NY, S). PUERTO RICO. Bosque Nacional Luquillo, cumbre de Monte Britton, 900 m, Sep–Oct 1966, *Byer 66-1008* (UPRRP). SAINT KITTS AND NEVIS. Saint Kitts, Slopes Mt. Misery, 8 Sep–5 Oct 1901, *Britton & Cowell 515* p.p. (NY). GUADELOUPE. Bains Jaunes entre Ajoupa et Savane à Mulets, 1 Jan 1937, *Stehlé & Stehlé 1470* p.p. (P); Basse Terre, comm. Petit-Bourg-Bouillante, Parc National de la Guadeloupe, route de la Traversée D23, Trace de Mamelle de Pigeon ou Déboulé, 615–768 m, 16°11'N, 61°44'W, 22 Mar 2005, *Christenhusz 4214* (UC). MARTINIQUE. Montagne Pelée, morne Paillasse, 600–1000 m, 1884, *Duss 1554* (NY). TRINIDAD AND TOBAGO. **Trinidad,** Height of Aripo, 10–26 Jan 1922, *Broadway 9954* (NY, US). FRENCH GUIANA. Mont Atachi Bacca-Région de l'Inini, plateau sommitale, 650 m, 03°33'N, 53°55'W, 16 Jan 1989, *Cremers et al.* 10248 (CAY, NY, P). SURINAME. **Sipaliwini:** East ridge overlook (Tafelberg), trail around the east ridge overlook of the Tafelberg, 990 m, 03°53'05"N, 56°08'28"W, 2 Jul 2001, *Hawkins 2111* (MO, NY, US). GUYANA. **Cuyuni-Mazaruni:** Monte Roraima, NW facing slopes of Mt. Roraima, vicinity of Camp 6, near the end of the "Waruma Trail", 1280–1310 m, 05°16'30"N, 60°44'45"W, 23 Mar 1978, *Warrington et al. K.E.R. 9* (NY). **Potaro-Siparuni:** Pakaraima Mts, Mt. Kukuinang, 2–3 km SSW from mountain peak, 950–1050 m, 05°04'N, 59°57'W, 27

Feb 1993, *Henkel et al.* 1628 (US). **U. Takutu-U. Essequibo:** Makarapan Mt., southern false summit, 870 m, 03°57'55"N, 58°51'58"W, 29 Sep 1997, *Clarke et al.* 6881 (CAY, NY, US). VENEZUELA. **Amazonas:** Atures, Caño Piedra, 115 km al SE de Puerto Ayacucho, 1500 m, 04°54'N, 66°54'W, Sep 1989, *Sanoja et al.* 2960 (UC). **Aragua:** El Portachuelo, between Ocumare and Maracay, 8 May 1925, *Pittier* 11821 (US). **Bolívar:** Cedenó, Serranía de Maigualida, 20 km al E de San José de Kayamá, 45 km al N de Cerro Impacto, 1250 m, 06°19'N, 65°12'W, Apr 1989, *Fernandez* 5435 (MO, UC). **Falcón:** Sierra de San Luis, arriba de Sta Maria, 1200 m, 6 May 1979, *van der Werff* 3492 (UC). **Lara:** Palavecino, road to Parque Nacional Terepaima, riecito, ca. 9 km SE of town of Río Claro, near summit of road, 1600 m, 09°53'N, 69°19'W, 14 Nov 1982, *Smith et al.* 1278 p.p. (MO, UC). **Miranda:** Paéz, Fila La Tigra, Qdo. San Juan, 18 km al SO de Cúpira, 10°04'N, 64°45'W, 2–7 Sep 1977, *Ortega & González* 399 (MO, UC). **Monagas:** Caripe, Cordillera de la Costa, 10 km al este de Caripe (distancia aérea), Quebrada Grande, propiedad de Rolf Struppek, 1250–1350 m, 10°10'30"N, 66°24'W, 28 Feb 2006, *Meier & Struppek* 13478 (UC). **North Santander:** Cúcuta, 17 Apr 1879, *Kalbreyer* 1184 (B). **Nueva Esparta:** Isla de Margarita, Cerro Copey, south of Santa Ana, 800–850 m, 11°02'N, 63°55'W, 24 Mar 1985, *Steyermark et al.* 131054 (UC). **Portuguesa:** Guanare, ESE of Paraíso de Chabasquén, along road to Córdoba, ca. 27 min. from Chabasquén, just below summit and below road, 1500 m, 09°23'N, 69°54'W, 7 Nov 1982, *Smith et al.* 1100 (UC). **Sucre:** Arismendi, Península de Paria, between Tacarigua and headwaters of Río Tacarigua, east of Cerro Humo, N of Río Grande Arriba, 700–900 m, 10°41'N, 62°36'W, 23 Feb 1980, *Steyermark et al.* 121633 (MO, NY, UC). **Táchira:** Cerro Azul at Cerro Las Minas, 18 km southeast of Santa Ana, 1200–1380 m, 07°36'N, 72°13'W, 11 Nov 1979, *Steyermark et al.* 120024 (MO, UC). **Yaracuy:** Urachiche, Monumento Natural María Lionza, Cordillera de la Costa, al sur de Chivacoa, subida Quebrada Quibayo-La Fortaleza-Tres Casitas, entre Tres Casitas y 1000 m, 780–1000 m, 10°06'N, 68°55'W, 26 Mar 2004, *Meier et al.* 10334 (UC). COLOMBIA. **Antioquia:** Anorí, Reserva la Forzosa, 1815 m, 06°59'15"N, 75°08'35"W, 27 Sep 2003, *Rodríguez et al.* 4003 (NY). **Cauca:** Río San Juan de Micay, 60 m, 21 Dec 1946, *Haught* 5364 (S, US). **Chocó:** Cerro Tacarcuna, to the Serranía del Darien, Cerro Mali, on border with Panama, 1200–1400 m, 17 Jan 1975, *Gentry & Mori* 13697 (MO). **Magdalena:** Alto Río Buritaca, Alto de Mira, por el camino hasta el pico de 1500 m, 1100–1500 m, 11°05'N, 73°48'W, 16 Jul 1989, *Madriñán & Barbosa* 328 (GH). **Risaralda:** Pueblo Rico, Vereda Montebello, cerca a Los Cajones, subiendo hacia la base militar, 1974 m, 05°15'03"N, 76°06'22"W, 14 Apr 2007, *Vasco & Sundue* 618 (NY). **Valle del Cauca:** Agua Clara, along highway from Buenaventura to Cali, 100 m, 6 Jun 1944, *Killip & Cuatrecasas* 38919 (US). ECUADOR. **Carchi:** Plateau above San Marcos de los Coaiqueres, on trail towards Gualpí Bajo, 1000 m, 01°06'N, 78°17'W, 7 Feb 1985, *Øllgaard et al.* 57291 (UC). **Carchi-Esmeraldas:** near

Lita, 600 m, 19 May 1987, *van der Werff et al.* 9511 (UC). **Cotopaxi:** Quevedo-Latacunga road, km 46 from Quevedo, 600 m, 00°55'S, 79°11'W, 4 Apr 1973, *Holm-Nielsen et al.* 2920 (NY, UC). **Imbabura:** In the vicinity of the Río Verde, ca. 5 km SW from the village of Mani, Río Cachaco, 1300 m, 00°46'N, 78°28'W, 7 Jun 1980, *Sperling & Bleiweiss* 5085 (US). **Pastaza:** Mera Canton, N northwest of Shell, 1100 m, 01°29'S, 78°04'W, 22 Jul 1992, *Fay & Fay* 3686 (MO). **Pichincha:** Reserva Maquipucuna, along Sendero Principal to Cerro Sosa, 1300–1900 m, 23 Aug 2001, *Smith et al.* 2827 (UC). PERU. **Ancash:** La Pampa, Río Tavera, 1916, *Watkins s.n.* (US). **Pasco:** Oxapampa, Pichis Valley, San Matias ridge, a 0–12 km SW of Puerto Bermúdez, above Santa Rosa de Chivis, trail to Puerto Nuevo, 500–900 m, 10°20'S, 75°00'W, 8 Sep 1982, *Foster* 8616 (MO). BOLIVIA. **La Paz:** Ticunhuaya, 1524 m, Apr 1926, *Tate* 1055 (US). BRAZIL. **Amazonas:** Barcelos, Platô da Serra Aracá, pico em cima da Serra Norte, 1400 m, 00°57'S, 63°22'W, 22 Feb 1984, *Amaral* 1649 (INPA, NY).

Moranopteris taenifolia is the most widely distributed species in Neotropic (Fig. 33A) and also it is the most common of the genus. The hairs are distinctive features of this species. These hairs are unbranched and branched with 1 or 2 setiform branch (Fig. 32F). Furthermore it has rhizome scales with long setiform projections on the margins, moderately setose fronds, gibbous segments, furcate veins, and two hydathodes per segment (Figs. 32A–E).

Moranopteris taenifolia can sometimes be confused with specimens of *Moranopteris nana* that occurs in Mato Grosso (Brazil) and French Guiana, because these species might have the same kind of hairs, unbranched hairs and sometimes branched hairs with a setiform branch. However, they can be easily distinguished by other characters as commented in *M. nana*.

The fragment of the type of *Polypodium sintenisii* at NY-127081 is pro parte with *Mazé s.n.*, and both are *Moranopteris taenifolia*.

- 25. *Moranopteris trichomanoides* (Sw.) R. Y. Hirai & J. Prado, Taxon 20XX.**
Polypodium trichomanoides Sw., Prodr. 131. 1788. *Grammitis trichomanoides* (Sw.) Ching, Bull. Fan Mem. Inst. Biol. 10: 16. 1940.
Xiphopteris trichomanoides (Sw.) Copel., Gen. Fil. 215. 1947.
Micropolypodium trichomanoides (Sw.) A. R. Sm., Novon 2: 423. 1992.
LECTOTYPE (designated by Smith, 1995).—JAMAICA. Without exact locality, s.d., *O. P. Swartz s.n.* (S-n.v.; duplicates: FI-n.v., M-151256, P-637672; frag. B-Herb. Willd. 19670; microfiche UC-n.v.; photos GH-n.v., US-n.v.; UPS-Thunb. 24583-n.v.). **Figs. 34A–G.**

Plants epiphytic. Rhizome erect with scales, the scales 2.2–4.7 x 0.25–0.60 mm, yellow-brown, lanceolate to linear, base slightly cordate to truncate, apex acute, with apical or subapical gland-like cells, margins

entire, or with small to large lateral projections, these projections sometimes furcate. *Fronde*s erect to arcuate, determinate, 4.6–12.0(–17.0) cm X (3.5–)4.0–6.0(–7.5) mm, moderately setose; stipes 0.20–0.35(–2.0) cm long, brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costa* slightly visible with dark sclerenchyma adaxially, sometimes slightly obscured by laminar tissue abaxially; *segments* patent to slightly ascending, ca. 70–90° to costa, 20–45(–84) pairs, spaced (0.3–)0.8–2.0 mm, alternate to subopposite, gibbous, asymmetric, 1.9–4.2 X (0.8–)1.2–2.1 mm, oblong to oblong-lanceolate, sometimes linear, deltate toward base, decurrent at base, apex rounded to slightly acute, margins plane, without hyaline cells; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, rarely 3 or 4 hydathodes, the hydathodes visible adaxially, elliptic or obovate; *setae* 0.8–2.0 mm long, dark red-brown, on both surfaces of the costa and laminar tissue; hairs present on the costa and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, (1 or) 2 or 3(or 4)-branched, the main branch (2 or) 3 or 4(–6)-celled, 0.1–0.2(–0.3) mm long, 1st branch 1 or 2(or 3)-celled, < 0.1(–0.15) mm long, 2nd branch 1 or 2(or 3)-celled, < 0.1(–0.15) mm long, 3rd and 4th branch, if present, 1(or 2)-celled, < 0.1 mm long. *Sori* one per segment, rounded, 0.9–1.5(–1.9) mm diam.

Distribution.—Mexico, Guatemala, Honduras, Cuba, Jamaica, Haiti, Dominican Republic, and Guadeloupe; 825–2263 m (Figs. 33B, 2).

SELECTED SPECIMENS EXAMINED.—MEXICO. **Chiapas:** La Trinitaria, east of Laguna Tzikaw, Monte Bello National Park, 1300 m, 23 Jan 1973, *Breedlove & Smith* 32225-A (NY). **Veracruz de la Llave:** San Andrés Tuxtla, Ejido Barrio Lerdo, Fladas del Volcán San Martín Tuxtla, 1480 m, 18°33'N, 95°11'W, 24 Aug 2005, *Krömer & Acebey* 2541 (UC). GUATEMALA. **Alta Verapaz:** Cobán, 1350 m, May 1908, *von Türckheim* 2383 (P). **Baja Verapaz:** Sierra de las Minas about 5 km, S of Purulhá, 1600 m, 2 Jan 1973, *Williams et al.* 41935 (UC). HONDURAS. **Comayagua:** Above El Achiote, above the plains of Siguatepeque, 1800 m, 28 Jul 1936, *Yuncker et al.* 6659 (NY). **Cortés:** Cantilles a Jilincó, trail from cerro Cantiles to Cerro Jilincó, 2140 m, 15°30'N, 88°14'W, 20 Mar 1993, *Hawkins & Mejía* 663 (TEFH). **Intibucá:** Cerro Duraznito, 25 km E de La Esperanza, 2000 m, 1 Mar 1985, *Gomez* 114 (NY). CUBA. Oriente, Crest of Sierra Maestra between Pico Turquino and La Bayamesa, 1350 m, 27–28 Oct 1941, *Morton & Acuna* 3552 (NY). JAMAICA. **Portland:** Along Murdock's Gap trail northwest from Portland Gap, 1676 m, 21 Apr 1951, *Proctor* 5787 (PH). **Saint Thomas:** along trail between Portland Gap and Blue Mt. Peak, 1676 m, 22 Jan 1967, *Evans* 2609 (LP). **Saint Andrew:** Slopes of Monkey Hill, above New Haven Gap, 1800 m, 22 Jun 1904, *Maxon* 2752 (B, NY, P, S). HAITI. Massif du Nord,

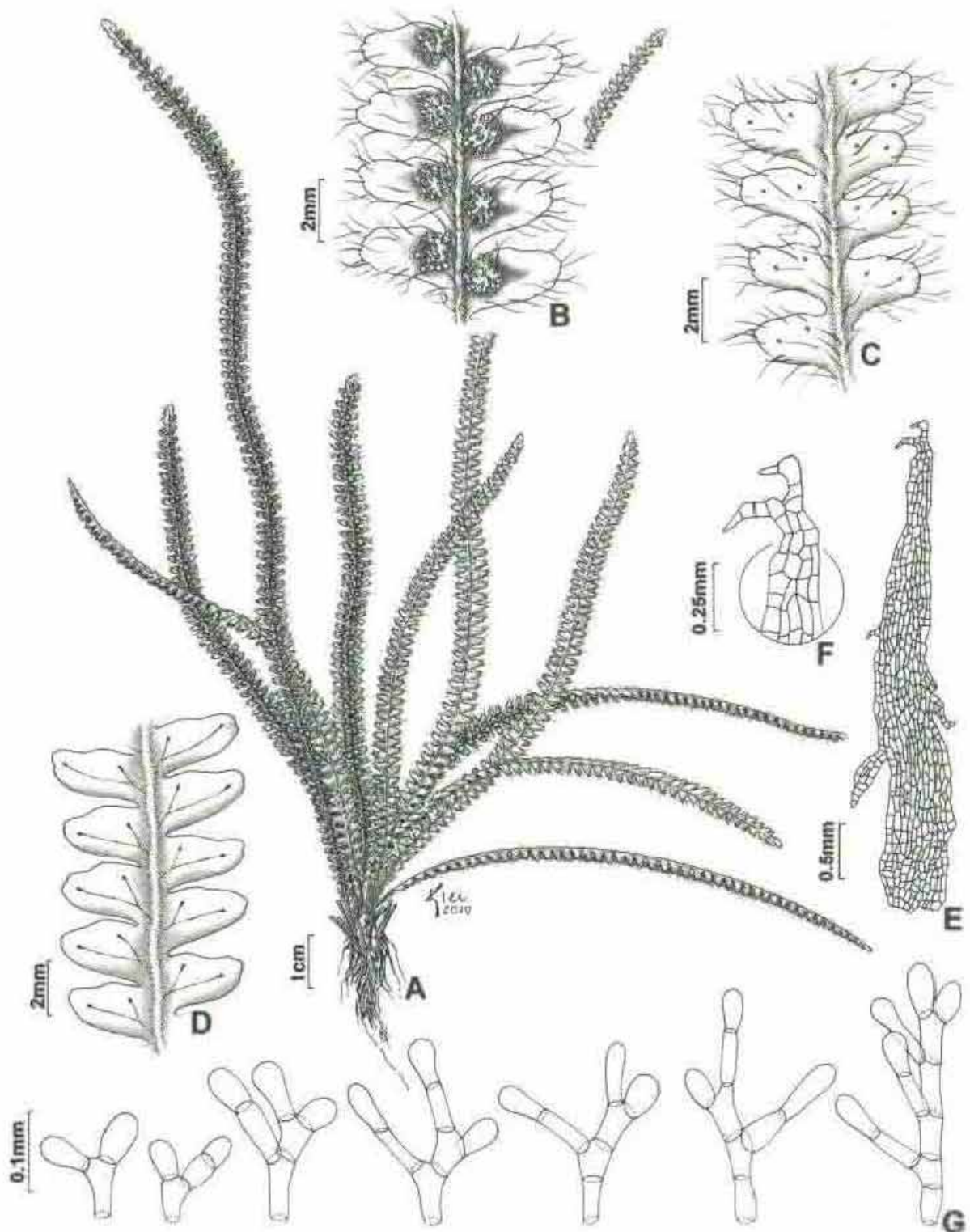


FIG. 34. *Moranopteris trichomanoides*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Detail of the apex of the rhizome scale. G. Branched hairs from the costa. A-C: Yuncker 18597 (NY). D, G: Gomes 114, NY. E, F: Underwood 966 (NY).

Le Borgne, Morne Darras, eastern top of the mountain, 1150 m, 3 Sep 1945, *Ekman* 4768 p.p. (K). DOMINICAN REPUBLIC. Barahona, between Monteada Nueva and Loma Alta, 1524 m, 2 Aug 1950, *Howard* 12319 (NY); Loma de la Sal, 1300–1400 m, 30–31 Oct 1968, *Liogier* 13370 (NY); Santo Domingo, La Vega, Reserva Científica Ebano Verde, en la cima de loma La Sal, 1350–1440 m, 19°04'N, 70°34'W, 27 May 1992, *Zanoni et al.* 45973 (NY). GUADELOUPE. Rochers de Godard-Gommier, s.d., *L'Herminier* 145 p.p. (P-696241, P-696242).

Moranopteris trichomanoides is characterized by rhizome scales with entire margins, gibbous segments, furcate veins, mostly two hydathodes per segment, and branched hairs (Figs. 34A–G).

Some specimens from Dominican Republic have linear segments, the segments are more spaced than in other specimens, sometimes with three or four hydathodes per segment, but they were interpreted here as variation in *Moranopteris trichomanoides*.

Moranopteris simplex, an endemic species from Venezuela, is the most similar species to *M. trichomanoides*. See *M. simplex* for comparison with that species.

26. *Moranopteris truncicola* (Klotzsch) R. Y. Hirai & J. Prado, *Taxon* 20XX. *Polypodium truncicola* Klotzsch var. *major* Klotzsch, *Linnaea* 20: 374. 1847. *Xiphopteris truncicola* (Klotzsch) Copel., *Amer. Fern J.* 42: 101. 1952. *Grammitis truncicola* (Klotzsch) C. V. Morton, *Contr. U.S. Natl. Herb.* 38: 98. 1967. *Micropolypodium truncicola* (Klotzsch) A. R. Sm., *Novon* 2: 423. 1992. LECTOTYPE (designated by Morton, 1967).—VENEZUELA. Colonia Tovar, s.d., *J. W. K. Moritz* 252 p.p. (US-1421963; duplicates: B-200142665, B-200142666 p.p., K s.n., L-52405, P-632712, P-632713, frag. P-696231, frag. US-867057). **Figs. 35A–F.**

Polypodium truncicola Klotzsch var. *minor* Klotzsch, *Linnaea* 20: 374. 1847. LECTOTYPE (designated by Morton, 1967).—VENEZUELA. Mérida, s.d., *J. W. K. Moritz* 333 p.p. (US-1067579; duplicates: US-523530 p.p., B-200142667, B-200142666, K p.p., NY-148624, P-637671 p.p., frag. NY-148628).

Polypodium andinum Hook., *Sec. Cent. ferns*, t. 6. 1860. *Grammitis andina* (Hook.) Ching, *Bull. Fan. Mem. Inst. Biol., Bot.* 10: 240. 1941. LECTOTYPE (designated by Morton, 1967).—ECUADOR. Banks of Río Hondacha, s.d., *W. Jameson* 780 (K-575415; duplicate: BM-n.v.).

Plants epipetric. *Rhizome* erect with scales, the scales 0.7–3.9 mm X 0.1–0.3 mm, golden to yellow-brown, lanceolate to slightly linear, base slightly cordate to truncate, apex acute, sometimes with apical or subapical gland-like cells, margins with long setiform projections, or

sometimes with also small lateral projections, setiform projections occurring on the scale surface, setiform projections red-brown, 0.1–0.2 mm long. *Fronde* erect to slightly pendent, determinate, sometimes ± indeterminate, (5.0–)7.1–20.0(–23.0) cm X (5.0–)6.5–11.5 mm, moderately to densely setose; *stipe* 0.2–0.4(–2.5) cm long, yellow-brown to dark-brown, narrowly winged; *laminae* linear, pinnatifid, deeply pinnatifid or pinnatisect, gradually tapering proximally to a narrow wing, membranaceous to slightly chartaceous; *costa* visible with dark sclerenchyma or obscured by laminar tissue abaxially, obscured by laminar tissue adaxially; *segments* slightly ascending, 65–80° to costa, 30–61(–70) pairs, spaced 0.1–1.4 mm, opposite to subopposite, not gibbous, sometimes slightly gibbous, symmetric, (2.4–)2.9–7.0 X (1.5–)2.0–3.2 mm, oblong, deltate and decurrent at base, apex rounded, to slightly truncate, sometimes crenulate, margins plane, with hyaline cells inconspicuous; *veins* usually furcate, at least in fertile segments, or sometimes simple in sterile segments, obscured, (1)2 hydathodes per segment, rarely 3 hydathodes, the hydathodes visible adaxially, elliptic or obovate, sometimes linear; *setae* (0.9–)1.2–3.3 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; hairs present on the costa and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, 1 or 2 (or 3)-branched, the main branch 2–4-celled, (<–)0.15(–0.25) mm long, 1st branch 1 or 2-celled, (<–)0.1(–0.25) mm long, 2nd branch, 1 or 2-celled, < 0.1(–0.15) mm long, 3rd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, rounded, (0.6–)1.0–1.7 mm diam.

Distribution.—Costa Rica, Guyana, Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil; (600–)1050–2775 m (Figs. 33B, 2).

SELECTED SPECIMENS EXAMINED. —COSTA RICA. **Cartago:** Quebrada Val Verde, 1500–1800 m, 09°43'N, 83°47'W, 1 Feb 1986, *Smith et al.* 2157 (UC). **Cascajal:** Jun 1920, *Lankester s.n.* (K). **Heredia:** National Park Braulio Carrillo, entre OTS-Station La Selva e Volcán Barva, 1700 m, 7 Apr 2003, *Kluge* 5932 (GOET). **La Palma:** 1400 m, 14 Mar 1908, *Brade* 21 (P, S). **Puntarenas:** Monte Verde, 1709 m, 10°20'19"N, 84°47'34"W, 1 Feb 2008, *Sundue et al.* 1729 (NY). **San José:** ao longo do Río Zurqui, Cordillera Central, 1400–1500 m, 10°03'N, 84°01'W, 18 Jan 1986, *Smith et al.* 1737 (UC). GUYANA. **Cuyuni-Mazaruni:** Upper slope Roraima, 1884, *im Thurn* 348 (K). VENEZUELA. **Amazonas:** Atabapo, Cerro Marahuaca, cumbre, sección suroriental, vecindades del zanjón, 2685 m, 03°37'N, 65°21'W, 15 Jan 1981, *Maguire et al.* 65651 (MO, NY). **Aragua:** Colonia Tovar e vicinity, 2100–2200 m, 26 Dec 1921, *Pittier* 9997 (US). **Bolívar:** Meseta de Jaua, Cerro Jaua, cumbre de la porción Central, Occidental de la Meseta, 36 millas náuticas o 60 km, noroeste de la misión de Campamento Sanidad del Río Kanarakuni, 1922–2100 m, 04°45'N, 64°26'W,

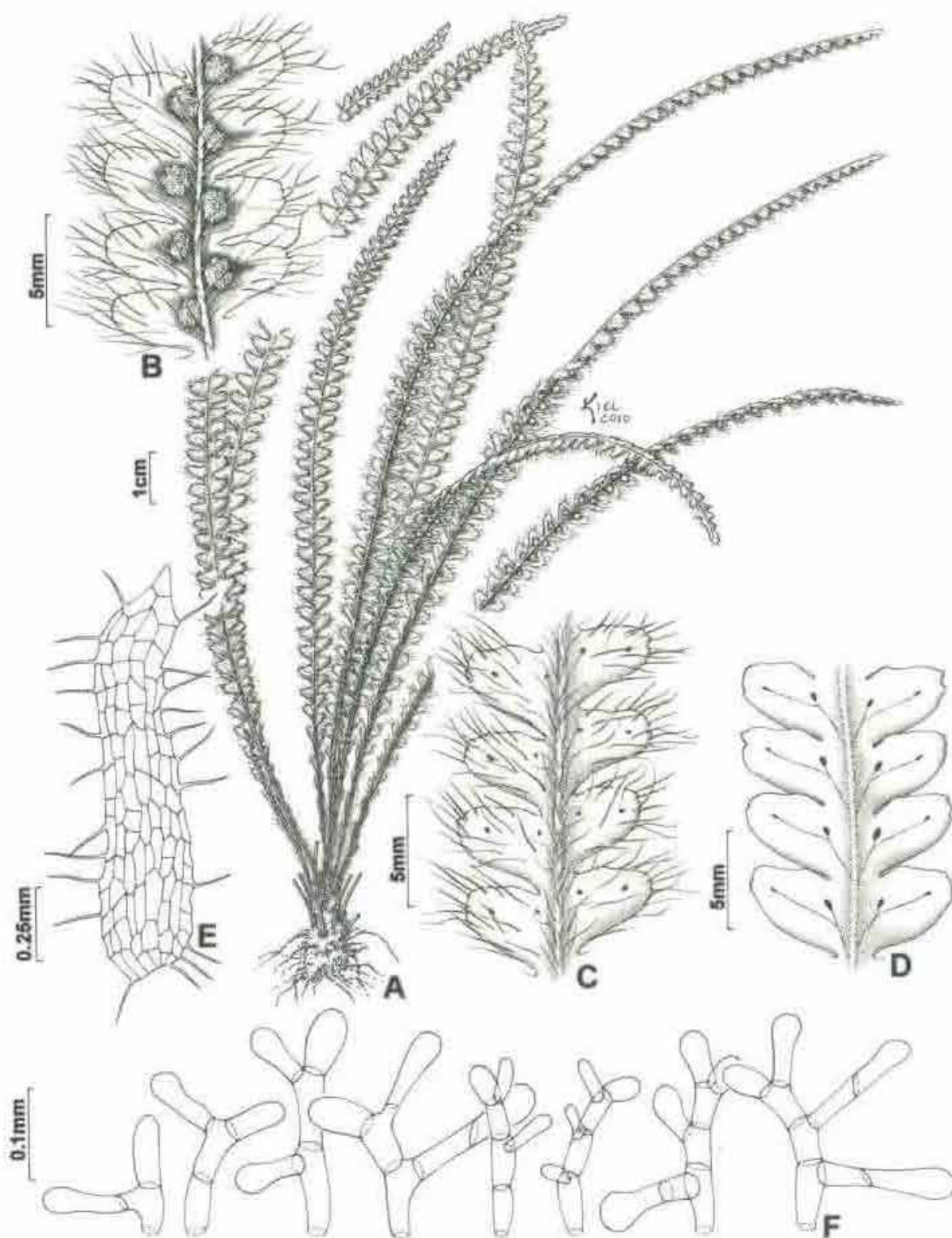


FIG. 35. *Moranopteris truncicola*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Branched hairs from the costa. A-C: Carvalho et al. 367 (INPA). D, F: Mostacero et al. 448 (VEN). E: Boom et al. 6008 (VEN).

22–27 Mar 1967, *Steyermark 98095* (NY, P, S, US). **Distrito Federal:** Cordillera de la Costa, cabeceras de la Quebrada Chacaíto, 2000–2050 m, 10°33'N, 66°52'W, 18 Oct 1991, *Meier & Reif 635* (M, UC). **Lara:** Buracal Valley, above Buena Vista, 1676 m, 20 Dec 1986, *Fay 1502* (UC). **Mérida:** Andres Bello, La Carbonera, ca. 13 min. NNW of Jají along Hwy 4, property of the Universidad de los Andes, 2000 m, 08°40'N, 71°26'W, 20 Nov 1982, *Smith et al. 1446* (MO, UC). **Miranda:** Parque Nacional "El Avila", subida al Pico Naiguata via Garete, arriba del canal de Garate, vertiente sur, al noreste de Caracas, 2100–2250 m, 10°33'N, 66°46'W, 20 Mar 1993, *Meier 3506* (VEN). **Portuguesa:** Sucre, localidad conocida como La Divisoria de la Concepción, 1500–1800 m, 09°18'N, 70°06'W, 23–26 Oct 1985, *Ortega et al. 2774* p.p. (UC). **Trujillo:** Orilla del Camino Laguna "Los Cedritos", Cerro Guaramacál, Boconó, 8 Sep 1980, *Stergios 2256* (UC). **Vargas:** Cordillera de la Costa, Serranía del Litoral, Monumento Natural Pico Codazzi, carretera Arco de la Colonia Tovar-Pro, Cruz, 1 km desde el Arco, Urb. Residencial Jenjibrillar, Sector La Neblina, 2250–2280 m, 10°26'N, 67°14'30"W, 13 Nov 1999, *Mostacero & Castillo 395* (UC). **Yaracuy:** Sierra de Aroa, Cerro Negro, 1200–1800 m, 10°17'N, 69°01'W, 1–2 Apr 1980, *Liesner & González 9904* (MO, VEN). COLOMBIA. **Antioquia:** Guatapé, 2316 m, 25 Feb 1880, *Kalbreyer 1472* (B, K). **Cauca:** Cali, 1500–2000 m, Sep 1877, *Lehmann 7653* (B, K, P, US). **Chocó:** San José del Palmar, Cerro del Torrá, vertiente occidental, abajo del helipuerto, Hoya del río Negro, vereda de Río Negro, 1900 m, 04°46'N, 76°29'W, 12 Aug 1988, *Ramos et al. 1309* (NY). **Cundinamarca:** Ridge above upper San Antonio, Río San Martín Valley, 15 km SE of Gutiérrez, 60 km S of Bogotá, 2775 m, 3 Aug 1944, *Grant 9821* (US). **Distrito Capital:** Bogotá, 26 Mar 1959, *Karsten s.n.* p.p. (B). **Huila:** Cordillera Oriental, 15 km SE of Garzón, 2346 m, 1 Feb 1945, *Little Jr. 9354* (US). **Meta:** Cordillera Oriental, upper Río Manzanares Valley, 20 km southeast of Gutiérrez, 65 km south of Bogotá, 2710 m, 7 Aug 1944, *Grant 9879* (HUA, NY, US). **Nariño:** Reserva Natural La Planada Sendero "La Vieja" e "La Piña", 1850–2050 m, 01°09'40"N, 77°58'78"W, 8 Jun 1996, *Bittner 2502* (UC). **Norte de Santander:** Chitagá, E slope of valley of Quebrada los Indios toward head, Fracción de Carvajal, 2460 m, 15 Nov 1942, *Fosberg 19119* (US). **Risaralda:** Apia-Pueblo Rico, Cuchilla de la línea, sector Quebrada Risaralda, PNN Tatamá, 2621 m, 05°08'54"N, 76°01'02"W, 16 Apr 2007, *Sundue & Vasco 1226* (NY). **Valle del Cauca:** Cali, San Antonio, Cerro La Horqueta, Cordillera Occidental, vertiente oriental, 2000 m, 28 Feb 1988, *Silverstone-Sopkin et al. 3605* (MO, UC). ECUADOR. **Zamora-Chinchipe:** Estación Científica San Francisco, around refuge, 2490 m, 03°59'23"S, 79°04'20"W, 22 Sep 2003, *Lehnert 862* (UC). PERU. **Amazonas:** Near the border with Dept. San Martín., 2000 m, 05°41'S, 77°48'W, 3 Apr 2001, *van der Werff et al. 16670* (MO, NY, UC); **San Martín:** 1950 m, 05°41'S, 77°48'W, 4 Mar 2001, *van der Werff et al. 16731* (MO, UC). BOLIVIA. **Cochabamba:** Chapare, Territorio Indígena Parque Nacional

Isiboro-Secure, Cordillera de Moseenez, 1550 m, 16°14'S, 66°25'W, 5 Sep 2003, Kessler et al. 13275 (LPB, UC). **La Paz:** Franz Tamayo, Región Madidi, Santo Domingo, sector arroyo Tintaya, 1468 m, 14°46'45"S, 68°35'30"W, 22 Oct 2006, Cayola et al. 2527 (MO, UC). BRAZIL. **Amazonas:** São Gabriel da Cachoeira, Parque Nacional da Neblina, trilha para a cachoeira do Anta, entre o acampamento Lajero e o Marco 5 da fronteira do Brazil com a Venezuela, 1900 m, 00°48'29"N, 65°58'56"W, 30 Dec 2004, Carvalho et al. 367 (INPA).

Moranopteris truncicola is recognized by having rhizome scales with long setiform projections on the margins, moderately to densely setose, not gibbous segments, furcate veins, two hydathodes per segment, and branched hairs (Figs. 35A–F).

The division of the fronds varies in *Moranopteris truncicola* from pinnatifid, deeply pinnatifid to pinnatisect, but there were intermediate forms of fronds and any other differences between them exist, consequently all variants were considered here the same species. The pinnatifid frond was considered as *Polypodium andinum* by Hooker (1860) and deeply pinnatifid as *Polypodium truncicola* var. *major* and *minor* by Klotzsch (1847). The specimen by Core 1345 p.p. (US), for instance, shows both taxa above.

Moranopteris truncicola is most closely related to *M. microlepis* (see some comments in this species). *Moranopteris microlepis* can be immediately distinct by its gibbous segments (Fig. 20C).

27. *Moranopteris williamsii* (Maxon) R. Y. Hirai & J. Prado, Taxon 20XX.

Polypodium williamsii Maxon, Contr. U.S. Natl. Herb. 17: 547, pl. 34. 1916. *Xiphopteris williamsii* (Maxon) Copel., Amer. Fern J. 42: 101. 1952. *Grammitis williamsii* (Maxon) Lellinger, Amer. Fern J. 74: 59. 1984. *Micropolypodium williamsii* (Maxon) A. R. Sm., Novon 2: 423. 1992. TYPE.—BOLIVIA. **La Paz:** próx. Apolo, 1524 m, 7 Jul 1902, R. S. Williams 1167 (holotype: US-700301; isotypes: US-1832079, NY-148625).

Figs. 36A–F.

Plants epiphytic or epipetric. Rhizome erect with scales, the scales 0.8–1.5 mm X 0.4–0.6 mm, golden to yellow-brown, ovate to oblong, base cordate to slightly truncate, apex acute, sometimes with apical or subapical gland-like cells, margins entire. Fronds erect to arcuate, determinate, 3.5–12.0 cm X 3.5–6.0 mm, sparsely setose; stipe 0.4–3.0 cm compr., yellow-brown to brown, wings absent; laminae linear, pinnatisect, pinnate at base, gradually tapering proximally, chartaceous; rachis or costa slightly visible with dark sclerenchyma abaxially, slightly obscured by laminar tissue adaxially; segments ascending, ca. 40–45° to rachis or

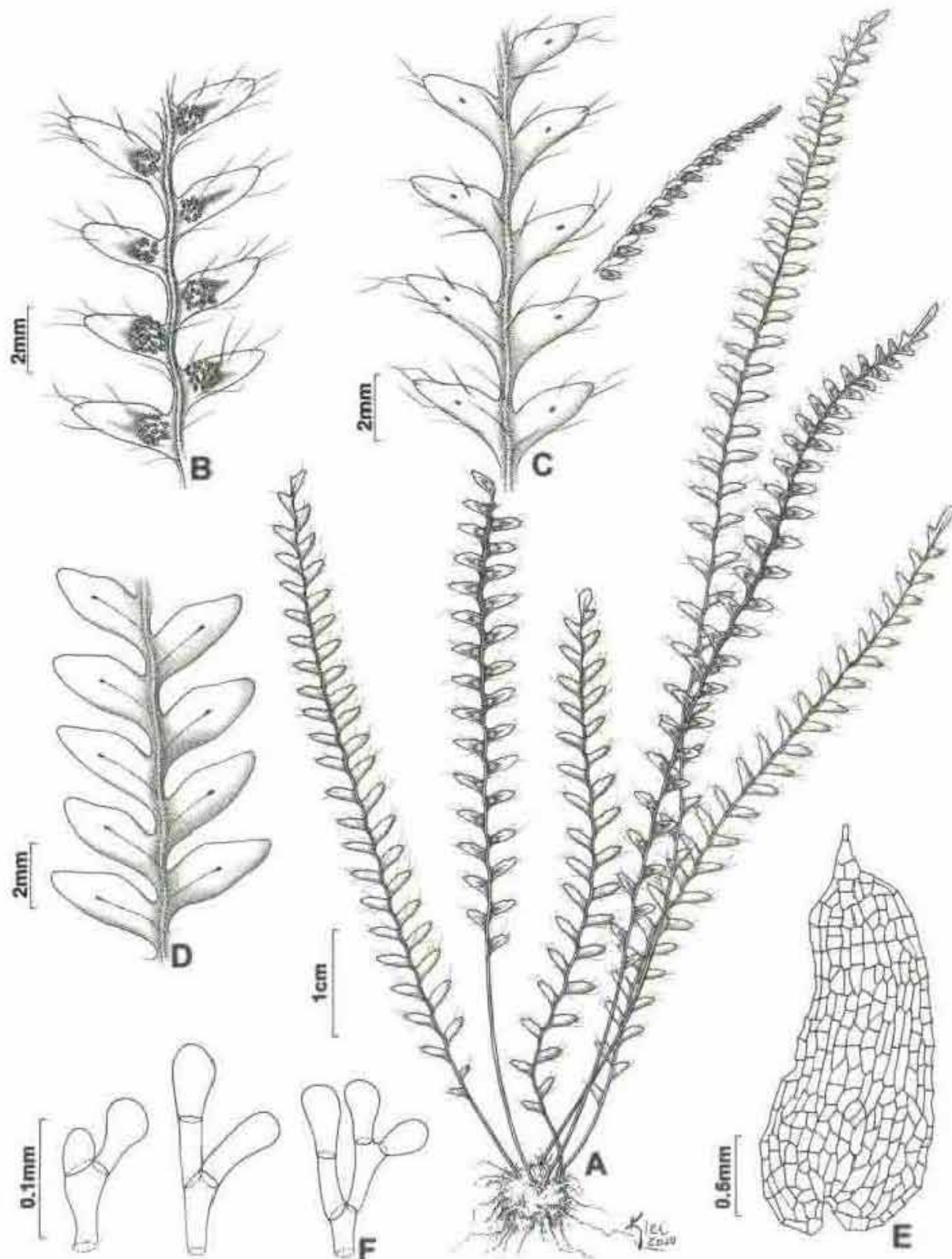


FIG. 36. *Moranopteris williamsii*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Branched hairs from the costa. A-F: Kessler et al. 7173 (LPB).

costa, 13–33(–40) pairs, spaced ca. 0.5–1.0 mm, alternate, gibbous, asymmetric, 2.5–3.2 x 0.9–1.5 mm, ovate to oblong, slightly decurrent at base, apex obtuse to acute, margins plane or slightly revolute, without hyaline cells; veins simple, obscured, 1 hydathode per segment, the hydathodes visible adaxially, linear; setae 0.8–2.5 mm long, dark red-brown, on both surfaces of the stipe, rachis or costa, and laminar tissue; hairs present on the rachis or costa and laminar tissue (mainly near to rachis or costa abaxially), hyaline, slightly red-brown, 1 or 2-branched, the main branch 2 or 3-celled, 0.10–0.15 mm long, 1st branch 1 or 2-celled, (0.05–)0.1–0.2(–0.3) mm long, 2nd branch, if present, 1 or 2-celled, < 0.1 mm long. Sori one per segment, rounded, 1.3–2.0 mm diam.

Distribution.—Endemic to Bolivia; 1524–2000 m (Figs. 21A, 2).

SPECIMENS EXAMINED.—BOLIVIA. **Cochabamba:** José Carrasco Torrico, 130 km antigua carretera Cochabamba-Villa Tunari, 2000 m, 17°07'S, 65°36'W, 10 Jul 1996, Kessler 7173 p.p. (GOET, LPB, UC).

Moranopteris williamsii is known only from few collections and it is easily recognized by its rhizome scales with entire margins, sparsely setose fronds, gibbous segments, simple veins (Figs. 36A–F). It is not readily confused with other species of *Moranopteris* because of its general appearance.

Moranopteris williamsii can resemble *M. cookii* and *M. zurquina* by having the same kind of scales with entire margins and one hydathode per segment. However these species do not present gibbous segments and also the first species differs by patent segments and the second by having deltate segments with rounded apex.

28. *Moranopteris zurquina* (Copel.) R. Y. Hirai & J. Prado, *Taxon* 20XX.

Xiphopteris zurquina Copel., *Amer. Fern J.* 42: 99. 1952. *Grammitis zurquina* (Copel.) F. Seym., *Phytologia* 31: 175. 1975. *Micropolypodium zurquinum* (Copel.) A. R. Sm., *Novon* 2: 423. 1992. TYPE.—COSTA RICA.

Heredia: northeast of San Isidro, "Cerros de Zurqui", s.d., P. C. Standley & J. Valerio 50495 (holotype: US). **Figs. 37A–G.**

Plants epiphytic. *Rhizome* erect with scales, the scales 1.4–3.0 mm x 0.2–0.3 mm, golden to yellow-brown, lanceolate to slightly linear, base slightly cordate to truncate, apex acute, sometimes with apical or subapical gland-like cells, margins entire, or sometimes with also small lateral projections. *Fronde*s erect to arcuate, determinate, 6.0–12.5 cm x 2.5–5.0 mm, sparsely to moderately setose; *stipe* (0.5–)0.7–2.5 cm compr., yellow-brown to dark-brown, narrowly winged; *laminae* linear, pinnatisect,

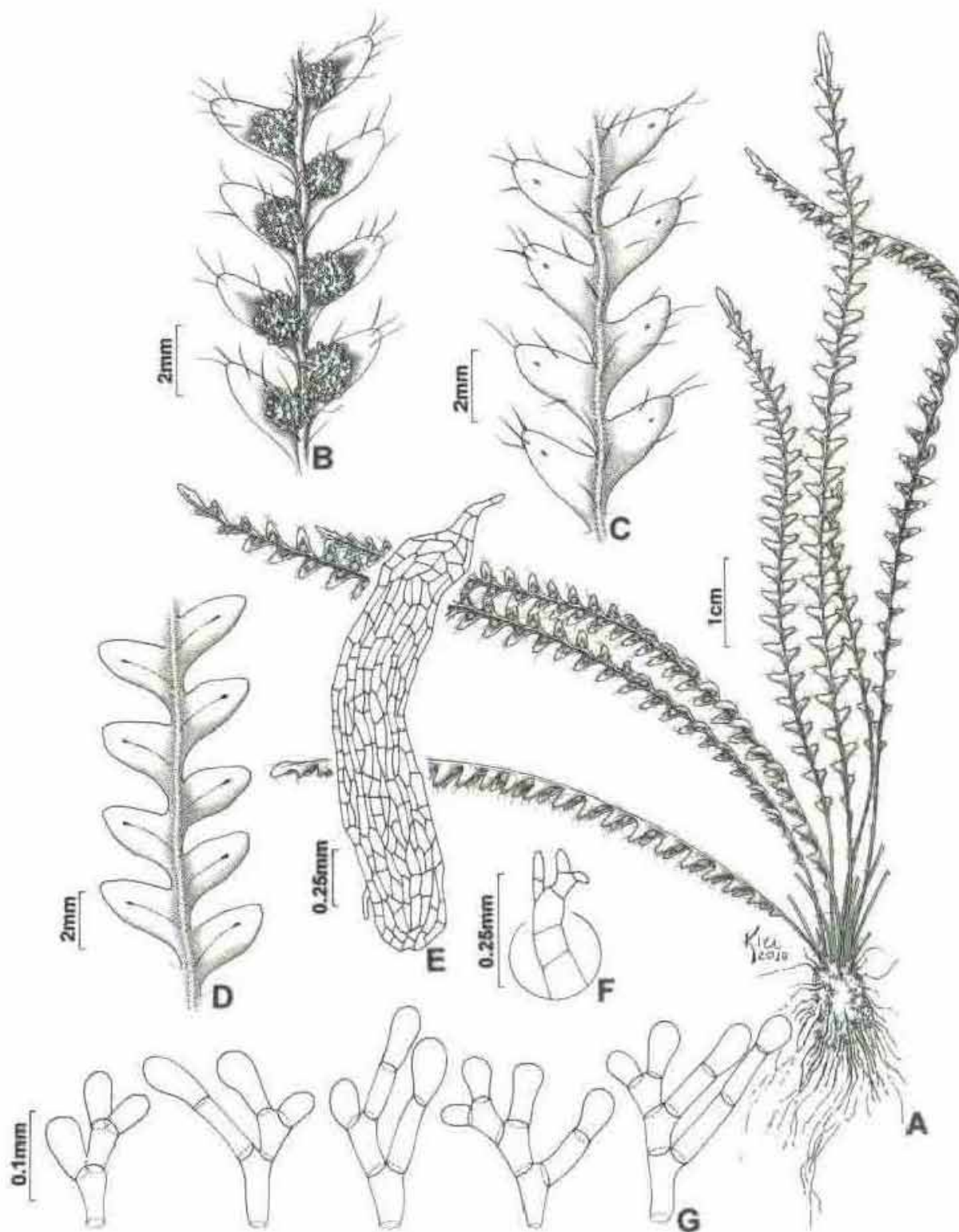


FIG. 37. *Moranopteris zurquina*. A. Habit. B. Detail of the fertile segments showing sori and setae abaxially. C. Detail of the segments showing setae and hydathodes adaxially. D. Detail of the venation (cleared leaf). E. Stem scale. F. Detail of the apex of the rhizome scale. G. Branched hairs from the costa. A-G: Mickel 3030 (NY p.p.).

gradually tapering proximally to a narrow wing, chartaceous; *costa* slightly visible with dark sclerenchyma abaxially, slightly obscured by laminar tissue adaxially; *segments* ascending, ca. 50–60°(–70) to *costa*, (15–)26–41 pairs, spaced 0.5–1.8 mm, alternate, sometimes subopposite or opposite at base, not gibbous, symmetric, 1.3–2.7 X 0.9–1.4 mm, deltate, sometimes oblong, decurrent at base, apex rounded, margins plane, without hyaline cells; *veins* simple, obscured, 1 hydathode per segment, the hydathodes visible adaxially, elliptic, sometimes obovate or linear; *setae* (0.7–)1.0–2.2(–3.5) mm long, dark red-brown, on both surfaces of the stipe, *costa*, and laminar tissue; hairs present on the stipe, *costa*, and laminar tissue (mainly near to *costa* abaxially), hyaline, slightly red-brown, rarely with branches tinged of red-brown, (1 or) 2(or 3)-branched, the main branch 3(or 4)-celled, 0.1–0.2 mm long, 1st branch (1 or) 2 or 3-celled, (<–)0.10–0.15(–0.25) mm long, 2nd branch, if present, 1 or 2-celled, < 0.1(–0.15) mm long, 3rd branch, if present, 1 or 2-celled, < 0.1 mm long. *Sori* one per segment, rounded, 0.8–1.0 mm diam.

Distribution.—Endemic to Costa Rica; 1100–2500 m (Figs. 7A, 2).

SELECTED SPECIMENS EXAMINED.—COSTA RICA. **Guanacaste**: Cantón de Liberia, P. N. Guanacaste, Cordillera de Guanacaste, Estación Cacao, 1100–1500 m, 10°55'45"N, 85°28'15"W, 5 Sep 1996, *Rojas & Mata 3021* (UC). **Heredia**: Braulio Carillo National Park, 2500 m, 2 May 2003, *Kluge 6458* (GOET). **San José**: 10 km N of San Rafael de Heredia on Volcán Barba, 1950 m, 30 Jul 1967, *Bishop 851* (UC).

Moranopteris zurquina has rhizome scales with entire margins, deltate segments, simple veins, and one hydathode per segment (Figs. 37A–E).

Haufler et al. 6936 p.p. (UC) and *Rojas & Soto 4258* (NY) are atypical specimens by having sometimes two hydathodes per segment, and slightly gibbous segments. In both cases, these characters become this species more similar to *M. serricula*. However, *Rojas & Soto 4258* (NY) has plants typical and atypical of *M. zurquina*. As the segments are more patent and its fronds are moderately setose we consider this collection from Guanacaste (Costa Rica) as *M. zurquina*.

Moranopteris zurquina is known just from few collections; maybe it might be synonymized to *M. serricula*, if more specimens will be finding having two hydathodes, because *Rojas & Soto 4258* is very similar to specimens of *M. serricula* from Dominica.

Moranopteris serricula from Lesser Antilles and Venezuela is the most similar species, but differs in general by having mostly sparsely setose fronds and two hydathodes per segment.

29. *Moranopteris* X *bradei* (Labiak & F. B. Matos) R. Y. Hirai & J. Prado, Taxon 20XX. *Micropolypodium* X *bradei* Labiak & F. B. Matos, Brittonia 59: 182. 2007. TYPE.—BRAZIL. Rio de Janeiro: Terezópolis, Serra dos Órgãos, Rio Paquequer, 17 Jul 1940, A. C. Brade 16676 p.p. (holotype: RB).

Plants epipetric. *Rhizome* short-creeping with scales, the scales 0.7–2.0 X 0.15–0.40 mm, golden to yellow-brown, lanceolate, base slightly cordate, apex attenuate, margins entire, rarely with also small lateral projections. *Fronde*s erect to arcuate, determinate, 2.5–9.2 X 0.3–1.2 cm, sparsely setose; *stipes* 0.5–1.0 cm long, brown, narrowly winged; *laminae* linear to linear-lanceolate, pinnatisect or pinnatisect-pinnatifid, gradually tapering proximally to a narrow wing, chartaceous; costa obscured by laminar tissue abaxially and adaxially; *segments* ascending, 40–70° to costa, 11–12 pairs, spaced ca. 0.1–0.3 mm, alternate, not gibbous, sometimes slightly gibbous, symmetric, 5.0–10.0 X 1.5–3.0 mm, deltate to linear, pinnatifid, decurrent at base, apex rounded, margins slightly lobate and revolute, without hyaline cells; *veins* furcate or pinnate, obscured, (1)2–8 hydathodes per segment, the hydathodes visible adaxially, rounded to elliptic; *setae* 0.9–1.1 mm long, dark red-brown, on both surfaces of the stipe, costa, and laminar tissue; *hairs* present on the stipe, costa, and laminar tissue (mainly near to costa abaxially), hyaline, slightly red-brown, branched or rarely unbranched, the unbranched hairs mostly 2 or 3-branched, the main branch 3-celled, ca. 0.1–0.2 mm long, 1st, 2nd and 3rd branches 1 or 2-celled, < 0.1 mm long. *Sori* 1–6 per segment, rounded or oblong, 0.8–2.0 mm diam.

Distribution.—Endemic to the state of Rio de Janeiro, southeastern Brazil; 1000 m (Fig. 2).

Moranopteris X *bradei* is known only from one collection by Brade. As stated by Labiak and Matos (2007), the specimens have aborted spores. However, we looked at the spores and concluded that there are normal spores plus some immature sporangia and spores. However, the putative hybrid could be only a variation of *Moranopteris achilleifolia*, but without more data we prefer to recognize the hybrid in the present study.

NAMES OF UNCERTAIN APPLICATION:

Polypodium gibbosum Fée, Mém. Foug. 6: 8, t. 2, f. 2. 1854. TYPE.—Mexico. Oaxaca, 2400–2600 m, *H. Galeotti* s.n. (P or RB n.v.).

It was not possible to locate the type-specimen. Based only on the Fée's protologue and illustration we cannot ascertain the application of this name.

Micropolypodium setulosum (Rosenst.) A. R. Sm., Novon 2: 423. 1992.
Polypodium setulosum Rosenst., Repert. Sp. Nov. Regni Veg. 10: 277. 1912. *Xiphopteris setulosa* (Rosenst.) Copel., Amer. Fern J. 42: 108. 1952. *Grammitis setulosa* (Rosenst.) F. Seym., Phytologia 31: 175. 1975. TYPE.—COSTA RICA. **San José**: S. Isidro del General, 656 m, A. Tonduz s.n. (Herb. Jiménez 214, n.v.; frag. US!).

The fragment of the type at US Herbarium does not have rhizome. Consequently, it is impossible to conclude the correct identity of this taxon. This fragment resembles a small plant of *Moranopteris basiattenuata* or *M. plicata* by the branched hairs and also by general appearance of the fronds (segments, setae, etc.). Rosenstock (1912) described *Polypodium setulosum* containing two setiform projections on the margins of rhizome scales. *Moranopteris basiattenuata* has rhizome scales with entire margins and with small lateral projections, whereas *M. plicata* has only setiform projections on its margins. If these projections described by Rosenstock will be setiform like on the scales of *M. plicata*, this species can be synonymus of *Micropolypodium setulosum*. Furthermore the hairs observed on the fragment at US are 1-branched and branched, and these kind of hairs are most similar to *M. plicata* than *M. basiattenuata*. Smith et al. 2200 (UC) from Cartago, Costa Rica (= *M. plicata*), resembles the description by Rosenstock.

To solve this problem is necessary to find and analyze the complete type of this taxon, until even to show that it can represent a good species or not.

Polypodium piligerum Hook., Ic. pl. t. 321. 1841. TYPE.—ECUADOR. Canar-Azuay, W. Jameson s.n. (K-n.v.).

The type has not found at K Herbarium. See comments at *Moranopteris longisetosa*.

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NY; P; PE, PH; QCA; QCNE; R; RB; S; SP; SPF; UC; UEC; UPCB; US; USCG; USJ, and VEN for loans. We thank Germinal Rouhan (P) and Maria Backlund (S), for assistance with information about type specimens; and also Pedro Bond Schwarzburd for photo of type of *Polypodium longisetosum* at LE Herbarium. We thank The New York Botanical Garden for providing herbarium and facilities for the first author and Alan R. Smith (UC) for his helpful comments from Venezuelan and Bolivian species. Finally, we are especially grateful to Dr. Robbin Moran, whose support was fundamental to the development of this study (grant from the United States National Science Foundation, DEB 0717056).

LITERATURE CITED

- BISHOP, L. E. and A. R. SMITH. 1995. Grammitidaceae. In: P. E. BERRY, B. K. HOLST and K. YATSKIEVYCH (eds.). Pteridophytes, Spermatophytes: Acanthaceae-Araceae. In: J. A. STEYERMARK, P. E. BERRY and B. K. HOLST (eds.). *Flora of the Venezuelan Guayana*. Timber Press, Portland, v. 2, pp. 135-158.
- BOWER, F. O. 1928. The ferns (Filicales). III. The leptosporangiate ferns. Cambridge University Press, Cambridge.
- COPELAND, E. B. 1952. The American Species of *Xiphopteris*. Amer. Fern J. 42:41-52; 93-110.
- CREMERS, G. 1997. Pteridophytes. In: S. A. MORI, G. CREMERS, C. GRACIE, J.-J. DE GRANVILLE, M. HOFF and J. D. MITCHELL. *Guide to the vascular plants of Central French Guiana. Part 1. Pteridophytes, Gymnosperms, and Monocotyledons*. Mem. New York Bot. Garden 76:1-422.
- FÉE, A. L. A. 1852. *Genera Filicum - Exposition des genres de las famille des Polypodiacées (Classe des Fougères)...*(Cinquième mémoire sur la famille des fougères) [Mém. foug. 5]. J. B. Baillière, Victor Masson, Strasbourg (Veuve Berger-Levrault et fils, Paris).
- GÓMEZ, L. D. and A. L. ARBELÁEZ. 2009. Tomo IV, Helechos. In: W. D. STEVENS, O. M. MONTIEL and A. POOL. *Flora de Nicaragua*. Monogr. Syst. Bot. Missouri Bot. Gard. 116:1-348.
- HIERONYMUS, G. 1905. *Polypodiorum species novae et non satis notae*. Hedwigia 44:102-103.
- HIRAI, R. Y., G. ROUHAN, P. H. LABIAK, T. A. RANKER and J. PRADO. 20XX. Molecular phylogeny reveals a new genus of grammitid ferns (Polypodiaceae) from the Neotropics. Taxon.
- HODGE, W. H. 1941. Notes on Dominica Ferns. Amer. Fern J. 31:103-111, 121-127. t. 1, 2.
- HOOKE, W. J. 1841. *Hooker's Icones Plantarum* 4. Longman, Orme, Brown, Green, and Longmans, London.
- HOOKE, W. J. 1860. *A Second Century of Ferns*. W. Pamplin, London, UK.

- KRAUS, J. E. and M. ARDUIN. 1997. Manual básico de métodos em morfologia vegetal. Edur, Seropédica, Rio de Janeiro.
- KLOTZSCH, J. F. 1847. Beiträge einer Flora der Aequinoctial-Gegenden der neuen Welt. *Linnaea* 20:374–75.
- LABIAK, P. H. and F. B. MATOS. 2007. A new hybrid and two new combinations in neotropical grammitid ferns. *Brittonia* 59:182–185.
- LABIAK, P. H. and J. PRADO. 2003. Grammitidaceae (Pteridophyta) no Brasil com ênfase nos gêneros *Ceradenia*, *Cochlidium* e *Grammitis*. *Hoehnea* 30:243–283.
- LABIAK, P. H. and J. PRADO. 2005a. As espécies de *Lellingeria* A. R. Sm. and R. C. Moran (Grammitidaceae – Pteridophyta) do Brasil. *Rev. bras. Bot.* 28:1–22.
- LABIAK, P. H. and J. PRADO. 2005b. As espécies de *Melpomene* e *Micropolypodium* (Grammitidaceae – Pteridophyta) no Brasil. *Bol. Bot. Univ. São Paulo* 23:51–69.
- LABIAK, P. H. and J. PRADO. 2005c. As espécies de *Terpsichore* A. R. Sm. e *Zygophlebía* L. E. Bishop (Grammitidaceae) do Brasil. *Acta Bot. Bras.* 19:867–887.
- LABIAK, P. H., G. ROUHAN and M. SUNDUE. 2010a. Phylogeny and taxonomy of *Leucotrichum* (Polypodiaceae): A new genus of grammitid ferns from the Neotropics. *Taxon* 59:911–921.
- LABIAK, P. H., M. SUNDUE and G. ROUHAN. 2010b. Molecular phylogeny, character evolution, and biogeography of the grammitid fern genus *Lellingeria* (Polypodiaceae). *Am. J. Bot.* 97:1354–1364.
- LABIAK, P. H. 2011. *Stenogrammitis*, a new genus of grammitid ferns segregated from *Lellingeria* (Polypodiaceae). *Brittonia* (no prelo).
- LELLINGER, D. B. 1989. The ferns and fern-allies of Costa Rica, Panamá and the Chocó (Part 1: Psilotaceae through Dicksoniaceae). *Pteridologia* 2A. American Fern Society, Inc., Washington.
- LELLINGER, D. B. 2002. A modern multilingual glossary for taxonomic pteridology. *Pteridologia* 3. American Fern Society, Inc., Washington.
- LEHNERT, M. 2008. Eleven new species in the grammitid fern genus *Melpomene* (Polypodiaceae). *Amer. Fern J.* 98:214–250.
- MAXON, W. R. 1914. Studies of tropical American ferns, nº 5. *Contr. U.S. Natl. Herb.* 17:406–407.
- MAXON, W. R. 1916. Studies of tropical American ferns, nº 6. *Contr. U.S. Natl. Herb.* 17:541–608.
- MICKEL, J. T. and J. M. BEITEL. 1988. Pteridophyte flora of Oaxaca, Mexico. *Mem. New York Bot. Gard.* 46:1–568.
- MICKEL, J. T. and A. R. SMITH. 2004. The Pteridophytes of Mexico. *Mem. New York Bot. Gard.* 88:1–1054.
- MORTON, C. V. 1967. The genus *Grammitis* in Ecuador. *Contr. U.S. Natl. Herb.* 38:85–123.

- PARRIS, B. S. 2009. New genera of Malesian Grammitidaceae (Monilophyta). *Blumea* 54:217–219.
- PROCTOR, G. R. 1977. Pteridophyta. In: R. A. HOWARD (ed.). *Flora of the Lesser Antilles*. Harvard University, Cambridge, v. 2.
- PROCTOR, G. R. 1985. *Ferns of Jamaica*. British Museum of Natural History, London.
- PROCTOR, G. R. 1989. *Ferns of Puerto Rico and Virgin Islands*. Mem. New York Bot. Gard. 53:1–389.
- PONCE, M. M. 2008 (org.). Pteridofitas. In: F. O. ZULOAGA, O. MORRONE and M. J. BELGRANO (eds.). *Catálogo de las plantas vasculares del Cono Sur (Argentina, Sur de Brasil, Chile, Paraguay y Uruguay)*. Monogr. Syst. Bot. Missouri Bot. Gard. 107:1–161.
- RANKER, T. A., A. R. SMITH, B. S. PARRIS, J. M. O. GEIGER, C. H. HAUFLE, S. C. K. STRAUB and H. SCHNEIDER. 2004. Phylogeny and evolution of grammitid ferns (Grammitidaceae): A case of rampant morphological homoplasy. *Taxon* 53:415–428.
- ROSENSTOCK, E. 1912. *Filices costaricensis*. Repert. Spec. Nov. Regni Veg. 10:277–278.
- ROSENSTOCK, E. 1925. *Filices novae a cll. Alfred et Curt Brade in Costarica collectae*. Repert. Spec. Nov. Regni Veg. 22:14.
- SEHNEM, A. 1970. Polipodiáceas. In: P. R. REITZ (ed.). *Flora Ilustrada Catarinense*. Herbário Barbosa Rodrigues, Itajaí.
- SMITH, A. R. 1981. Pteridophytes. In: D. E. BREEDLOVE (ed.). *Flora of Chiapas* 2:1–370. California Academy of Sciences, San Francisco.
- SMITH, A. R. 1990. Pteridophytes of Venezuelan Guayana: New species. *Ann. Missouri Bot. Gard.* 77:256–259.
- SMITH, A. R. 1992. A review of the fern genus *Micropolypodium* (Grammitidaceae). *Novon* 2:419–425.
- SMITH, A. R. 1993. *Terpsichore*, a new genus of Grammitidaceae (Pteridophyta). *Novon* 3:478–489.
- SMITH, A. R. 1995. *Micropolypodium*. Pp. 383–385. In: R. C. MORAN and R. RIBA (eds.), *Psilotaceae a Salviniaceae*. In: G. DAVIDSE, M.S. SOUSA and S. KNAPP (eds.), *Flora Mesoamericana*, v. 1. Universidad Nacional Autónoma de México. Ciudad de México.
- SMITH, A. R. and R. C. MORAN. 1995. *Terpsichore*. Pp. 385–392. In: R. C. MORAN and R. RIBA (eds.), *Psilotaceae a Salviniaceae*. In: G. DAVIDSE, M.S. SOUSA and S. KNAPP (eds.), *Flora Mesoamericana*, v. 1. Universidad Nacional Autónoma de México. Ciudad de México.
- SMITH, A. R., R. C. MORAN and L. E. BISHOP. 1991. *Lellingeria*, a new genus of Grammitidaceae. *Amer. Fern J.* 81:76–88.
- SOTA, E. R. DE LA. 1966. Analisis de los caracteres foliares em ciertas "Grammitidaceae" de Brasil. *Lilloa* 32:477–495.

- SOTA, E. R. DE LA, L. A. CASSÁ DE PAZOS and M. M. PONCE 2000. Grammitidaceae (Pteridophyta) de Argentina y Chile. *Darwiniana* 38:299–306.
- STOLZE, R. G. 1981. Fern and fern allies of Guatemala, part 2: Polypodiaceae. *Fieldiana, Botany* 6:1–522.
- SUNDUE, M. 2010. A morphological cladistic analysis of *Terpsichore* (Polypodiaceae). *Syst. Bot.* 35:716–729.
- TRYON, R. M. 1972. Endemic areas and geographic speciation in Tropical American ferns. *Biotropica* 4:121–131.
- TRYON, R. M. and R. G. STOLZE. 1993. Pteridophyta of Peru part V, 18. Aspleniaceae - 21. Polypodiaceae. *Fieldiana, Botany, new series* 32:1–190.

LIST OF NAMES

The number in parentheses refers to the species numbers assigned in the taxonomic treatment.

- Ctenopteris achilleifolia* (Kaulf.) J. Sm. (1)
- Ctenopteris gradata* (Baker) Copel. (7)
- Ctenopteris myriophylla* (Mett. ex Hook. & Baker) Copel. (13)
- Ctenopteris schwackei* (Christ) Copel. (7)
- Grammitis achilleifolia* (Kaulf.) R. M. Tryon & A. F. Tryon (1)
- Grammitis andina* (Hook.) Ching (26)
- Grammitis aphelolepis* C. V. Morton (2)
- Grammitis basalis* (Maxon) Lellinger (6)
- Grammitis basiattenuata* (Jenman) Proctor (3)
- Grammitis basiattenuata* (Jenman) Proctor var. *valens* Mickel & Beitel (3)
- Grammitis blanchetii* (C. Chr.) A. R. Sm. (15)
- Grammitis blepharidea* (Copel.) Stolze (4)
- Grammitis blepharodes* (Maxon) F. Seym. (24)
- Grammitis blepharolepis* (C. Chr.) C. V. Morton (24)
- Grammitis buesii* (Maxon) Lellinger (4, 9)
- Grammitis caucana* (Hieron.) C. V. Morton (5)
- Grammitis cookii* (Underw. & Maxon) F. Seym. (6)
- Grammitis daguensis* (Hieron.) C. V. Morton (24)
- Grammitis exigua* (Fée) Brade (15)
- Grammitis gradata* (Baker) R. M. Tryon & A. F. Tryon (7)
- Grammitis grisebachii* (Underw. ex C. Chr.) Proctor (8)
- Grammitis hyalina* (Maxon) F. Seym. (9)
- Grammitis killipii* (Copel.) Lellinger (10)
- Grammitis knowltoniorum* (Hodge) Proctor (11)
- Grammitis liesneri* A. R. Sm. (12)
- Grammitis micropteris* (C. Chr.) Brade (21)

- Grammitis myosuroides* Raddi (21)
Grammitis myriophylla (Mett. ex Hook. & Baker) C. V. Morton (13)
Grammitis nimbata (Jenman) Proctor (16)
Grammitis plicata A. R. Sm. (18)
Grammitis serricula (Fée) Proctor (20)
Grammitis setosa (Kaulf.) C. Presl (21)
Grammitis sherringii (Baker) Proctor (22)
Grammitis taenifolia (Jenman) Proctor (24)
Grammitis trichomanoides (Sw.) Ching (25)
Grammitis truncicola (Klotzsch) C. V. Morton (26)
Grammitis williamsii (Maxon) Lellinger (27)
Grammitis zurquina (Copel.) F. Seym. (28)
Micropolypodium achilleifolium (Kaulf.) Labiak & F. B. Matos (1)
Micropolypodium aphelolepis (C. V. Morton) A. R. Sm. (2)
Micropolypodium basiattenuatum (Jenman) A. R. Sm. (3)
Micropolypodium blepharideum (Copel.) A. R. Sm. (4)
Micropolypodium caucanum (Hieron.) A. R. Sm. (5)
Micropolypodium cookii (Underw. & Maxon) A. R. Sm. (6)
Micropolypodium gradatum (Baker) Labiak & F. B. Matos (7)
Micropolypodium grisebachii (Underw. ex C. Chr.) A. R. Sm. (8)
Micropolypodium hyalinum (Maxon) A. R. Sm. (9)
Micropolypodium knowltoniorum (Hodge) A. R. Sm. (11)
Micropolypodium liesneri (A. R. Sm.) A. R. Sm. (12)
Micropolypodium nanum (Fée) A. R. Sm. (15)
Micropolypodium nimbatum (Jenman) A. R. Sm. (16)
Micropolypodium perpusillum (Maxon) A. R. Sm. (17)
Micropolypodium plicatum (A. R. Sm.) A. R. Sm. (18)
Micropolypodium serricula (Fée) A. R. Sm. (20)
Micropolypodium setosum (Kaulf.) A. R. Sm. (21)
Micropolypodium sherringii (Baker) A. R. Sm. (22)
Micropolypodium taenifolium (Jenman) A. R. Sm. (24)
Micropolypodium trichomanoides (Sw.) A. R. Sm. (25)
Micropolypodium truncicola (Klotzsch) A. R. Sm. (26)
Micropolypodium williamsii (Maxon) A. R. Sm. (27)
Micropolypodium zurquinum (Copel.) A. R. Sm. (28)
Micropolypodium X *bradei* Labiak & F. B. Matos. (29)
Polypodium achilleifolium Kaulf. (1)
Polypodium andinum Hook. (26)
Polypodium basale Maxon (6)
Polypodium basiattenuatum Jenman (3)
Polypodium blanchetii C. Chr. (15)
Polypodium blepharideum Copel. (4)
Polypodium blepharodes Maxon (24)

- Polypodium blepharodes* Maxon var. *microlepis* Rosenst. (14)
Polypodium blepharolepis C. Chr. (24)
Polypodium buesii Maxon (4)
Polypodium caucanum Hieron. (5)
Polypodium cookii Underw. & Maxon (6)
Polypodium daguense Hieron. (24)
Polypodium exiguum Fée (15)
Polypodium exiguum Griseb. (8)
Polypodium gracillimum Hieron. (24)
Polypodium gradatum Baker (7)
Polypodium grisebachii Underw. ex C. Chr. (8)
Polypodium hirsutulium Fée (7)
Polypodium hyalinum Maxon (9)
Polypodium knowltoniorum Hodge (11)
Polypodium longisetosum Hook. (13)
Polypodium micropteris C. Chr. (21)
Polypodium myriophyllum Mett. ex Hook. & Baker (13)
Polypodium nanum Fée (15)
Polypodium nimbatum Jenman (16)
Polypodium perpusillum Maxon (17)
Polypodium schwackei Christ (7)
Polypodium serricula Fée (20)
Polypodium sherringii Baker (22)
Polypodium sintenisii Hieron. (24)
Polypodium taenifolium Jenman (24)
Polypodium trichomanoides Sw. (25)
Polypodium truncicola Klotzsch var. *major* Klotzsch (26)
Polypodium truncicola Klotzsch var. *minor* Klotzsch (26)
Polypodium williamsii Maxon (27)
Terpsichore achilleifolia (Kaulf.) A. R. Sm. (1)
Terpsichore gradata (Baker) A. R. Sm. (7)
Terpsichore longisetosa (Hook.) A. R. Sm. (13)
Xiphopteris aphelolepis (C. V. Morton) Pichi-Serm. (2)
Xiphopteris basiattenuata (Jenman) Copel. (3)
Xiphopteris blepharidea (Copel.) Copel. (4)
Xiphopteris blepharodes (Maxon) Copel. (24)
Xiphopteris blepharolepis (C. Chr.) Copel. (24)
Xiphopteris buesii (Maxon) Copel. (4)
Xiphopteris caucana (Hieron.) Copel. (5)
Xiphopteris cookii (Underw. & Maxon) Copel. (6)
Xiphopteris daguensis (Hieron.) Copel. (24)
Xiphopteris grisebachii (Underw. ex C. Chr.) Copel. (8)
Xiphopteris hyalina (Maxon) Copel. (9)

- Xiphopteris killipii* Copel. (10)
Xiphopteris knowltoniorum (Hodge) Copel. (11)
Xiphopteris myriophylla (Mett. ex Hook. & Baker) Crabbe (13)
Xiphopteris nana (Fée) Copel. (15)
Xiphopteris nimbata (Jenman) Copel. (16)
Xiphopteris perpusilla (Maxon) Copel. (17)
Xiphopteris serricula (Fée) Copel. (20)
Xiphopteris setosa Kaulf. (21)
Xiphopteris sherringii (Baker) Copel. (22)
Xiphopteris taenifolia (Jenman) Copel. (24)
Xiphopteris trichomanoides (Sw.) Copel. (25)
Xiphopteris truncicola (Klotzsch) Copel. (26)
Xiphopteris williamsii (Maxon) Copel. (27)
Xiphopteris zurquina Copel. (28)

LIST OF TAXA

1. *Moranopteris achilleifolia* (Kaulf.) R. Y. Hirai & J. Prado
2. *Moranopteris aphelolepis* (C. V. Morton) R. Y. Hirai & J. Prado
3. *Moranopteris basiattenuata* (Jenman) R. Y. Hirai & J. Prado
4. *Moranopteris blepharidea* (Copel.) R. Y. Hirai & J. Prado
5. *Moranopteris caucana* (Hieron.) R. Y. Hirai & J. Prado
6. *Moranopteris cookii* (Underw. & Maxon) R. Y. Hirai & J. Prado
7. *Moranopteris gradata* (Baker) R. Y. Hirai & J. Prado
8. *Moranopteris grisebachii* (Underw. ex C. Chr.) R. Y. Hirai & J. Prado
9. *Moranopteris hyalina* (Maxon) R. Y. Hirai & J. Prado
10. *Moranopteris killipii* (Copel.) R. Y. Hirai & J. Prado
11. *Moranopteris knowltoniorum* (Hodge) R. Y. Hirai & J. Prado
12. *Moranopteris liesneri* (A. R. Sm.) R. Y. Hirai & J. Prado
13. *Moranopteris longisetosa* (Hook.) R. Y. Hirai & J. Prado
14. *Moranopteris microlepis* (Rosenst.) R. Y. Hirai & J. Prado
15. *Moranopteris nana* (Fée) R. Y. Hirai & J. Prado
16. *Moranopteris nimbata* (Jenman) R. Y. Hirai & J. Prado
17. *Moranopteris perpusilla* (Maxon) R. Y. Hirai & J. Prado
18. *Moranopteris plicata* (A. R. Sm.) R. Y. Hirai & J. Prado
19. *Moranopteris rupicola* R. Y. Hirai & J. Prado
20. *Moranopteris serricula* (Fée) R. Y. Hirai & J. Prado
21. *Moranopteris setosa* (Kaulf.) R. Y. Hirai & J. Prado
22. *Moranopteris sherringii* (Baker) R. Y. Hirai & J. Prado
23. *Moranopteris simplex* R. Y. Hirai & J. Prado
24. *Moranopteris taenifolia* (Jenman) R. Y. Hirai & J. Prado
25. *Moranopteris trichomanoides* (Sw.) R. Y. Hirai & J. Prado
26. *Moranopteris truncicola* (Klotzsch) R. Y. Hirai & J. Prado

27. *Moranopteris williamsii* (Maxon) R. Y. Hirai & J. Prado
 28. *Moranopteris zurquina* (Copel.) R. Y. Hirai & J. Prado
 29. *Moranopteris* X *bradei* (Labiak & F. B. Matos) R. Y. Hirai & J. Prado

LIST OF EXSICCATAE

The number in parentheses refers to the species numbers assigned in the taxonomic treatment. The numbers in boldface are types.

- Abendroth, A.: 517 (1)
 Acevedo-Rodríguez, P.: 2967 (24)
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 Ackerman, J. *et al.*: 1616 (24)
 Adolfo, Bro.: 76 (4)
 Albert de la Rüe E.: s.n. (15)
 Allorge, P.: s.n. (20); s.n. (24)
 Almeida, T. E. *et al.*: 552 (21)
 Alston, A. H. G.: 5101 (24); 7560 (15)
 Amaral, I. L. do: 1649 (24)
 Amaral, I. L. do *et al.*: 1010 (15)
 Anderson, A. B.: 359 (15)
 Araújo, H. S.: s.n. (1)
 Araújo, I.: 36, 37, 110, 128, 144, 158, 228 (15)
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 Atehortúa, L. & Callejas, R.: 292 (18)
 Atwood, J. T.: 5453 (24)
 Axelrod, F. & Axelrod, A. B.: 9884 (24)
 Axelrod, F. & Herscoviz, S.: 5169 (24)
 Axelrod, F. & Proctor, G.: 375 (24)
 Axelrod, F. & Rodríguez, I.: 7682, 8596, 8607 (24)
 Axelrod, F. *et al.*: 408 (24)
 Aymard, G. C.: 5816 (15)
 B.D.: 3551 (1)
 Bach, K. *et al.*: 1084 (13); 1634, 1759 (4); 1853 (13); 1880 (4)
 Badini, J.: 56 (1); 79, 101 (7); s.n. (7)
 Baker, R.: s.n. (28)
 Baracaldo, P. S.: 128 (5)
 Barbosa, E. & Ribas, O. S.: 434 (1)
 Barbosa, E. & Silva, J. M.: 496 (1)
 Barbosa, H.: s.n. (1)
 Barcia, J.: 105, p.p. (21); 901, p.p. (21); 983, 1177 (1); 1203 (21)
 Barnard *et al.*: 544 (24)
 Barros, F. & Ribeiro, J. E. L. S.: 2046 (1); 2048 (7)

- Barros, W. D.: 723 (1)
- Baudouin, A.: 646, p.p. (20); 646, p.p. (24)
- Bautista, H. P. & Barroso, G.: 235, 271 (1)
- Beaupertuis, M.: 1322 (20)
- Beck, S. G.: 17493, 21973 (4)
- Beitel, J.: 85283 (18); 85303, p.p. (18); 85303, p.p. (24)
- Bena, P.: 1014, 1866 (24)
- Berg, C. C. *et al.*: P19492, P19494 (15)
- Beyrich, H. K.: s.n. (1); s.n. (21)
- Beyrich, H. K. & Uhlorm, O.: s.n. (1)
- Bishop, E.: 805 (24); 811 (3); 833 (14); 847 (24); 851 (28); 874 (24); 1972 (2)
- Bittner, J.: 2502 (26); 2670 (10)
- Bittner, J. & Herrera, G.: 2004 (24)
- Blanchet, J. S.: **8**, 3944 (15)
- Boeke, J. D. & Jaramillo A., J.: 2701 (2)
- Boldingh, I.: 1837B (24)
- Boom, B. M. & Gopaul, D.: 7431, 7521 (24)
- Boom, B. M. *et al.*: 6008, p.p. (5); 6008, p.p. (26); 8606 (15)
- Bordin, J. *et al.*: s.n. (7)
- Borgo, M.: 703 (1)
- Boudrie, M.: 2862, 3284 (15)
- Boudrie, M. *et al.*: 4081 (15)
- Bovini, M. G. *et al.*: 2241 (1)
- Brade, A. C.: 16, p.p. (24); 21 (26); 80 (24); **80b** (14); 80b, p.p. (14); 80b, p.p. (24); 81 (26); 5226 (7); 6592 (1); 8400 (21); 9215 (1); 9386, 10002 (7); 10318 (21); 10849, p.p. (7); 11630 (1); 12697, 13999 (21); 14029, 15188 (1); 15888, 16400, 16401 (21); 16610 (7); **16676** (29); 16677 (1); 16824 (7); 17353 (1); 17461 (7); 18781 (1); 19156 (7); 19980 (1); 19982 (7); 21124, 21298 (1); 21340 (7); 21359, 21360 (1); 31098 (21); s.n. (14); s.n. (21)
- Brade, A. C. & Santos Lima, J. J.: 11629 (7)
- Braga, J. M. A. *et al.*: 3797 (1)
- Breedlove, D. E.: 30809 (24)
- Breedlove, D. E. & Smith, A. R.: 32225-A (25)
- Breedlove, D. E. & Thorne, R. F.: 30160 (3)
- Brenes, A. M.: 11679a, 14212 (24), 14214 (15); 14839a, 16133b, 19954, 20018, 22337 (24); s.n. (24)
- Breutel, J. C.: s.n. (24)
- Bristan, N.: 1239 (15)
- Britton, E. G.: 1140 (25)
- Britton, N. L. & Bruner, E. M.: 7584 (24)
- Britton, N. L. & Cowell, J. F.: 515, p.p. (24)

- Britton, N. L. & Hess, W. E.: 2301 (24)
Britton, N. L. *et al.*: 1269 (24)
Broadway, W. E.: 5659 (24), 6061 (15), 7106, 9954 (24); s.n. (24)
Brooke, W. M. A.: 6730 (13)
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Burch, D.: 4576 (24)
Byer, M. D.: 66-1008 (24)
Byron: s.n. (15)
Byron & Luiz Coelho: 397 (15)
Cabrera, I. R. & van der Werff, H.: 15774 (26); 15790 (5)
Camp, W. H.: **E-5107**, E-5139 (2)
Campos, J. *et al.*: 5970 (18)
Cantarero, K. J.: 92 (24)
Capell, S. J. P.: s.n. (7)
Cárdenas, M.: 2091 (13)
Carnevali, G. & Santana, G.: 2441 (18)
Carreira, L. *et al.*: 780 (15)
Carter, A. *et al.*: 241B (24)
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Chrysler, M. A. & Roever, W. E.: 5246 (15)
Churchill, S. & Betancur, J.: 17031 (15)
Cid, C. A. *et al.*: 590, 965 (15)
Cilinski, J. & Cervi, A. C.: 118a (1)
Clarke, H. D.: 3685, 4898 (15)
Clarke, H. D. *et al.*: 5348 (15); 5571, 5600, 5726, 6881, 7260, 7397, 8232, 8377, 9197 (24)
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Coelho, R. L.: 1481 (15)
Cogollo, A. *et al.*: 3325 (24)
Condack, J. P. S.: 267 (1), 370 (7)
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Cook, O. F. & Griggs, R. F.: **80** (6)
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Cordeiro, J. & Manosso, A.: 285 (1); 289 (7)
Cordeiro, J. & Ribas, O. S.: 1398 (1)
Cordeiro, J. & Silva, J. M.: 231 (21)
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Core, E. L.: 1345, p.p. (3); 1345, p.p. (26)

- Cowan, R. S.: 1378 (24)
- Cowan, R. S. & Wurdack, J. J.: **31164** (18); 31211 (24); 31415 (12); 31483 (15)
- Cremers, G.: 4486, 7006, 7260, 8281, 8687, 9910, 10771, 11632, 12172 (15)
- Cremers, G. *et al.*: 9028 (24); 10177 (15); 10248 (24)
- Croat, T. B.: 71244 (5)
- Croat, T. B. & Hannon, D. P.: 64276 (24)
- Cruz, J. M. & Ribas, O. S.: 121 (21)
- Cruz, J. M. *et al.*: 272 (1)
- Cuatrecasas, J.: 16880 (15); 17217, 21100 (24)
- Damasceno, E. R. & Condack, J. P. S. 343 (7)
- Damasceno, E. R. *et al.* 420 (1)
- Damazio, L.: 185 (7); 1247 (1); 1656 (7); s.n. (7)
- Daniel, B.: 1727 (2)
- Daniëls, A. G. H. & Jonker, F. P.: 959 (24)
- d'Assumpção, G.: s.n. (7)
- Davidse, G. & Herrera, G.: 29398 (13)
- Davidse, G. & Holland, D. L.: 36701, 36782 (24)
- Davidse, G. & Huber, O.: 22882 (24)
- Davidse, G. & Miller, J. S.: 27056, 27071, 27214 (15)
- Davidse, G. *et al.*: 25822 (13)
- Dávila, E. N. *et al.*: 28 (24)
- Davis, P. H. & Coelho, D. F.: 60332 (15)
- Day, E. H.: 4691 (16); s.n. (8)
- Day, J.: 233 (14)
- Delgado, L.: 405 (15)
- Díaz, C. & Peña, A.: 8810 (9)
- Díaz, W. *et al.*: 4747 (15)
- Dittrich, V. A. O.: 1127 (1)
- Dittrich, V. A. O. & Amado, E. F.: 388 (7); 396 (1)
- Dittrich, V. A. O. & Jorge, M. C. O.: 421 (7)
- Dittrich, V. A. O. *et al.*: 217 (1)
- Döbbeler, P.: P61 (24); 189B, 579 (9)
- Dombrowski, L. D.: 13304 (1)
- Dombrowski, L. D. & Scherer, G. C.: 12139 (1)
- D'Orbigny, A.: 295 (4)
- Douglas: s.n. (3)
- Dudley, T. R.: 11134A (13)
- Duke, J. A.: 11675 (15); 13219 (6)
- Duss, P.: 5 (3); 277, p.p. (20); 757, 1554 (24); 1654, p.p. (20); 1654, p.p. (24); 1654b, p.p. (20); 1654c, p.p. (24); 1655, p.p. (8); 4048 (24); 4084, p.p. (11); 4084, p.p. (20); 4084, p.p. (24); 4085, p.p.

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DISCUSSÃO GERAL



Moranopteris taenifolia (Jerman) R. Y. Hirai & J. Prado (Foto: R. C. Moran, 2004)

DISCUSSÃO GERAL

Nessa última década, com os avanços nos estudos moleculares, vários grupos monofiléticos foram reconhecidos e uma nova classificação para as samambaias foi proposta por Smith *et al.* (2006, 2008) que alterou a re-circunscrição principalmente em nível de família. Uma das famílias que teve essa delimitação aprimorada foi Polypodiaceae, que até pouco tempo atrás era um grupo a parte das gramitidóides. Hoje são reconhecidas como uma única família uma vez que formam claramente um grupo monofilético.

Posteriormente ao rearranjo realizado para as famílias, os gêneros foram alvos dos estudos realizados por diversos pesquisadores e com isso esses gêneros tem sido melhor delimitados. Os estudos filogenéticos tem auxiliado cada vez mais na sistemática das samambaias, permitindo grandes avanços na área. Ou seja, está sendo possível conhecer melhor as relações filogenéticas entre eles, permitindo com isso o reconhecimento de grupos mais naturais, ou seja, monofiléticos. Sem essa ferramenta da biologia molecular, jamais seria possível, apenas com a taxonomia tradicional, utilizando caracteres basicamente morfológicos, a delimitação de tais grupos.

Vários gêneros apareceram nos estudos filogenéticos como parafiléticos ou polifiléticos, como foi possível observar nos gêneros de gramitidóides em geral. A partir desses estudos moleculares, há uma grande tendência em se propor gêneros novos e menores como aconteceu no caso do grupo das gramitidóides, por exemplo: *Leucotrichum* com cinco espécies (Labiak *et al.* 2010), *Stenogrammitis* com 23 espécies (Labiak 2011) segregados de *Lellingeria* s.l., *Ascogrammitis* com 17 espécies (Sundue, 2011) e *Alansmia* com 26 espécies (Kessler *et al.* 2011) segregados de *Terpsichore* s.l. Alguns gêneros Paleotropicals também foram segregados basicamente de *Ctenopteris* s.l., *Grammitis* s.l. e *Xiphopteris* s.l., tais como: *Ctenopterella* (Parris 2007), *Dasygrammitis* (Parris 2007) e *Radiogrammitis* (Parris 2007), *Xiphopterella* (Parris 2007), respectivamente. Entretanto, esses grupos paleotropicais ainda necessitam de mais estudos, como é o caso de *Ctenopteris* e *Grammitis* que ainda permanecem como grupos polifiléticos, uma vez que apresentam um grande número de espécies e uma revisão taxonômica ainda é necessária, bem como os seus estudos filogenéticos, incluindo mais terminais desses grupos. Esta relação incerta entre esses grupos Paleotropicais também surgiram no presente estudo, porém resolver essas relações não era o objetivo deste trabalho.

A partir dos estudos que vem sendo realizados, observa-se que vários nomes genéricos descritos para o Velho Mundo ou outras regiões estavam sendo mal aplicados para as espécies Neotropicais, como por exemplo, *Serpocaulon* (Polypodiaceae), que foi segregado de

Polypodium, cuja espécie-tipo é *Polypodium vulgare* L., uma espécie dos EUA. Assim como em *Micropolypodium s.l.*, um nome erroneamente aplicado para as espécies neotropicais.

Os resultados do presente estudo corroboraram aqueles previamente publicados por Ranker *et al.* (2004), de que as espécies neotropicais de *Micropolypodium s.l.* formam um grupo monofilético e que, de agora em diante, serão consideradas em um gênero à parte chamado de *Moranopteris*. Da mesma forma que os estudos anteriores, um novo gênero está sendo criado e com um número menor de espécies do que haviam sido reunidas em *Micropolypodium s.l.*

Com relação às gramitidóides, em geral, faltam principalmente estudos com os gêneros que possuem distribuição Pantropical, e por isso, sem as revisões taxonômicas das espécies Paleotropicais não é possível avançar nos estudos desses grupos. Este é o maior desafio a ser enfrentado neste grupo de plantas.

Para tentar progredir nos estudos filogenéticos com as samambaias gramitidóides em geral, um grupo está sendo mobilizado para discutir sobre os avanços que precisam ser realizados em cada grupo de espécies. Este grupo foi chamado informalmente de Grammitid Phylogeny Group (GPG), cuja idéia inicial partiu do Dr. Tom A. Ranker, da Universidade do Havaí, EUA.

O objetivo principal desse grupo é gerar uma filogenia geral de todas as gramitidóides e para isso pretende-se reunir as sequências gênicas disponíveis de todos os grupos e com isso sanar as lacunas que existem para essa filogenia. A priori, já existe um banco de dados, com basicamente três marcadores moleculares: *atpB*, *rbcL* e *trnL-trnF*, que são sequências já publicadas e não publicadas, resultado dos trabalhos de Tom A. Ranker e Michael Sundue. Paulatinamente, serão acrescentadas todas as outras sequências já obtidas por outros pesquisadores, incluindo as do presente estudo.

Este grupo tem como participantes diversos pesquisadores: Alan R. Smith (University of California, Berkeley, EUA), Barbara Parris (Fern Research Foundation, Kerikeri, Bay of Islands, Nova Zelândia), France Rakotondrainibe (Muséum national d'Histoire naturelle, Paris, França), Germinal Rouhan (Muséum national d'Histoire naturelle, Paris, França), Harald Schneider (Georg-August University Göttingen, Untere Karspüle, Gotinga, Alemanha), Jefferson Prado (Instituto de Botânica, São Paulo, Brasil), Marcus Lehnert (Staatliches Museum für Naturkunde Stuttgart, Stuttgart, Alemanha) Michael Kessler (University of Zurich, Zurique, Suíça), Michael Sundue (The New York Botanical Garden, Nova Iorque, USA), A. T. Nor Ezzawanis (Institut Penyelidikan Perhutanan Malaysia, Kepong, Malásia), Paulo H. Labiak (Universidade Federal do Paraná, Curitiba, Brasil), Regina Y. Hirai (Instituto de Botânica, São Paulo, Brasil), Sabine Hennequin (Universite

Pierre et Marie Curie, Paris, França), Tom A. Ranker (University of Hawaii, Honolulu, Hawai) e Xian-Chun Zhang (Institute of Botany, Chinese Academy of Science, Pequim, China).

A primeira pré-reunião informal de parte do grupo deverá acontecer em Melbourne (Austrália) no Congresso Internacional de Botânica, em julho de 2011 e, posteriormente, um encontro específico com todo o grupo em 2012, nos EUA, provavelmente em Berkeley, Califórnia.

Referências Bibliográficas

- Kessler, M., Velázquez, A.M., Sundue, M. & Labiak, P.H.** 2011. *Alansmia*, a new genus of grammitid ferns (Polypodiaceae) segregated from *Terpsichore*. Brittonia (no prelo).
- Labiak, P.H., Rouhan, G. & Sundue, M.** 2010. Phylogeny and taxonomy of *Leucotrichum* (Polypodiaceae): A new genus of grammitid ferns from the Neotropics. Taxon 59: 911-921.
- Labiak, P.H.** 2011. *Stenogrammitis*, a new genus of grammitid ferns segregated from *Lellingeria* (Polypodiaceae). Brittonia (no prelo).
- Parris, B. S.** 2007. Five new genera and three new species of Grammitidaceae (Filicales) and the re-establishment of *Oreogrammitis*. Gardens' Bulletin, Singapore 58: 233-274.
- Ranker, T.A., Smith, A.R., Parris, B.S., Geiger, J.M.O., Haufler, C.H., Straub, S.C.K. & Schneider, H.** 2004. Phylogeny and evolution of grammitid ferns (Grammitidaceae): A case of rampant morphological homoplasy. Taxon 53: 415–428.
- Smith, A.R., Pryer, K.M., Schuettpelz, E., Korall, P., Schneider, H. & Wolf, P.G.** 2006. A Classification for extant ferns. Taxon 55: 705-731.
- Smith, A. R., Pryer, K. M., Schuettpelz, E., Korall, P., Schneider, H. & Wolf, P.G.** 2008. Fern classification. In: T.A. Ranker & C.H. Haufler (eds.). Biology and evolution of ferns and lycophytes. Cambridge University Press, Cambridge. pp. 417–467
- Sundue, M.** 2011. A monograph of *Ascogrammitis*, a new genus of grammitid ferns (Polypodiaceae). Brittonia 62: 357–399.