

SUMMARY

Taxithelium is represented in Brazil by three species. Each species is described and illustrated and its distribution in Brazil is mapped. *Taxithelium planum* {Brid.} Mitt. is weedy but mainly confined to the low elevations of Amazonia; *T. pluripunctatum* {Ren. & Card.} Buck is reported for the first time for Brazil from three localities; *T. juruense* {Broth.} Broth. is apparently endemic to Acre.

INTRODUCTION

The genus *Taxithelium* is characterized by leaves with linear cells covered with uniseriately arranged papillae. The alar cells are usually differentiated, but not nearly as strongly as is typically encountered in the Sematophyllaceae. The capsules are hypnalean with a double peristome. The only sporophytic feature of any note is the presence, in some species, of a small, swollen neck.

In lowland Amazonia, *Taxithelium planum* is one of the most common and conspicuous mosses. However, whenever the great majority of specimens of a genus belong to a single, variable species, the rare species are often overlooked or misidentified. It was for this reason that the current review was undertaken.

TAXONOMY

Taxithelium Spruce ex Mitt., Jour. Linn. Soc., Bot. 12: 496. 1869.

Taxithelium Spruce, Cat. Musc. Amaz. And. 14. 1867, nom. nud.

Signatella (C. Müll.) C. Müll., Bot. Jahrb. 23: 328. 1896, hom. illeg., non Kützinger, Spec. Algarum 18. 1849.

Small to medium-sized plants in yellow-green, thin, often extensive mats. Stems creeping, subpinnately branched, usually complanate-foliate; pseudoparaphyllia foliose. Stem leaves more acuminate, somewhat larger and less papillose than branch leaves; leaves ovate to lanceolate, acuminate to obtuse, concave, lateral and

(*) The New York Botanical Garden, Bronx, New York, USA.

ventral leaves often differentiated; margins usually plane, serrulate to subentire; costa short and double or absent; cells linear, sometimes flexuose, mostly with several small, serially arranged papillae over each lumen, rarely prurulose or smooth; alar cells few and quadrate in basal angles or inflated and colored or scarcely differentiated. Autoicous or dioicous. Perichaetial leaves erect, usually lanceolate; margins serrate to serrulate; cells linear, papillose as vegetative leaves or smooth. Setae elongate, slender, usually reddish, smooth or rarely papillose; capsules inclined, asymmetric, contracted below the mouth when dry and empty, sometimes with a small, swollen neck at base of urn; exothecial cells only indistinctly collenchymatous; annulus none; operculum conic to conic-rostrate; peristome double, exostome teeth front surface with a zig-zag median line, cross-striolate below, coarsely papillose above, projecting at back; endostome with a high basal membrane, segments broad, papillose, keeled, perforate, cilia usually single. Spores small to medium-sized, finely papillose. Calyptrae cucullate, smooth, naked.

Taxithelium is very easy to recognize, and indeed, *T. planum* is one of the most common and weedy mosses in lowland tropical America. The pluripapillose cells with the papillae arranged serially immediately separate the genus from all others among the Sematophyllaceae.

KEY TO THE BRAZILIAN SPECIES OF *TAXITHELIUM*

1. Cells at very apex of leaf smooth; leaf margins plane2
2. Alar cells quadrate in triangular groups in basal leaf angles.....1. *T. planum*
2. Alar cells scarcely differentiated but with row of oblong cells extending across insertion, not up the margin.....2. *T. pluripunctatum*
1. Cells at very apex of leaf papillose; leaf margins usually incurved3. *T. juruense*

1. *Taxithelium planum* (Brid.) Mitt., Jour. Linn. Soc., Bot. 12: 469. 1869
Hypnum planum Brid., Musc. Recent. Suppl. 2: 97. 1812; *Sigmatella plana* (Brid.) C. Müll., Hedwigia 37: 259. 1898.--Plate 1, figs. 1-14.
- Hypnum concavum* Hook. in Kunth, Syn. Pl. Aequinoc. 1: 63. 1822; *Taxithelium concavum* (Hook.) Spruce, Cat. Musc. Amaz. And. 14. 1867, comb. inval.
- Hypnum acuminulatum* Hornsch., Fl. Brasil. 1(2): 76. 1840; *Taxithelium acuminulatum* (Hornsch.) Jaeg., Ber. St. Gall. Naturw. Ges. 1876-77: 423. 1878; *T. planum* var. *acuminulatum* (Hornsch.) Par., Ind. Bryol. 1262. 1898.
- Sigmatella quelchii* C. Müll., Malpighia 10: 519. 1896; *Taxithelium quelchii* (C. Müll.) Par., Ind. Bryol. 1262. 1898, syn. nov.
- Sigmatella olida* C. Müll., Hedwigia 40: 69. 1901; *Taxithelium olidum* (C. Müll.) Ren. & Card., Rev. Bryol. 28: 110. 1901, syn. nov.

Rather slender plants in yellow-green, complanate mats. Stems long-creeping, subpinnae, prostrate to slightly ascending, complanate to terete-foliate.

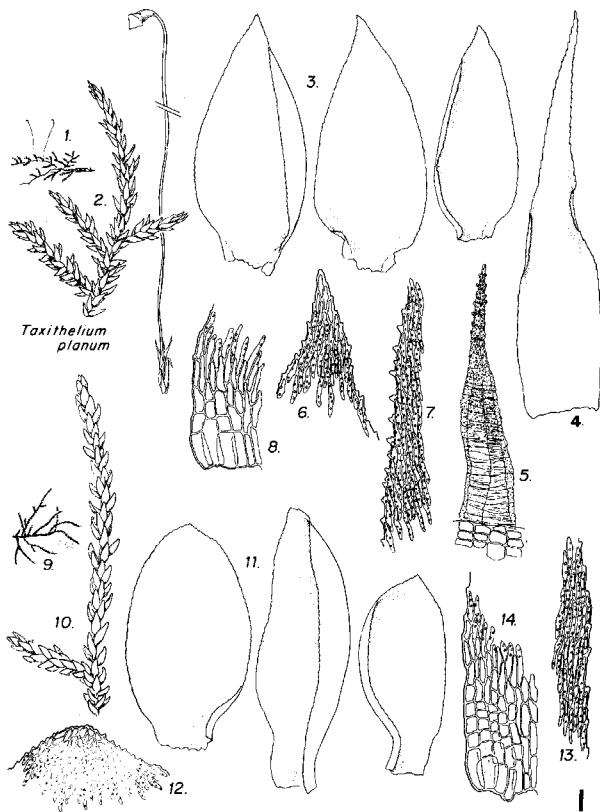
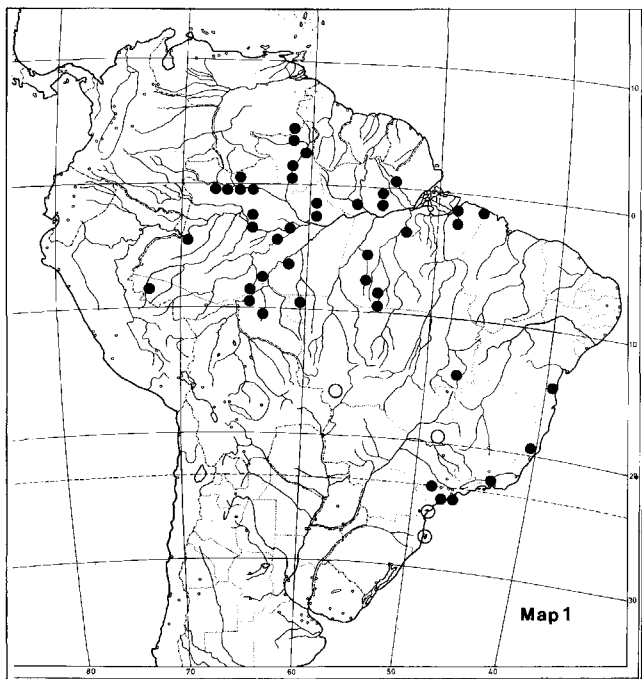


Plate I. Figs. 1-8: *Taxithelium planum*. Fig. 1: Habit, x 0.5; Fig. 2: Habit and sporophyte, x 6; Fig. 3: Leaves, x 50; Fig. 4: Perichaetial leaf, x 50; Fig. 5: Exostome tooth, x 100; Fig. 6: Leaf apex, x 200; Fig. 7: Leaf margin, x 200; Fig. 8: Alar region, x 200. Figs. 9-14: *Taxithelium* "acuminulatum" expression. Fig. 9: Habit, x 0.5; Fig. 10: Habit, x 6; Fig. 11: Leaves, x 50; Fig. 12: Leaf apex, x 200; Fig. 13: Leaf margin, x 200; Fig. 14: Alar region, x 200.



Map 1. Brazilian distribution of *Taxithelium planum*. Solid circles represent specimens examined. Open circles are significant literature reports (see Yano, 1981).

Leaves erect-spreading, densely or rarely laxly foliate, 0.63-1.2mm long, 0.3-0.6 mm wide, narrowly to broadly ovate, obtuse to acute to short-acuminate; margins plane, serrulate nearly to base, sometimes doubly so; upper cells linear, thin-walled, with 5-9 papillae serially arranged over each lumen at back, the papillae small and blunt, sometimes variously branched, apical cells and those at insertion shorter and smooth; alar cells consisting of a small marginal group of thin-walled, quadrate cells subtended by 2-4 large, inflated, occasionally colored cells at the angles. Autoicous. Perichaetial leaves elongate, erect, \pm tortuous, acuminate; margins serrate to serrulate; cells laxly hexagonal, papillose to smooth. Setae 0.8-2.0 cm long, reddish, smooth, usually curved at base of urn; capsules inclined, ca 1 mm long, ovoid to short-cylindric, constricted at base to a small neck, asymmetric; exothecial cells short-rectangular to isodiametric, somewhat collenchymatous; annulus none; operculum conic-rostrate; exostome teeth on front surface cross-striolate below, coarsely papillose above, projecting at back; endostome with a high basal membrane, segments yellow, finely papillose, keeled, perforate, cilia single. Spores finely papillose, almost smooth, 10-15 μ m in diameter.

Range: Florida to central South America; growing on almost all substrates, common and weedy, especially at low elevations.

Distribution in Brazil: Map 1.

Representative specimens examined: ACRE: Rio Juruá-Mirim, near Lucania, 14 May 1971, **P.J. Maas et al. 12936** (NY). AMAPÁ: Rio Jari, Cachoeira das Guaribas, 00°24'N 53°07'W, 16 Aug 1961, **W.A. Egler & H. S. Irwin 46454** (NY). AMAZONAS: São Gabriel, Aug 1852, **R. Spruce 968** (NY); along Rio Cauaburi between Rio Negro and Cachoeira do Cangaueijo, 00°15'S, 65°55'W, 3 Jul 1979, **W.R. Buck 2316** (INPA, NY). BAHIA: Mun. Ilhéus, 6-8 km W of Olivença on road to Maruim, 10 May 1981, **B.M. Boom & S. A. Mori 858** (CEPLAC, NY). ESPÍRITO SANTO: Linhares, near the Laguna Juparana, 14 Oct 1971, **D.M. Vital 1926** (FLAS, SP). GOIÁS: ca 3 km S of São João da Aliança, 16 Mar 1971, **H.S. Irwin et al. 31992** (NY). MATO GROSSO: Mun. Aripuanã, Dardanelos, 26 Sep 1975, **P. Lisboa et al. 275** (FLAS, INPA). MINAS GERAIS: without locality, without collector (M). PARÁ: Distrito Acará, Thomé Assu, Agua Branca, 18 Jul 1931, **Y. Mexia 5932-a** (FH, NY); Serra do Cachimbo, Base Aérea do Cachimbo, ca 09°22'S, 54°54'W, 25-30 Apr 1983, **W.D. Reese 16164** (INPA, NY). RIO DE JANEIRO: without locality, without collector (M); Morro do Dois Irmãos, May 1893, **E. Ule 1723** (lectotype of *Sigmatella otila*, HBG). RONDÔNIA: Alto Rio Candeias near Mibrasa tin mine, 10°35'S, 63°35'W, May 1982, **A.J. Fife et al. 4187** (INPA, NY) **4205** (INPA, NY); Rio Jaciparanã, 9-12 km above Jaciparanã, 30 Jun 1968, **G.T. Prance et al. 5370** (INPA, NY). RORAIMA: km 517 on BR 174, just S of Igarapé Dias, 21 Nov. 1977, **W.R. Buck et al 1923** (INPA, NY); Rio Uraricoera, Canal Maracá, abaixo da Cachoeira Grande, 61°40'W, 19 Feb 1979, **J.M. Pires et al. 16750** (MG, NY). SÃO PAULO: just N of Mongagua, 6 km N of Rio Mongagua, 24°56'S, 46°35'W, 27 Aug 1977, **D.H. Vitt 20676** (ALTA, FLAS); Cardoso Is., Mun. de Cananeia, sloping part of island, 23 May 1974, **D.M. Vital 3180** (FLAS, SP).

Taxithelium planum ranges in the New World from southern Florida, throughout

Central America and the West Indies, to South America. In South America, I have seen specimens from the Guianas, Brazil, Venezuela, Colombia, Ecuador, Peru, and Bolivia. It is much less common in the southern part of its range. *Taxithelium planulum* is probably pantropical. It has been reported from Africa under its own name but in addition there are probably a number of synonyms there as well, including *T. planum* Besch. and *T. callicostelloides* Par. In tropical Asia, the species has gone under the name *T. nepalense* (Schwaegr.) Broth., yet shows the same variation patterns as in the New World.

Taxithelium planum is extremely variable. Leaf shape and apex vary with the habitat. When the plants are growing on rotten logs in humid, but not hydric, habitats, the plants are \pm complanate-foliate with acute to short-acuminate, ovate leaves (Fig. 3). The alar cells are few with the basal ones inflated (Fig. 8). However, when the plants are growing on sand or rocks at the edge of water, and are periodically inundated as is common in the Amazon basin with its seasonal rising and falling of rivers, the plants are \pm terete, with broadly ovate leaves with obtuse apices (Figs. 11, 12). The alar cells become more numerous and occupy a larger area, but are usually only quadrate and not at all inflated (Fig. 14). This latter expression is the basis for both *Hypnum concavum* and *H. acuminatum*. *Taxithelium quelchii*, described from Guayana, is intermediate between these two extremes. Although Mitten (1869) listed *Hypnum crassicollum* Tayl., described from Ecuador, in the synonymy of *T. planum*, an examination of what appears to be a portion of the type in Mitten's herbarium (NY) reveals that Mitten erred in his placement and in fact the species is in the Hypnaceae.

Taxithelium planum is one of the most widespread and weedy of all mosses in Amazonia. It occurs in all habitats in the area, even occasionally on twigs. However, it can always be separated from the other Brazilian species by the ovate leaves with the apical cells smooth and the relatively well developed alar region.

2. *Taxithelium pluripunctatum* (Ren. & Card.) Buck, Moscosoa 2: 60. 1983.

Trichosteleum pluripunctatum Ren. & Card., Bull. Soc. Roy. Bot. Belg. 29 (1): 184. 1890.--Plate 11, figs. 10-15.

Taxithelium thelidium Besch., Jour. de Bot. 16:10. 1902.

Taxithelium patulifolium Thér. in Thér., Dix. & Buch, Ann. Bryol. 7: 160. 1934.

Plants medium-sized in golden, wiry, lax, often extensive mats. Stems creeping, irregularly but freely branched. Stem leaves somewhat larger, longer acuminate and less papillose than branch leaves; branch leaves laxly disposed, wide-spreading, 0.75-1.1 mm long, 0.2-0.35 mm wide, lanceolate-ovate to ovate, acuminate, somewhat concave; margins plane, subentire to distantly serrulate; cells linear, \pm firm-walled, obscurely porose, with 2-5 low, blunt, papillae serially arranged over the lumina at back; alar cells not differentiated or with 1-2 oblong cells at the margins and a single row of oblong, thick-walled, porose cells across the insertion. Autolcous; perichaetia and perigonia on branches. Perichaetial leaves erect, 1.0-1.3 mm long, narrow

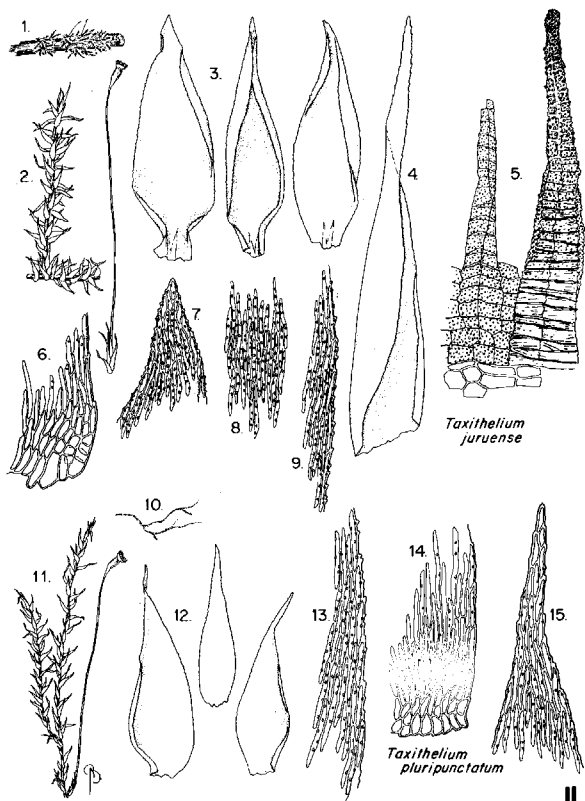
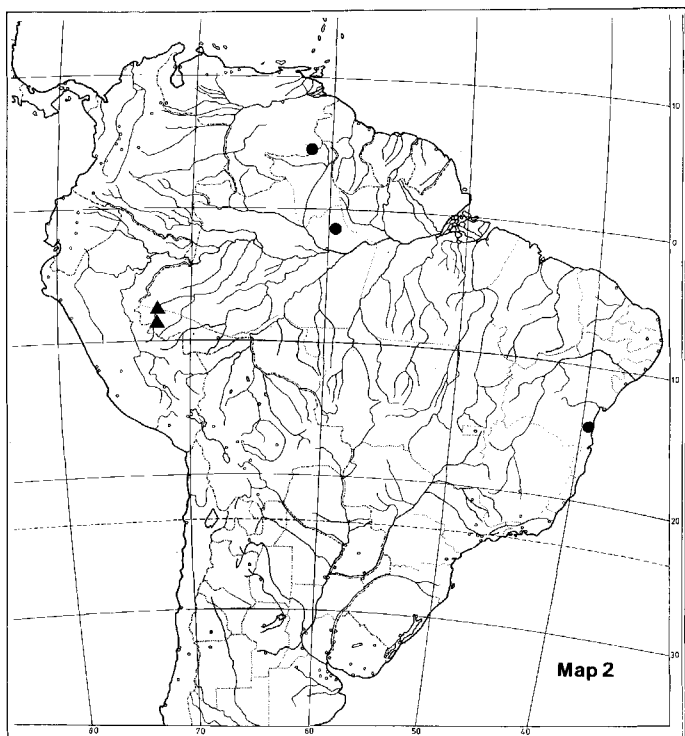


Plate II. Figs. 1-9: *Taxithelium juruense*. Fig. 1: Habit, x 0.5; Fig. 2: Habit and sporophyte, x 8; Fig. 3: Leaves, x 50; Fig. 4: Perichaetial leaf, x 50; Fig. 5: Portion of peristome, x 200; Fig. 6: Alar region, x 200; Fig. 7: Leaf apex, x 200; Fig. 8: Median leaf cells, x 200; Fig. 9: Leaf margin, x 200. Figs. 10-15: *T. pluripunctatum*. Fig. 10: Habit, x 0.5; Fig. 11: Habit, x 8; Fig. 12: Leaves, x 50; Fig. 13: Leaf margin, x 200; Fig. 14: Alar region, x 200; Fig. 15: Leaf apex, x 200.



Map 2. Distribution of *Taxithelium juruense* (triangles) and the Brazilian distribution of *T. pluripunctatum* (solid circles).

rowly triangular to oblong-triangular; margins serrulate throughout, more sharply so above; cells linear above, thick-walled, porose, smooth, rectangular below. Setae 7-13 mm long, orange, smooth, slightly curved just below urn; capsules inclined, ca. 0.8 mm long, ovoid. Somewhat asymmetric, neck slightly differentiated; exothecial cells slightly collenchymatous; annulus none; operculum short-rostrate; exostome teeth on front surface cross-striolate below, coarsely papillose above, projecting at back; endostome with a high basal membrane, yellow, finely papillose, segments keeled, perforate, cilia single. Spores finely papillose, 15-18 μ m in diameter.

Range: Martinique, Dominica, French Guiana, Brazil; mostly growing on tree trunks.

Distribution in Brazil : Map 2.

Specimens examined: AMAZONAS: primary forest along E shore of Rio Uatumã at junction of Rio Pitinga, 01°31'S, 59°50'W, 25 Aug 1979, W.R. Buck 3148 (INPA, NY). BAHIA: Mun. Ilhéus, 6-8 km W of Olivença on road to Marulm, 10 May 1981, B.H. Boom & S.A. Mori 870 (CEPLAC, NY). RORAIMA: Boca da Mata, vicinity of abandoned army base 216 km N of Boa Vista on BR 174, ca. 2 km N of Rio Surumu, ca 19 km S of Venezuela border, 29 Nov 1977, W.R. Buck et al., 1949 (INPA, NY).

Taxithelium pluripunctatum is very much like a *Mittenothamnium* in aspect due to the lax, wiry growth form. However, the papillose leaves leave little doubt as to its affinities. It is separated from the other Brazilian species by the laxly disposed leaves with alar cells not or only scarcely extending up the leaf margins, but rather with a row of thick-walled, porose oblong cells across the insertion.

This report of *T. pluripunctatum* is the first for Brazil.

3. *Taxithelium juruense* (Broth.) Broth., Nat. Pfl. I (3): 1090. 1908.

Trichosteleum juruense Broth., Hedwigia 45: 285. 1906.--Pl. II. figs. 1-9.

Rather slender plants in small, yellow-green, thin to dense mats. Stems long-creeping subpinnate, prostrate along twigs with branches complanately -spreading; branches usually less than 1 cm long, complanately foliate. Leaves wide-spreading, fairly laxly foliate, 0.69-1.1 mm long, 0.25-0.41 mm wide, ovate-lanceolate to ovate, constricted at insertion, gradually to abruptly broadly acuminate, concave; margins mostly incurved above (making the apex look abruptly acuminate) and at insertion, rarely plane, subentire except for projecting marginal papillae; upper cells linear, thin-walled, with 3-5 papillae serially arranged over each lumen at back, the papillae small and blunt, apical cells somewhat shorter but still papillose, cells across insertion shorter, thicker-walled, porose, smooth, often yellowish; alar cells in very small areas in basal angles, extending up margins by 2-3 cells, quadrate, the basal ones somewhat enlarged, rarely inflated. Autoicous. Perichaetial leaves erect, abruptly long-and broadly-acuminate from an oblong base; margins plane, entire to serrulate, occasionally sparsely and coarsely toothed; cells long-rhombic to linear above, rectangular below, smooth, thick-walled, porose. Setae 7-9 mm long, reddish, smooth or

obscurely roughened above, straight or slightly curved at base of urn; capsules sub-erect to horizontal, ca. 0.8 mm long, short-cylindric, constricted slightly at base to a small swollen neck, constricted below mouth when dry, asymmetric; exothecial cells short-rectangular, somewhat collenchymatous; annulus none; operculum conic-rotate; exostome teeth on front surface cross-striolate below, the striolae becoming papillose at mid-tooth, coarsely papillose above, projecting at back; endostome with a high, papillose basal membrane, segments yellow, papillose, keeled, narrowly perforate above, cilia rudimentary or very short and single. Spores papillose, 14-19 μ m in diameter.

Range: endemic to Brazil, growing on twigs.

Distribution: Map 2.

Specimens examined: ACRE: Rio Juruá, Juruá Miry, Sep 1901, E. Ule 2295 (Type; H-BR, HBG), Jun 1901, E. Ule 2307 p.p. (H-BR); Rio Moa, 8 km above Cachoeira Grande, 27 Apr 1971, G.T. Prance et al. 12541 (INPA, NY).

There is some question as to the exact location of the type locality. Brotherus (1906) cited Amazonas as the state of the original collection. However, Juruá Miry is probably the same as Juruá Mirim, which is in present-day Acre. Even Ule's (1903) own account of his trip to the area used this spelling for the small river, but gave no indication as to nearby settlements or other landmarks which could aid in a more accurate determination of the locality. Under any circumstances, this distinctive species is very limited in its distribution. The reports of Lisbôa and Lisbôa (1978) are based on misidentifications.

Taxithelium juruense, like its more northern congener, *T. portoricense*, is distinguished by its ramicolous plants. However, unlike that species or any other American species of *Taxithelium*, the leaves have incurved margins with projecting marginal papillae and papillose apical cells.

RESUMO

Taxithelium é representado no Brasil por três espécies. Cada espécie é ilustrada e sua distribuição mapeada. *Taxithelium planum* (Brid.) Mitt. é muito frequente, embora principalmente limitada às elevações baixas da Amazônia. Ela é reconhecida pelos filídios ovatos e células alares relativamente numerosas. A forma do ápice dos filídios e o desenvolvimento alar são dependentes do substrato e umidade. *Taxithelium pluripunctatum* (Ren. & Card.) Buck é registrada pela primeira vez para o Brasil em três localidades; ela é reconhecida pelos filídios frouxamente dispostos e com pouco desenvolvimento alar. *Taxithelium juruense* (Broth.) Broth. é aparentemente endêmica no Acre. Ela é distinguida pelas células papilosas no ápice do filídio e pelas margens enroladas do filídio.

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