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Five new species of *Fissidens* Hedw. (Fissidentaceae, Bryophyta), taxonomic notes and a new species record for South Africa

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ABSTRACT
In this paper, three topics concerning the genus *Fissidens* Hedw. are addressed. Firstly, description of five new species of the genus, viz. the Malagasy *Fissidens arboricola* Brugg.-Nann. and *F. granulidens* Brugg.-Nann., the Mauritian *F. papillisetus* Brugg.-Nann., the Tanzanian *F. rotundifolius* Brugg.-Nann. and the Brazilian *F. pseudoscindulatus* Brugg.-Nann. All five belong to *F.* subgen. *Polypodiopsis* (Müll. Hal.) Broth. sect. *Antennidens* (Müll.Hal.) Paris, are corticolous and have anomalous peristomes. Secondly, taxonomic studies revealed that *F.* subgen. *Aloma* (Kindb.) Pursell & Brugg.-Nann. is subsumed under *F.* subgen. *Polypodiopsis* (Müll.Hal.) Broth. and *F.* sect. *Semilimbidium* Müll.Hal. under sect. *Antennidens* (Müll.Hal.) Paris and their names are considered new synonyms of the names of the respective infrageneric taxa. *Fissidens jonesii* Bizot ex Pócs, previously considered conspecific with *F. lagenarius* Mitt. is re-instated as a good species, described, illustrated and compared to *F. lagenarius.* Thirdly, *Fissidens lagenarius* is newly recorded for the Republic of South Africa and its African distribution is amended and updated, with consideration of the revised taxonomic concept of *F. jonesii*.

KEY WORDS
Africa,
Brazil,
Fissidentaceae, Bryophyta,
Fissidens,
nomenclature,
new synonyms,
new species.

RÉSUMÉ
Cinq espèces nouvelles de Fissidens *Hedw. (Fissidentaceae, Bryophyta), notes taxonomiques et nouvel enregistrement pour l'Afrique du Sud.*
Dans cet article, trois sujets concernant le genre *Fissidens* Hedw. sont abordés. Tout d'abord, cinq nouvelles espèces du genre sont décrites, à savoir *Fissidens arboricola* Brugg.-Nann. et *F. granulidens* Brugg.-Nann. à Madagascar, *F. papillisetus* Brugg.-Nann. à Maurice, *F. rotundifolius* Brugg.-Nann. en Tanzanie et *F. pseudoscindulatus* Brugg.-Nann. au Brésil. Tous les cinq appartenant à *F.* subgen. *Polypodiopsis* (Müll.Hal.) Broth. sect. *Antennidens* (Müll.Hal.) Paris, sont corticoles et ont des péristomes anormaux. Ensuite, les études taxonomiques ont révélé que *F.* subgen. *Aloma* (Kindb.) Pursell & Brugg.-Nann. est inclus dans *F.* subgen. *Polypodiopsis* (Müll.Hal.) Broth. et *F.* sect. *Semilimbidium* Müll.Hal. dans la sect. *Antennidens* (Müll.Hal.) Paris; leurs noms sont donc considérés comme de nouveaux synonymes des noms des taxons infragénériques. *Fissidens jonesii* Bizot ex Pócs, précédemment considéré comme conspécifique à *F. lagenarius* Mitt. est réintégré comme une bonne espèce; celle-ci est décrite, illustrée et comparée à *F. lagenarius*. Enfin, *Fissidens lagenarius* est nouvellement enregistré pour la république d'Afrique du Sud et sa distribution africaine est modifiée et mise à jour, en tenant compte du concept taxonomique révisé de *F. jonesii*.

MOTS CLÉS
Afrique,
Brésil,
Fissidentaceae, Bryophyta,
Fissidens,
nomenclature,
synonymes nouveaux,
espèces nouvelles.

INTRODUCTION

The contents of this paper are diverse. Five new species are described. Two of these, viz. *F. arboricola* and *F. granulidens* are from Madagascar and came to me as part of the MadBryo project. Secondly, new synonymy of infrageneric taxon names is presented, *F. jonesii* is reinstated as a distinct species and *F. lagenarius* is added to the moss flora of South Africa. All included species are corticoles and have anomalous peristomes. Corticolous species of *Fissidens* Hedw. with the anomalous peristomes are described, illustrated and discussed in detail in a separate complimentary paper (Bruggeman-Nannenga 2022) and these peristomes are compared to the *scariosus*-type, which is the (presumed) ancestral type.

METHODS AND TERMINOLOGY

Descriptions and figures are, unless otherwise stated, based on the type specimens.

Peristome teeth of *Fissidens* consist of two layers, an outer (OPL) and an inner (IPL).

REMARKS

This paper was submitted together with Bruggeman-Nannenga (2022) and should have been published first as it refers species that are only described in the now second paper, thus before they were actually described.

Rectification. In the legends of *F. papillisetus* (Bruggeman-Nannenga 2022) it is stated that the holotype is in private herbarium Bruggeman-Nannenga, this should be L.

RESULTS

All five new species have limbidia restricted to the vaginant laminae; mammillose or pluripapillose laminal cells; and ± 32 columns of exothecial cells around the capsule. These characters are diagnostic for *Fissidens* subg. *Polypodiopsis* sect. *Antennidens* (Müll.Hal.) Paris. Species of this subgenus typically have *scariosus*-type peristomes (Pursell & Bruggeman-Nannenga 2004; Bruggeman-Nannenga 2021). The five new species, however, have anomalous peristomes, the same being true for many other corticolous species.

Genus *Fissidens* Hedw.
Subgenus *Polypodiopsis* (Müll.Hal.) Broth. in Engl. & Prantl
Section *Antennidens* (Müll.Hal.) Paris.

Fissidens arboricola Brugg.-Nann., sp. nov.
(Fig. 1)

Cryptogamie, Bryologie 43 (2): 14 *nomen nudum*.

Holotype. — **Madagascar**. Toamasina, Alaotra-Mangoro, Moramanga District, Association Mitsinjo, Parc Mitsinjo, Analamazotra Forest Station south of Andasibe, trails between Mitsinjo office and Orchid Park, 18°56'01.2"S, 48°24'43.8"E, secondary forest, wood, corticolous on small tree, alt. 885 m, 30.IX.2018, *Brinda 12240* (holo-, MO; iso-, L).

Additional specimen examined (paratype). — **Madagascar**. Tulear, Horombe, Ihosy, Betroka, RS Kalambatrita, Forêt d'Analamaro, 23°28'40"S, 46°23'38"E, on twig, alt. 1330 m, 6.XI.2004, *Roger Andriamiarisoa ALR-237* (private herbarium Bruggeman-Nannenga).

Etymology. — The species grows on the bark of trees, hence the name arboricola (*arbor*: tree; *colere*: inhabit; *cola*: dweller).

Ecology. — Secondary forest, growing on bark of a small tree in pure mats and/or between mosses and liverworts; on twigs.

Distribution. — Madagascar, 885-1330 m.

Illustration
Bruggeman-Nannenga (2022: fig. 3).

Description
Stem in cross-section elliptical with central strand, outer cortical cells with thick walls, inner cortical cells thick- (Fig. 1G) to thin-walled (Fig. 1F), pinnately foliate, mostly unbranched, 3.5-5 × 0.9-1.5 mm, hardly heterocaulous, slightly colouring in KOH; rhizoids bright brown, smooth; axillary nodules not differentiated; leaves distant to close, as many as 17 pairs, slightly inflexed when dry, oblong-lanceolate with acute-acuminate apex, 0.8-1.0 × 0.3-0.4 mm, 2.4-3.0 times as long as wide, margins serrulate where elimbate; limbate on the vaginant laminae of upper leaves of perichaetial stems, limbidium reaching up to ± half the vaginant lamina, 14.5 µm wide, marginal; vaginant lamina reaching to almost ¾ the leaf length, slightly unequal, margins plane, near the insertion about as wide as to slightly wider than the stem, rounded at the insertion, often slightly decurrent, unistratose; dorsal lamina rounded below, reaching the insertion, not decurrent, dorsal and apical lamina unistratose; costa ending 1-2 cells below the apex to excurrent, *bryoides*-type; lumina of mid dorsal laminal cells (4.5-)6.5-9.5 × 4.5-7.0 µm, mammillose (conical in sideview); lumina of mid vaginant laminal cells (5.0-)6.0-10 × 4.0-7.0 µm, mammillose. Gemmae not observed.

Perigonia not observed; perichaetia terminal, perichaetial leaves ± 1.4 mm long, archegonia 250 µm long; calyptra not observed. Sporophyte: seta ± 1 mm long (0.6 mm in *ALR-237*), smooth to slightly rugose, 1-2 per perichaetium; capsule symmetrical, narrowly cylindrical, 0.8-1.1 × 0.3 mm, ± 32 columns of narrowly oblong exothecial cells with thickened vertical walls around the capsule; peristome anomalous, teeth deeply divided (completely divided in *ALR-237*), ± straight, reflexed at the bifurcation (straight in the undivided teeth of *ALR-237*), up to 160 µm long, 32-40 µm wide at base, basal OPL trabeculae and lamellae smooth; IPL trabeculae of the short undivided part papillose (hard to observe), filaments spirally ornamented; operculum rostrate, 0.25 mm long; spores subglobose to ellipsoid, 23.5-32.5 × 19.5-25.5 µm, green, strongly papillose.

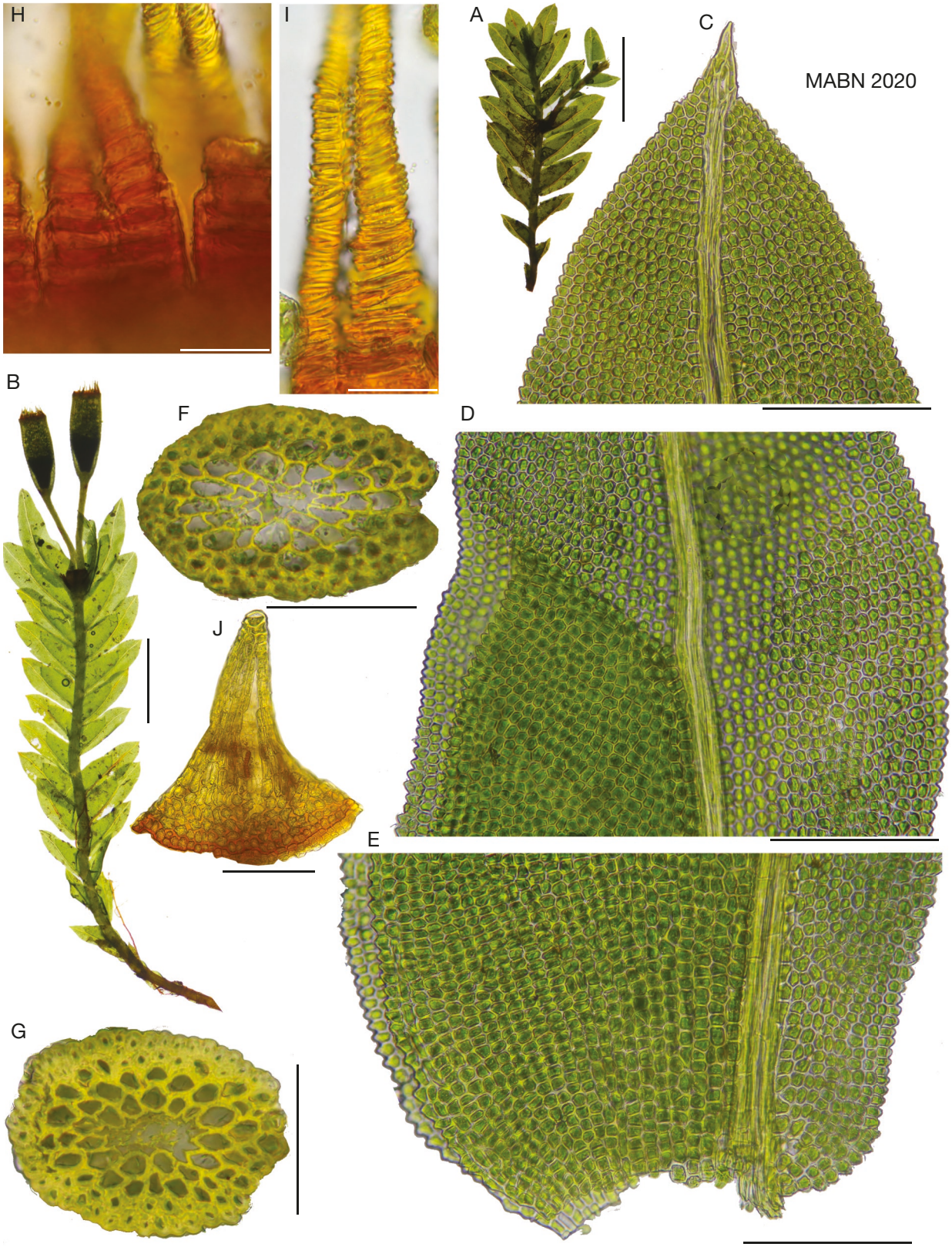

FIG. 1. — *Fissidens arboricola*, sp. nov. **A**, vegetative plant; **B**, sporophytic plant; **C**, leaf apex; **D**, mid leaf; **E**, basal part of leaf; **F**, **G**, cross-sections of stems, **F** with thin-walled inner cortical cells and **G** with thick-walled inner cortical cells; **H**, exterior side (OPL) of peristome; **I**, interior side (IPL) of peristome teeth; **J**, operculum (all from holotype). Scale bars: A, B, 1 mm; C-E, J, 100 µm; F, G, 50 µm; H, I, 20 µm.

Fissidens arboricola is characterized by mammillose cells, vaginant laminae with plane margins, limbidia restricted to the upper leaves of perichaetial stems, costa evanescent to excurrent, spores large, 23.5-32.5 × 19.5-25.5 µm, strongly papillose, and peristomes deeply to completely divided, filaments spirally ornamented. The peristome of *F. arboricola* resembles that of *F. aristifer* Brugg.-Nann. These two species differ in the width of the leaves and the apex of the perichaetial leaves. *Fissidens aristifer* has narrower leaves, asymmetric apices and long-excurrent costae, whereas the apices of the new species are symmetrical and the costae percurrent or short-excurrent. Moreover, short axillary perichaetial stems are frequent in *F. aristifer*, but lacking in *F. arboricola*. *Fissidens arboricola* can further be confused with *F. inclusus* Bizot & Dury ex Pócs, which also has mammillose laminal cells and divided peristomes. It differs from the new species in the less deeply divided peristomes and the low papillose ornamentation of the undivided part of the teeth. *Fissidens macroglossus* (Broth.) Brugg.-Nann. and *F. pseudoplumosus* Bizot & Onr. ex Brugg.-Nann. also have divided peristomes. Both differ from *F. arboricola* in having pluripapillose laminal cells. The peristomes of these species are described and compared with other anomalous peristomes in Bruggeman-Nannenga 2022.

Fissidens granulidens Brugg.-Nann., sp. nov.
(Fig. 2)

Cryptogamie, Bryologie 43 (2): 20 *nomen nudum*.

Holotype. — **Madagascar**. Forêt primitive de Manjkatompo, 16.VIII.1934, *R. Heim s.n.* (holo-, PC0773629A).

Etymology. — The species is named for the characteristic granulose peristome (*granula*: granule; *dens*: tooth).

Ecology. — Growing scattered between other mosses, corticolous.

Illustration
Bruggeman-Nannenga (2022: fig. 8).

Description
Stem heterocaulous? (only one short sporophyte observed and that unclear whether it is a detached branch or a main stem), with central strand, pinnately foliate, branched or not, 2-4 × 0.5-0.8 mm; rhizoids brown, smooth; axillary nodules and cells not differentiated; leaves distant, up to 20 pairs, hardly crispate when dry, oblong-lanceolate to lanceolate with acute to acute apiculate apex, 0.4 × 0.1 mm, 3.5 times as long as wide; margin sharply crenulate, elimbate on all leaves; vaginant lamina ⅗ the leaf length, at the base narrower than the stem, unistratose, distinctly unequal with lesser lamina ending ± half way between costa and margin; dorsal lamina rounded below, reaching the insertion, not decurrent, dorsal and apical lamina unistratose; costa ending 1-2 cells below the apex to percurrent, *bryoides*-type; lumina of mid dorsal laminal cells 5.0-8.5 × 3.5-6.5 µm, with (1-)2(-3) large papillae; lumina of mid vaginant laminal cells 4.0-7.0 × 2.5-5.0 µm, (1-)2(-3) papillose, papillae blunt and large, indistinctly rugose. No gemmae observed.

Perigonia not observed; perichaetia terminal, perichaetial leaves 0.7 mm long, archegonia and calyptra not observed. Sporophyte (only one seen): seta 1.9 mm long, smooth, 1 per perichaetium, capsule small, symmetrical, 0.3 × 0.2 mm, less than 32 (exact number unclear) columns of exothecial cells around the capsule; peristome incurved when wet, teeth undivided, short, ± 50 µm long, tooth base 17-20 µm wide, thin with distinct granulose ornamentation; operculum not seen; spores not seen.

This tiny corticolous species is best characterized by its granulose ornamentation (Fig. 2F, G) of the undivided peristomes. Gametophytically it is characterized by elimbate leaves, per to excurrent costa and laminal cells with ± 2 large papillae. The papillae are rugose (Fig. 2E), but this is easily overlooked.

Fissidens papillisetus Brugg.-Nann., sp. nov.
(Fig. 3)

Cryptogamie, Bryologie 43 (2): 23 *nomen nudum*.

Holotype. — Mauritius. Mt. Le Pouce, 20°13'05"S, 57°31'19"E, dwarf (0.5-2 m tall) elfin forest on sharp W ridge leading to the main peak, S face, ramicolous, alt. 770-780 m, 20.III.1995, *Florins & Pócs 9538/*B (holo-, L; iso-, EGR).

Additional specimen (paratype). — **Mauritius**. Mt. Le Pouce, 20°13'15"S, 57°31'08"E, huge open basalt cliff at S face, ramicolous, alt. 560 m, 20.III.1995, *Florins & Pócs 9538/C* (holo-, L; iso-, EGR). (This specimen has almost the same number as the holotype but comes from a different location.)

Etymology. — This species has been named for its papillose setae.

Ecology. — On bark of branches, growing in dense mats; once collected on an open basalt cliff, and once in an elfin forest.

Distribution. — Mauritius, Le Pouce, alt. 560-780 m.

Illustration
Bruggeman-Nannenga (2022: fig. 13).

Description
Stem branched or not, pinnately foliated, in cross-section with thick-walled cells surrounding a central strand of small, thin-walled cells (Fig. 3L), 4-6 × 1-1.5 mm; rhizoids brown and smooth; axillary nodules not observed; leaves distant to close, up to 20 pairs, slightly flexuose when dry, lanceolate, less often elliptical, acute to slightly acute-acuminate, 0.8-1.0 × 0.2 mm, (3.6-)4.5-5.0 times as long as wide, margin crenulo-serrulate to serrulate; limbidium on the vaginant laminae of all well-developed leaves (in *Florins* & *Pócs 9538/C* some stems have elimbate leaves), up to ¾ the length of the vaginant lamina in perichaetial leaves, reaching the insertion or not, up to 33.5 µm wide, intramarginal; vaginant lamina ⅗ the leaf length, about as wide as the stem, slightly rounded or straight at the insertion, gaping, margins plane (not revolute), unequal, minor lamina mostly ending about halfway between margin and costa, in perichaetial leaves sometimes

Fig. 2. — *Fissidens granulidens*, sp. nov. **A**, two vegetative stems; **B**, sporophytic stem; **C**, leaf; **D**, detail of mid vaginant lamina; **E**, detail of D showing the rugose papillae; **F**, IPL of peristome; **G**, OPL of peristome (structure obscured by through-shining IPL) (all from holotype). Scale bars: A, B, 0.5 mm; C, F, G, 50 µm; D, E, 20 µm.

ending on the costa, unistratose; dorsal lamina narrow and slightly rounded below, reaching the insertion, not decurrent, dorsal and apical lamina unistratose; costa ending 2-3 cells below the leaf apex, in cross-section *bryoides*-type; lumina of mid dorsal laminal cells 4.0-7.0 (-8.0) × (2.0-) 3.0-6.0 µm, convex to bluntly conical; lumina of mid vaginant lamina cells 4.5-9.0 × 4.0-7.0 µm, firm-walled, lowly to highly and sharply mammillose. No gemmae observed.

Perigonia and perichaetia on the same as well as on different stems; perigonia axillary, bud-shaped and terminal on short, ± 0.3 mm long branches or on main stems; antheridia 130-150 µm long; perichaetia terminal on free plants as well as on short branches from the middle part of perichaetial stems; perichaetial leaves 1-1.5 mm long; archegonia 250-330 µm long; calyptra 0.6 mm long, strongly scindulose. Sporophyte: seta 1.2-1.6 mm long,

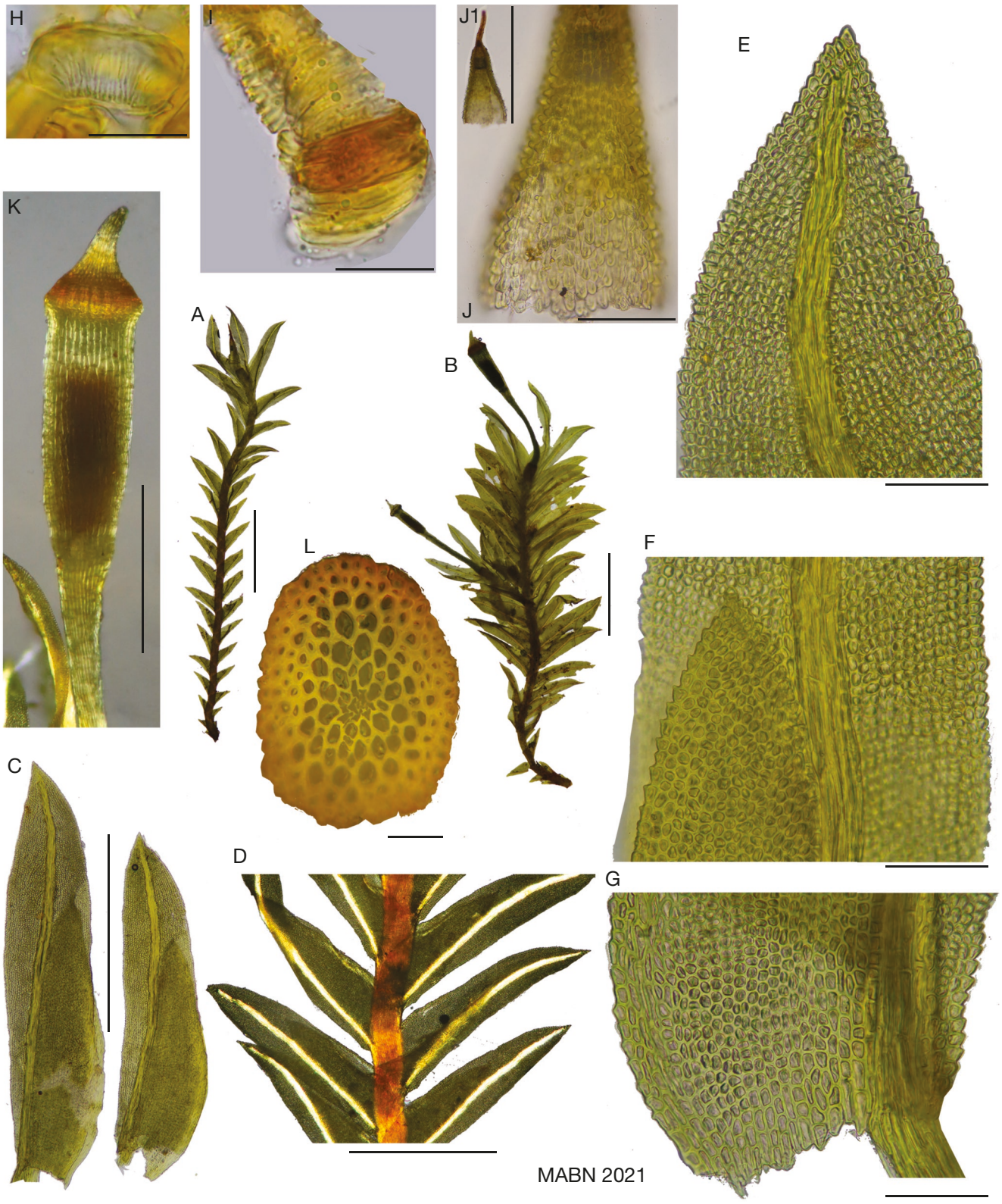

FIG. 3. — *Fissidens papillisetus*, sp. nov. **A**, vegetative stem; **B**, sporophytic stem; **C**, leaves; **D**, leaves in polarized light to show the limbidia; **E**, leaf apex; **F**, mid leaf; **G**, basal part of leaf; **H**, detail of I, showing a single lamellar plate with distinct vertical ornamentation; **I**, basal part of peristome with close-packed, horizontal plates; **J**, papillose calyptra; **J1**, J papillose calyptra with detail of the basal part to show the papillae; **K**, capsule with operculum; **L**, cross-section of stem showing thick-walled inner cortical cells and the central strand (all from holotype). Scale bars: A, B, 1 mm; C, D, K, J1, 0.5 mm; E-G, 50 µm; H, I, L, 20 µm; J, 100 µm.

strongly papillose, 1-2 per perichaetium; capsule erect, narrowly cylindrical, 0.5-0.65 × 0.2-0.25 mm with *c.* 32 columns of linear-oblong, exothecial cells around capsule; peristome undivided, teeth deeply inserted, just above the insertion genuflexed (Fig. 3I), ± 100 µm long (hard to measure), tooth base 25-33 µm wide, basal OPL lamellae not or hardly distinguishable from the close, high, horizontal trabeculae, with vertical ribs (Fig. 3H), IPL with thick, close, horizontal ridges; filaments long, terete, with close annular-spiral ornamentation, papillose near the apex; operculum short rostrate, 0.2-0.25 mm long, spores subglobose, 16.0-25.5 µm, smooth.

Fissidens papillisetus is characterized by the narrow, lanceolate, acute to slightly acute-acuminate leaves, margins of the vaginant laminae not revolute, mammillose laminal cells, limbidia usually well developed and intramarginal, setae and calyptrae strongly papillose, and undivided peristome teeth with annular-spiral filaments.

Remark

This specimen was previously cited as *Fissidens pocsii* Bizot et Dury ex Pócs (Bruggeman-Nannenga & Arts 2010).

Fissidens pseudoscindulatus Brugg.-Nann., sp. nov. (Fig. 4)

Cryptogamie, Bryologie 43 (2): 27 *nomen nudum*.

Holotype. — **Brazil**. Goiás State, *c.* 18 km S of Itaberai Town, on tree trunk, in plateau forest, 28.XII.1974, *D. Vital 4992* with *F. lagenarius* Mitt. (holo-, L; iso-, SP).

Additional specimen (paratype). — **Brazil**. São Paulo State, Município de Mogi Guaçu, at fazenda Sete Lagoas, on bark of small tree trunk, in a small area of secondary forest, 2.II.1977, *D. Vital 6946* mixed with *F. lagenarius* Mitt. (private herbarium Bruggeman-Nannenga; SP).

Etymology. — This species has been named for its cells with somewhat overlapping papillae. These resemble scindulose cells, but are pluripapillose. Hence "pseudoscindulatus". From *scindula* or *scandula*: wooden; *pseudo*: false.

Ecology. — On bark of small tree trunk, in a small area of secondary forest and in a plateau forest.

Description

Stem 1-4 × 1-1.4 mm, branched or not, pinnately foliated, with central strand; rhizoids brown and smooth; axillary nodules not differentiated; leaves close to distant, up to 14 pairs, crispate when dry, lanceolate, with acute apex, 0.6-1.0 × 0.2 mm, (3.0-)4.0-4.5 times as long as wide, margin crenulate, elimbate except for the vaginant laminae of perichaetial leaves; limbidia reaching up to about half the length of the vaginant lamina, reaching the insertion or not, unistratose, marginal; vaginant lamina ½-⅗ of the total leaf length, at the base narrower than the stem, unequal, unistratose; dorsal lamina slightly rounded to rounded at the insertion, reaching the insertion, not decurrent; dorsal and apical lamina unistratose; costa ending 1-3 cells below the apex, in cross-section *bryoides*-type; lumina of mid dorsal laminal cells 3.5-6.5 × 2.5-4.5 µm, 1-3 papillose (most easily observed in 5 % KOH); lumina of mid vaginant laminal cells 3.5-8.0 × 2.0-5.0 µm, 2-3 papillose. No gemmae observed.

Perichaetia and perigonia on separate stems, perigonia terminal; antheridia ± 140 µm long; perichaetia terminal on main stems and branches; archegonia 150-250 µm long; perichaetial leaves 0.9 mm long; calyptra not observed. Sporophyte: seta 1.7-1.9 mm long, smooth, 1 per perichaetium, capsule cylindrical, 0.5-0.7 × 0.25 mm with ± 32 columns of oblong exothecial cells with thick vertical walls around the capsule; peristome straightening when moistened, undivided, basal ± 3 cells more or less incurved, distal parts straight, teeth ± 160 µm long, tooth base 24-29 µm wide; OPL of basal 3-5 cells with high, smooth trabeculae (Fig. 4H), trabeculae becoming less distinct in distal direction, OPL lamellae in mid tooth with well-developed ornamentation (Fig. 4J); lamellar IPL ornamentation in mid tooth consisting of high, oblique, close ridges (Fig. 4G, I), filaments distally papillose on both sides; operculum rostrate, 0.25 mm long; spores subglobose to ellipsoid, 11.0-17.5 × (7.0-) 9.5-15.5 µm, faintly to coarsely papillose.

This corticolous species is characterized by limbidia restricted to the perichaetial leaves, undivided peristomes with a characteristic OPL-ornamentation on the mid part and pluripapillose laminal cells with papillae overlap neighboring cells somewhat (Fig. 4F). It is most likely to be confused with other neotropical species adorned with anomalous peristomes. These peristomes are usually species-specific. They are described and figured by Pursell (2007). Most species with anomalous peristomes are corticolous, but *F. michoacanus* Thér. grows on rock and soil, whereas *F. termitarum* (Herzog) Pursell typically lives on termite mounds, though it is also known from bark. Apart from in their peristomes, the neotropical species with anomalous peristomes differ from the new species as follows. *Fissidens lagenarius* Mitt. has rather similar peristomes, but has mammillose laminal cells. *Fissidens termitarum* is distinct by mammillose laminal cells, *F. cylindrothecus* Pursell & J. Aguirre differs by its smooth laminal cells, deeply divided peristome teeth and collenchymatous exothecial cells (exothecial cells of the new species have thickened vertical walls, but no incrassate corners). The pluripapillose *F. michoacanus* and *F. gardneri* Mitt. also have anomalous peristomes. The first can be distinguished from *F. pseudoscindulatus* by its short costae ending 12-20 cells below the apex and *F. gardneri* by its strongly unequal vaginant lamina where the minor lamina ends at or near the costa, and its wide, obtuse leaf tips.

Fissidens rotundifolius Brugg.-Nann., sp. nov. (Fig. 5)

Cryptogamie, Bryologie 43 (2): 28 *nomen nudum*.

Holotype. — **Tanzania**. Hunga Valley below Amani, East Usambara Mts, on bark in rain forest, alt. 860 m, *Pócs & Jones s.n.* (holo-, EGR, between *F. diaphanodontus*; iso-, H. Inoue *Bryophyta Selecta Exsiccata* no. 580, *Fissidens diaphanodontus*, EGR, mixed with *F. diaphanodontus*).

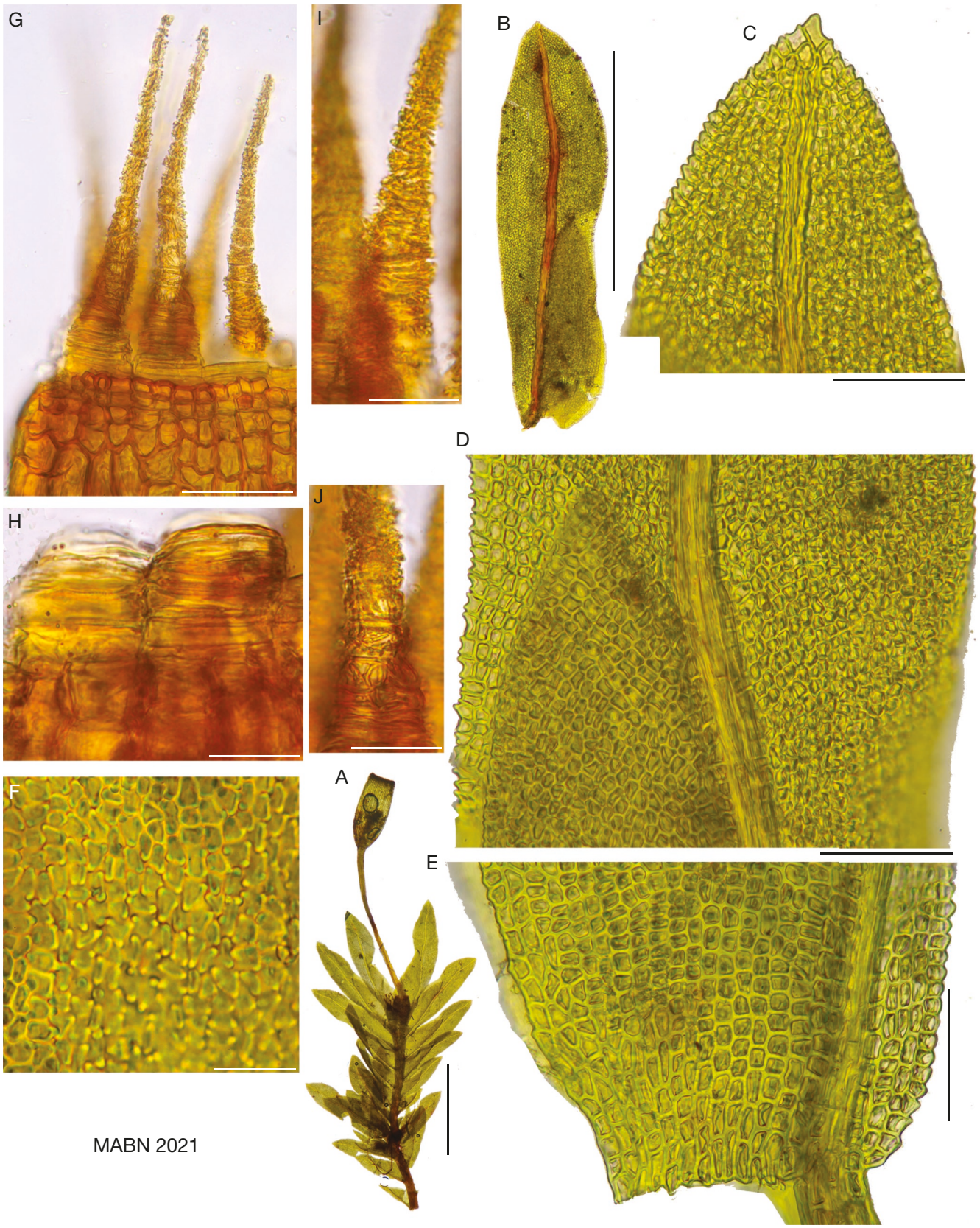

Fig. 4. — *Fissidens pseudoscindulatus*, sp. nov. **A**, sporophytic stem; **B**, leaf; **C**, leaf apex; **D**, mid leaf; **E**, leaf insertion; **F**, pseudo-scindulose mid vaginant laminal cells; **G**, peristome, OLP (two teeth on the left) and IPL (on the right); **H**, basal OPL of two teeth; **I**, detail of IPL; **J**, detail of OPL showing the characteristic ornamentation of the mid part (all from holotype). Scale bars: A, 1 mm; B, 0.5 mm; C-E, G, 50 µm; F, H-J, 20 µm.

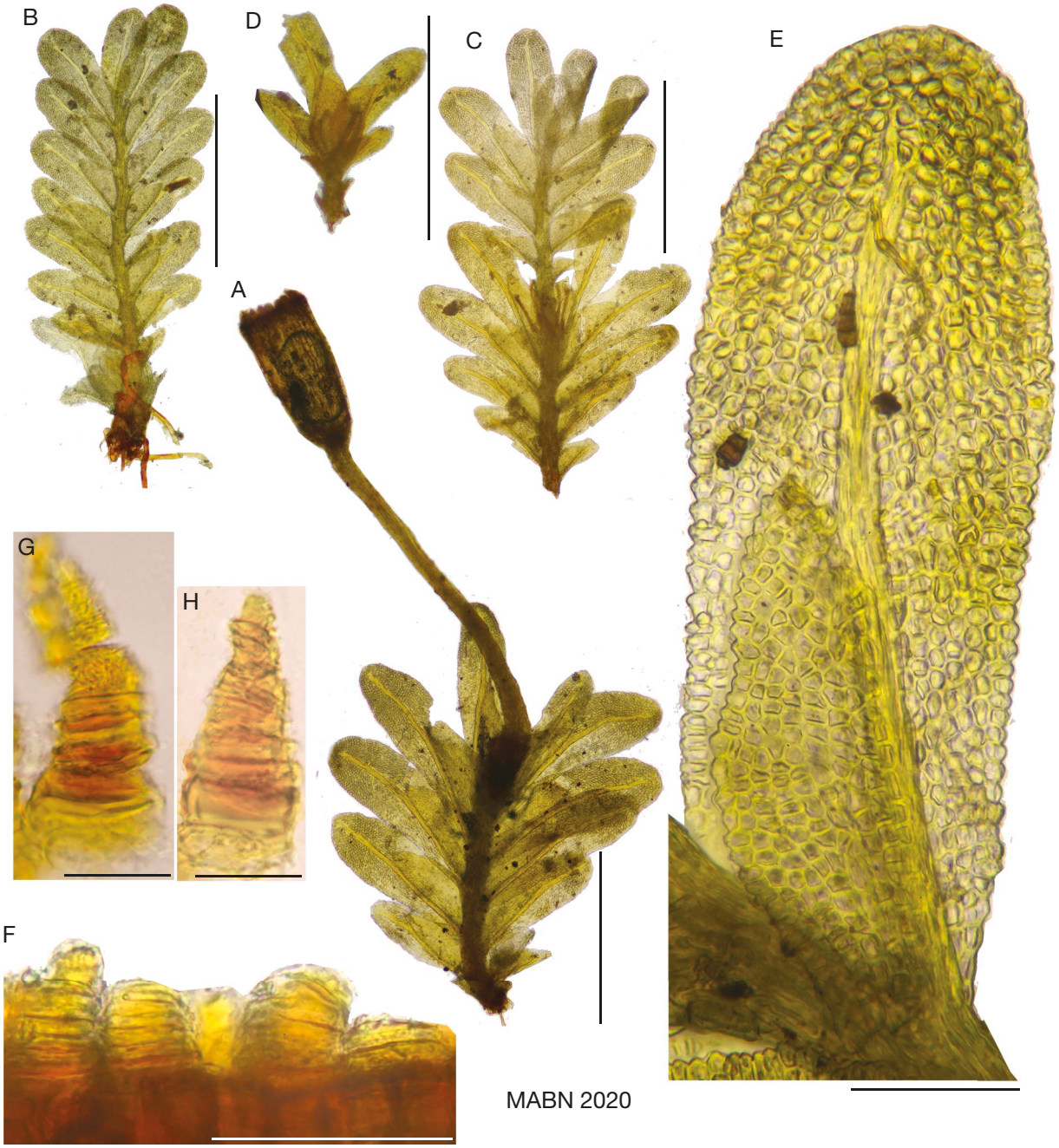

Fig. 5. — *Fissidens rotundifolius*, sp. nov. **A**, sporophytic stem; **B**, vegetative stem; **C**, perichaetial stem with apical proliferation; **D**, perigonial stem; **E**, leaf; **F**, basal part of four peristome teeth (OPL), showing the genuflexed base and OPL trabeculae; **G**, peristome tooth exterior side (OPL); **H**, peristome tooth interior side (IPL) (all from holotype). Scale bars: A-D, 0.5 mm; E, F, 50 µm; G, H, 20 µm.

Etymology. — This species is named for its rounded leaf tips (*rotundus*: rounded; *folium*: leaf).

Ecology. — On bark in rain forest mixed with *Fissidens diaphanodontus*.

Description

Stem small, 0.8-1.4 × 0.5-0.8 mm, unbranched, pinnately foliate; rhizoids brown and smooth; axillary nodules not differentiated; leaves close to distant, 9-15 pairs, oblong to lingulate, apex rounded-obtuse, 0.2-0.4(-0.6) × 0.1(-0.2) mm, 2.5-3.5 times as long as wide, margin serrulate, elimbate; limbidium weak (consisting of short, wide cells), reaching ¾ the length of the vaginant laminae on perichaetial leaves; vaginant lamina ½-⅗ the total leaf length, at the insertion narrower than to about as wide the stem, unequal with the minor lamina mostly ending about halfway between margin and costa, unistratose; dorsal lamina slightly rounded at base, reaching the insertion, not decurrent; dorsal and apical lamina unistratose; costa ending 3-9 cells below the apex; lumina of mid dorsal laminal cells 5.5-8.0 × 4.0-6.0 µm, conical; lumina

of mid vaginant laminal cells 5.0-9.0 (-10.5) × 4.0-5.5 µm with firm (1.5 µm wide), mammillose walls. Gemmae not seen.

Perigonial stems (one seen) on rhizoids at the base of a vegetative stem, 0.5 mm tall, short, budlike, perigonial branches also present, antheridia 100-130 µm long; perichaetia terminal; perichaetial leaves 0.5-1.3 mm long; archegonia 190-230 µm long; calyptra not seen. Sporophyte: seta ± 1 mm long, smooth, 1 per perichaetium, capsule erect, 0.35 × 0.1.5 mm, with 22-32 columns of oblong exothecial cells around the capsule; peristome poorly developed, stiff, genu-inflexed when wet, teeth undivided, short, ± 60-100 µm long, tooth base 18-28.5 µm wide, basal 4 OPL cells with high, thin, smooth trabeculae, lamellae hard to observe, probably smooth, distal part densely papillose; operculum not seen; spores subglobose, 19-21.5 × 17-19 µm, papillose.

This corticolous species is characterized by its small size, wide oblong-lingulate leaves with rounded obtuse tips, distally spurred costae that end 3-9 cells below the apex, firm-walled laminal cells that appear smooth but are mammillose, and undivided peristomes. If it were not for its peristome this species could be taken for a young expression of some larger species like *F. punctulatus* Sande Lac., *F. diaphanodontus* (P.de la Varde) Bizot or *F. alomoides* Müll.Hal. ex Dusén. These species likewise have oblong-lingulate leaves, short costae, mammillose laminal cells and limbidia that are more or less restricted to the perichaetial leaves. These species, however, are all larger, have longer leaves and different peristomes. Peristomes are anomalous in the first two, whereas *F. alomoides* has *scariosus*-type peristomes. For figures of the peristomes of *F. diaphanodontus* and *F. punctulatus* see Bruggeman-Nannenga 2022 (figs 6, 16). Expressions of *F. serratus* Müll.Hal. with oblong leaves can be separated from the new species by their distinctly serrulate margins (coarsely serrulate on the basal part of the vaginant laminae), whereas *F. hymenodon* Besch. has slightly longer leaves and 1-2 papillose laminal cells. Both *F. serratus* and *F. hymenodon* have *scariosus*-type peristomes.

Remark

The holotype was found hidden amidst *Fissidens diaphanodontus*. Portions of this collection have been distributed as H. Inoue *Bryophyta Selecta Exsiccatae* no. 580: *F. diaphanodontus*. It is likely that at least some of the duplicates of this exsiccate will also contain the new species. Because of the paucity of the material and the small size of the plants no cross-sections were made.

TAXONOMIC NOTES

New synonyms

Fissidens subgen. *Polypodiopsis* (Müll.hal.) Broth. *in* Engl. & Prantl, *Nat. Pflanzenfam*. 1 (3): 352 (1901); *Conomitrium* sect. *Polypodiopsis* Müll.Hal., *Linnaea* 39: 360 (1875). Type species: *Conomitrium metzgeria* Müll.Hal.

Fissidens subgen. *Aloma* (Kindb.) Pursell & Brugg.-Nann., *Bryologist* 107 (1): 14 (2004). Lectotype (designated by Pursell & Bruggeman-Nannenga 2004): *F. pauperculus* Howe, **syn. nov.** *Fissidens* subgen. *Fissidens* sect. "clade (*Aloma* + *Areofissidens* + *Polypodiopsis* + *Semilimbidium*)" Suzuki *et al*. (2018).

Subgenus *Polypodiopis* is characterized by *bryoides* type costae, capsules with ± 32 columns of exothecial cells around the capsule and peristomes *scariosus*-type (Pursell & Bruggeman-Nannenga 2004; Bruggeman-Nannenga 2021). Convinced by the phylogenetic tree by Suzuki *et al.* (2018) I now consider this subgenus to be subdivided into sections (Bruggeman-Nannenga 2021). In the 2004 paper we did not distinguish sections because many species are transitional (Pursell & Bruggeman-Nannenga 2004). In general the sections in the tree correspond with the traditional classifications (Müller 1900; Brotherus 1909, 1924). One of these sections is *Semilimbidium* Müll.Hal. Traditionally, this section is diagnosed as having semilimbate leaves and small, papillose laminal cells. This is supported by the phylogenetic tree with the exception of the rather unexpected appearance in *Semilimbidium* of the elimbate, smooth celled *F. pellucidus* that traditionally was considered a typical sect. *Aloma* species in *Semilimbidium.* The lectotype species of sect. *Antennidens* (Müll.Hal.) Paris is *F. undatus* (Müll.Hal.) Paris, a semilimbate species with pluripapillose cells that belongs to *F. intramarginatus* (Hampe) A. Jaeger *s.l.* The lectotype of sect. *Semilimbidium* Müll.Hal. is *F. flavifrons* Besch., another species that belongs in the synonymy of *F. intramarginatus s.l.* The name *Antennidens* has priority over *Semilimbidium* (1901) and has to replace this well-known name.

Fissidens subgen. *Polypodiopsis* sect. *Antennidens* (Müll.hal.) Paris, *Index Bryol.* 46 (1894); *Conomitrium* sect. *Antennidens* Müll.Hal., *Linnaea* 39: 364 (1875). Lectotype (designated by Pursell & Bruggeman-Nannenga 2004): *Conomitrium undatum* Müll.Hal.

Fissidens sect. *Semilimbidium* Müll.Hal. 1901, *Gen. Musc. Frond.*: 60 (1901 [1900]). Lectotype (designated by Pursell & Bruggeman-Nannenga 2004): *Fissidens flavifrons* Besch., **syn. nov.**

Reinstatement *Fissidens jonesii* Bizot ex Pócs

Bruggeman-Nannenga (2009) considered *Fissidens jonesii* as a synonym of *F. lagenarius*. Both species share mammillose laminal cells, axillary male buds, limbidia restricted to the (sub)perichaetial leaves, ± 32 columns of exothecial cells around the capsule, and short setae, but their peristomes differ. Those of *F. jonesii* are wider (27-43 µm versus 18-30 µm in *F. lagenarius*) and have a lamellar ornamentation that consists of a neat pattern of parallel, vertical ridges stretching from trabecula to trabecula (Fig. 6I), whereas the teeth of *F. lagenarius* show an irregular pattern of wavy vertical to oblique ridges (Fig. 6J). More elaborate descriptions and illustrations of these peristomes can be found in Bruggeman-Nannenga (2022: figs 10, 11). Because of the different peristomes, *F. jonesii* is here reinstated as a distinct species.

The two species are best distinguished by their peristomes. Furthermore, they have a different substrate preference, *Fissidens jonesii* is restricted to tree ferns, *F. lagenarius* is known from branches, trunks and rotting wood.

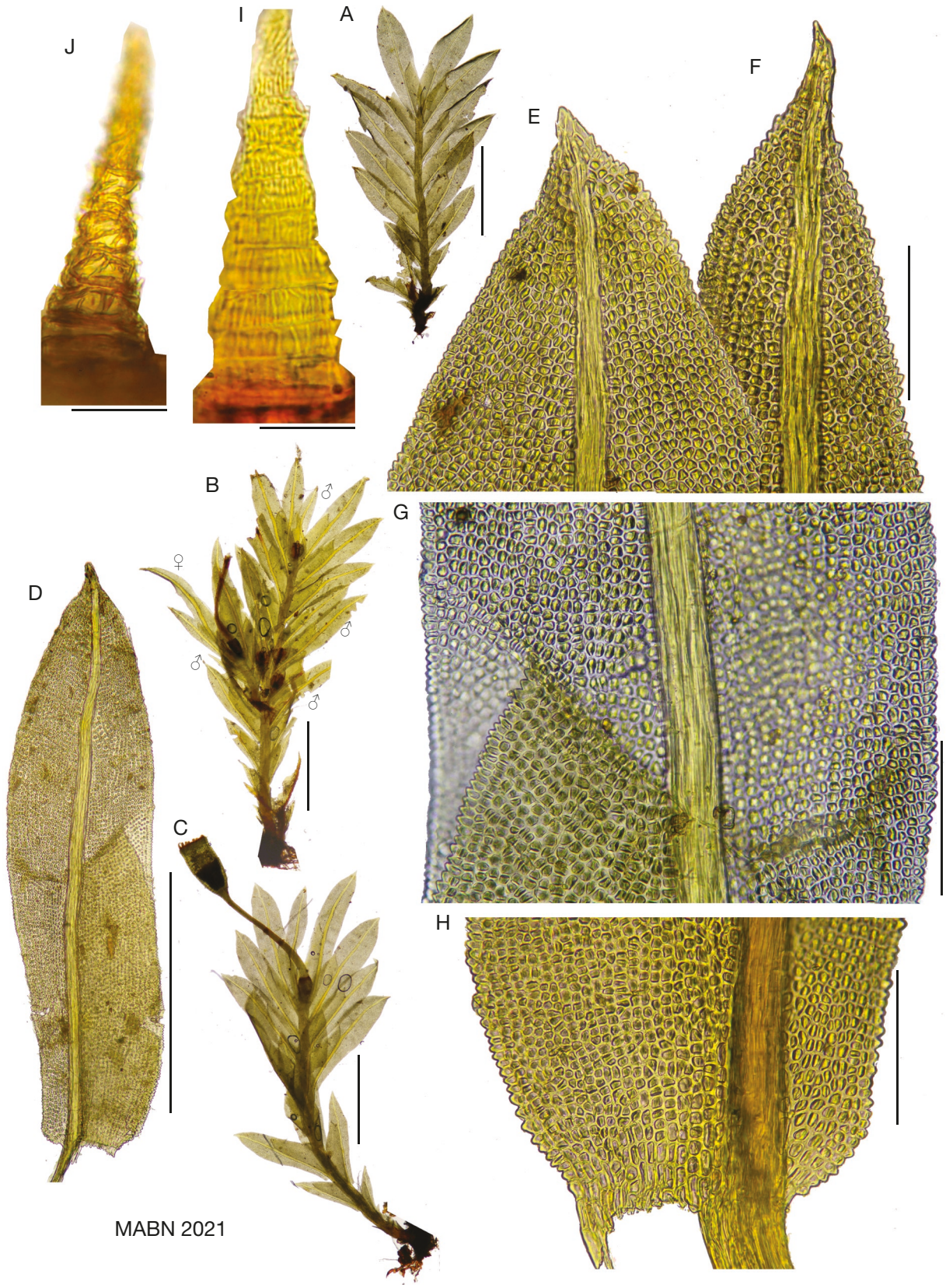

FIG. 6. — *Fissidens jonesii* Bizot ex Pócs and *F. lagenarius* Mitt. **A**-**I**, *F. jonesii*: **A**, detached perichaetial branch; **B**, detached branch with perichaetial branch, perigonial buds and long perigonial branch; **C**, sporophytic stem; **D**, leaf; **E**, leaf apex; **F**, apex of perichaetial leaf; **G**, mid leaf; **H**, insertion leaf; **I**, exterior side peristome tooth. **J**, *F. lagenarius*, exterior side of peristome teeth. **A**-**E**, **G**-**H** from *Pócs 86114/B*; **F** from *Pócs 8616/F*; **I** from *Pócs 6372/CA*; **J** from Brazil, São Paulo, *Yano 235*. Scale bars: A-C, 1 mm; D, 0.5 mm; E-H, 100 µm; I, J, 20 µm.

Description of Fissidens jonesii

A brief diagnosis (Bizot 1974) is the only published description of *Fissidens jonesii*. Therefore, a complete description and illustration are supplied here:

Fissidens jonesii Bizot ex Pócs
(Fig. 6)

Folia Hist.-Nat. Mus. Matraensis 4: 29 (1976 [1977]). — *Revue bryologique et lichénologique* 40: 133 (Bizot 1974), [nom. inval. holotype non cit.].

Holotype. — **Tanzanie**. Uluguru Mts, sur tronc de *Cyathea*, forêt de Bondwa, alt. 2100 m, *E.W. Jones et T. Pócs 6309/N* (holo-, Tanzania, Uluguru Mts, on the top of Bondwa. Elfin forest on *Cyathaea* stem. alt. 2100 m, *T. Pócs & E.W. Jones 6309/N* – GR!; iso-, PC! – hb. E.W.Jones, DSM).

Ecology. — On bark of tree ferns, in rather dense mats, sparsely mixed with liverworts.

Distribution. — Tanzania, alt. 1200-2030 m.

Examined specimens. — **Tanzania**. Uluguru Mountains, Morogoro District, E slope of Bondwa, *Pócs, Harris, Faden 6260/A* (EGR); North slope of Bondwa, *Pócs, Kitale & Kwamba 8616/F* (EGR); above Morogoro, WNW slope of main Lupanga ridge, *Pócs, Pócs & Van Zanten 86114/B* (EGR); West Usambara Mountains, university of Mazumbai, on the sharp ridge W of the ridge W of the village, *E.W. Jones & T. Pócs 6372/CA* (EGR); Nguru Mountains, above Kwamanga village, Mhonda mission, *Pócs & Mabberley 6397/C* (EGR).

Description

Stems pinnately foliated, densely branched, with branches up to 8 × 2.2 mm wide (simple stems up to 6 mm long), in cross-section elliptical, with central strand; rhizoids bright brown and smooth; axillary nodules weakly differentiated, hardly protruding; leaves close together, up to 11 leaf pairs, crispate when dry, more or less flattening when moist**,** lanceolate to narrowly oblong, acute- acuminate, 1.5-1.6 × 0.4 mm, about 4 times as long as wide, margin of stem leaves elimbate, serrulate; margins of perichaetial and subperichaetial leaves limbate, limbidia reaching up to ⅗ the vaginant laminae, not reaching the insertion, composed of short, wide, marginal, unistratose cells, 19-24 µm wide; vaginant lamina ⅗ of the total leaf length, at the base about as wide as the stem, more or less straight towards the insertion, slightly to rather strongly unequal, unistratose; dorsal lamina slightly rounded below, reaching the insertion, not decurrent; dorsal and apical lamina unistratose; costa percurrent, in cross-section *bryoides*-type; lumina of mid dorsal laminal cells 6.0-7.5 × 4.5-7.5 µm, mammillose with thick, pale walls, lumina of mid vaginant laminal cells 5.0-9.0(-10.5) × 3.5-7.0(-8.0) µm, mammillose. No gemmae seen.

Polyoicous. Perigonia gemmiform, axillary on perichaetial stem and/or terminal on stems and branches, antheridia 180 µm long; perichaetia terminal on main stem and branches, archegonia 220-320 µm long; perichaetial leaves up to 1.7 mm long. Sporophyte: seta 0.65-1.8 mm long, smooth to rough; capsule erect, emergent or exserted, cylindrical to narrowly cylindrical, 0.7-0.8 × 0.25-0.35 mm, with ± 32 columns of oblong exothecial cells with thickened vertical walls around capsule; peristome thin, distal ends gently bending inwards when moist, teeth undivided, short, ± 130 µm long (hard to measure), tooth base 27-43 µm wide, spores 15-26.5 µm, papillose.

Remark

The isotype in PC has the label, like the protologue, written in French language, whereas the label of the holotype in EGR is in English.

Amended African distribution of *Fissidens lagenarius* Mitt. var. *lagenarius*

This pantropical species is rare in Africa. It is known from Malawi, Zambia and South Africa. Only the type variety is known from Africa. The species is newly recorded for South Africa.

Examined specimens. — **Malawi**. Mulanje, Mulanje Mt. Lujeri forest, Gridref: 802322, bark of *Psychotria* tree on river bank, alt. 1120 m, 17.VI.91, *Kathumba M5906* A (E, L).
Zambia. North-Western Province, Mwinilunga District, Mushitu forest, gallery forest in Chingabola Dambo, near Matonchi, on trunk of tree, alt. 1350 m, in gallery forest, 17.II.1975, *Townsend 75/135* (E, L).
South Africa. Transvaal, Mariepskop Plantation Nature Reserve, 40 km N Pilgrim's Rest, near gate of reserve, 23°31'0"S, 30°52'0"E, indigenous forest, on tree trunk, alt. 1600-1700 m, 11.I.1973, *Crosby & Crosby 7615* (MO, pure; L, mixed with *F. serratus*).

Illustrations

Pursell (2007: fig. 94); Bruggeman-Nannenga (2011: fig. 26; 2022: fig. 11).

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REFERENCES

Bizot M. 1974. — *Enumeratio muscorum novarum*. *Revue bryologique et lichénologique*, *nouvelle série* 40 (2): 101-138.

Brotherus V. F. 1909. [1901] — Fissidentaceae, *in* Engler A. & Prantl K. (eds), *Die natürlichen Pflanzenfamilien*. Band 1 (3). Verlag Wilhelm Engelmann, Leipzig: 351-363.

Brotherus V. F. 1924. — Fissidentaceae, *in* Engler A. (ed.), *Die natürlichen Pflanzenfamilien*. Band 10. Ed. 2. Verlag Wilhelm Engelmann, Leipzig: 143-155.

Bruggeman-Nannenga M. A. 2009. — Notes on *Fissidens* VII-IX. *Journal of Bryology* 31: 106-116. https://doi.org/10.1179/174328209X415103

Bruggeman-Nannenga M. A. & Arts T. 2010. — A revision of the Fissidentaceae (Musci) of La Réunion (including all species known from Mauritius and Rodriguez). *Journal of Bryology* 32: 170-207. https://doi.org/10.1179/037366810X12735734836179

Bruggeman-Nannenga M. A. 2011. — Order Fissidentales, *in*

Jansen-Jacobs M. J. (ed.), *Flora of the Guianas*, *series C: Bryophytes, fascicle 2. Musci IV*. Royal Botanic Gardens, Kew: 40-109.

Bruggeman-Nannenga M. A. 2013. — Subgenus *Fissidens* in tropical eastern Africa with emphasis on the Tanzanian collections by Tamás Pócs. *Polish Botanical Journal* 58 (2): 369-417.

Bruggeman-Nannenga M. A. 2021. — *Fissidens* subgen. *Aloma*, the *scariosus*- and *bryoides*-type of peristome in the light of the phylogenetic tree by Suzuki *et al*. *Lindbergia* 44: 1-8. https://doi.org/10.25227/linbg.01137

Bruggeman-Nannenga M. A. 2022. — On the peristomes of the corticolous African species of *Fissidens. Cryptogamie, Bryologie* 43 (2): 9-36.

Müller C. 1900. [1901] — *Genera muscorum frondosorum*. Verlag von Eduard Kummer, Leipzig, 474 p.

Pursell R. A. & Bruggeman-Nannenga M. A. 2004. — A revision of the infrageneric taxa of *Fissidens*. *The Bryologist* 107: 1-20. https://doi.org/10.1639/0007-2745(2004)107[1:AROTIT]2.0.CO;2

Pursell R. A. 2007. — Fissidentaceae. *Flora Neotropica Monograph* 101: 1-278.

Suzuki S., Inoue Y. & Tsubota H. 2018. — Molecular phylogeny of the genus *Fissidens* (Fissidentaceae, Bryophyta) and a refinement of the infrageneric classification. *Molecular Phylogenetics and Evolution* 127: 190-202. https://doi.org/10.1016/j.ympev.2018.05.020

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