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with liverworts new to Brazil and
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Bryophytes from Uei tepui (Serra do Sol), with liverworts new to Brazil and the description of *Leptoscyphus incisus* sp. nov.

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ABSTRACT

A collection of bryophytes from Uei tepui in Mount Roraima National Park, Roraima state, northern Brazil, yielded 45 species, in 25 genera and 15 families. Twenty four species are new to state of Roraima, of which seven are new to the Brazilian Amazon domain and six species are new to Brazil: *Colura rhynchophora* Jovet-Ast, *Frullania mirabilis* J.B.Jack & Steph., *Micropterygium bialatum* Fulford, *M. tumidulum* Fulford, *Plagiochila steyermarkii* H.Rob. and *Syzygiella campanulata* Herzog. The liverwort *Leptoscyphus incisus* Gradst., F.R.Oliveira-da-Silva & Ilk.-Borg., sp. nov. is described as new to science. The new species is characterized by plants autoicous, leaves bifid to trifid and underleaves absent or rudimentary.

KEY WORDS

Brazilian Amazon,
Uei tepui,
Roraima state,
new species.

RÉSUMÉ

Des bryophytes d'Uei tepui (Serra do Sol), avec des hépatiques nouvelles pour le Brésil et description de Leptoscyphus incisus sp. nov.

Une collecte de bryophytes d'Uei tepui dans le parc national du Mont Roraima, état de Roraima, nord du Brésil, a donné 45 espèces, dans 25 genres et 15 familles. Vingt-quatre espèces sont nouvelles dans l'état de Roraima, dont sept sont nouvelles dans le domaine amazonien brésilien et six espèces sont nouvelles au Brésil : *Colura rhynchophora* Jovet-Ast, *Frullania mirabilis* J.B.Jack & Steph., *Micropterygium bialatum* Fulford, *M. tumidulum* Fulford, *Plagiochila steyermarkii* H.Rob. et *Syzygiella campanulata* Herzog. L'hépatique *Leptoscyphus incisus* Gradst., F.R.Oliveira-da-Silva & Ilk.-Borg., sp. nov. est décrite comme nouvelle pour la science. La nouvelle espèce se caractérise par des plantes autoïques, des feuilles bifides à trifides et des sous-feuilles absentes ou rudimentaires.

MOTS CLÉS
Amazonie brésilienne,
Uei tepui,
état de Roraima,
espèce nouvelle.

INTRODUCTION

Tepuis are table mountains of *c.* 1000 to 3000 m elevation, isolated and almost inaccessible. They are underlain by Proterozoic (1.8 Ga) sandstones of the Roraima Group that extensively cover the Precambrian Guiana Shield, across southern Venezuela, northern Brazil and northwestern Guyana (Huber 1995; Désamoré *et al.* 2010). This group of table mountains (Tepuis) forms a large biogeographic province, the Pantepui, that has been considered a major center of diversity and endemism of neotropical bryophytes, especially liverworts (e.g. Gradstein & Florschütz-de Waard 1989; Rico & Pócs 2004; Désamoré *et al.* 2010; Costa *et al.* 2020).

This paper focuses on Uei tepui, the southernmost Tepui of the Eastern Pantepui province, also known as *Serra do Sol* or *Cerro del Sol*, being part of Mount Roraima National Park in the state of Roraima, northern Brazil. Most of the territory of the state consists of little dissected to flat lowlands, but a considerable part is mountainous. The highest elevation in the state of Roraima is the Roraima Table Mountain (Mt. Roraima National Park), rising to 2810 m and located at the border with Guyana and Venezuela.

The bryophyte flora of Roraima state is still poorly known as compared to other states of Brazil and has been subject of a limited number of studies (e.g. Yano 1992; Yano & Mello 1999; Costa *et al.* 2020). Nevertheless, collections from Roraima state have been quoted in numerous taxonomic papers (e.g. Frahm 1991; Gradstein 1994; Gradstein & Costa 2003; Yano 2011; Bordin & Yano 2013; Costa 2015a, b; Bastos *et al.* 2016; Bastos 2017; Sierra *et al.* 2019; Bastos & Gradstein 2020a; Lima *et al.* 2020; Carmo & Peralta 2020; Oliveira-da-Silva *et al.* 2021) and indicate that Roraima has a rich bryophyte flora, especially on the highlands.

A first bryophyte checklist of Roraima state was compiled by Yano & Mello (2016) who reported 209 species, including 138 mosses and 71 liverworts. Costa (2015a, b) added two additional species from Parque Nacional Monte Caburai, *Eucamptodontopsis pilifera* (Mitt.) Broth. and *Vanaea plagiochiloides* (Inoue & Gradst.) Inoue & Gradst. Gradstein & Costa (2018) showed that the latter record represented an undescribed species of *Plagiochila*, *P. lamyana* Gradst. & Costa. New species from Roraima state were also published

by Bastos *et al.* (2016) who described *Cheilolejeunea caracariensis* C.J.Bastos *et al.* (synonym of *C. ornata* C.J.Bastos) and *C. cuspidifera* C.J.Bastos *et al.* from Serra da Mocidade, while Lima *et al.* (2020) described *Frullania amazonica* E.Lima *et al.* from Serra do Tepequem. Sierra *et al.* (2019) reported 19 species and two varieties of bryophytes new to the state from Serra da Mocidade and further new state records were reported by Bastos (2017), Carmo & Peralta (2020), Bastos & Gradstein (2020a) and Oliveira-da-Silva *et al.* (2021). Finally, Costa *et al.* (2020) added 74 species, some of them new records for Brazil. As a result, 321 species, 19 varieties and one subspecies of bryophytes are currently known from the state of Roraima.

During a field campaign to study the geobiodiversity of Uei tepui in April 2019 (UFV/MPEG/UFRR joint cooperation), a vascular plant collection of the southern part of Uei tepui, was complemented by a collection of bryophytes made by the third author. Study of the material yielded a considerable number of species new to state of Roraima, to the Brazilian Amazon domain or new to the country. One liverwort species belonging to the genus *Leptoscyphus* Mitt. proved to be new to science.

The aim of this paper is to present a list of the bryophyte species for Uei tepui with notes on their distribution, habitat and morphology. In addition, a full description and illustration is given of the new species.

MATERIAL AND METHODS

Uei tepui (*c.* 2150 m) is a sandstone to arkose table mountain located in the southernmost part of the Eastern Tepui Chain, at the border of Brazil and Venezuela (05°00'N, 60°37'W) (Fig. 1). Annual average temperature on the mountain is between 12–18°C (Huber 1995). The vegetation of the southern portion of the Tepui is dominated by open rocky fields alternating with shrublands and peat bogs, whereas in the wetter northern part *Bonnetia*-dominated cloudy woodlands dominate. Other woodlands are also found dispersed in crevices on the slopes of the mountain (Fig. 2). Safont *et al.* (2016) classified the vegetation of Uei tepui as a transitional secondary successional, because of frequent historical fire events.

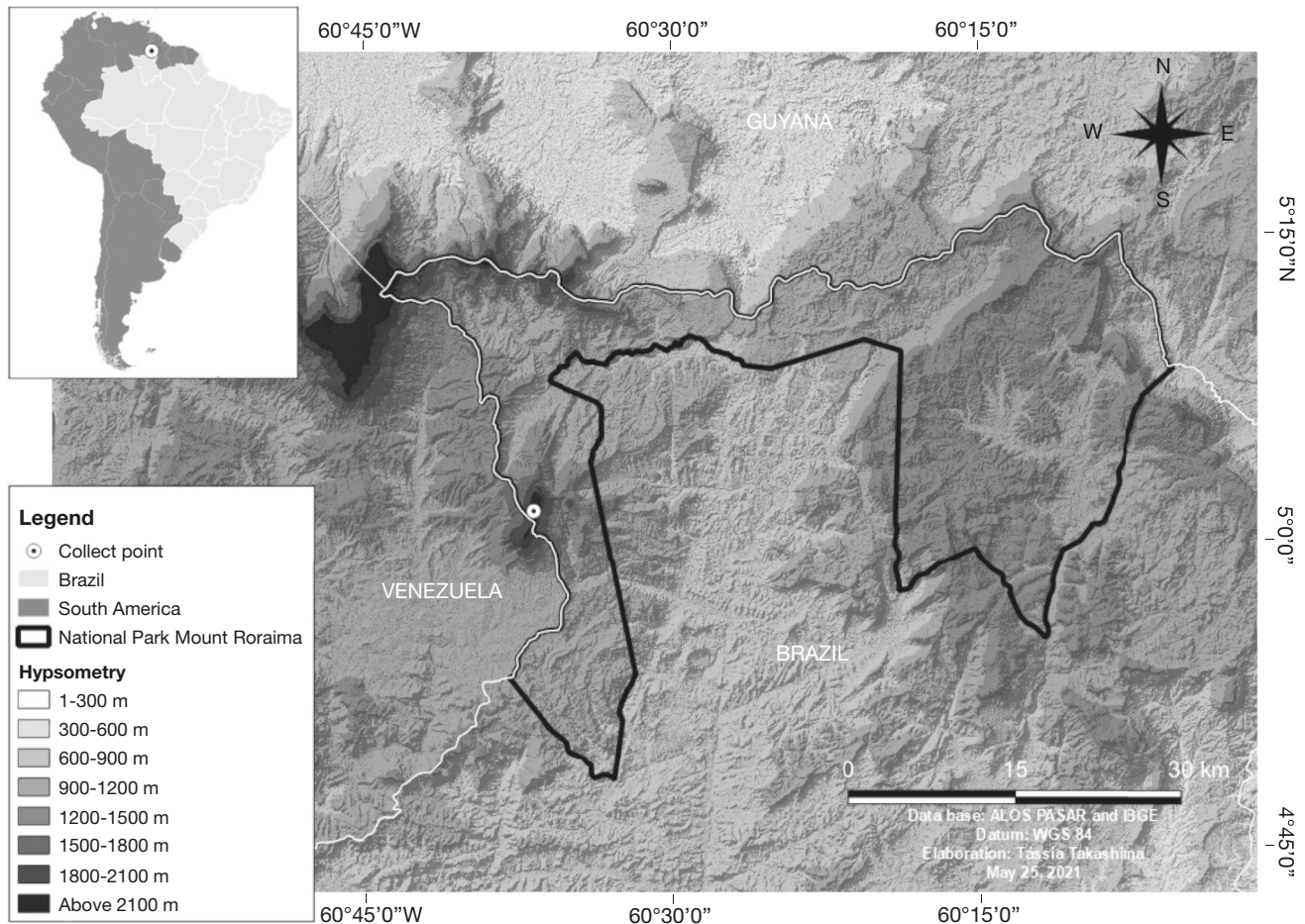


FIG. 1. — Localization map of Uei tepui (Serra do Sol).

During the fieldtrip to Uei tepui in 2019 about thirty mixed collections of bryophytes were randomly made by free walking in the *Bonnetia* woodlands and woodlands in crevices during 8-9 April. Identification of specimens was done in the Bryophyte Laboratory (BRIOLAB) of the Museu Paraense Emílio Goeldi (MPEG) and vouchers were deposited in the João Murça Pires Herbarium (MG).

The specimens were identified with, e.g. Churchill & Linares (1995), Fulford (1966), Inoue (1966), Gradstein *et al.* (2001), Gradstein & Costa (2003), Gradstein & Ilkiu-Borges (2009), Bastos & Gradstein (2020a, b) and Gradstein (2021). Classification of bryophytes follows Goffinet *et al.* (2009) for mosses (Bryophyta), with exception of the genus *Microcalpe* (Mitt.) W.R.Buck (Carvalho-Silva *et al.* 2017), and Crandall-Stotler *et al.* (2009) for liverworts (Marchantiophyta).

RESULTS AND DISCUSSION

Forty-five (45) species, in 25 genera and 15 families, were identified (see list below). The species are treated in alphabetical order by family of mosses and liverworts. Taxa new to

Roraima state are marked by a single asterisk (*), to Amazonia by two asterisks (**) and to Brazil by three asterisks (***). Remarks are provided for species new to Amazonia or Brazil.

Phylum BRYOPHYTA Schimp.
Family LEUCOBRYACEAE Schimp.
Genus *Campylopus* Brid.

Campylopus savannarum (Müll. Hal.) Mitt.

SPECIMENS EXAMINED. — Uei tepui, *Bonnetia* woodland, on soil, 5°01'30"N, 60°36'45"W, alt. 2103 m, Viana *et al.* 6263. Uei tepui, woodland in crevice, on soil, 5°00'25"N, 60°36'52"W, alt. 2046 m, Viana *et al.* 6278; on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, Viana *et al.* 6281.

Genus *Leucobryum* Hampe

Leucobryum martianum (Hornsch.) Müll. Hal.

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on soil, 5°00'25"N, 60°36'52"W, alt. 2046 m, Viana *et al.* 6278.

Family SEMATOPHYLLACEAE Broth.
Genus *Microcalpe* (Mitt.) W.R.Buck

Microcalpe subsimplex (Hedw.) W.R.Buck

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on Polypodiaceae, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6275.

Family SPHAGNACEAE Dumort.
Genus *Sphagnum* L.

***Sphagnum cyclophyllum* Sull & Lesq.

SPECIMEN EXAMINED. — Uei tepui, Bonnetia woodland, on soil, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6263.

REMARKS

Sphagnum cyclophyllum has a wide distribution in tropical America and southeastern North America. In Brazil, this species occurs on swampy soil or wet rock, in *campo rupestre* (Cerrado domain) and Atlantic Forest, at 600–1200 m (Flora do Brasil 2020). Characteristic are the absence of branches and lack of a capitulum at the stem tip, the very broad stem leaves with a cucullate apex and a distinct border of linear cells, and the numerous pores arranged in a continuous series along the margins of the hyalocysts.

Phylum MARCHANTIOPHYTA Stotler & Crand.-Stotl.
Family ADELANTHACEAE Grolle
Genus *Pseudomarsupidium* Herzog

***Pseudomarsupidium decipiens* (Hook.) Grolle

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on Polypodiaceae, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6275; on tree trunks, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6281.

REMARKS

Pseudomarsupidium decipiens is a widespread species (tropical America, Africa, western Europe) that was first recorded from Brazil by Gradstein & Costa (2003, as *Adelanthus decipiens* (Hook.) Mitt.) from Serra do Itatiaia and Serra Caparaó. This species is currently known from five states in the Atlantic forest region (Flora do Brasil 2020) and usually grows on rotten trunks in upper montane forests, at 1800–2350 m. *Pseudomarsupidium decipiens* is distinguished by subtransverse rounded leaves with two small, well-spaced teeth at the leaf apex and stems with a stoloniferous base. Some Brazilian plants have scattered teeth along the upper parts of the ventral and dorsal leaf margins (Gradstein & Costa 2003), however, the specimens examined in this study does not possess this feature.

Family CALYPOGEEACEAE Arnell
Genus *Mnioloma* Herzog

***Mnioloma cellulorum* (Spreng.) R.M.Schust.

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on rock, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6276.

REMARKS

The neotropical *Mnioloma cellulorum* was reported in Brazil from Minas Gerais and São Paulo states (Fulford 1968; Gradstein & Costa 2003), occurring on tree trunks, rock and decaying wood in montane rainforest (Atlantic forest), at 700–2000 m. This species is identified by crenulate to dentate leaf margin bordered by narrowly rectangular cells, and cuticle densely papillose.

Family CEPHALOZIACEAE Mig.
Genus *Alobiella* (Spruce) Schiffn.

***Alobiella husnotii* (Spruce) Schiffn.

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on rock, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6276.

REMARKS

Alobiella is a rare neotropical genus with one species, *A. husnotii*. The genus was first reported from Brazil by Giancotti & Vital (1989) from Distrito Federal. Besides, it is currently known from Ceará and São Paulo states (Oliveira & Bastos 2009). *Alobiella husnotii* usually grows on rock and soil in scrub, sometimes along streams and watercourses, at 500–2000 m (Giancotti & Vital 1989; Oliveira & Bastos 2009). The species is characterized by pale green plants with leaves laterally inserted on the stem, ovate-lanceolate with acute and very short-bifid apex, rarely undivided, leaf cells rectangular with finely papillose cuticle, and underleaves imbricate, longly lanceolate and bifid.

Genus *Nowellia* Mitt.

**Nowellia curvifolia* (Dicks.) Mitt.

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on Polypodiaceae, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6275; on rock, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6276.

Family FRULLANIACEAE Lorch
Genus *Frullania* Raddi

**Frullania intumescens* (Lehm. & Lindenb.)
Lehm. & Lindenb.

SPECIMENS EXAMINED. — Uei tepui, Bonnetia woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6261.

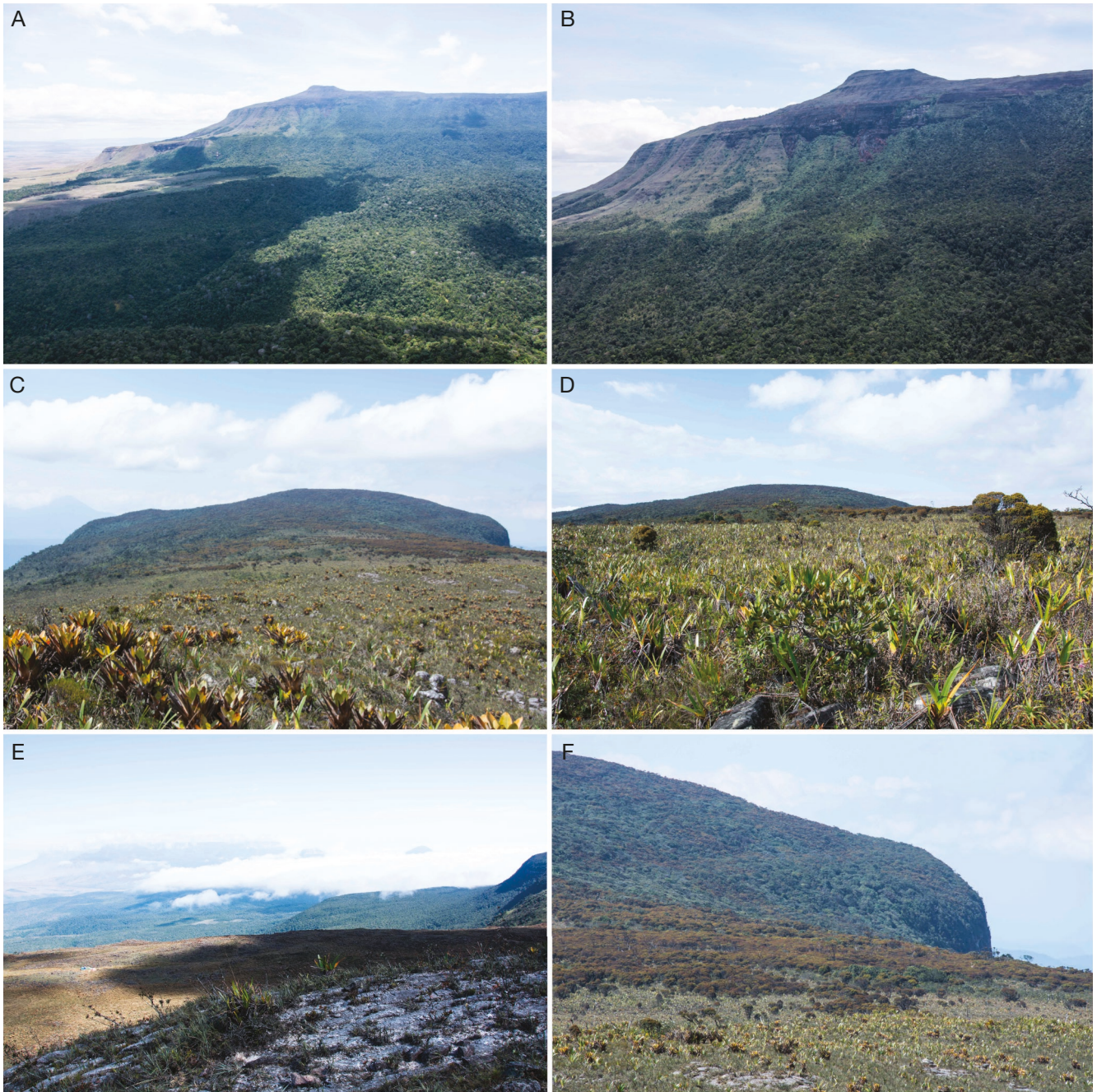


FIG. 2. — Uei tepui (Serra do Sol). **A, B**, general view of the study area; **C-F**, vegetation types at the top of the mountain.

Uei tepui, woodland in crevice, on Polypodiaceae, $5^{\circ}00'25''\text{N}$, $60^{\circ}36'52''\text{W}$, alt. 2046 m, *Viana et al.* 6275.

****Frullania mirabilis* J.B.Jack & Steph.
(Fig. 3A-G)

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on tree trunk, $5^{\circ}00'25''\text{N}$, $60^{\circ}36'52''\text{W}$, alt. 2046 m, *Viana et al.* 6273, 6274, 6281.

REMARKS

Frullania mirabilis was recorded from Costa Rica, Guyana, Venezuela, Colombia, Ecuador and Peru, growing on bark of tree, rock and soil in montane rainforest at 1200–1600 m (Clark & Svihla 1948; Stotler 1969; Gradstein & Florschütz-de Waard 1989; Rico & Pócs 2004). This species is characterized by one large appendix at the ventral leaf base near the lobule base, which emerges from the keel between lobe and lobule and is variable in shape being entire or with 1–several lobes (Clark & Svihla 1948). Another diagnostic characteristic is the appendiculate dorsal leaf base.

Frullania obcordata (Lehm. & Lindenb.)
Lehm. & Lindenb.

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on Polypodiaceae, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6275.

**Frullania schaefer-verwimpii* Yuzawa & S.Hatt.

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on Polypodiaceae, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6275.

***Frullania setigera* Steph.

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6080.

REMARKS

Frullania setigera is a neotropical species that has been reported from southern and southeastern Brazil (Gradstein & Costa 2003), growing on tree trunks and rock in montane and submontane rainforest at 600–2500 m. The species is characterized by leaf apex acuminate, underleaf apex apiculate to acuminate with auriculate base, female bracts and bracteole entire, and perianth long-ovate, 3-keeled.

Frullania subtilissima (Mont.) Lindenb.

SPECIMENS EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6261, 6264.

REMARKS

According to Gradstein (2021) *Frullania subtilissima* is the correct name for the neotropical species previously called *F. exilis* Taylor (*F. apiculata* auct.).

Family HERBERTACEAE Fulford & Hatcher
Genus *Herbertus* Gray

Herbertus pensilis (Taylor) Trevis.

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on Polypodiaceae, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6275; on tree trunks, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6273, 6279, 6281.

Family JAMESONIACEAE He-Nygrén *et al.*
Genus *Syzygiella* Spruce

****Syzygiella campanulata* Herzog
(Fig. 4A, B)

SPECIMENS EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6261, 6264. Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6280.

REMARKS

Syzygiella campanulata was recorded from Costa Rica, Venezuela, Colombia, Ecuador, Bolivia and the Dominican Republic, growing usually on tree trunks in upper montane forest at 2000–3700 m (Inoue 1966; León *et al.* 1998; Schäfer-Verwimp & Pócs 2009; Feldberg *et al.* 2010). The species is characterized by plants *c.* 2 mm wide, leaves ventrally and dorsally opposite and connate, ovate, entire, ventral and dorsal bases shortly decurrent, leaf cells with large, nodulose trigones and cuticle strongly papillose, with 10–20(–30) rounded papillae on each cell. Another important characteristic is the long-exserted perianth, *c.* 5 mm long, with bracteoles united with the bracts for more than 2/3 of their length (Inoue 1966).

***Syzygiella contigua* Steph.

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on soil, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6278; on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6281.

REMARKS

Syzygiella contigua is a neotropical species that has been reported from southern and southeastern Brazil (Flora do Brasil 2020). The species is similar to *S. campanulata* (see above), but the latter has a papillose cuticle while in *S. contigua* the cuticle is smooth.

Syzygiella rubricaulis (Nees) Steph.

SPECIMENS EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6261, 6264.

Family LEJEUNEACEAE Cavers
Genus *Cheilolejeunea* (Spruce) Steph.

Cheilolejeunea cuspidifera C.J.Bastos *et al.*

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6280.

Cheilolejeunea lobulata (Lindenb.) C.J.Bastos & Gradst.

SPECIMENS EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6264. Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6273, 6279; on soil, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6278.

Cheilolejeunea ornata C.J.Bastos

SPECIMEN EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6261.

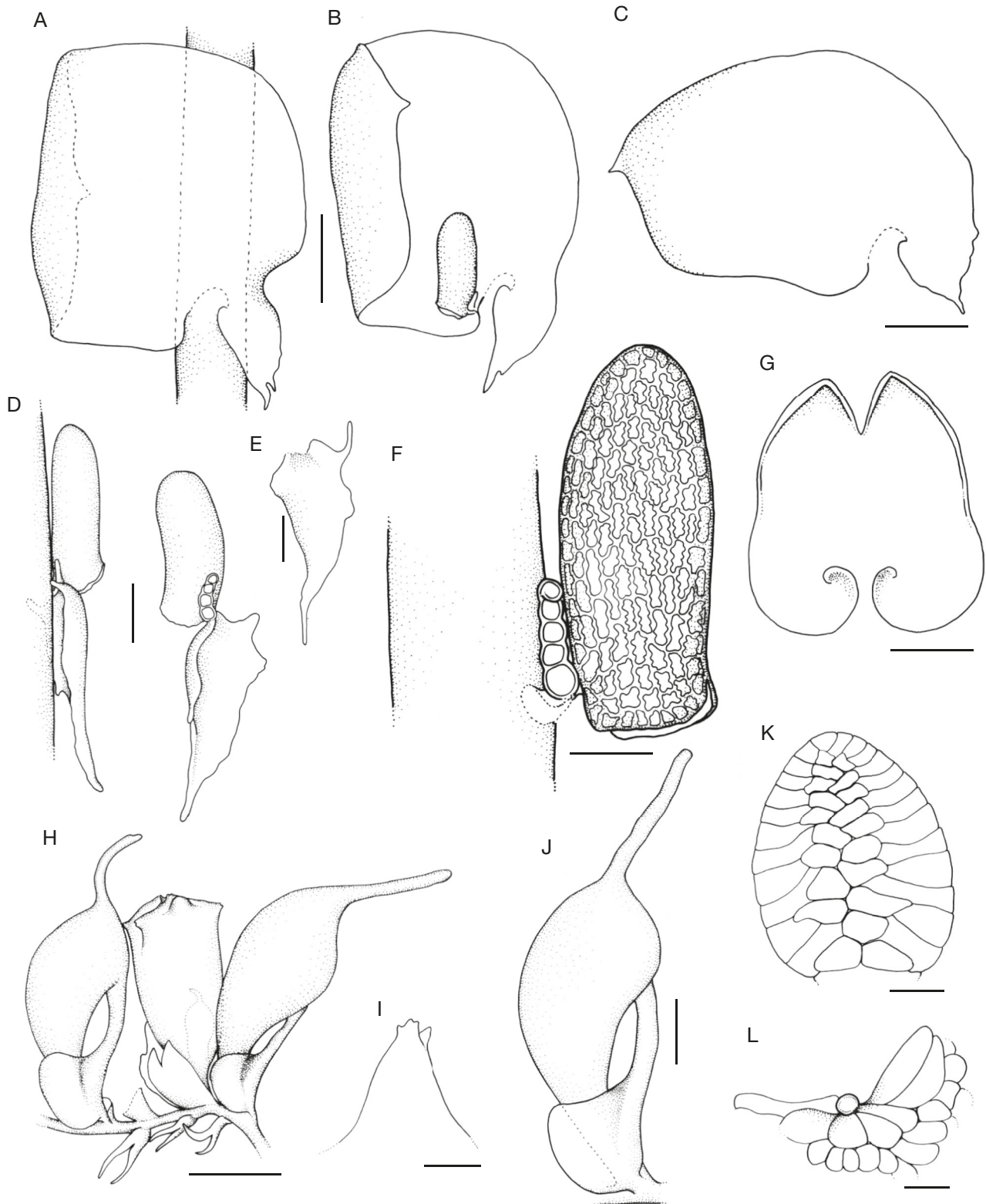


FIG. 3. — Liverworts new to Brazil. **A-G**, *Frullania mirabilis* J.B.Jack & Steph: **A**, leaf on stem, dorsal view; **B**, leaf on stem, ventral view; **C**, flattened leaf, dorsal view; **D**, lobules with appendix; **E**, appendix of lobule; **F**, lobule without appendix; **G**, underleaf. **H-L**, *Colura rhynchophora* Jovet-Ast: **H**, sector of a stem with perianth; **I**, apex of a perianth keel; **J**, leaf; **K**, valve; **L**, base of valve. **A-G** from Viana *et al.* 6273; **H-L** from Viana *et al.* 6260. Scale bars: A-C, G, H, J, 250 μ m; D, E, 100 μ m; F, I, K, L, 50 μ m.

Cheilolejeunea tonduzana (Steph.) W.Ye *et al.*

SPECIMENS EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6261, 6264. Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6280, 6281.

Cheilolejeunea xanthocarpa (Lehm. & Lindenb.) Malombe

SPECIMENS EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6259, 6261, 6262, 6264.

Genus *Colura* (Dumort.) Dumort.

**Colura calyptrifolia* (Hook.) Dumort.

SPECIMEN EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6259.

****Colura rhynchophora* Jovet-Ast
(Fig. 3H-L)

SPECIMEN EXAMINED. — Uei tepui, *Bonnetia* woodland, on leaves of *Orectanthe ptaritepuiana* (Steyerm.) Maguire, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6260.

REMARKS

Colura rhynchophora is a rare species reported from Guadeloupe (Jovet-Ast 1953), Dominica (Eggers *et al.* 1998; Schäfer-Verwimp 1999) and Guyana (Gradstein & Florschütz-de Waard 1989; Gradstein & Hekking 1989). It grows on leaves and dead wood usually in rainforest at 500-900 m. This species is distinguished by large leaves (1.7-2.2 mm) ending in a longly cylindric horn, as well as by long-rectangular cells of the sac and perianths tipped by five very short, erect horns (Jovet-Ast 1953).

Genus *Cyclolejeunea* A.Evans

**Cyclolejeunea luteola* (Spruce) Grolle

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on rock, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6276.

Genus *Diplasiolejeunea* (Spruce) Schiffn.

***Diplasiolejeunea pauckertii* (Nees) Steph.

SPECIMEN EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6259.

REMARKS

Diplasiolejeunea pauckertii is a neotropical-montane species that has been recorded from Serra do Itatiaia in Minas Gerais and Rio de Janeiro (Schäfer-Verwimp 1992), grow-

ing on tree trunks and decaying logs at 1500-2300 m. This species is mainly characterized by plants 2.5-3 mm wide and lobules very large, usually $\frac{4}{5}$ of the leaf length, strongly swollen-involute, continuing to the leaf apex by an involute ventral leaf margin.

*Genus *Drepanolejeunea* (Spruce) Steph.

**Drepanolejeunea biocellata* A.Evans

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on Polypodiaceae, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6275.

**Drepanolejeunea crassiretis* A.Evans

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6279.

Genus *Neurolejeunea* (Spruce) Schiffn.

**Neurolejeunea breutelii* (Gottsche) A.Evans

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on Polypodiaceae, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6275; on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6281.

Family LEPIDOZIACEAE Limpr.

Genus *Bazzania* Gray

Bazzania bookeri (Lindenb.) Trevis. var. *bookeri*

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6274, 6281.

Bazzania longistipula (Lindenb.) Trevis.

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6280.

Genus *Lepidozia* (Dumort.) Dumort.

Lepidozia cupressina (Sw.) Lindenb.

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on Polypodiaceae, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6275; on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6279, 6280.

Genus *Micropterygium* Gottsche

****Micropterygium bialatum* Fulford
(Fig. 4C-E)

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on Polypodiaceae, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6275; on rock, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6276.

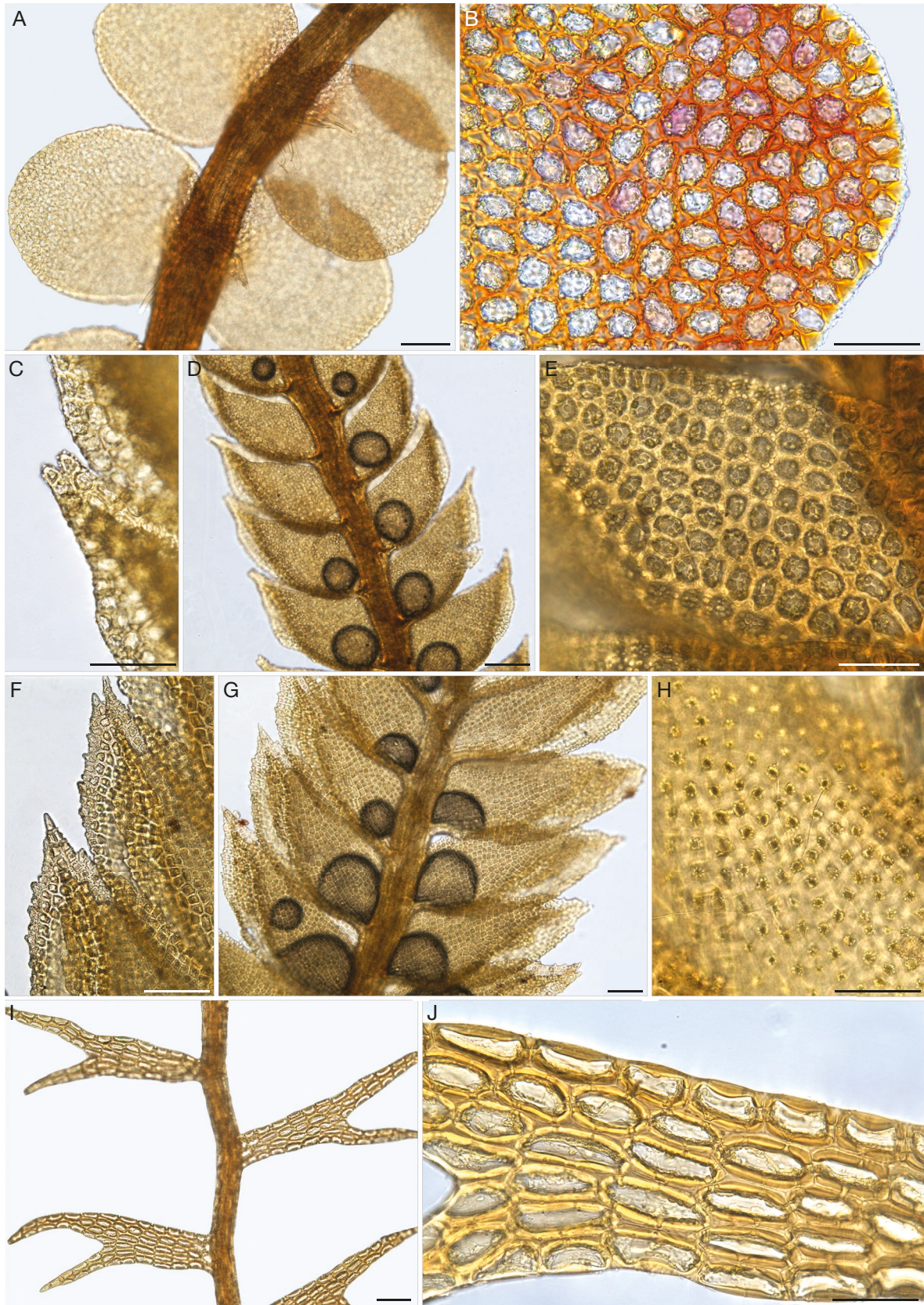


FIG. 4. — Liverworts new to Brazil. **A, B**, *Syzygiella campanulata* Herzog: **A**, habit, ventral view; **B**, leaf cells showing papillose cuticle. **C–E**, *Micropterygium bilatum* Fulford: **C**, leaf apex with papillae; **D**, habit, ventral view; **E**, leaf cells with papillae. **F–H**, *Micropterygium tumidulum* Fulford: **F**, leaf apex; **G**, habit, ventral view; **H**, leaf cells with papillae. **I–J**, *Plagiochila steyermarkii* H.Rob.: **I**, habit; **J**, leaf cells. **A, B**, from Viana et al. 6261; **C–E** from Viana et al. 6275; **F–H** from Viana et al. 6278; **I–J** from Viana et al. 6261. Scale bars: A, D, G, I, 100 μ m; B, C, E, F, H, J, 50 μ m.

REMARKS

Micropterygium bialatum is only known from the tepuis of Venezuela (Fulford 1966; Dauphin & Ilkiu-Borges 2002; Morales *et al.* 2007), growing on moist soil, sandstone bluffs and bases of trees at 1700–2300 m. This species can be distinguished by underleaves decreasing in size toward the apex of ascending branches, leaves ovate with a 2-winged keel, leaf apex often shortly bifid (by 1–2 cells) and dorsal cell surface with a low papilla (Fulford 1966).

Micropterygium campanense Reimers

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on rock, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6277.

**Micropterygium lechleri* Reimers

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6273, 6279, 6281.

****Micropterygium tumidulum* Fulford
(Fig. 4F–H)

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on soil, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6278.

REMARKS

Micropterygium tumidulum is a rare tepui species reported from Auyan tepui (Fulford 1966), Cerro Venamo (Dauphin & Ilkiu-Borges 2002) and Cerro Marutani (Morales *et al.* 2007) in Venezuela, and Mount Roraima in Guyana (Gradstein & Florschütz-de Waard 1989). This species usually grows on sandstone and dry bark in montane scrub at 1200–2300 m. *Micropterygium tumidulum* is distinguished by underleaves decreasing in size to the apex of ascending branches, leaves ovate an evenly folded from base to apex, cell surface papillose and cell walls with nodulose trigones (Fulford 1966).

Genus *Telaranea* (Spruce) Schiffn.

Telaranea nematodes (Austin) M.Howe

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on rock, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6276.

Family LOPHOCOLEACEAE Vanden Berghen

Genus *Leptoscyphus* Mitt.

**Leptoscyphus cuneifolius* (Hook.) Mitt. subsp. *fragilis*
(J.B.Jack & Steph.) Grolle

SPECIMENS EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6261, 6264.

Uei tepui, woodland in crevice, on soil, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6278.

Leptoscyphus incisus

Gradst., F.R.Oliveira-da-Silva & Ilk.-Borg., sp. nov.
(Fig. 5)

Autoicous. Plants prostrate with ascending branches, branching usually by innovations, sometimes with stoloniferous ventral branches with rhizoids and rudimentary leaves. Leaves succubous to almost transversally inserted, subopposite, subrectangular, bifid to trifid to 1/3–1/4 of leaf length; leaf cells with nodulose and confluent trigones. Underleaves absent or rudimentary. Perianths long-ovoid to subcylindrical, mouth circular to broadly elliptic, entire, marginal cells little differentiated, isodiametrical to subquadrate, outer cell walls thickened.

HOLOTYPE. — Brazil. Roraima state, Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, 8.IV.2019, *Viana et al.* 6264 (holo-, MG).

ETYMOLOGY. — The epithet refers to the incised leaves, an unusual character in neotropical *Leptoscyphus*.

DISTRIBUTION AND HABIT. — *Leptoscyphus incisus* Gradst., F.R.Oliveira-da-Silva & Ilk.-Borg., sp. nov. is only known from cloudy forest with dominance of *Bonnetia* sp. on Uei tepui, state of Roraima, northernmost Brazil, growing on the trunks of treelets at about 2100 m.

DESCRIPTION

Sexual system

Autoicous.

Habit

Plants prostrate with ascending branches, orange to red-brown, 1.3–2.6 mm wide on leafy ascending branches, considerably smaller in prostrate branches (to 0.5 mm wide), branched usually by innovations, innovations intercalary, originating ventro-laterally at the perianth base in the ventral axil of a bract, sometimes with intercalary, stoloniferous ventral branches with rhizoids and rudimentary leaves.

Stem

In cross section with epidermis weakly differentiated, one layer of *c.* 26 thick-walled epidermal cells surrounding *c.* 45 somewhat thin-walled medullary cells, the medullary cells little larger than epidermal cells.

Leaves

Succubous to almost transversally inserted, widely to obliquely spreading, contiguous to imbricate, subopposite, subrectangular, 1.5–2× longer than wide, (0.5–)0.7–1.3 mm long, 0.35–0.5 mm wide, apex bifid to trifid, incised 1/3–1/4 of leaf length, uniseriate tips 2–4 cells long, margins entire, dorsal margin ± straight, ventral margin arched; leaf cells (sub)isodiametric in prostrate branches, 20–40 μm, elongate in ascending branches, 25–60 μm long, 15–25 mm wide, trigones nodulose, sometimes confluent, intermediate thickenings rare in elongate cells only, cuticle smooth.

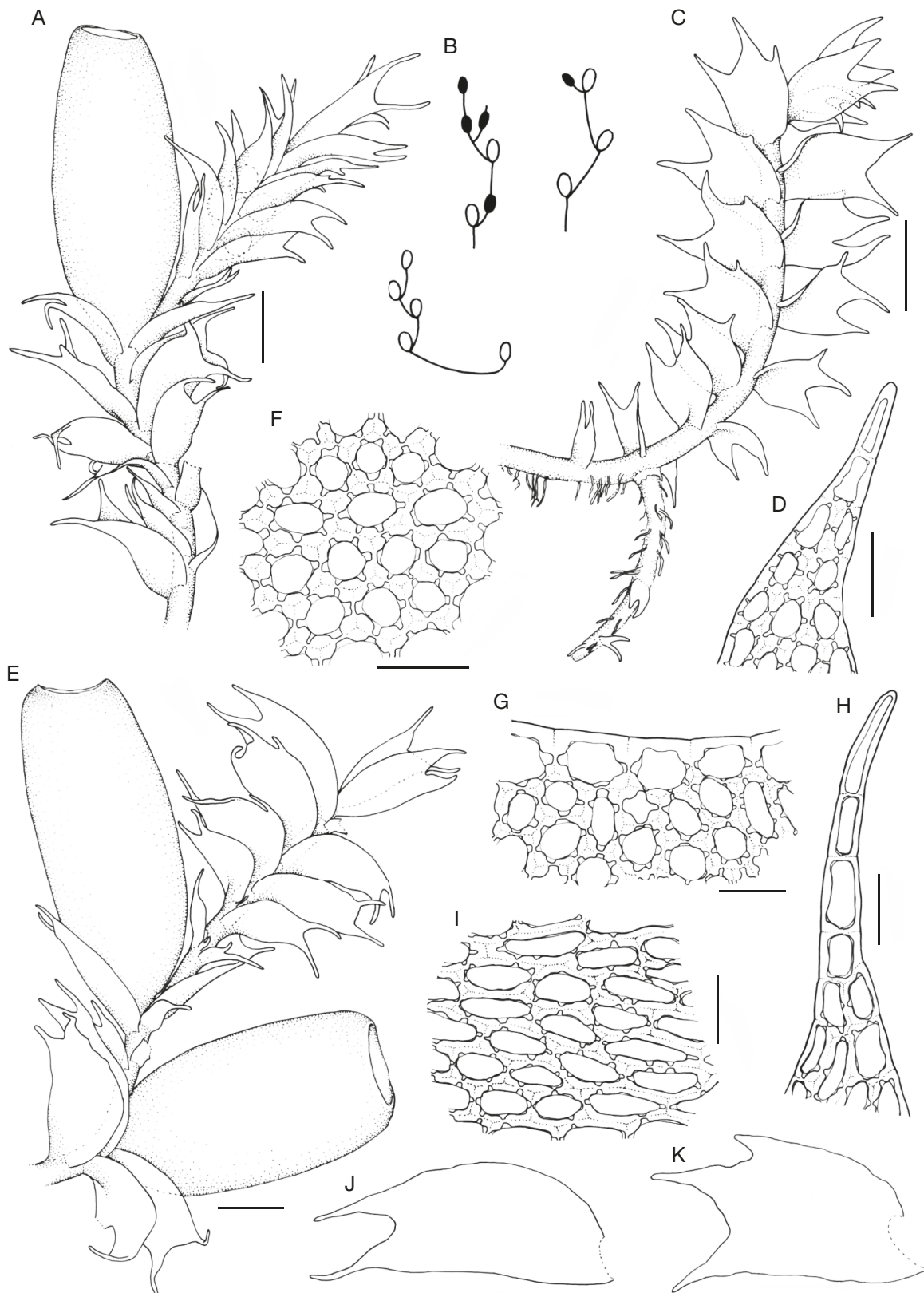


FIG. 5. — *Leptoscyphus incisus* Gradst., F.R.Oliveira-da-Silva & Ilk.-Borg., sp. nov.: **A**, sector of a stem with gynoecia with perianth and male fertile innovation; **B**, cladographs of fertile plants, solid ellipse = androecia, open ellipse = gynoecia with perianth; **C**, sector of a stem with stoloniferous branch; **D**, apex of a leaf; **E**, sector of a stem with gynoecia with perianth and female fertile innovation; **F**, median cells of leaves of a prostrate branch; **G**, marginal cells of perianth mouth; **H**, apex of a leaf; **I**, median cells of leaves of an ascending branch; **J**, **K**, leaves. All from the holotype. Scale bars: A, C, E, 500 μ m; D, F-I, 50 μ m; J, K, 250 μ m.

Underleaves

Absent or rudimentary.

Rhizoids

Colorless, little ramified at the tip forming an adhesive patch.

Androecia

On innovations from axil of bracts or intercalary on the stem, with 4-5 pairs of bracts; bracts imbricate, subopposite, 0.5-0.7 mm long, 0.3-0.5 mm wide, apex bifid to trifid, incised $\frac{1}{3}$ of bract length, uniseriate tips 2-4 cells long, margins entire; bracteoles rudimentary (inconspicuous).

Gynoecia

Terminal on ascending branches and on innovations, usually repeatedly innovated, with one pair of bracts; bract subopposite, 0.7-1.3 mm long, 0.35-0.5 mm wide, apex bifid; bracteoles absent or rudimentary.

Perianths

Long-ovoid to subcylindrical, (1.0-)1.6-2.2 mm long, 0.5-1.1 mm wide, terete, narrowed to the mouth, the apex in profile truncate, mouth circular to broadly elliptic, entire, marginal cells little differentiated, isodiametrical to subquadrate, outer cell walls thickened.

REMARKS

The new species shares several features with *Leptoscyphus autoicus* (J.J. Engel & Gradst.) Vanderp. & Gradst. (basionym *Physotheca autoica* J.J. Engel & Gradst.) from Ecuador, such as the autoicous sexuality, branching via innovations and perianths terete, inflated, bladder-like, with a narrow, fully entire mouth (Engel & Gradstein 2003). The two species also have rather similar habitats, occurring as epiphytes in low woody vegetation on very mineral-poor soil. *Leptoscyphus incisus* sp. nov. clearly differs from *L. autoicus*, however, in the bifid to trifid leaves and reduced underleaves. In *L. autoicus* the leaves are undivided, suborbicular to oblate, and underleaves not reduced. Very small underleaves are otherwise also seen in *Leptoscyphus* subg. *Anomylia* (R.M.Schust.) R.M.Schust., and 2-3-fid leaves occur in the African *L. infuscatus* (Mitt.) E.W.Jones (*L. sect. Physoscyphus* Grolle). The latter species, however, has dioicous sexuality, much larger underleaves and a flattened perianth with a wide, toothed mouth, similar as in most *Leptoscyphus* species.

Family METZGERIACEAE H.Klinggr.

Genus *Metzgeria* Raddi

**Metzgeria ciliata* Raddi

SPECIMENS EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6259, 6261, 6262.

Family PALLAVICINIACEAE Mig.

Genus *Jensenia* Lindb.

Jensenia spinosa (Lindenb. & Gottsche) Grolle

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on rock, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6276.

Family PLAGIOCHILACEAE Müll.Frib.

Genus *Plagiochila* (Dumort.) Dumort.

Plagiochila bifaria (Sw.) Lindenb.

SPECIMENS EXAMINED. — Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6273, 6281; on soil, *Viana et al.* 6278. Uei tepui, *Bonnetia* woodland, on ferns, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6275.

Plagiochila simplex (Sw.) Lindenb.

SPECIMEN EXAMINED. — Uei tepui, woodland in crevice, on tree trunk, 5°00'25"N, 60°36'52"W, alt. 2046 m, *Viana et al.* 6273.

****Plagiochila steyermarkii* H.Rob.

(Fig. 4I-J)

SPECIMENS EXAMINED. — Uei tepui, *Bonnetia* woodland, on tree trunk, 5°01'30"N, 60°36'45"W, alt. 2103 m, *Viana et al.* 6261; on ferns, *Viana et al.* 6275.

REMARKS

Plagiochila steyermarkii is a rather rare neotropical species that has been recorded from Venezuela, Guyana, Cuba and Dominica, growing on trees and rock in montane rainforest at 960-2200 m (Robinson 1965; Schäfer-Verwimp 1999; Grolle & Heinrichs 1999; Rico & Pócs 2004). The species is recognized by the small plants with distant, deeply bifid (to $\frac{1}{2}$ - $\frac{2}{3}$) and frequently caducous leaves, and thick-walled leaf cells with large trigones.

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