

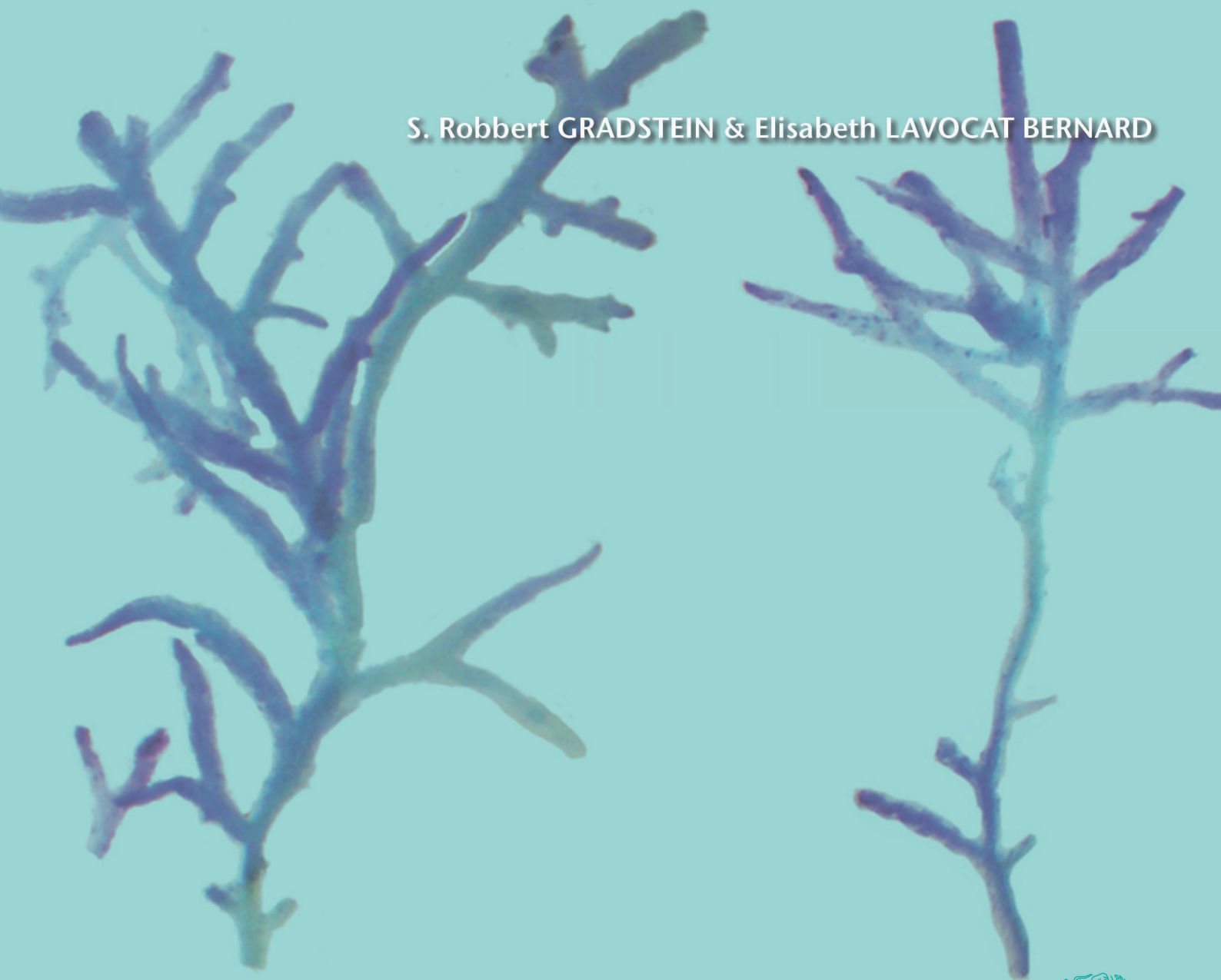
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An evaluation of the endemic bryophyte flora of Guadeloupe

S. Robbert GRADSTEIN & Elisabeth LAVOCAT BERNARD



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An evaluation of the endemic bryophyte flora of Guadeloupe

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ABSTRACT

The Guadeloupe archipelago has a rich bryophyte flora with 633 species, including 19 species considered endemic to Guadeloupe. Most of the endemic species are only known from type material and are of doubtful taxonomic status. An examination of the types and literature leads to the recognition of three confirmed endemic species in the Guadeloupe archipelago: *Frullania trigona* L.Clark, Jovet-Ast & Frye, *Riccardia innovans* (Steph.) Pagán and *Trichosteleum glaucinum* (Besch.) A.Jaeger. All three are very rare and only known from the type. Field searches to locate further populations were unsuccessful. The remaining “endemic” species are not restricted to Guadeloupe and most of them are synonyms of widely distributed taxa. Nine new synonyms and four new lectotypifications are proposed. The study shows that bryophyte endemism in the Guadeloupe archipelago is 0.5%. The results confirm the notion that endemism in bryophytes is low.

KEY WORDS

Confirmed endemics,
geographical distribution,
rejected endemics,
Frullania trigona,
Riccardia innovans,
Trichosteleum glaucinum,
lectotypifications,
Guadeloupe.

RÉSUMÉ

Évaluation de la bryoflore endémique de la Guadeloupe.

L'archipel de la Guadeloupe possède une bryoflore riche avec 633 espèces, dont 19 espèces considérées comme endémiques de la Guadeloupe. La plupart des espèces endémiques ne sont connues que par leur échantillon type et sont de statut taxonomique douteux. Un examen des types et de la littérature a permis de reconnaître trois espèces endémiques dans l'archipel de la Guadeloupe: *Frullania trigona* L.Clark, Jovet-Ast & Frye, *Riccardia innovans* (Steph.) Pagán et *Trichosteleum glaucinum* (Besch.) A.Jaeger. Ces trois espèces sont très rares et ne sont connues que de leur type. Les recherches sur le terrain pour localiser d'autres populations n'ont pas abouti. Les autres espèces signalées comme endémiques s'avèrent non limitées à la Guadeloupe; la plupart d'entre elles sont des synonymes de taxons largement répandus. Neuf nouveaux synonymes et quatre nouvelles lectotypifications sont proposés. L'étude montre que l'endémisme des bryophytes dans l'archipel Guadeloupéen est de 0,5 %. Les résultats confirment le faible taux d'endémisme chez les bryophytes.

MOTS CLÉS

Endémiques confirmées,
distribution géographique,
endémiques rejetées,
Frullania trigona,
Riccardia innovans,
Trichosteleum glaucinum,
lectotypifications,
Guadeloupe.

INTRODUCTION

The Guadeloupe archipelago has a rich bryophyte flora with 633 recorded species (Lavocat Bernard & Schäfer-Verwimp 2011; Lavocat Bernard & Reeb 2016). The majority of the species occurs on the main island, Guadeloupe, which is ecologically highly diverse and reaches to 1467 m on the active volcano La Soufrière, constituting the highest elevation in the Lesser Antilles. Many species have been described from the Guadeloupe archipelago and Lavocat Bernard & Schäfer-Verwimp (2011) listed 19 bryophyte species as being endemic to the archipelago, including *Cheilolejeunea falcata* Steph., *Cheilolejeunea ovistipula* Steph., *Drepanolejeunea valiae* Jovet-Ast, *Frullania guadalupensis* Steph., *Frullania minima* Steph., *Frullania trigona* L.Clark, Jovet-Ast & Frye, *Frullania urbanii* Steph., *Harpalejeunea herzogii* Jovet-Ast, *Plagiochila desciscens* Steph., *Plagiochila germani* Steph., *Plagiochila herminieri* Steph., *Plagiochila saxicola* Steph., *Radula subsimplex* Steph., *Rectolejeunea dussii* Steph. (synonym of *Cheilolejeunea dussii* Steph. nom. inval.), *Riccardia innovans* (Steph.) Pagán, *Taxilejeunea irregularis* Steph., *Taxilejeunea linguaefolia* Steph., *Megaceros solidus* Steph. and *Trichosteleum glaucinum* (Besch.) A.Jaeger. Most of them, however, are only known from the type and, as noted by Lavocat Bernard & Schäfer-Verwimp (2011), their taxonomic status is usually doubtful and in need of verification.

The purpose of this paper is to verify the taxonomic status of the endemic bryophytes of Guadeloupe archipelago based on the study of types, literature and fieldwork.

RESULTS AND DISCUSSION

The species recorded as endemic to the Guadeloupe archipelago are treated in alphabetical order, in two sections: confirmed endemics and rejected endemics. Confirmed endemics include species that are only known from Guadeloupe and are accepted here as good taxa. Rejected endemics, on the other hand, have wider ranges and are not restricted to Guadeloupe. Almost all of them are synonyms of widely distributed species. Type

citations and full bibliographic references are provided for all species except for those treated as synonyms in recent taxonomic revisions. The Guadeloupe archipelago is for brevity referred to as "Guadeloupe".

CONFIRMED ENDEMICS

Family FRULLANIACEAE Lorch

Genus *Frullania* Raddi

Frullania trigona L.Clark, Jovet-Ast & Frye
(Figs 1, 4)

The Bryologist 50: 52 (1947). — Type: Guadeloupe, Traces Hugues, "sur branchettes", *P. & V. Allorge s.n.* (iso-, PC[PC0102212, PC0102211 (slide)]!).

Remarks

Frullania trigona is a member of subg. *Frullania* sect. *Microphyllae* (R.M.Schust.) Gradst., Lima & Ilk.-Borg., a small group of about ten species including three in the Neotropics (Lima *et al.* 2020). Characteristic of this section are the small, dioicous plants, less than 1 mm wide, with caducous leaf lobes, ocelli in leaf lobes (and sometimes in underleaves), and small, distant underleaves. Within this group, *F. trigona* stands out by scattered ocelli in leaves but not in underleaves, margins of leaves and underleaves distantly crenulate by projecting trigones, underleaves scarcely wider than the stem, and female bracts and bracteoles with entire margins. The species is only known from the type.

Family ANEURACEAE H. Klinggr.

Genus *Riccardia* Gray

Riccardia innovans (Steph.) Pagán
(Figs 2-4)

The Bryologist 45: 80 (1942). — Basionym: *Aneura innovans* Steph., in Urban, *Symbolae Antillarum* 2: 470 (1901). — Type: Guadeloupe, Savane-à-Mulets, «Sur les arbrisseaux», 1901, *Duss*

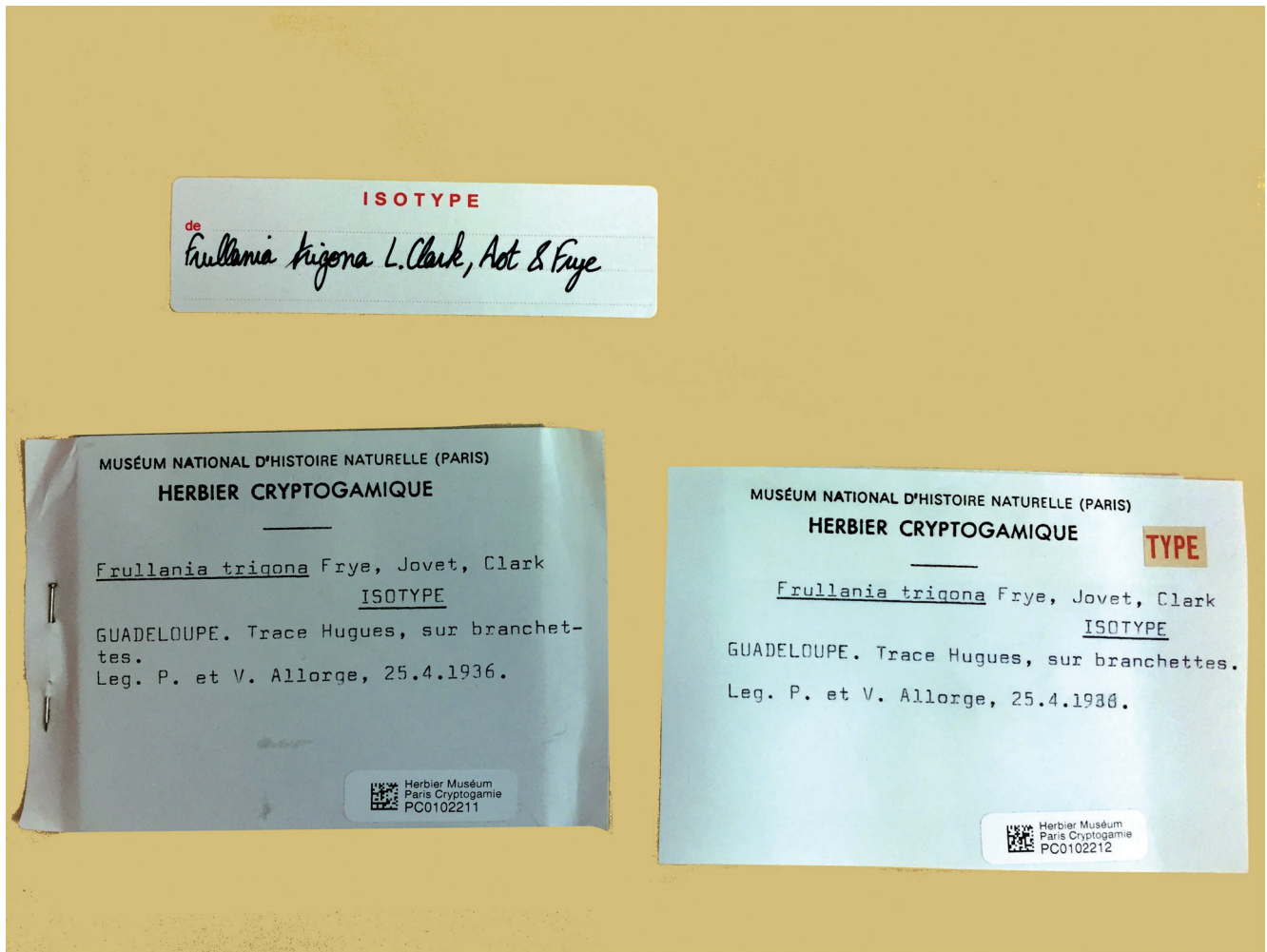


FIG. 1. — Isotypes of *Frullania trigona* L.Clark, Jovet-Ast & Frye (PC).

484, ex hb. Urban (lecto-, designated here, G[G00066662!], c. gyn.; isolecto-, NY n.v., fide Pagán 1942).

Description

The outstanding characters of *R. innovans* are the very delicate, 2-pinnate plants with a very narrow (150-250 µm in diameter), biconvex, almost wingless axis and numerous long and narrow, linear to subulate branches. The branches are only little narrower than the axis, plano-convex, obliquely to widely spreading, usually tapering to narrow tips, and narrowly winged by 1-2 cell wide wings. The presence of small scales on the calyptra, made up of large cells, may be a further characteristic of the species. The plants are dioicous; gemmae have not been observed.

Remarks

Riccardia innovans approaches *R. regnellii* (Ångstr.) K.G.Hell, but the latter is a larger plant with a flat axis (not biconvex) and with broader, frequently tongue-shaped branches. In the type material, some *R. regnellii* plants are growing mixed in the dense mat of *R. innovans* and are immediately recognized by their much larger size. *Riccardia innovans* is thus far only

known from the type. A field search by the second author in the type locality and elsewhere has not revealed further populations of the species. The taxonomic relationships of the species will be dealt with in a comprehensive study on the genus *Riccardia* in Guadeloupe (Lavocat Bernard & Reeb in prep.).

Family SEMATOPHYLLACEAE Broth.
Genus *Trichosteleum* Mitt.

Trichosteleum glaucinum (Besch.) A.Jaeger
(Fig. 5)

Berichte über die Thätigkeit der St. Gallischen Naturwissenschaftlichen Gesellschaft 1876-1877: 416 (1878). — Basionym: *Rhaphidostegium glaucinum* Besch., *Annales des Sciences naturelles, Botanique*, sér. 4, 3: 253 (1876). — Type: Guadeloupe, without locality, *l'Herminier s.n.*, "in herb. Schimp., no 28" (lecto-, designated here, PC[PC0121060!]; isolecto-, PC[PC0733118!], NY n.v.).

Remarks

According to Buck (1998) *T. glaucinum* is characterized by oblong-triangular, shortly acuminate leaves with plane to

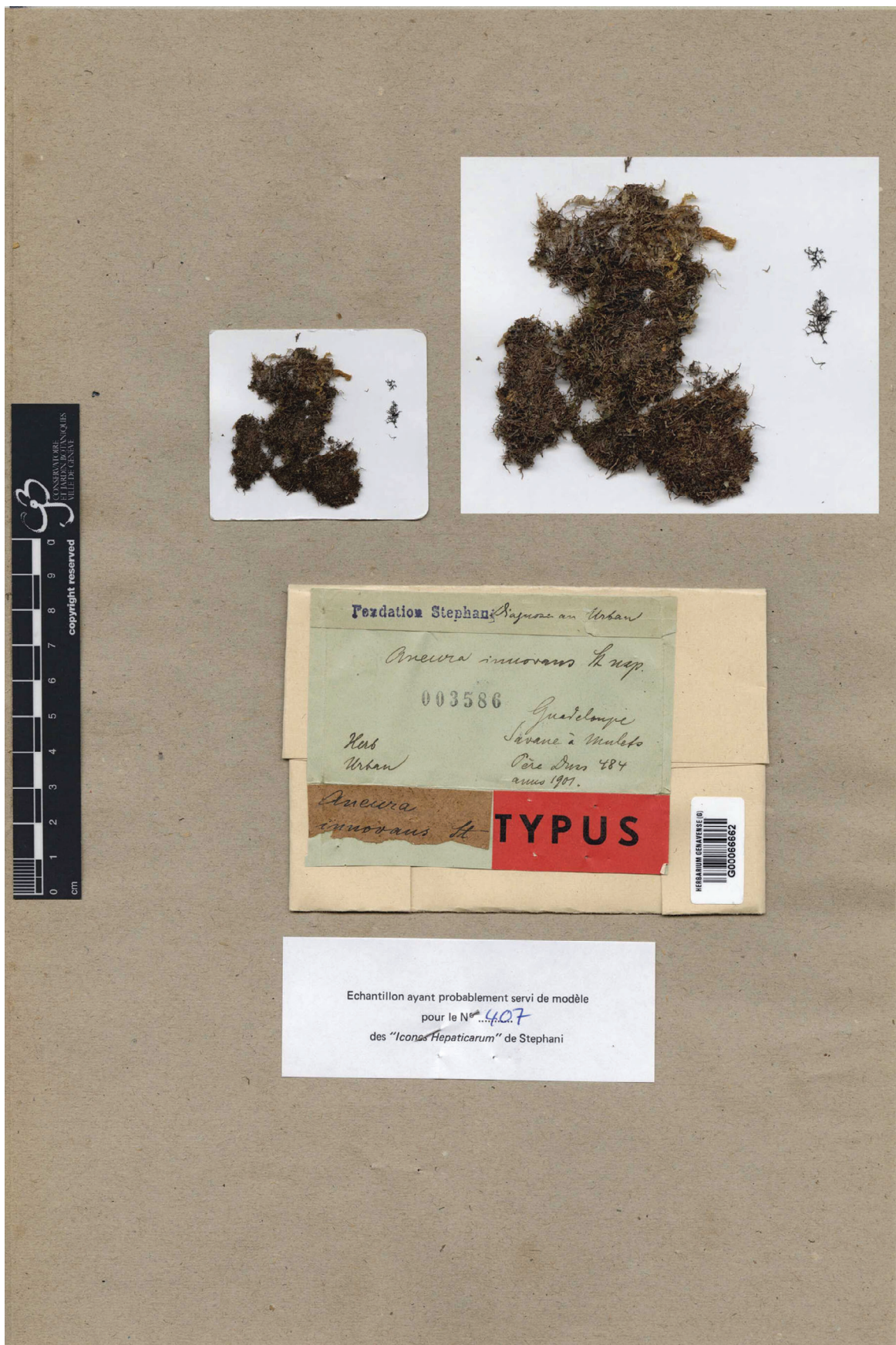


FIG. 2. — Lectotype of *Riccardia innovans* (Steph.) Pagán (G).

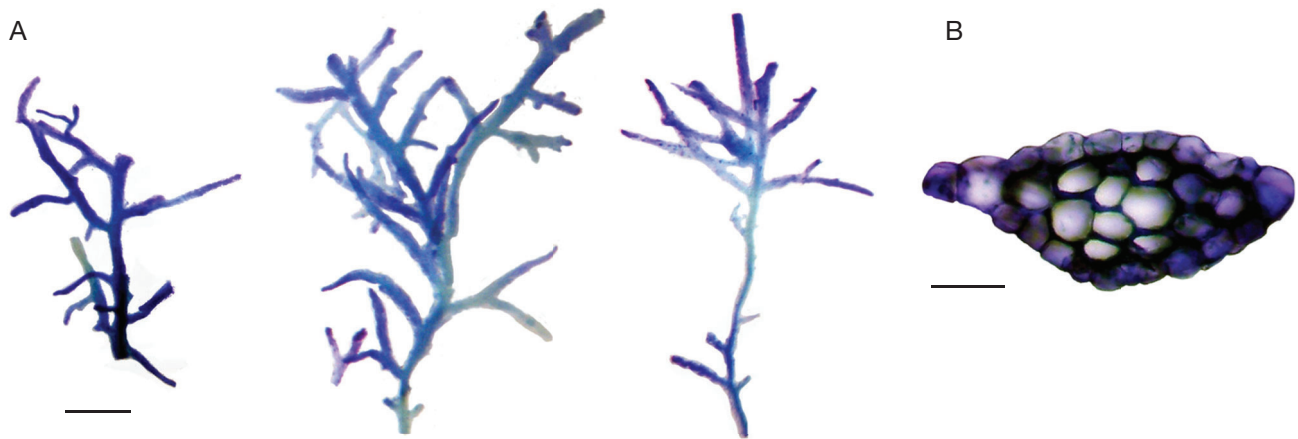


FIG. 3. — *Riccardia innovans* (Steph.) Pagán. **A**, habit; **B**, main axis in cross section (from the lectotype). Scale bars: A, 1 mm; B, 50 μ m. Photographs by C. Reeb.

slightly twisted apices, obscurely serrulate margins, cells with a conspicuous papilla in the upper $\frac{1}{3}$, and leaf bases rather abruptly constricted to a narrow insertion. Buck considered *T. glaucinum* probably most closely related to *T. vincentinum* (Mitt.) A. Jaeger, a species widely distributed in the West Indies, but the leaves in the latter species are narrower and more longly acuminate, with subulate and more conspicuously twisted apices. Moreover, the leaves are presumably more gradually narrowed to the base.

We have examined the two isotype specimens of *Trichosteleum glaucinum* in Bescherelle's "Antillean Bryophytes" herbarium in PC. Both have leaves with shortly acuminate tips and fit the prologue very well. The specimen PC0121060 in this herbarium is chosen as the lectotype as it refers to the Schimper herbarium. A portion of the type kept in the general bryophyte herbarium of Paris (PC0099421!), however, has longly acuminate leaves with twisted, piliferous tips and does not belong to *T. glaucinum*; instead it represents typical *T. vincentinum*. This suggests that the original collection of *T. glaucinum* may have been a mixture of *T. glaucinum* and *T. vincentinum*. A close examination of leaves of the two species showed that the piliferous, twisted tips measured about $\frac{1}{4}$ – $\frac{1}{3}$ of total leaf length in *T. vincentinum* and $\frac{1}{10}$ – $\frac{1}{5}$ ($\frac{1}{4}$) in *T. glaucinum*. Moreover, the upper part of the leaf (beyond the widest portion of the lamina) was about twice longer than the lower part in *T. vincentinum* and only about 1.5 $\times$ longer in *T. glaucinum*. We could not confirm the difference in leaf base constriction mentioned by Buck. In both species the leaves seemed to be gradually narrowed to the base. Since the two species essentially differ only in the length of the piliferous tips, *T. glaucinum* should probably be treated as a variety of *T. vincentinum*.

According to Buck (1998) *Trichosteleum glaucinum* is only known from the type from Guadeloupe. Recently, however, the species has been reported from three different states of Brazil: Bahia (Evangelista *et al.* 2018), Maranhão (Silva 2018) and Mato Grosso (www.splink.croia.org.br).

However, all three Brazilian records appear to be erroneous. According to Dr Denilson Peralta (pers. com.) the material from Maranhão belongs to *T. subdemissum* (Besch.) A. Jaeger, and that from Mato Grosso to an undescribed species (det. A. Leal & P. Camara). Furthermore, based on images sent by Dr Cid J. P. Bastos we found that the material from Bahia belongs to *T. intricatum* (Thér.) J. Florsch. It thus appears that *T. glaucinum* does not occur in Brazil and is endemic to Guadeloupe.

REJECTED ENDEMICS

Cheilolejeunea rigidula (Mont.) R.M. Schust.

Castanea 36 (2): 102 (1971).

Cheilolejeunea falcata Steph., *Species Hepaticarum* 5: 655 (1914).

Cheilolejeunea ovistipula Steph., *Hedwigia* 34: 244 (1895). Bastos (2017: 42, fig. 12). — Type: Guadeloupe, l'Herminier 124 (holo-, G[G00112875!]), **syn. nov.**

DISTRIBUTION. — A species widespread in tropical America and Africa.

Remarks

Cheilolejeunea ovistipula is a phenotype of *C. rigidula* with rather large trigones and a relatively long lobule tooth. The record of *C. ovistipula* from Capesterre-Belle-Eau, Guadeloupe (Bastos 2017: "on isolated tree at the margin of banana plantation, 400 m, 3 April 2002, Schäfer-Verwimp & Verwimp 22500/C") presumably belongs to *C. rigidula* as well.

Drepanolejeunea valiae Jovet-Ast

Revue Bryologique et Lichénologique 18: 38 (1949). — Type: Guadeloupe, Ananas, «avec *Bazzania* sur branchette», Allorge *s.n.* (holo-, PC[PC0102340!]).

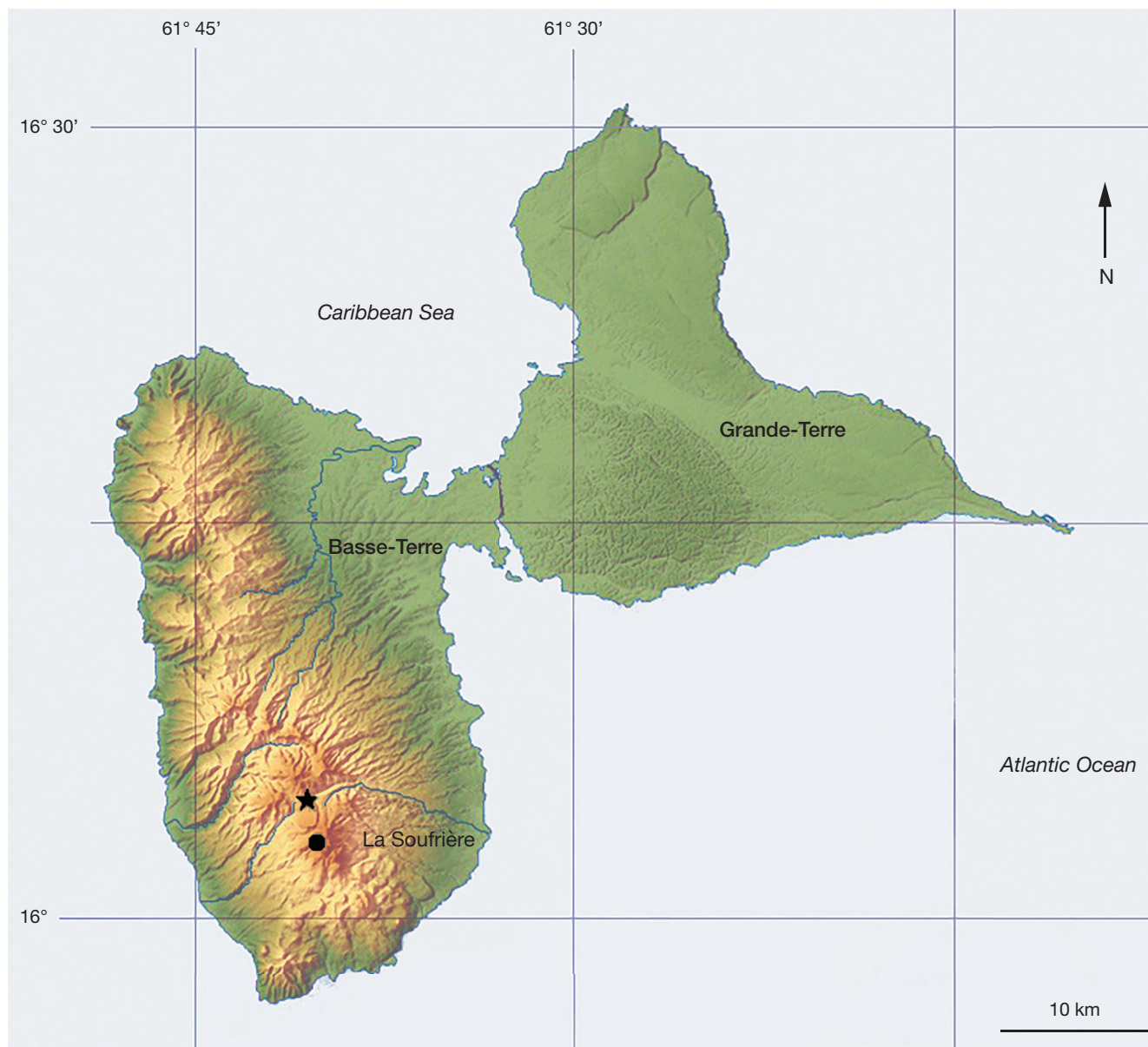


FIG. 4. — Distribution of *Frullania trigona* L.Clark, Jovet-Ast & Frye (★) and *Riccardia innovans* (Steph.) Pagán (●) in Guadeloupe.

Remarks

Drepanolejeunea valiae has been reported from Dominica (Schuster 1992, 1996) and Jamaica (Schäfer-Verwimp & van Melick 2016), hence is not endemic to Guadeloupe. According to Bischler (1964) and Schuster (1996) it is a good species. The holotype material was erroneously cited as “isotype” by Bischler (1964).

Frullania brasiliensis Raddi

Crittogame Brasiliane 12 (1822).

Frullania guadelupensis Steph. (“Gottsche ex Steph.”), *Species Hepaticarum* 4: 496 (1911). — Type: Guadeloupe, l’*Herminier* s.n.

(lecto-, G[G00120036!], c. gyn. juv.; isolecto-, G[G00262943!], PC[PC0102248!]), **syn. nov.**

Remarks

Frullania guadelupensis has been reported from Brazil (Stotler 1969) and Colombia (Van Reenen *et al.* 1984; Vasco *et al.* 2002), hence is not endemic to Guadeloupe. Although mature perianths are lacking in the type material, the large plant size, the recurved, apiculate leaf tips, the narrowly recurved under-leaf margins and the subentire female involucre indicate that the plants belong to the common *F. brasiliensis*. The latter species is widespread in the Neotropics (e.g., Stotler 1969; Gradstein & Costa 2003).



FIG. 5. — Lectotype of *Trichosteleum glaucinum* (Besch.) A. Jaeger (PC-hb. Bescherelle "Antillean Bryophytes").

Frullania kunzei (Lehm. & Lindenb.) Mont.

Histoire physique, politique et naturelle de l'Île de Cuba, Botanique, Plantes cellulaires 537 (1842). (fide Stotler 1969, as *F. neesii*; Gradstein & Costa 2003)

Frullania minima Steph. *Species Hepaticarum* 4: 532 (1911).

Frullania urbanii Steph., *Species Hepaticarum* 4: 527 (1911).

Remarks

A widespread neotropical species.

Harpalejeunea stricta Lindenb. & Gottsche) Steph.

Species Hepaticarum 5: 259 (1913).— Type: Mexico, Veracruz, Mirador, *Liebmann s.n.*, c. gyn. (isosyn-, G[G00115038, G0011539]!).

Harpalejeunea herzogii Jovet-Ast, *Feddes Repertorium Species Novae Regni Veg.* 58: 19 (1955). — Type: Guadeloupe, “Carbet, sur rocher humide,” 15.II.1936, *P. & V. Allorge s.n.*, c. gyn. (holo-, PC[PC0103158!]), **syn. nov.**

Remarks

Harpalejeunea stricta is a widespread neotropical species. *Harpalejeunea herzogii* is a phenotype with ciliate perianths; typical *H. stricta* has shortly toothed keels. In other respects, the two species are identical. Perhaps *H. herzogii* may be retained as a variety of *H. stricta*. In Brazil plants with ciliate perianths has been described as *H. schiffneri* S.W.Arnell (see Gradstein & Costa 2003), which may be a further synonym of *H. stricta*.

Nothoceros vincentianus (Lehm. et Lindenb.)
J.C.Villarreal

The Bryologist 113 (1): 111 (2010). (fide Villarreal & Renner 2014).

Megaceros solidus Steph., *Species Hepaticarum* 5: 950 (1916).

Remarks

A widespread neotropical species.

Plagiochila bifaria (Sw.) Lindenb

Species Hepathicarum fasc. 5: 127 (1843).

Plagiochila desciscens Steph., *Bulletin de l'Herbier Boissier*, sér. 2, 2: 867 (1902); Stephani, *Icones Ineditae* 11701. — Basionym: *Plagiochila guadalupensis* Gottsche ex Steph. “var.”, non typus (synonym of *P. stricta* Lindenb.). — Type: Guadeloupe, l'Herminier s.n. (lecto-, designated here, G[G00128749!]; isolecto-, G[G00065517, G00048148!]), **syn. nov.**

Remarks

Plagiochila bifaria is common and variable species that is distributed throughout the Neotropics and, in addition, occurs in coastal areas of western Europe (e.g., Heinrichs *et al.* 2004). *Plagiochila desciscens* is a phenotype with distant, ovate-oblong leaves.

Plagiochila punctata (Taylor) Taylor

London Journal of Botany 5: 261 (1846).

Plagiochila germani Steph., *Bulletin de l'Herbier Boissier*, sér. 2, 5: 938 (1905); Stephani, *Icones Ineditae* 11480. — Type: Guadeloupe, Germain s.n., ex hb. l'Herminier (holo-, G[G00067838!], c. gyn. & andr.), **syn. nov.**

Remarks

Plagiochila punctata is a widespread species of tropical America, East Africa and western Europe (Heinrichs *et al.* 2005) that had not yet been recorded from Guadeloupe. The type material of *P. germani*, containing *P. punctata* in a mixture with *P. gymnocalycina* (Lehm. & Lindenb.) Mont., fits Stephani's illustration (*Icones Ined.* 11701) very well but the type label is confusing, stating “*Plag. herminieri* St. sub *Pl. germani* G[ottsche] ms, Guadeloupe, l'Herminier”. The material is not copious but contains well-developed male and female plants of *P. punctata*, with the characteristic denuded branches due to leaves dropping off. The leaves are transverse, small, ovate, with a conspicuous vitta-like area at the base and 3-4 teeth on the margins (2 near the apex and 1-2 on the ventral margin), and the leaf cells have large trigones. The species is close to *P. bifaria* but the latter is a more robust plant with more numerous teeth on leaf margins and without caducous leaves.

Plagiochila bicornis Hampe & Gottsche

Linnaea 25: 338 (1852[1853]). (fide Gradstein 2015).

Plagiochila herminieri Steph.

Remarks

A species widespread in the West Indies (Heinrichs 2002, as *P. herminieri*).

Plagiochila deflexa Mont. & Gottsche

Annales des Sciences Naturelles; Botanique, série 4, 6: 192 (1856).

Plagiochila saxicola Steph., *Bulletin de l'Herbier Boissier*, sér. 2, 5: 886 (1905), *nom. illeg.* (non [Schrad.] Nees); Stephani, *Icones Ineditae* 11361, 11362. — Type: Guadeloupe, l'Herminier s.n. (lecto-, designated here, G[G00113020!], c. gyn. & andr.; syn-, *Duss* 317, G[G00113022!], *Duss* 453, G[G00113021!]), **syn. nov.**

Remarks

Plagiochila deflexa is a neotropical-Hawaiian disjunctive species that is known in the Neotropics from Cuba, Central America and the northern Andes (Heinrichs *et al.* 2002; Gradstein in press); it had not yet been recorded from the Lesser Antilles. The species is recognized by the medium-sized plants (c. 3-5 mm wide) with exclusively intercalary branching, ovate-oblong to elongate-triangular, ventrad leaves with a rather narrow apex, an ampliate ventral base, rather few (c. 15-20)

triangular teeth along the leaf margins, leaf cells *c.* 25–35 µm wide in midleaf and with large trigones, and leaf base with a conspicuous vitta-like area of larger cells. The species may be confused with *P. adianthoides* (Sw.) Lindenb. but the latter species lacks a vitta, the leaf margin in *P. adianthoides* is usually bordered by thicker-walled cells (forming a yellowish border), the marginal teeth are more numerous (20–50 per leaf) and more linear in shape, the trigones are smaller and the leaf apex is more broadly rounded.

Radula pallens (Sw.) Mont.

Voyage dans l'Amérique Méridionale Botanique 71 (1839).

Radula subsimplex Steph., *Hedwigia* 23: 130 (1884); Castle (1959: 21, fig. 22); Yamada (1980: 254, fig. 9). — Type: Guadeloupe, without collector (holo-, G[G00043857]!, c. andr.). Further collection: Guadeloupe, “leg. Germain, misit Dr. l’Herminier” (G[G00112875]!), **syn. nov.**

Remarks

Radula pallens is a widespread neotropical species, that has been misunderstood in the past and was considered endemic to Jamaica (Gradstein in press). *Radula subsimplex* is a phenotype of *R. pallens* with lobule margins not sinuate. Several Caribbean species of *Radula* described by Castle (1959) in the section “*Dichotomae*”, such as *R. obovata* Castle and *R. variolobula* Castle, are probably further synonyms of *R. pallens*.

Rectolejeunea flagelliformis A.Evans

Bulletin of the Torrey Botanical Club 33: 9 (1906). (fide Reiner-Drehwald & Grolle 2012).

Rectolejeunea dussii Steph. (*Cheilolejeunea dussii* Steph., *nom. inval.*)

Remarks

A species with scattered distribution in the Neotropics (Reiner-Drehwald & Grolle 2012).

Lejeunea bermudiana (A.Evans) R.M.Schust.

The Hepaticae and Anthocerotae of North America 4: 1105 (1980).

Taxilejeunea irregularis Steph. *Species Hepaticarum* 5: 490, 1914; Stephani, *Icones. Ineditae* 10103. — Type: Guadeloupe, *Duss* 514 (holo-, G[G00069917]!, autoic.), **syn. nov.**

Remarks

Lejeunea bermudiana is a common Caribbean species that is characterized by sharply apiculate leaves without or with 1–2 additional teeth on the ventral margin near apex, inflated lobules *c.* ¼ × leaf length, thin-walled leaf cells, and bifid underleaves *c.* 3 × stem width and with a cordate-subauriculate base, autoicous sexuality and toothed female bracts and perianths (Schuster 1980, as *Crossotolejeunea bermudiana* A.Evans; Reiner-Drehwald & Goda 2000).

Lejeunea pulverulenta (Steph.) M.E.Reiner

Cryptogamie, Bryologie 26: 60 (2005). — Basionym: *Taxilejeunea pulverulenta* Steph., Type: Guadeloupe, *l’Herminier s.n.* (lecto-, designated by Reiner-Drehwald [2005], G[G00052572]!).

Taxilejeunea linguifolia Steph. (“*linguaeifolia*”) *Species Hepaticarum* 5: 471 (1914); Stephani, *Icones Ineditae* 10033. — Type: Guadeloupe, *l’Herminier s.n.* (lecto-, designated here, G[G00043994]!, c.gyn.; isolecto- (?), without collector, G[G00043993]!, ster.), **syn. nov.**

Remarks

Lejeunea pulverulenta is a rather rare neotropical species that is known from Guadeloupe, Guyana and the northern Andes (Reiner-Drehwald 2005; Gradstein in press). The latter author already suggested the present synonymy based on the description and illustration of *T. linguifolia* by Jovet-Ast (1949). Study of the types confirmed that the two species are identical. Both were collected by l’Herminier in Guadeloupe and were described by Stephani in the same fascicle of *Species Hepaticarum*, as members of the genus *Taxilejeunea*.

CONCLUSIONS

Of 19 species listed as endemic to Guadeloupe, only three, *Frullania trigona*, *Riccardia innovans* and *Trichosteleum glaucinum*, are accepted here as confirmed endemics. All three are very rare species that are hitherto only known from the type specimens. Efforts by the second author to collect additional material of these species have remained unsuccessful.

The remaining sixteen species are rejected endemics. Only one of them, *Drepanolejeunea valiae*, is an accepted taxon, all the other species are synonyms. Some synonyms had already been proposed in recent taxonomic revisions but the majority of the synonyms are newly established here. Three of them belong to species that had not previously been reported from the Guadeloupe archipelago, viz. *Plagiochila deflexa* and *P. punctata* and *Radula pallens*. The latter species is widespread in the West Indies and elsewhere in the Neotropics (Gradstein in press), but the two *Plagiochila* species have more limited Caribbean distributions and had not yet been recorded from Guadeloupe.

As a result of this study, bryophyte endemism in the Guadeloupe archipelago is reduced to 0.5%. The results confirm the notion that endemism in bryophytes is very low (e.g., Vanderpoorten & Goffinet 2009).

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