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(Lepidoziaceae, Marchantiophyta)
in New Caledonia with a review
of the type specimens

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A revision of the genus *Bazzania* Gray (Lepidoziaceae, Marchantiophyta) in New Caledonia with a review of the type specimens

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ABSTRACT

The genus *Bazzania* Gray (Lepidoziaceae, Marchantiophyta) was reviewed in several countries around New Caledonia, but the species of the local flora remain still imperfectly known and the oncoming survey of this flora often faces challenges in identifying new specimens. Some morphological characters used to differentiate the species are commented on, especially the insertion of the underleaves in relation to the ventral leaf bases. A review of types and reference specimens examined at G, PC and REN, together with about 250 recent vouchers collected mainly by the author allows characterization of 18 species based on morphological criteria and several taxonomic changes, mainly synonymies. Among the 18 species, seven are endemic: *Bazzania bernieri* (Steph.) Inoue & H.A.Mill., *B. bescherellei* Steph., *B. consociata* (Steph.) H.A.Mill., *B. deplanchei* (Gottsche ex Steph.) Jovet-Ast, *B. incrassata* (Steph.) N.Kitag., *B. paucidens* (Steph.) H.A.Mill. and *B. quadratistipula* H.A.Mill. Environmental conditions may have a strong impact on some morphological characters, so, to support species circumscriptions, further studies are needed that take account of ecological data and use macromolecular analysis. Several years ago, chemical investigations were initiated and could help to consolidate species delineation. A key to the New Caledonian species is provided and each species described and illustrated.

KEY WORDS

Marchantiophyta,
Lepidoziaceae,
Bazzania,
New Caledonia,
identification key,
lectotypifications.

RÉSUMÉ

Une révision du genre *Bazzania* Gray (Lepidoziaceae, Marchantiophyta) en Nouvelle Calédonie, incluant les spécimens types.

Le genre *Bazzania* Gray (Lepidoziaceae, Marchantiophyta) a été révisé dans plusieurs pays autour de la Nouvelle-Calédonie, mais les espèces de la flore locale restent encore imparfaitement connues et, lors de travaux d'inventaire de cette flore, on est souvent confronté à des difficultés d'identification des nouveaux spécimens. Quelques caractères morphologiques utilisés pour différencier les espèces sont commentés, en particulier l'insertion des amphigastres par rapport à la base ventrale des feuilles. Une révision des types et de spécimens de référence examinés à G, PC et REN, auxquels s'ajoutent environ 250 échantillons récents collectés pour l'essentiel par l'auteur, permet de définir 18 espèces sur la base de critères morphologiques et de proposer plusieurs modifications taxonomiques, essentiellement des mises en synonymie. Parmi ces 18 espèces, sept sont endémiques: *Bazzania bernieri* (Steph.) Inoue & H.A.Mill., *B. bescherellei* Steph., *B. consociata* (Steph.) H.A.Mill., *B. deplanchei* (Gottsche ex Steph.) Jovet-Ast, *B. incrassata* (Steph.) N.Kitag., *B. paucidens* (Steph.) H.A.Mill., and *B. quadratistipula* H.A.Mill. Les caractéristiques de l'environnement peuvent avoir une forte influence sur certains caractères morphologiques; aussi, pour consolider la circonscription des espèces, des études plus poussées sont nécessaires, intégrant les données écologiques et utilisant les techniques d'analyse macromoléculaire. Depuis quelques années, des analyses chimiques sont effectuées et pourront aussi aider à la consolidation des définitions d'espèces. Une clé des espèces néocalédoniennes est fournie et chaque espèce est décrite et illustrée.

MOTS CLÉS
Marchantiophyta,
Lepidoziaceae,
Bazzania,
Nouvelle-Calédonie,
clé d'identification
lectotypifications.

INTRODUCTION

The liverwort genus *Bazzania* Gray includes nearly 300 specific or infraspecific names (Söderström *et al.* 2016a, b, 2018, 2020, 2022) or about 360 species worldwide (Meagher 2019), mostly in tropical and subtropical regions (Kitagawa 1977). According to Frey *et al.* (2009), this number is only 100–150 species “with the center of taxonomic diversity in tropical America”, but Meijer (1960) noted that “the centre of the genus seems to lie in the Malaysian region”. The affinity of that region with New Caledonia regarding their bryophyte floras is already documented (Iwatsuki 1990; Thouvenot *et al.* 2011). The most recent in-depth reviews of the genus occurring in the surrounding areas (South-East Asia and Australasia) concern Malaysia (Meijer 1960; Cheah & Yong 2016), Thailand (Kitagawa 1967), New Guinea (Kitagawa 1980), Central Java (Khotimperwati *et al.* 2018), Australia (Meagher 2019) and New Zealand (Engel & Glenny 2008; Gibb *et al.* 2020). In New Caledonia, the checklist of hornworts and liverworts and a subsequent paper report 21 species (Thouvenot *et al.* 2011, 2018). Among them, some species have not been reviewed since their first description by Stephani (1908a–d, 1924).

New Caledonia is a remote archipelago in South-West Pacific, 1220 km away from Australia, 1700 km from New Zealand and 400 km from Vanuatu, with the main island Grande Terre (16 890 km²) peaking at 1629 m. Subject to a moderate tropical climate with an average annual rainfall of 1700 mm (Moniod 1966), most of the island is covered by wet evergreen forests with anthropogenic savannahs dominating at low elevations with only a few small fragments of sclerophyll dry forest; shrubby vegetation occurs on metaliferous soils, mostly in the south (Grandcolas *et al.* 2008). It is generally considered a major hot spot of biodiversity (Myers *et al.* 2000; Heads 2008). First bryophyte collections began in 1853 (Mitten 1871) but most of the type specimens of *Bazzania* were collected by M. and Mrs Le Rat (1906–1909) and I. Franc (1910) with a few earlier collections in 1861 by Deplanche and 1896 by Etesse.

Since the Stephani’s diagnosis in *Species Hepaticarum* (Stephani 1908a–d, 1924), reviews of *Bazzania* species from New Caledonia were scattered in papers dealing with liverworts in a whole or regional reviews of that genus. Paris sent to Stephani many specimens collected by M. and Mrs Le Rat and he published 23 names given by Stephani in his correspondence (Paris 1906, 1910a, b). Several of them are invalid names, published prior the Stephani’s diagnosis; they are reviewed in part in Thouvenot *et al.* (2018) and in the present study. Kitagawa (1973) published short notes on 11 type specimens from New Caledonia observed at G and asserted several synonymies. Although he omitted to formally designate lectotypes, he let handwritten indications of his choices in the packets that could help latter lectotypifications. Then, authors who examined bryophyte collections from New Caledonia reported 22 occurrences of *Bazzania* with scanty morphological notes or no one: Pearson (1922); Jovet-Ast (1949); Herzog (1953); Tixier (1973, 1985); Engel (1975); Thouvenot *et al.* (2018). Furthermore, Hürlimann gathered many liverworts during

field trips in 1950–1952 and published 12 *Bazzania* species from New Caledonia. Among this set, only Kitagawa’s paper (Kitagawa 1973) contains taxonomical novelties especially new synonymies and Miller (1981) published 6 name changes. Recently, Meagher (2010, 2019) took account of New Caledonian species present in Australia describing them in detail and Schwarz *et al.* (2023) published a new species.

Bazzania are usually occurring in sterile condition, so that only vegetative characters can be used to define and identify the species, mainly leaf and underleaf shape, areolation, marginal roughness and apical cutting patterns. In addition, the available protologues are often scanty and do not provide information on the range of variations. As a result, newly collected specimens may be hard to identify because of the intra-specific variability, which is frequently linked to environmental conditions (Gradstein 2017), especially when species are separated by few characters. Checking types is essential, but, as underlined by Bakalin & Maltseva (2023), holotypes were exceptionally designated and one must look for potential lectotypes in the herbaria holding parts of the original collections.

Chemical analysis of New Caledonian liverworts, including the genus *Bazzania*, show a rich data set of organic molecules that can be used to evaluate their diversity (Métoyer 2017; Métoyer *et al.* 2018). These studies provide some support for taxonomic decisions, for instance when assessing synonymies in the *Bazzania bernieri* (Steph.) Inoue & H.A. Mill. complex. Some New Caledonian species are very similar to others initially described from remote countries, but some morphological traits differ, typically smaller plant size, thicker cell walls and trigone shapes. As Fedosov *et al.* (2022) say, “This underlines the need for molecular barcoding to verify species suggested morphologically based on types from geographically distant regions, and also to show the distinctness of plants exhibiting morphological differences when compared with otherwise similar plants described from elsewhere.” In the absence of molecular data, when I was unable to assert if such New Caledonian taxa are good species instead of environmental forms of foreigner taxa, I conservatively kept them as good species.

MATERIAL AND METHOD

For this revision, I used all available type specimens, drawings and representative historic collections kept in G, REN and PC (Figs 1; 2). Most of the specimens kept as types in G were reviewed in 1970 by Kitagawa who annotated some of them as type, that remained unpublished and no lectotype was formally designated. I am not aware of Kitagawa’s selection criteria, but in most cases, after checking all the available specimens, I agree with his choice and designate the lectotype according to Kitagawa. Most of the specimens used by Stephani to describe new species were sent by E.G. Paris who usually kept parts of them in his herbarium, housed in REN (Rennes University 1) and offered duplicates to PC. In addition, I used about 250 specimens from personal collections made during field



FIG. 1. — Leaves and underleaves drawn at the same scale from type specimens of New Caledonian *Bazzania* Gray species: **A**, *Mastigobryum leratii* Beauverd ex Steph.; **A1**, underleaf; **A2**, leaf (both from isotype REN000232); **A3**, leaf (lectotype G00067047); **B**, *M. bescherellei* (Steph.) Steph. (lectotype G00066912); **B1**, **B4**, underleaves; **B2**, **B3**, leaves; **C**, *M. consociatum* Steph. (syntype PC0101765); **C1**, **C2**, underleaves; **C3**, leaf; **D**, *M. francanum* Steph. (lectotype G00066893); **D1**, **D2**, **D5**, leaves; **D3**, **D4**, underleaves; **E**, *M. dognyense* Steph. (lectotype G0011718); **E1**, leaf; **E2**, **E3**, underleaves; **F**, *M. incrassatum* Steph. (isolectotype PC0101851); **F1**, **F2**, underleaves; **F3**, **F4**, leaves; **G**, *M. marginatum* Steph. (lectotype G00066911); **G1**, leaf; **G2**, underleaf; **H**, *M. paucidens* Steph. (holotype G00066787); **H1**, leaf; **H2**, underleaf; **I**, *M. quadratum* Steph. (lectotype G00066891); **I1**, leaf; **I2**, **I3**, underleaves. Scale bar: 200 μ m.

trips in New Caledonia between 2008-2019, together with vouchers collected and kindly loaned by F. Müller. Regarding species described in detail in recent publications (Meagher 2010, 2013, 2015, 2019), I used such

descriptions to identify and compare the specimens I had at hand. Specimens were examined and photographed using various dissecting and compound microscopes; in addition, types were drawn using cameras lucida.

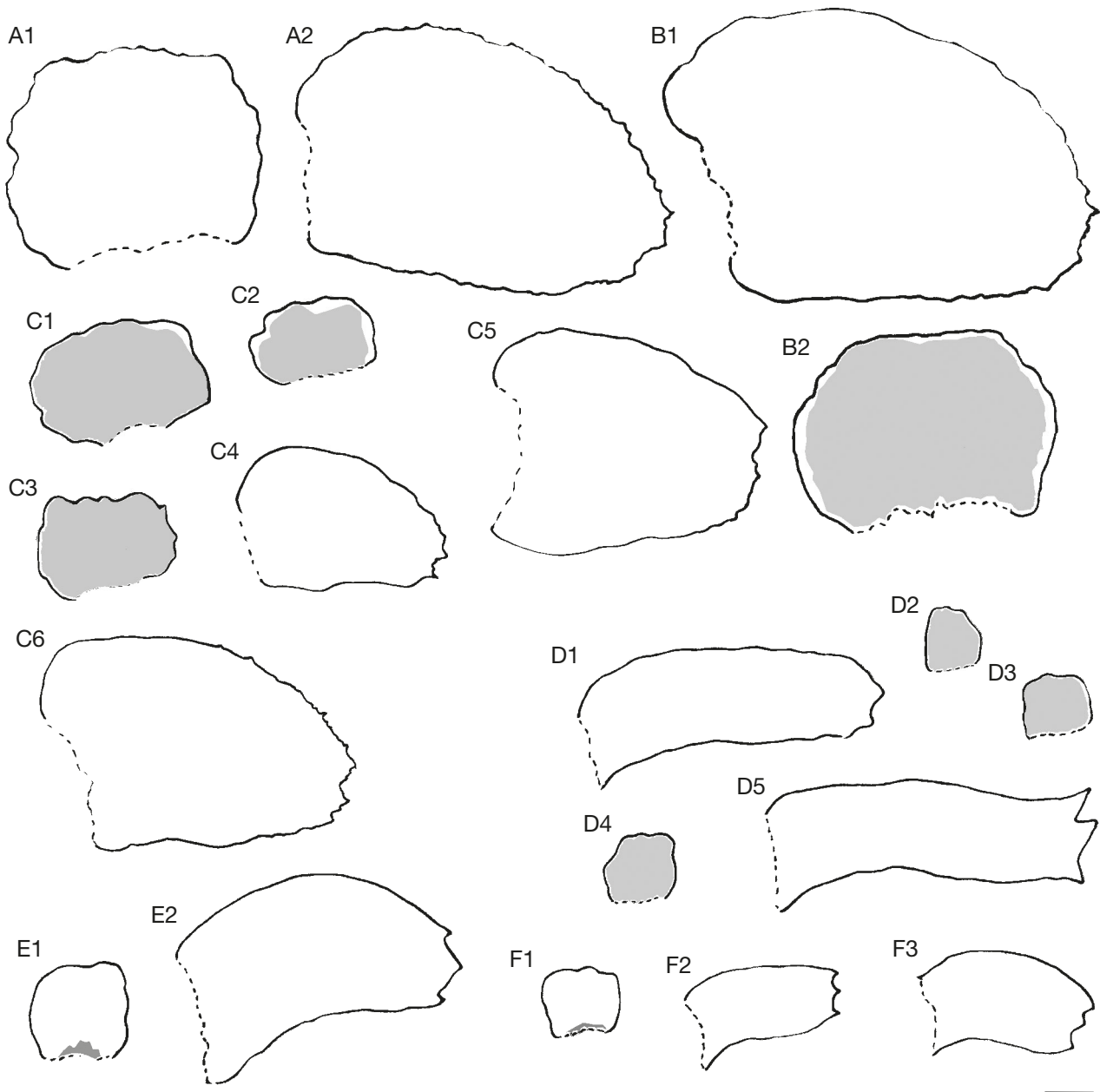


FIG. 2. — Leaves and underleaves drawn at the same scale from type specimens of New Caledonian *Bazzania* Gray species: **A**, *Mastigobryum serrifolium* (Steph.) Steph. (syntype G00282526); **A1**, underleaf; **A2**, leaf; **B**, *M. bernieri* f. *falcifolium* Steph. (lectotype G00282530); **B1**, leaf; **B2**, underleaf; **C**, *M. subintegrum* Steph. (isotype G00112148); **C1-C3** underleaves; **C4-C6** leaves; **D**, *M. pectinatum* Lindenb. & Gottsche (isotype G00282552); **D1, D5**, leaves; **D2-D4** underleaves; **E**, *Herpetium australe* Mont. (lectotype PC0769355); **E1**, underleaf; **E2**, leaf; **F**, *Jungermannia tridens* Reinw., Blume & Nees (isotype G00064266); **F1**, underleaf; **F2, F3**, leaves. Scale bar: 200 μ m.

Collections by the author in New Caledonia were made with the following permits: Province Sud, nr 1238-2012, 794-2016 and 2825-2019; Province Nord, nr 609012-2008, 1275-2016 and 609011-45/2019. Unless otherwise specified, specimens cited are kept in the author's private herbarium. Note about some morphological characters used to describe the *Bazzania* gametophytes.

Leaf sizes

Length measured from the antical base to the apex or the top of the longest lobe; when unspecified, width at the widest

part of the leaf (Fig. 1D2); length-width ratio calculated from the above values.

Leaf cells

They can be strongly differentiated from the margins onto the leaf insertions: below the marginal cells, usually in a single rank, subapical (often like the apical cells) and dorsal intra-marginal cells usually form a homogeneous whole (see the "cellulae superae" in many Stephani's diagnosis). Here, they are called "median cells" with descriptions made after the dorsal area inside the marginal band. Central and basal cells can be sharply or progressively

KEY TO THE *BAZZANIA* GRAY SPECIES IN NEW CALEDONIA

1. Leaf and underleaf apices deeply dissected into similar long lanceolate lobes; large plant with shoots up to 6 mm wide when flattened and leaves 1.80-3.75 mm long *B. deplanchei* (Gottsche ex Steph.) Jovet-Ast
— Leaves entire, dentate, or with the most developed lobes triangular to finger-like; underleaves various; plants medium to small with shoots up to 3 mm wide when flattened and leaves less than 2 mm long, if larger, leaves entire 2
2. Leaves caducous, fragile, with sub-entire apices, generating endogenous propagules made of daughter cells born inside the leaf cells and released when leaves are broken *B. kokawana* N.Kitag. & T.Kodama
— Leaves not caducous, apices various, not producing endogenous propagules 3
3. Leaves widely ovate-triangular, shortly bifid, deflexed when moist as well as dry; underleaves entire, rounded to reniform *B. wooroonooran* Meagher
— Leaves ovate to oblong or lingulate, apices entire, dentate, or more often 3-lobate, usually deflexed only when dry; underleaves various 4
4. Hyaline cells occupying all or part of the underleaf surface, at least forming an apical marginal band, then thinner-walled than the basal cells 5
— Hyaline cells lacking, underleaf surface only made of chlorophyllous cells; if marginal cells are discoloured, they are few and otherwise like the underlying chlorophyllous cells 13
5. Hyaline cells filling the whole underleaf surface or nearly so, with a few chlorophyllous cells at base 6
— Hyaline cells forming a narrow or wide marginal band 7
6. Leaves glaucous green, opaque due to their strongly warty surfaces; apices entire; vitta obvi
..... *B. vittata* (Gottsche) Trevis.
— Leaves not glaucous, translucent, surfaces smooth except the marginal cells; apices 3-dentate; vitta lacking
..... *B. tridens* (Reinw., Blume & Nees) Trevis.
7. Underleaves with a narrow hyaline margin, usually 1-2(-4) cells wide 8
— Underleaves with wider hyaline margin, at least 3 cells wide 10
8. Leaf apices truncate, 3-lobate; lobes tooth-like to shortly triangular, up to 3 cells long
..... *B. paucidens* (Steph.) H.A.Mill.
— Leaf apices narrowly truncate to rounded, typically unlobed but some leaves with 1-3 one-celled teeth or emarginate 9
9. Leaves widely ovate, nearly as wide as long; margins sharply and densely denticulate to serrate by mamillated cell protrusions; median cells with firm walls and large trigones, often confluent; areolation nearly homogeneous without subvitta; only a few hyaline cells along the underleaf margins
..... *B. loricata* (Reinw., Blume & Nees) Trevis.
— Leaves from ovate to oblong, longer than wide; margins sub-entire or with denticulations produced by cell protrusions with evenly thickened walls; margins less arched; median cells with null or medium trigones; areolation homogeneous or not; underleaf hyaline margins narrow, continuous when fully developed and not eroded ...
..... *B. bernieri* (Steph.) Inoue & H.A.Mill.
10. Lateral leaf margins denticulate; underleaf apices dentate-denticulate
..... *B. adnexa* (Lehm. & Lindenb.) Trevis.
— Lateral leaf margins entire, or little crenulate-denticulate in upper part; underleaf apices repand to lobulate 11
11. Plants small, shoots 0.8-1.5 mm wide; underleaves wider than long, with hyaline cells firm walled, slightly different from the chlorophyllose cells; margins lobulate-dentate; central and basal leaf cells conspicuously larger than the median cells, forming a clear subvitta *B. consociata* (Steph.) H.A.Mill.
— Plants larger, shoots 2.0-3.5 mm wide; underleaves as wide as long or slightly wider, with hyaline cells thin-walled; margins roundly lobulate to sub-entire; leaf cells more homogeneous, subvitta hardly defined 12
12. Leaves ovate-oblong to oblong, length-wide ratio over 1.5; apices conspicuously 3-lobate, lobes triangular; median cells with small acute trigones; underleaf hyaline margins width variable
..... *B. franciana* (Steph.) N.Kitag.
— Leaves shortly ovate, length-ratio up to 1.5; apices 3-lobate; lobes less obvious, tooth-like to triangular; median cells with large bulging trigones, sub-confluent; underleaf hyaline margins narrow
..... *B. paucidens* (Steph.) H.A.Mill.
13. Underleaf lobes elongated, triangular, lanceolate or finger-like 14

- Underleaf entire or with shorter lobes, usually tooth-like 16
- 14. Underleaf margins deeply incised all around, lobes acute; basal margins appendiculate, free of the leaves, appendiculae acuminate-filiform; leaf cells warty; subvitta inconspicuous
..... *B. caudistipula* (Steph.) Inoue & H.A.Mill.
- Underleaf margins deeply incised only at the apices, lobes elongate, acute or finger-like; basal margins non-appendiculate, unevenly connate to the leaves; leaf cells smooth; subvitta conspicuous or ill-defined 15
- 15. Underleaf insertions close to the leaf bases on both sides of the stem, strongly recurved, nearly squarrose, underleaf apices divided in 3(-4) lobes, lobes widely triangular to lanceolate, the median lobe often shorter or lacking; leaves narrowly oblong to ligulate, leaf lobes triangular to lanceolate-acute *B. incrassata* (Steph.) N.Kitag.
- Underleaf insertions close to the leaf bases on a single side of the stem, loosely recurved, patent, underleaf apices divided in more than 3 finger-like lobes; leaves oblong, leaf lobes triangular *B. subtilis* (Sande Lac.) Trevis.
- 16. Underleaves obviously wider than long 17
- Underleaves nearly quadrate to longer than wide 20
- 17. Leaf apices with long, narrowly triangular lobes, separated by a wide lunate sinus; underleaves apices truncate, entire to variously lobate, lobes wide and apiculate *B. parisii* (Steph.) N.Kitag.
- Leaf apices with short lobes; underleaf apices entire, denticulate, repand or round-lobed 18
- 18. Leaves widely ovate, nearly as wide as long, both margins similarly arched; leaf apices unlobed, at most few dentate and denticulate; median cells with firm walls and large trigones, often confluent; areolation nearly homogeneous without forming a subvitta; plants large, shoots 4-5 mm wide
..... *B. loricata* (Reinw., Blume & Nees) Trevis.
- Leave ovate-oblong to ovate-ligulate, markedly longer than wide; asymmetrical with ventral margins nearly straight to concave; leaf apices usually 3-lobed; median cells with or without trigones; areolation homogeneous or not; plants smaller, shoots up to 2.5 mm wide 19
- 19. Shoots less than 2 mm wide when moist; leaf cells with a sharp transition between the median cells with evenly thickened walls, trigones lacking or inconspicuous, and the larger central and basal cells with large acute trigones, forming a clear subvitta; leaf apices denticulate, truncate, shortly 3-dentate; underleaf apices lobulate-dentate, often with a marginal band of hyaline cells with firm walls *B. consociata* (Steph.) H.A.Mill.
- Shoots more than 2 mm wide when moist; leaf cells progressively increasing in size from apices and margins towards the bases, forming a poor subvitta; cells firm walled with more or less conspicuous rounded trigones; leaf apices smooth to remotely denticulate, truncate to obtuse (rarely rounded), variously 3-lobate, lobes shortly triangular or tooth-like; underleaves at most with a few hyaline cells on margins; underleaf apices repand to shallowly lobulate *B. bescherellei* Steph.
- 20. Leaves complanate when dry, spreading at right angle when moist, shortly imbricate only at bases; median cells thick-walled, small triangular trigones barely visible; subvitta conspicuous; underleaves with repand margins, as wide as the stem *B. pectinata* (Lindenb. & Gottsche) Schifffn.
- Leaves more or less deflexed when dry, variously set in moist condition, imbricate; median cells thin-walled with conspicuous trigones; leaves with at most a small basal subvitta; underleaves various 21
- 21. Leaves deflexed in moist condition; long ligulate, length to width ratio 2.8 on average, nearly symmetrical; median cells with very large trigones, as large as the cell lumina, often confluent; underleaves small, 1.0-1.5 times the stem width *B. quadratistipula* H.A.Mill.
- Leaves spreading in moist condition; ovate-oblong to widely lingulate, length to width ratio 1.6 on average; asymmetrical; median cells with rounded trigones, smaller than the cell lumina, not confluent; underleaves larger, 2-4 times the stem width *B. bescherellei* Steph.

differentiated from the surrounding cells and form respectively a true vitta or a vitta-like area (subvitta). A true vitta “consists of a band of very large, quadrate to rectangular cells through the length of the leaves, c. 4-6(-8) cell rows wide, that is sharply separated from the rest of the leaf cells” (Gradstein 2017). Otherwise, in many *Bazzania* species, the central and basal bands of larger cells can gradually merge with the surrounding cells and differ in wall and trigone patterns. So, they define a wide area diffusely limited, here called a subvitta.

The *underleaf insertion*, namely its position in relation to the ventral leaf bases, was underlined by Gradstein (2024) as a

useful criterion to separate species, in addition to their connation. Regardless of their connation, underleaf and ventral leaf base insertions can be either contiguous on both sides (Fig. 3A) or on a single side and distant on the other side (Fig. 3B).

In the *underleaves*, *hyaline cells* occur in different patterns ranging from a narrow apical band, often eroded, to a wider decurrent marginal band, rarely occupying the entire lamina. True hyaline cells are conspicuously thinner walled than chlorophyllose cells. In some species, apical underleaf cells can be discoloured but otherwise similar to the chlorophyllose cells. In addition, underleaf hyaline cells can be strongly

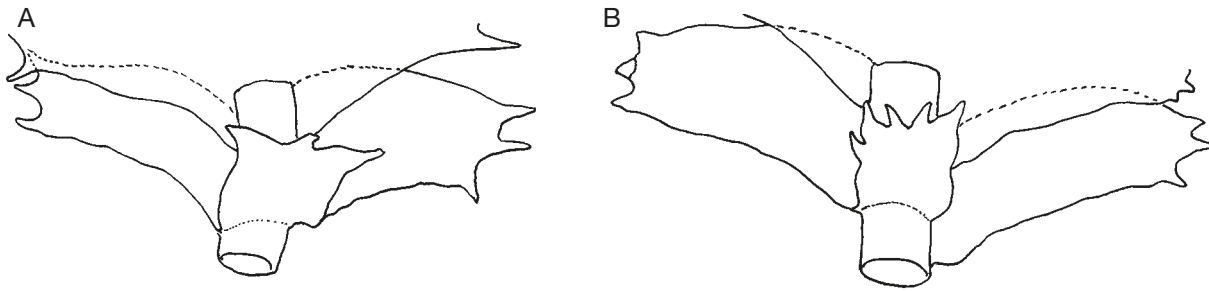


FIG. 3. — Underleaf insertions schemas in two *Bazzania* Gray species: **A**, *B. incrassata* (Steph.) N.Kitag. (*Thouvenot* NC3301); **B**, *B. subtilis* (Sande Lac.) Trevis. (*Thouvenot* NC2497). Scale bar: 200 μ m.

eroded so that the hyaline band seems narrow, discontinuous or lacking, but in that instance they leave some wall fragments on the border.

RESULTS

The presence of 18 *Bazzania* species is documented here for New Caledonia. Among them, seven species are endemic: *Bazzania bernieri*, *B. bescherellei* Steph., *B. consociata* (Steph.) H.A.Mill., *B. deplanchei* (Gottsche ex Steph.) Jovet-Ast, *B. incrassata* (Steph.) N.Kitag., *B. paucidens* (Steph.) H.A.Mill. and *B. quadratistipula* H.A.Mill. These species are described from their types and a set of reference specimens that allow their variation to be described to some extent. Species delimitation can sometimes be uncertain because of the influence of environmental conditions on several morphological characters that could not be evaluated in this kind of review in the absence of precise ecological data about the specimen localities. When a set of species are separated by few characters, known to be ecologically dependent, these taxa may become synonymous in the light of further research involving environmental and molecular data. The following pairs need such additional studies to verify the robustness of their distinctive features: 1) *Bazzania bescherellei* vs *B. consociata*; 2) *B. franciana* (Steph.) N.Kitag. vs *B. paucidens* and 3) *B. incrassata* vs *B. subtilis* (Sande Lac.) Trevis.

The underleaf insertion line in reference to the nearest leaves on both sides of the stem (Gradstein 2024) is described for the first time in the regional context. It is noteworthy that most of the New Caledonian species have underleaf insertion lines positioned close to the leaf bases on both sides, especially the endemic species. Only five species have the leaves and underleaves contiguous on a single side: *Bazzania pectinata* (Lindenb. & Gottsche) Schiffn., *B. subtilis*, *B. vitata* (Gottsche) Trevis. and *B. wooroonooran* Meagher and the endemic *B. quadratistipula*. In addition, this character is essential to separate *B. subtilis* from the endemic *B. incrassata*. The type of one of the endemic species, *Bazzania subserifolia* (Beauverd) H.A.Mill., could not be located since its designation by Stephani (1924) is puzzling and, without the opportunity to check the morphological features of the type,

I was unable to assign any collected specimens to this species. But according to the Stephani diagnosis, I conclude that it is likely synonymous with *B. tridens* (Reinw., Blume & Nees) Trevis (see notes below the latter). In addition, *Bazzania limbata* (Steph.) Tixier was treated as a synonym of *B. franciana* by Kitagawa (1973), but checking the type brought evidence that it is another synonym of *B. tridens*. Further taxonomic changes came from the examination of several specimens including types, belonging to a group of species closely related to *B. franciana*. Among them, *Mastigobryum motelayi* Steph. which was synonymised with *B. marginata* (Steph.) N.Kitag. by Kitagawa (1973) is transferred here to *B. paucidens*, whereas *B. marginata* is included in *Bazzania adnexa* (Lehm. & Lindenb.) Trevis., a species newly reported from New Caledonia from recent specimens, but also from a misidentified historic collection. In addition, the androecium of *Bazzania caudistipula* (Steph.) Inoue & H.A.Mill. is described for the first time, although the species is reported from a wide range from South-East Asia to the Pacific Islands and Australasia.

DISCUSSION

Altogether, the review of earlier publications showed a need of revision of the nomenclatural and taxonomical status quo by studies of the type materials and detailed descriptions of most of the species. This study tries to fill the gap. Now the high diversity of the genus *Bazzania* in New Caledonia is confirmed, although details have to be finalized, especially the putative synonymy of some local endemic species with the ones present in other countries whose type could not be observed or when intraspecific morphological variability could not be evaluated. Regarding surface (16.9 M km²) and number of species (18 of which 7 endemics), the territory can be compared with the near Australasian countries where Australia (7741 M km²) is the closest, sharing 8 of its 34 species (12 endemics) (Meagher 2019). In contrast, New Zealand (268 M km²) with 14 species shares only one with New Caledonia. Melanesian islands seem poorer, but they are less studied. For example, Fiji (18.2 M km²) has 13 species whose three are shared. In the Indo-Malaysian world, Java (132 M km²) has 30 species, five shared, Thailand (513 M km²)

has 34 species, four shared, while, in their Pacific Asia region, Bakalin & Klimova (2024) report only five species also found in New Caledonia among the 74 *Bazzania* species of that region. The number of *Bazzania* decrease when we leave these regions. For example, Réunion Island (2.5 M km²) has only four species and Hawaii (28.3 M km²) 11 species, no one being shared with New Caledonia.

TAXONOMIC TREATMENT

Family LEPIDOZIACEAE Limpr.

Genus *Bazzania* Grey

Bazzania adnexa (Lehm. & Lindenb.) Trevis.

(Figs 1E, G; 4)

Memorie del Reale Istituto Lombardo de Scienze e Lettere, serie 3, Classe di Scienze Matematiche e Naturali 4: 414 (Trevisan 1877). — *Jungermannia adnexa* Lehm. & Lindenb., *Novarum et minus cognitarum stirpium pugillus quartus* 4: 58 (Lehmann 1832). — *Mastigobryum adnexum* (Lehm. & Lindenb.) Mont, in *Voyage au Pôle Sud et dans l'Océanie sur les corvettes l'Astrolabe et la Zélée, Botanique* 1: 243 (Hombron & Jacquinot 1845). — Type: **Australia** (collector and date unknown).

Mastigobryum marginatum Steph., *Revue bryologique* 35 (2): 31 (Stephani 1908a). — *Bazzania marginata* (Steph.) N.Kitag., *Journal of the Hattori Botanical Laboratory* 36: 449 (Kitagawa 1972 [1973]). — Type: **New Caledonia, Le Rat s.n.** (lecto-, designated here *vide* Kitagawa (1970, *in sched.*), G["Sine Schedula", 1907, *Le Rat* G00066911!]), **syn. nov.**

Mastigobryum dognyense Steph. *Species hepaticarum* 6: 461 (Stephani 1924). — Type: **New Caledonia, Dogny, Lerat.** (lecto-, designated here *vide* Kitagawa 1970, *in sched.*, G[Dogny; 1050 m; s.d., *L. Lerat* G00112718!]), **syn. nov.**

Mastigobryum lenormandii Steph. *Bulletin de l'Herbier Boissier, série 2*, 8 (11): 852 (Stephani 1908c). — Type: **New Caledonia, Lenormand** (not seen), **syn. nov.**

MATERIAL EXAMINED. — **New Caledonia** • North Province, Hienghène, Panié massif, path between Bwa Téan and Payolé; on dead wood in mountain wet forest on mica schist bedrock; 1000 m; 9.X.2012; *Thouvenot NC1303, NC3463* • Tao; lowland wet forest, on mica schist bedrock; 6.X.2012; *Thouvenot NC3387* • Poindimié, Tango Plateau, Upper Hoeène; on wet rock in riparian forest on volcano-sedimentary bedrock; 350 m; 11.X.2019; *Thouvenot NC3324* • *ibid*; on the ground in riparian forest; 350 m; 11.X.2019; *Thouvenot NC3021* • Pouébo, Diahoué; on metamorphic rock in dry creek; 450 m; 21.IX.2019; *Thouvenot NC3299* • South Province, Boulouparis, Mt Do; wet forest on ultramafic bedrock with *Nothofagus* sp. and *Araucaria* sp.; 960 m; 14.IX.2016; *Thouvenot NC3441* • Mont Dore, Pirogues River; on rocks in riparian woodland with *Pandanus* sp.; 13 m; 29.IX.2019; *Thouvenot NC3322* • Mouirange; on barks; 500-550 m; 17.IX.2019; *Thouvenot NC3303* • La Foa, Mt Dogny; eastern ridge of Mt Dogny, on dead wood in mountain forest on volcano-sedimentary bedrock; 990 m; 23.IX.2008; *Thouvenot NC636, NC668* • Mont-Doré, Mouirange; on dead wood in a wet forest with *Nothofagus* sp. on ultramafic bed-rock; 546 m; 17.IX.2019; *Thouvenot NC3316* • Yaté, Chakéké lake; episodic creek, on lateritic silt deposited on trunks; 411 m; 4.X.2019; *Thouvenot NC3051* • Païta, Mt Mou; VII.1909; *Le Rat s.n.* (herbarium E.G. Paris as *Mastigobryum lenormandii*; REN[REN000219]) • Mt Ouin; on humus on rocks, in mountain wet forest, ultramafic massif; 925 m;

19.IX.2016; *Thouvenot NC2480* • Mt Humboldt; cloud forest on ultramafic bedrock, at the base of a tree fern; 1255 m; 1.X.2008; *Thouvenot NC3420* • Dumbéa, Mt To; on dead wood in a hollow on the summit; 880 m; 10.V.1951; *Hürlimann 2579 p.p.* as *Bazzania marginata* (Steph.) N.Kitag.; PC[PC0793205] • Mt Bouo; on the trunk of dead tree in wet forest, ultramafic massif; 930 m; 16.IX.2016; *Thouvenot NC3243, NC3439* • Montagne des Sources; on bark in wet forest with *Araucaria rulei* F.Muell., ultramafic massif, 940 m; 21.IX.2016; *Thouvenot NC3431* • Sarraméa, on the trail to Dogny plateau; mountain wet forest on volcano-sedimentary bedrock; 889 m; 26.IX.2016; *Thouvenot NC3427* ("dognyense" form) • Pembäi; VII.1909; *L. Le Rat s.n.* (herbarium E.G. Paris as *Mastigobryum lenormandii*; REN[REN000220]).

DISTRIBUTION IN NEW CALEDONIA. — *Bazzania adnexa* is common in both provinces where it was known under various names of endemic species, now synonyms. It is found at all elevations mainly on grounds and dead woods but also on barks, in wet or riparian forests.

TOTAL RANGE. — Australia, New Zealand, China (Meagher 2019) and New Caledonia.

DESCRIPTION

Plants

Medium, creeping, rigid, forming dense wefts or mixed with other bryophytes, shoots 2-3.2 mm wide, terminal branching common, pseudo-dichotomous; ventral-intercalary branching common, flagelliform; leaves imbricate, convex, unevenly deflexed when dry, widely spreading and complanate when moist.

Leaves

Asymmetrically ovate oblong to ovate lingulate, falcate, (0.55-)1.00-1.80(-2.00) mm long, (0.25-)0.50-1.15 mm wide near the bases, 0.24-0.50 mm below apices, length-width ratio 1.4-2.4; dorsal margins widely arched proximally, nearly straight distally, ventral margins straight, undulate or concave, shortly rounded at base, both margins with loose to dense denticulation in upper part, sometimes with a few sharp teeth; apex obliquely truncate, with three conspicuous triangular lobes, 3-8 cells long or longer, margins denticulate, often ornamented with additional sharp teeth.

Cells

Homogeneous but gradually becoming longer and wider toward the base, typically forming an ill-defined subvitta; median cells quadrate rounded to oblong, 20-30 µm wide, 20-60 µm long, either thin-walled with small to medium bulging trigones or thicker walled with inconspicuous trigones; marginal cells smaller; cells in the subvitta 30-50 µm wide, 38-75 µm long.

Underleaves

Erect, rounded-quadrate to wider than long, 0.50-1.30 mm wide, 0.35-1.00 mm long, 1.5-3 times wider than the stem, transversally to obliquely inserted, positioned near and connate to the leaf bases on both sides of the stem; lateral margins straight to convex, sometimes with 2-3 rounded lobules, apices lobulate-dentate with sharp ovate-triangular lobules or teeth, border denticulate; hyaline border narrow to wide all around the free margins, consisting of (1-)2-7 rows of thin-walled cells, occupying 0.15-0.25(-0.50) times the underleaf length; basal

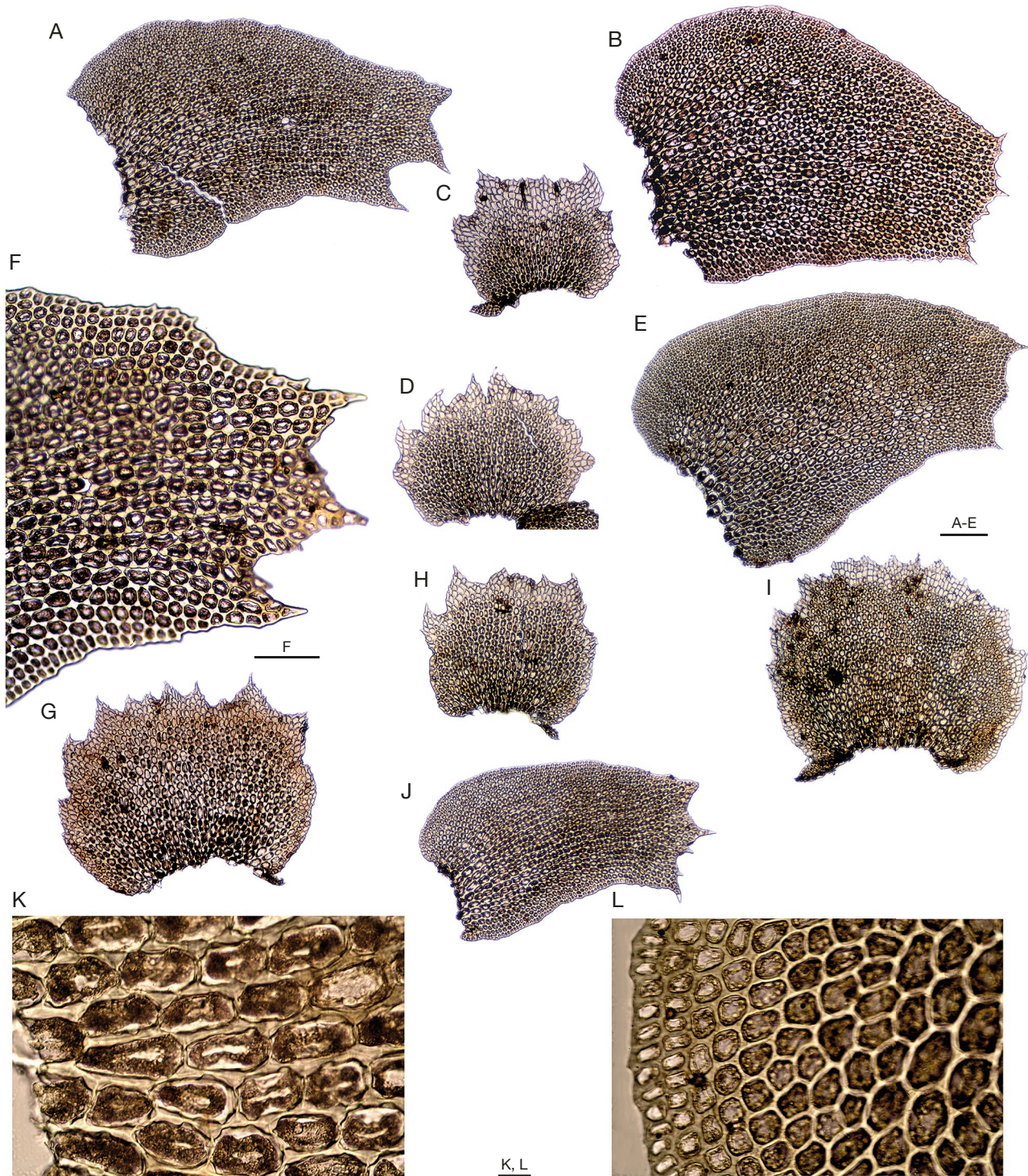


FIG. 4. — *Bazzania adnexa* (Lehm. & Lindenb.) Trevis.: **A, B, E, J**, leaves; **C, D, G-I**, underleaves; **F**, leaf apex; **K**, basal leaf cells; **L**, median leaf cells. **A, C, D, F, H, J-L**, from *Thouvenot NC3316*; **B, G**, from *Thouvenot NC3431*; **E, I**, from *Thouvenot NC1303*. Scale bars: A-E, G-J, 200 µm; F, 100 µm; K, L, 20 µm.

cells oblong to rectangular, firm walled with small trigones (Description after New Caledonian specimens).

NOTES

Bazzania adnexa is known to be a very variable species (Stephani 1908c, Meagher 2013). It can be distinguished from the more or less similar species, by: 1) leaf margins

denticulate, more strongly at the apices where additional small teeth are common; 2) leaf apices conspicuously 3-lobate with triangular lobes; 3) underleaves wider than long, bordered by a wide band of hyaline cells, sharply dentate at apices, in addition, leaves are imbricate, ovate oblong to lingulate, strongly narrowed at apices, somewhat falcate; and 4) upper leaf cells have thin to sparingly thickened walls and medium

trigones, gradually expanding toward the base forming an ill-defined subvitta. From *B. franciana* and *B. paucidens*, the sharply toothed underleaf apex is distinctive. In addition, *B. paucidens* has shorter leaves, with an ovate shape, apices shallowly trifid or with widely triangular lobes, margins less sharply denticulate. In the largest specimens, leaves are more strongly falcate and narrowed at apex. Furthermore, the underleaves of the youngest parts of the shoots may have a triangular shape due to the strongly recurved lateral margins. In the most depauperate specimens the leaves tend to be more narrowly ovate, with more denticulate margins. Meagher (2010) underlined the similarity of *B. marginata* with *B. franciana*, but the synonymy of *B. marginata* with *B. adnexa* is here recognized on the basis of the denticulate leaf margins and dentate underleaf apices. As I was unable to check the type of *Mastigobryum lenormandii*, I transfer it to *B. adnexa* following Kitagawa (1973) who synonymized it with *Bazzania marginata*.

Bazzania bernieri (Steph.) Inoue & H.A.Mill.
(Figs 2A, B; 5)

Bulletin of the National Science Museum, Tokyo, n.s. 8 (2): 142 (Inoue & Miller 1965). — *Mastigobryum bernieri* Steph., *Bulletin de l'Herbier Boissier*, série 2, 8 (11): 852 (Stephani 1908c). — Type: **New Caledonia**, Bernier (lecto-, designated here *vide* Kitagawa (1970, *in sched.*), G[G00066866]).

Mastigobryum bernieri f. *falcifolium* Steph., *Bulletin de l'Herbier Boissier*, série 2, 8 (11): 852 (Stephani 1908c). — *Mastigobryum falcifolium* Steph. ex Paris, *Revue bryologique* 33: 29 (Paris 1906). — Type: **New Caledonia**, Etesse 6 (lecto-, designated here; G[Mt Malaouï pr. Nouméa, G00264036]); iso-, REN[REN000098]).

Bazzania serrifolia Steph., *Revue bryologique* 35 (2): 34 (Stephani 1908a). — *Mastigobryum serrifolium* (Steph.) Steph., *Bulletin de l'Herbier Boissier*, série 2, 8 (11): 860 (Stephani 1908c). — Type: **New Caledonia**, Le Rat, Etesse (lecto-, designated here *vide* Kitagawa (1970, *in sched.*), G[Mt Dzumac, XII.1904, *Le Rat*, G00066887]); isolecto-, REN[REN00022]); para-, G[Mt Koghis, V-VI.1905, Etesse s.n., G00282526]; G[IX.1906, *Le Rat* s.n. G00282527]; G[Mt Dzumac, VII.1905, *Le Rat* s.n. G00282530]).

Mastigobryum angustum Steph., *Species hepaticarum* 6: 453 (Stephani 1924). — *Bazzania angusta* (Steph.) Herzog, *Transactions of the British Bryological Society* 1 (4): 307 (Herzog 1950). — Type: **New Caledonia**, Le Rat (lecto-, designated here *vide* Kitagawa (1970, *in sched.*), G[In jugo Dogny (1050 m), *L. Le Rat*, G00066885]); isolecto-, PC[In jugo Dogny (1050 m), VII.1909, *L. Le Rat*, PC0101781, PC0101782, PC0150631]; REN[s.n.]) **syn. nov.**

MATERIAL EXAMINED. — **New Caledonia** • North Province, Poya, Aoupinié; on dead wood in wet forest; 700 m; 16.XII.2015; *Métoyer* MET099 • Touho, Tipilé upper valley; on litter, in sedimentary massif, lowland wet forest; 315 m; 12.X.2012; *Thouvenot* NC1221 • Poindimié, Tango plateau, Napupwa; on trunk base in wet forest, in volcano-sedimentary massif; 467 m; 20.IX.2019; *Thouvenot* NC3297 • South Province, Mt Koghis; II.1905; Etesse s.n.; PC[PC0101882] • Mé Areimbo; 1088 m; X.1909; *L. Le Rat* s.n.; REN[REN000227] • La Foa, Dogny plateau; on ground and rocks in a creek, volcano-sedimentary bedrock, in wet forest; 1000 m; s.d.; *Coulerie* COU66 (as *Bazzania angusta* (Steph.) Herzog) • *ibid.*; 950 m; 24.X.2019; *Thouvenot* NC2619 • Yaté, Marais Kiki, soil

on rocks in damp forest; 8.VIII.2014; *Métoyer* MET031; VI.2015; *Métoyer* MET067 • Dumbéa, Koghis; on dead wood in wet forest; 8.VIII.2014; *Métoyer* MET028 • Mont Dore, Mouirange Pass; on dead wood in wet forest; 284 m; VI.2015; *Métoyer* MET063 • Païta, Mt Humboldt; on litter in cloud forest; 1255 m; 1.X.2018; *Thouvenot* NC1809 • *ibid.*; on dead wood in mountain shrubland; 1280-1300 m; 11.IX.2014; *Métoyer* MET036, MET038, MET041.

DISTRIBUTION IN NEW CALEDONIA. — Widely distributed in both provinces of the main island (Grande Terre), from the lowest altitudes to the highest mountains, mainly on ground and dead wood.

TOTAL RANGE. — Endemic to New Caledonia.

DESCRIPTION

Plants

Medium to large, rigid, decumbent, growing in dense wefts or creeping among bryophytes and filmy ferns; moist shoots 2-3 mm wide, stems about 0.30-0.50 mm wide; branching common, terminal branching pseudo-dichotomous, ventral-intercalary branches flagelliform.

Leaves

Imbricate, spreading usually at right angle when moist, convex, deflexed when dry; leaves 1.5-2.0 mm long, 1.0-1.5 mm wide near the bases, short-elliptical or widely ovate, asymmetrical to sub-symmetrical, not falcate, length-width ratio 1.2-1.5; both margins sub-entire, crenulate to sharply denticulate at least in upper part, dorsal margins strongly arched, sub-auriculate at base, sometimes obliquely sub-straight in upper half; ventral margins ranging from convex to sub-straight or sinuous; apices usually rounded or shortly truncate to angular, shallowly (2-)3(-4) dentate, teeth often reduced to a single cell, at most low and very widely triangular separated by shallowly lunate sinuses; rarely, apices more deeply dissected in some leaves.

Cells

Leaf areolation more or less heterogeneous, with an obvious intramarginal area of thick-walled cells and a large internal subvitta of larger cells; median cells rounded-quadrate to oblong, 8-25 µm wide, 15-30 µm long, moderately thick-walled with inconspicuous to medium trigones; marginal and intramarginal cells smaller, thick-walled; basal cells oblong to rectangular, up to 45 µm wide and 55 µm long, thin-walled with larger bulging trigones.

Underleaves

Patent to spreading, recurved, transversally to obliquely inserted, positioned near and connate to the leaf bases on both sides of the stem, reniform to slightly wider than long, 0.60-1.20 mm long, 0.80-1.50 mm wide, usually up to 2-3 times wider than the stem, lateral margins repand to rounded lobulate, apices variously shaped, usually entire margined to eroded, at times shortly incised, then with large lobes rounded to ovate; hyaline borders narrow, from null to unevenly continuous, made of 0 to 4(-5) files of small hyaline cells, internal cells like the leaves (Description after the type specimens of *M. bernieri* and *M. serrifolium*).

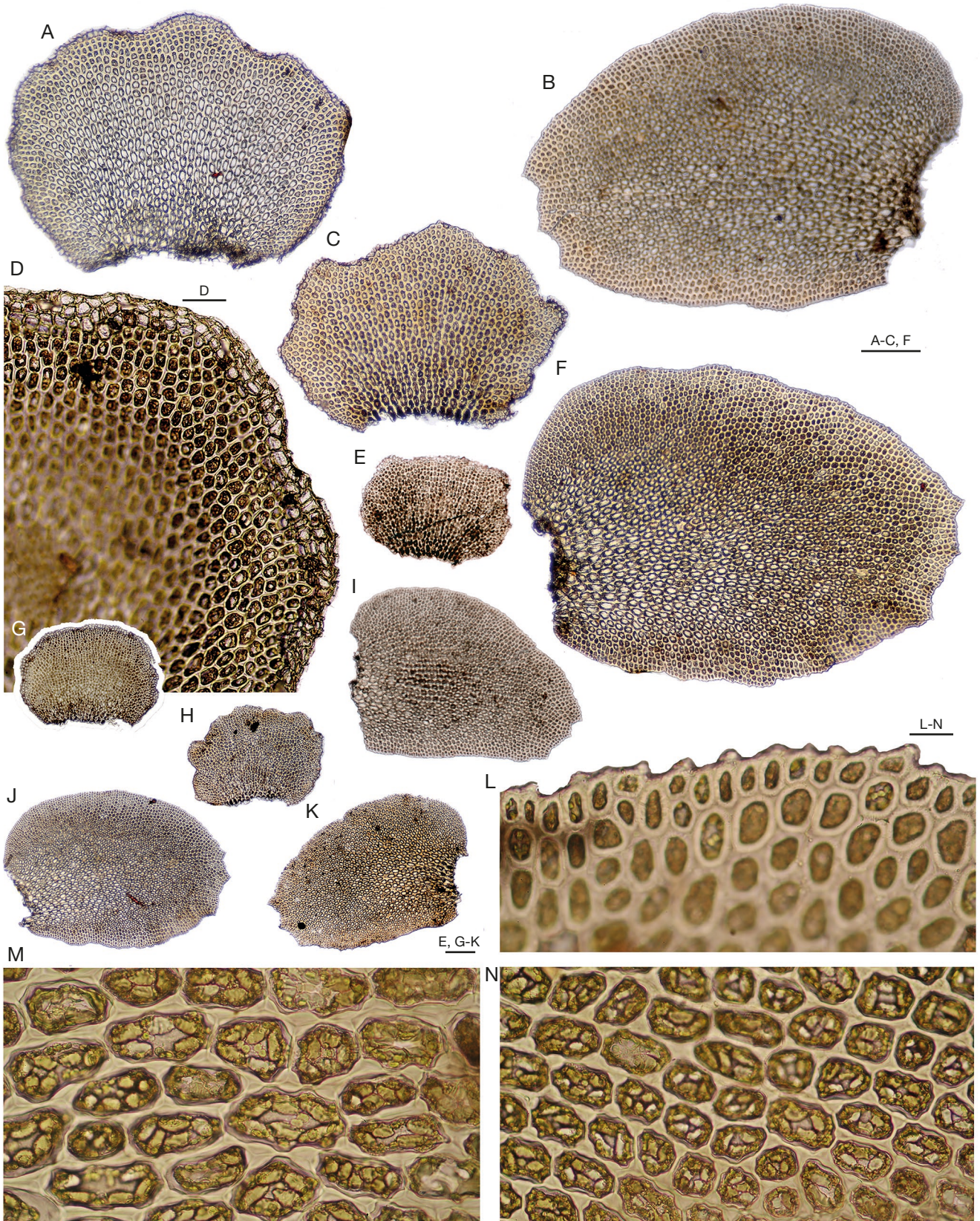


FIG. 5. — *Bazzania bernieri* (Steph.) Inoue & H.A.Mill.: **A, C, E, G, H**, underleaves; **B, F, I-K**, leaves; **D**, underleaf margin; **L**, marginal leaf cells; **M**, basal leaf cells; **N**, median leaf cells. **A, B**, from the isotype of *Mastigobryum angustum* Steph. [REN000226]; **C, F, H, J**, from *Thouvenot NC1690*; **D, G**, from *Thouvenot NC2619*; **E, I**, from the isotype of *M. angustum* [PC0101781]; **K, L-N**, from *Thouvenot NC1666*. Scale bars: A-C, F, 200 μm; D, 50 μm; E, G-K, 200 μm; L-N, 20 μm.

NOTES

Bazzania bernieri is a very distinctive species in New Caledonia, although Stephani described several taxa based on characters varying in a few details. But, after checking a lot of specimens showing a mix of these characters, they turned out to be synonyms. Typical *B. bernieri* is a medium to strong species usually fragrant, distinguished by: 1) convex leaves imbricate and widely spreading when moist, mostly at (60°-)90° to the stems; 2) leaves more or less symmetrically broadly elliptical to ovate with denticulate margins and shallowly dentate apices; 3) intramarginal cells small and thick-walled, forming a more or less wide strip surrounding a wide subvitta; 4) cells in the subvitta larger with large rounded trigones, cell lumina usually filled with large oil bodies, oblong or rounded; and 5) reniform underleaves up to 3 times the stem width, recurved, with a narrow hyaline border, the apices usually entire to eroded. It could only be confused with *B. loricata* (Reinw., Blume & Nees) Trevis. but leaves of the latter have more widely expanded dorsal bases and are entirely filled with thin-walled cells with large trigones.

The synonyms are hardly separated since the above-mentioned features are constant in their types. Variations may occur in the width of the underleaf hyaline border, that remains relatively narrow because the hyaline cells are small and often partly collapse. Furthermore, the subvitta may be hardly distinct from the surrounding cells but leaves with such areolation may occur mixed with typical leaves in the same shoots. In addition, I could see rare plants with quadrate underleaves, or with underleaves shallowly incised mixed with entire ones. In addition, Métoyer *et al* (2018) underline the chemical proximity between *B. serrifolia* and *B. bernieri* and the lack of chemospecific status for *B. serrifolia*. So, the chemical analysis supports that synonymy. In the type of *Mastigobryum angustum*, Kitagawa (1973) pointed out the erect spreading leaves instead of widely spreading, the smaller trigones of the leaf cells and the underleaf hyaline margins wider and incised. But comparison of different isotypes shows that the leaves can be oriented at *c.* 60° to 90° from the stem in the same specimen and the other quantitative characters are included within the limits described above.

The name *Bazzania serrifolia* was used by Stephani when he first published the new species in the *Revue bryologique* (Stephani 1908a). In the same paper, Stephani used the generic name *Mastigobryum* for four new species, especially *M. subintegrum* Steph., but, inexplicably in our view, he used *Bazzania* just for *B. serrifolia*. However, Stephani's name has priority and the later combination *Bazzania serrifolia* (Steph.) Tixier (1973) is illegitimate. At PC, the specimen PC0101882, collected by Etesse, is regarded as a type of *Mastigobryum serrifolium*, but the collection date (February 1905) differs from that of the syntype at G (May-June 1905) and I cannot state that it is a part of the original material seen by Stephani.

Bazzania bescherellei Steph.
(Figs 1B; 6)

Hedwigia 32 (4): 204 (Stephani 1893). — *Mastigobryum bescherellei* (Steph.) Steph., *Bulletin de l'Herbier Boissier*, série 2, 8 (10): 766

(Stephani 1908b). — Type: **New Caledonia**, herb. Bescherelle (lecto-, designated here *vide* Kitagawa (1970, *in sched.*), G[“Nova Caledonia”, Anon. *s.n.*, ex herb. Bescherelle, G00066912!]; paralecto-, G[G00066913!]).

MATERIAL EXAMINED. — **New Caledonia** • North Province, Hienghène, Panié massif, between Bwa Téan and Payolé; 1000 m; 09.X.2009; *Thouvenot NC3337* • South Province, Païta, Mt Mou; 1190 m; on bark of branch in cloud forest, ultramafic massif; 17.IX.2016; *Thouvenot NC3593* • Mt Mou summit; 1000 m; VI.1909; *Le Rat s.n.*; REN[REN000217] • Pic des Mousses (Mt Mou); 1200 m; 23.VIII.1950; *Baumann-Bodenheim 5741*; PC[PC0793142] • Mt Humboldt; on bark in mountain scrubland, ultramafic massif; 1400 m; 01.X.2008; *Thouvenot NC3679* • *ibid.*; 1205 m; 30.IX.2008; *Thouvenot NC3676* • Dumbéa; Mt To; 880 m; 10.V.1951; *Hürlimann 2569b*; PC[PC0793143], *Hürlimann 2579* p.p.; PC[PC0793205] • Montagne des Sources; on bark in wet forest with *Araucaria rulei* F.Muell.; 940 m; 21.IX.2016; *Thouvenot NC3680* • Sarraméa, Mé Amméri; on bark in forest; *c.* 700 m; 29.XI.1950; *Guillaumin & Baumann-Bodenheim 8905*; PC[PC0793141] • Mont Dore, Mourange; on rocks in ultramafic massif; 500-550 m; 17.IX.2019; *Thouvenot NC3296* • Yaté, near the Goro old mine; on rocks in wooded scrubland, ultramafic massif; 242 m; 31.III.2016; *Métoyer 110* • Pic du Grand Kaori; on rocks in xerophilous forest; 250 m; 22.X.2012; *Thouvenot NC731* • Creek Nooti; on bark at ground level in creek bed, ultramafic massif; 426 m; 05.X.2019; *Thouvenot NC2737*.

DISTRIBUTION IN NEW CALEDONIA. — Frequent on trunks and branches in both provinces of Grande Terre at any elevation.

TOTAL RANGE. — Endemic to New Caledonia.

DESCRIPTION

Plants

Medium sized, rigid; moist shoots 2.4-2.5 mm wide, stems 0.30-0.35 mm thick, terminal branching common, pseudo-dichotomous, ventral-intercalary branches numerous, flagelliform.

Leaves

Imbricate, complanate when moist, a little convex, obliquely spreading at a wide angle, more than 60°, deflexed when dry; leaves asymmetrically ovate-oblong, (0.70-)1.3(-1.50) mm long, (0.40-)0.85 mm wide near the bases, (0.28-)0.50 mm at apices, length-width ratio (1.5-)1.6(-1.9); leaf surface smooth; margins entire, or unevenly denticulate-crenulate in upper parts, dorsal margins widely arched at bases, sub-straight to slightly convex above, ventral margins sub-straight to hardly concave, shortly rounded at bases; apices obliquely truncate to obtuse, from sub-entire to shortly dissected, typically three dentate with the outer teeth narrowly triangular, acute, 1-3 cells long, and the median tooth widely triangular to flat, with few denticulations or none.

Cells

Heterogeneous, gradually increasing in length and trigone size towards the centre-basal part of the leaves, drawing a more or less obvious subvitta; median cells rounded quadrate to oblong, 12-20 µm wide, 12-35 µm long, medium thick-walled, trigones acute, large, but often hardly larger than the cell walls, marginal cells smaller, otherwise like the median cells, cells



FIG. 6. — *Bazzania bescherelei* Steph.: **A-D**, leaves; **E, G-J**, underleaves; **F**, leaf base; **K**, basal leaf cells; **L**, median leaf cells. **A, E, H**, from Hürlimann 2569b; PC[PC0793143] ; **B, C, J-L**, from Thouvenot NC731; **D**, from Thouvenot NC3676; **F, G**, from Thouvenot NC3296; **I**, from Hürlimann 2579; PC[PC0793205]. Scale bars: A-E, 200 µm; F-J, 100 µm; K, L, 20 µm.

in the subvitta oblong to long rectangular, 18-24(-38) µm wide, 35-45(-68) µm long, with medium to thick walls and large trigones, sometimes confluent.

Underleaves

Obliquely inserted, positioned near and widely connate to the leaf bases on both sides of the stem, erect-patent, recurved,

slightly wider than long, with rounded corners, (0.30-)0.50-0.60 mm long, (0.45-)0.60-0.75 mm wide, 2 (-3) times wider than the stem; apices truncate, sub-straight or with some shallow rounded lobules, usually entire margined but sometimes with some sharp teeth; internal cells oblong to narrowly rectangular with thick walls and large trigones; in some or many underleaves, an uneven marginal band of 0-2 files of hyaline cells, with medium thick walls lacking trigones, may be present without forming a true hyaline band (Description after the lectotype).

NOTES

Bazzania bescherellei is close to *B. consociata* and the two species could be confused if the hyaline borders of the underleaves of *B. consociata* are overlooked. Both are small plants with the leaves ovate-oblong, shortly 3-dentate. In the type specimens, leaves and underleaves may be variable along shoot segments of a same plant. In typical forms, areolation patterns are distinctive, since *B. bescherellei* has median cells with neat trigones, becoming progressively larger toward the base, whereas median cells of *B. consociata* have less conspicuous trigones and are sharply separated from the larger oblong cells with large trigones forming a clear subvitta. Further characters may be useful to separate the two species such as the plant size, *B. bescherellei* being usually larger (0.70-)1.3(-1.50) mm long versus 0.80-1.00 mm long.

Even though there is no doubt that *Bazzania bescherellei* is the basionym rather than *Mastigobryum bescherellei*, Stephani's name is puzzling since, at the same time, he used *Mastigobryum* and rejected expressly *Bazzania* in his correspondence with Bescherelle (1887-1893, manuscript kept in the MNHN Library, Botany (MS CRY 170/150-154)), while he inconsistently used the name *Bazzania* for 21 species in his *Hepaticarum species novae* (Stephani 1893). The combination *Bazzania bescherellei* (Steph.) Tixier (1985) is superfluous.

Bazzania caudistipula (Steph.) Inoue & H.A.Mill. (Figs 7A-E)

Bulletin of the National Science Museum, Tokyo n.s. 8 (2): 141 (Inoue & Miller 1965). — *Mastigobryum caudistipulum* Steph., *Bulletin de l'Herbier Boissier*, série 2, 8 (12): 945 (Stephani 1908d). — Type: Fiji (Viti-Levu), *Graeffe s.n.* (holo-, G[G00066870] not seen).

MATERIAL EXAMINED. — **New Caledonia** • North Province, Hienghène, Tao falls; epiphytic, valley with rain forest and waterfall; 50 m; *c.* 12.IX.2001; *F. Müller NC216* (DRE, duplicate seen) • Touho, Pombei (Tiwaka valley); on bark, 230 m; 13.X.2016; *Thouvenot NC3411* • Poindimié, Amoa valley, below Goro Até Mèkébo; on roots in mesophilous forest; 359 m; 12.X.2019; *Thouvenot NC3160* • Tipwadabwé; on tree-fern trunk in wooded river bank; 244 m; 13.X.2019; *Thouvenot NC3671*; PC[PC0779828].

DISTRIBUTION IN NEW CALEDONIA. — Rare, hitherto known from a few collections collected in North Province, on barks and roots in lowland wet forests.

TOTAL RANGE. — The Philippines, Papua New Guinea, Australia, Fiji, Samoa (Meagher 2010), Sumatra, (Siregar *et al.* 2018), New Caledonia.

DESCRIPTION

Plants

Medium-sized, forming loose wefts, leaves and underleaves fragile; moist shoots 3-4 mm wide; stems 0.35 mm wide; pseudo-dichotomous terminal branching uncommon, ventral-intercalary flagelliform branches common, normal leaved-branches of ventral-intercalary origin abundant in some populations.

Leaves

Imbricate in lower parts of the shoots, contiguous in upper parts, deflexed when dry, complanate and spreading at right angle in wet condition, ovate-oblong, asymmetric but often slightly so, 1.35-2.00 mm long, 0.55-1.10 mm wide near bases, 0.50 mm at apices, apex to base width ratio 1/2, length-width ratio 1.4-2.3; cuticle warty at least along the borders, margins sub-entire, at most unevenly crenulate, dorsal margins widely arched in basal mid-length, sub-straight in upper part, ventral ones sub-straight to slightly concave, narrowly rounded at bases; apices truncate, 2-3-fid, with strong acute lobes, triangular, typically 3-8 cells long, angular sinus acute to right-angled.

Cell

Areolation homogenous, cells oblong to elongate with thin walls and large bulging trigones often confluent, cells slowly increasing in size toward bases, median cells 15-25 µm wide, 25-45 µm long, marginal cells not differentiated; basal cells 25-40 µm wide, 50-65 µm long.

Underleaves

Erect to patent, transversally inserted on the stem by half their base width, the remainder of the width being free and auriculate, positioned close to the ventral leaf bases, underleaves slightly wider than long, 0.50-0.60 mm long, 0.60-0.85 mm wide, *c.* 3 × wider than the stem; underleaf in outline subquadrate rounded, lobate-dentate all around, basal margins often appendiculate-laciniate, lobes and teeth irregular, mostly triangular, blunt or acute; cells elongate, with thin walls and medium bulging trigones, the longer walls usually with intermediate thickenings.

Gynoecia

Not seen (description from Meagher 2010) terminal on short ventral-intercalary leafless branches; outer bracts *c.* 1 mm long, triangular, margins ciliate; inner bracts *c.* 2 mm long, margins strongly concave, densely ciliate.

Androecia

In short ventral-intercalary spikes, *c.* 1.5-2 mm long, oblong in outline, dorsally (adaxially) deeply furrowed, with *c.* four pairs of monandrous bracts closely imbricate; bracts involute, ovoid in outline, 0.85-1.05 mm long, 0.5 mm in transverse

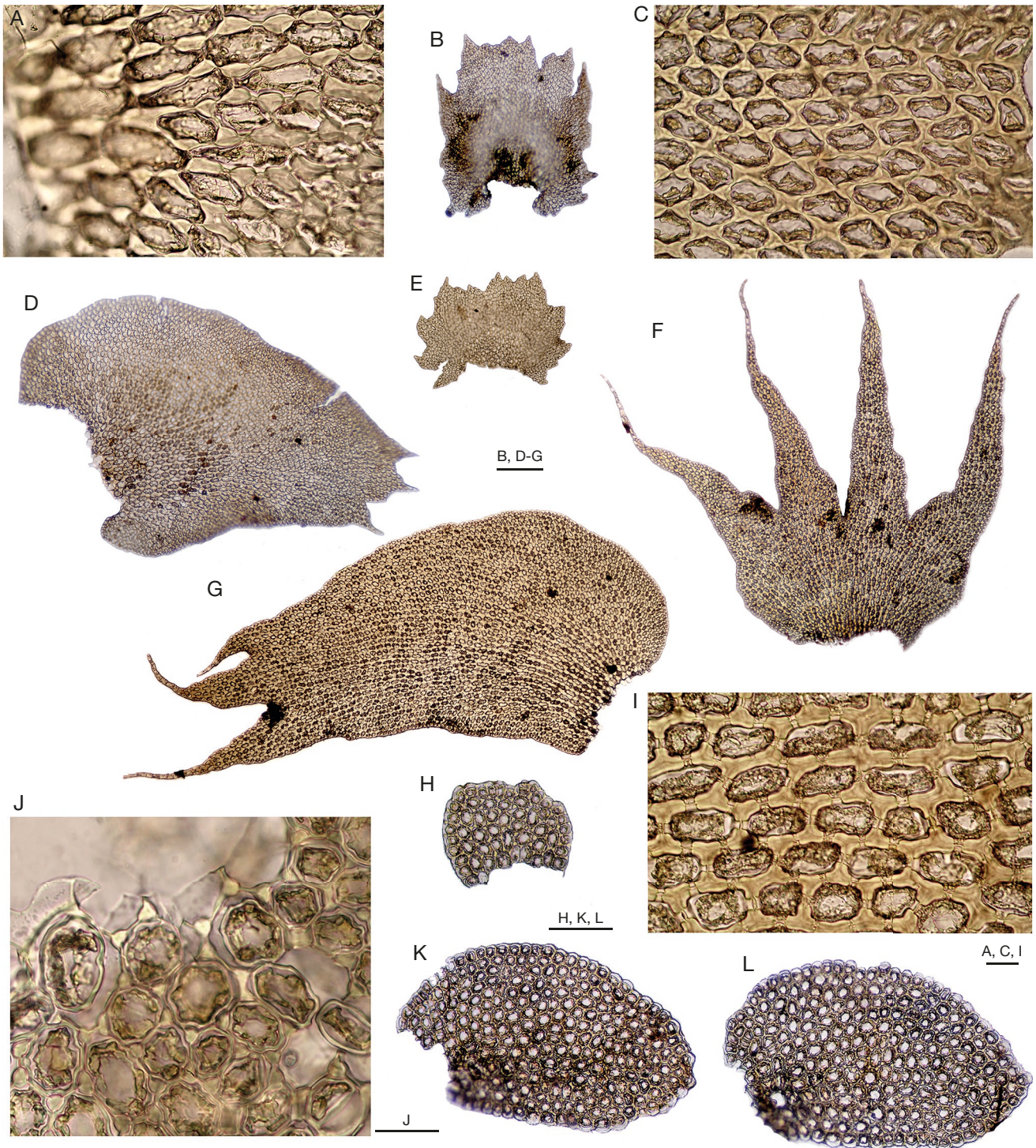


FIG. 7. — **A-E**, *Bazzania caudistipula* (Steph.) Inoue & H.A.Mill.: **A**, basal leaf cells; **B**, **E**, underleaves; **C**, median leaf cells; **D**, leaf; **F**, **G**, **I**, *B. deplanchei* (Gottsche ex Steph.) Jovet-Ast: **F**, underleaf; **G**, leaf; **I**, median leaf cells; **H**, **J-L**, *B. kokawana* N.Kitag & T.Kodama: **H**, underleaf; **J**, median cells of a broken leaf with daughter cells; **K-L**, leaves; **A**, **C**, **E**, from Müller NC216; **B**, **D**, from Thouvenot NC3160; **F**, **G**, **I**, from Thouvenot NC3430; **H**, **J-L** from Hürlimann 2741a; PC[PC0793200]. Scale bars: A, C, I, 20 µm; B, D-G, 200 µm; H, K, L, 100 µm; J, 20 µm.

diameter, shortly bifid, bract margins dentate with sharp teeth and a few short cilia, bract margins appendiculate at base; bracteoles ovate to shortly lanceolate, 0.75-0.80 mm long, 0.30-0.45 mm wide, margins sharply dentate (Description after the New Caledonian specimens).

NOTES

Bazzania caudistipula is well characterized by the underleaf shape, that makes it distinctive from *Bazzania parisii* (Steph.) N.Kitag. in the New Caledonian context. A few male shoots were found in a New Caledonian specimen and allow androecia to be described for the first time.

Bazzania consociata (Steph.) H.A.Mill.
(Figs 1A, C; 8)

Phytologia 47: 320 (Miller 1981). — *Mastigobryum consociatum* Steph., *Species hepaticarum* 6: 458 (Stephani 1924). — Type: **New Caledonia**, *Franc s.n.* (lecto-, designated here *fide* Kitagawa (s.d., *in sched.*), G[Tao, 600 m, s.d., *Franc s.n.* G00066871]! lecto-, G[“forêt de Tao, de 100 à 600 m”, I.1910, *Franc s.n.* G00066872]!; PC[PC0101765]!).

Mastigobryum leratii Beauverd, *Species hepaticarum* 6: 477 (Stephani 1924). — *Bazzania leratii* (Beauverd) H.A.Mill. *Phytologia* 47: 320 (Miller 1981). — Type: **New Caledonia**, *Mastigobryum pulchellum* Steph. mss, non *M. pulchellum* Steph. 1908., *Le Rat*. (lecto-, designated here, G[“*Nov. Caled. Septentr. In fossis inter Panié et Hyenghene*”, II.1910, *Le Rat* 310. ex herbarium Général Paris, G00067047]!; para-, REN[REN000232]!) **syn. nov.**

MATERIAL EXAMINED. — **New Caledonia** • North Province, Diahot; on sand in a rock cleft in the Diahot riverbed; c. 430 m; 31.VIII.1951; *Hürlimann* 2904; PC[PC0793192], G[G00240716] • *ibid.*; on riverbank of a Diahot tributary; c. 450 m; 30.VIII.1951; *Hürlimann* 2895; PC[PC0793191] • South Province, Sarraméa, Dogny; VII.1909; *Le Rat* 313 (herbarium E.G. Paris as *Mastigobryum dognyanum* Steph. ex Paris; REN[REN000218] • Dogny plateau; on rocks in a creek bed in wet forest, volcano-sedimentary bedrock; 1000 m; 15.IV.2013; *Coulerie* COU074, COU075 • Dumbéa, Mt Bouo; on dead tree in a wet forest in ultramafic massif; 930 m; 16.IX.2016; *Thouvenot* NC3686.

DISTRIBUTION IN NEW CALEDONIA. — Rare in both provinces of Grande Terre.

TOTAL RANGE. — Endemic to New Caledonia.

DESCRIPTION

Plants

Small, fragile, soft, moist shoots 1.0-1.5 mm wide, stems 0.16-0.30 mm thick, terminal branching common, pseudo-dichotomous, ventral-intercalary branches flagelliform.

Leaves

Imbricate, when moist sub-complanate, slightly convex, widely spreading, deflexed when dry; leaves asymmetrically ovate-oblong, hardly falcate, 0.80-1.00 mm long, 0.50-0.60 mm wide near bases, 0.24-0.30 mm at apices, length-width ratio 1.5-2.0; cuticle smooth; margins unevenly denticulate-crenulate in upper parts, dorsal margins widely arched at bases, sub-straight to slightly convex above, ventral margins sub-straight to hardly concave, shortly convex at bases; apices obliquely truncate, shallowly 3-lobulate-dentate, lobules short, widely triangular or tooth like, 1-4 cells long, apical margins with scattered sharp denticulations; leaves usually with a subvitta of 6(-9) rows of large cells contrasting with the surrounding smaller cells occupying a wide dorsal intramarginal zone and a narrow ventral band.

Cells

Rather homogeneous, sub-quadrate to sub-rectangular, 14-22(-25) μm as wide as long, cell walls firm to medium thickened, trigones lacking or small and inconspicuous, marginal cells slightly smaller, inner basal cells oblong to long

rectangular, 25-28(-35) μm wide, 35-50(-75) μm long, thin-walled with large acute trigones not confluent.

Underleaves

Erect-patent recurved, transversally inserted, positioned near and widely connate to the leaf bases on both sides of the stem, reniform to sub-rectangular and transversally elongate, 0.30-0.45 mm long, 0.35-0.60 mm wide, 2-3 times wider than the stem; lateral margins with some shallow bumps, apices truncate with rounded angles, lobulate-dentate; internal cells rectangular with evenly thickened walls without trigones; in some or many underleaves, a hyaline border usually occurs but the hyaline cells are slightly differentiated from the chlorophyllous cells, the walls being a little thinner (Description after the isotype [PC0101765]).

NOTES

Bazzania consociata is close to *B. bescherellei* with which it shares: 1) asymmetrically ovate-oblong leaves; 2) leaf apices shortly 3-dentate in typical forms; and 3) underleaves relatively widely connate to the leaves on both sides, without appendages, 2-3 \times wider than the stem. See comments under the latter. However, typical *B. consociata* can be distinguished by its smaller size (shoots 1.0-1.5 mm wide versus 2.4-2.5 mm wide in *B. bescherellei*), wide hyaline underleaf margins, although their width varies, an obvious subvitta in most of the leaves, the median cell walls evenly thick with or without inconspicuous trigones, the incised-dentate underleaf apices.

Both *Mastigobryum leratii* and *M. consociatum* were described by Stephani in the last volume of *Species hepaticarum* (Stephani 1924) but their diagnoses are very similar. The former differs from the latter only in the smaller underleaf sizes and the lack of mention of marginal leaf denticulations. After checking the types of both species at G and REN, I did not find any discriminating characters with specific values, since the characters given by Stephani as specific of *M. leratii* also occur in many specimens of *B. consociata*. In view of this, I understand why no specimens have been identified as *Bazzania leratii* since the type collection. Notably by Hürlimann (1985), who cites several *B. consociata* specimens.

Stephani (1924) described *Macromitrium leratii* after a specimen initially assigned to *M. pulchellum*, a name used before for a species from Samoa (Stephani 1908b). The New Caledonian specimen here designated as a lectotype was kept at G in the folder holding the type of *M. pulchellum* from Samoa. It was annotated by Grolle in 1977 (*in sched.*) that the New Caledonian specimen was not *M. pulchellum*. The isolectotype, in the E.G. Paris herbarium (REN), is kept in an original envelope bearing the same name and collecting data as the lectotype.

Bazzania deplanchei (Gottsche ex Steph.) Jovet-Ast
(Figs 7F, G, I)

Revue bryologique et lichénologique 18: 83 (Jovet-Ast 1949). — *Mastigobryum deplanchei* Gottsche ex Steph., *Bulletin de l'Herbier Boissier*, série 2, 8: 955 (Stephani 1908c). — Type: **New Caledonia**,

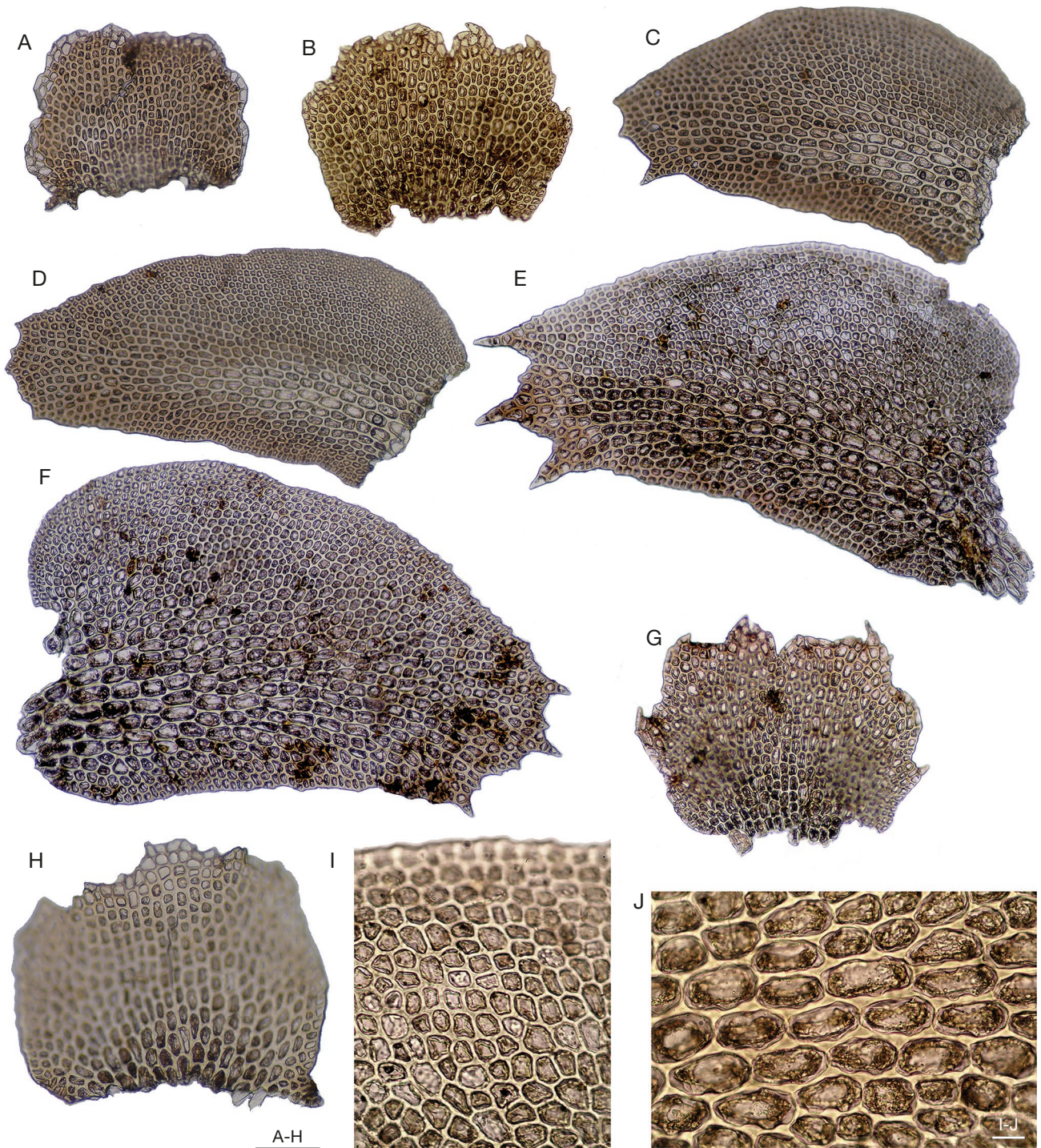


FIG. 8. — *Bazzania consociata* (Steph.) H.A.Mill.: **A, B, G, H**, underleaves; **C-F**, leaves; **I**, median leaf cells; **J**, basal leaf cells; **A, C, D** from *Thouvenot NC1708*; **B, E, G, I, J** from *Hürlimann 2895*; PC[PC0793191]; **F**, from *Hürlimann 2904*; PC[PC0793192]; **H**, from *Thouvenot NC3243*. Scale bars: A-H, 100 µm; I-J, 20 µm.

Deplanche s.n., *Pancher s.n.* (lecto-, designated here, G[“sommet du Mont Mi”, 25.III..., *Pancher s.n.* G00282413]! isolecto-, G[G00282414]!; paralecto-, G[Balade, 1861 (“1869”), *Deplanche 7*, G00282415, G00282416]!; PC[PC0101771, PC0101772, PC0101773, PC0101774]!).

Bazzania deplanchei var. *filamentosa* Tixier, *Cryptogamie, Bryologie, Lichénologie* 6: 179, f.1 (Tixier 1985). — Type: New Caledonia, Mont Oungoué; 17.VI.1979; *MacKee 39923*.

MATERIAL EXAMINED. — New Caledonia • South Province, Yaté, Wé Toa; on bark in wet forest in ultramafic massif; 500 m; 8.IX.2019; *Thouvenot NC3311* • Pic du Grand Kaori; on dead wood fragments in the litter, wet forest in ultramafic massif; 470 m; 4.X.2016, *Thouvenot NC3434* • Dumbéa, Montagne des Sources, on dead wood in wet forest with *Araucaria rulei* F.Muell., ultramafic massif; 950 m; 21.IX.2016; *Thouvenot NC2076* • Païta, Mt Humboldt; on litter in mountain bush with *Araucaria humboldtensis* J.Buchholz, ultramafic massif; 1400 m; 1.X.2008; *Thouvenot NC1725*.

DISTRIBUTION IN NEW CALEDONIA. — One of the most frequent and obvious *Bazzania* on bark, dead wood, litter, rarely rocks, in the forests of both provinces of Grande Terre at any elevation.

TOTAL RANGE. — Endemic to New Caledonia.

DESCRIPTION

Plants

Large, rigid, in thick wefts; moist shoots up to 6 mm wide when flattened, tube-like when dry, stems 0.50 mm wide; terminal branching common, distant, with long pseudo-dichotomous branches, ventral-intercalary branches flagelliform.

Leaves

Imbricate, deflexed when moist or dry, spreading when moist and flattened, 1.80-3.75 mm long, 0.85-1.65 mm wide near bases, 0.55-0.75 mm below apices, asymmetrically ovate-lingulate, slightly falcate or not, length-width ratio 2.0-2.6; cuticle smooth, margins entire, dorsal margins arched in lower half or more, obliquely straight in upper part, ventral margins slightly concave or sub-straight; apices truncate, deeply 3-lobed, with lobes narrowly triangular, long acuminate in linear points up to 8 cells long, point often broken, sinus narrowly lunate.

Cells

Areolation homogenous, cells oblong to elongate, with strongly thickened walls interrupted by a single pit on each side and forming huge trigones at cell angles; median cells 20-30 µm wide, 25-45 µm long; marginal cells smaller, often oblate; basal cells 30-40 µm wide, 55-110 µm long.

Underleaves

Spreading, large, transversally inserted, positioned close to the leaf bases on both sides, free or very narrowly connate, 1.75-2.50 mm long, 1.50-2.20 mm wide, deeply dissected, up to half the whole underleaf length, the basal lamina sub-quadrate to transversally elongate, trapezoid, 2.5 times wider than the stem, lateral margins straight or slightly divergent, sometimes with some bumps; apices typically with four long narrow lobes, from oblong to triangular bases extending into long linear acumina, lateral lobes usually divergent so that underleaves are trapezoid in outline; cells like in the leaves but narrower, 25-30 µm wide, 60-75 µm long. *Gynoecia* not seen. *Androecia* in very short ovoid spikes, inserted at underleaf axis, 0.5-0.7 mm as wide as long, with 3-4 inflated bracts, sharply dentate at apices (Description after type and non-type specimens).

NOTES

Bazzania deplanchei is easily distinguished from all other New Caledonian species by the large underleaves deeply incised to half-length into four narrow lobes, the lobes long acuminate, tapering in linear apices when unbroken, the lateral ones usually divergent. The leaf apices are also deeply 3-lobed, a character shared with *B. parisi*, that is clearly distinct by its smaller size and underleaves that are shallowly indented. The leaf cells of

B. deplanchei are very distinctive. They are reminiscent of the cells in some *Heteroscyphus* species, *i.e.*, *H. assurgentissimus* J.J.Engel, Thouvenot & Frank Müll. (Engel *et al.* 2021) or *H. diestianus* (Sande-Lac.) Piippo (1985) (Thouvenot 2023).

When he defined the variety *filamentosa*, Tixier (1985) underlined as single distinctive feature the filiform apices of leaf and underleaf lobes, that is a character widely shared by most of the typical *B. deplanchei* specimens, so that the length of filiform parts is a variable feature.

The date 1869 written on the label of the paratypes at G *Deplanche* 7 [G00282415, G00282416] is unlikely the collection date since Émile Deplanche left New Caledonia in 1867. The date 1861 on the isosyntype labels at PC is the more probable one because Balade is situated in the northern part of the island explored by É. Deplanche from 1860 to 1867 (Vieillard 1876).

Bazzania franciana (Steph.) N.Kitag. (Figs 1D; 9)

Journal of the Hattori Botanical Laboratory 36: 446 (Kitagawa 1972 [1973]). — *Mastigobryum francianum* Steph., *Species Hepaticarum* 6: 463 (Stephani 1924). — Type: New Caledonia, Franc (lecto-, designated here *fide* Kitagawa (1970, *in sched.*), G[“in monte Koghis, 450 m”, Franc 20 (Herb. Thériot), G00066893!]).

MATERIAL EXAMINED. — New Caledonia • North Province, Hienghène; XI.1909; *Etesse s.n.* (herbarium E.G. Paris as *Mastigobryum motelayi*; REN[REN000233]) • Mt Panié; epiphyte in cloud forest on mica schist bedrock; *c.* 1400 m; 9.X.2012; *Thouvenot NC2561, NC3464* • Poya, Mt Aoupinié; on rock in wet forest; 700 m; 16.XII.2015; *Metoyer MET085* (author's herbarium) • Poindimié, Amoa valley, Tipwadabwé; on dead wood on river side, on volcano-sedimentary bedrock; 106 m; 13.X.2019; *Thouvenot NC2653* • South Province, Mont-Dore, Mouirange Pass; on dead wood in lowland forest; 284 m; 1.VI.2015; *Metoyer MET062* (author's herbarium) • Dumbéa, Mts Koghis, South eastern ridge of Mt Bouo; on dead wood in mountain mesophile forest; *c.* 830 m; 18.XI.1950; *Hürlimann 2094* • Boulouparis, foot hill of Mt Dent de St Vincent; VII.1909; *Le Rat s.n.* (PC) • Sarraméa, Dogny; along the path to the plateau, volcano-sedimentary bedrock; 600 m; 13.IV.2013; *Coulerie COU50* (author's herbarium) • Yaté, Kiki swamp; on the ground in lowland forest; VI.2015; *Metoyer MET065* (author's herbarium).

DISTRIBUTION IN NEW CALEDONIA. — Common on grounds, rocks and dead wood in both provinces of Grande Terre, collected at any elevation.

TOTAL RANGE. — Australia (Meagher 2019) and New Caledonia.

DESCRIPTION

Plants

Medium, rigid, creeping in loose or dense wefts or mixed with other bryophytes, shoots 2-3 mm wide, terminal branching common, pseudo-dichotomous, ventral-intercalary branches flagelliform.

Leaves

Imbricate, obliquely spreading, convex when moist, deflexed when dry, asymmetrically ovate-oblong, slightly falcate if any, (1.00-)1.20-1.70(-2.00) mm long, 0.60-0.90(-1.20) mm

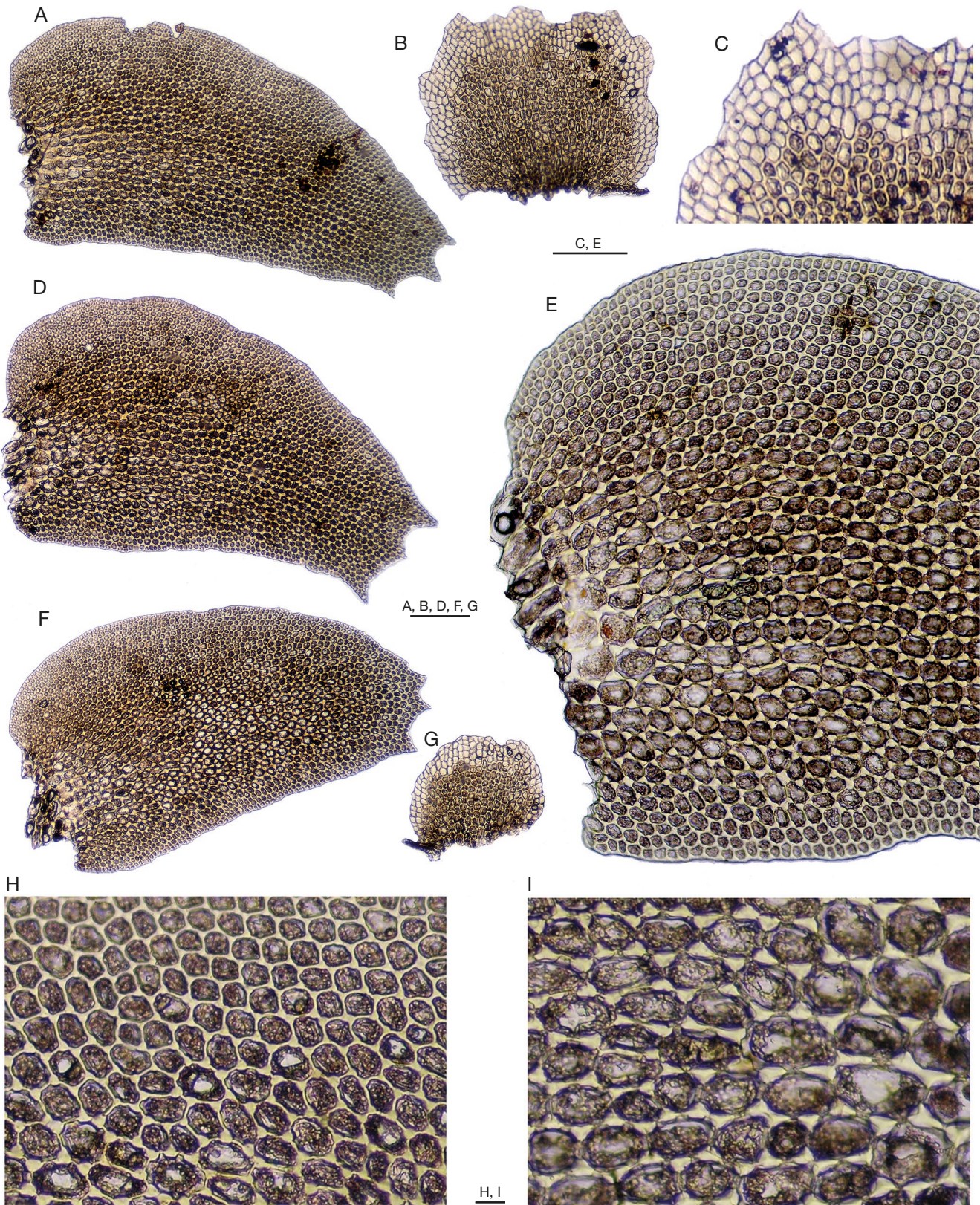


FIG. 9. — *Bazzania franciana* (Steph.) N.Kitag.: **A, D, F**, leaves; **B, G**, underleaves; **C**, underleaf margin; **E**, leaf base; **H**, median leaf cells; **I**, basal leaf cells all from *Thouvenot NC3464*. Scale bars: A, B, D, F, G, 200 µm; C, E, 100 µm; H, I, 20 µm.

wide near bases, length to width ratio (1.4-)1.5-1.9; dorsal margins widely arched in lower half and nearly straight in upper part, ventral margins nearly straight or slightly concave in upper half, shortly rounded at base, both margins subentire or sparingly crenulate below apices; leaf apices obliquely truncate to widely triangular, shortly 3-dentate, teeth small and triangular, separated by large flat or lunate sinus.

Leaf cells

Homogeneous but progressively increasing in size from margins to central bases, without forming a clear subvitta; median cells isodiametric to oblong, 15-25 µm wide, 15-38 µm long, thin- to firm-walled with small trigones; marginal cells smaller in 1-2 rows; basal cells larger with broad bulging trigones, 25-30 µm wide, 25-50 µm long; up to 50 µm wide, 75 µm long at insertion.

Underleaves

Transversely inserted, positioned close to the leaf bases and usually connate on both sides, usually recurved, rounded-subquadrate, somewhat broader than long, 0.50-1.00 mm wide, 0.35-0.90 mm long, 1.5-2.5 times wider than the stem; lateral margins arched, sometimes with 2-3 rounded lobules, apical margins repand to superficially lobulate, with widely rounded lobules, rarely mixed with sharp-edged ones; hyaline border conspicuous, typically with 2-6 rows of thin-walled cells or more; inner cells oblong to rectangular, moderately thick-walled with small trigones (Description after type and non-type specimens).

NOTES

Bazzania franciana is distinctive by: 1) leaves ovate-oblong shortly 3-dentate; 2) leaf lateral margins subentire; 3) a median area of thin- to firm-walled cells with small trigones gradually merging in a central band of larger cells and trigones without forming a clear subvitta; and 4) underleaves rounded-subquadrate, recurved, connate to the leaves on both sides, at most a little wider than long, with a conspicuous hyaline border and apical margins not dentate. Among the group of species close to *B. franciana*, *B. paucidens* (Steph.) H.A.Mill. can be separated from by: 1) ovate leaves, mostly L/W < 1.6; 2) median cells with large bulging trigones; 3) upper leaf margins denticulate; and 4) narrower hyaline margin. *Bazzania adnexa* is separated by its larger leaf lobes and wider underleaves with dentate apices.

Bazzania incrassata (Steph.) N.Kitag. (Figs 1F; 10)

Journal of the Hattori Botanical Laboratory 36: 448 (Kitagawa 1972[1973]). — *Mastigobryum incrassatum* Steph., *Species Hepaticarum* 6: 469 (Stephani 1924). — Type: **New Caledonia**, *Franc s.n.* (lecto-, designated here *fide* Kitagawa (1970, *in sched.*), G[Tao forest, 600-800 m, I.1910, *Franc s.n.* G00066894]!; paralecto-, PC[PC0101851]!; para-, G[G00066895, G00066896]!).

Mastigobryum varians Steph., *Species Hepaticarum* 6: 484 (Stephani 1924). — Type: **New Caledonia**, *Le Rat s.n.* (lecto-, designated here, G[Pic des Sources; VI.1909; *Le Rat s.n.* G00120752]! isolecto-, REN[REN000230, REN000231]!; para-, G[Pic des Sources, s.d., *Le Rat s.n.* G00120753]!; PC[Pic des Sources; IX.1909; *Le Rat s.n.* PC0101823]).

MATERIAL EXAMINED. — **New Caledonia** • South Province, Dumbéa, Montagne des Sources; on bark in ridge wet forest with *Araucaria rulei* F.Muell., mixed with *Bazzania deplanchei* and *Kurzia caduciloba* R.M.Schust., in ultramafic massif; 950 m; 21.IX.2016; *Thouvenot NC3449* • Montagne des Sources tack; on dead wood in mesophilous forest with *Nothofagus balansae* (Baill.) Steenis; 490 m; 28.XII.1950; *Hürlimann 2211*; PC[PC0793195] • Mt Bouo; on bark in wet forest, ultramafic massif; 930 m; 16.IX.2016; *Thouvenot NC3473* • Yaté, Rivière Bleue natural park, la Tranchée; on bark of thin tree, lowland wet forest, ultramafic massif; 222 m; 16.X.2016; *Thouvenot NC3471* • Rivière Blanche, Bon Secours; on bark in mesophilous forest; 400 m; 31.III.1951; *Guillemin & Baumann 11911*; PC[PC0793193] • Creek Nooti; on dead wood and ground, wet forest, ultramafic massif; 442 m; 5.X.2019; *Thouvenot NC3055* • Wé Toa; on stump in wet forest, ultramafic massif; 478 m; 8.IX.2019; *Thouvenot NC2975* • La Foa, Dogny plateau; on litter in wet forest; 910 m; 23.IX.2008; *Thouvenot NC633* • Thio, Grand Borindi; on bark in dry forest, ultramafic massif; 193 m; 22.X.2016; *Thouvenot NC3474*.

DISTRIBUTION IN NEW CALEDONIA. — The type locality is Tao in North Province, but recent collections of typical forms were only found in South Province (Hürlimann 1985 and this paper), mainly in ultramafic massifs. Conversely, depauperate forms were collected in sedimentary massifs of the central range or remote mountains in both provinces, that raises the issue of links between morphology and ecological conditions.

TOTAL RANGE. — Endemic to New Caledonia.

DESCRIPTION

Plants variable.

Typical plants

Medium, decumbent, often creeping in dense wefts among other Lepidoziaceae; moist shoots 2-2.5 mm wide, stems 0.28-0.30 mm wide; terminal branching common, pseudo-dichotomous, ventral-intercalary branches usually flagelliform, rarely normal leaved.

Leaves

Imbricate, widely spreading at 60-90°, complanate both in moist or dry condition, more rarely deflexed when dry, slightly convex, ovate-oblong to ovate-ligulate, falcate, asymmetrical, 1.00-1.40 mm long, 0.45-0.62 mm wide near bases, 0.30-0.40 mm below apices, length-width ratio 2.0-2.5; cuticle warty, at least in borders and apical lobes, both lateral margins entire to crenulate, bases of dorsal margins strongly arched up to 1/2-2/3 the length, straight above, ventral margins concave to sub-straight; apices obliquely truncate, typically deeply trifid, lobes narrowly triangular, acute, 5(-8) cells long, 2(-4) cells wide at bases, lateral ones usually divergent, the central erect, unevenly shorter, wider or lacking.

Cell

Walls contrasting with lumina: lumina opaque to dark; trigones large and translucent, areolation heterogeneous with a wide subvitta, more or less sharply delimited, made of 5(-7) files of longer



FIG. 10. — *Bazzania incrassata* (Steph.) N.Kitag.: **A, J, L-Q**, leaves; **B-I, K**, underleaves; **R**, marginal and median leaf cells. **A-E, G, I**, from *Thouvenot NC3300*; **F, J**, from *Thouvenot NC3312*; **H, K, L, O**, from *Thouvenot NC3449*; **M, N, P, Q**, from *Thouvenot NC3310*; **R**, from *Thouvenot NC3302*. Scale bars: **A**, 100 µm; **B-Q**, 200 µm; **R**, 20 µm.

and wider cells, ending at short distance below apices, median cells in dorsal sectors rounded-oblong, 20-35 µm wide, 25-35 µm long, thin or thick-walled, with large bulging trigones, cellular contents dark with small to medium persistent oil bodies; marginal cells smaller with free walls thicker and warty, cells oblate in postical margins; inner cells oblong to rectangular, 35-40 µm wide, 60-70 µm long, thin-walled with huge trigones usually confluent, cell lumina filled by very large persistent oil bodies.

Underleaves

Spreading-recurved, obliquely inserted, positioned close to the leaf bases on both sides of the stem and narrowly connate on one or both sides, sub-quadrangle to longer than wide in overall shape, 0.50-0.70 mm long, 0.40-0.70 mm wide, 1.5-2 times wider than the stem; lateral margins entire, convex or with a widely arched lobe, narrowing beneath the lobed apices, apices deeply dissected, typically 3-lobed, lobes similar to the leaf lobes, the lateral often divergent and somewhat horn-like, the central often lacking or shorter, additional lobes may occur; underleaf cells like in the leaves, the central basal cells may be narrower and thicker walled.

Weak forms

Differ in being smaller, shoots 1.5-2.0 mm wide; leaves 0.55-0.80 mm long, 0.45-0.50 mm wide, ovate-oblong, margins evenly crenulate, apices entire to shallowly angled or shortly dentate; median leaf cells with smaller trigones, otherwise like the cells in the typical forms; underleaves with typical shape but smaller, 1.5 times wider than the stem, 0.23-0.30 mm long, 0.30-0.35 mm wide.

NOTES

Bazzania incrassata is a very variable species, but always noteworthy by a contrasting areolation: translucent large trigones and opaque to dark cell lumina make up the whole cell patchwork like a leopard skin. This typical tissue is obvious in the upper branches, and in the most robust populations while leaves in the lower sections have median cells with smaller or inconspicuous trigones. Furthermore, typical forms have: 1) leaves and underleaves distinctive in shape, both with apices deeply 3-lobed; 2) leaves ovate-oblong to lingulate, sparingly to strongly falcate, the leaf lobes typically narrowly triangular to finger-like, often divergent; and 3) underleaves subquadrangle, spreading-recurved to nearly squarrose, the typical underleaf lobes widely triangular. However, in some populations, lobes are lacking or strongly reduced in most of the leaves and underleaves, then the apices seem entire, angulate to shortly dentate. But many specimens have at least a few leaves and underleaves with the typical ornamentation.

Kitagawa examined and annotated as types the two parts of the original material of *Mastigobryum varians* kept at G (1970, *in sched.*), but he did not select a lectotype from them. The lectotype and isotypes of *M. varians* at G, PC and REN showed no significant differences from the type of *M. incrassata* except for the more denticulate leaf margin and somewhat less deeply incised leaf apices. I agree with Kitagawa's treatment of *M. varians* as a synonym of *Bazzania incrassata*.

Bazzania subtilis (Sande Lac.) Trevis. differs from *Bazzania incrassata* mainly by the underleaf orientation and

insertion, patent instead of squarrose, and positioned close to the leaf bases on a single side of the stem. In addition, it can be distinguished by: 1) smaller size; 2) smaller leaf lobes, not divergent; 3) relatively wider leaves, hardly falcate or not; and 4) underleaves with more lobes, narrower and erect. The relationship between these two species and their weak forms needs further investigation.

Bazzania kokawana N.Kitag. & T.Kodama (Figs 7H, J-L)

Journal of Japanese Botany 50 (1): 11 (Kitagawa & Kodama 1975) — Type: Sabah (North Borneo), Kinabalu National Park: Mamut Ridge, west of Mamut Camp; on tree trunk; s.d.; 1500-1800 m; *S. Kokawa & M. Hotta 5937*; holotype: OSA, not seen.

MATERIAL EXAMINED. — New Caledonia • Province sud, Dumbéa, Dumbéa valley, Sunshine branch; on dead wood in meso-hygrophilous forest; 650 m; 20.VII.1951; *Hürlimann 2729a*; PC[PC0793199] • *ibid.*; on bark; 700 m; 21.VII.1951; *Hürlimann 2741a*; PC[PC0793200].

DISTRIBUTION IN NEW CALEDONIA. — Only known on dead wood and bark from two localities in South Province: Dumbéa (*Hürlimann 1985*) and Koghis (*Kitagawa 1982 in GBIF 2022*).

TOTAL RANGE. — Malaysia (Sabah, *Kitagawa & Kodama 1975*), New Guinea, Solomon Islands (*Kitagawa 1980*), New Caledonia.

DESCRIPTION

Plants

Small, prostrate, creeping among other liverworts; moist shoots 1-1.5 mm wide, stems 0.08 mm wide; terminal branching very rare, normal leaved stems usually simple with many flagelliform branches, ventral-intercalary in origin.

Leaves

Imbricate, complanate both when moist or dry, spreading at right angle, 0.40-0.55 mm long, 0.28-0.32 mm wide, sub-symmetrically elliptic-oblong, length to width ratio 1.4-1.8; every border crenulate by the protrusion of marginal cells, dorsal margins widely arched, ventral ones somewhat less convex; apices sub-entire, rounded, obtuse or retuse.

Cell

Areolation homogeneous, cuticle strongly warty to striolate; each cell including a single endogenous gemma, surrounded by a membrane closely pressed against the thin cell walls except in the corners where an empty rounded space simulates a globose trigone (Fig. 7J); median cells rounded to oblong, 15-25 µm wide; marginal cells similar but with the free walls strongly thickened; basal cells up to 25 µm wide, 40 µm long.

Underleaves

Erect, positioned near the leaf bases on both sides of the stem, very narrowly connate by 1-2 cells on a single side, 0.17-0.22 mm long, 0.13-0.17 mm wide, 2.0-2.5 times wider than the stem, rounded quadrangle to slightly broader than long, margins entire or crenulate, lateral margins straight to convex, apices truncate,



FIG. 11. — **A-E**, *Bazzania loricata* (Reinw., Blume & Nees) Trevis.: **A**, marginal underleaf cells; **B**, marginal and median leaf cells; **C**, leaf; **D**, underleaf; **E**, leaf apex; **F-K**, *B. parisii* (Steph.) N.Kitag.: **F**, **G**, underleaves; **H**, **J**, leaves; **I**, median cells; **K**, basal cells; **L-R**, *B. pectinata* (Lindenb. & Gottsche) Schiffn.: **L**, median leaf cells; **M**, basal and marginal ventral leaf cells; **N-P**, underleaves; **Q**, **R**, leaves. **A-E** from Müller NC143 (DR); **F-K**, from Metoyer MET109A; **L-R** from Thouvenot NC3423. Scale bars: A, B, I, K-M, 20 µm; C, D, F-H, J, O-R, 200 µm; E, 100 µm; N, 50 µm.

straight to slightly convex, rounded at angles, sub-entire to shallowly bifid; cells as in the leaves (Description after New Caledonian specimens).

NOTES

Among the other members of the genus in New Caledonia, *Bazzania kokawana* stands out by the small size and the branching pattern, but more strikingly by its unique

endogenous gemmae. The cell contents, wrapped in membranes, represent as daughter cells that can be released when leaves or underleaves are broken and likely act as propagules. Vegetative reproduction by endogenous gemmae, namely single daughter cells filling the entire lumina of mother cells in leaves and underleaves, is a very rare feature in liverworts (Kitagawa & Kodama 1975). It occurs only in *Acromastigum stellare* N.Kitag. (Kitagawa 1985) and two species of *Schistochila*:

S. vitreocincta (Herzog) X.L.He & Glenney (2010) and *S. gradsteinii* Thouvenot (2021). The three species are endemic to New Caledonia. The occurrence of such a rare feature in two distinct liverwort orders remains puzzling.

Bazzania loricata (Reinw., Blume & Nees) Trevis.
(Figs 11A-E)

Memorie del Reale Istituto Lombardo de Scienze e Lettere, serie 3, Classe di Scienze Matematiche e Naturali 4: 414 (Trevisan 1877). — *Jungermannia loricata* Reinw., Blume & Nees, *Nova Acta Physico-Medica Academiae Caesareae Leopoldino-Carolinae Naturae Curiosorum* 12: 233 (Reinwardt *et al.* 1824). — Type: **Java**, *Blume s.n.* (iso-, S [B14700] not seen).

MATERIAL EXAMINED. — **New Caledonia** • North Province, Hienghène, Mt Panié; along the hiking trail from the road RPN3 to the summit; epiphytic in very wet rainforest; 900 m; *c.* 13.IX.2001; *F. Müller NC153* (DR).

Malaysia • Pahang, Gunung Uli Kali; mountain top (5500 ft); upper montane ericaceous forest; 21.IV.1972; *Gillis Een s.n.*; PC[PC0793176].

Java • Junghuhn; s.d. (“Gottsche” handwritten on the label); PC[PC0793174].

DISTRIBUTION IN NEW CALEDONIA. — Hitherto known from a single collection in North Province. Another New Caledonian specimen, labelled *Mastigobryum loricatum*, from the Vieillard’s Herbarium [PC0793177] is *Bazzania bernieri*.

TOTAL RANGE. — New Guinea, Solomon Islands, Java, Thailand, Malaysia, Malacca, Sumatra, Borneo (?), Philippines (Meagher 2015), New Caledonia.

DESCRIPTION

Plants

Large, rigid, fragile; moist shoots 4–5 mm wide when flattened, stems 0.50 mm wide; terminal branching common, remote, with long pseudo-dichotomous branches, ventral-intercalary branches flagelliform.

Leaves

Strongly imbricate with auriculate dorsal bases overlaying the stem, deflexed when moist, strongly incurved when dry so that shoots seem tube-like, leaves spreading at right angle when moist and flattened, 2.20–2.60 mm long, 1.70–2.10 mm wide, very asymmetrically ovate-cordate, length to width ratio 1.2–1.4; cuticle smooth, margins denticulate to serrulate by the protrusion of mammillose marginal cells, dorsal margins auriculate, broadly expanded and arched, ventral ones convex, appendiculate at bases, basal appendage semi-circular, bent down and covering the basal border of the corresponding underleaf; apices rounded, denticulate with or without small additional teeth, 1–2-celled.

Cells

Homogenous, gradually longer toward bases, median cells oval-oblong, 25–30 µm wide, 30–50 µm long, with thin walls and large bulging trigones sometimes confluent; marginal cells narrower, oval to lanceolate; basal cells elongate, 25–50 µm wide, 40–80 µm long, thin-walled, with huge trigones often confluent.

Underleaves

Erect, somewhat laterally recurved, positioned near the leaf bases and free on both sides, transversally inserted, large, reniform, entire, 0.75–0.85 mm long, 1.10–1.25 mm wide, about 3 times wider than the stem; apices entire or eroded; bordered by 2–3(–4) files of hyaline cells, chlorophyllous cells as for the leaves (Description after the Malayan specimen [PC0793176] det. Grolle).

NOTES

This species, widespread in tropical Asia and Australia, stands out among other New Caledonian species by: 1) its large size (leaves 2.20–2.60 mm long); 2) strongly asymmetrical leaf shape; and 3) sub-entire leaf and underleaf apices. It could be confused with the New Caledonian endemic *B. bernieri*, that is a smaller species (leaves 1.5–2.0 mm long) with less asymmetrical leaves which are never appendiculate, less sharply serrate, with median leaf cells thick-walled and trigones small or none.

Bazzania parisii (Steph.) N.Kitag.
(Figs 11F-K)

Journal of the Hattori Botanical Laboratory 47: 135 (Kitagawa 1980). — *Mastigobryum parisii* Steph., *Bulletin de l’Herbier Boissier, série 2*, 8 (10): 769 (Stephani 1908b). — Type: **New Caledonia**, *Le Rat s.n.*; (holo-, G[G00066889]; iso-, PC[PC0101878]!).

MATERIAL EXAMINED. — **New Caledonia** • South Province, Yaté, *c.* Goro mine; soil on rock in forest in ultramafic massif; 200–310 m; 20.III.2016; *Métayer MET109A* • Païta, Dzumac massif; on bark, dry mountain forest in ultramafic massif; 915 m; 18.IX.2008; *Thouvenot NC1715*.

DISTRIBUTION IN NEW CALEDONIA. — Only collected in South Province, in the large southern ultramafic massif, in bush and mountain forest, in dry to wet conditions.

TOTAL RANGE. — Australia (Meagher 2010), New Caledonia.

DESCRIPTION

Plants

Small, in dense wefts, relatively rigid for the size; moist shoots around 1.5 mm wide; stems 0.3 mm wide; terminal branching common, pseudo-dichotomous, ventral-intercalary branches mostly flagelliform, rarely normal leaved.

Leaves

Imbricate, deflexed when dry, sub-complanate in wet condition, slightly convex, spreading at right angle, shortly ovate-oblong, 0.70–1.10 mm long, 0.50–0.70 mm wide near bases, 0.30–0.40 mm at apices, length-width ratio 1.4–1.7; cuticle smooth, margins sub-entire, the dorsal margins widely arched, the ventral ones sub-straight to slightly concave; apices obliquely truncate, 2–3-fid, with lobes triangular, acute, usually 3–4 cells long.

Cells

Relatively small in intramarginal band and sub-apical region, rounded to oblong, 12–20 µm wide, 12–28 µm long; cells

conspicuously longer and wider in most of the leaf blade, rounded rectangular 20–40 µm wide, 30–65 µm long, with thin walls and large to huge trigones.

Underleaves

Transversally inserted, positioned close to the leaf bases and widely connate on both sides, recurved, patent to spreading, roundly cuneate, transversally rectangular, rarely quadrate, up to 2 times broader than long, 0.30–0.45 mm long, 0.45–0.70 mm wide, 2–3 times wider than the stem; lateral margins straight to convex, sometimes with a small acute tooth, apex transversally truncate, from repand with a few sharp teeth, 1(–2) cells high, scattered along the apical margin, to unevenly dissected in wide lobules, acute or not; cells oblong to elongate, with large trigones often confluent, inconsistently with 1(–2) marginal row of thin-walled hyaline cells (Description after the isotype and New Caledonian specimens).

NOTES

Bazzania parisii is outstanding in the New Caledonian context of the genus in being a small pretty plant with: 1) leaves relatively compact, shortly ovate-oblong; 2) leaf apices conspicuously trifid, better seen when moist and complanate; 3) underleaves recurved, transversely rectangular; 4) underleaf apices transversely straight or more or less deeply dissected into wide lobules, the apical margin remotely and sharply toothed; and 5) underleaf apices usually bordered by 1(–2) row of thin-walled hyaline cells.

Meagher (2010) reported Papua New Guinea in the range of *Bazzania parisii*. However, I am unaware of any specimen from this country. The only mention of this species in a paper dealing with this country is from Kitagawa (1980) who mentioned it only for comparison with *B. morokensis* (Steph.) Grolle (1968). In this instance, he published the new combination with *Bazzania* as a generic name, but he did not claim its presence in Papua New Guinea. Furthermore, the GBIF data base (accessed in November 2024) only contains New Caledonian localities.

Bazzania paucidens (Steph.) H.A.Mill. (Figs 1H; 2C1; 12)

Phytologia 47 (4): 321 (Miller 1981). — *Mastigobryum paucidens* Steph., *Bulletin de l'Herbier Boissier*, série 2, 8 (11): 860 (Stephani 1908c). — Type: **New Caledonia**, Bernier, Lerat; (holo-, G [New Caledonia, s.d., Bernier 341 p.p., ex herbarium Général Paris, G00066787]!; iso-, PC[PC010817]!; para-, G[Mt Dzumac; IX.1906; *Le Rat s.n.* PC00282556]!; PC[*Le Rat s.n.*, PC0104030]!; REN[REN000223]!).

Mastigobryum motelayi Steph., *Bulletin de l'Herbier Boissier*, série 2, 8 (10): 775 (Stephani 1908b). — Type: **New Caledonia**, Motelay, Etesse (lecto-, designated here *vide* Kitagawa (1970, *in sched.*), G[New Caledonia, 1896, herbarium Motelay G00048003]!; para-, G[Hienghène; XI.1905; Etesse 15, G00048005]; G[Hienghène, XI.1905; Etesse 16; G00048004]) **syn. nov.**

Bazzania subintegra (Steph.) L. Söderstr. & A. Hagborg., *Phytotaxa* 202 (1): 69 (Söderström *et al.* 2015). — *Mastigobryum*

subintegrum Steph., *Bulletin de l'Herbier Boissier*, série 2, 8 (10): 775 (Stephani 1908b). — Type: **New Caledonia**, Le Rat. “sine schedula”, 1907, *Le Rat s.n.* (lecto-, G[G00067097]!; iso-, G[G00112148]!) **syn. nov.**

Bazzania subintegra (Steph.) Herzog, *Arkiv för Botanik (n. ser.)* 3 (3): 46 (Herzog 1953). *Nom. inval.* [ICN Art. 41.5; basionym not cited (Turland *et al.* 2018; Loiseau *et al.* 2019)] **syn. nov.**

Mastigobryum subintegrifolium Steph. ex Paris, *Revue bryologique* 37: 41 (Paris 1910a). *Nom. inval.* [ICN Art. 38.1(a): no description (Turland *et al.* 2018; Loiseau *et al.* 2019)]. — Reference specimen (as *Mastigobryum subintegrum*): **New Caledonia**, Île des Pins; 1908; *Placide s.n.*; REN[REN000228]! **syn. nov.**

MATERIAL EXAMINED. — **New Caledonia** • North Province, Hienghène, Southwest ridge of Mt Colnett; on dead wood in mesophile forest; 15.IX.1951; *Hürlimann 2942* (PC[PC0793159]) • Panié massif, path between Bwa Téan and Payolé; on dead wood in mountain wet forest on mica schist bedrock; 1000 m; 9.X.2012; *Thouvenot NC1303* • South Province, Mont-Dore, Mouirange Pass; on dead wood; 284 m; 1.VI.2015; *Métayer MET064* • Dumbéa, Montagne des Sources; on bark in wet forest with *Araucaria rulei* F.Muell. on ultramafic bedrock; 940 m; 21.IX.2016; *Thouvenot NC3444* • Yaté, between Pourina and Pondjémia valley; on dead wood in primary mesophile forest; 250 m; 3.VI.1951; *Hürlimann 2642* (PC[PC0793153]) • Rivière Bleue natural park, Germain bridge; on bark in mesophile forest, on ultramafic bedrock; 190 m; 5.X.2016; *Thouvenot NC3448* • *ibid.*; in the vicinity of the Goro old-mine; in wooded scrubland; 242 m; 31.III.2016; *Métayer MET102* • Plaine des Lacs; photo-xerophilous forest on laterite soil; 305 m; 1.X.2019; *Thouvenot NC3462* • Païta, Mt Mou, Pic des Mousses; on bark; c. 1200 m; 23.VIII.1950; *Hürlimann 5699* (PC, as *Bazzania franciana*) • Thio, Grand Borindi, Nému Kwéré Chékwa; on bark and dead wood in dry forest on ultramafic bedrock; 193 m; 22.X.2016; *Thouvenot NC3425, NC3429*.

DISTRIBUTION IN NEW CALEDONIA. — Frequent on bark and dead wood in both provinces of Grande Terre, at any elevation.

TOTAL RANGE. — Endemic to New Caledonia.

DESCRIPTION

Plants

Medium sized, rather rigid, creeping in dense wefts or among other bryophytes, shoots 2–2.5(–3.0) mm wide, terminal branching common, pseudo-dichotomous, ventral-intercalary branches flagelliform.

Leaves

Loosely imbricate, spreading at right angle, complanate and hardly convex in wet condition, deflexed when dry, asymmetrically ovate-truncate to oblong, (0.65–)0.90–1.70(–1.90) mm long, (0.50–)0.75–1.00(–1.20) mm wide near bases, 0.35–0.50 mm below apices, length to width ratio 1.0–1.6(–1.8); dorsal margins nearly straight to widely arched, ventral margins nearly straight to slightly concave, shortly rounded at base, border sparingly and unevenly denticulate in upper parts; apices obliquely truncate, with three wide triangular lobes ending in sharp points, small to medium, 1–7 cells long, separated by lunate to obtuse sinus.

Leaf cells

Relatively homogeneous, median cells rounded to oblong, 16–25 µm wide, 16–42 µm long, with thin walls and conspicuous trigones, usually bulging; marginal cells smaller in

1-2 files, rounded to oblate, thick-walled, 12-16 µm wide, 20-24 µm long; cell size gradually increasing toward the base without defining any distinct subvitta, basal cells up to 45 µm wide and 75 µm long.

Underleaves

Patent, recurved, obliquely inserted, positioned close to the leaf bases and usually narrowly connate on both sides, reniform to transversely elongate, 0.45-0.65(-1.00) mm wide, 0.30-0.50(-0.80) mm long, 2-2.5 times wider than the stem; lateral margins repand or convex, unevenly denticulate; apex slightly convex to straight, margins repand to shallowly lobulate, more or less obtusely denticulate by protruding hyaline cells; hyaline border narrow to wide, typically decurrent up to the bases, thin-walled cells usually in 2-5(-8) rows, inner cells oblong to elongate, thin-walled with usually large trigones (Description after the types of *Mastigobryum paucidens*).

NOTES

Bazzania paucidens is distinctive by: 1) compact leaf shape, usually ovate-oblong to widely ovate, obliquely truncate, less than 1.6 times longer than wide, shortly 3-lobate; 2) leaf cells thin-walled with usually bulging trigones, gradually larger toward base without forming a distinct subvitta; 3) underleaves wider than long; 4) underleaf border conspicuously hyaline, usually 2-5 cells wide; and 5) underleaf apices repand-lobulate, shallowly denticulate. It is quite close to *B. franciana* or *B. adnexa*. For distinctive features, see the notes under these species.

Bazzania paucidens is quite variable, likely linked to ecological conditions, since the strongest forms are growing in cloud forests of the central range, while the weakest forms are found at the lowest elevations; but they share an overall shape of leaves, widely ovate with obliquely truncate apices shortly tridentate, median cells with usually trigones and limbate underleaves with repand margins; the usually faint denticulation is sharp and obvious only in the strongest forms.

Among the specimens at G, only two could be observed by Stephani before he published the new species. In the protologue, Stephani cites two collectors, Bernier and Le Rat. The first syntype at G[G00066787], collected by Bernier, was formally designated by Stephani as the type on his drawing 291 (unpublished Icones, nr 007138 [G]). Therefore, it is the holotype. Regarding the second, among the specimens collected by Le Rat, only G00282559 was collected earlier 1908 and can therefore be a syntype. Morphological differences between the type specimens involve leaf shapes that can be falcate, ovate in basal half and oblong-lingulate above, to widely ovate with arched antical bases and not falcate. The two types are figured by Stephani in Icones, nr 291, so both forms are included in the variability of the species. This species has some similarity with *Bazzania adnexa*; see comments below the latter.

The type and reference specimens of *Bazzania subintegra* do not show a significant difference with *B. paucidens*. The name *Mastigobryum subintegrifolium* was used by E.G. Paris in his paper reporting the bryophyte collections of Mrs Louise Le Rat in Île des Pins in 1908 (Paris 1910a). As the single

voucher specimen from Île des Pins present in his herbarium (REN) is labelled *Mastigobryum subintegrum*, I believe that “*subintegrifolium*” must be regarded as a lapsus calami.

Mastigobryum motelayi was synonymized with *Bazzania marginata* by Kitagawa (1973). But the type at G, designated by this author (1970, *in sched.*), fit the distinctive features of *B. paucidens*, namely the thin-walled leaf cells, with bulging trigones. Here I consider *Mastigobryum motelayi* as a synonym of *Bazzania paucidens*.

Bazzania pectinata (Lindenb. & Gottsche) Schiffn. (Figs 2D; 11L-R)

Nova Acta Academiae Caesareae Leopoldino-Carolinae Germanicae Naturae Curiosorum 60 (2): 259 (Schiffner 1893). — *Mastigobryum pectinatum* Lindenb. & Gottsche, *Species Hepaticarum* (fasc. 8-11): 84 (Lindenberg & Gottsche 1851). — Type: Java, Blume *s.n.* in herbarium N. L. Lg. G. (iso-, G[« original sub J. tridens β », herb. Nees G00282551, G00282552]; iso-?), PC[Java, ex herbarium Dozy & Molkenboer PC0103140]).

MATERIAL EXAMINED. — New Caledonia • South Province, Humboldt massif; in mountain scrubland; 1280-1300 m; 11.IX.2014; Métoyer MET037, MET042, MET043, MET04 • *ibid.*; on bark in cloud forest; 1255 m; 1.X.2008; Thouvenot NC3423.

DISTRIBUTION IN NEW CALEDONIA. — First reported in New Caledonia by Hürlimann (1985), *Bazzania pectinata* is rarely collected in the large ultramafic massif of South Province, at the highest elevations (1200-1300 m) in mountain forests and scrublands.

TOTAL RANGE. — Indonesia, Philippines, Thailand, Malaysia, Cambodia, Papua New Guinea and New Caledonia (GBIF accessed in November 2022).

DESCRIPTION

Plants

Medium sized, in loose wefts, moist shoots 2 mm wide, stems 0.20 mm wide; terminal branching common with long pseudo-dichotomous branches, ventral-intercalary branches usually flagelliform, rare normal leaved ventral branches, secondarily able to produce terminal branching.

Leaves

Bases narrowly imbricate, upper parts spaced from one another in a longer part, complanate and spreading at right angle when moist, slightly downcurved when dry; leaves narrowly lingulate, falcate, with bases slightly wider, 0.60-1.10 mm long, 0.25-0.45 mm wide, length-width ratio 2.2-2.5; cuticle smooth, margins sub-straight, entire, sub-parallel, the dorsal margins slightly arched at base, the ventral hardly concave or straight; apices truncate, usually 3-lobate, lobes conspicuous, typically erect, narrowly to widely triangular acute, 3-8 cells long, 1-8 cells wide at bases.

Cell

Areolation heterogeneous with a more or less conspicuous subvitta of 5-7 rows of larger and longer cells unevenly separate from the median isodiametric cells; in few or many leaves, subvitta can be reduced to a few larger cells near

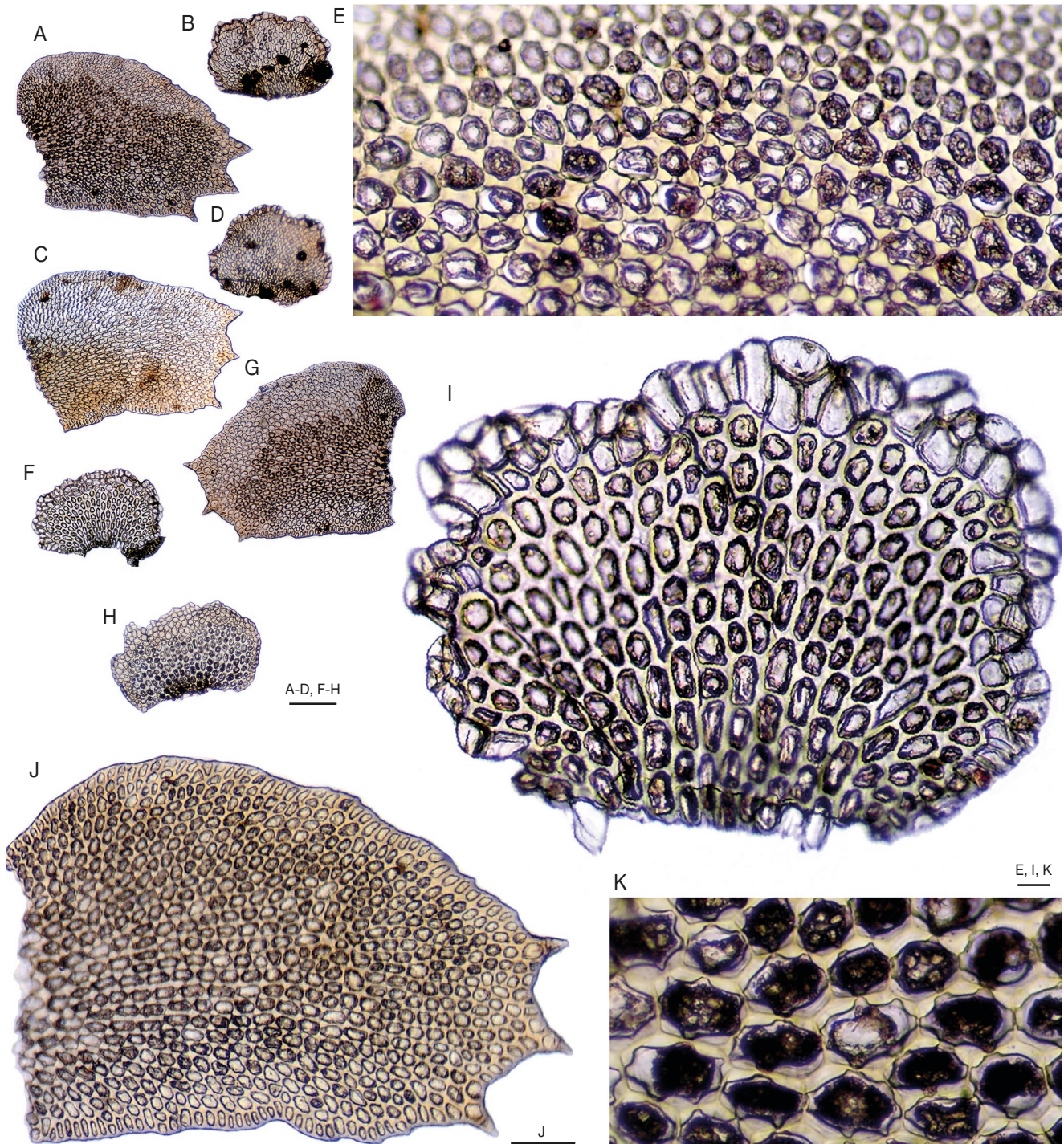


FIG. 12. — *Bazzania paucidens* (Steph.) H.A.Mill.: **A, C, G, J**, leaves; **B, D, F, H, I**, underleaves; **E**, median leaf cells; **K**, basal leaf cells. **A-D, G, J**, from Thouvenot NC3225; **E, H, K**, from Thouvenot NC3444; **F, I**, from Metoyer MET068. Scale bars: A-D, F-H, 200 μ m; E, I, K, 20 μ m; J, 100 μ m.

the base or less neatly distinguished from the surrounding cells; oil bodies numerous in any kind of cells, small, smooth, spherical to ovoid, persistent; median cells small, mostly quadrate rounded, 12-20 μ m wide, 15-25 μ m long, with medium thick walls without trigones, marginal cells not differentiated, subvitta cells 20-30 μ m wide, 25-40 μ m long, walls thin to medium, trigones conspicuous, acute with convex or flat sides.

Underleaves

Transversally inserted, positioned near the leaf base on one side of the stem, indifferently on right or left hand, free on both sides, small, appressed, barely visible, quadrate rounded or wider than long, 0.12-0.15 mm long, 0.13-0.21 mm wide, at most as wide as the stem; apices entire or shallowly emarginate-lobulate; cells like the median leaf cells.

Gynoecia

Terminal on short ventral-intercalary branches, unfertilized in the specimens seen, c. 1 mm long, inner bracts ovate-oblong, deeply trifid, apical margins ciliate, lateral margins denticulate to shortly ciliate, perianth tubular, apices constricted and ciliate (Description after New Caledonian specimens).

NOTES

Bazzania pectinata is a delicate pretty plant immediately distinctive by the conspicuous pinnate setting of the narrow, parallel-sided leaves. The complanate shoots, hardly modified when dry, the discreet underleaves and the conspicuous subvitta in most of the leaves complete the picture of this species.

I was unable to locate the original material of *Mastigobryum pectinatum* and I could not get evidence of the isotype status for the sample kept at PC which came from the herbarium of Dozy and Molkenboer, but without any collector name nor other inscription proving that it could be part of the original material used by the authors. Conversely, two isotypes at G provided reliable material.

Bazzania quadratistipula H.A.Mill. (Figs 11; 13A-G)

Phytologia 47: 321 (Miller 1981). — *Mastigobryum quadratum* Steph., *Species Hepaticarum* 6: 477 (Stephani 1924). Non *Mastigobryum quadratum* Colenso 1886. — Type: **New Caledonia**, *Le Rat s.n.* (lecto-, designated here, G[“In jugo Dogny (1050 m)”, s.d., *L. Le Rat s.n.* G00066891!])

Mastigobryum quadratum Steph. ex Paris, *Revue bryologique* 37: 131 (Paris 1910b). *nom. nud.* (Reference specimen: REN[New Caledonia, South Province, Mt Mou; VII.1909; *Le Rat s.n.* REN000224!]).

DISTRIBUTION IN NEW CALEDONIA. — Only known by a few old collections in South Province.

TOTAL RANGE. — Endemic to New Caledonia.

DESCRIPTION

Plants

Medium sized, soft and fragile, creeping in dense wefts of interwoven stems and branches; moist shoots 2-2.5 mm wide, stems 0.22-0.32 mm wide; pseudo-dichotomous terminal branching rare, often asymmetrical, ventral-intercalary branching common, both flagelliform and normal leaved, axillary to underleaves.

Leaves

Imbricate, spreading, hardly convex, deflexed when moist or dry, ovate-oblong to ovate-ligulate, asymmetrical, with the sub-apical width about half the basal, 1.00-1.60 mm long, 0.50-0.75 mm wide near bases, 0.30-0.40 mm below apices, length-width ratio 1.7-2.0; both margins crenulate-denticulate to dentate in upper part, dorsal margins widely arched in basal 1/3-2/3, straight in upper part, the ventral sub-straight to slightly concave; apices unevenly and

coarsely 3-lobate, lobes triangular acute or obtuse, margins denticulate.

Cells

Pattern rather homogenous, except a poor subvitta in a short basal part; upper cells rounded-quadrate to oblong, 20-30 µm wide, 20-36 µm long, thin-walled, with large bulging trigones; marginal cells smaller, oval oblate; basal cells oblong to rectangular, up to 40 µm wide and 60 µm long, thin-walled with very large trigones usually confluent.

Underleaves

Patent, transversally inserted, positioned near the leaf bases on one side of the stem and unconnected, flat to slightly concave, sub-quadrate to longer than wide, 0.40-0.50 mm long, 0.30-0.50 mm wide, as wide as the stem or slightly more; underleaf outline variously dissected in a same plant, at most strongly dentate all around the free margins, but the lateral margins may also be repand, entire or with a few teeth at bases; apex various, usually lobate, lobes acute to obtuse, often secondarily toothed; underleaf areolation like in the leaves, without hyaline border (Description after the lectotype at G and the reference specimen at REN).

NOTES

Bazzania quadratistipula is a relatively small and soft species which is readily distinguished by its interwoven habit due to predominant ventral intercalary branching. In addition, specific characters include: 1) small quadrate underleaves; 2) underleaf margins variable, either strongly toothed to lobed all around, or simply repand, dentate, denticulate, or entire; 3) leaves falcate-ligulate, fragile, dentate-denticulate in upper part; 4) leaf apices coarsely 3-lobate, lobes triangular acute usually denticulate; and 5) all leaf cells with large bulging trigones, becoming gradually larger below.

Paris (1910b) conservatively published the name *Mastigobryum quadratum* after his correspondence with Stephani (31.III.1910, unpublished, Rennes University Library), but without any description. The specimen kept at REN that matches the locality and collector quoted in Paris (1910b) can be a reference specimen for the invalid name *M. quadratum* Steph. ex Paris, but locality and collector of the type of *M. quadratum* Steph. at G are different; so, the specimen at REN cannot be a part of the type material for *B. quadratistipula*.

Bazzania subtilis (Sande Lac.) Trevis. (Fig. 14)

Memorie del Reale Istituto Lombardo de Scienze e Lettere 4 (13): 414 (Trevisan 1877). — *Mastigobryum subtile* Sande Lac., *Annales Musei Botanici Lugduno-Batavi* 1: 302 (Sande Lacoste 1864). — Types: **Java**, *Teysman s.n.*; **Sumatra**, *Korthals s.n.* (lectotype: L[Sumatra, *Korthals s.n.*], *vide* Meijer 1960, not seen).

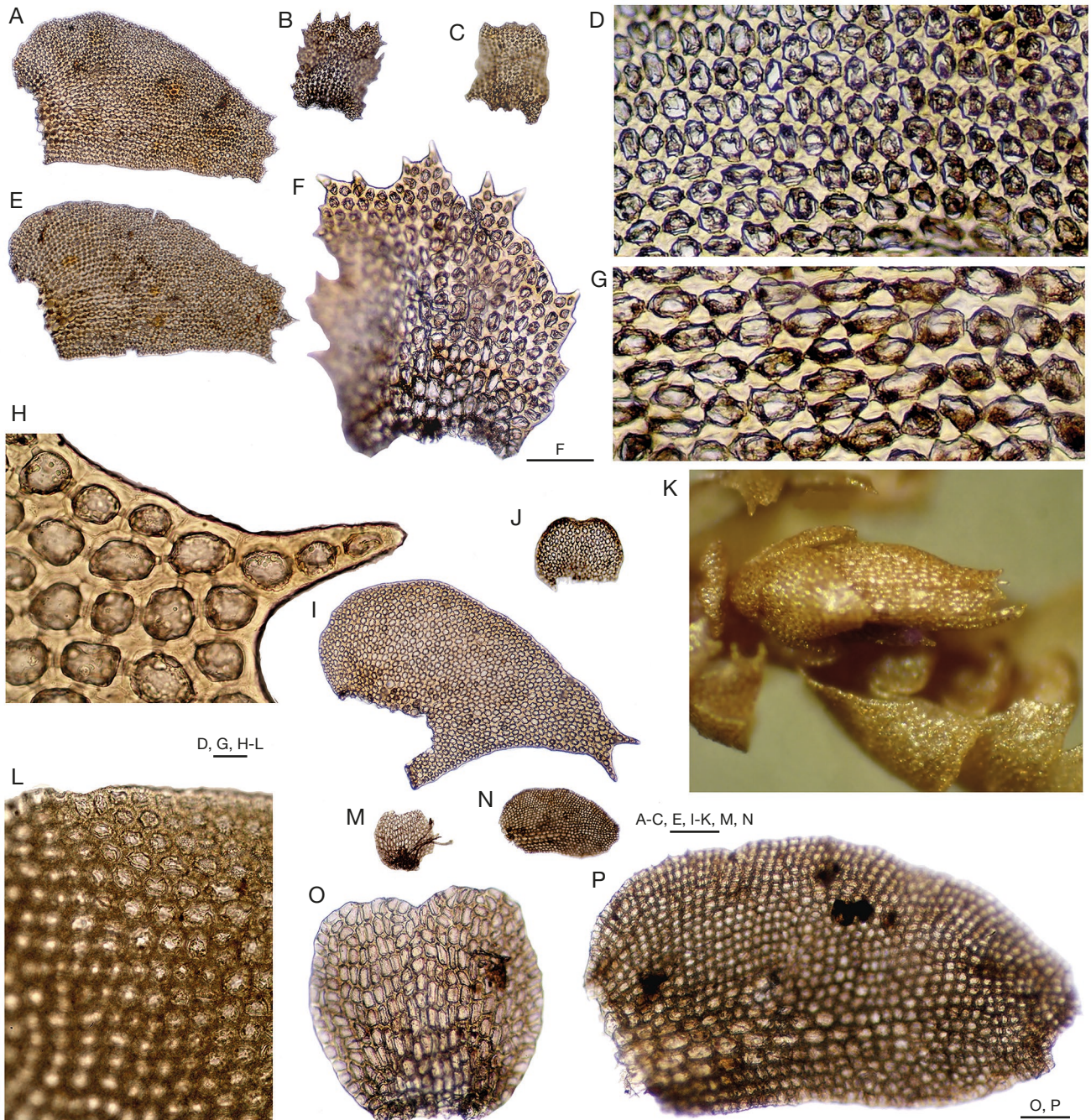


FIG. 13. — **A-G**, *Bazzania quadratistipula* H.A.Mill.: **A, E**, leaves; **B, C, F**, underleaves; **D**, median leaf cells; **G**, basal leaf cells. **H-K**, *B. wooroonooran* Meagher: **H**, median and apical leaf cells; **I**, leaf; **J**, underleaf; **K**, perianth. **L-P**, *B. vittata* (Gottsche) Trevis.: **L**, median and marginal leaf cells obscured by warts; **M, O**, underleaves; **N, P**, leaves. **A-G** from the reference specimen of *Mastigobryum quadratum* Steph. ex Paris; REN[REN000224]; **H-K**, from the New Caledonian specimen Müller NC773; **L-P** from the New Caledonian specimen Thouvenot NC1681. Scale bars: A-C, E, I-K, M, N, 200 µm; D, G, H, L, 20 µm; F, 100 µm; O, P, 50 µm.

MATERIAL EXAMINED. — **New Caledonia** • North Province, Hienghène, Mt Panié massif, Payolé; litter on roots, cloud forest, mica schists massif; 1400 m; 9.X.2012; *Thouvenot NC2497* • Poindimié, Amoa valley, below Goro Até Mèkébo; on bark in cloud forest, volcano-sedimentary massif; 721 m; 12.X.2019; *Thouvenot NC2658* • South Province, Sarraméa, Dogny massif, along the path to Dogny Plateau; on dead wood in wet forest; 23.IX.2008; *Thouvenot NC1713* • La Foa, Dogny Plateau; on laterite in wet forest; 950 m; 24.X.2019; *Thouvenot NC2674* • *ibid.*; on dead wood; *Thouvenot NC2629, NC3407* • Païta,

Humboldt Massif, path to the hut; on tree fern stipe; 1255 m; 1.X.2008, *Thouvenot NC3469*.

DISTRIBUTION IN NEW CALEDONIA. — Present in both provinces of the main island (Grande Terre).

TOTAL RANGE. — Australia (Meagher 2019), Java, Sumatra, Borneo (Meijer 1960), Papua New Guinea (Grolle & Piippo 1984), Malaysia (Cheah & Yong 2016), New Caledonia.

DESCRIPTION

Plants

Fragile, small and soft, decumbent, forming loose wefts; shoots complanate both in dry and wet condition, 1.5–2.0 mm wide, stems (0.15–)0.20(–0.27) mm wide; terminal branching common, pseudo-dichotomous, ventral-intercalary branches common, usually flagelliform, but normal leaved branches may arise ventrally at underleaf axils.

Leaves

Contiguous, spreading, hardly convex, leaf bases more or less imbricate, dorsal insertion reaching the stem midline, at most the dorsal leaf bases hiding the stem, leaves 0.65–1.05 mm long, 0.33–0.55 mm wide near bases, 0.18–0.35 mm below apices, asymmetrically ovate-oblong to ovate-lingulate, not falcate, length-width ratio 1.5–2.4; cuticle smooth or slightly verrucose, especially at margins and apices, margins usually crenulate-denticulate, the dorsal ones widely convex, the ventral slightly concave or sub-straight; apices variously dissected even in a same plant, typically obliquely truncate, 3-dentate, teeth shortly linear to narrowly triangular, 2–4 cells long, but some ones often wider and shorter or apices may be just unevenly crenulate-dentate.

Cells

Central basal cells forming a conspicuous subvitta made of 5 (–7) files of longer and wider cells, surrounded by 1–2 files of smaller transitional cells; median cells rounded-oblong, 12–25 µm wide, 12–30 µm long, usually thick-walled with inconspicuous trigones, more rarely firm walled with medium acute trigones; marginal cells smaller with thicker and verrucose free walls, oblate on ventral side, rounded-oblong on dorsal margin; internal cells oblong to rectangular, 25–40 µm wide and 30–70 µm long, thin-walled with large acute trigones.

Underleaves

Patent, slightly down curved, positioned close to the leaf bases on one side of the stem, then very narrowly connate if any, small, sub-quadrate to longer than wide in outline, 0.23–0.55 mm long, 0.28–0.48 mm wide, 1–2 times wider than the stem; lateral margins convex or lobulate with widely rounded lobules, sometimes with a strong tooth in one or both sides; apices variously dissected, typically with 3–4 narrow lobes, triangular or finger-like, then one cell wide, but lobes may be lacking or fused in polygonal appendage or reduced into small rounded bump; hyaline margin lacking; central cells oblong to rectangular, thick-walled, with inconspicuous trigones.

NOTES

Bazzania subtilis can be recognized by: 1) relatively small size; 2) shoots complanate both when dry and moist; 3) leaves asymmetrically oblong lingulate, with variously dissected apices, from obliquely truncate and shortly 3-dentate to obtuse and shallowly denticulate; and 4) underleaves

patent-spreading, the apices typically with four finger-like lobes, and additional ones on lateral margins. *Bazzania subtilis* shares many features with *B. incrassata* especially complanate habit, conspicuous subvitta, leaf and underleaf main shapes. For distinctive characters, see under the latter. Like *B. incrassata*, weak forms occur among *B. subtilis* specimens with less dissected leaf and underleaf apices.

Mastigobryum pulchellum Steph. (Stephani 1908b) was synonymized with *Bazzania subtilis* by Grolle (1980). In a paper on New Caledonian liverworts, Paris (1910b) added *Mastigobryum pulchellum* Steph. in a list of liverworts collected by Mrs and Mr Le Rat. But the corresponding specimen was later named *Mastigobryum leratii* (see under *Bazzania consociata*). However, *B. subtilis* was also quoted by Paris in the same paper as *Mastigobryum subtile* (from Dogny and Panié, not seen) and was therefore known since that date in the country.

Bazzania tridens (Reinw., Blume & Nees) Trevis.
(Figs 2E, F; 15)

Memorie del Reale Istituto Lombardo de Scienze e Lettere, serie 3, Classe di Scienze Matematiche e Naturali 4: 415 (Trevisan 1877). — *Jungermannia tridens* Reinw., Blume & Nees, *Nova Acta Physico-Medica Academiae Caesareae Leopoldino-Carolinae Naturae Curiosorum* 12: 228 (Reinwardt et al. 1824). — Type: **Java, Blume**; (iso-, G[G0064266]!) not seen.

Herpetium australe Mont., *Annales des Sciences naturelles; Botanique, (sér. 2),* 1: 254 (Montagne 1843). — *Mastigobryum australe* (Mont.) Lindenb., *Synopsis hepaticarum* (fasc. 2): 228 (Gottsche et al. 1845) [Gottsche, Lindenb. & Nees (1845)].

Bazzania australis (Mont.) Trevis., *Memorie del Reale Istituto Lombardo de Scienze e Lettere, serie 3, Classe di Scienze Matematiche e Naturali* 4: 415 (Trevisan 1877). — Type: **Fiji, Balaou**, (lecto-, designated here *fide* Grolle (1986, *in sched.* “Holotypus”); PC[PC0769355]!).

Mastigobryum limbatum Steph., *Species Hepaticarum* 6: 472 (Stephani 1924). — *Bazzania limbata* (Steph.) Tixier., *Bulletin du Muséum national d’Histoire naturelle, série 3,* 10 (190): 77 (Tixier 1973). — Type: **New Caledonia, Lerat**, (lecto-, designated here: G[New Caledonia, ex herb. Paris, *Le Rat* 42 G00066868] !) **syn. nov.**

Mastigobryum subserrifolium Beauverd, *Species Hepaticarum* 6: 480 (Stephani 1924). — *Bazzania subserrifolia* (Beauverd) H.A.Mill., *Phytologia* 47: 321 (Miller 1981). — Type: **New Caledonia, Lerat s.n.** (not seen) **syn. nov.**

MATERIAL EXAMINED. — **Java** • ex herb. Nees, “original” (G[G00064266] as *Mastigobryum tridens*); Preanger Prov.; 11.II.1894; *V. Schiffner s.n.* (PC, s.n.).

New Caledonia • s.l., s.d.; *Pancher s.n.* ex hb. Bescherelle (G, s.n. as *Bazzania ‘australe’*) • South Province, La Foa, Mt Dogny; in the litter on the ground in forest on a ridge of sedimentary bed rock; 900 m; 23.IX.2008; *Thouvenot NC578, NC599* • Dumbéa, Mt Koghis; on old trees; VIII.1905; *Le Rat s.n.* (herbarium E.G. Paris as *Mastigobryum limbatum*, REN[REN000221]) • *ibid.*; on bark in wet forest; 8.VIII.2014; *Métoyer MET033* • *ibid.*; 8.IV.2013; *Coulerie COU99*.

DISTRIBUTION IN NEW CALEDONIA. — Hitherto only found in South Province, on bark and litter.

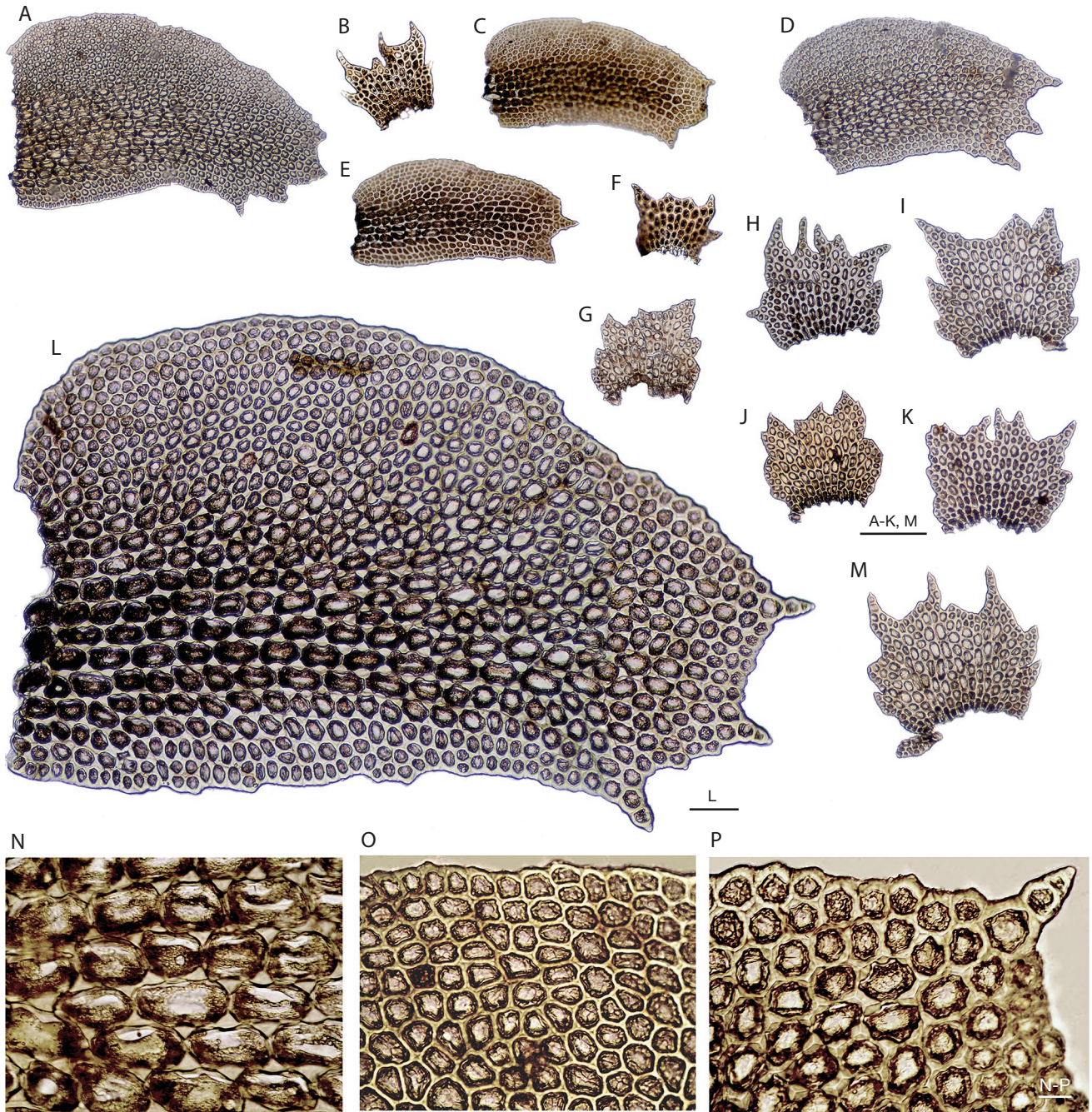


FIG. 14. — *Bazzania subtilis* (Sande Lac.) Trevis.: **A, C-E, L**, leaves; **B, F-K, M**, underleaves; **N**, basal leaf cells; **O**, median leaf cells; **P**, apical leaf cells. **A, D, H, I, K-P**, from Thouvenot NC1713; **B, C, E, F**, from Thouvenot NC3407; **G, J**, from Thouvenot NC2629. Scale bars: A-K, M, 200 µm; L, 50 µm; N-P, 200 µm.

TOTAL RANGE. — South-East Asia (from India to Indonesia, Philippines, Japan) and New Caledonia. Also reported from Samoa, Fiji, Papua New Guinea (GBIF 2023).

DESCRIPTION

Plants

Medium sized, rigid, growing in wefts or creeping among other bryophytes, shoots 2(-3) mm wide, terminal branching common, pseudo-dichotomous, ventral-intercalary branches flagelliform.

Leaves

Imbricate, widely spreading at nearly right angle when moist, deflexed when dry, asymmetrically obovate to lingulate, usually falcate, (1.00-)1.10-1.35 mm long, 0.60-0.85 mm wide near base, length to width ratio 1.5-1.8; dorsal margins widely arched in lower half, slightly convex to straight in upper part, ventral margins concave to nearly straight, shortly rounded at base, both margins crenulate to unevenly denticulate, mainly in upper half including apex; leaf apices obliquely truncate to

rounded, shortly 3-dentate, teeth shortly triangular, usually 1-2 cells long, 1-2 cells at bases.

Areolation

Contrasted, median cells evenly thick-walled, trigones inconspicuous or lacking, hexagonal to oblong, 12-25 µm wide, marginal cells oblate; internal cells larger, 25-35 µm long, 16-25 µm wide, up to 40 µm wide and 60 µm long at insertion, thin-walled with acute trigones, forming a poor subvitta.

Underleaves

Plane, appressed, obliquely inserted, positioned near leaf insertion on both sides, shortly connate or not, quadrate-rounded, 0.50-0.70 mm as wide as long, 1-2(-3) times wider than the stem; margins repand all around; cells hyaline, thin-walled, except in a small area at insertion; basal cells chlorophyllose, thick-walled, oblong to rectangular (Description after the type of *Herpetium australe*).

NOTES

Bazzania tridens was reported as *Mastigobryum australe* from New Caledonia by Stephani (1908c), based on a specimen collected by Pancher. It was successively reported by Jovet-Ast (1951) and Thouvenot *et al.* (2011) without further reference. I examined the specimen Pancher kept at G (from the Bescherelle's herbarium *s.n.*) and compared it to the holotype of *Herpetium australe* at PC. In the Pancher specimen, the underleaves have narrow hyaline margins, 3-4 cells wide, instead of being nearly entirely hyaline and median leaf cells have large bulging trigones whereas the leaf cells of *H. australe* lack them. Therefore, it cannot be that species; more likely it is *Bazzania franciana*. Fortunately, new collections have provided evidence for the presence of this species in New Caledonia.

As underlined by Meijer (1960), in the neighbouring islands of the type location (Java), the forms of *B. tridens* “differ by shorter, more blunt leaves and by amphigastria which are in their lower half not hyaline”. New Caledonian specimens match the main characters of *B. tridens*, allowing for the above variation highlighted by Meijer. They were described by Stephani under the name *Mastigobryum limbatum*. Kitagawa (1973) considered *M. limbatum* synonymous with *Bazzania franciana*, as did Meagher (2010), but in our opinion it differs from the latter by the almost entirely hyaline underleaves that are mainly free, the leaf margins faintly serrulate and the median leaf cells without trigones. These features are characteristic of *B. tridens*. The apices are shortly dentate as are those of *B. australis*, another synonym of *B. tridens fide* Grolle (1980).

Stephani described *Mastigobryum subserrifolium* as a new species from a specimen initially named *M. serrifolium* that did not fit the type of *M. serrifolium* Steph. (Stephani 1908c), nowadays synonymous with *Bazzania bernieri*. If Stephani expressly excluded the latter type as a reference for *B. subserrifolia*, in contrast, he did not clearly designate any type specimen for *M. subserrifolium*, and I was unable to find any original material labelled under the following new combination at G: “*Mastigobryum subserrifolium* Bvrd. n. nov. = *M. serrifolium* Stephani mss., non in Sp. Hep. III [1908] 484.” Furthermore, there is no corresponding illustration

in Stephani's *Icones* consulted at G. Stephani described *M. subserrifolium* from a specimen collected by Le Rat, likely sent by E.G. Paris (Stephani's correspondence to E.G. Paris, unpublished manuscript [Rennes1 University Library]). I therefore looked for a potential type in the herbaria that usually house duplicates of Le Rat specimens distributed by Paris, firstly the E.G. Paris herbarium at REN, as well as G and PC. In these herbaria, I checked all specimens labelled *M. serrifolium* to look for a voucher that differed from *B. bernieri* and could therefore be a potential type for *M. subserrifolium*, as asserted by Stephani in the protologue. Unfortunately, all the specimens checked at G match the characters of *Bazzania bernieri* and do not fall within the original description of *M. subserrifolium* by Stephani, the only reference available. The main differences between these two species are the leaf shapes and underleaf hyaline margins as follows: *M. subserrifolium*: leaves oblong, asymmetrically sub-lingulate, and underleaf hyaline areolation well defined; *M. serrifolium*: leaves sub-symmetrically ovate and underleaf hyaline margins very narrow, usually eroded (character omitted in the diagnosis but conspicuous in the types). Conversely, the Stephani diagnosis fits the characters of *B. tridens* as described here above, the only notable differences are in the leaf and median cell sizes, but it is common that the measures given by Stephani are larger than those observed on the New Caledonian specimens of many species. Accordingly, I regard *Bazzania subserrifolia* as a synonym of *B. tridens*, but cautiously, pending finding a type specimen.

Bazzania vittata (Gottsche) Trevis.
(Fig. 13L-P)

Memorie del Reale Istituto Lombardo de Scienze e Lettere, serie 3, Classe di Scienze Matematiche e Naturali 4: 414 (Trevisan 1877). — *Mastigobryum vittatum* Gottsche., *Synopsis hepaticarum* 216 (Gottsche *et al.* 1845). [Gottsche, Lindenberg & Nees (1845)]. — Type: **Java, Hasskarl s.n.** (not seen).

Mastigobryum integristipulum Steph., *Denkschriften der Akademie der Wissenschaften in Wien. Mathematisch-Naturwissenschaftliche Klasse* 88: 33 (Stephani 1911). — *Bazzania integristipula* (Steph.) H.A.Mill., *Phytologia* 47: 320 (Miller 1981). — Type: **Samoa, Rechingher s.n.**, (lecto-, designated here *fide* Kitagawa (1970, *in sched.*), G[G00067287]; para-, G[G00067286]).

Mastigobryum integristipulum Steph. ex Paris, *Revue bryologique* 37: 131 (Paris 1910b), *nom. inval.* [ICN Art. 38.1(a): no description (Turland *et al.* 2018; Loiseau *et al.* 2019)]. — Reference specimens, PC[New Caledonia, “In Jugo Dogny” (1072 m); IX.1909; *L. Le Rat s.n.* PC0103806!]; REN[*s.n.*] !).

Mastigobryum luxurians Steph. ex Paris, *Revue bryologique* 37: 131 (Paris 1910b), *nom. inval.* [ICN Art. 38.1(a): no description (Turland *et al.* 2018; Loiseau *et al.* 2019)]. — Reference specimens, REN[New Caledonia, “In summo Mt Dent de St Vincent”; 1425 m; VII.1909; *L. Le Rat s.n.*!]; PC[“In jugo Dogny”; 1050 m; VII.1909; *L. Le Rat s.n.* PC0203807!]; REN[*s.n.*] !).

MATERIAL EXAMINED. — **New Caledonia** • North Province, Hienghène, Panié massif, path from Bwa Téan to Payolé; on dead wood in mountain wet forest, sedimentary bedrock; 1000-1400 m; 9.X.2012; *Thouvenot NC1300* • South Province, Païta, Humboldt massif; on stipe of tree fern in cloud forest; 1255 m; 1.X.2008; *Thouvenot NC1783* • Mont Dore, Mouirange pass; on bark in *Nothofagus*

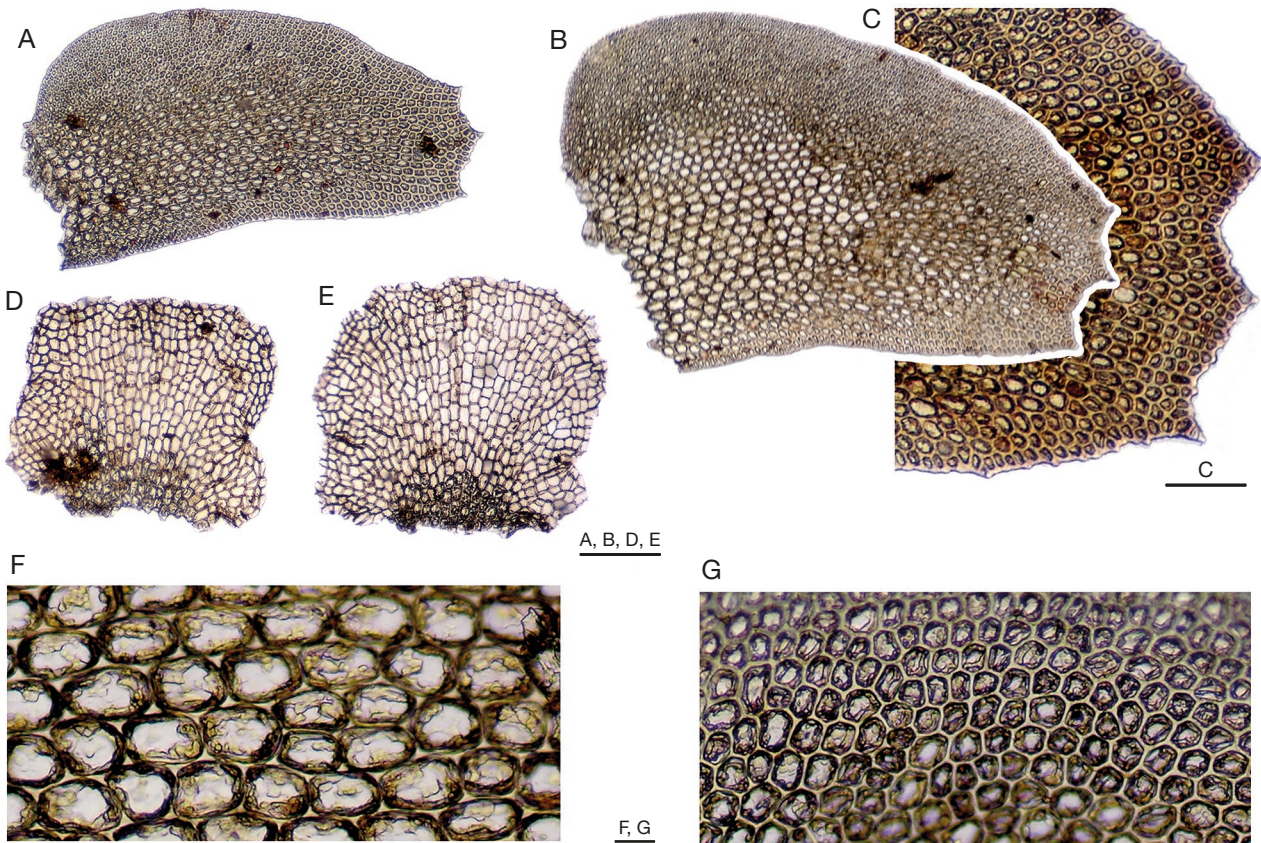


FIG. 15. — *Bazzania tridens* (Reinw., Blume & Nees) Trevis.: **A, B**, leaves; **C**, leaf apex; **D, E**, underleaves; **F**, basal leaf cells; **G**, median leaf cells. **A**, from Thouvenot NC599; **B-G**, from Thouvenot NC578. Scale bars: **A, B, D, E**, 200 μm ; **F, G**, 20 μm ; **C**, 100 μm .

forest; 300 m; 9.IV.2013; *Coulerie COU81* • Yaté, Pic du Grand Kaori; ultramafic massif; 16.IV.2013; *Coulerie COU197* • Sarraméa, path to Dogny plateau; on dead tree trunk in wet forest; 540 m; 9.V.2015; *Métoyer MET060*.

DISTRIBUTION IN NEW CALEDONIA. — On soil, wet rocks, dead wood, or epiphyte. Common in both provinces of Grande Terre, in forests and scrublands at any elevation (200-1480 m).

TOTAL RANGE. — Southeast Asia, Indonesia, Melanesia, Australia, South-Pacific Islands.

DESCRIPTION

Plants

Small, in dense mats, glaucous green, with a matt and opaque aspect, whitish in the herbarium; moist shoots 1.5 mm wide, stems 0.10 mm wide; branching uncommon, mainly ventral-intercalary, with remote normal-leaved or flagelliform branches, terminal branching rare, pseudo-dichotomous.

Leaves

Contiguous to slightly imbricate, complanate and spreading at right angle or nearly so when moist, unmodified when dry; leaves sub-symmetrically oblong, 0.40-0.65 mm long, 0.20-0.35 mm wide, length-width ratio 1.7-2.1; cuticle densely and finely warty; margins sub-straight to slightly curved, entire, the dorsal margins sub-straight to widely convex, the

ventral sub-straight to hardly concave; apices rounded, entire or with 1-3 protruding angles or small teeth.

Cells

Obscured by the warty leaf surface; areolation heterogeneous with a conspicuous vitta of (1-3(-4) rows of larger cells abruptly differentiated from the median cells; oil bodies numerous, small, smooth, ovoid, persistent; median cells mostly quadrate rounded to oblong, 12 μm wide, 12-18 μm long, thick-walled, without trigones or trigones hardly larger than the walls, marginal cells not differentiated, vitta cells 20-25 μm wide, 25-40 μm long, walls thin to medium, bulging trigones conspicuous or not.

Underleaves

Imbricate to contiguous, positioned near the leaf base on one side of the stem and free on both sides, small, appressed, quadrate-rounded, 0.20-0.30 mm long and wide, 2-3 times wider than the stem; apices truncate, straight to repand; cells hyaline, quadrate-rounded to oblong with thick walls and medium trigones (Description after the reference specimens of *Mastigobryum luxurians* and recent New Caledonian specimens).

NOTES

This common species is well differentiated by the combination of the following characters: 1) glaucous green colour and

matt appearance due to the densely verrucosus leaf surface; 2) small size; 3) sub-entire leaves with a conspicuous vitta; and 4) subentire hyaline underleaves.

Bazzania wooroonooran Meagher
(Fig. 13H-K)

Nova Hedwigia 100 (3-4): 549 (Meagher 2015). — Type: **Australia**, Bellenden Ker Range; 3.VII.1986; *Scott s.n.*; holo-, *MELU-116*; not seen.

MATERIAL EXAMINED. — **New Caledonia** • South Province, Païta, Mt Humboldt, ascent from the hut to the summit; *c.* 1600 m; epiphytic; 31.VIII.2003; *F. Müller NC773* (DRE).

DISTRIBUTION IN NEW CALEDONIA. — Hitherto known from a single collection in South Province at the highest elevations.

TOTAL RANGE. — Australia (Queensland), New Caledonia.

DESCRIPTION

Plants

Small, rigid; moist shoots 1.5 mm wide, 2 mm when flattened, stems relatively strong, 0.35 mm wide; terminal branching uncommon in the specimen seen, distant, with long pseudo-dichotomous branches, ventral-intercalary branches usually flagelliform, sometimes normal leaved.

Leaves

Imbricate, incurved when moist, more strongly deflexed when dry, the auriculate dorsal bases overlaying the stem, leaves spreading at right angle when flattened, 1.30-1.55 mm long, strongly asymmetrically ovate-cordate, more strongly narrowed below the apices than above the bases, 0.15-0.20 mm vs. 0.85-0.90 mm, length to width ratio 1.4-1.8; cuticle smooth, margins entire, dorsal margin strongly arched, auriculate, ventral margin concave, more rarely straight; apices usually bifid, rarely entire to crenulate, lobes erect, narrowly triangular to linear, typically 3-5 rounded cells long.

Cell

Areolation homogeneous, cell size and trigones slowly becoming larger to the leaf bases, cells with strongly thickened walls interrupted by a single pit on each side and fused into huge trigones at the cell angles, median cells rounded to oval, *c.* 30 µm wide, 30-45 µm long, marginal cells a little smaller, with thicker free walls; basal cells 40-50 µm wide, 50-65 µm long.

Underleaves

Positioned near the leaf bases on one side of the stem and free on both sides, spreading with recurved apices; underleaves rounded, slightly wider than long, 0.30-0.35 mm long, 0.40 mm wide, as wide as the stem or hardly more; apices entire or emarginate; cells as in the leaves.

Gynoecia

Terminal on short ventral-intercalary branches, outer bracts rounded to ovate, shortly bifid, inner bracts ovate-lanceolate,

deeply bifid, the margins and apices sparsely and shortly ciliate-laciniate or crenulate, perianth (according to F. Müller *in* Thouvenot *et al.* 2018): 3.7-4.1 mm long, 0.8-0.9 mm wide, tubular, 3-sided, apices constricted, long ciliate, cilia 250-400 µm long (Description after the New Caledonian specimen).

NOTES

The discovery of this rare species in New Caledonia is interesting in many ways. Besides the similarity of the bryophyte floras between Queensland and New Caledonia, the rarity of their localities restricted to the highest mountains, reflects the importance of the long-distance dispersal mechanisms, together with habitat availabilities (Gradstein 2018). While most *Bazzania* species are usually in vegetative condition, both known populations of *B. wooroonooran* have many gynoecia. Also interesting is the leaf areolation that looks like that of *B. deplanchei* and some other New Caledonian liverworts (see under the latter).

DOUBTFUL OR EXCLUDED TAXA

Doubtful reports and excluded taxa were mentioned in the checklist (Thouvenot *et al.* 2011).

In the light of the present research, the following species quoted by Miller *et al.* (1983) without precise reference remain unknown from New Caledonia since we were unable to find reference specimens or first-hand reports:

Bazzania inaequabilis Steph., *Transactions of the Connecticut Academy of Arts and Sciences* 12 (1): 21 (Cooke 1904).

Bazzania minuta (Austin) A.Evans, *Transactions of the Connecticut Academy of Arts and Sciences* 8 (15): 255 (Evans 1891).

Bazzania tridens var. *cornutistipula* (Steph.) Pócs, *Journal of the Hattori Botanical Laboratory* 32: 83 (Pócs 1969).

In addition, *Bazzania falcifolia* (Steph.) H.A.Mill., *Phytologia* 47 (4): 320 (Miller 1981) [synonym of *Mastigobryum falcifolium* Steph., *Denkschriften der Akademie der Wissenschaften in Wien, Mathematisch-Naturwissenschaftliche Klasse* 88: 33 (Stephani 1911)] was erroneously synonymized with *B. bernieri* in some online resources (Tropicos, GBIF, Catalogue of life) but not in the world checklist (Söderström *et al.* 2016a), likely by confusion with the invalid name *Mastigobryum falcifolium* Steph. ex Paris (synonym of *M. bernieri* f. *falcifolium* Steph., non *M. falcifolium* Steph.). *Bazzania falcifolia* can easily be separated from *B. bernieri* by its leaf and underleaf shapes and the large trigones of median cells. I did not find any specimen of *B. falcifolia* collected in New Caledonia. In contrast, I think that reports of *B. bernieri* out of that country are likely to be assigned to *B. falcifolia* which is a good species as far as I can know, but I could not check the relevant specimens.

Bazzania reicheliana U.Schwarz, Schäf.-Verw. & Shevock (*Frahmia* 33: 19-20, pl. 35-38 (Schwarz *et al.* 2023) was described from a single specimen from New Caledonia and separated from *B. subtilis* by the following features: dorsal leaf base crossing the stem midline, underleaf lobes irregular and fragile, leaves more than 0.9 mm long. However,

B. subtilis and the close *B. incrassata* are very variable with the occurrence of depauperate forms so that leaf and underleaf shapes can be puzzling, especially in the lobe characters. *Bazzania reicheliana* is clearly separated from *B. incrassata*, but, in contrast, it shares many features with the typical forms of the specimens I assigned to *B. subtilis*. However, these specimens are not fragile and dorsal leaf bases unevenly reach stem midlines. In the context of the morphological variability in the genus *Bazzania* often linked to ecological conditions, I believe it is too early at this stage to confirm a new species from a single specimen without studying the range of morphological forms together with ecological features from a broad sample of specimens. Pending more investigation, I keep the name *B. subtilis* and regard *B. reicheliana* as a doubtful new species, likely synonym with *B. subtilis*.

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APPENDIX

APPENDIX 1. — Index of names. The names of *Bazzania* species according to the checklist of these New Caledonian liverworts (Thouvenot *et al.* 2011) are listed below with their currently accepted name in **bold**. The species unknown in New Caledonia at the time of the checklist publication, are marked with an **asterisk**.

<i>B. adnexa</i> (Lehm. & Lindenb.) Trevis. *	=	<i>B. bernieri</i>
<i>B. angusta</i> (Steph.) Herzog		
<i>B. bernieri</i> (Steph.) Inoue & H.A.Mill.		
<i>B. bescherelei</i> Steph.		
<i>B. caudistipula</i> (Steph.) Inoue & H.A.Mill. *		
<i>B. consociata</i> (Steph.) H.A.Mill.		
<i>B. deplanchei</i> (Gottsche ex Steph.) Jovet-Ast		
<i>B. franciana</i> (Steph.) N.Kitag.		
<i>B. incrassata</i> (Steph.) N.Kitag.		
<i>B. kokawana</i> N.Kitag. & T.Kodama		
<i>B. leratii</i> (Beauverd) H.A.Mill.	=	<i>B. consociata</i>
<i>B. loricata</i> (Reinw., Blume & Nees) Trevis. *		
<i>B. marginata</i> (Steph.) N.Kitag.	=	<i>B. adnexa</i>
<i>B. parisii</i> (Steph.) N.Kitag.		
<i>B. paucidens</i> (Steph.) H.A.Mill.		
<i>B. pectinata</i> (Lindenb. & Gottsche) Schiffn.		
<i>B. quadratistipula</i> H.A.Mill.		
<i>B. subintegra</i> (Steph.) Herzog	=	<i>B. paucidens</i>
<i>B. subserrifolia</i> (Beauverd) H.A.Mill.	=	<i>B. tridens</i>
<i>B. subtilis</i> (Sande Lac.) Trevis.		
<i>B. tridens</i> (Reinw., Blume & Nees) Trevis.		
<i>B. vittata</i> (Gottsche) Trevis.		
<i>B. wooroonooran</i> Meagher *		