

# ***Macromitrium panduraefolium* (Orthotrichaceae, Bryophyta), a new species from New Caledonia, with a key to the aristate *Macromitrium* species in the Pacific, Malesia and Australasia regions.**

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**Abstract** – After the discovery of two *Macromitrium* species with aristate leaves, new to science, in New Caledonia, another aristate species, *M. panduraefolium*, is described and commented on herein. It is distinguished from the formerly known species by its smaller size, leaves spirally coiled around the branch axis and branch leaf shape narrower at the middle. Its ecology and its status are discussed. In addition, the author provides a key to the aristate species known from the region including Malesia, Australasia, Pacific Islands and Melanesia.

**Musci / New Caledonia / Orthotrichaceae / Pacific region**

**Résumé** – À la suite de la découverte en Nouvelle-Calédonie de deux espèces de *Macromitrium* avec des feuilles aristées, nouvelles pour la science, une autre espèce aux feuilles aristées, *M. panduraefolium*, est ici décrite et commentée. Elle se distingue des précédentes par sa petite taille, des feuilles à sec enroulées en spirale autour du rameau et surtout par une forme de feuilles raméales originale, rétrécie au milieu. Son écologie et son statut sont précisés et commentés. De plus, l'auteur fournit une clé de détermination des espèces aristées connues de la région incluant la Malaisie, l'Australasie, l'Océanie et la Mélanésie.

**Mousse / Nouvelle-Calédonie / Orthotrichaceae / Région Pacifique**

## **INTRODUCTION**

*Macromitrium* Brid. is one of the richest genera of mosses in New Caledonia with 45 names currently accepted at specific or infraspecific level (Thouvenot & Bardat, 2010; Thouvenot & Yong, 2015; Thouvenot & Müller, 2016). Thouvenot and Müller (2016) underlined the necessary revision of the species number in the territory. They emphasised the relative diversity of the species with conspicuous aristae and compared them to the aristate species present in the neighbouring countries. After the discovery of two new *Macromitrium* species with conspicuous aristae, *M. larrainii* Thouvenot et K.T.Yong (Thouvenot & Yong, 2015) and *M. humboldtense* Thouvenot et Frank Müll. (Thouvenot & Müller, 2016), one more undescribed long cuspidate *Macromitrium* is found amongst the specimens collected

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in 2016 by the author in New Caledonia. It was gathered in two separate ultramafic massifs in Province Sud: a mountain wet forest in Mont Do Botanic Reserve, near the summit, separated by 75 km from the second location, the Strict Nature Reserve of Montagne des Sources, where it was growing on the bark of isolated small trees in a typical mountain scrubland.

## DESCRIPTION

*Macromitrium panduraefolium* Thouvenot sp. nov.

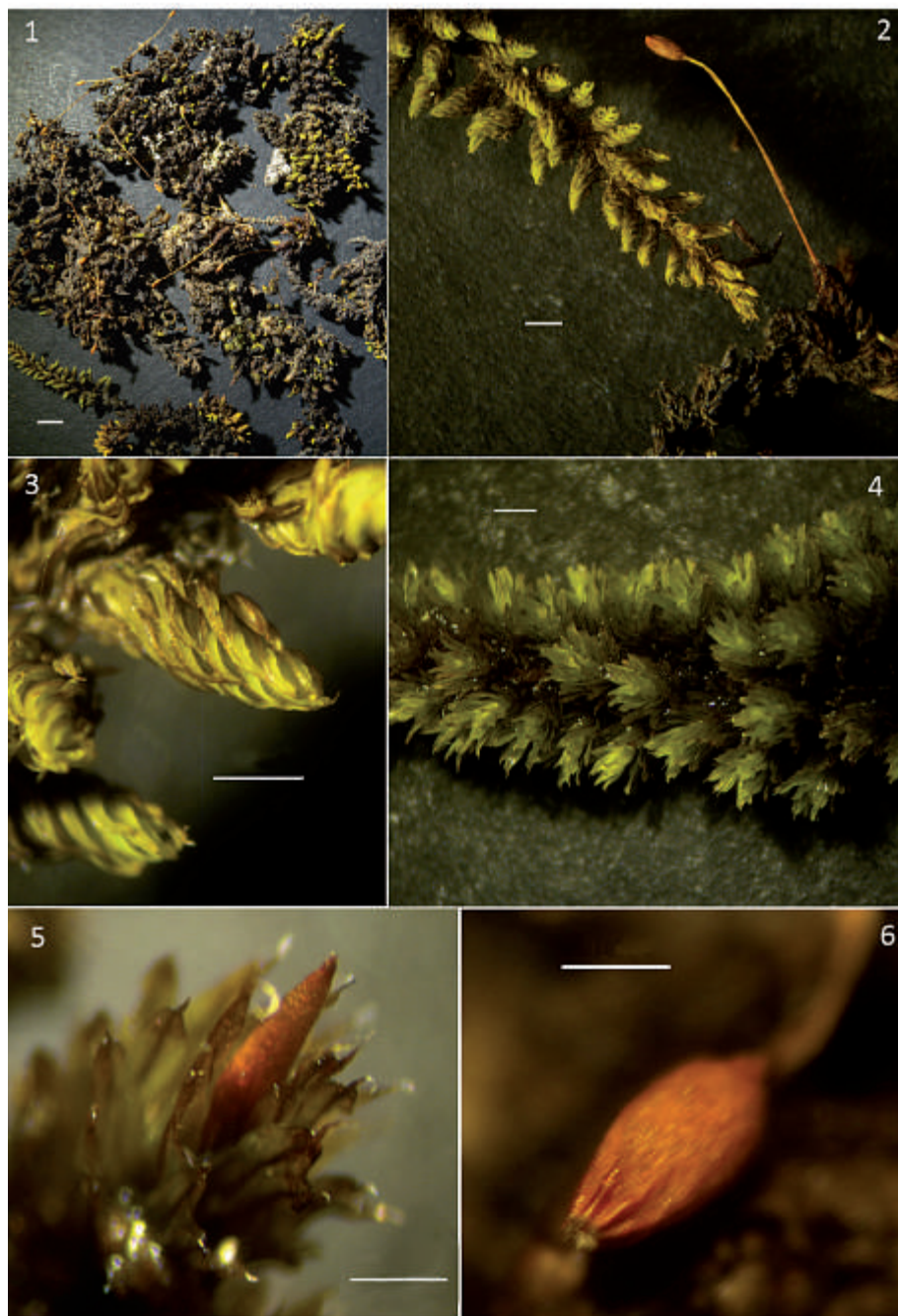
Figs 1-24

**Diagnosis:** Plants small, erect branches crowded, when dry fusiform, acute, with leaves obliquely appressed, spirally coiled, erect when moist, leaves pyriform to panduriform, strongly keeled in lower part, apex usually rounded to obtuse or truncate, reddish costae excurrent in conspicuous hyaline aristae in upper leaves, cells in upper part rounded to oval, bulging and papillose, in basal part long rectangular to linear with straight lumina, smooth, perichaetial leaves lanceolate with longer aristae, not sheathing the seta, capsules exserted, elliptic, peristome lacking, calyptrae naked. Perigonia not seen.

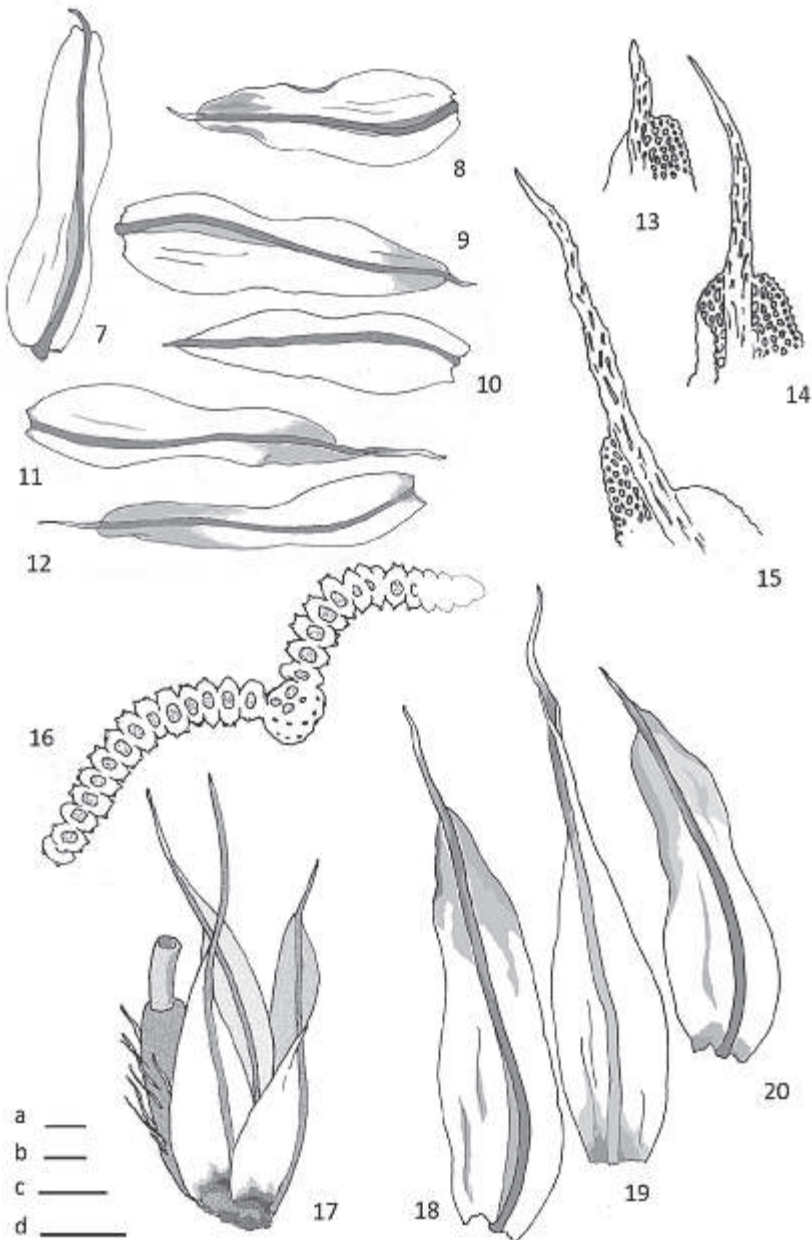
**Typus:** NEW CALEDONIA. Province Sud, Dumbéa, Montagne des Sources Nature Reserve, *Neocallitropsis* Plateau, on the bark of *Dacrydium araucarioides* Brongn. et Gris in mountain scrubland, in ultramafic massif, 22°08'S, 166°35'E, 745 m, 21 September 2016, L. Thouvenot NC2329 (holotype: PC0786119!, isotype: L. Thouvenot private herbarium!).

**Plants** small, light brown with the youngest parts light green, the oldest blackish. **Stems** creeping with crowded erect branches, branches short, fusiform, simple, 3-4 mm long, 0.70-1 mm wide when dry, branch leaves when dry obliquely appressed, spirally coiled around the branch, with conspicuous reddish costae, when moist erect, slightly twisted, strongly keeled in 1/2 lower part, **Branch leaves** 1.10-1.60 mm long, 0.35-0.50 mm wide, green and often red tinged in upper parts, hyaline in conspicuous basal parts 1/3 the whole leaf length, pyriform to panduriform i.e. with the basal parts oval to oblong, the upper parts elliptic to ligulate, constricted at middle, in part due to the recurved margins on both sides at middle, apices usually rounded, less often obtuse to more or less asymmetrically truncate or emarginate, aristate, margins at base entire, in upper part crenulate, more or less papillose, with a conspicuous file of smaller cells, flat except in the median part, costae reddish, stout, abaxially strongly prominent, adaxially furrowed, excurrent in more or less long hyaline aristae, reddish at base, usually 0.1-0.3 mm, up to 1 mm long. **Upper cells** green or red, rounded or oblong, 10-18 µm long, thick-walled, the external walls thicker and protruding, convex to conical, with 0-3(-4) small but conspicuous papillae; **intermediate cells** forming a relatively short transitional part, hyaline, short rectangular with thick walls, bulging at angles, and wide lumina, low rounded single papillae more or less frequent; **basal cells** long rectangular to linear, 20-60 µm long, 7-8 µm wide, with thick walls, usually porous, and straight lumina unevenly narrow, smooth.

Sexual condition unknown. **Perichaetia** inconspicuous, not erect sheathing, perichaetial leaves larger than the vegetative ones, the inner 1.8-2.1 mm long, lanceolate, long acuminate, the laminae asymmetrically decurrent on aristae up to 1 mm long. **Vaginulae** with a few short stiff paraphyses or naked. **Setae** 7-8 mm long,

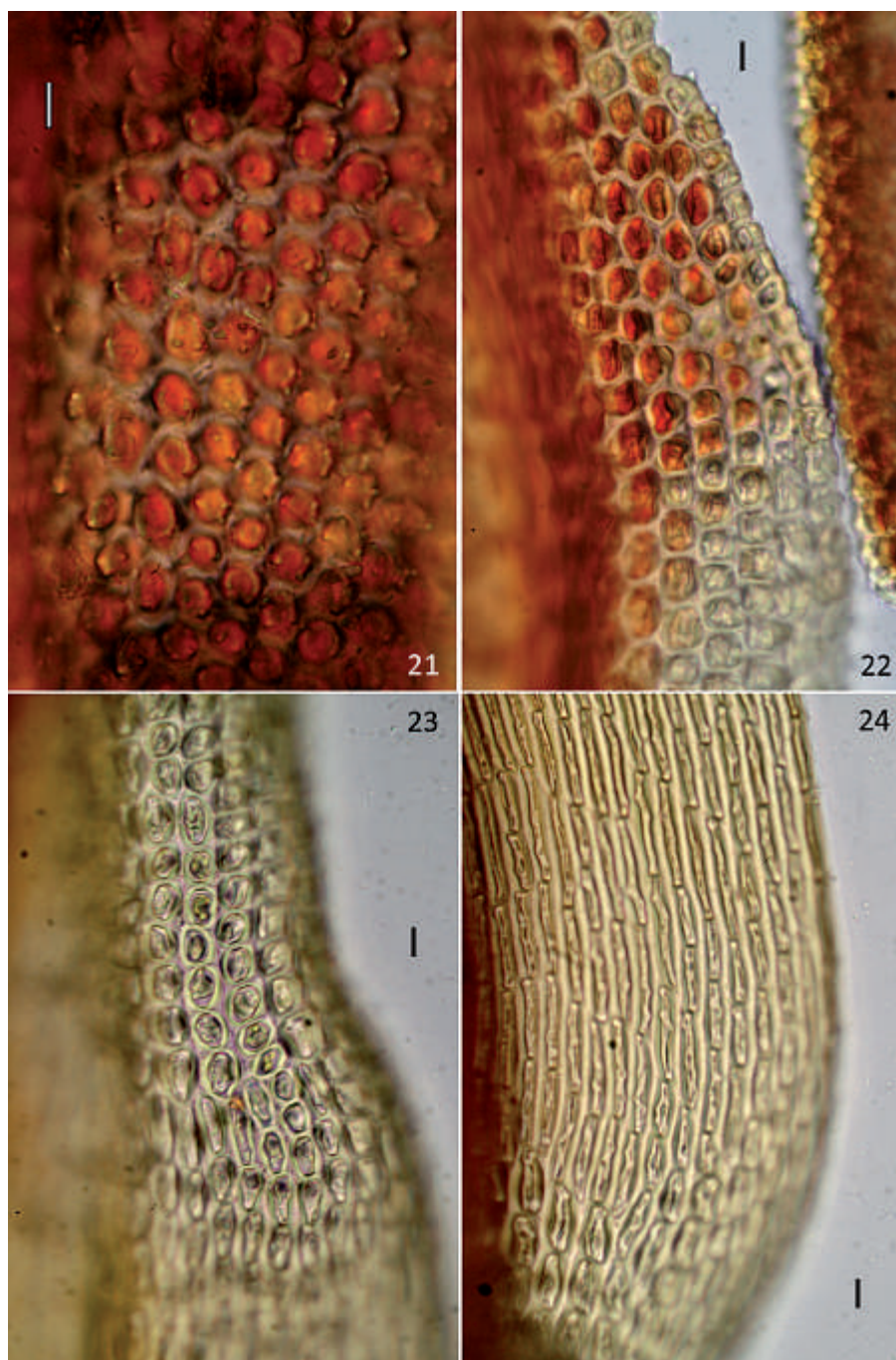


Figs 1-6. *Macromitrium panduraefolium*. 1. Type specimen. 2. Sterile and fertile stem segments in dry condition. 3. Dry branch habit. 4. Wet stem segment. 5. Young calyptra in situ. 6. Capsule. (Scale bars: 1: 5 mm; 2 & 4: 1 mm; 3, 5 & 6: 0.5 mm). All from *Thouvenot NC2329* (holotype)



Figs 7-20. *Macromitrium panduraefolium*. 7-12. Vegetative branch leaves. 13-15. Vegetative branch leaf apices and aristae. 16. Transverse section in a branch leaf upper part. 17. Perichaetium and vaginula (some perichaetial leaves removed). 18-20. Perichaetial leaves. (Scale bars. a: 20  $\mu$ m for 16; b: 200  $\mu$ m for 7 to 12 & 18 to 20; c: 100  $\mu$ m for 13 to 15; d: 0.5 mm for 17). All from the holotype except 17 from Thouvenot NC2386 (paratype)





Figs 21-24. *Macromitrium panduraefolium* vegetative leaf areolation. 21. Upper cells. 22. Upper cells with marginal band of smaller cells. 23. Transitional zone. 23. Basal cells. (Scale bars: 10  $\mu$ m). All from Thouvenot NC2306 (paratype)

straight or slightly flexuose, twisted to the left. **Capsules** exserted, 1(-2) mm long, elliptic, mouths concolorous, narrowed and plicate when dry, smooth and erect when moist; **peristome** absent; **spores** isomorphic, smooth, small, 12-15  $\mu\text{m}$ . **Calyptrae** naked. Perigonia not seen.

**Ecology:** Corticolous, the two specimens were collected on the bark of endemic gymnosperms in mountain scrubland and wet forest on medium elevation ridges, 745-990 m a.s.l., in ultramafic massifs.

**Distribution:** Endemic, only known from two localities, in the South Province of New Caledonia.

**Additional specimen seen (paratypes):** NEW CALEDONIA. Province Sud, Boulouparis, Mt Do, corticolous, on the bark at the basis of a dead *Araucaria* sp.; wet forest in an ultramafic massif; 21°45'S, 165°59'E, 990 m, 15 September 2016, *L. Thouvenot NC2306* (L. Thouvenot private herbarium); Dumbéa, Montagne des Sources Nature Reserve, *Neocallitropsis* plateau, on the bark of *Dacrydium araucarioides* in mountain scrubland in an ultramafic massif, 22°08'S, 166°35'E, 745 m, 21 September 2016, *L. Thouvenot NC2386* (PC0786118), *NC2334* (L. Thouvenot private herbarium).

## DISCUSSION

*Macromitrium panduraefolium* is characterized by 1) small branches fusiform, with leaves spirally appressed in dry condition, erect when moist, 2) costae of vegetative and perichaetial leaves excurrent in conspicuous hyaline aristae, 3) branch leaves oblong-ligulate constricted at middle, rounded to obtuse or truncate at apices, 4) upper cells relatively large with thick bulging external walls and small acute papillae, 5) basal cells linear, all or most smooth, with straight lumina, and 6) exserted capsules with medium sized setae 8 mm long. It differs from the three other aristate species in New Caledonia by the following characters: *M. rufipilum* Cardot is a larger plant in all its parts, with reddish longer aristae and leaves not constricted at middle, *M. larrainii* has longer branches, long acuminate lanceolate leaves and smooth upper cells, *M. humboldtense* is also a small plant but it differs obviously from by the shaggy habit when dry, with leaf apex unevenly directed, and soft leaves narrowly lanceolate.

However, *Macromitrium panduraefolium* shares the same pattern of areolation in upper part of leaves with the New Caledonia endemic species *M. pulchrum* Besch., *M. neocaledonicum* Besch., *M. rufipilum* and *M. humboldtense*, namely large cells with external walls strongly thickened and protruding, lens-like or conical, and bearing 1-3 small papillae. This feature, together with the long excurrent of the costa and reddish colour, is linked to ecological constraints of high elevation habitats (Vitt & Ramsay, 1985; Thouvenot & Yong 2015). But *M. pulchrum* and *M. neocaledonicum* cannot be confused with *M. panduraefolium* as they are larger species without conspicuous longer setae, while *M. humboldtense* is a very different species (Thouvenot & Müller 2016). On the contrary, the similarity of *M. rufipilum* poses the question to decide if *M. panduraefolium* is a good species. At first glance, the specimens are very distinctive by the sizes of fertile branches, leaves and setae which are obviously smaller in *M. panduraefolium*, respectively 3-4 mm long, 1.1-1.6 mm long, 8 mm long, versus 5-13 mm long, 3-3.6 mm long, 20-25 mm long in *M. rufipilum*, as well as by the outline of the vegetative leaf shape and the

look of its branches in dry condition, where *M. rufipilum* erect leaves are individually twisted, in loose spiral arrangement, and curved at apices so that the branches are spiky. On the other hand, both species share features including forms and sizes of cells and urns, lack of peristome, shape of vegetative leaf sections and perichaetial leaves. However, the vouchers assigned to these two names can be separated in two very consistent groups without any intermediate form. As these species are restricted to remote locations of the New Caledonia Central Range, they could be an example of micro-endemism, an important aspect of the biodiversity in New Caledonia (Grandcolas *et al.*, 2008). But, in the current state of our knowledge on the status of *Macromitrium* species in the area, in particular given the lack of molecular or biological evidence, it is not clear whether *M. panduraefolium* would be a form or variety of *M. rufipilum* or a separate species. For these reasons and in a conservative way, I propose to consider both species as distinct pending further collections and the study of their relationship in this group of *Macromitrium* sharing the same areolation pattern.

Key to aristate *Macromitrium* species in New Caledonia (in bold characters) and adjacent region

- 1 Small species, most branches less than 8 mm long.....2
- 1' Larger species, most branches more than 8 mm long .....6
- 2 Cells smooth thorough ..... *M. dielsii* Broth. ex Vitt et H.P.Ramsay (Australia)
- 2' Upper cells papillose..... 3
- 3 Lower cells smooth..... 4
- 3' Lower cells papillose ..... 5
- 4 When dry, branches fusiform, leaves carinate, tightly spirally coiled .....  
..... ***M. panduraefolium***
- 4' When dry, branches shaggy, leaves soft, unevenly erecto-patent.....  
..... ***M. humboldtense***
- 5 Branch leaves more than 3 mm long, with upper margins crispate; aristae winged, firm, smooth ..... ***M. humboldtense***
- 5' Branch leaves less than 2.5 mm long, with upper margins plane; aristae filiform, fragile, crispate, papillose .....  
..... *M. piliferum* Schwaegr. (Hawaii, Sandwich Islands)
- 6 Upper cells smooth .....7
- 6' Upper cells papillose.....12
- 7 Lower cells smooth.....8
- 7' Lower cells papillose .....15
- 8 Lower cell lumina sinuous.....9
- 8' Lower cell lumina straight.....10
- 9 Leaves erect-spreading and straight when moist, oblong lanceolate, 2.6-3 mm long; capsule emergent, setae 2 mm long.....  
..... *M. peraristatum* Broth. (Lord Howe Island)
- 9' Leaves wide spreading and recurved when moist, ovate lanceolate to elliptic lanceolate, 3.5-4.3 mm long; capsules exserted, setae 5-6 mm long.....  
..... *M. cuspidatum* Hampe (Malesia)
- 10 When dry, branches funiculate, leaves spirally arranged .....  
..... *M. funiform* Dixon (Australia)
- 10' When dry, branches not funiculate, shaggy, leaves not spirally arranged ..... 11
- 11 Leaves smooth thorough, lanceolate long narrowed in asymmetrical acumina, lower cells evenly thick-walled ..... ***M. larrainii***
- 11' Supra-basal cells tuberculate, leaves lanceolate less narrowly acuminate, lower cells unevenly thick walled.....*M. ochraceoides* Dixon (Borneo)

- 12 Lower cells smooth, lumina sinuous, setae short (5-6 mm long) ..... *M. cuspidatum*
- 12' Lower cells papillose, lumina straight, setae long (> 15 mm long) ..... 13
- 13 Plant larger, branches usually more than 50 mm long, leaves oval-lanceolate, long acuminate to acute apices ..... *M. longipilum* (Malesia)
- 13' Plant medium, branches usually less than 20 mm long, leaves oval-ligulate with obtuse apices ..... 14
- 14 Aristae reddish, more than 0.5 mm long, setae longer, 20-25 mm long ..... *M. rufipilum*
- 14' Aristae shorter, less than 0.2 mm long, setae medium, 18-20 mm long ..... *M. pulchrum* var. *aristatum* Thér.
- 15 Lower cell lumina sinuous, robust plant, branches up to 40 mm long ..... *M. crinale* Broth. (Western Melanesia)
- 15' Lower cells lumina straight, medium plant, branches up to 18 mm long ..... *M. funiform*

## CONCLUSION

The discovery of a new species of *Macromitrium* in New Caledonia confirms the need of further collections in this territory. It will offset the decrease in species number which will inevitably follow the on-going revisions.

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