

Contribution to the bryophyte flora of New Caledonia. I. New taxa and amendments

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Abstract – Seven mosses, *Erpodium biseriatum*, *Floribundaria pseudofloribunda*, *Leptodictyum riparium*, *Macromitrium serpens*, *Rhodobryum aubertii*, *Sematophyllum phoeniceum*, *Trichostomum brachydontium*, and one liverwort *Lepidozia flexuosa*, are new for the New Caledonian flora following identification of some gatherings made in 2008 and herbarium specimens at PC and REN. In addition, new localities have been found for three species of mosses recently discovered in the Territory, *Anomodon pseudotristis*, *Calymperes motlei*, *Euptychium piliferum* and two new synonyms are given for *Paris nomina nuda*, the moss *Vesicularia compienei* (= *V. subfuscescens*) and the liverwort *Lepidozia etesseana* (= *Telaranea kogiana*). Moreover two doubtful names of the recent checklist of liverworts are rejected after examination of specimens cited from New Caledonia, *Lepidozia supradecomposita* and *Telaranea lawesii* and the data of *Zoopsis liukiensis* in New Caledonia earlier than its first publication is reported. In spite of the relatively numerous data dealing with it, the knowledge of bryophyte flora in New Caledonia will increase and be clarified by sampling many widely overlooked areas (for example dry forests) and biotopes and re-examination of herbarium collections.

Bryophyta / Marchantiophyta / New Caledonia / mosses / liverworts / new species / Pacifique région

Résumé – Suite à des récoltes effectuées en 2008, et à l'examen de parts de deux Herbiers, Rennes (REN) et Paris (PC), il est possible d'ajouter sept espèces de mousses à la flore des bryophytes de Nouvelle-Calédonie : *Erpodium biseriatum*, *Floribundaria pseudofloribunda*, *Leptodictyum riparium*, *Macromitrium serpens*, *Rhodobryum aubertii*, *Sematophyllum phoeniceum*, *Trichostomum brachydontium*, et une hépatique *Lepidozia flexuosa*. Des nouvelles stations sont indiquées pour trois espèces de mousses récemment découvertes pour cette région ; *Anomodon pseudotristis*, *Calymperes motlei* et *Euptychium piliferum*. Deux nouveaux synonymes sont établis à partir de *nomina nuda* publiés par Paris, une mousse *Vesicularia compienei* (= *V. subfuscescens*) et une hépatique *Lepidozia etesseana* (= *Telaranea kogiana*). Deux noms d'hépatiques notées comme douteuses dans la récente check list sont rejetés après examen des échantillons sur lesquels étaient basées leurs citations, *Lepidozia supradecomposita* et *Telaranea lawesii*. Enfin, la mention d'une récolte de *Zoopsis liukiensis* antérieure à sa description initiale est rapportée. Dans un territoire pourtant déjà bien exploré, ces nouvelles données soulignent l'intérêt de poursuivre l'étude des bryophytes en échantillonnant les milieux et les massifs peu explorés comme les forêts sèches et en révisant les échantillons d'herbier.

Bryophyta / Marchantiophyta / Nouvelle Calédonie / mousses / hépatiques / nouvelles espèces / région pacifique

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INTRODUCTION

During field trip in September 2008, the first author collected many samples of bryophytes in New Caledonia. Elsewhere we have published two checklists of New Caledonian bryophytes (Thouvenot & Bardat, 2010; Thouvenot *et al.*, 2011). The total number of species and subspecific taxa now reaches one thousand (468 liverworts, 14 hornworts and 520 mosses). This high number from an area of 18 564 km² would seem to represent a maximum, but the following and other recent reports of new species (Müller, 2011, 2012; Zhu & Müller, 2012), and the description of a new genus (Engel *et al.*, 2012) indicate the likelihood of increasing our knowledge of the New Caledonian bryophyte diversity. Some ecosystems or little accessible places remain overlooked, such as lowland dry forest, the southeastern part of the main island and the Loyalty Islands.

For example, Tiéa in Pouhembout in Province Nord, a small but well preserved dry forest, is part of the New Caledonian “Programme Forêt Sèche” for research and conservation of this endangered ecosystem (<http://www.foretseche.nc>). Several interesting taxa, new for the Territory (see below), have been found in this area, underlining the fact that the bryophyte flora of this ecosystem has formerly been overlooked.

Another source for investigating the bryophyte flora is herbarium collections and several unpublished new reports of species could be found at PC, (Paris, Natural History National Museum) and REN (University of Sciences Rennes 1, France) where the herbarium of E.G. Paris is kept. The latter enabled us to check original specimens of Paris’ *nomina nuda*. We must continue with our researches on these collections and those of IRD at Nouméa (NOU).

SPECIES NEW FOR NEW CALEDONIA

Bryophyta

Erpodium biseriatum (Austin) Austin

A specimen of this species from New Caledonia is kept in PC. It was collected by Guillaumin and Baumann, then identified by Hürlimann, but this data remained unpublished. It has also been collected recently in Tiéa by the first author. For the genus only *Erpodium solmsiellaceum* (Müll.Hal. *et* Broth.) I.G.Stone was previously known in New Caledonia (Thouvenot & Bardat, 2010). The two species have very similar gametophytes and look like liverworts in the field, but they have two different kinds of leaves in dorsal and ventral double ranks. The sporophytes of *E. biseriatum* are distinctive by a cucullate and narrowly conic calyptra and theca without peristome. In sterile samples, the appearance of the papillae and the stem structure are useful features to delimit the species. In *E. biseriatum*, the papillae are solid, simple or multifid, instead of being hollow and “c” shaped in *E. solmsiellaceum* (Fig. 1). They are similar on the two kinds of leaves. In addition, the cortical cells of the stem are arranged in a single row (Fig. 2). According to Stone (1997), the species is widespread in the tropics and the nearest records are from Australia, Java, Thailand and Philippines.

Specimens examined: Nouvelle-Calédonie, Province Nord, upper valley of Voh river, 250 m a.s.l., on bark in hygrophile forest, 12-04-1951. *Guillaumin & Baumann 12100* (PC 0096554). Nouvelle-Calédonie, Province Nord, Tiéa, Pouembout, on bark in dry lowland forest, 40 m a.s.l., coordinates UTM 58K: 0492991-7662914, 26-09-2008. *L. Thouvenot NC119* (PC0710473).

***Floribundaria pseudofloribunda* M.Fleisch.**

There is no earlier mention of this species in New Caledonia, unlike *Floribundaria floribunda* (Dozy *et* Molke.) M.Fleisch. At first glance these two species are very similar and only microscopic examination allows observation of the 1-3 papillose cells of the former in contrast to the 3-8 seriate papillae of the latter. *F. pseudofloribunda* occurs in India, Southeast Asia, Taiwan, Papua New Guinea, Vanuatu and Australia (North Queensland) (Streimann, 1991).

Specimens examined: Nouvelle-Calédonie, Province Sud, Moindou, Parc des Grandes Fougères, Houé river, 370 m a.s.l., on branches in riparian forest, coordinates UTM 58K: 05781-76089, 24-09-2008. *L. Thouvenot NC540* (herb. L. Thouvenot).

Nouvelle-Calédonie, Province Sud, La Foa, east ridge of Mt Dogny, 990 m a.s.l., on branches in mountain forest, coordinates UTM 58K: 05910-76101, 23-09-2008. *L. Thouvenot NC639* (PC0710480).

***Leptodictyum riparium* (Hedw.) Warnst.**

This subcosmopolitan moss has been collected for the first time in New Caledonia on flooded rock in a hard water creek. The sample is sterile. The other bryophytes found on emergent travertine nearby were *Barbula indica* (Hook.) Spreng., *Folioceros fusciformis* (Mont.) D.C.Bharadwaj, *Vesicularia vesicularis* var. *vesicularis* (Schwaegr.) Broth. and *Philonotis runcinata* Müll. Hal. ex Ångstr.

It is the first report of the family Amblystegiaceae in New Caledonia. Its nearest known locality is in Queensland, Australia (Ramsay & Cairns, 2004).

Specimen examined: Nouvelle-Calédonie, Province Nord, Rivière Paxit, Koumac, on travertine, coordinates UTM 58K: 04303-77313, 28-09-2008. *L. Thouvenot NC 527* (PC0710474).

***Macromitrium serpens* (Bruch *ex* Hook. *et* Grev.) Brid.**

M. serpens has also been collected at Tiéa. It is a very distinctive species with leaves irregularly bistratose due to isolated pluripapillose cells which are placed on both sides of the upper part of the otherwise unistratose lamina. In ventral or dorsal view, the upper half of the leaves seems dotted with rounded unicellular corpuscles. The basal hyaline part is filled with elongated, incrassate, sinuate and nonporose cells with a few single papillae.

It could be confused with *M. subvillosum* Broth. *et* Paris (“Mont Dzumac, leg. A. Le Rat, avril 1907”, PC0096521) but the latter has a unistratose lamina whose folds look like pluristratose bands.

This species was formerly known only from Africa and Indian Ocean Islands (Wilbraham & Ellis, 2010). The New Caledonian specimens differ from the Africa ones in having leaves dry, straight and appressed instead of incurved and spirally twisted (Fig. 3).

Specimen examined: Nouvelle-Calédonie, Province Nord, Tiéa, Pouembout, barks in dry forest, 40 m a.s.l., coordinates UTM 58K: 04929-76629, 26-09-2008. *L. Thouvenot NC124* (PC0710477).

Rhodobryum aubertii (Schwaegr.) Thér.

This species, new for New Caledonia, has been found on the ground in mesophilous forest of Dogny mountains. The sample is relatively large, up to 25-30 mm in height, dark green, with leaves distant along the stems and not forming rosettes, obovate, acute, the mid upper margin coarsely serrate, a thin costa without stereids but filled with thin walled parenchyma, apex excurrent and aristate. The only member of the genus hitherto reported from New Caledonia was *R. leratii* Paris *et* Broth. The features of this species described by Brotherus (1906) match those of *R. aubertii* but Brotherus did not provide any information on the costal structure. In addition, his comment raises the possibility that they are likely synonyms: “*Species R. humipetenti* (C.Müll.) Par. *affinis sed foliis multo laxius dispositis, aristatis dignoscenda*”, but *Bryum humipetenti* Müll.Hal. is a synonym of *R. aubertii*. (Spence & Ramsay, 2006). We were not able to examine the type of *R. leratii* to check whether it may be a synonym of *R. aubertii*.

Pantropical, its nearest reports are from Australia, Papua New Guinea and Fiji (Haji Mohamed, 1984).

Specimen examined: Nouvelle-Calédonie, Province Sud, Sarraméa, path to Mt Dogny, humus in mesophile forest, coordinates UTM 58K: 0590-7608, 23-09-2008. *L. Thouvenot NC544* (PC0710478).

Sematophyllum phoeniceum (Müll.Hal.) M.Fleisch.

This species has been collected on dead wood, bark or rock (laterite) in xerophilous scrub or forest in the ultramafic massif of Thiebaghi, in the vicinity of nickel mines, near Koumac. It grows in intact or recently disturbed vegetation, but we cannot be sure that it is able to resist disturbances such as dust deposition or vegetation clearing. This *Sematophyllum* can be recognized by its narrowly lanceolate leaves which are straight and concave with entire margins, longly tapering into a filiform acumen. The basal cells are large and broadly oblong, with ca. two rows of quadrangle cells above (Figs 4, 5). Perichaetial leaves are similar to the normal leaves, but have their base truncate instead of rounded.

This new record for New Caledonia represents the first known extension of this African and Asian species towards the South Pacific and Australasia. It was earlier reported from the Indian subcontinent, China and Malaysia (B.C. Tan, personal communication), Thailand, Southeast Asia, Africa (Pollawatn, 2008).

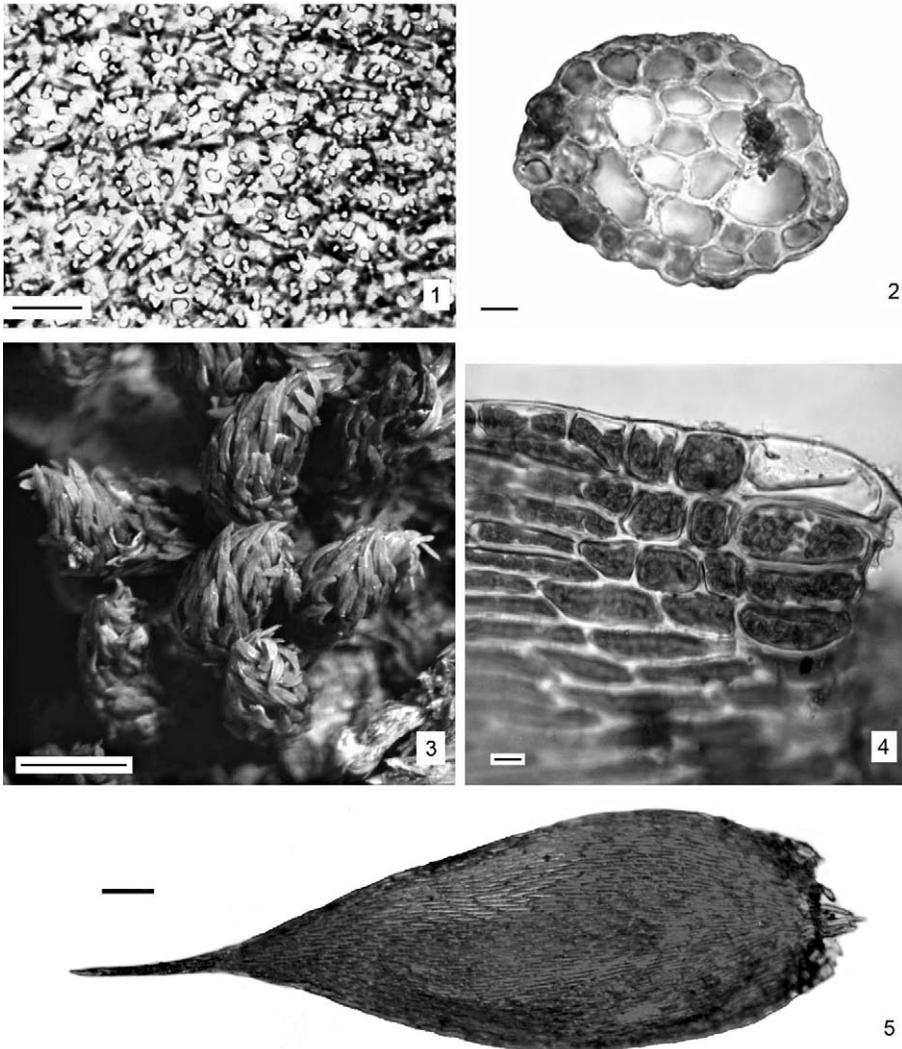
Specimens examined: Nouvelle-Calédonie, Province Nord, Koumac, dôme de Tiébaghi, dead wood in xerophilous forest on ultramafic rocks, 335 m a.s.l., coordinates UTM 58K: 04156-77375, 28-09-2008. *L. Thouvenot NC395* (PC0710475).

Nouvelle-Calédonie, Province Nord, Koumac, dôme de Tiébaghi, on laterite rock in xerophilous forest on ultramafic rocks, 500 m a.s.l., coordinates UTM 58K: 04177-77376, 28-09-2008. *L. Thouvenot NC394* (Herb. L. Thouvenot).

Trichostomum brachydontium Bruch

This *Trichostomum* is new for New Caledonia, where six other species of the genus have been recorded (Thouvenot & Bardat, 2010). It differs in the shape of its leaves which are ligulate, plane, never canaliculate, the apex is widely obtuse, mucronate, not cucullate, and the hyaline base not ascending along the margins.

This cosmopolitan plant has likely been overlooked or recently introduced. It was growing as a pioneer on rocks cleaned out by periodic water flows.



Figs 1-5. **1-2.** *Erpodium biseriatum*. **1.** Papillae on dorsal leaf (scale: 10 μ m). **2.** Transverse section of stem (scale: 10 μ m). **3.** *Macromitrium serpens*, dry habit (scale: 1 mm). **4-5.** *Sematophyllum phoeniceum*. **4.** Angular cells (scale: 10 μ). **5.** Stem leaf (scale: 100 μ m). 1-2 from *Guillaumin & Baumann 12100* (PC), 3 from *Thouvenot NC124* (PC), 4-5 from *Thouvenot NC395* (PC).

Specimens examined: Nouvelle-Calédonie, Province Sud, Moindou, Parc des Grandes Fougères, Houé river, on emerged rocks in the bed of the river, 370 m a.s.l., coordinates UTM 58K: 05781-76089, 24-09-2008. *L. Thouvenot NC416* (PC0710479). Nouvelle-Calédonie, Province Nord, Koumac, dôme de Tiébaghi, on laterite rock in dried up creek, 335 m a.s.l., coordinates UTM 58K: 04156-77375, 28-09-2008. *L. Thouvenot NC 278* (herb L. Thouvenot).

Marchantiophyta

Lepidozia flexuosa Mitt.

This flagelliform plant was collected in 1981 by Mac Kee on serpentine rocks in a wet forest of Mont Kouakoué, Province Sud. It was misidentified by Tixier as *L. supradecomposita* Lindenb. (see below), but it differs from the latter in having 4-lobed stem leaves which are erect and appressed, instead of bilobed and patent, the lobes of the leaves and underleaves have a deeper sinus (to 2/3), oblong to triangular with 2-4 cells at their base (Figs 6-8). It looks like *L. trichodes* (Reinw. ex Blume et Nees) Gottsche, but that species has less deeply divided leaves, smaller leaf cells with a verrucose cuticle instead of being smooth, as in this specimen. It is the first report of this species in New Caledonia.

L. flexuosa was first reported from Sikkim and Burma (Myanmar) (Mizutani, 1968). It occurs from Himalaya (Tibet, Nepal, Buthan, Sikkim, Darjeeling, Arunachal Pradesh, Assam, Meghalaya) to Thailand and The Philippines (ELPT project data base, 07-2012, Söderström & Hagborg, pers. comm.). The discovery in New Caledonia of this mainly Indo-Malaysian species increases significantly its distribution area in the South Pacific. It matches with the underlined relationship of the New Caledonia bryophyte flora to the Indo-Malaysian region (Thouvenot & Bardat, 2010; Thouvenot *et al.*, 2011).

Specimen examined: Nouvelle-Calédonie, Province sud, Yaté, Mont Kouakoué, on serpentine rocks in low wet forest, 1300 m a.s.l., 20-11-1981. *Mac Kee 39951* (PC0085844).

NEW INTERESTING REPORTS AND AMENDMENTS

Bryophyta

Anomodon pseudotrictis (Müll.Hal.) Kindb.

This plant has been collected on the bark of a log in Tiéa forest in September, 2008. Previously, a sample collected near Hienghène, Province Nord, by Baumann-Bodenheim, was first identified by Hürlimann as *Thuidiopsis francii* (Thér.) Broth. A. Touw, however, checked it and recognized it as *Haplohymenium pseudotricte* (Müll. Hal.) Broth. (A. Touw 1992, handwritten note in herbarium). Müller (2012) also mentioned it as new species and new genus from Sarraméa, Province Sud. It is the only species of the Anomodontaceae in New Caledonia.

Specimens examined: Nouvelle-Calédonie, Province Nord, Tiéa forest, Pouhembout, bark on log, 40 m a.s.l., coordinate UTM 58K: 04929-76629, 26-09-2008. *L. Thouvenot NC274* (PC0710472).

Nouvelle Calédonie, Province Nord, Hienghène, summit of Oula-Tilou, on bark in scrub in ultramafic massif, 1000-1100 m a.s.l. 14-04-1951. *Baumann-Bodenheim s.n.*, (PC 0025651).

Calymperes motleyi Mitt.

This species looks like *C. tenerum* Müll.Hal., which was also collected on bark in Tiéa and Île des Pins, but it differs by its percurrent costa, instead of shortly excurrent in *C. tenerum* and its hemispherical gemmae groups on the ventral tip of the costa, not all around the costal apex. This new location in New

Caledonia is in keeping with its usually low altitude or coastal habitat. The nearest range includes Queensland (Australia), Fiji, Papua New Guinea. Total range reaches the Seychelles, westward and northward to India and eastward to the Society Islands (Reese *et al.*, 1986). It was also mentioned by Müller (2012) as new for New Caledonia from Koumac, Province Nord.

Specimen examined: Nouvelle-Calédonie, Île des Pins, Baie d'Oro, Krony, on bark, 31-12-2010. *T. Guionnet*, (herb L. Thouvenot n° NC502).

***Euptychium piliferum* Frank Müll.**

This species, recently described by Müller (2011), has been collected on pieces of dead wood from liana. The specimen shows all the characteristic features of the genus with a long, piliferous acumen of the leaf and angular cells having incrassate walls, and the sharply toothed upper margins contrast with the nearly entire basal part. It was fertile but, like in the specimen examined by Müller, the operculum and calyptra were missing. This locality matches more or less with the sample collected by LeRat in 1904 and mentioned by Müller.

Specimen examined: Nouvelle-Calédonie, Province Sud, La Foa, east ridge of Mt Dogny, on log in mountain forest, 990 m a.s.l., coordinate UTM 58K: 05910-76101, 23-09-2008. *L. Thouvenot NC601* (PC0710476).

***Vesicularia subfuscescens* (Broth. et Paris) Broth.**

Vesicularia compienei Broth. et Paris, *Rev. Bryol.* 36: 1-8 (paged separately, *fide* Pursell & Reese, 1982), 1909; *nom. nud.*, **syn. nov.**

We have been able to examine an original specimen of *V. compienei* reported by Paris (1909) and conserved at REN. In addition, we have found at PC two further samples matching *V. compienei*: a duplicate originating from REN, and a sample of *V. subfuscescens* (Koumac, leg. Compiene, sept. 1908, ex herb. E.G. Paris, PC n° 0097577) which was checked by M. Higushi in April 1988). The three samples are duplicates of the same aquatic plant, collected in the same locality, all covered by the same diatom frustules and having the same features: complanate branches irregularly pinnate, ecostate (or nearly so) leaves, widely ovate, quite abruptly narrowed in a short acumen, comparatively large for the genus in the region, 1.6-1.8 mm long, 0.9-0.95 mm wide (Figs 9, 10).

Therefore, we can state with certainty that *V. compienei* is a synonym of *V. subfuscescens*.

Specimens examined: “Nov. Caledon., ..., Koumac, 7br. 1908, leg. Compiene”, ex herb. E.G. Paris, Faculté des Sciences de Rennes (PC n° 0101418). “Nov. Caledon. Sept., Koumac, 7br. 1908, leg. Compiene” (herb. E.G. Paris, REN s.n.).

Marchantiophyta

***Lepidozia supradecomposita* Lindenb.**

L. supradecomposita was reported by Paris (1910) from St Vincent. In the herbarium of E.G. Paris at REN, we found a sample collected by Mrs Louise Le Rat in Dent de St Vincent (1425 m) during July 1909. The packet does not contain any *Lepidozia* but only *Chiastocaulon dendroides* (Nees) Lindenb., whose flagelliform shoots could be confused with *L. supradecomposita* and we were unable to find any other specimen of *Lepidozia supradecomposita* from New Caledonia in REN.

There are two samples from New Caledonia labelled *L. supradecomposita* at PC. One of them is a duplicate from the herbarium E.G. Paris and shows the same misidentification. The other was collected by McKee in Mt Kouakoué, n° 39951. It differs from this species in having erect leaves with four lobes instead of two and underleaves more deeply lobed, also in four lobes, and it has been identified as *L. flexuosa* (see above).

Therefore the report of *L. supradecomposita* from New Caledonia must be rejected.

Specimens examined: “*Lepidozia supradecomposita* Lindenb., Nov. Caledon. In summo M. Dent de St Vincent (1425 m), Julio 1909, leg. Dna L. Le Rat”. (herb. E.G. Paris, REN s.n.). “*Lepidozia supradecomposita* Lindenb., Nov. Caledon. In summo M. Dent de St Vincent (1425 m), Julio 1909, leg. Dna L. Le Rat”. (PC0085843).

Telaranea kogiana (Steph.) Grolle

Lepidozia etesseana Steph. ex Paris, *Rev. Bryol.* 33: 28, 1906; *nom. nud.*, **syn. nov.**

Lepidozia etesseana Steph. ex Paris was listed as invalid in Thouvenot *et al.* (2011). An original specimen in the herbarium E.G. Paris in REN is labelled “*Lepidozia etesseana* St.”. After examination, it appears to be *T. kogiana*, according to the deeply lobed stem and branch leaves, with very short discs one row high, 6-8 cells wide and the half fused pair of cells at the base of the lobes. Leaf lobes are divergent, more or less turned toward the shoot tip and filiform with more or less 6 oblong, slightly inflated cells, with length twice the width. Stem leaves are 3-4 lobed and branch leaves 2-3 lobed. The mouth of the perianth is long ciliate. Hürlimann (1985, page 105, Abb. 2) identified as *T. fissifolia* (Steph.) Hürl. a specimen in PC labelled *L. etesseana* by Stephani and referred to the Paris *nomen nudum* (Paris, 1906). But the specimen in Paris herbarium is not *T. fissifolia* and are similar to the a-d figures drawn by Hürlimann.

Therefore, according to original material in herbarium E.G. Paris in REN, *L. etesseana* Steph. ex Paris is new synonym of *T. kogiana*.

Specimen examined: “*Lepidozia etesseana* St., Nov. Caledon., M. Koghi, in ... ad rad. arb. – 400 m, Augusto 1905”. (herb E.G. Paris, REN s.n.).

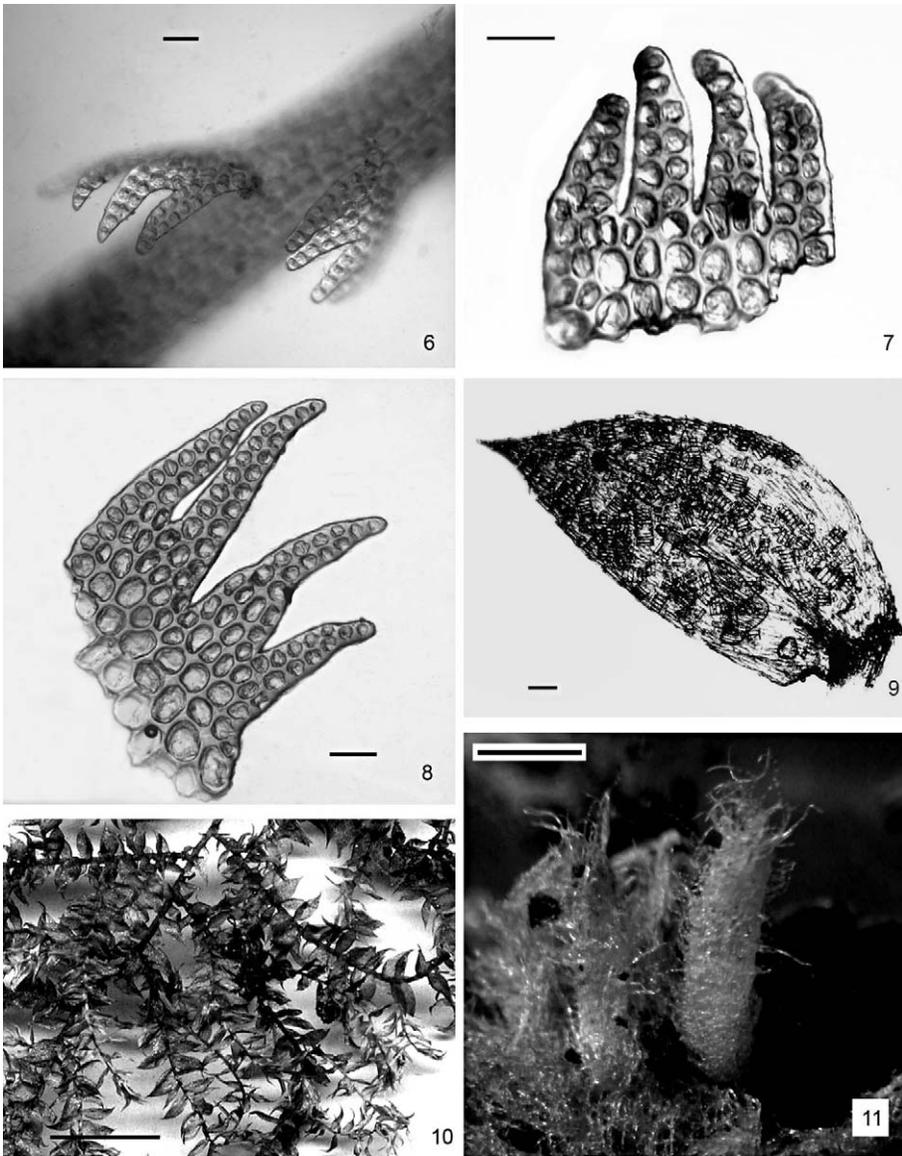
Telaranea lawesii (Steph.) Grolle

Telaranea lawesii was listed as doubtful in Thouvenot *et al.* (2011). It was reported by Paris (1910) from Pic des Sources. We were able to examine a part of the specimen, kept in the Paris herbarium at REN, with well developed perigynia. The densely and longly hairy perianths (Fig. 11) are characteristic of *Telaranea chaetocarpa* (Pearson) Grolle (see Engel & Smith Merrill 2004, fig. 41) and confirms its conspecificity with the latter. Therefore, since it is the only report of *Telaranea lawesii*, this species must be rejected from New Caledonian flora.

Specimen examined: “*Lepidozia lawesii* St., Nov. Caledon., Pic des Sources, julio 09, leg. Le Rat”; (herb. E.G. Paris, duplicatas, REN s.n.).

Zoopsis liukiensis Horik.

Zoopsis liukiensis has been identified in the herbarium of E.G. Paris at REN as the main component of a packet labelled “*Lepidozia fissifolia* St.” which does not contain any sample of the latter. This very distinctive species was collected by Le Rat in July 1909 on Mt Mou. But it had remained unknown for more than twenty years because of the misidentification by Paris, until Horikawa described it from Japan in 1931. Historically, its presence in New Caledonia has



Figs 6-11. **6-8.** *Lepidozia flexuosa*. **6.** Branch leaves (scale: 100 μ m). **7.** Stem underleaf (scale: 40 μ m). **8.** Stem leaf (scale: 40 μ m). **9-10.** *Vesicularia compienei*; **9.** Stem leaf (scale: 100 μ m). **10.** Habit (scale: 5 mm). **11.** *Telaranea chaetocarpa*, perianth (scale: 1 mm). 6-8 from Mac Kee 39951 (PC); 9-10 from *Compiene s.n.* (REN); 11 from *Le Rat s.n.* (REN).

been attested for many years, although its identity unrecognised. It was discovered again in the Territory by Herzog (1953) as *Zoopsis argentea* and by Hürlimann (1983), from the same locality.

Specimen examined: "Lepidozia fissifolia St., Nov Caledon., In summo M. Mou, julio 09, Leg. Le Rat". (herb E.G. Paris, REN s.n.).

CONCLUSION

The bryophyte flora of New Caledonia is well known compared to other countries in the South Pacific. But it will certainly increase with the examination of herbarium material or new collections, as shown here by our examination of specimens in the Paris herbarium in REN, and also collections in PC, as well as by sampling unexplored areas in New Caledonia. Furthermore, the phytogeographical and ecological features of this flora are also insufficiently known and must be the subject of ongoing research.

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