

# Notes on *Philonotis* (Bartramiaceae, Bryophyta). 17. Australian and New Zealand taxa *P. tenuis*, *P. austrofalcata*, *P. pseudomollis* and *P. streimannii*, *nom. nov.*

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A number of the Australian and New Zealand *Philonotis* specimens mainly in V.F. Brotherus's herbarium (H-BR) and in NY were studied, with special attention to the placement of mammillae/papillae on the leaf cells and the cell areolation, and to the taxa synonymized previously with *Philonotis tenuis*. *Philonotis austrofalcata* (*syn. nov. P. rigens*) is distinct from *P. tenuis* at the specific level. *Bartramia pallida* and *Philonotis laii* are synonymized with *Philonotis pseudomollis*. *Philonotis streimannii* T.J. Kop. is a new name for *P. fontanoides* Broth. & Watts (*hom. illeg.*). Lectotypes are selected to *P. pallida* and *P. streimannii*. *Philonotis pseudomollis* is recorded as new to New Zealand.

## Introduction

When the range of *Philonotis laii* (= *P. pseudomollis*) was found to extend from SE Asia to the Pacific area (author's unpubl. data), a search through *Philonotis* taxa described from Australian flora seemed necessary. Streimann and Klazenga (2002) accepted 12 species of *Philonotis* for Australia and Gilmore (2006) reduced the number to seven. Of them, *P. australiensis*, *P. hastata*, *P. pyriformis*, *P. scabrifolia* and *P. slateri* were morphologically rather clearly delimited, while *P. pallida* was given as a rare endemic, and the leaves of *P. tenuis* were described as varying “from broadly triangular-

lanceolate with a percurrent costa and highly recurved margins to narrowly lanceolate with an excurrent costa and only slightly reflexed margins”. *Philonotis fontanoides* Broth. & Watts (*hom. illeg.*) is given as a doubtful name: “This is likely to fall into synonymy with one of the foregoing species”.

Gilmore (2006) listed five names as synonyms under *Philonotis tenuis*: *P. fertilis*, *P. dicranallacea* (Watts & Whitelegge 1906), *P. austrofalcata* (Brotherus & Watts 1912) and *P. rigens* (Brotherus 1914), and hesitatingly *P. pseudomollis*. *Philonotis austrofalcata*, *P. fontanoides*, *P. pallida*, *P. pseudomollis* and *P. rigens* are treated in this paper.

## Taxonomy

### *Philonotis tenuis s. lato*

A study in V.F. Brotherus's herbarium (H-BR), using the placement of mammillae/papillae on the leaf cells in different combinations and leaf cell areolation as criteria, showed that *P. tenuis* includes different groups. For instance, the type materials of *P. austrofalcata* and *P. rigens* have mid-leaf cells with a central papilla among cells with papilla at the distal cell end in the leaf areolation. This kind of mixture of cells with different papilosity is rare, and until now reported only from *P. trachyphylla* from the Himalayas (Koponen & Higuchi 2020). The unexpected discovery of *P. streimannii* (*P. fontanoides*, *hom. illeg.*) of the section *Philonotis* in Australia can be cited as an example of the use of mammillae/papillae as a diagnostic character. All the other species of *Philonotis* in Australia belong to the section *Philonotula*.

A preliminary study of *Philonotis* specimens in H-BR and in NY showed that, in addition to the taxa distinguished in this paper from *P. tenuis s. lato* (*P. austrofalcata*, *P. pseudomollis* and *P. rigens*), at least two other taxa can be distinguished from *P. tenuis s. lato* on the basis of mammilosity/papilosity in the leaf areolation and the structure of the leaf border. These taxa may merit specific status. However, to confirm this, a revision of *P. tenuis s. lato* including the study of the type specimens, is necessary. I also felt it necessary for another study, not yet published, to try to confirm the characteristics of *P. tenuis s. stricto*.

### *Philonotis tenuis* (Taylor) Reichart *s. stricto*

Reise Novara 1(1): 178. 1870. — *Bartramia tenuis* Taylor, Phytologist 1: 1095. 1844. — TYPE: Australia. Norfolk Island, *A. Cunningham* (not seen).

The diagnostic characters of *P. tenuis s. stricto* based on the protologue (Taylor 1844), Scott and Stone (1976), Streimann (2002), Seppelt (2004), Bednarek-Ochyra (2014) and on a number of Australian and New Zealand specimens studied, are: (1) a rather slender habit

with leaves erect-spreading to widely spreading from the stem, and a strongly acuminate or nearly piliferous leaf apex; (2) outer basal cells short-rectangular to subquadrate and mid-leaf cells long-elongate; (3) the cell walls are thick or thin and the papillae at the distal cell end are rather low, leaf cells with central papillae were not observed; (4) The basal leaf margin cells are  $\pm$  quadrate or roundish and thin-walled and the margin next to them is biseriate by small, blunt teeth; and (5) the areolation is  $\pm$  translucent.

DESCRIPTIONS AND ILLUSTRATIONS: Scott and Stone 1976: 339 (pl. 63); Streimann 2002: 8 (fig. 2); Seppelt 2004: 79 (fig. 31); Bednarek-Ochyra 2014: 300 (figs. 1–7).

TOTAL RANGE (Gilmore 2006): Australia, including Lord Howe and Norfolk Islands, New Zealand, Africa.

### *Philonotis austrofalcata* Broth. & Watts

Proc. Linn. Soc. New South Wales 37: 373. 1912. — SYNTYPES: Australia. New South Wales: Yarrangobilly Caves, [Reservoir Gully], January 1906 *W.W. Watts 8702* (H-BR3121032, marked as "typus!" by Brotherus); syntypes: at ca. 3700 ft., 18 January 1906 *W.W. Watts 8702* (H-BR 3121038), Yarrangobilly Caves, [Reservoir Gully], at ca. 3800 ft., 18 January 1906 *W.W. Watts 8680* (H-BR3121054), *W.W. Watts 8718* (H-BR3121004); [Gully beyond Kiandra Road], January 1906 *W.W. Watts 8854*, forma (H-BR3121006, marked "typus!" by Brotherus), at ca. 4000 ft., 22 January 1906 *W.W. Watts 8854* (H-BR-3121057).

*Philonotis rigens* Broth., Pap. & Proc. Royal Soc. Tasmania 1913: 195. 1914, *syn. nov.* — Holotype: From the protologue: "Near Sorell"; from the label: "V. F. B. Bartramia (*Philonotis*) remottfolia Hook. et Wils: rigens Broth. + Ph. tenuis cfr. The Bridge Gully, Glen Rae, Wattle Hill, Sorell! 9 January 1891 W.A. Weymouth 556, R.Br 11/9/91" (H-BR-3121052).

Brotherus and Watts (1912) gave only two collector numbers of *P. austrofalcata* with localities (8702, 8854). In addition, they mentioned two other localities without citing the collector numbers: "near Hot Springs; Cliffs, Yarrangobilly Village". Based on the locality information, the following specimens are obviously syntypes: Yarrangobilly, near Hot Springs at ca. 3200 ft., 18 January 1906 *W.W. Watts 8577* (H-BR3121037); Gully, at ca. 3800 ft., 20 January 1906 *W.W. Watts 8790* (H-BR3121048); Falls, at ca. 4000 ft., 22

January 1906 *W.W. Watts* 8799 (H-BR3121045), 8804 (H-BR3121050), 8846 *ex p.* (H-BR-3121023), 8856 (H-BR3121056).

The collector of the type specimen of *P. rigens* has been unknown (Gilmore 2006). Rodway (1913) says that W.A. Weymouth submitted his large collections to European experts: the hepatics to Stephani, the *Sphagna* to Warnstoft [sic!], *Othotricha* to Venturi, and the rest to V.F. Brotherus. **V. F. B.** in the upper left corner of the specimen means that so happened. V.F. Brotherus received a total 46 letters in 1892–1927 from W.A. Weymouth (Koponen & Piippo 2002). The marking “R.Br.11/9/91” is added later on the specimen and possibly means that Weymouth showed or gave a duplicate of the specimen to Mr. R. Brown.

The syntype specimens of *P. austrofalcata* differ in several characters from the circumscription of *P. tenuis s. stricto*. *Philonotis austrofalcata* has brown, imbricate, falcate and concave leaves with a strong costa, (up to 40 µm wide at insertion), and percurrent to shortly excurrent at the acute apex. In some specimens the apex is very short, nearly obtuse. The leaf cells are thin-walled and from nearly quadrate to short rectangular at mid-leaf. The leaf cells of the basal leaf are nearly smooth or with bulging cell ends. The mid-leaf cells have a papilla at the distal cell end, on the lumen at the distal or proximal cell end, or the cells have a central papilla. In some specimens cells with a central papilla are frequent. The leaf margin is biseriate at mid-leaf.

The type of *P. rigens* has similar imbricate, falcate and acute leaves with excurrent costa as *P. austrofalcata*. The former is darker, the cell walls are thicker and the costa stronger (up to 50 µm wide at insertion). The mammilosity/papilosity is similar as in *P. austrofalcata*, but the papillae tend to be taller. The leaf margin at mid-leaf is biseriate. *Philonotis rigens* is synonymized with *P. austrofalcata*.

ADDITIONAL SPECIMENS EXAMINED. **Australia.** New South Wales: Cuttings, Mt. Talbigo, at ca. 2500 m, January 1906 *W.W. Watts* 8480 (H-BR3121051). Victoria: Lorne, Erskine River, November 1919 *W.W. Watts* 1029, as *P. fontanoides* (H-BR3121046), *W.W. Watts* 1053a, as *P. austrofalcata* (H-BR3121055), *W.W. Watts* 1057, as *P. austrofalcata* (H-BR3121047).

## *Philonotis pseudomollis* (Müll. Hal.)

A. Jaeg.

Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1873–74: 1875 (Ad. 1: 544). 1875. — *Bartramia pseudomollis* Müll. Hal., *Linnaea* 37: 150. 1872. — TYPE: Australia. Queensland, Brisbane river Australiae occidentalis, unde inter alios muscos misit Amalie Dietrich (not seen).

*Bartramia pallida* Hampe, *Linnaea* 40: 307. 1876, *syn. nov.* — *Philonotis pallida* (Hampe) A. Jaeg., Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1877–78: 1879 (Ad. 2: 701). 1879. — LECTOTYPE (designated here): Australia. “Ostaustralien”, leg. *Eaves* (H-BR3121012).

*Philonotis laii* T.J. Kop., Acta Bryolich. Asiatica 3: 91, fig. 1. 2010, *syn. nov.* — HOLOTYPE: China. Hunan Prov., Wulingyuan World Heritage Area, Zhangjiajie, Huangshizhai. On cliffs in low evergreen forest along path, on moist partially shaded cliff, at 910–985 m a.s.l., 8 October 1997 *T. Koponen, S. Huttunen & P.-C. Rao* 51641 (H). — Synonyms and paratypes, see Koponen (2010).

The diagnostic characters of *P. laii* given by Koponen (2010, 2019a, 2019b) are very narrow, elongate leaves with an acuminate apex and a percurrent costa. The mid-leaf cells near costa are up to 50 µm long but narrow, ca. 5 µm broad. The leaf cell areolation is translucent. A special character is that at the end of the growing season, the stems and innovations may grow to slender stolons with numerous propagules.

The description of *P. pseudomollis* (Müller 1872) and especially of the leaf cells: “cellulis pellucidis minutis angustis elongatis” and his note: “Ex habitu *B. mollis* Javanicae haud dissimilis” agree with the characters of *P. laii*.

Hampe’s (1876) protologue of *Bartramia pallida* includes a description of sterile shoots: “ramis sterilibus gracillimis elongatis uncialibus plumulosis pallidis laxe foliatis”; leaf cells: “cellulis parvis rectangulis subpellucida” and evident propagules: “nodulis interruptis eviderter tuberculata”. These characters also fit *P. laii*, as well as Hampe’s note: “Inter *Bartramias* plumulosas colore pallido notabilis”.

Gilmore’s (2006) note on *P. pallida*: “Few cells are found between the costa and the margin as the leaves are quite narrow. The leaf apices are also rather narrow but somewhat rounded” is accurate. This character was confirmed by studying the type (see above). My study in V.F. Brotherus’s herbarium revealed several more Australian specimens.

*Philonotis pseudomollis* was listed hesitatingly as a synonym of *P. tenuis* by Dixon (1942) and Gilmore (2006). Cairns *et al.* (2019) considered *P. pseudomollis* to be an uncertain taxon, pending a detailed study. Brotherus (1924: 463) may have had an idea of its status, while he gave *P. pseudomollis*, *P. slateri* and *P. tenuis* as separate species. It may be worth mentioning that the sheet of *P. pseudomollis* originating from W. Mitten's herbarium (NY) bears a handwritten copy of the description of *P. pseudomollis*, a correctly identified specimen, *Bailey 254* (see below) and a sketch of a long and narrow leaf with acuminate apex.

DESCRIPTIONS AND ILLUSTRATIONS: Tixier 1986: 229, (fig. 2, as *Philonotis angustissima*); Whittier 1976: 189 (fig. 52H–K, as *P. runcinata*); Tan and Ho 2008: (fig. 9 and figs. on pp. 78 and 79, as *P. hastata*); Koponen 2010: 138 (fig. 1, as *P. laii*); Koponen *et al.* 2019: 81 (fig. 4, as *P. laii*).

TOTAL RANGE. *Philonotis pseudomollis* (old records as *P. laii*) has a wide range in continental SE Asia (map in Koponen 2010), in Hunan province of China (Koponen 2019a), and it has been recorded from Japan and the Philippines (Koponen 2018), New Guinea (Koponen 2019b), Vietnam (Koponen *et al.* 2019), Pakistan (Koponen & Higuchi 2020). It has a wide range also in the Pacific from Hawai'i to New Caledonia (author's unpubl. data).

The stolon-like shoots in the New Zealand specimen cited below are in the beginning of their growth. At the leaf base there are only few cells between the leaf margin and costa and the mid-leaf cells are long, rectangular and narrow. This fits with *P. pseudomollis*, and the specific character of *P. pseudomollis*, the abundant propagules along the stolon confirms the identity.

SELECTED SPECIMENS EXAMINED. **Australia.** "Ostaustralien". Mt. William, leg. *Sullivan* (H-BR3121026). Queensland: Brisbane, (*J.B.*) *Bailey 254* (NY, herb. W. Mitten). New South Wales: Richmond R., Rouo Falls, 29 September 1900 *W.W. Watts 4841* (H-BR3121053, as *P. percapillaris* Müll. Hall., *nom. nud.*), September 1900 *W.W. Watts a.m.s* (NY, det. Brotherus as *P. percapillaris*); Richmond River, Uralba, September 1901 *W.W. Watts a.m.8* (NY, det. as *P. tenuicola* Geh. by Brotherus); Richmond River, Alstonville Cutting, September 1902 *W.W. Watts 5730*, with propagules (H-BR3121043, as *P. micropteris* Broth., *nom. nud.*); Alstonville Road, 27 September 1896 *W.W. Watts 886* (NY, det. Brotherus as *P. slateri*); National Park, 22 July 1899 *W.*

*Forsyth 595* (H-BR3121018). **New Zealand** (first record). Canterbury: Banks Peninsula, Hickory Bay, 6 June 1983 *A.J. Fife 5622*, as *P. tenuis* (NY, ex CHR 103669).

### *Philonotis streimannii* T.J. Kop., *nom. nov.* (Fig. 1)

*Philonotis fontanoides* Broth. & Watts, Proc. Linn. Soc. New South Wales 37: 374. 1912, *hom. illeg.* — LECTOTYPE (designated here): Australia. New South Wales, Yarrangobilly, swamp, Kiandra Road about 48 m. from Tumut, 4–5000 ft., 24 January 1906 *W.W. Watts 8879* (H-BR3121039). SYNTYPES: The same date and site, identical with the lectotype, "*W.W. Watts 8873*" (H-BR3121030), "*W.W. Watts 8879 + 8873*" (H-BR3121003).

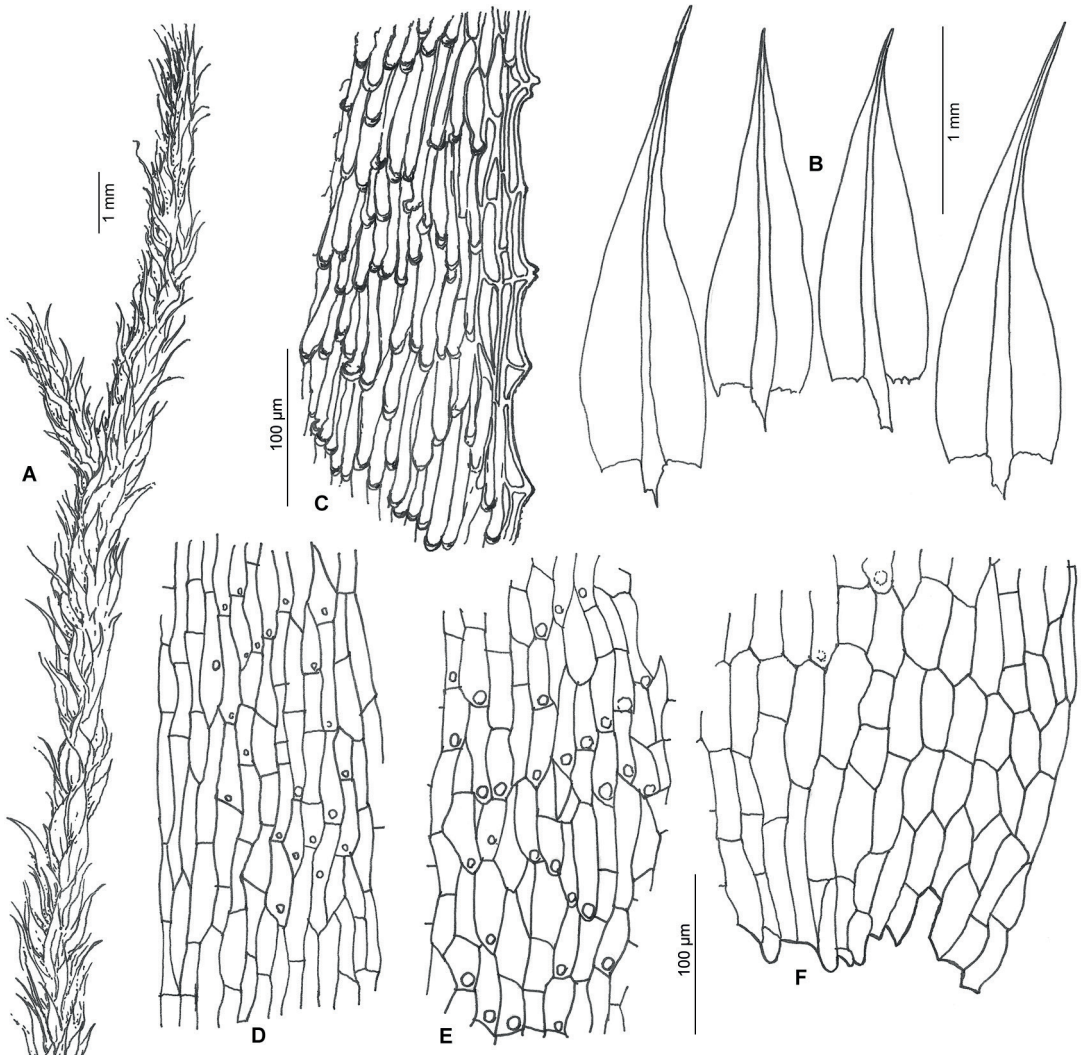
ETYMOLOGY: I selected the epithet *streimannii* to honor the memory of the Estonian bryologist, Heinar Streimann (1938–2001), an expert of Australian bryoflora, and the most notable collector and distributor of bryophytes from Papua New Guinea.

#### DESCRIPTION BASED ON SYNTYPE H-BR3121003.

Plants brownish, loosely tufted, shoots to 3 cm, innovations ± erect; leaves to 2.2 mm long and 0.7–1.0 mm broad, not arranged in rows; leaf bases erect when dry covering the stem, leaves falcate-secund, broadest above insertion, slightly plicate, from ovate base gradually tapering to acuminate apex; margin plane, several basal marginal cells thin-walled, entire, margin cells next to them and at mid-leaf double-crenulate, at apex serrate; costa very strong, 100–125 µm broad at leaf insertion, dorsal side smooth at base, slightly mammillate by protruding cell corners apically, excurrent; leaf areolation ± translucent, all leaf cells thin-walled; basal leaf cells rectangular or rhomboidal, mammillate at proximal cell end, 12–25 × 60–90 µm, at mid-leaf cells papillate at proximal cell end, 12–20 × 37–55 µm, gradually narrower toward apex, at apex papillate at proximal cell end, cells 5–12 × 20–55 µm. Dioicous. Female plant and sporophyte not seen; base of perigonal leaves erect and concave, leaves from very broad lower part quickly tapering to spreading, secund apex with excurrent costa; leaf cells in ovate part thin-walled, slightly mammillate at proximal cell end, 12–25 × 50–112 µm, in narrow apical part cells thick-walled, ca. 5 µm broad; leaf margin in ovate part entire, cells narrow, elongate, apical leaf margin double-crenulate or serrate.

Gilmore (2006) regarded *P. fontanoides* as a doubtful species. Brotherus (1924) accepted





**Fig. 1.** *Philonotis streimannii* (from H-BR3121033). — **A:** Habit. — **B:** Leaves. — **C:** Leaf border near leaf apex. — **D:** Areolation at mid-leaf. — **E:** Areolation at basal part of leaf. — **F:** Areolation and leaf margin at leaf insertion.

it in the section “*Euphilonotis*” in the group with *P. falcata*, *P. afrofontana* and *P. austrofalcata* having, among other common characters, “mamillös vortretenden Zellecken, und zwar auf Aussenseite meist die unteren Zellecke, auf der Innenseite die obere Zellecke vorgewölbt”.

The sectional characters separating the section *Philonotis* from the section *Philonotula* (see Koponen *et al.* 2012) are the major mammilla/papilla at the proximal cell end of all leaf cells and the double-crenulate leaf margin at mid-leaf. The exceptions of this mammilla/papilla arrangement are *P. yezoana*, with central papillae

on the mid-leaves, and *P. trachyphylla* having cells with central papillae and cells with papillae at the proximal cell end (Koponen & Higuchi 2020).

*Philonotis fontanoides* has the major mammilla/papilla at the proximal cell end of all leaf cells and the double-crenulate leaf margin at mid-leaf, and, accordingly, it belongs in the section *Philonotis*. Since *P. fontanoides* is a later homonym, a new name *P. streimannii* is proposed for it. It is easily distinguished from the other Australian *Philonotis* by the sectional characters mentioned above. The leaf shape,

leaf cell areolation and strong costa separate *P. streimannii* from *P. fontana* (see its description in Koponen *et al.* 2012).

Most of the taxa of the section *Philonotis* occur on the northern hemisphere (see Koponen *et al.* 2012). *Philonotis tricolor* is known from central African high mountains (Koponen 2015) and *P. brevifolia* from Chile (Jimenez *et al.* 2016). The most widely ranging southern hemisphere taxon of the section *Philonotis* is circum-subantarctic *P. polymorpha* (Ochyra *et al.* 2008). TOTAL RANGE. Endemic to Australia.

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