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Taxonomic status of two subantarctic species of *Philonotis* (Bartramiaceae, Musci)

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Abstract – Two species of the genus *Philonotis* Brid. described from subantarctic Îles Crozet are taxonomically assessed and some details of their gametophytes are illustrated. *Philonotis angustifoliia* Kaal. is conspecific with *Ph. tenuis* Taylor, and *Ph. tenella* Kaal. is identical to *Ph. polymorpha* (Müll.Hal.) Kindb. These taxonomic conclusions confirm the occurrence of *Ph. tenuis* in this subantarctic archipelago, whereas *Ph. polymorpha* is a new record for Îles Crozet and this discovery completes its circumsubantarctic range.

Bryophyta / Îles Crozet / Kerguelen Province / *Philonotis* / phytogeography / Subantarctica / taxonomy

INTRODUCTION

The diversity of *Philonotis* Brid. in the austral polar region is rather inconsiderable, both in terms of the number of species and their prominence in the tundra vegetation, although locally some species may occur in abundance. Hitherto, the genus was revised taxonomically only in the South American and Australasian sectors of the Subantarctic and the Antarctic. On South Georgia in the South American sector of this biome three species of *Philonotis* are known to occur, including *Ph. scabrifolia* (Hook.f. & Wilson) Braithw., *Ph. vagans* (Hook.f. & Wilson) Mitt. and *Ph. acicularis* (Müll.Hal.) Kindb. [= *Ph. polymorpha* (Müll.Hal.) Broth.] (Clarke, 1973). Likewise, three species of this genus have been recorded on Macquarie Island in the Australasian sector of Subantarctica, namely *Ph. tenuis* (Taylor) Reichardt, *Ph. scabrifolia* and *Ph. polymorpha* (Seppelt, 2004; Blockeel *et al*., 2008). Finally, in the Antarctic only *Ph. polymorpha* is known from a single locality on the volcanic Deception Island in the South Shetland Islands archipelago (Ochyra *et al*., 2008). So far, the genus *Philonotis* is least known taxonomically in the Kerguelen Biogeographical Province in the African sector of the Subantarctic.

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A BRIEF HISTORICAL ACCOUNT ON *PHILONOTIS* IN THE KERGUELEN BIOGEOGRAPHICAL PROVINCE

The Kerguelen Biogeographical Province consists of four widely separated archipelagoes and island groups in the South Indian Ocean, namely Prince Edward Islands, Îles Crozet, Îles Kerguelen and the Heard Island and McDonald Islands group. The first records of *Philonotis* were made on Marion Island in the Prince Edward Islands by H. N. Moseley, a naturalist to the *Challenger* expedition of 1873-1876. Mitten (1876a) reported three species from this island under *Bartramia* Hedw., the then catch-all genus encompassing most species of the modern family Bartramiaceae, including *B. tenuis*, *B. remotifolia* Hook.f. & Wilson and *B. quadrata* Hook. The former is now accepted as a distinct species, the second is conspecific with *Ph. scabrifolia* (Mitten, 1869; Dixon, 1912) and the third was subsequently described by Mitten (1884) as a species in its own right, *Ph. marionensis* Mitt., which is now considered to be identical to *Ph. tenuis* (Zanten, 1971).

At the same time Mitten (1876b) reported two species of *Philonotis* from Îles Kerguelen on the basis of specimens collected by A. E. Eaton, a naturalist to the British Transit-of-Venus Expedition of 1874-1876. Again, they were published as species of *Bartramia*: *B. australis* Mitt. [= *Philonotis pyriformis* (R.Br.ter.) Wijk & Margad.] and *B. appressa* Hook.f. & Wilson. The former name refers to a New Zealand species but the voucher material from Îles Kerguelen in the Mitten herbarium at NY represents *Ph. tenuis*, whereas the second name is a synonym of *Ph. scabrifolia* (Dixon 1912) and actually the specimens in the Mitten herbarium represent this species. *Philonotis australis* was again reported from this archipelago by Cardot (1916) but the original collection in PC represents *Ph. tenuis*.

Two species of *Philonotis* were described by Müller (1883, 1889) from Îles Kerguelen, again under the generic name *Bartramia*. Of these, *B. polymorpha* is now considered to be a distinct species, *Ph. polymorpha*, whilst *B. subexigua* Müll.Hal. is conspecific with *Ph. tenuis* (Brotherus, 1906; Dismier, 1910).

At the turn of 1907 and 1908 the Norwegian expedition operated on Îles Crozet. The representative collection of bryophytes made by Th. Ring and O. Raknes was studied by B. Kaalaas who reported 15 species of liverwort (Kaalaas, 1911) and 26 species of moss (Kaalaas, 1912). Of these seven species and one variety were described as new to science but most of them proved to be identical to species described earlier from other areas (Zanten, 1971; Ochyra, 1999, 2002; Ochyra & Bednarek-Ochyra, 2013). The only exception is *Campylopus subnitens* Kaal., a distinct species endemic to Kerguelen Province (Frahm, 1985, 1988). Kaalaas (1912) reported four species of *Philonotis* from Île de la Possession and Île de l'Est, the two largest islands of the archipelago, namely *Ph. scabrifolia*, *Ph. subexigua* (Müll.Hal.) Kindb., *Ph. angustifolia* Kaal. and *Ph. tenella* Kaal. The last two species were described as new to science but their taxonomic status has not been revised since their inception. It was only Zanten (1971) who briefly assessed the type material of *Ph. angustifolia* and applied this name, with some reservation, to the specimen from Marion Island in the Prince Edward Islands. This name was also used, again with some reservation, for specimens from Heard Island (Selkirk *et al*., 2008).

During the course of the present study the type specimens of the two species of *Philonotis* described by Kaalaas (1912) were located in the herbarium of the Botanical Institute of the University of Bergen (BG), where the collection of B. Kaalaas is kept. The purpose of this account is to clarify the identity of *Ph. angustifolia* and *Ph. tenella* by the examination of the original collections of these species.

CHARACTERISATION OF *PHILONOTIS ANGUSTIFOLIA* AND *PH. TENELLA* AND TAXONOMIC CONCLUSIONS

Philonotis angustifolia was described from a single, small and entirely sterile specimen growing intermixed in a tuft of *Dicranella hookeri* (Müll.Hal.) Cardot. No closer locality data were available but Kaalaas (1912) suggested that the material most probably originated from Île de la Possession. In the Kaalaas herbarium the specimen could not be located at present and only the microscopic slide is available and is designated as a holotype. However, a small specimen of the original collection was discovered in GRO which was apparently taken by B. O. van Zanten during his work on the mosses of the Prince Edward Islands (Zanten, 1971).

The plants are small and slender, forming dense tufts, profusely tomentose below with brown to reddish-brown, smooth rhizoids, yellow-greenish and somewhat lustrous above. The stems are erect, simple or sparingly branched above and densely foliate with erect to erect-spreading leaves. The leaves (Figs 1-4) are straight, narrowly lanceolate, 1.5-2.1 mm long and 0.3-0.5 mm wide, long acuminate from a broader, ovate or triangular base and gradually tapering to a fine subulate point made up mostly of the excurrent costa and sharply acute at the apex (Fig. 5). The margins are plane or somewhat recurved, singly or doubly, sharply serrulate from near the base to the apex (Figs 5-7). The costa is well differentiated, yellow-brown, 60-80 µm wide at the base, bluntly denticulate in the distal part at the back (Fig. 6) and excurrent in a short or long arista. The laminal cells are rectangular to oblong, 20-35(-50) µm long and 7-8 µm wide, smooth or with low distal mamillae in the median and upper part (Figs 5-6), becoming shorter and wider, (15-)20-25(-35) µm long and 10-12 µm wide in the basal part.

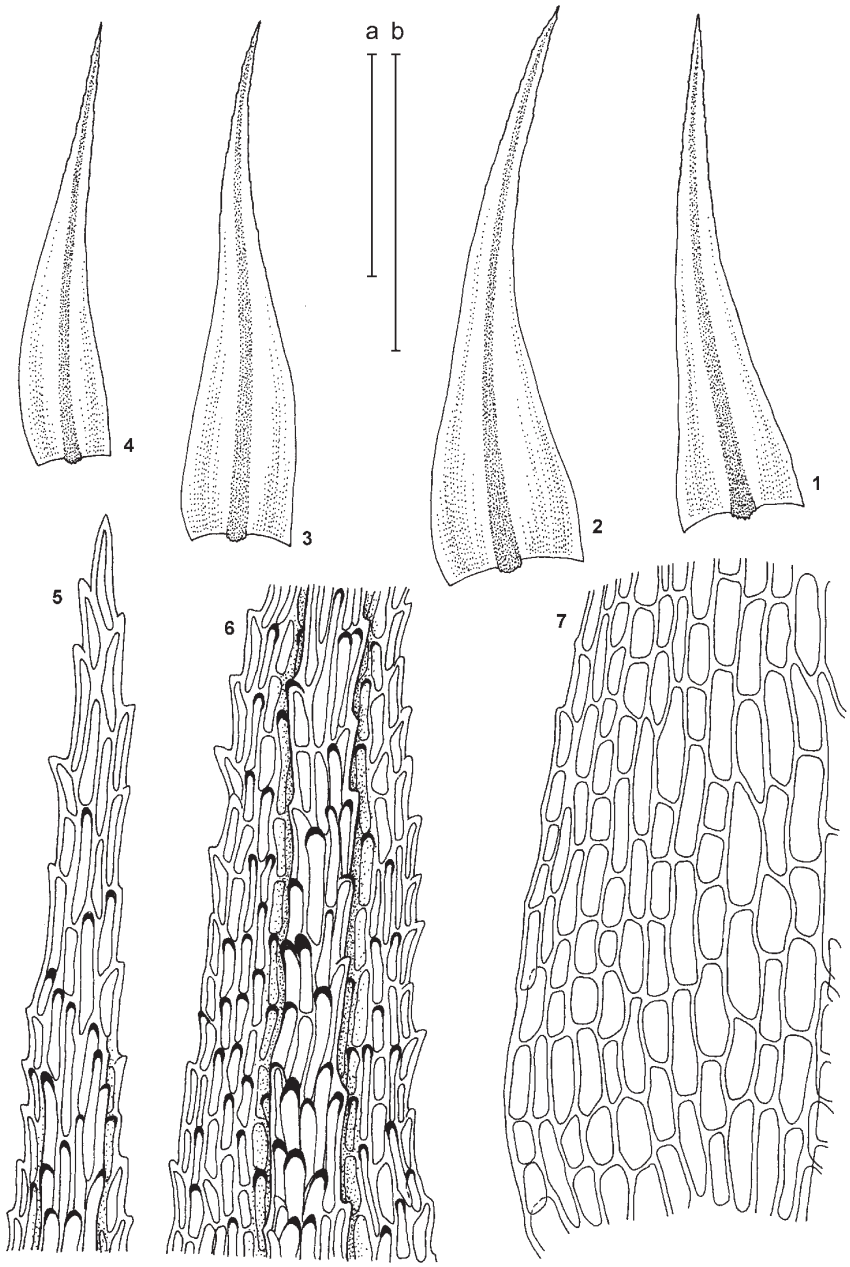
The slender stature of the plants and the narrowly lanceolate-subulate leaves with a long excurrent costa presented by the type material of *Philonotis angustifolia* are typical of *Ph. tenuis* which is otherwise a very variable species. Because the diagnostic features of the two species match well each other, they are here considered to be conspecific and *Ph. angustifolia* is reduced to synonymy with *Ph. tenuis*.

Philonotis tenuis has the maximum occurrence in New Zealand (Sainsbury, 1955) and Australia (Scott & Stone, 1976), including subantarctic Macquarie Islands (Seppelt, 2004). Additionally, the species is widespread on all subantarctic islands in the Kerguelen biogeographical province, as well as in Tristan da Cunha (Dixon, 1960). It was earlier reported from Îles Crozet by Desplanques and Hébrard (1972).

Philonotis tenuis (Taylor) Reichardt, *Reise Novara* 1(1): 178. 1870

Philonotis angustifolia Kaal., *Nyt Mag. Naturvidensk.* 50: 108. 1912. **Type citation**: [Îles Crozet] Einige kleine, ganz sterile Rasenstückchen dieser neuen Art fanden sich eingemischt in einem grossen Rasen von *Dicranella Hookeri* von einem nicht näher angegebenen Standort, wahrscheinlich jedoch aus dem Possession Island. [**Lectotype** (*selected here*): "Philonotis angustifolia Kaal. Type Crozet Isls. Leg. Ring et Raknes No 60 m 1907/1908" – GRO!; isotype: "Philonotis angustifolia Kål. n. sp. Africa, Crozet Islands Th. Ring & Raknes B. Kaalaas det. 8/1-1912" – BG! (M-17870) (only slide)], **syn. nov.**

Philonotis tenella was described from sterile plants forming loose tufts in mats of *Brachythecium rivulare* Schimp. with no closer locality data. In accordance with its specific epithet, *Ph. tenella* is a fairly small and slender plant, 2-3 cm tall,



Figs 1-7. *Philonotis tenuis*. **1-4.** Leaves. **5.** Leaf tip. **6.** Cells below leaf apex. **7.** Basal leaf cells. (All from *Ring & Raknes s.n.*, Crozet Islands, isotype of *Ph. angustifolia*, BG-M-17870). Scale bars: a - 100 µm (5-7); b - 1 mm (1-4).

yellow-green above and brown below. The stems are rather soft, slender and red and they are densely matted with a tomentum of brown rhizoids in the lower part. The leaves (Figs 8-11) are straight, distant, erect to erect-flexuose when dry, erecto-patent when wet, non-decurrent, 1.2-1.5 mm long, 0.4-0.5 mm wide, ovate to oblong-ovate, short-acuminate, gradually tapering to a short, acute acumen. The margins are plane, entire below (Fig. 14), variously singly serrate in the distal part (Figs 12-13). The costa is intensively yellow-brown to yellow-reddish, rather strong below, 85-100 µm wide at the base, percurrent to short excurrent (Fig. 12). The laminal cells are variable, transparent and weakly papillose in the distal portion by projecting lower cell ends. The upper cells are rectangular to oblong-hexagonal, 20-30 µm long, 7-10 µm wide (Figs 12-13) and become larger and laxer, rectangular, 30-45 µm long, 10-20 µm wide in the lower portion (Fig. 14).

When describing *Philonotis tenella* Kaalaas (1912) stated that it is very close to *Ph. polymorpha* from Îles Kerguelen and showed the growth form and uniform leaves as differentiating characters. Actually, *Ph. polymorpha* is a highly protean species, especially in leaf shape and the type material of *Ph. tenella* falls well within the range of variation of this species. Accordingly, the following synonymy has to be proposed.

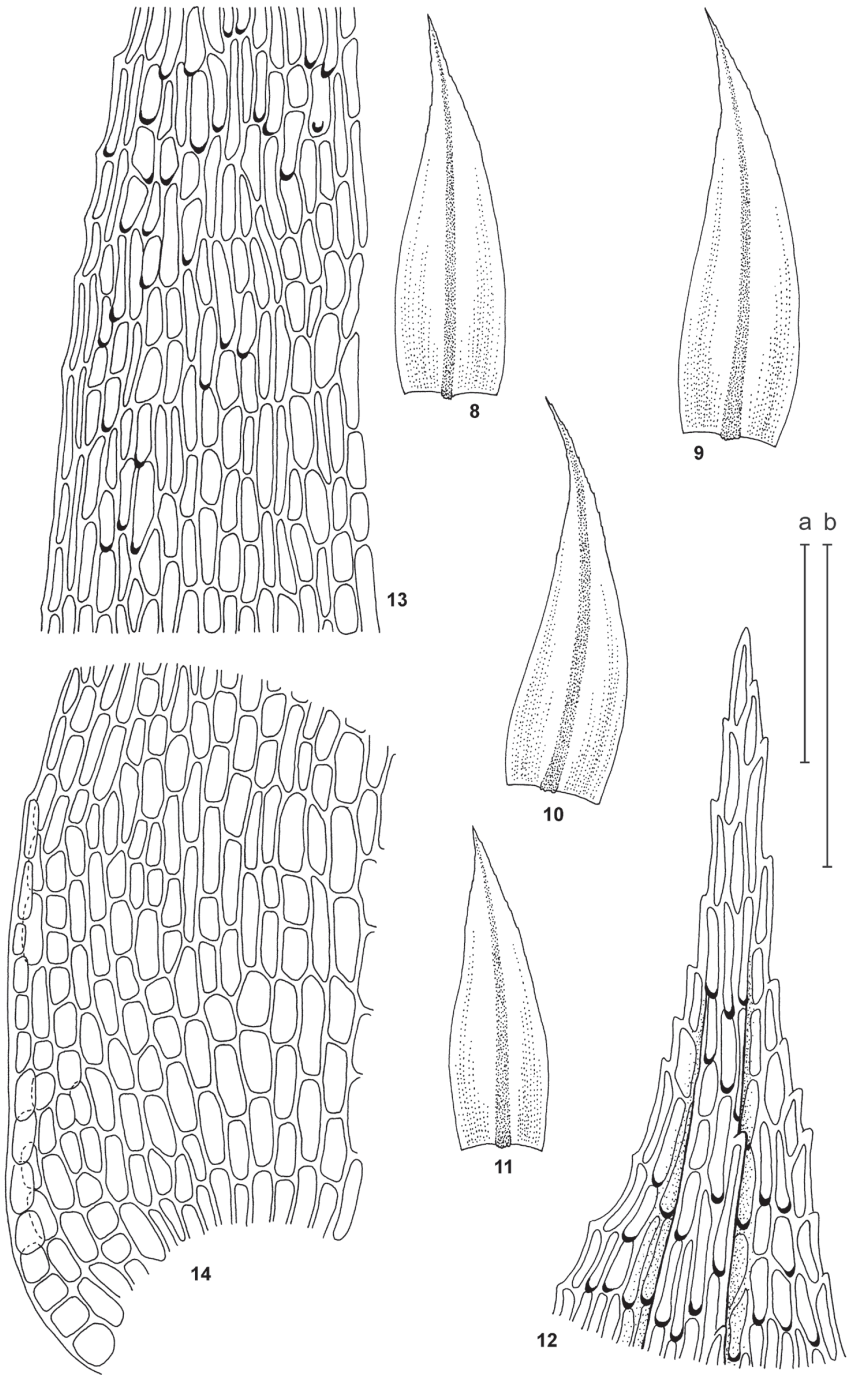
Philonotis polymorpha (Müll.Hal.) Kindb., *Enum. Bryin. Exot*.: 93. 1889

Philonotis tenella Kaal., *Nyt Mag. Naturvidensk.* 50: 109. 1912. **Type citation**: [Îles Crozet] Gesammelt in einigen kleinen Rasen mit *Brachythecium rivulare* vergesellschaftet an einem nicht näher angegebenen Orte. [**Lectotype** (*selected here*): "N° 45 Philonotis tenella Kaal. n. sp. Crozet Island 1907-1908 (I tuer av Brachythec. rivulare N° 43). leg. Ring & Raknes" – BG-Kaalaas! (M-17869); isotype: "N° 45 Philonotis tenella Kaal. n. sp. Crozet Island 1907-1908 (I tuer av Brach. rivulare n° 43). leg. Ring & Raknes" – BG-Kaalaas! (M-17868), **syn. nov.**

Philonotis polymorpha is a circumsubantarctic species which is known from all subantarctic islands, from South Georgia in the west to Macquarie Island in the east. In the Kerguelen biogeographical province it is known from the Prince Edward Islands and Îles Kerguelen (Ochyra *et al*., 2008) and recently it was also reported from Heard Island (Ellis *et al*., 2011) and Îles Crozet (Ellis *et al*., 2013a). It is worth noting that the material reported by Desplanques and Hébrard (1972) from Île de la Possession as *Ph. australis* also represents *Ph. polymorpha* and has nothing to do with the New Zealand species which is correctly named *Ph. pyriformis*.

CONCLUDING REMARKS

The conspecificity of *Philonotis tenella* and *Ph. polymorpha* reduces the number of species known from Îles Crozet. Until recently, this archipelago was the least studied of all islands in the Kerguelen province and up to the 1970s only about 40 species were recorded from its two largest islands, i.e. Île de la Possession and Île de l'Est (Brotherus, 1906; Hébrard, 1970; Desplanques & Hébrard, 1972). It is worth noting that recently the moss *Sanionia uncinata* (Hedw.) Loeske was also recorded from Île aux Cochons, the third largest island in the Îles Crozet archipelago (Ellis *et al*., 2012).



Figs 8-14. *Philonotis polymorpha*. **8-11.** Leaves. **12.** Leaf tip. **13.** Cells in mid-leaf at margin. **14.** Basal leaf cells. (All from *Ring & Raknes 45*, lectotype of *Ph. tenella*, BG-M-17869). Scale bars: a - 100 μm (12-14); b - 1 mm (8-11).

The recent field studies of B. G. Bell and R. Ochyra resulted in many additions to the moss flora of Îles Crozet (e.g. Blockeel *et al*., 2006, 2007a, b, 2008, 2009, 2010; Cano, 2008; Ellis *et al*., 2010, 2012, 2013a, b, c). Some of them are of great bryogeographical importance, for example *Hymenoloma tortifolium* (Hook.f. & Wilson) Ochyra, *Bucklandiella ochracea* (Müll.Hal.) Bednarek-Ochyra & Ochyra and *Hennediella marginata* (Hook.f. & Wilson) R.H.Zander. Hitherto, they were considered as endemic to Îles Kerguelen and their discovery in Îles Crozet shows that local endemic species could have spread from the geologically older Îles Kerguelen and colonised much younger islands in this province. Although direct palaeobotanical evidence is lacking for Îles Crozet (Van der Putten *et al*., 2010), it is very likely that, as is the case with the coterminous Prince Edward Islands, the cryptogamic flora, including mosses are postglacial immigrants which could have reached this archipelago after the Last Glacial Maximum.

Including all recent additions the diversity of mosses of the Îles Crozet archipelago is about 70 species. However, considering the similar size, climate and vegetation, one can assume that the moss flora of this archipelago is comparable to that of the coterminous Prince Edward Islands where so far about 100 species of moss have been detected (Ochyra & Smith, 2003, 2004; Ochyra *et al*., 2003; Ellis *et al*., 2013c).

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