

Revision and Checklist of *Philonotis* (Bartramiaceae, Bryophyta) in Pakistan, with the status of *P. trachyphylla* Dixon & Badhw. and note on *Mnium riparium* Mitt. (Mniaceae)

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(Received 5 March 2020; accepted 25 March 2020)

Abstract The *Philonotis* Brid. flora of Pakistan contains four species, *P. falcata* (Hook.) Mitt., *P. fontana* (Hedw.) Brid., *P. laii* T.J. Kop. and *P. trachyphylla* Dixon & Badhw. *Philonotis calcarea* (Bruch & Schimp.) Schimp., *P. marchica* (Hedw.) Brid., *P. nitida* Mitt. and *P. turneriana* (Schwägr.) Mitt. recorded previously from the country are excluded. A key to the species and lists of previously published representative illustrations are provided, and *P. trachyphylla* is illustrated. The taxa are shortly discussed. The record of *Mnium riparium* Mitt. from Pakistan is *M. lycopodioides* Schwägr.

Key words: Bryophyta, checklist, mosses, nomenclature, ranges, taxonomy, Pakistan, *Philonotis*.

Introduction

This paper deals with the genus *Philonotis* based mainly the collection by the second author, a member of the Botanical Expedition to Pakistan organized by the National Museum of Nature and Science, Tokyo, during his trips from July to September, 1990. The investigated area includes Swat Valley (Fig. 1), Kagahn Valley, Mt. Nanga Parbat area and Murree area (cf. Higuchi, 1992).

Nishimura & Higuchi (1993) and Higuchi & Nishimura (2003) listed six species of *Philonotis* from Pakistan: *P. calcarea* (Bruch & Schimp.)

Schimp., *P. falcata* (Hook.) Mitt., *P. fontana* (Hedw.) Brid., *P. marchica* (Hedw.) Brid., *P. nitida* Mitt. and *P. turneriana* (Schwägr.) Mitt. Of them, *P. calcarea*, *P. marchica* and *P. turneriana* (syn.: *P. nitida*) are excluded from the Pakistan moss flora in this paper (see below). The Higuchi collection from Pakistan contains *P. falcata*, *P. fontana*, *P. laii* T.J. Kop. and *P. trachyphylla* Dixon & Badhw., the latter two new to Pakistan moss flora. *P. trachyphylla* is a new record to China and Nepal. We do not repeat all bibliographic references of *P. falcata* and *P. fontana*, but refer to the latest checklist of Pakistan mosses by Higuchi and Nishimura (2003).

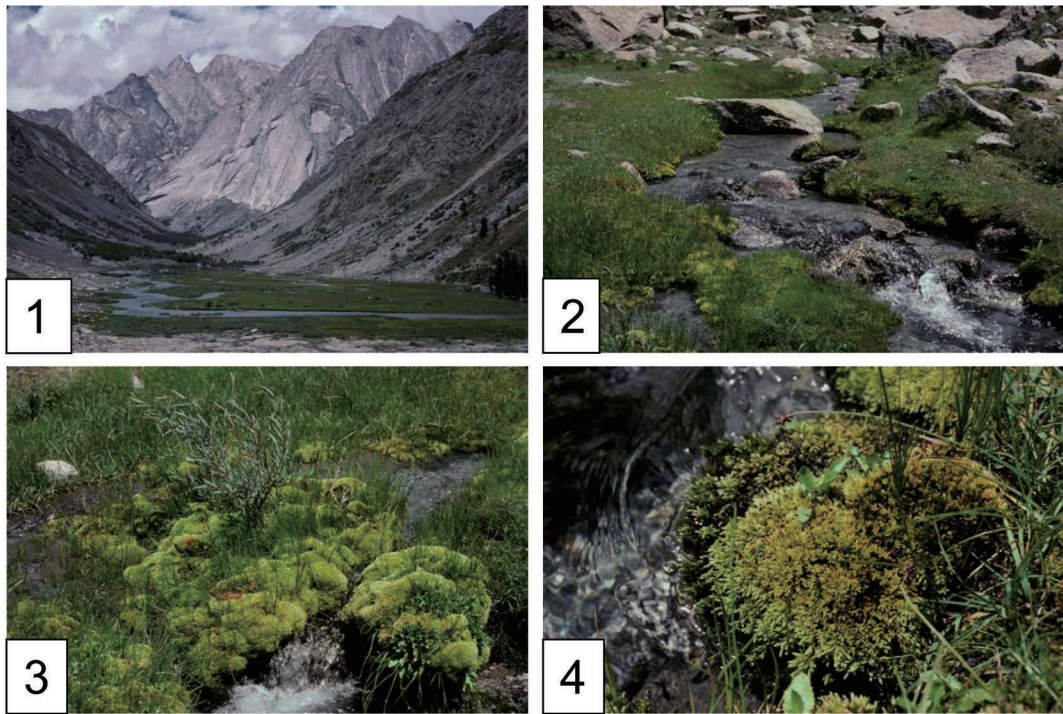


Fig. 1. Swat Valley, North-West Frontier Province, Pakistan 1. Upper part of Swat Valley (M. Higuchi, 1990). 2. Small stream near Lake Mahodand, Swat Valley (M. Higuchi, 1990). 3. Several mosses growing at small stream valley near Lake Mahodand, Swat Valley (M. Higuchi, 1990). 4. *Philonotis fontana* growing at small stream valley near Lake Mahodand, Swat Valley (M. Higuchi, 1990).

Key to *Philonotis* in Pakistan

1. Mammillae/papillae in mid-leaf either central on cell or/and at proximal cell end..... *P. trachyphylla*
1. Mammillae/papillae in mid-leaf cells either at proximal or distal cell end, cells with central papillae absent..... 2
2. Mammillae/papillae in mid-leaf at the proximal cell end..... *P. fontana*
2. Mammillae/papillae in mid-leaf at distal cell end..... 3
3. Leaves on stem in five ranks, carinate and falcate; basal part of leaf $\pm$ triangular..... *P. falcata*
3. Leaves not ranked, plane or slightly concave; basal part of leaf ovate..... 4
- [4. Plants lustrous; leaf apex piliferous (1/5 of leaf or more); basal leaf cells subquadrate to narrow rectangular; areolation opaque..... *P. turneriana*]
4. Plants green to brownish; leaf acuminate with atmost a short uniseriate apex; basal leaf cells elongate rectangular; areolation translucent *P. laii*

Taxa and Specimens

The collector numbers are by M. Higuchi. The voucher specimens are deposited in the herbaria of Finnish Museum of Natural History, Botany

Unit (H) and Department of Botany, National Museum of Nature and Science (TNS). Abbreviation: "c.fr." = with sporophytes.

***Philonotis falcata* (Hook.) Mitt.**

J. Proc. Proc. Linn. Soc., Bot., Suppl. 1: 62. 1859. —*Bartramia falcata* Hook., Trans. Linn. Soc. London 9: 317, 27 fig. 4. 1808. —*Philonotis fontana* var. *falcata* (Hook.) Brid., Bryol. Univ. 2: 21. 1827. —Lectotype (designated by Koponen 2012): Nepal, coll. Dr. *Buchanan*, ex herb. Hooker, ex herb. Kew, 'Dr. Smith 1808, No. H/2359' (BM); isolectotypes: ex herb. Dawson Turner, ex herb. Hooker (BM); ex herb. Mitten, ex herb. Hooker (FH).

P. carinata Mitt., Trans. Linn. Soc. London, Bot., ser. 2, 3: 164. 1891. —Isotype: Japan. Kiga, Miyanoshta, V.1887 *J. Bisset* 67 (H-BR). —Synonymized by Dismier (1912).

Illustrations. Ochi 1962: pl. 4 (figs. A–D, drawn from the type of *P. falcata*); pl. 5 (figs. A–F, drawn from the type of *P. carinata*); Noguchi 1989: 569 (fig. 252, A, B); Koponen 1996: 115 (fig. 1); 2012: 154 (fig. 1); Kürschner and Ochrya 1999: 272 (fig. 2); Eddy 1996: 234 (fig. 489); 235 (fig. 490, as *P. turneriana*); Koponen *et al.* 2012: 29 (fig. 3); Koponen *et al.* 2019a: 79 (fig. 3, J–N); 97 (fig. 13 H).

Specimens examined, leg. *M. Higuchi*. **Pakistan.** *North-West Frontier Prov.* Besham – Dassu, 20324, 20327, on wet rock-cliff at 1000 m; Kaghan Valley, Shogran, 20025, on wet soil at 2270 m; Sharan 20263, on wet humus at 2370 m; Swat Valley, Matiltan, 19404, on wet boulder at 2100 m, 19410, on wet soil at 2240 m; Lake Mahodand (N of Matiltan), 19548, on wet soil at 2850 m, 19561, on rock-cliff at 2900 m; Mt. Nanga Parbat. Tarashing – Rupal, 20329 c.fr., 20333, on soil at 2960 m.

Other specimens. Hindukush Expedition. NW Indien, Rawalpindi, kleines Tälchen in d. Ebene, XI.1935 *Karsten* 63 (JE, as *P. nitida*). *Baltistan.* Karakorum Range, Hushe Valley, Hushe Village, wet ground near springs at 10 000 ft., 4.VII.1955 *G.L. Webster & E. Nasir* 5977, 5983 (US, as *P. turneriana*), Hushe Valley, Ghondakoro Glacier, along lateral moraine at Ghondagoro at c. 13 500 ft., 14.VII.1955 *G.L. Webster & E. Nasir* 6126 (US, as *P. turneriana*), upper Hushe Valley, Ato-sar Valley, mesophytic juniper woods at c. 12

500 ft., 17.VII.1955 *G.L. Webster & E. Nasir* 6161 (US, as *P. turneriana*). *Barum Gol.* Shokor Shal, on wet ground, associated with *Poa supina* Schrad., and on a slope above the camp, both sterile, at c. 3500 m, 15. and 16.VII.1950 *P. Wendelbo*, s.n. (OSLO, as *P. marchica*). Oghi – Battagram road. N side of hill, vertical earth cliff of micaceous soil, dripping rock, 7.VI.1958 *B.L. Burt* B 752 (E, as *P. turneriana*). *Swat State.* VIII.1952 *Sultan Ahmed* 22 (NICH-308006, herb. Dr. A. Noguchi 35921 as *P. turneriana*). The following specimens listed from Pakistan as *Philonotis calcarea* in Brotherus (1898) are *P. falcata*: *Kashmir.* Kaylee-ban, Gurais Valley, 10 500 p., 1.VII.1901 *Inayal Khan* 2933, Bryotheca E. Levier. Musci Indiae orientalis, curante cl. W. Gollan lecti, det. V. F. B. (H-BR 3125 007, as *P. calcarea*); Vallis Surú, Surú – Purkutte, 3200–3400 m, 11. VI.1913 *L. Borelli* (H-BR 3125 004, as *P. calcarea*); Vallis Brahma in jugo Nun – Kun, c. 3800 m, VII.1913 *L. Borelli* (H-BR 3125 001, as *P. calcarea*).

The taxonomy and range of *Philonotis falcata* has been discussed in several papers by Koponen (1996, 2003, 2012, 2019a, Koponen *et al.* 2012, Koponen *et al.* 2019b). It is widely distributed from Africa through SW Asia, the Himalayas, China and Japan to Russian Far East and to Java Island in south. Range maps are in Koponen (1996, 2003). The range in Asia is mainly in temperate and warm temperate (meridional) vegetation zones. Records from the Pacific area need to be confirmed (Koponen, in prep.). *P. falcata* is easily distinguished from the other Asiatic species of *Philonotis* by the $\pm$ triangular basal part of the leaf, the foliation in five ranks on the stem, the leaf serrate to serrulate in lower half of the leaf and faintly biseriate in the apical leaf. The basal leaf cells are more or less translucent, sub-quadrate to short rectangular with a papilla at the distal cell end.

***Philonotis fontana* (Hedw.) Brid.**

Bryol. Univ. 2: 18. 1827. —*Mnium fontanum* Hedw., Spec. Musc. 195. 1801. —Type: Europe (not seen).

Illustrations. In many American, European and Asiatic flora works. A selection: Brotherus 1923: 358 (fig. 63, F, G, perigonal leaves); Lawton 1971: pl. 116 (1–6, as *P. fontana* var. *fontana*); Gangulee 1974: 1115 (fig. 541); Smith 1978: 463 (fig. 223, 1–6); 2004: 652 (fig. 215, 1–6); Crum & Anderson 1981: 654 (fig. 310); Noguchi 1989: 571 (fig. 253 A, as *P. fontana* var. *fontana*); Nyholm 1998: 263 (fig. 222); Ignatov & Ignatova 2003: 584 (fig. 418); Hallingbäck 2008: 295, 296; Ederra 2010: 268 (fig. 95a–f); Koponen *et al.* 2012: 38 (fig. 11); 39 (fig. 12); 40 (fig. 13); Griffin 2014: 110 (as *P. fontana* var. *fontana*).

Specimens examined, leg. M. Higuchi. **Pakistan.** *North-West Frontier Prov.* Swat Valley, Gabral, 19650, on sandy soil at river at 2300 m; Kaghan Valley, Batakundi, 19854, on soil at 2800 m; Lake Mahodand (N of Matiltan), 19520, 19545 c.fr., on soil and on wet soil at 2850, Higuchi no. 19557 (coll. T. Nakaike), on rock-cliff at 2900 m. Mt. Nanga Parbat. Rupal – Nanga Parbat Base Camp, 20392, 20396, on wet humus at 3400 m; Mazeno Base Camp, 20443, on soil at 3900 m, 20456, 20458, on soil at 3950 m.

Philonotis fontana is the most common species of *Philonotis* in the northern hemisphere occurring from the arctic to cool temperate (nemoral) areas (see e.g. Koponen *et al.*, 2012). The southern stations are at the corresponding vegetation zones on high mountains. The present collections suit to this pattern, as well as the present substrate observations (Fig. 1: 4). It differs from most of SE Asiatic species of *Philonotis* in having the mammillae/papillae on leaves at the proximal cell end and by double-crenulate serration of the leaf margin. As to the taxonomy and Asiatic ranges of *P. seriata* Mitt. and *P. tomentella* Molendo having leaf cell and leaf margin characters similar to *P. fontana*, see Koponen *et al.* (2012).

Philonotis laii T.J. Kop.

Acta Bryolich. Asiat. 3: 137. 2010a. —Holotype: **China.** Hunan Prov.: Wulingyuan World Heri-

tage Area, Zhangjiajie, Huangshizhai. On cliffs and in low evergreen forest along path, warm temperate zone, alt. 910–985 m, 29°20'N, 110°25'E, on moist partially shaded cliff, collecting locality 19d, 8.X.1997 T. Koponen, S. Huttunen & P.-C. Rao 51641 (H).

Illustrations and descriptions. Tan and Ho 2008: (fig. 9 and figs. on p. 78 and 79, as *Philonotis hastata*); Koponen 2010a: 138 (fig. 1); Koponen *et al.* 2019a: 81 (fig. 4).

Specimens examined. **Pakistan.** *Rawalpindi Distr.* Karot, c. 5 km W of Jhelum Valley on road to Rawalpindi, on wet sand in an almost dry stream bed in deep ravine with thorn scrub, 4. IV.1973 C.C. Townsend 73/1624 (E, as *P. turneriana*). *North-West Frontier Prov.* Kaghan Valley, Shinu, Higuchi 20223 c.fr., on rock-cliff at 1450 m.

After its description (Koponen, 2010a), the taxonomy of *Philonotis laii* has been discussed by Koponen (2019a, b, and Koponen *et al.*, 2019a). The range map (Koponen, 2010a) shows a rather large distribution in SE Asia, and has since then been reported from the Philippines and Japan (Koponen, 2018), New Guinea (Koponen, 2019b) and Vietnam (Koponen *et al.*, 2019a). The sporophytes of *P. laii* were previously reported from Yunnan in China and Vietnam (Koponen *et al.*, 2019a).

The diagnostic characters of *Philonotis laii* are the upright stems with propagules on innovations, which later grow in length to slender creeping shoots with miniature leaves and numerous propagules. The young plants, in which the propagules have not yet developed, can be separated from *P. hastata* (Duby) Wijk & Margad. having wide leaf cells in all parts of leaves, and from *P. mollis* (Dozy & Molk.) Mitt. having spreading leaves with piliferous apex and elongated, rectangular to rhomboidal and wide cells at the basal leaf. The differences from *P. runcinata* Müll.Hal. ex Ångstr. were discussed by Koponen *et al.* (2019b). As to the difference with *P. turneriana*, see the key and below.

Philonotis trachyphylla Dixon & Badwh. (Fig.

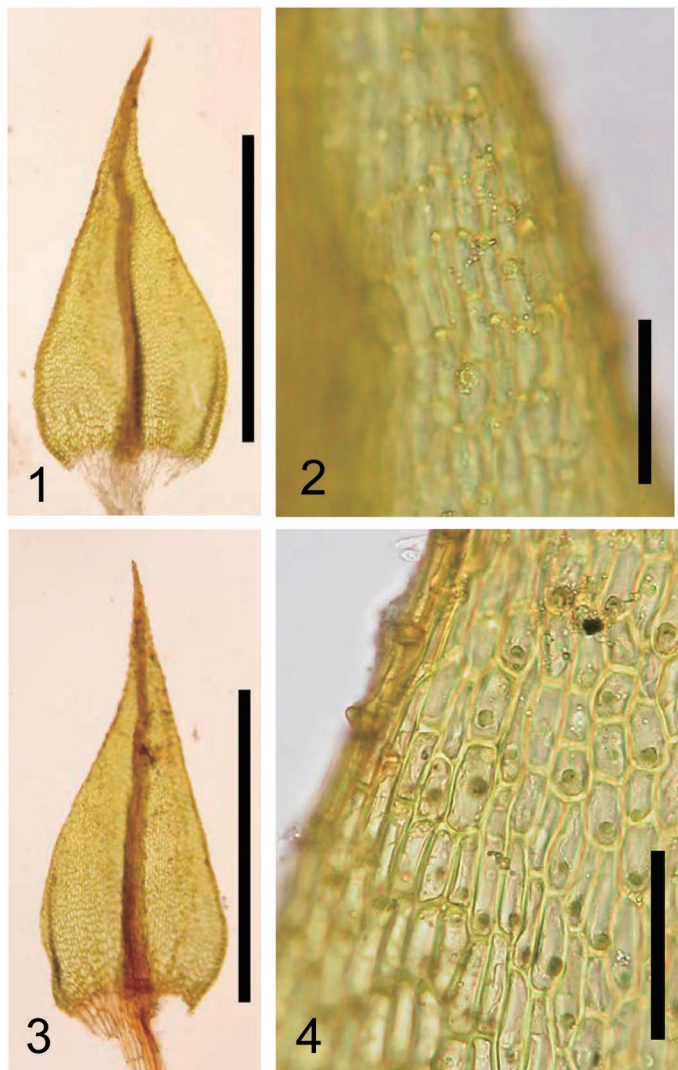


Fig. 2. *Philonotis trachyphylla* Dixon & Badwh. (Higuchi 19487). 1, 3. Leaves. Scale bar = 1 mm. 2. Ventral surface of cells at upper part of leaf. Scale bar = 50 µm. 4. Dorsal surface of cells at upper part of leaf. Scale bar = 50 µm.

2)

Rec. Bot. Surv. India 12: 175. 1938. —Holotype: **India**. Kashmir, Zanskar (below Shingo-la), 15 000 ft., 28th Aug. 1928 *R.L. Badhwar 931* (BM). —Paratype: Lahul-Bhaga valley (Ramzak to Rampozampa), 12 500 ft., *R.L. Badhwar 965* (BM).

At first, the Higuchi specimens from Pakistan were named as *Philonotis yezoana* Besch. & Cardot on the basis of the leaf cells with central papilla. However, the plants looked different

from the Japanese specimens of *P. yezoana* in having, in addition to leaf cells with central papilla, also cells with papilla at the proximal cell end. Other differences with *P. yezoana* s.str. were discovered, as well.

The Higuchi specimens and a number of similar unnamed specimens from Himalayan area were studied and compared with 11 Japanese *Philonotis yezoana* specimens (listed in Koponen *et al.*, 2012).

The plants in both groups have similar habit,

plants are slender, leaves distant on stem, with ovate leaf bases and acute to acuminate leaf apices. The shape of basal leaf cells is rather similar, wide, subquadrate, rectangular or rhomboidal. The apical leaf cells are narrow and mamillate/papillate at the distal cell end.

The differences are (1) in *Philonotis yezoana* the mid-leaf cells are $\pm$ quadrate or short rectangular with the papilla at the center of the cell. Only one specimen with some cells with papilla at the proximal cell end was found. In the Himalayan plants, mid-leaf cells are quadrate rectangular and elongate rectangular. The narrower central leaf cells are either with a central mamilla or the mamilla/papilla is near the proximal cell end on lumen (Fig. 2: 4). Cells with central papilla are present in any part of the leaf, also on the narrow elongate cells near leaf border or costa. The position of the cells with central papilla on leaves and the number of such cells varies even on leaves from the same stem. (2) The leaf borders in *P. yezoana* are plane or only slightly recurved at leaf base, the leaf border in the Himalayan plants is strongly recurved from base to near the apex. (3) The leaf margin is entire or slightly serrulate or double-crenulate in *P. yezoana*. The Himalayan plants have strongly toothed margin by double-crenulate teeth. (4) The leaves of *P. yezoana* are plane, the leaves in some Himalayan specimens are plicate. (5) *P. yezoana* has thin-walled lamina cells while the plants in the Himalayan populations have thick-walled, firm cell walls.

In 1996, in an early phase of the study of SE Asian *Philonotis* (by T. Koponen) the identity of the type specimen of *P. trachyphylla* Dixon & Badhw. (in BM) remained uncertain. It was hesitatingly named as *P. tomentella* Molendo, although the leaf shape is different. In 2004, Blanka Buryová attached the identification label on the specimen: "*Philonotis* sp. — not *P. tomentella* Jur." The type specimen of *P. trachyphylla* resembles *P. tomentella* in having the basal marginal cells elongate rectangular and having a tall papilla at the proximal cell end. Similarly, the leaf margin is recurved and the leaf is plicate.

The leaves are broadly ovate and with a short, acute point, while the leaves in *P. tomentella* are gradually tapering from triangular base to acuminate apices, the narrow distal part of leaf is 1/4–1/3 of leaf length and straight or slightly bending to different directions (Koponen *et al.*, 2012).

In the type of *P. trachyphylla* most of the cells have the papilla at the proximal cell end, but several cells with central papilla were found. This, and the other characters such the shape of leaves, strongly recurved leaf margin, serration of the leaf margin and thick-walled lamina cells correspond to the unnamed Himalayan specimens discussed above.

The site of the papilla/mamilla on the lamina cells and the presence of differently papillate/mamillate cells in different parts of the leaf is one of the few stable characters by which the identification of *Philonotis* species can be done. In the species of *Philonotis* section *Philonotis*, in addition to *P. yezoana*, cells with central papilla are occasionally present in the quadrate basal leaf cells of *P. fontana* and more regularly in the basal cells of *P. seriata* (Koponen *et al.*, 2012). The presence of cells both with central and proximal papillae/mamillae dispersed in all parts of the leaves is a unique character of *P. trachyphylla*. The recurved leaf border with rough dentation and thick-walled lamina cells are other constant characters which distinguish it from *P. yezoana* and reinforce the specific status to *P. trachyphylla*.

Specimens studied. **China.** *Yunnan.* Gaoligongshan region, Gongshan Co.: Eastern slope of the Gaoligongshan. Along unimproved trail from tunnel at Heipu Pass toward lakes, headwaters of the Pula River, 51.5 km from the city of Gongshan, 27°45'N, 98°27'E. Alpine slopes of bamboo, *Salix* and *Betula*, stream from cirque in granitic boulder field, wet rocks in stream in sun, 3300 m, 12.IX.2013 J.R. Shevock 43015, with Ma, W.Z., Yao, Y.L. and Fan, X.Z. (CAS, E, H, KUN, MO, as *P. yezoana* in Koponen *et al.* (2019b), and: Gaoling Shan Range, Gongshan Co. at 3270–3715 m, D.G. Long 35756, 35818

(E), *J.R. Shevock 23306* (E). **India.** *Kashmir.* Lidda Valley, Liddarwat, S-facing mountinside at 10750', 4.IX.1983 *C.A. Chadwell B107* (E). *Himachal Pradesh.* Udaipur, Chimrat, rocks near waterfall at 3650 m, 10.VIII.1990 *R.J.D. McBeath 2438* (E). *Sikkim.* West Distr.: Dzongri, 27°28'N, 88°09'E. Small marshy valley, in cushions at margin of flush, 3965 m, 16.VII.1992 *D.G. Long 22633* (E, as *P. yezoana* in Koponen *et al.*, 2019b). **Nepal.** *Sankhuwasabha Distr.* Upper valley of tributary N of Barun Khola, NE of Pemathang Kharka, open rocky alpine valley, in boggy ground by stream at 3950 m, 9.X.1991 *D.G. Long 21084* (E, as *P. yezoana* in Koponen *et al.* 2019b). **Pakistan.** *North-West Frontier Prov.* Kaghan Valley, Batakundi, *Higuchi 19837*, on soil at 2800; Swat Valley, Matildan – Lake Mahodand, *Higuchi 19487*, on wet soil at 2800 m; Lake Mahodand (N of Matiltan), *Higuchi 19561* (coll. T. Nakaike), on rock-cliff at 2900 m.

Excluded and Doubtful

Philonotis calcarea (Bruch & Schimp.) Schimp. Coroll. Bryol. Eur. 86. 1856. —*Bartramia calcarea* Bruch & Schimp., Bryol. Eur. 4: 49. 325. 1842. —*Philonotis fontana* ssp. *calcarea* (Bruch & Schimp.) Boulay, Musc. France 214. 1884. — Type: Europe (not seen).

The specimens reported as *Philonotis calcarea* from Pakistan by Brotherus (1898) are *P. falcata*, see above. *P. calcarea* is mostly a European species. Easternmost localities in Asia are in Altai in Russia (Koponen *et al.*, 2012), Kazakhstan and Kyrgyzstan (Koponen, in prep.)

Philonotis marchica (Brid.) Hedw.

Bryol. Univ. 2: 23, 735. 1827. —*Mnium marchicum* Hedw., Spec. Musc. 196. 1801. — Type: Europe (not seen).

Störmer (1954) recorded *Philonotis marchica* from Pakistan. The voucher specimens (leg. *P. Wendelbo, s.n.*) are *P. falcata* (see above).

Philonotis marchica occurs in Europe, near East in Asia and North America. Its presence in

Korea and Japan was excluded by Ochi (1962, 1963), and its presence in China was doubted by Koponen (2010b).

According to Koponen *et al.* (2012), the leaves of *Philonotis marchica* are not as carinate as the leaves in *P. falcata*, have a narrower costa, always serrate, not partly biseriate leaf margin. The leaves in some specimens are as rows on stem, but not in all specimens. The papilla of leaf cells seem to be taller at the basal leaf than the papilla in *P. falcata*, and the cells are narrower, which makes the cell areolation more dim than the translucent basal leaf in *P. falcata*. According to Ochi (1962, 1963), *P. falcata* differs from *P. marchica* having leaves more triangular, more strongly carinate, and arranged in regular rows on stem. Cells of leaf-blade are more conspicuously broader toward base, which is hardly narrowed.

Philonotis turneriana (Schwägr.) Mitt.

J. Proc. Linn. Soc., Bot., Suppl. 1: 62. 1859. — *Bartramia turneriana* Schwägr., Spec. Musc. Suppl. 3(1): 238. 1828 (“*Turneriana*”). — Lectotype (designated by Koponen, 2009b): Nepal. “*Bartram Hookeriana Turneriana* var Nepal Hook [illegible] longiss cuspidater fol Schwaegrichen cui Hooker misit (G, herb. Schwägrichen; also fragment in G); syntype: “cui misit Hooker” (G, herb. Schwägrichen).

Philonotis nitida Mitt., J. Proc. Linn. Soc., Bot., Suppl. 1: 62. 1859. —*Bartramia nitida* Wils., Kew J. Bot. 9: 370. 1857, *nom. nud.* — Lectotype (designated by Koponen, 1998): NW. Himalaya, Simla, 7 000 ped., *T. Thomson 561* (NY); isolectotype (BM); syntypes: N.W. Himalaya, *Royle* (NY, BM, ex herb. Hooker). — Synonymized actually by Fleischer (1904) by citing no. 561 in the list of synonyms, and by Koponen (1998).

We confirmed the identity of the vouchers cited by Noguchi (1956, *Sultan Ahmed 22*) and Robinson (1965, *G.L. Webster & E. Nasir 5977, 5983, 6161, 6126*) as *Philonotis turneriana* from Pakistan. They are *P. falcata* (see above). Also the record by Herzog (1938, *Karsten 63*) as *P.*

nitida from Pakistan is *P. falcata* (see above).

Townsend's (1993, Townsend 73/1624) record as *P. turneriana* (see above) is *P. laii*.

The characters of *Philonotis turneriana* are its lustrous, lanceolate, plane or slightly concave, $\pm$ straight leaves with piliferous apex, and rather opaque areolation throughout the leaf. Leaf border may be slightly revolute at basal leaf. Such plants occur in the Himalayas and Yunnan and Sichuan provinces of China and have been identified from the Philippines and Taiwan (Koponen, in prep).

For understanding the taxonomy and nomenclature of East Asiatic *Philonotis*, it is necessary to understand the status of *P. turneriana*, since it is the second oldest taxon described from the Himalayan area (see Koponen, 1998, 2009b, 2010c). In addition to *P. turneriana*, *P. laii*, *P. mollis* (Dozy & Molk.) Mitt. and *P. secunda* (Dozy & Molk.) Bosch & Sande Lac. have longly acuminate leaves, and *P. falcata* and *P. speciosa* (Griff.) Mitt. may have acuminate leaves. *P. turneriana* has a piliferous leaf apex one fifth of the leaf length. *P. mollis* has similarly piliferous leaves but the piliferous part of the leaf apex is longer. The best microscopic character separating *P. mollis* from *P. turneriana* and from *P. secunda* is its lax basal areolation and its low papillae and, therefore, transparent areolation. The leaves in *P. mollis* and *P. turneriana* are gradually tapering while the leaves in *P. secunda* taper more quickly from ovate base, and it has often a group of translucent, subquadrate, strongly papillate angular cells. In the forms of *P. speciosa* with piliferous leaves, the piliferous part is fragile and the apex then is truncate.

The plants most commonly named as *Philonotis turneriana* are forms of *P. falcata* with longly acuminate leaves. The long-leaved forms of *P. falcata* can be separated from *P. turneriana*, in addition to ranked leaves, by carinate and $\pm$ triangular leaf base, the more strongly bending nerve which makes the leaf falcate. The basal leaf cell areolation in *P. falcata* is more lax and cells subquadrate to short rectangular, while in *P. turneriana* the narrow linear to vermiculate leaf

cells extend to two lowest rows of basal cells. In *P. turneriana* the basal leaf cells have prominent papillae, which are lower in *P. falcata*.

The leaf shapes of *Philonotis turneriana* and *P. laii* are rather similar. *P. laii* is smaller and has narrower, long acuminate but not piliferous leaves. The leaf cell areolation has long, translucent, rectangular and narrow cells, while the cell areolation in *P. turneriana* is opaque and cells shorter. The creeping stem apices or innovations with propagules and miniature leaves are absent in *P. turneriana*.

Mniaceae

Mnium lycopodioides Schwägr.

Spec. Musc. Suppl. 2(2): 24, pl. 160, figs. 1–9. 1826. —Lectotype (designated by Koponen 2014): Nepal. Wallich (BM, no. 2510 dupl.).

The record of *Mnium riparium* Mitt. from Pakistan (Störmer 1954) is here corrected to *Mnium lycopodioides*. *M. riparium* represents a dioicous population of *Mnium marginatum* (Dicks.) P. Beauv. It has once been found in Britain (Koponen, 1980).

Acknowledgments

Collection of plants was supported in part by Grant-in Aid (no. 02041091) from the Ministry of Education, Culture, Sports, Science and Technology, Japan. The curators of the herbaria (BM, E, JE, NICH, OSLO, US) are thanked for forwarding specimens on loan to our study.

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