

# On the taxonomy of some East Asian *Brachythecium* (Brachytheciaceae, Musci)

Michael S. Ignatov & Timo Koponen

*Michael S. Ignatov, Main Botanical Garden of Russian Academy of Sciences, Botanicheskaya 4, 127276 Moscow, Russia*

*Timo Koponen, Department of Ecology and Systematics, P.O. Box 7, FIN-00014 University of Helsinki, Finland*

*Received 19 March 1996, accepted 22 September 1996*

The taxonomy of *Brachythecium buchananii* (Hook.) Jaeg., *B. garovaglioides* C. Müll., *B. glaciale* Schimp., *B. helminthocladum* Broth. & Par., *B. plumosum* (Hedw.) Schimp., and *B. rivulare* Schimp. in East Asia are discussed. Descriptions and illustrations based on specimens from China are provided, and distribution and habitat ecology discussed. *Brachythecium longicuspidatum* (Mitt.) Jaeg. is considered distinct from *B. garovaglioides* and *B. procumbens* (Mitt.) Jaeg. from *B. buchananii*. *Brachythecium abakanense* Kaal., *B. amnicola* C. Müll., *B. carinatum* Dix., *B. cuspidiferum* (Mitt.) Jaeg., *B. fasciculirameum* C. Müll., *B. perminusculum* C. Müll., *B. pilicuspis* C. Müll., *B. planiusculum* C. Müll., *B. tenuipilum* Dix., *B. thraustum* C. Müll., *B. viridefactum* C. Müll., *B. yunnanense* Herz., and *B. buchananii* var. *gracile* Broth. are considered to be synonymous with *B. buchananii* (Hook.) Jaeg.; *B. complanatum* Broth., *B. nivescens* Broth. in Par., *B. wichurae* (Broth.) Par., and *B. wichurae* var. *robustum* Dix. are conspecific with *B. garovaglioides* C. Müll.; *B. rivulare* var. *gracile* Broth., *B. glaucoviride* C. Müll., and *B. permolle* C. Müll. are conspecific with *B. rivulare* Schimp.; *B. densirete* Broth. & Par., *B. glauculum* C. Müll., *B. homocladum* C. Müll., *B. oedistegium* (C. Müll.) Jaeg., and *B. subpopuleum* Card. & Thér. are conspecific with *B. plumosum* (Hedw.) Schimp. Lectotypes are selected for 17 names (indexed). *Brachythecium garovaglioides* is recorded for the first time from Burma and Indonesia and *B. glaciale* for the second time from the Sichuan Province of China. The presence of *B. procumbens* in China and Japan is doubted. The presence of *B. helminthocladum* in China is confirmed. After these synonymizations the number of *Brachythecium* taxa in China is 48 species and 12 infraspecific taxa.

**Key words:** *Brachythecium*, distribution, East Asia, nomenclature, taxonomy

In the recent checklist of mosses of China, Redfearn *et al.* (1996) listed as many as 62 species (actually 63 species, when the validly published

*Brachythecium subpopuleum* Card. & Thér. is included) and 13 infraspecific taxa of *Brachythecium*. This number seems too high, contrasting

with the better studied territories of Japan with 32 species and 1 variety (Noguchi 1991); East Himalayas with 11 species (Gangulee 1978); the Himalayas altogether have 32 species and 2 varieties (Vohra 1983); U.S.A. and Canada have 34 species and 3 varieties (Anderson *et al.* 1990); Mexico has 11 species (McFarland 1994); Europe and Macaronesia have 31 species and 11 infraspecific taxa (Duell 1992), former territory of the USSR has 28 species and 1 variety (Ignatov & Afonina 1992). Certainly, the high number of names for China depends mostly on the lack of re-examination of many types of species, described by C. Müller, and also by V. F. Brotherus and H. N. Dixon. Many of these taxa are known mostly or exclusively from the type material. Because Carl Müller's herbarium has been destroyed, we select located iso- or syntype specimens as lectotypes when possible.

The collections made recently by T. Koponen from Sichuan, Yunnan and Taiwan, as well as the study of herbarium material (especially in H, S, MHA) allow us to estimate the variability of some species and to re-evaluate the rank of several taxa. The following descriptions are based on these Chinese specimens. We cite Koponen's specimens in an abbreviated way, since they will be dealt with in detail in other publications later. Koponen's collecting localities in Sichuan were listed by Koponen (1994) and Stenroos *et al.* (1994). Details of the collecting localities (numbers in italics in the lists) in Yunnan (T. Koponen in 1985), and Taiwan (T. Koponen in 1970) will be published later and can be received from the second author on request until then. The first set of Koponen's specimens are preserved in the Botanical Museum, University of Helsinki (H), and duplicates will be distributed as exchange from the same institute.

After the synonymizations in this paper the number of *Brachythecium* taxa in China is 48 species and 12 infraspecific taxa.

***Brachythecium buchananii* (Hook.) Jaeg. (Figs. 1, 2)**

Ber. St. Gall. Naturwiss. Ges. 1876–77: 341. 1878 (Adumbr. 2: 407). — *Hypnum buchananii* Hook., Trans. Linn. Soc., 9: 320, pl. 28, fig. 3. 1808 ('*Buchanani*'). — Type: Nepal. *Buchanan* (BM!, lectotype, *nov.*, BM!, S!, NY!, isotypes).

*Brachythecium abakanense* Kaal., Kongel. Norske Vidensk. Selsk. Skr. (Trondheim) 1918(2): 8, pl. 1: a–c, pl. 2: d. 1919. — Type: Southern Siberia, island in Abakan-floden near Askys. 15.VI.1914 *Printz* (BG!, holotype). — Synonymised by Ignatov and Afonina (1992).

*Brachythecium amnicola* C. Müll., Nuov. Giorn. Bot. Ital., n. ser. 3: 125. 1896 ('*amnicolum*'), *syn. nov.* — Type: China interior, prov. Schen-si sept., in saxis secus rivulos prope Huo-gia-ziez, 20.IX.1890 *Giraldi* (det. C. Müller n. 1008, H-BR 362002!, lectotype, *nov.*).

*Brachythecium carinatum* Dix., Rev. Bryol. Lichénol. n. ser. 7: 114. 1934, *syn. nov.* — Type: China. Manchuria, Prov. Ryonei, Sookako, 1.VIII.1931 *Kobayasi* 3943 (BM!, holotype).

*Hypnum cuspidiferum* Mitt., J. Linn. Soc. Bot. Suppl. 1: 78. 1859, *syn. nov.* — *Brachythecium cuspidiferum* (Mitt.) Jaeg., Ber. St. Gall. Naturw. Ges. 1876–77: 342. 1878 (Adumbr. 2: 408). — *B. buchananii* var. *cuspidiferum* (Mitt.) Gang. & Vohra, Mosses Eastern Ind., 7: 1712. 1978. — Type: India. Sikkim, Nangkli, 10 000', *J. D. Hooker* (NY!, holotype).

*Brachythecium fasciculirameum* C. Müll., Nuov. Giorn. Bot. Ital., n. ser. 4: 269. 1897, *syn. nov.* — Types: China interior, Schen-si sept., Sche-kin-tsuen (Hu-schien) ad latera montium Tsin-lin, 28.XII.1895 *Giraldi* (det. C. Müller n. 1411, H-BR 0362004!, lectotype, *nov.*, S!, isolectotype); Pan-ko-tschien (Hu-schien), in muro vetusto "varietas flaccida", 10.I.1896 *Giraldi* (det. C. Müller n. 1470, H-BR 362007!, G!, syntypes).

*Brachythecium perminuscolum* C. Müll., Nuov. Giorn. Bot. Ital., n. ser. 5: 200. 1898, *syn. nov.* — Types: China interior, prov. Schen-si sept., in monte Tui-kio-san, 4.IX.1896 *Giraldi* (det. C. Müller n. 1865, H-BR 0390012!, lectotype, *nov.*); in alveo fluminis Lao-y-huo prope Schangen-ze, 12.III.1897 *Giraldi* (det. C. Müller n. 1887, H-BR 0362010!, syntype).

*Brachythecium pilicuspis* C. Müll. in Par., Ind. Bryol. Suppl. 47. 1900, *nom. nud.*, *new assign.* — Original collection: "*Brachythecium pilicuspis* C. Müll. sp. nova. N.W. India: Mussoorie. Leg. J. F. Duthie 1899" (H-BR 0363003!, ex herb. J. Cardot).

*Brachythecium planiusculum* C. Müll., Nuov. Giorn. Bot. Ital., n. ser. 4: 268. 1897, *syn. nov.* — Types: China interior, prov. Schen-si sept., Fu-Kio, IX.1894 *Giraldi*, c. fr. (det. C. Müller n. 1469, H-BR 0390009!, lectotype, *nov.*, G!, isolectotype); same locality and date (det. C. Müller n. 1468, H-BR 0390008!, syntype).

*Brachythecium tenuipilum* Dix. in Yang, Sci. Rep. Nat. Tsing Hua Univ. B. Biol. Sci. 2: 130. 1936, *nom. nud.*, *new assign.* — Original collections: China. Hopei, on rocks, roadside, under *Ulmus*, East Tomb, 17.XI.1934 *C. Y. Yang* 66 (BM); same, on grassy slope 10.XI.1934 *C. Y. Yang* 7 (BM!).

*Brachythecium thraustum* C. Müll., Nuov. Giorn. Bot. Ital. n. ser. 4: 270. 1897, *syn. nov.* — Type: China interior, prov. Schen-si sept., in monte Lao-y-san, III.1896 *Giraldi* (not seen, see below).

*Brachythecium viridefactum* C. Müll., Nuov. Giorn. Bot. Ital., n. ser. 4: 270. 1897. — Type: China interior,

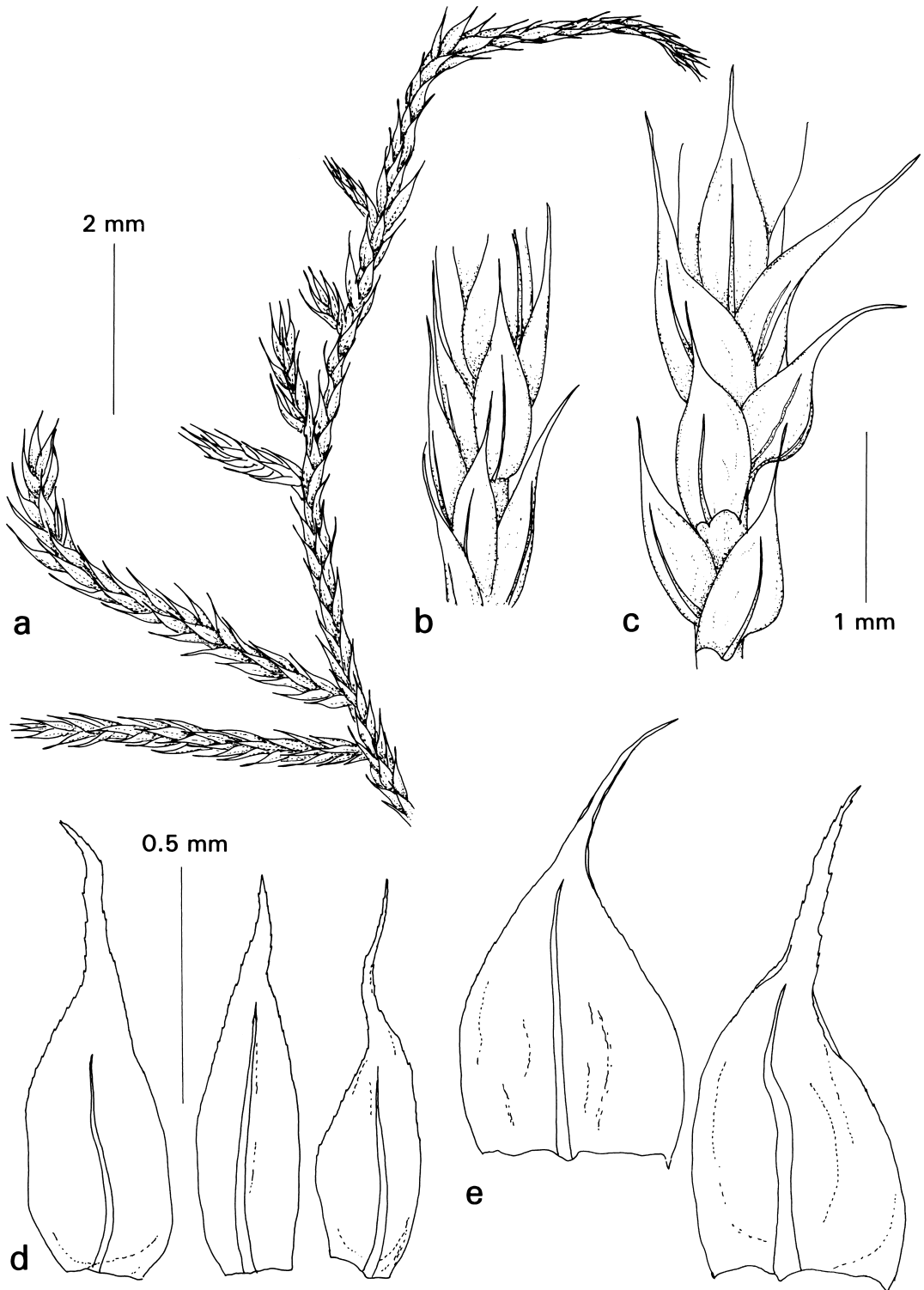


Fig. 1. *Brachythecium buchananii* (Hook.) Jaeg. (a–c: Yunnan, *Koponen 42190*; d, e: isotype, S). — a: Habit. — b: Part of branch. — c: Portion of shoot. — d: Branch leaves. — e: Stem leaves. — Scale bars: 2 mm for a; 1 mm for b, c.

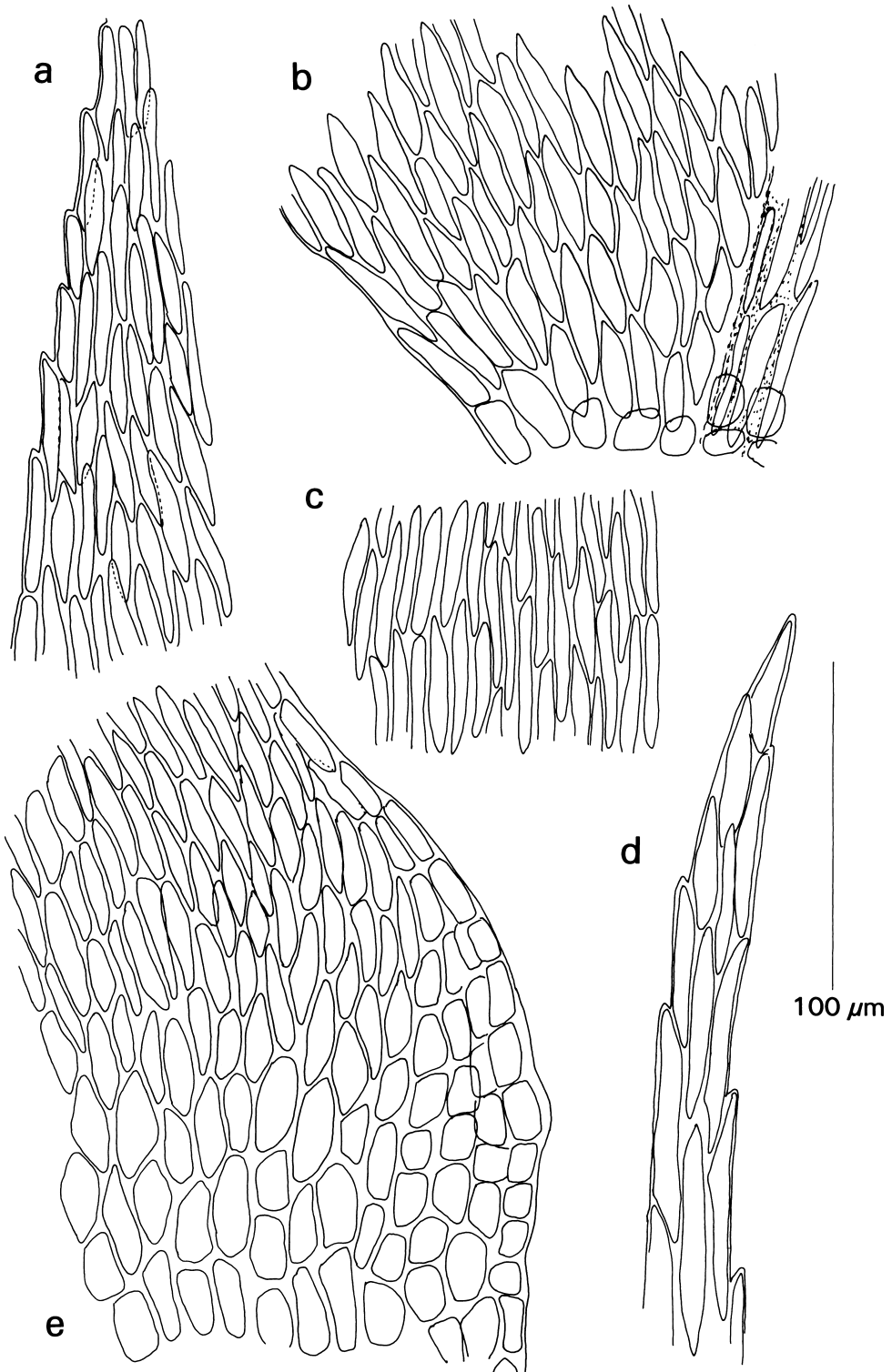


Fig. 2. *Brachythecium buchananii* (Hook.) Jaeg. (isotype, S). — a: Middle part of branch leaf at margin. — b: Base of branch leaf. — c: Middle cells of stem leaf. — d: Apex of stem leaf. — e: Base of stem leaf.

Schen-si sept., prope Schan-kio, VIII.1895 *Giraldi* (det. C. Müller n. 1405, H-BR 0410002!, lectotype, *nov.*, S!, G!, isolectotypes); in monte Lun-san-huo, XI.1895 *Giraldi* (det. C. Müller n. 1404, H-BR 0401001!, syntype). — According to Redfearn *et al.* (1996) synonymized by Qian (unpublished).

*Brachythecium yunnanense* Herz., *Hedwigia* 65: 167. 1925, *syn. nov.* — Type: China. Yunnan, Pe yen tsin, *Ten 24* (H-BR 0362021!, isotype).

*Brachythecium buchananii* var. *gracile* Broth. ex Sasaoka, *Bot. Mag. Tokyo* 35: 69. 1921, *nom. nud.*, *new assign.* — Original collection: Japan. Prov. Mimasaku: Toyama-mc., Tomada-g., (on rocks), 4.VIII.1918 *Nagai* (H-BR 0373058!).

*Notes on typifications.* Due to plasticity in this species the name *Hypnum buchananii* needs careful typification. In BM there are three sheets with collections of Buchanan from Nepal. Two specimens numbered H3506 are supplemented with pencil drawings; one specimen (in envelope) represents a branch portion, with drawings of branch leaves, the other is a stem with branches and one capsule, which is mounted on paper and supplemented with drawings of stem leaves. The latter is designated as the lectotype. All other specimens seem to be duplicates of the same collection and are considered to be isotypes, as well as the so labelled specimens in NY! and S!.

We could not study the type of *Brachythecium thraustum* C. Müll. If no original material is found in FI (see Levier 1906) one of the specimens "*C. Müller n. 1879*" listed below can be selected as neotype later.

Plants small to medium-sized, regularly pinnately branched, bright green, yellow-green or, more commonly, pale yellow, with silky gloss. Pseudoparaphyllia acuminate. Axillary hairs 2-celled, hyaline upper cell 60–80 µm long. Stem 1–5 cm long with branches up to 0.5 cm long. Stem leaves erecto-patent, straight to somewhat flexuose, from ovate or broadly ovate base ± abruptly narrowed to long-acuminate apex, concave, slightly or moderately plicate, 1.0–1.8(2.5) mm long, 0.5–0.9 mm wide; nerve reaching 4/7–2/3 of leaf length, 40–80 µm wide near base, not ending in a spine; margin plane or reflexed or recurved in transition to acumen, finely denticulate throughout to almost entire; mid-leaf cells 35–65 × 4.5–6 µm, slightly flexuose; basal cells shorter and wider, more strongly incrassate and porose; alar cells shortly rectangular to subquadrate, 15–30 × 12–18 µm, in large transversely triangular group usually reaching from leaf margin 1/2–3/4 or more of distance to nerve, shortly decurrent. Branch leaves narrower than stem leaves, more concave, without distinct plicae, more strongly denticulate,

nerve often exerted on abaxial surface near the leaf base, so leaf in lower portion is rather keeled; acumina of branch leaves often flexuose when dry. Dioicous. Perichaetial leaves from broadly ovate base, ± suddenly narrowed to longly acuminate apex, nerve weak and indistinct. Seta ca. 10 mm long, smooth throughout. Capsule slightly inclined. Operculum conic. Annulus absent. Exostome well developed, above entire. Endostome well developed, pale yellow, cilia mostly 2, as long as segments, nodose. Spores 8–13 µm.

The species is dioicous and rarely found with sporophytes. The lack of an annulus and the slightly inclined capsule in *Brachythecium buchananii* indicate its affinity with the widespread tropical and subtropical American species *B. stereopoma* (Spruce) Jaeg. Recently McFarland (1994) suggested segregating them in a new section, roughly corresponding to the unnamed group "II.A" defined within the section *Salebrosa* Limpr. by Brotherus (1925: 360). Both species are extremely variable and seem to be the most common representatives of the genus in the corresponding south temperate areas of East Asia and Central America. On average, *B. stereopoma* is a larger plant with denser foliation, and the cells at the leaf base are not as lax as in *B. buchananii*. However, some weak forms of *B. stereopoma* are very similar to some forms of *B. buchananii*.

Buck (1993) suggested that *Brachythecium stereopoma* is conspecific with the African *B. implicatum* (Hornsch.) Jaeg.

In sterile condition *Brachythecium buchananii* can be recognized by small to medium-sized plants, pale colour, concave and above ± abruptly contracted leaves, very lax areolation of the base of the branch leaves, costa abaxially distinctly exerted in the lower portion of the leaves, so that the leaf at base looks keeled. The stem leaves are usually moderately plicate, slightly to moderately decurrent, usually abruptly tapered from the ovate base. The width of the median lamina cells is variable. Typically, above the several rows of basal cells there is a zone of cells that are about 7 µm wide, whereas the cells in the upper leaf (usually starting close to where the costa ends) are narrower, ca. 5 µm wide. However, sometimes narrow cells reach near the base. Such a pattern is seen, for example, in the type specimen of *B. viridefactum*. However, transitional forms indicate

that this taxon is only an extreme phenotype of *B. buchananii*.

*Brachythecium buchananii* is very common in China, Japan and the Himalayan region, extending westwards to Pakistan (Nishimura & Higuchi 1993), northwards to South Siberia: Altai (Ignatov 1994) and the Sayan Mountains, South Baikal Area, south of the Russian Far East, southwards to Vietnam, Thailand and Burma (Tan & Iwatsuki 1993; specimens were seen from the two latter countries), and to the Philippines (Tan & Iwatsuki 1991; specimens seen in NY and FH).

*Selected specimens studied.* — **China.** Shaanxi. China interior, prov. Schen-si sept., prope In-Kia-po, 25.VIII.1896 *Giraldi*, (det. C. Müller n. 1879 as *B. thraustus*, H-BR 0390009!, G!, S!). Sichuan. Nanping Co. Shu-Zheng, secondary orotemperate forest, 2 300 m, on boulder, *Koponen* 46385 (H). Yunnan. Lijiang Co., 2 525–3 680 m, 1985 *T. Koponen* 2a. 42761. 4a. 39725. 4c. 43332. 5b. 42474. 6b. 39877. 7d. 42526. 8a. 42190, 42204. 8b. 42227, 42235, 42243. 8c. 42271. 9a. 42063. 9b. 42134. 10a. 43194, 43198. 11b. 42895. 11c. 43015 (all H).

### **Brachythecium procumbens** (Mitt.) Jaeg.

Ber. St. Gall. Naturwiss. Ges. 1876–77: 341. 1878 (Adumbr. 2: 407). — *Hypnum procumbens* Mitt., J. Linn. Soc. Bot. Suppl. 1: 79. 1859. — Type: India. In mont. Nilghiri, *Thomson 1141* (FH! lectotype, *nov.*, syntypes in NY!, see below, and H-SOL!).

Takaki (1955) compared *Brachythecium buchananii* var. *gracillimum* Dix. with *B. procumbens* and found similarities between them. He provided some characters for their distinction. However, he could not study the original collection of *B. procumbens*, but based his opinion on some other Indian collection. The separating characters of *B. buchananii* and *B. procumbens* were discussed also by Vohra (1983). We agree that these two species are distinct, but disagree with both Takaki and Vohra regarding how to separate them. *Brachythecium procumbens* is a more robust plant than *B. buchananii*, with less concave and less plicate stem leaves, which are, however, abruptly tapered to a long acumen in both species. In *B. procumbens* the lamina cells are narrowly linear nearly almost throughout the leaf, with a less extensive area of basal cells than in *B. buchananii*. These differences were observed in all duplicates of the collection *Thomson 1141* (in

NY, FH, H-BR). We suggest typifying this species by the FH duplicate rather than the NY duplicate, where the main collection of Mitten is deposited. The reason is that in NY the specimen *Thomson 1141* is labelled “Madras”, which disagrees with the protologue. However, this appears to be just a labelling error, since all specimens of *Thomson 1141* in these three herbaria are similar.

The distribution of *Brachythecium procumbens* is limited to India, Nepal and Sri Lanka. All so-named collections studied in FH, H, NY, and S until now from China and Japan belong to other species, mostly to *B. buchananii*.

### **Brachythecium garovaglioides** C. Müll. (Figs. 3, 4)

Nuov. Giorn. Bot. Ital., n. ser. 4: 270. 1897. — Type: China interior, prov. Schen-si, Sche-kin-tsuen (Hu-schien), parce inter alios muscos, 28.XII.1895 *Giraldi* (det. C. Müller n. 1462, H-BR 0362006!, lectotype, *nov.*).

*Brachythecium complanatum* Broth., Rev. Bryol. n. ser. 2: 11. 1929, *syn. nov.* — Type: Russia. Amur, distr. Zeiskobureinsk, Michailofskoje, 25.VI.1910 *Korotki* (H-BR 0418046!, holotype, LE!, isotype).

*Brachythecium nivescens* Broth. ex Par., Ind. Bryol. Suppl. 46. 1900, *nom. nud.*, *new assign.* — Original collection: Burma. “*Hypnum nivescens* Broth. Birma, 639 ex Herb. E. Zickendrath” (H-BR 0364001!, 0364002!, S!).

*Hypnum Wichurae* Broth., Hedwigia 38: 239. 1899, *syn. nov.* — *Brachythecium wichurae* (Broth.) Par., Ind. Bryol. Suppl. 52. 1900. — Type: Japan. Nagasaki, an Felsen, *Wichura 1451f*, (H-BR 0402006!, holotype).

*Brachythecium Wichurae* var. *robustum* Broth. ex Dix., Rev. Bryol. n. ser. 4: 158. 1932, *syn. nov.* — *Brachythecium Wichurae* forma *robusta* Broth., Symb. Sin. 4: 106. 1929, *nom. nud.* — Type: China. Yunnan, zwischen Kalkfelsen auf dem Tschangtschung-schan, 2 375 m bei Yunnanfu, *Handel-Mazzetti 8625* (not seen, on loan from H-BR), in regione calide temperate prope urbem Yunnanfu, in silva Keteleeria ad templum Djindien-se, in terra 2 050 m, *Handel-Mazzetti 81* (H-BR 0402003!, S!, syntypes). — Synonymized by Takaki (1955).

*Note.* It is obvious that specimens named by Brotherus in H-BR as *Hypnum nivescens* Broth. represent the original of *Brachythecium nivescens* Broth. ex Paris.

Plants robust, ± regularly pinnately branched, bright yellow–green to pale green or pale yellow, glossy. Pseudoparaphyllia acuminate. Axillary hairs 2-celled, hyaline upper cell 40–60 µm long. Stem 3–5 cm long or longer, tumidly foliated. Stem leaves soft and rugose, straight to somewhat

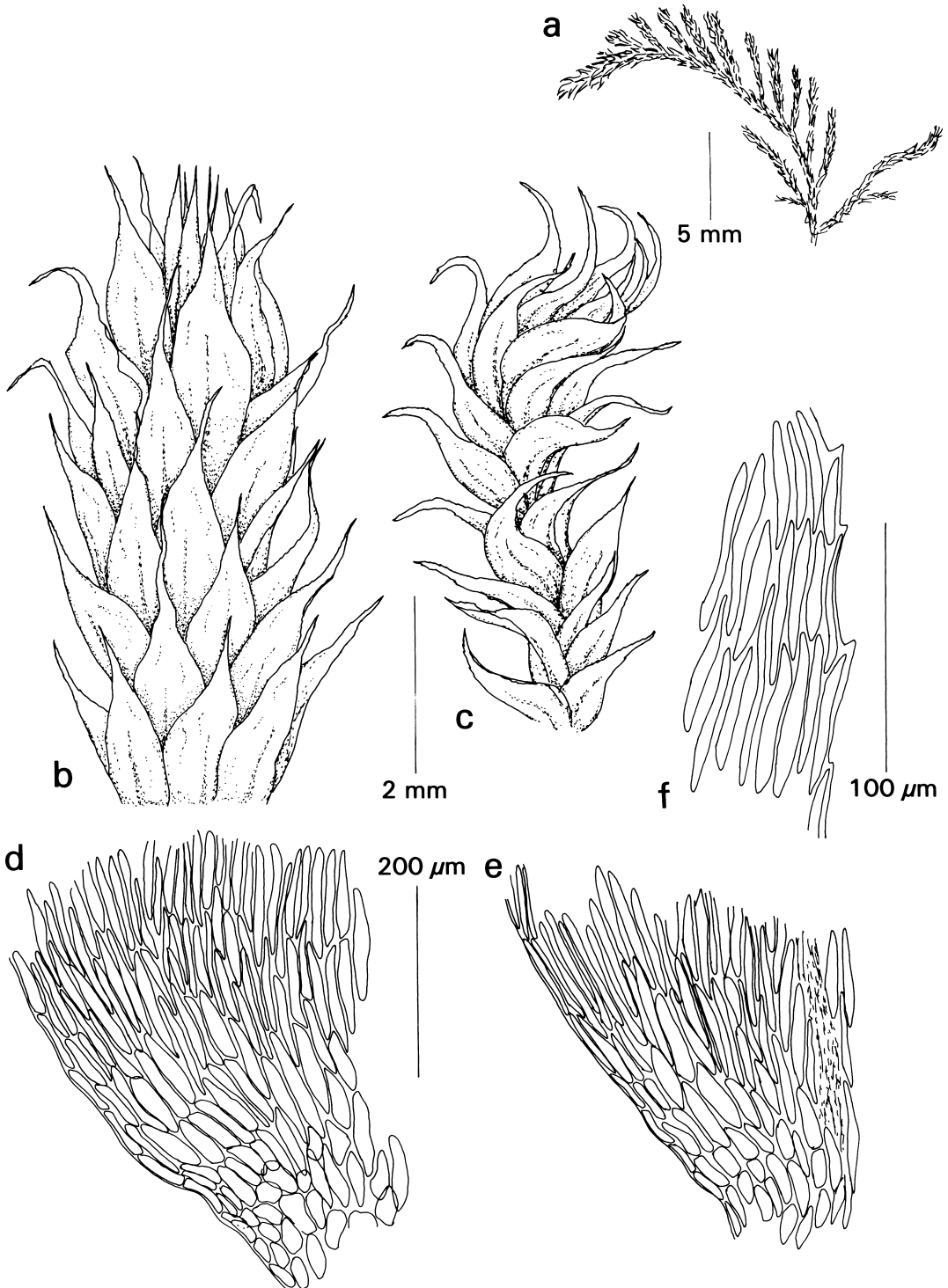


Fig. 3. *Brachythecium garovaglioides* C. Müll. (a: Sichuan, *Koponen 47481*; b–f: type, H-BR). — a: Portion of shoot. — b, c: Stem tips, showing variations. — d, e: Basal cells. — f: Midleaf cells at margin. — Scale bars: 5 mm for a; 2 mm for b, c; 200 µm for d, e; 100 µm for f.

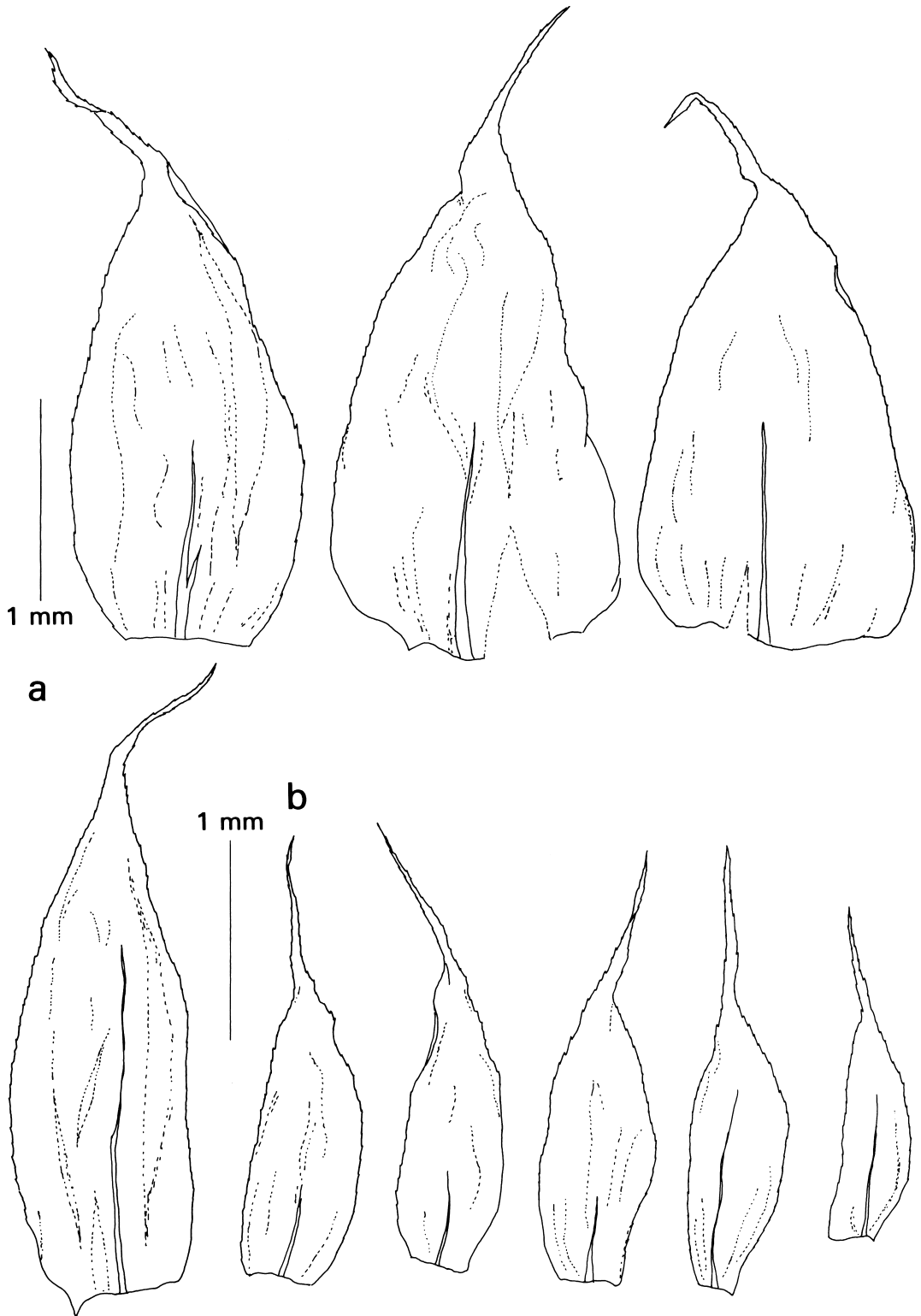


Fig. 4. *Brachythecium garovaglioides* C. Müll. (type, H-BR). — a: Stem leaves. — b: Branch leaves.



flexuose or falcate, shortly decurrent, from ovate or broadly ovate base abruptly contracted to narrow acumen, very concave, strongly plicate, ca. 3.0 mm long, 1.5 mm wide; nerve reaching 3/7–5/7 of leaf length, 40–60 µm wide near base, not ending in a spine; margin finely denticulate to subentire below, sharply serrate above, especially in acumen; mid-leaf cells (50)80–120(155) × 9–12 µm, not or slightly flexuose; toward the base transit to the group of wide basal cells, ca. 70–100 × 20 µm, occupying the whole area to the costa and becoming smaller towards insertion, there up to 30 × 15 µm. Branch leaves narrower than stem leaves, more strongly denticulate. Autoicous or dioicous. Seta ca. 15 mm long, smooth throughout. Capsule slightly inclined. Operculum obtusely conic. Annulus of 1 row of separating cells. Exostome well developed, above entire. Endostome well developed, pale yellow, cilia 2, as long as segments, nodose.

In recent floristic publications (cf. Ignatov 1992, 1994, Koponen & Li 1992, Koponen & Luo 1992) this species has been called *Brachythecium wichurae*, described from Japan and well known due to revisions of Takaki (1955) and Noguchi (1991). *Brachythecium garovaglioides* is an earlier validly published name for this species.

*Brachythecium garovaglioides* is easy to recognize. Typical plants are at first glance more like a form of *Rhytidiadelphus triquetrus* (Hedw.) Warnst. rather than a *Brachythecium*. When growing in shade, the plants become more complanately foliate with many leaves falcate (but not especially secund). The leaves are always strongly concave, rugose and deeply plicate, the plicae having various directions, so that dry leaves look crumpled. Among the diagnostic characters are: (1) the sharply serrate upper leaf margin and (2) the large cells across the whole leaf base above the insertion cells.

*Brachythecium garovaglioides* is very variable in appearance. A form common in Japan has less plicate leaves with more or less straight apices. These plants appear more regular, somewhat resembling *B. helminthocladum*, and the type of *B. wichurae* represents such a form. The Asian mainland populations are usually more robust, with variously directed leaf acumens, making the plants tousled, irregular, “*Rhytidiadelphus triquetrus*-like”. However, the latter phenotype occurs also in Japan and there are transitions to typical

“*B. wichurae*”. Takaki (1955) compared Japanese plants with the typical mainland Asiatic form (= *B. wichurae* var. *robustum* Dix.) and synonymized it with *B. wichurae* var. *wichurae*. We agree with Takaki.

*Brachythecium garovaglioides* has been described as an autoicous species, but there are no perigonia in the fruiting specimen in H-BR; however the specimen is scanty, so the sexual condition can not be determined with certainty. *Brachythecium wichurae* was reported as dioicous by Takaki (1955). However, Koponen and Li (1992) found it autoicous in Yunnan and one of the studied fruiting collections from Japan (see below) is also autoicous. Only perichaetia were found in many various sterile collections. A parallel situation is known for *Brachythecium rivulare*, a mostly dioicous but occasionally autoicous species. The sexual condition may have only limited importance in the taxonomy of *B. garovaglioides* and *B. rivulare*, although in some other cases it can be used. For instance, *B. salebrosum* (Web. & Mohr.) Schimp. is constantly autoicous and frequently with sporophytes, while *B. buchananii* of the same section *Salebrosa* is dioicous and rarely with sporophytes.

The distribution of *Brachythecium garovaglioides* much resembles that of *B. buchananii*: Japan, China, Korea, Russian Far East (north to Amur River Basin), Altay, Himalayas, Pakistan (Nishimura & Higuchi 1993), and Burma. We have also seen one collection from Java.

*Selected specimens studied.* — **India.** Assam, nos. 739 & 747 ex Herb. E. Zickendrath (H-BR 0364004!, 0364005!). **Burma.** Rangoon, no 728 ex Herb. E. Zickendrath (H-BR 0364003!). **Nepal.** In montibus circa Khatmandu, II/IV. 1900 *Karnwar Narsing Rana* (H-BR 0364008!). **Indonesia.** Java, Pangerango, 1893 Möller (NY). **Japan.** *Uyematsu N 94* (H-BR 0402033).

### *Brachythecium longicuspidatum* (Mitt.) Jaeg.

Ber. S. Gall. Naturwiss. Ges. 1876–77: 341. 1878 (Adumbr. 2: 407). — *Hypnum longicuspidatum* Mitt., J. Proc. Linn. Soc. Bot. Suppl. 1: 77. 1859. — Types: India. Sikkim, (1) Nanghili; (2) Singalelah; (3) Tonglo, *J. D. Hooker* (NY!, syntypes).

*Note.* We prefer not to select any of the syntypes as the lectotype yet, since specimen 2 represents rather well developed plants, but sterile, while specimen 3 has sporo-

phytes, but with a relatively poor gametophyte. In Hooker's original collection (in BM) there may be more representative and larger syntype material.

The Himalayan *Brachythecium longicauspdatum* is very close to *B. garovaglioides*, but we consider it as a distinct species due to: 1) its almost entire leaf margins; 2) stem leaves which are very abruptly contracted into a narrow, "cirriphylloid" acumen, and strongly contracted at the base, which is composed of 3–4 very large cells in each of the leaf halves. We can confirm the occurrence of *B. longicauspdatum* only in the Himalayas; all the so-named collections from China (although not recorded from China by Redfearn *et al.* 1996) and Burma (in FH, NY, S) we assign to *B. garovaglioides*.

### *Brachythecium glaciale* Schimp. (Fig. 5)

Bryol. Eur. 6: 15, pl. 542. 1853 (fasc. 52–54, Mon. 11. pl. 8). — Type: Switzerland. Zwischen dem Fauthorn und Wildgerst (BM!, lectotype, *nov.*). Norway. Gustafjeld Norweg. occid., *Blytt* (BM!, syntype).

Plants medium-sized, ± regularly pinnately branched, green. Stem leaves from broadly ovate base abruptly narrowed to a short narrow acumen, strongly concave, smooth, erect or erecto-patent, straight; nerve ending in mid-leaf, 40–50 µm wide near base, but not far above becoming much thinner; margin plane, minutely denticulate above; mid-leaf cells 50–60 × 7–9 µm, flexuose; basal cells shorter and wider, more incrassate and porose; alar cells rectangular or shortly rectangular, slightly inflated, forming a limited triangular group which reaches usually 1/3–1/2 of the distance towards the nerve, shortly and narrowly decurrent. Branch leaves usually not much differentiated from the stem leaves. Dioicous. Chinese specimens seen without sporophytes.

*Brachythecium glaciale* is fairly rare in East Asia, although in China it has been reported from 7 provinces (Redfearn *et al.* 1996), including Sichuan. Some of those reports are doubtful, because *B. glaciale* is arctic–alpine and its southern stations are on high mountains. For instance, the report from Anhui should be confirmed since the maximal altitude of Anhui is only 1 751 m.

*Specimen studied.* — **China.** Sichuan, Songpan Co. 1.5 km W of Xue-Shan Pass, pastured sloping meadows

and cliffs on N slope, alt. 3 800 m, on cliff, 1991 *T. Koponen* 45723 (H).

### *Brachythecium rivulare* Schimp. (Fig. 6)

Bryol. Eur. 6: 17, pl. 546. 1853 (fasc. 52–54, Mon. 11. pl. 12).

*Brachythecium rivulare* var. *gracile* Broth., Symb. Sin. 4: 106. 1929, *syn. nov.* — Type: China. North-West Yunnan: Im birm. Mons. auf Schiefererde und Felsen von Gräben im tp. Walde am Talhange ober Londjre gegen den Schöndsu-la, 28°6', 2 800 m, 21.IX.1915 *Handel-Mazzetti* 8235 (S!, lectotype, *nov.*).

*Brachythecium glauco-viride* C. Müll., Nuov. Giorn. Bot. Ital., n. ser. 5: 198. 1898, *syn. nov.* — Type: China interior, prov. Schen-si sept., in monte Tui-kio-san, 14.IX.1896 *Giraldi* (det. C. Müller n. 1873, H-BR 0407010!, lectotype, *nov.*, G!, isolectotype; det. C. Müller n. 1852, H-BR 0407009!, syntype). — Same locality and date, det. C. Müller n. 2239 in G!, syntype = *B. plumosum*; same locality and date, two collections without numbers in S!, syntypes = *B. rivulare* and *B. plumosum*.

*Brachythecium permolle* C. Müll., Nuov. Giorn. Bot. Ital., n. ser. 3: 126. 1896, *syn. nov.* — Type: China interior, prov. Schen-si sept., in loco non notato, 1894 *Giraldi* (det. C. Mueller n. 935, H-BR 0407007!, lectotype, *nov.*; S!, isolectotype). — According to Redfearn *et al.* (1996), *B. permolle* was synonymized with *B. rutabulum* (Hedw.) B.S.G. by Qian (unpublished).

Plants medium-sized or large, irregularly or regularly pinnately branched, green or yellow–green. Axillary hairs with 1–2 upper hyaline cells, the upper cell ca. 40 µm long. Stem leaves from sub-cordate base triangular or broadly triangular, gradually narrowed to broadly acuminate point, erect, straight; nerve usually ending at about 2/3 of leaf length, 40–60 µm wide near base; margin plane, denticulate throughout; mid-leaf cells 60–130 × 8–10 µm, flexuose, thin-walled or incrassate and slightly porose; basal cells shorter and wider, more incrassate and porose; alar cells rectangular or shortly rectangular, strongly inflated, hyaline and forming a large, distinctly delimited triangular group, broadly decurrent. Branch leaves narrower and shorter than stem leaves. Dioicous. Seta ca. 20 mm long, strongly papillose, capsules inclined; operculum conic. Peristome normal for the genus.

This species is very common in boreal and forested areas of temperate and boreal zones, but also occurs in oroboreal to orotemperate zones of low latitudes. The studied southern Chinese specimens of *Brachythecium rivulare* have a more grac-

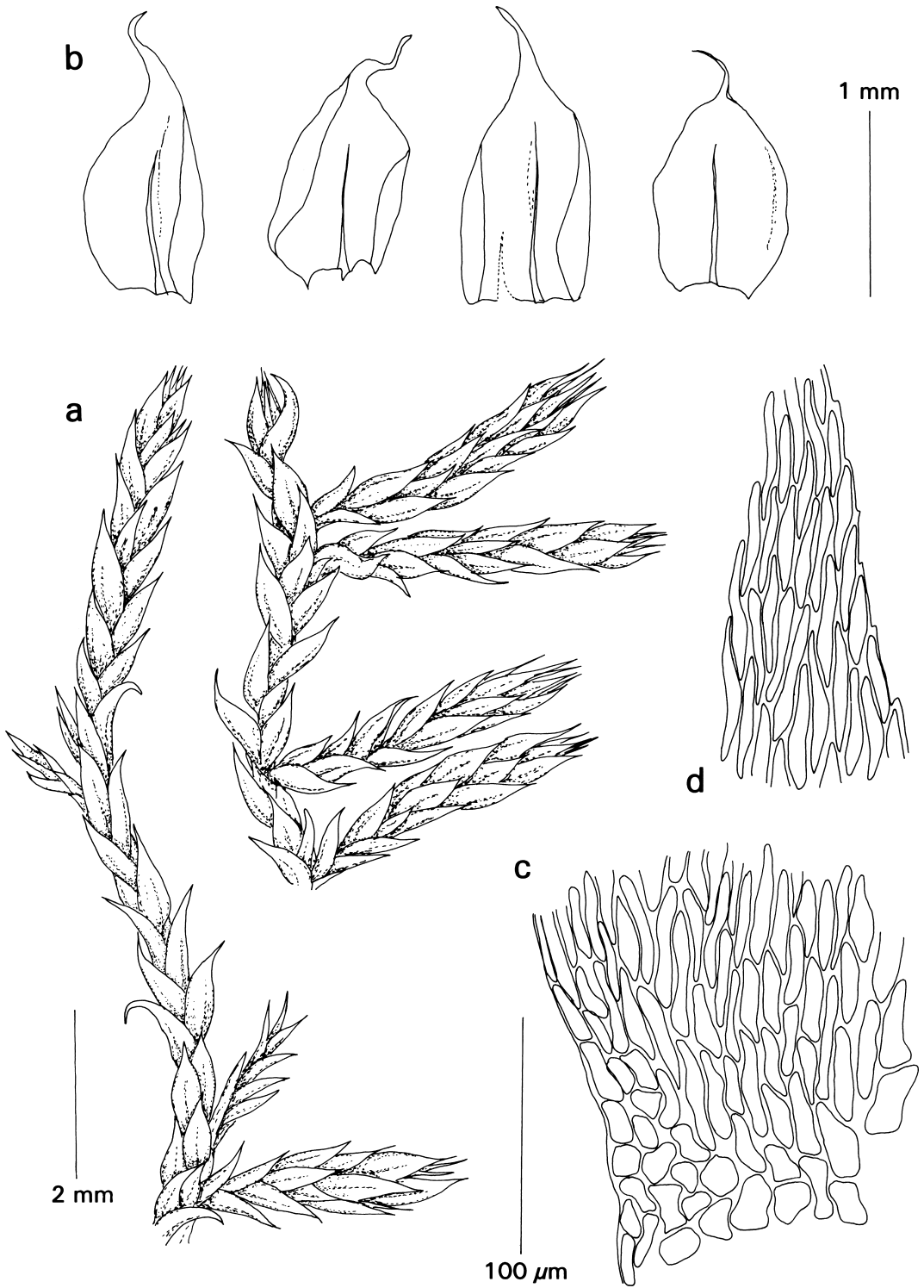


Fig. 5. *Brachythecium glaciale* Schimp. (Sichuan, *Koponen 45723*). — a: Habit. — b: Stem leaves. — c: Alar cells. — d: Midleaf cells at margin. — Scale bars: 2 mm for a; 1 mm for b; 100 μm for c, d.

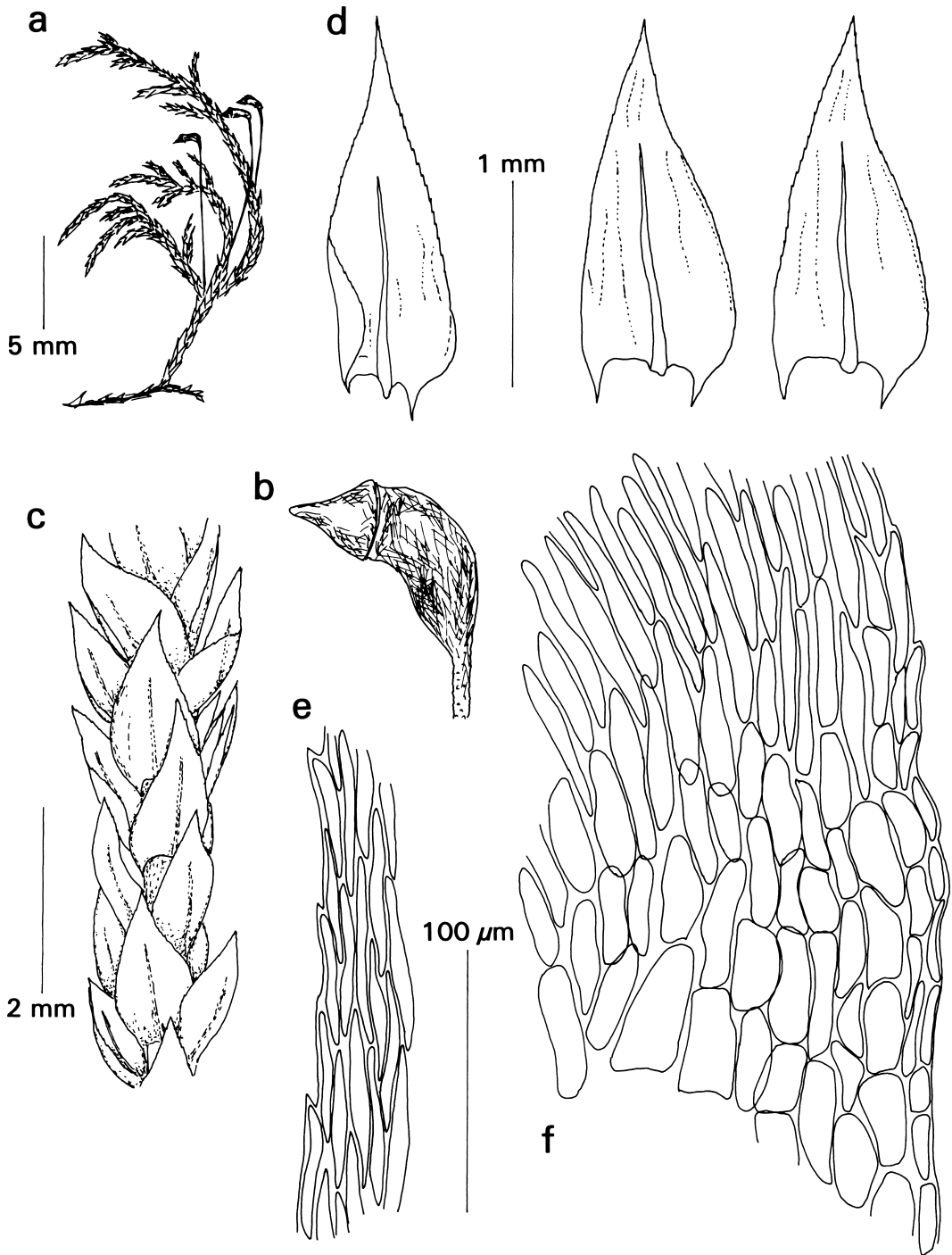


Fig. 6. *Brachythecium rivulare* Schimp. (type of *B. glaucoviride* C. Müll.). — a: Habit. — b: Capsule. — c: Part of stem. — d: Stem leaves. — e: Cells of mid-leaf at margin. — f: Alar cells. — Scale bars: 5 mm for a; 2 mm for b, c; 1 mm for d; 100 μm for e, f.

ile habit than specimens from many other areas, mainly due to smaller branch leaves. The combination of shortly acute triangular stem leaves, denticulate margin and well demarcated large alar cells seems stable and allows the synonymization of *B. glauco-viride*, *B. permolle* and *B. rivulare* var. *gracile* with *B. rivulare*. *Brachythecium glauco-viride* was originally described as autoicous, but Brotherus (1925) noted that it is dioicous.

*Selected specimens studied.* — **China.** Sichuan, Songpan Co. 2 500–2 900 m, 1991 *T. Koponen* Ic. 45434, 45446, 45447. Sc. 45073, 45249. Nanping Co. 2 400 m 19d. 46781 (H). **Taiwan.** Hua-lien Co., Shyu-lin Village, Mt. Ho-huan, unforested slope, in stream on bolder, 2 800 m, 1970 *T. Koponen* 18236 (H).

### ***Brachythecium helminthocladum* Broth. & Par. (Fig. 7)**

Rev. Bryol. 31: 63. 1904. — *Brachythecium kuroishicum* Besch. var. *helminthocladum* (Broth. & Par.) Card. in Dix., Rev. Bryol. n. ser. 4: 158. 1932. — Type: Japan. Nagasaki, V.1901 *Faurie* (H-BR 0381003!, lectotype, *nov.*, S!, isolectotype).

Plants medium-sized, sparsely and irregularly branched, yellow–green. Pseudoparaphyllia acuminate. Axillary hairs 2-celled, hyaline upper cell ca. 40 µm long. Stem usually 2–3 cm long, more or less tumidly foliated. Stem leaves soft, straight to somewhat flexuose in acumen, shortly decurrent, from ovate or broadly ovate very concave base abruptly contracted to narrow acumen, slightly to moderately plicate, 2.2–3.0 mm long, 1.0–1.3 mm wide; nerve reaching ca. 1/2 of leaf length, 30–50 µm wide near base; margin denticulate above, subentire below; mid-leaf cells 40–85 × 8–11 µm, not or slightly flexuose; across the base cells in several rows wider and shorter, ca. 40 × 15–20 µm. Branch leaves narrower than stem leaves, more strongly denticulate. Chinese specimens sterile.

The abruptly contracted leaves and sparse branching make this species very easy to recognize.

For a long time this species was considered an endemic of southern Japan (Noguchi 1991). First published reports for China were from Anhui and Shandong (Redfearn *et al.* 1996). We can confirm its presence in Taiwan.

*Specimen studied.* — **Taiwan.** Tai-chong Co. Near Tayu-ling. Road side cut, on cliff, 2 560 m, 1970 *T. Koponen* 17987 (H).

### ***Brachythecium plumosum* (Hedw.) Schimp. (Fig. 8)**

Bryol. Eur. 6: 8, pl. 537. 1853 (fasc. 32–54. *Mon.* 4, pl. 3). — *Hypnum plumosum* Hedw., Sp. Musc. Frond. 257. 1801. — Type and typification: See Hedenäs & Isoviita (1996).

*Brachythecium densirete* Broth. & Par., Rev. Bryol. 31: 62. 1904, *syn. nov.* — *B. plumosum* var. *densirete* (Broth. & Par.) Tak., J. Hattori Bot. Lab. 15: 55, fig. 26: 1–9. 1955. — Types: Japan. Kanita, VI.1902. *Faurie* (H-BR 0433001!, lectotype, *nov.*, S!, isolectotype); SW Japan, Mayazan, X.1901 *Faurie* 1543 (H-BR 0433003!, syntype); same, *Faurie* 1545 (H-BR 0433004, syntype); Aomori, X.1899 *Faurie* 790 (not seen, syntype).

*Brachythecium homocladum* C. Müll., Nuovo Giorn. Bot. Ital., n. ser. 3: 126. 1896, *syn. nov.* — Type: China interior, prov. Schen-si sept., in loco non indicato, 1894 *Giraldi* (not seen).

*Hypnum oedistegium* C. Müll., Syn. Musc. Frond. 350. 1851, *syn. nov.* — *Brachythecium oedistegium* (C. Müll.) Jaeg., Ber. S. Gall. Naturwiss. Ges. 1876–77: 342. 1878 (Adumbr. 2: 408). — Type: India. Nilgherries, *Perrottet* (H-BR 0433012!, lectotype, *nov.*, G!, isolectotype).

*Brachythecium glauculum* C. Müll., Nuov. Giorn. Bot. Ital., n. ser. 5: 199. 1898, *syn. nov.* — Type: China interior, prov. Schen-si sept., in monte Tui-kio-san, 12.IX.1896 *Giraldi* (det. C. Müller n. 1853, H-BR 0436004!, lectotype, *nov.*); same locality (det. C. Müller n. 1870, G!, syntype); in monte Kuan-tou-san (det. C. Müller n. 2239, H-BR 0436005!, G!, syntypes); same locality (det. C. Müller n. 2239, H-BR 0436012!, syntype); in G! n. 2239 has been labelled as *B. glauco-viride*.

*Brachythecium subpopuleum* Card. & Thér., Bull. Acad. Int. Géogr. Bot. 3, Sér. 15: 40. 1905, *syn. nov.* — Type: China. Kouy-Tscheau, Pui-Ja, rochers, I.1903 *Cavalerie* 857 (H-BR 0436015!, S!, syntypes).

*Notes.* We could not study the type of *Brachythecium homocladum* C. Müll. If no original material is found in FI (see Levier 1906) one of the specimens “C. Mueller n. 880” listed below can be later selected as the neotype. Takaki (1955) gave “Aomori U. F. 870” as “the original” of *B. densirete*. The protologue gives the Aomori specimen as cited above.

Redfearn *et al.* (1996) and Index muscorum (Van der Wijk *et al.* 1959) gave *Brachythecium subpopuleum* as a *nomen nudum*, but it is validly published as indicated above. The same concerns *B. laevipes* Card. & Thér.

Plants medium-sized, ± regularly pinnately branched, green to golden-brownish and often

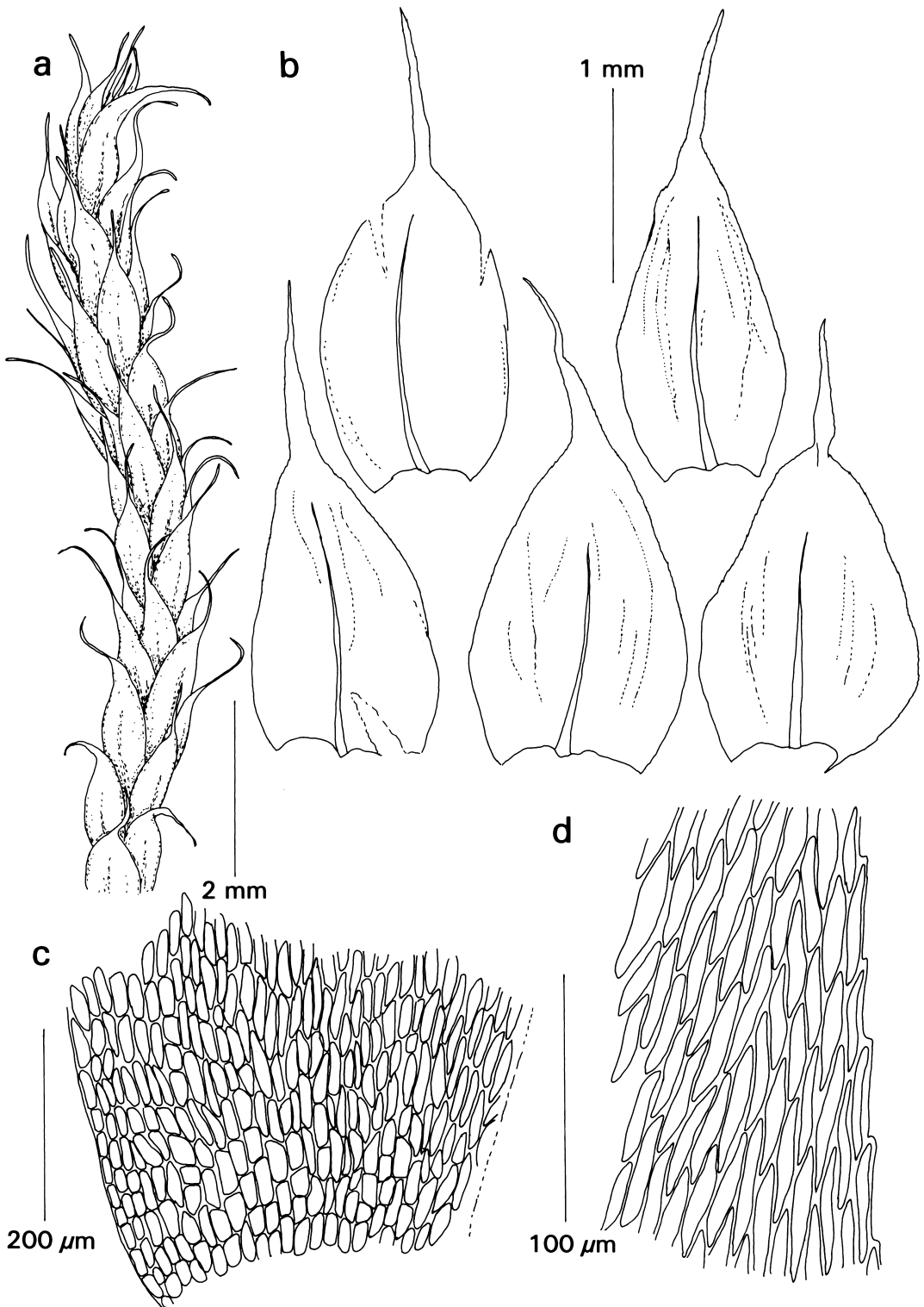


Fig. 7. *Brachythecium helminthocladum* Broth. & Par. (Taiwan, *Koponen 17987*). — a: Portion of stem. — b: Stem leaves. — c: Midleaf cells at margin. — d: Alar cells. — Scale bars: 2 mm for a; 1 mm for b; 100 μm for c; 200 μm for d.

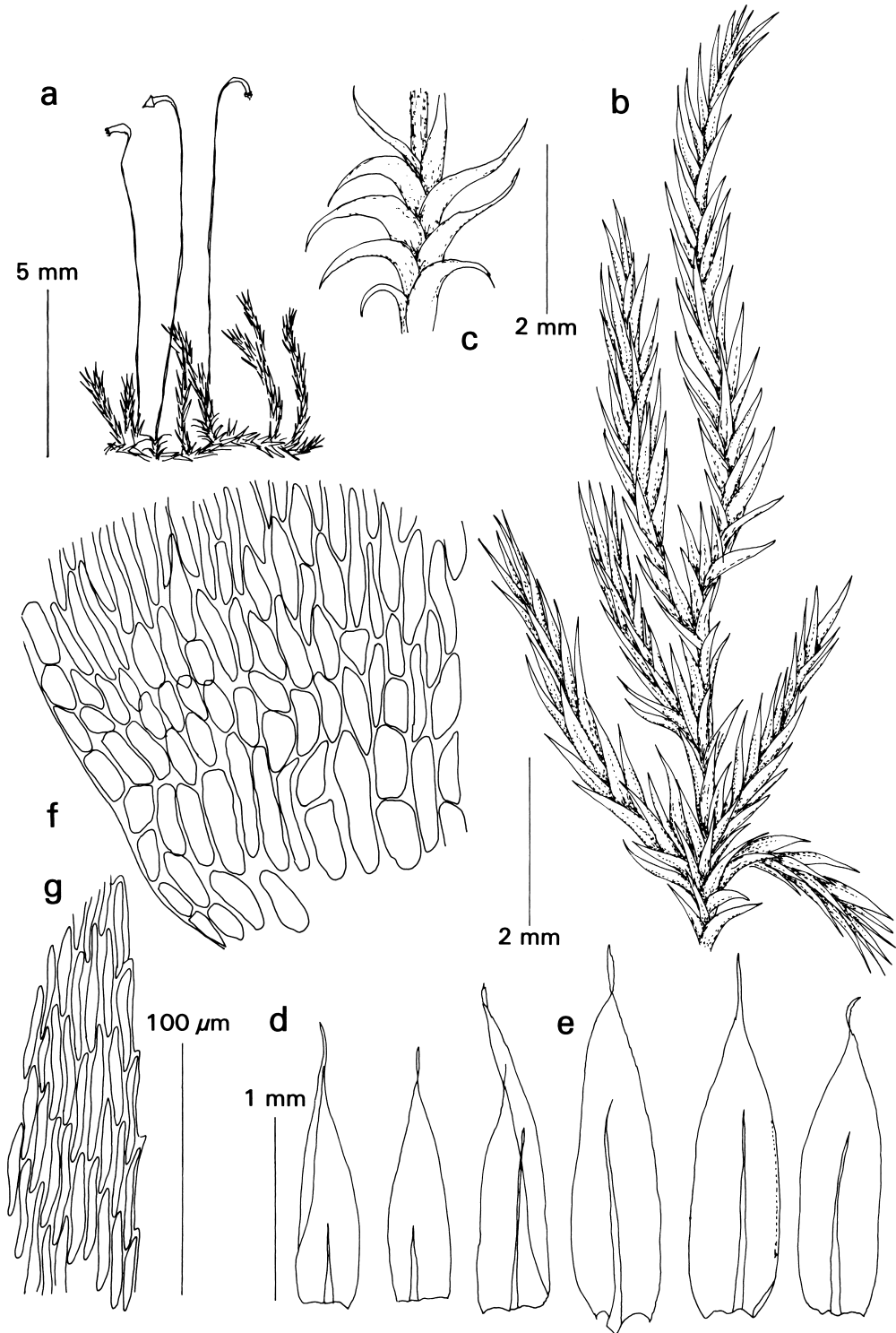


Fig. 8. *Brachythecium plumosum* (Hedw.) Schimp. (Taiwan, *Koponen 17135*). — a, b: Portion of stem. — c: Perichaetium. — d: Branch leaves. — e: Stem leaves. — f: Basal cells. — g: Midleaf cells at margin. — Scale bars: 5 mm for a; 2 mm for b, c; 1 mm for d, e; 100  $\mu\text{m}$  for f, g.

with reddish tinge. Axillary hairs with 2-celled, upper hyaline cell ca. 35  $\mu\text{m}$  long. Stem leaves erecto-patent to patent, straight or slightly falcate, from lanceolate or ovate-lanceolate base gradually narrowed to shortly acuminate apex, concave or strongly so, not or hardly plicate; nerve reaching 1/2–3/4 of leaf length, 40–60  $\mu\text{m}$  wide near base, becoming narrower high above the base; margin plane or near leaf base slightly reflexed or recurved, finely denticulate to subentire below, more distinctly denticulate above; mid-leaf cells 40–90  $\times$  5–8  $\mu\text{m}$ , slightly flexuose, strongly incrassate to thin-walled; basal cells shorter and wider; alar cells variable — in wider leaves alar cells numerous, intraluculent, forming triangular group in leaf corners, in narrower leaves — inflated, wide, with incrassate pellucid to brownish cell walls. Branch leaves sometimes markedly narrower than stem leaves, often with more strongly denticulate margins, nerve often ending in a spine. Autoicous. Inner perichaetial leaves from broadly ovate, strongly concave basal portion suddenly narrowed to longly acuminate apex, nerve weak to indistinct. Seta 12–20 mm long, roughly papillose above, finely or equally roughly papillose below; capsule inclined to horizontal, ovoid to narrow and curved; operculum conic, sometimes with short rostrum; annulus separating, of 2 rows of large cells. Exostome well developed, dentate above. Endostome well developed, yellowish, cilia 2–3, nodose or appendiculate, processes widely perforate. Spores 15–20  $\mu\text{m}$ .

The variability of *Brachythecium plumosum* is reflected in the many varietal taxa described under it (Van der Wijk *et al.* 1959). In boreal and north-temperate areas this species displays a series from straight to falcate-secund leaves and from a rough to a smooth seta (the proximal seta is usually smooth). However, the shape of the stem leaves remains rather constant: the leaves are ovate-lanceolate, with a length to width ratio of 2–3:1. The branch leaves have nearly the same shape, or are only slightly narrower. The East Asian plants referred by us to this species have mostly lanceolate to linear lanceolate leaves. This character is correlated with longer and more reflexed perichaetial leaves, a longer seta and narrower and more curved capsules. These plants look quite different from the northern phenotype, and have also longer seta, longer perichaetial

leaves and narrower cells. Takaki (1955) observed the complete series of transitions of this expression to the northern phenotype and therefore reduced the species known in Japan as *Brachythecium densirete* to a variety of *B. plumosum*, and Noguchi (1991) omitted *B. densirete* completely. We can confirm the existence of all transitions between the extremes in Japan. In southern China wide-leaved phenotypes are not frequent.

Practically the same pattern of variation is observed in southernmost Europe. We consider that the “elongation” of different parts of plants (leaves, perichaetial leaves, lamina cells, seta, capsule, operculum) is environmentally induced. In southern East Asia *B. plumosum* grows in forests on soil and is not rare on rotten wood, while in boreal regions it nearly always inhabits wet rocks. If further investigations reveal enough differences between northern and southern populations, they may deserve recognition at some taxonomic level.

*Selected specimens studied.* — **China.** China interior, prov. Schen-si sept., in monte Si-Ku-tzui-san, VII.1894 *Giraldi* (det. C. Mueller n. 880 as *Brachythecium homocladum*, H-BR 0436001!, G!). Sichuan, 1 750–2 800 m, 1991 *T. Koponen*, Nanping Co. 11c. 45950. 19e. 46927. Ma-Er-Kang Co. 25b. 47444. 26b. 47293. **Taiwan.** 1 800–3 100 m, 1970 *T. Koponen* 16884, 16885, 16918, 16937, 17011, 17038, 17074, 17139, 17867, 17774, 17979, 18051, 18066, 18068. Yunnan, Lijiang Co., 2 900–3 050 m, 1985 *T. Koponen* 6e. 42012. 9a. 42089. 10a. 43137.

*Acknowledgements.* We are grateful to the curators of BG, BM, FH, H-BR, NY, and S for the loan of type material and to Dr. R. Ochyra (Kraków) and Dr. Lars Hedenäs (Stockholm) for their comments on the manuscript. Financial support was received from the Finnish–Chinese Botanical Foundation to M. Ignatov, and from the Academy of Finland to T. Koponen (grants 31335, 34229).

## REFERENCES

- Andersson, L. E., Crum, H. A. & Buck, W. R. 1990: List of the mosses of North America north of Mexico. — *Bryologist* 93: 448–499.
- Brotherus, V. F. 1925: Musci. II. — In: Engler, A. & Prantl, K. (eds.), *Die natürlichen Pflanzenfamilien*, ed. 2, 11: 1–542. W. Engelmann, Leipzig.
- Buck, W. R. 1993: Taxonomic results of the BRYOTROP Expedition to Zaire and Rwanda. 24. Leskeaceae, Brachytheciaceae, Stereophyllaceae, Plagiotheciaceae, Entodontaceae, Sematophyllaceae p.pte, Hypnaceae (except Hypnum). — *Trop. Bryol.* 8: 199–217.



- Duell, R. 1992: Distribution of the European and Macaronesian mosses (Bryophytina). Annotations and progress. — Bryol. Beitr. 8/9: 1–223.
- Gangulee, H. C. 1978: Mosses of Eastern India and adjacent regions. Fasc. 7: 1547–1752. — Published by the author, Calcutta.
- Hedenäs, L. & Isoviita, P. 1996: Proposals to conserve the names *Hypnum plumosum* Hedw. and *H. salebrosum* Hoffm. ex F. Weber & D. Mohr (Musci, Brachytheciaceae) with conserved types. — Taxon 45: 535–537.
- Ignatov, M. S. 1992: The relationships of moss flora of Altai Mts. — Bryobrothera 1: 63–72.
- Ignatov, M. S. 1994: Bryophytes of Altai Mountains. I. Study area and history of its bryological exploration. — Arctoa 3: 13–27.
- Ignatov, M. S. & Afonina, O. M. 1992: Check-list of mosses of the former USSR. — Arctoa 1: 1–85.
- Koponen, T. 1994: Cinclidiaceae, Mniaceae and Plagiomniaceae from Minshan Range, northwestern Sichuan, China. — Hikobia 11: 387–406.
- Koponen, T. & Li, X.-J. 1992: Mosses from Kunming City and its surroundings, Yunnan Province, China. — Bryobrothera 1: 185–194.
- Koponen, T. & Luo, J.-X. 1992: Moss flora of Wo-long Nature Reserve, Sichuan Province, China. — Bryobrothera 1: 161–175.
- Levier, E. 1906: Muscinee raccolte nello Schen-si (Cina) dal Rev. Giuseppe Giralaldi. — Nuovo Giorn. Bot. Italiana N. Ser. 8: 1–54.
- McFarland, K. D. 1988: Revision of *Brachythecium* (Musci) for Mexico, Central America, South America, Antarctica, and circum-subantarctic islands. — Ph.D.-thesis, University of Tennessee, Knoxville. 537 pp.
- McFarland, K. D. 1994: *Brachythecium* B. S. G. — In: Sharp, A. J., Crum, H. & Eckel, P. M. (eds.), The moss flora of Mexico 2: 917–932. New York Bot. Garden.
- Nishimura, N. & Higuchi, M. 1993: Checklist of mosses of Pakistan. — Cryptog. Flora of Pakistan 2: 275–299.
- Noguchi, A. (supplemented by Z. Iwatsuki) 1991: Illustrated moss flora of Japan 4: 743–1012. Hattori Bot. Lab., Nichinan.
- Redfearn, P. L. Jr., Tan, B. C. & He, S. 1996: A newly updated and annotated checklist of Chinese mosses. — J. Hattori Bot. Lab. 79: 163–357.
- Stenroos, S., Vitikainen, O. & Koponen, T. 1994: Cladoniaceae, Peltigeraceae and other lichens from northwestern Sichuan, China. — J. Hattori Bot. Lab. 75: 319–344.
- Takaki, N. 1955: Researches on the Brachytheciaceae of Japan and adjacent regions. II. — J. Hattori Bot. Lab. 15: 1–69.
- Tan, B. C. & Iwatsuki, Z. 1991: A new annotated Philippine moss checklist. — Harvard Pap. Bot. 3: 1–64.
- Tan, B. C. & Iwatsuki, Z. 1993: A checklist of Indochinese mosses. — J. Hattori Bot. Lab. 74: 325–406.
- Van der Wijk, R., Margadant, W. D. & Florschütz, P. A. 1964: Index Muscorum. — Regnum Vegetabile 19: i–xxviii, 1–548.
- Vohra, J. N. 1983: Hypnobryales suborder Leskeineae (Musci) of the Himalayas. — Rec. Bot. Survey India 23: 1–336.

## INDEX TO NAMES

An asterisk means that a lectotype has been proposed in this paper. The accepted names of taxa are in boldface. The names proposed as new synonyms are marked *syn. nov.*

**Brachythecium**

* <i>abakanense</i> .....	286
* <i>amnicola</i> , <i>syn. nov.</i> .....	286
* <b><i>buchananii</i></b> .....	286
var. <i>cuspidiferum</i> .....	286
var. <i>gracile</i> , <i>new assign</i> .....	289
<i>carinatum</i> , <i>syn. nov.</i> .....	286
* <i>complanatum</i> , <i>syn. nov.</i> .....	290
<i>cuspidiferum</i> .....	286
<i>densirete</i> , <i>syn. nov.</i> .....	297
* <i>fasciculirameum</i> , <i>syn. nov.</i> .....	286
* <b><i>garovaglioides</i></b> .....	290
* <b><i>glaciale</i></b> .....	294
* <i>glaucoviride</i> , <i>syn. nov.</i> .....	294
* <i>glauculum</i> , <i>syn. nov.</i> .....	297
* <b><i>helminthocladum</i></b> .....	297
<i>homocladum</i> , <i>syn. nov.</i> .....	297
<i>implicatum</i> .....	289
<i>kuroishicum</i> var. <i>helminthocladum</i> .....	297
<i>laevipes</i> .....	297
<b><i>longicuspdatum</i></b> .....	293
<i>nivescens</i> , <i>new assign</i> .....	290
* <i>oedistegium</i> .....	297
* <i>perminusculum</i> , <i>syn. nov.</i> .....	286
* <i>permolle</i> , <i>syn. nov.</i> .....	294
<i>pilicuspis</i> , <i>new assign</i> .....	286
* <i>planiusculum</i> , <i>syn. nov.</i> .....	286
<b><i>plumosum</i></b> .....	297
var. <i>densirete</i> .....	297
<b><i>procumbens</i></b> .....	290
<i>rivulare</i> .....	294
*var. <i>gracile</i> , <i>syn. nov.</i> .....	294
<i>stereopoma</i> .....	289
<i>subpopuleum</i> , <i>syn. nov.</i> .....	297
<i>tenuipilum</i> , <i>new assign</i> .....	286
<i>thraustum</i> , <i>syn. nov.</i> .....	286
* <i>viridefactum</i> .....	286
<i>wichurae</i> .....	290
forma <i>robusta</i> .....	290
var. <i>robustum</i> , <i>syn. nov.</i> .....	290
<i>yunnanense</i> , <i>syn. nov.</i> .....	289
<i>Hypnum</i>	
<i>buchananii</i> .....	286
<i>cuspidiferum</i> , <i>syn. nov.</i> .....	286
<i>longicuspdatum</i> .....	293
<i>oedistegium</i> , <i>syn. nov.</i> .....	297
<i>plumosum</i> .....	297
* <i>procumbens</i> .....	290
<i>wichurae</i> , <i>syn. nov.</i> .....	290