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Revision of Asian *Herbertus* (Herbertaceae, Marchantiophyta)

Aino Juslén

Botanical Museum, P.O. Box 7, FI-00014 University of Helsinki, and Department of Biological and Environmental Sciences, P.O. Box 65, FI-00014 University of Helsinki, Finland

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Based on a study of approximately 1300 herbarium specimens, 12 species are recognized in the genus *Herbertus* Gray (Herbertaceae, Marchantiophyta) in Asia: *H. aduncus* (Dicks.) Gray subsp. *aduncus*, *H. armitanus* (Steph.) H.A. Mill., *H. buchii* Juslén *sp. nova*, *H. ceylanicus* (Steph.) Abeyw., *H. circinatus* (Steph.) H.A. Mill., *H. dicranus* (Taylor *ex* Gottsche *et al.*) Trevis, *H. guangdongii* P.J. Lin & Piippo, *H. kurzii* (Steph.) R.S. Chopra, *H. longispinus* Jack & Steph., *H. pilifer* (Steph.) H.A. Mill, *H. ramosus* (Steph.) H.A. Mill., and *H. sendtneri* (Nees) Lindb. Nine binomials are proposed as new synonyms. *Herbertus subrotundatus* X. Fu & Y.J. Yi does not belong to the genus *Herbertus*. The ranges of *H. aduncus* subsp. *aduncus*, *H. dicranus*, and *H. sendtneri* extend to other continents in addition to Asia. Four species are shared by Asia and Australasia. The distribution areas of five species are restricted to Asia. Of those five, two are known only from their type localities: *H. buchii* from Amur province, Russia, and *H. guangdongii* from Hainan Island, China. A key to the species is presented. Descriptions, illustrations, and distribution maps are presented for each species.

Key words: distribution, *Herbertus*, liverwort, nomenclature, taxonomy

Introduction

Background

This paper is a revision of species of *Herbertus* reported from Asia. The study covers the areas As 1, As 2, As 3, and As 4 excluding Papua New Guinea (*see* van der Wijk *et al.* 1959). *Herbertus* is a well-defined liverwort genus with erect growth form, ventral intercalary branching (occasionally also *Frullania* type (Fulford 1963, Gradstein 2001)), transversely inserted, deeply bifid, usually conspicuously falcato-secund, often asymmetric leaves with a conspicuous vitta. Underleaves are similar to lateral leaves, but slightly smaller and more symmetrical than lateral leaves. Cell walls have large trigones and intermediate thickenings. Species delimitation is still very problematic because of the large morphological variation observed. Complicated nomenclature has also caused much confusion. Schuster (2000) stated that no competent revision has been made and a revision should be presented before publication of keys for the genus. He introduced several potentially useful characters for future studies (Schuster 2000).

Species of *Herbertus* grow in humid areas, that have not been glaciated during Pleistocene. The plants often establish extensive hummocks. *Herbertus* grow on rock faces, boulders, on tree bases, trunks, and branches, and also on litter; often amongst mosses. In Asia the species often remain infertile. In this study twelve *Herbertus* species are accepted for Asia.

Historical outline

Gray (1821) established the genus *Herbertus* in his *Natural Arrangement of British Plants*. He described this new genus based on *Jungermannia adunca* Dicks., as *Herbertus aduncus* (Dicks.) Gray. Almost simultaneously Dumortier (1822) introduced the genus *Schisma*, with the species *Schisma* '*adunca*' (Dicks.) Dumort., *S.* '*juniperina*' (Sw.) Dumort. and *S.* '*concinnata*' (Lightf.) Dumort., based on *Jungermannia adunca*, *J. juniperina* Sw. and *J. concinnata* Lightf., respectively. Later, he made changes under the same generic name (Dumortier 1831). Dumortier did not pay attention to Gray's genus until 1874, when he rejected the name *Herbertus* because of its masculine form and synonymized it with his own genus *Schisma*. *Herbertus* was also overlooked by Nees von Esenbeck (1833, 1838) who considered *Schisma* to be the valid name and even discussed synonymizing *Schisma* under *Mastigophora* Nees. In the *Synopsis Hepaticarum* both *Schisma* and *Mastigophora* were treated as part of the genus *Sendtnera* Endl. (Gottsche *et al*. 1844–1847). Among 18 species of *Sendtnera*, six species belonging to the group now considered as *Herbertus* were listed. Carruthers (1865) reminded that Gray's (1821) generic name *Herbertus* should have the priority. Carrington (1870) preferred and suggested the female form '*Herbertia*' (*nom. illeg. non* Sweet 1827). Subsequently, Lindberg (in Lindberg & Lackström 1874) proposed the name in the form '*Herberta*'. This was in use until 1975 when the name *Herbertus* was accepted as valid following decision by the ICBN (Florschütz & Grolle 1975). Schiffner (1898) recognized '*Herberta adunca*' (Dicks.) Gray and '*H. dicrana*' (Taylor *ex* Gottsche *et al*.) Trevis. in his *Hepaticarum Archipelagi Indici*. However, Stephani (1909) continued using the name *Schisma* for the 71 mostly geographically very limited species he listed.

Evans (1917) reviewed the early history of the genus and presented a valuable evaluation of characters revising species from Europe, Canada and the United States. At that time 75 species were recognized worldwide. Later, Stephani (1922) described even more species, raising the total number to 86. For a long time after Evans (1917), only Schuster (1957) dealt with the comparative taxonomy of the genus. Both predicted a mass reduction of the number of species. Until now the number of *Herbertus* species published amounts to ca. 100 (Bonner 1966, Geissler & Bischler 1990), and new species were described even recently (e.g. Kumar & Manocha 2000, Yi *et al*. 2001). However, Gradstein (2001) gave a conservative but altogether more realistic worldwide estimation of 25 species.

After decades lost with nomenclatural confusion, Proskauer (1962) detected the Dickson's type and showed it to be probably a Menzies collection from the west coast of North America. Miller (1965) presented a review of *Herbertus* in the tropical Pacific and Asia, dividing the genus into five sections. The higher level taxonomy and evolution of the suborder Herbertinae R.M. Schust. was studied carefully by Schuster (1966), who also provided a description of '*Herberta adunca*'. Van Reenen (1982) discussed and clearly illustrated the huge variability of *Herbertus* in his work on the Andean species. Schuster (2000) recently reviewed the Austral taxa. Meinunger and Köckinger (2002) discussed and illustrated the variability of *H. sendtneri* (Nees) Lindb. in Europe. So (2003) presented an account of the genus in Australasia and the South Pacific. Feldberg *et al*. (2004) and Feldberg and Heinrichs (2005a, 2005b) studied the phylogeny and especially the relationships of *H. sendtneri* and close relatives based on nuclear ITS sequences and morphology. Besides these studies, *Herbertus* has also been treated in many local floras (e.g. Nicholson *et al*. 1930, Hattori 1947, Fulford 1963, Inoue 1977, Grolle 1978, Piippo 1984, Hong *et al*. 1993, Paton 1999, Gradstein 2001, Gradstein & da Costa 2003).

Asian *Herbertus*

The first Asian species was *Sendtnera dicrana* Taylor (= *H. dicranus* (Taylor *ex* Gottsche *et al.*) Trevis.) described from Nepal (Gottsche *et al.* 1844–1847). Already Montagne (1842) mentioned *Schisma* '*juniperina*' var. *sanguineum* Montagne (= *H. dicranus*) from Neelgherries (= Nilgiri), India. At the variety level, it is not valid as an earliest Asian species name. Jack and Stephani (1892) described '*Herberta longispina*' Jack & Steph. from the Philippines. Schiffner (1893) discussed '*H. pilifera*' from Ambon Island, Indonesia, under the name '*Herberta longispina*'. *Schisma piliferum* was validly published only by Stephani (1909). Stephani (1895) described the first species from China, *H. chinensis* Steph., *H. delavayi* Steph., and *H. wichurae* Steph. Stephani (1909) added many taxa to the genus: *Schisma giraldianum* Steph. from China, *S. ceylanicum* Steph. and *S. perrottettii* Steph. from Ceylon (= Sri Lanka), *S. kurzii* Steph. from the Himalayas, *S. sikkimense* Steph. and *S. nilgerriense* Steph. from India, *S. javanicum* Steph. and *S. ramosum* Steph. from Java, Indonesia, and *S. decurrens* Steph. from the Philippines. The next species described from Asia was *Schisma sakuraii* Warnst. (Warnstorf 1915). Herzog (1921) described *S. divaricatum* from Seram Island, Indonesia. Stephani (1922) added *S. fleischeri* Steph., *S. fragile* Steph., *S. gracile* Steph., *S. himalayanum* Steph., and *S. pinnatum* Steph. from India and *S. pusillum* Steph. from South Korea. Nicholson (in Nicholson *et al.* 1930) published '*Herberta handelii*' Nichols. from Yunnan, China, and Herzog (1932) '*H. angustissima*' Herzog from the Philippines. Horikawa (1934) listed six species, five of them new, '*Herberta imbricata*', '*H. longifolia*', '*H. minima*', '*H. minor*', and '*H. remotiusculifolia*'. Herzog (1939) mentioned '*H. lonchobasis*', '*H. nicholsonii*', and '*H. mastigophoroides*' as herbarium names in his paper dealing with Himalayan bryophyte collections. Chopra (1943) wrote a census of Indian hepatics, and made the combination '*H. kurzii*' (Steph.) R.S. Chopra. Hattori (1947) made a new combination '*H. sakuraii*' (Warnst.) S. Hatt., and two forms under '*H. sakuraii*', fo. '*pusilla*' and fo. '*remotiusculifolia*'. In 1955 Hattori listed *H. pusilla*, *H. remotiusculifolia*, '*H. minor*', and '*H. minima*' as synonyms of *H. aduncus* subsp. *aduncus*. *Herbertus maximus* (*nom. nud.*) was mentioned by Yang (1960) from Taiwan, but Piippo (1990) was not able to find a description under that name.

Miller (1965) published a review of *Herbertus* in the tropical Pacific and Asia, which, however, did not solve the taxonomy of the genus (*see* Schuster 2000). He listed 48 species from tropical Pacific and Asia. '*Herbertus lonchobasis*', and '*H. mastigophoroides*' from India, Himalayas, and '*H. nepalensis*' from Nepal were presented as new Asian species and '*H. darjeelingensis*' was published as *nom. nov.* for *Schisma gracile* Steph. (*non Schisma gracile* Montagne). Later Miller (1968) published further notes on *Herbertus*.

Hattori (1966, 1971, 1975) dealt with species of *Herbertus* in the series on the flora of the eastern Himalaya. He synonymized '*H. handelii*' and '*H. imbricata*' with '*H. kurzii*', and *H. delavayi* with *H. sendtneri* (Hattori 1966), and described '*Herberta giraldiana* var. *verruculosa*' from Bhutan (Hattori 1971). In the third report Hattori (1975) reduced this variety under '*Herberta giraldiana*'. Del Rosario (1971) described *H. milleriana* from the Philippines, and later he studied the *Herbertus* flora of the Philippines (Del Rosario 1975). Tixier (1972) reported '*H.* cf. *minima*' Horik. from the Philippines. According to Inoue (1974) the type specimen of '*H. minima*' proved it to be synonymous with '*H. sakuraii*' and not with *H. aduncus* as was assumed since Hattori (1955). Inoue (1977) also published one of the few studies of the Asian *Herbertus*. There he synonymized several species under *H. dicranus* and *H. sakuraii*. *Index of Bryological List*, *China*, reported 15 species from China, but several earlier taxonomical changes were neglected (Hsu 1979). Chang (in Gao & Zhang 1981) described *H. suafangnesis* from Heilongjiang and *H. aduncus* f. *minor* from Liaoning.

Hattori (1984) discussed the identity of *H. sakuraii*. Piippo (1984) studied the Papua New Guinean *Herbertus*, and the distribution areas of the two species extend also to Asia. Lin and Piippo (in Lin *et al.* 1992) described two new

species, *H. guangdongii* P.J. Lin & Piippo and *H. hainanensis* P.J. Lin & Piippo from Hainan Island, China. Kumar and Manocha (2000) described *H. udarii* from India. Bapna and Kachroo (2000) introduced 20 species from India, but they disregarded the taxonomical changes made earlier. Gao and Cao (2000) listed 23 species of *Herbertus* from Yunnan, China. They synonymized *H. suafangnesis* with *H. fragilis* (Steph.) Herzog and *H. aduncus* f. *minor* with *H. aduncus* subsp. *tenuis (*Evans) H.A. Mill. & E.B. Scott. Gao and Cao (2000) mentioned also *H. gymnocoloides* X. Fu from Yunnan and Tibet, China, but I have been unable to find the original description of the species. Another new species, *Herbertus subrotundatus* X. Fu & Y.J. Yi was described from Tibet, China (Yi *et al*. 2001). Hodgetts (2001) retypified *H. sakuraii* (Warnst.) S. Hatt. Kumar and Manocha (2002) described another species, *H. mehrae* Kumar & Manocha from Darjeeling, India. So (2003) revised *Herbertus* in South Pacific and Australasia, accepting eight species, the distribution of four of which reaches Asia. Hodgetts (2003) synonymized the European *H. borealis* Crundw., Asian *H. sakuraii* (Warnst.) S. Hatt., and South American *H. subdentatus* auct. *non* (Steph.) Fulford with *H. dicranus*. Juslén (2004) began revising the Asian Herbertus with a study based on a collection from Hunan, China. There, *H. lonchobasis* H.A. Mill. and *H. wichurae* Steph. were synonymized with *H. dicranus*, and lectotypes for *H. aduncus*, *H. dicranus*, and *H. wichurae* were selected. Recently, Feldberg and Heinrichs (2005b) synonymized *H. giraldianus* with *H. dicranus*.

In addition to the studies specifically concentrating on *Herbertus*, species of the genus have been reported from Asia also in numerous regional studies, e.g. by De Notaris (1874) from Borneo, Schiffner (1898) from Malay peninsula and archipelago, Hattori (1957, 1958, 1959), Hattori and Inoue (1959), and Kitagawa (1962) from Japan, Hattori *et al*. (1962a, 1962b) from South Korea, Grolle (1966) and Hattori (1968a) from Nepal, Hattori (1968b) from Ceylon (Sri Lanka), Iwatsuki and Mizutani (1972) from Japan, Lai and Wang-Yang (1976) and Lai (1977) from Taiwan, Kitagawa (1978a) from Japan, Kitagawa (1978b) from Thailand, Long (1979) from Bhutan, Choe (1980) from South Korea, Inoue (1981) from Japan, Hu and Wang (1981) from Zhejing, China, Lin *et al*. (1982) from Guangdong, China, Iwatsuki and Mizutani (1983) from Taiwan, Wu *et al*. (1984) from Fujian, China, Aur and Zhang (1985) from Heilongjiang, China, Hu and Wang (1985) from Xizang, China, Guo *et al*. (1988) from Anhui, China, Long and Grolle (1990) from Bhutan, Zhu and So (1996) and Zhang and Lin (1997) from Hong Kong, Piippo *et al*. (1997) from Sichuan, China, Piippo *et al*. (1998) from Yunnan, China, Zhao and Cao (1998) from Shandong, China, Zhu *et al*. (1998) from Zhejian, China, Wang (in Wu & Wang 2000) from South West China, and Iwatsuki (2001) from Japan.

Material and methods

Approximately 1300 *Herbertus* specimens were examined for the present study. The specimens were borrowed from B, BM, C, DUKE, G, GOET, FH, H, HIRO, JE, L, LE, MANCH, M, MU, NICH, NY, PC, PNH, S, U, UC, and Z.

Initially the specimens were studied in dry condition to observe the leaf arrangement. Other characters were studied from shoots soaked in water. The leaf apices in old specimens are often very fragile, but they possess important characters, such as the apex shape and number of uniseriate cells. In badly fragmented specimens finding even a single lateral leaf with undamaged leaf apex was sometimes impossible. Cross-sections of stems were made manually by holding the shoot with forceps and cutting the stem with a razor blade. They were always made from the middle part of stem.

The length and width of the leaves were measured according to the standard introduced by Van Reenen (1982). The cell-counts presented for dorsal basal lamina, between sinus and vitta bifurcation point, and from height and width of stem cross-section are from a direct line. The cell sizes refer to the lumen. The illustrations are based on microscope drawings made with a drawing tube. I have also listed selected illustrations from the earlier literature, which succeed in showing the important features of taxa. Representative specimens examined are listed shortly, showing only one specimen per country or per

state. The illustrations of *H. aduncus* and *H. dicranus* were published earlier (Juslén 2004).

Nomenclature follows the latest edition of Greuter *et al.* (2000). Authors' names are abbreviated according to Brummit and Powell (1992). Herbarium abbreviations follow Holmgren *et al.* (1990).

Taxonomic treatment

Key to the species of *Herbertus* in Asia

1. Leaf lobes strongly circinate ..... *H. circinatus*
1. Leaf lobes falcate or straight 2
2. Leaf lobe apices piliferous 3
2. Leaf lobe apices not piliferous 4
3. Leaf length–width ratio 4.1–4.6; lobes lanceolate, gradually tapering into a piliferous tip, lobe apex formed of 6–9 uniseriate strongly elongated cells, which are 5–10 times longer than wide ..... *H. pilifer*
3. Leaf length–width ratio 4.1–5.9; lobes long, linear, lobe apex formed of 5–15 uniseriate not much elongated cells, which are 2–3 times longer than wide ..... *H. longispinus*
4. Leaf lobe apices acuminate 5
4. Leaf lobe apices acute 6
5. Vitta very indistinct, bifurcating above mid basal lamina ..... *H. guangdongii*
5. Vitta strong, bifurcating below or by the mid basal lamina ..... *H. armitanus*
6. Leaves ± straight 7
6. Leaves falcate 8
7. Leaf length–width ratio 1.0–1.3(–1.5) ..... *H. sendtneri*
7. Leaf length width ratio > 1.8 10
8. Vitta indistinctive, bifurcating near the base or well below mid lamina, leaf length–width ratio 2.6–2.7 ..... *H. buchii*
8. Vitta bifurcating by mid or above basal lamina, leaf length–width ratio 1.8–4.0 9
9. Leaf lobes long and narrow, (2–)4–7 uniseriate cells in the apex, leaf length–width ratio 2.6–4.0 ..... *H. aduncus*
9. Leaf lobes broad, 2–3 uniseriate cells in the apex, leaf length–width ratio 1.8–2.5 ..... *H. ceylanicus*
10. Leaf margins often with coarse appendices, leaf length–width ratio 1.0–1.3(–1.5), leaf lobes broadly acute or triangular, stem cross-section triangular or rounded ..... *H. sendtneri*
10. Leaf margins without coarse appendices, leaf length–width ratio 1.3–3.7, leaf lobes lanceolate, acute, stem cross section oval 11
11. Margins of underleaf lobes often serrate, leaf length–width ratio 1.3–2.0, vitta deeply grooved below ..... *H. kurzii*
11. Margins of underleaves not serrate, leaf length–width ratio 1.5–3.7, vitta often strong, but not deeply grooved 12
12. Basal disc moderately expanded, cells of the basal lamina 10–13 × 12–25 μm ..... *H. dicranus*
12. Basal disc conspicuously expanded, cells of the basal lamina 15–20 × 30–35 μm ..... *H. ramosus*

Asian species of *Herbertus*

Herbertus aduncus (Dicks.) Gray subsp. *aduncus*

Nat. Arr. Brit. Pl. 1: 705. 1821 ('*Herbertia aduncа*'). — *Jungermannia aduncа* Dicks., Pl. Crypt. Brit. fasc. 3: 12. 1793. — *Schisma aduncum* (Dicks.) Dumort., Syll. Jungerm. Europe: 77. 1831. — *Sendtnera aduncа* (Dicks.) Gottsche & Rabenh. in Rabenhorst, Hep. Eur. (Exsicc.) n. 210. 1962. — TYPE: [Canada. British Columbia, "Banks Isles", 1787 *A. Menzies*, according to Proskauer 1962: 224] Herb. Dickson (lectotype BM-000661088! designated by Proskauer 1962: 224, only the shoot on the right with sporophyte).

Schisma pusillum Steph., Spec. Hep. 6: 361. 1922. — *Herbertus pusillus* ('*Herberta pusilla*') (Steph.) S. Hatt., Bull. Tokyo Sci. Mus. 11: 8. 1944. — *Herbertus sakuraii* f. *pusillus* ('*Herberta sakuraii* f. *pusilla*') (Steph.) S. Hatt., J. Hattori Bot. Lab. 2: 6. 1947. — TYPE: South Korea. Hallaisan, 1906 *Faurie 86* (lectotype G designated by Miller 1965: 316, BM-000661063!, PC! isolectotypes). — Synonymized by Hattori (1947: 6), as *H. sakuraii* (Warnst.) S. Hatt. f. *pusillum*, (1955: 81), as *H. sakuraii*.

Schisma fragile Steph., Spec. Hep. 6: 359. 1922, *syn. nov.* — *Herbertus* ('*Herberta*') *fragilis* (Steph.) H.A. Mill., J. Hattori Bot. Lab. 28: 311. 1965. — TYPE: India. Sikkim, Himalayas, *Cardot 237* (lectotype G! designated by Miller 1965: 311).

Herbertus ('*Herberta*') *darjeelingensis* H.A. Mill., J. Hattori Bot. Lab. 28: 307. 1965, *nom. illeg.* — *Schisma gracile* Steph., Spec. Hep. 6: 359. 1922 (*non Schisma gracile* Mont., Ann. Sci. Nat. 19: 254. 1843.) — TYPE: India. West Bengal, Himalayas, distr. Darjeeling, Chhangoo, 14 300 ft, 1908 *Ribu*, pro E. Long, herb. E. Levier 6149 (lectotype G! designated by Miller 1965: 308). — Synonymized with *H. fragilis* by Miller (1968: 248).

Herbertus ('*Herberta*') *minor* Horik., J. Sci. Hiroshima Univ., ser. B., div. 2, 2: 211. 1934. — TYPE: China. Taiwan, Prov. Taihoku, Mt. Taiheizan (Mururoafu-Kyôgetsu), 1932 *Iwasama 3472* (herb. Horikawa 11506) (holotype HIRO!). — Synonymized by Hattori (1955: 81), as '*H. sakuraii*'.

Herbertus remotiusculifolius ('*Herberta remotiusculifolia*') Horik., J. Sci. Hiroshima Univ. ser. b, div. 2, 2: 209. 1934. — *Herbertus sakuraii* f. *remotiusculifolius* ('*Herberta sakuraii* f. *remotiusculifolia*') (Horik.) S. Hatt., J. Hattori Bot. Lab. 2: 6. 1947. — TYPE: China. Taiwan, Prov. Taihoku, Mt. Taiheizan, Minamoto, Toganooduni-Mururoafu, 1932 *Horikawa 9405* (holotype HIRO!). — Synonymized by Hattori (1947: 6) as *H. sakurai* fo. *remotiusculifolia*, (1955: 81), as *H. sakuraii*. There are three different species in the specimen. One was described and illustrated by Horikawa (1934) and it belongs to *H. aduncus subsp. aduncus*. But also leaves of *H. dicranus* and *H. kurzii* can be found in the same mixed

specimen. *Herbertus kurzii* (as *H. imbricata* Horik.) was noted also by H. A. Miller (1965). The origin of this mixture remains a puzzle. However, the specimens annotated as *H. remotiusculifolius* are *H. aduncus*.

Herbertus sakuraii subsp. *sakuraii* auct. *non* (Warnst.) S. Hatt.: Schuster in Rev. Bryol. Lichénol. 26: 132. 1957.

Plant size very variable, small to medium-sized, green, brown, yellowish, rarely reddish, 2–8 cm long. Stem cross-section often rounded, or oval, 0.1–0.35 × 0.1–0.3 mm. Leaves ± imbricate, erect, ± straight and almost symmetrical, basal lamina hardly expanded, in dorsal side 3–7(–8) cells wide, leaf length 0.5–2.5 mm, width 0.3–0.9 mm, leaf length–width ratio 2.6–4.0; bifid usually to ca. 3/4, lobes long and narrow, 8–24 cells wide at lobe base, 4–8 cells wide at point half way towards apex, lobe apex acute, with (2–)4–7 uniseriate cells and (2–)4–7 rows below apex two cells wide, leaf margin usually plane, slime papillae few and sessile if present; vitta not very strong, extending to 2/5–4/5 of lobe, vitta cells 10–18 × 28–63 μm in mid basal lamina, bifurcating usually above mid basal lamina, 3–8(–10) cells between sinus and vitta bifurcation point, 10–20 × 12–30 μm; basal lamina cells 10–12 × 12–23 μm, usually with triangular trigones; underleaves smaller and symmetrical.

Dioecious. Intercalary androecia with bracts in 4–6 pairs, not falcate and not as deeply lobed as leaves, margins occasionally denticular. Bracteoles similar to bracts. Terminal gynoecia with similar bracts and bracteoles bifid to ca. half of their length, margins denticulate. Perianth ovate, narrowed to mouth, divided into 6 lobes. Sporophytes seen only in North American specimens. For further description *see* Schuster (1966).

Selected illustrations: Horikawa 1934: 210 (fig. 36) as *H. remotiusculifolia*; Schuster 1957: 139 (fig. 4: 3–14) as *H. sakuraii* subsp. *sakuraii*.

The type specimen of *Herbertus aduncus* is poor, only one shoot mounted on herbarium sheet. Proskauer (1962) assumed that it was collected from Western North America, despite the original description "*alpibus Scoticis*". Indeed, the lectotype resembles other North American *H. aduncus* subsp. *aduncus* specimens. It has a sporophyte and shortly stalked slime papillae, whereas Asian *H. aduncus* subsp. *aduncus* seldom has either of them. The other *Herbertus* shoot on the same herbarium sheet is *H. aduncus* subsp. *tenuis* or *H. dicranus*. Already Proskauer wrote a note attached to herbarium sheet that only the shoot with sporophyte should be considered as the type; he commented that the other shoot might or might not be of the same species. *Herbertus aduncus* subsp. *aduncus* occurs in western North America and Asia. *Herbertus aduncus* subsp. *hutchinsiae* grows in Europe (Paton 1999), and *H. aduncus* subsp. *tenuis* in the Appalachian mountains, U.S.A. (Schuster 1966).

Herbertus aduncus subsp. *aduncus* is distributed from North America to eastern Asia and the Himalayan area. The species has been reported altogether from eight provinces of China (Piippo 1990, Fang *et al.* 1998, Juslén 2004). The record published in the present paper from Sichuan, China is new for the province (*see* Piippo *et al.* 1997). *Herbertus aduncus* grows on tree trunks and rocks. It has been collected from 180 m in U.S.A to 3600 m in the Himalayas. However, it does not reach as high elevations as the other species of the Himalayan area: *H. dicranus*, *H. kurzii* and *H. sendtneri*.

Some of the specimens earlier identified as *H. fragilis* were very fragile indeed. Despite the almost leafless shoots, I was in most cases able to remove one or few leaves or at least parts of leaves for examination. In addition to its fragility *H. fragilis* does not show other specific features and the type specimen of *H. fragilis* is *H. aduncus* subsp. *aduncus*. However, many of the specimens identified as *H. fragilis* proved to be *H. dicranus*.

Total distribution (Fig. 1): Am 1: Canada, USA; As 2: China, Japan, South Korea; As 3: Bhutan, India, Nepal.

Representative specimens examined. Am 1: **Canada**. British Columbia. Swindle Island, Mayers Passage, just E. of Meyers Narrows, on *Chamaecyparis* trunk in forest, 1986 *Schofield 86474* (UC-1723173). **USA**. Alaska. Mitkof, on spruce branch, *Worley 8398* (UC-1451585). Washington. Jefferson Co., South Nolan Natural Resource Conservation Area SSE of Forks, on moist, diffusely lit log in forest of very large and old *Thuja* and *Tsuga*, on log, ca. 180 m, 1997 *Norris 88878* (UC-1723166). New York. Ulster Co., Catskill Mountains, Frost Valley YMCA, Oliverea, on moist shaded rock face along High Falls Creek, 2000 ft, 1980 *Steere* (UC-1709306). Virginia. On rock, 5648 ft, *Vail & Britton* (UC-46952). North Carolina. On rock, 2100–2500

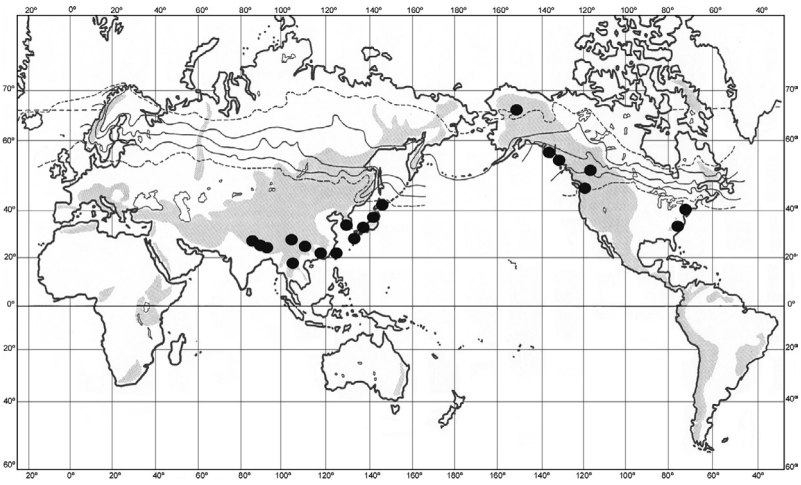

Fig. 1. Distribution of *Herbertus aduncus* subsp. *aduncus* based on examined specimens.

m, 1996 *Allen 17850* (MO-4425959). As 2: **China**. Hong Kong. Tai Mo Shan, 2500 ft, 1931 *Youngsaye* (JE). Sichuan. On rock, 1980 *Chien 20778* (MO-5127747). Taiwan. Chiayi, Mt. Alishan, trunk in forest, 2000–2200 m, 1979 *Yamada & Lai 13859* (JE, as *H. dicranus*). Yunnan. On trunk, 3620 m, 1990 *Long 18584* (JE). **Japan**. Kyushu, Kagoshima-ken, Yakushima I., Mt. Mochumu, on rock, 600–900 m, 1983 *Mizutani 10666* (F-1059891, NY). Shikoku, on rock, *Horikawa 2333* (HIRO); Iyo, on trunk, 1400 m, *Inoue 1573* (M-0025166). Honshu, on cliff, 400 m, 1983 *Nakashima 7591* (HIRO). **South Korea**. Seoul, Mt. Dukyu, on rocks, 1110 m, 1961 *Hong 9306* (MO-4446799 as *H. hutchinsiae* subsp. *schusteri*). As 3: **Bhutan**. Bumthang, on trunk, 2855 m, *Long 28616* (H). **India**. Sikkim, Himalayas, 2072 m, *Decoly & Schaul* (JE). **Nepal**. The Annapurna Range, below Lamjung Himal, on *Rhododendron*, 3600 m, 1976 *Kunisawa et al.* (NY, S-B49688, as *H. fragilis*).

Herbertus armitanus (Steph.) H.A. Mill. (Fig. 2)

J. Hattori Bot. Lab. 28: 324. 1965 ('*Herberta armitana*'). — *Schisma armitanum* Steph., Spec. Hep. 4: 28. 1909. — TYPE: Papua New Guinea. Mt. Dayman, 1894 *W. Armit Jr.*, F. v. Müller misit (lectotype G!, designated by Miller 1965: 325).

Schisma decurrens Steph., Spec. Hep. 4: 24. 1909, *syn. nov.* — *Herbertus* ('*Herberta*') *decurrens* (Steph.) H.A. Mill., J. Hattori Bot. Lab. 28: 317. 1965. — TYPE: The Philippines. Luzon Central, *Loher* (lectotype G!, designated by Miller 1965: 318).

Schisma divaricatum ('*divaricata*') Herzog, Beih. Bot. Centralbl. 38: 326. 1921. — *Herbertus divaricatus* ('*Herberta divaricata*') (Herzog) H.A. Mill., J. Hattori Bot. Lab. 28: 325. 1965. — TYPE: Indonesia. Moluccas, Ceram I., Mansela–Wolu, 1750 m, 1911 *Stresemann* (lectotype S, designated by Miller 1965: 325; isolectotype PC!). — Synonymized by Piippo (1984: 26).

Herbertus ('*Herberta*') *zantenii* S. Hatt. & Grolle *in* Grolle, J. Hattori Bot. Lab. 30: 113. 1967. — TYPE: Indonesia. New Guinea, West Irian, Antares Mts, Camp 39a, 1500 m, on tree trunks in rain forest, 1959 *van Zanten 39c*. (holotype NICH-234630!) — Synonymized by Piippo (1984: 26).

Plants medium-sized to robust, brown, with some orange, purple or green, 5–10(–15) cm. Stem cross-section oval or flattened oval 0.2–0.6 × 0.15–0.45 mm. Leaves ± imbricate, falcate and almost symmetrical, basal lamina expanded, in dorsal side 5–16(–23) cells wide, leaf length 1.3–3.5 mm, width 0.3–1.5 mm, length–width ratio 2.3–7.2; bifid 2/3–3/4 of leaf length, lobes linear-lanceolate, 8–37 cells wide at lobe base, 6–12 cells wide at point half way towards apex, lobe apices acuminate, with 3–9 short or somewhat elongated uniseriate cells and 1–9 rows below apex two cells wide, leaf margins usually with sessile or up to 4 cells long stalked slime papillae; vitta strong, extending mostly to apex or at least half of lobe, vitta cells 10–20 × 33–108 μm in mid basal lamina, bifurcating at half or a little lower of mid basal lamina, 7–22 cells between sinus and vitta bifurcation point, 7–17 × 10–34 μm; basal lamina cells 8–23 × 14–42 μm, with small to medium-sized trigones; underleaves smaller and symmetrical. Sex organs not seen.

SELECTED ILLUSTRATIONS: Piippo 1984: 27 (fig. 5).

Piippo (1984) and So (2003) studied *H. armitanus* in the Australasian area and concluded that

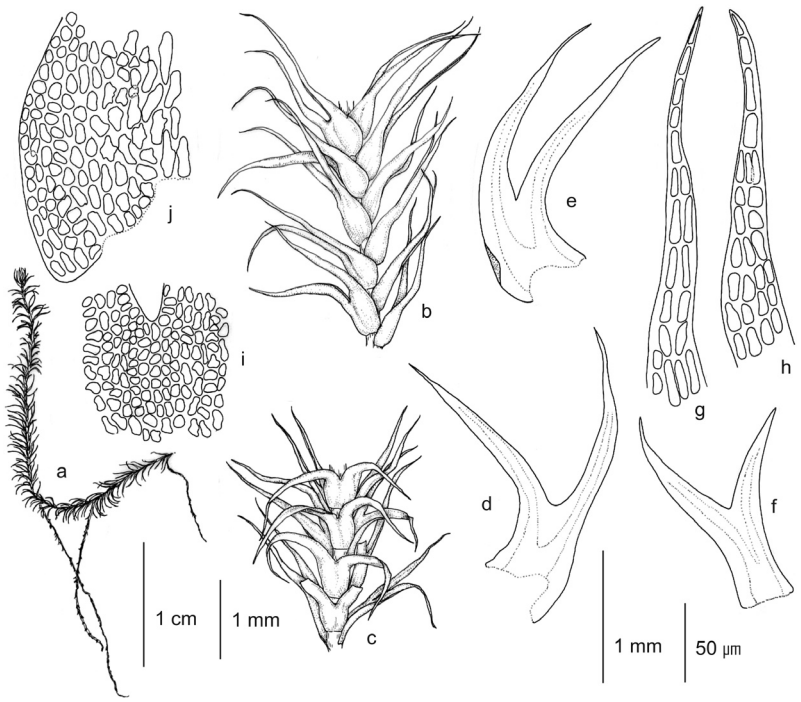

Fig. 2. *Herbertus armitanus* (from isolectotype of *H. divaricatus*, PC). — **a**: Habit. — **b**: Part of shoot, dorsal view. — **c**: Part of shoot, ventral view. — **d** and **e**: Leaves. — **f**: Underleaf. — **g** and **h**: Leaf apices. — **i**: Cells in sinus. — **j**: Cells of basal lamina and vitta. Use the 1 cm scale for **a**, the shorter 1 mm scale for **b** and **c**, the longer 1 mm scale for **d**–**f**, and the 50 µm scale for **g**–**j**.

the species is common and very variable in size, leaf shape, and size of trigones in New Guinea. Characteristic for the species are the sharp acuminate leaf lobes pointing in different directions. The leaf lobe apex cells are 3–9 in number, and they may be elongated. The *H. armitanus* records are mostly from wood, but rarely also from rock. It grows at 1260–3000 m in Asia and even higher, to 3600 m, in Papua New Guinea (*see* also Piippo 1984 and So 2003).

TOTAL DISTRIBUTION (Fig. 3): As 3: Thailand, Vietnam; As 4: Indonesia, Papua New Guinea, the Philippines.

REPRESENTATIVE SPECIMENS EXAMINED. — As 3: **Thailand**. Mt. Luang, on granite, 1740 m, 1966 *Touw 11803* (BM-000825638 as *H. ramosus*). **Vietnam**. Kontum, NW slope of Ngoc Linh mountain system in very deep stream canyons, 1600–1800 m, 1995 *Averyanov et al. B298* (MO-4458834). As 4: **Indonesia**. Sumatra, 2600 m, 25.VII.1894 *Schiffner* (B-300230144); Java, m. Salak, inter *Meteorium longissimum*., 6000–7000 ft, 1860 *Kurz* (H-SOL 2303001, H-SOL 2303014); Sulawesi, Poka Pindjang, 2500 m, 1929 *Kjellberg 28* (JE as '*H. divaricata*'); Lesser Sunda Islands, on bark, 2050–2130 m, 1988 *Schmutz 6868* (L-0410306); Borneo, 7200 ft, 1959–1962 *Meijer B12624* (L-0410300); New Guinea, an Felsen, 1400 m, 1976 *Hiepko & Schultze-Motel 2387* (B-300219627). **The Philippines**. Luzon, 2700–2800 m, 1968 *Jacobs B136* (B-300234527); Mt. Pulog, Mt. Province, 2200–2800 m, 1965 *Miller 10442* (MO-4416272). **Papua New Guinea**. Morobe Prov., Cromwell Mts., 2500–2600 m, on climber, 1981 *Koponen 31118* (H-3173791).

Herbertus buchii Juslén, *sp. nova* (Fig. 4)

Plantae graciles, *foliis parum secundis penitus bilobatis*, *foliis apice fere obtusis cellulis 1–4 uniseriatis*, *vittis non distinctis*, *prope basin laminae bifurcatis*, *14–16 cellulis inter sinum et punctum bifurcationis*, *cellulis basalibus aliis 10 µm longis et 10 µm latis*, *folia inferiora non secunda*.

TYPE: Russia. [Amur Region, Stanovoy Range, Dzhiktangra River] "Sibiria, pr. Amur, Sea-Flussgebiet, Marschrute vom astron. Punkt bei Wosdwischensk zum See Toko (Jakutsk); am Flusse Dsiktangra", 1911 *Prochorow & Kusenewa*, Exped. Amur. no 193 (holotype H-3173965!; isotypes H-SOL!, C!).

ETYMOLOGY. Named in honour of Prof. Hans Buch (1883–1964), distinguished Finnish hepaticologist, who described this species as new in herbarium already in 1929.

Plants medium-sized, orange brown, 3–7 cm long. Stem cross-section oval; 0.35–0.4 × 0.2–0.32 mm. Leaves ± imbricate, ± straight and almost symmetrical, basal lamina somewhat expanded, in dorsal side ca. 15 cells wide, leaf length 1.6–3 mm, width 0.6–1.1 mm, length–width ratio 2.6–2.7; bifid more than half, lobes broadly acute, 20–22 cells wide at lobe base and 11–12 cells wide at point half way towards

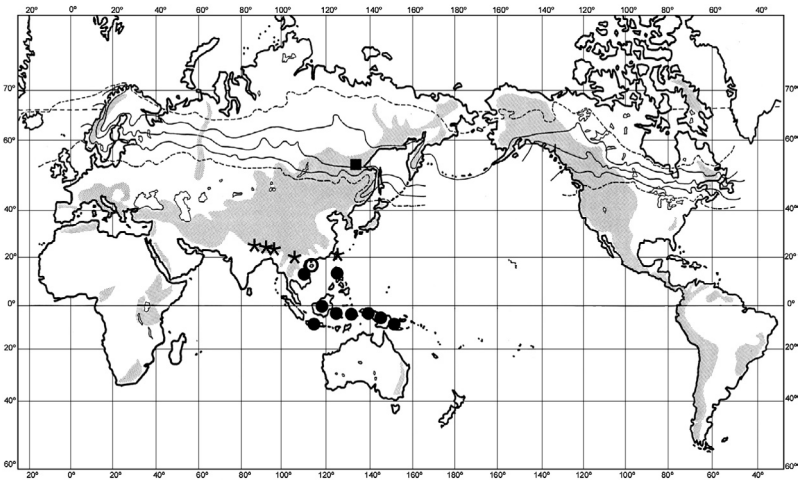

Fig. 3. Distribution of *Herbertus armitanus*, *H. buchii*, *H. guangdongii*, and *H. kurzii*. Solid circles = *H. armitanus*, square = *H. buchii*, open circle = *H. guangdongii*, asterisks = *H. kurzii*.

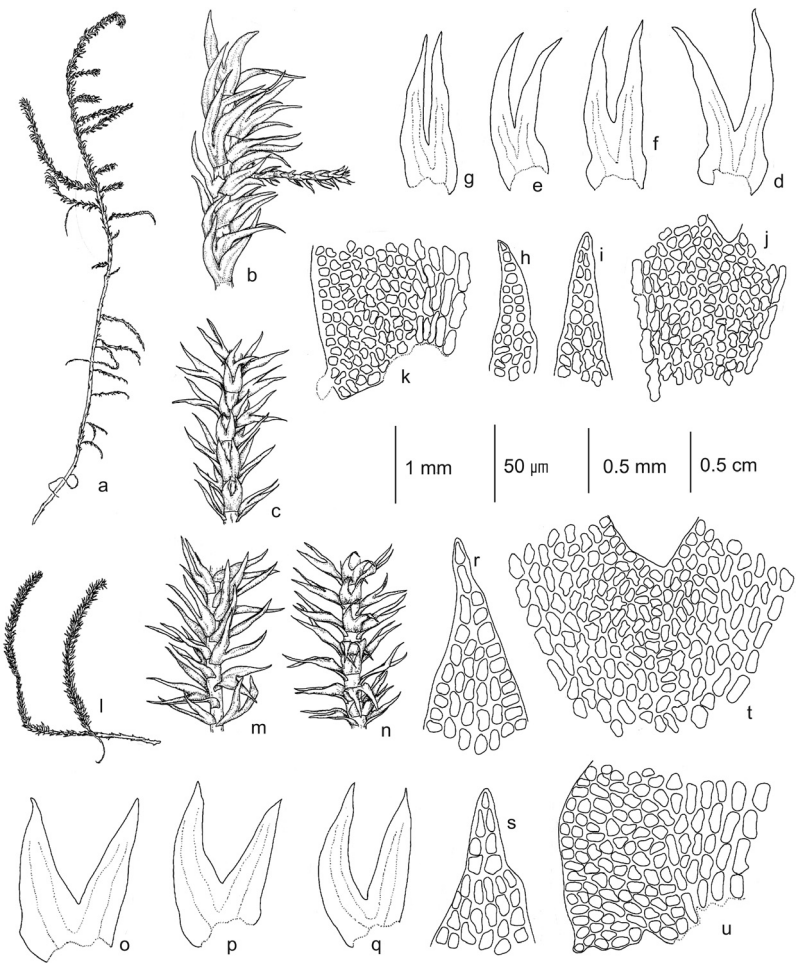

Fig. 4. — **a**–**k**: *Herbertus buchii* (from holotype H-3173965). — **a**: Habit. — **b**: Part of the shoot, side view. — **c**: Part of the shoot, ventral view. — **d** and **e**: Leaves. — **f** and **g**: Underleaves. — **h** and **i**: Leaf apices. — **j**: Cells in sinus. — **k**: Cells of basal lamina and vitta. — **l**–**u**: *Herbertus ceylanicus* (from isolectotype MANCH-10675). — **l**: Habit. — **m**: Part of the shoot, dorsal view. — **n**: Part of the shoot, ventral view. — **o** and **p**: Leaves. — **q**: Underleaf. — **r** and **s**: Leaf apices. — **t**: Cells in sinus. — **u**: Cells of basal lamina and vitta. Use the 0.5 cm scale for **a** and **l**, the 1 mm scale for **b**, **c**, **m** and **n**, the 0.5 mm scale for **d**–**g** and **o**–**q**, and the 50 µm scale for **h**–**k** and **r**–**u**.

apex, lobe apex shortly acute, somewhat blunt in appearance, with 1–4 uniseriate cells and 4 rows below apex two cells wide; leaf margins with a few slime papillae; vitta not conspicuous, extending to beyond half of lobe, vitta cells 11–14 × 56–75 μm in mid basal lamina, bifurcating near base of lamina or well below mid basal lamina, 14–16 cells between sinus and vitta bifurcation point, 11–17 × 11–17 μm; basal lamina cells ca. 10 × 10 μm, with large trigones; underleaves smaller and symmetrical. Sex organs not seen.

My examinations support Prof. Buch's concept of an independent species. The collection locality in the Stanovoy Mountain Range, Dzhiktangra River, is ca. 300 km W from the Sea of Okhotsk. According to Qian *et al*. (2003), the area belongs to the Upper Amur geographical region, which has continental to subcontinental climate with severe winters. The climate of Upper Amur region is influenced by the Pacific air masses. Box and Choi (2003) describe a high annual moisture index for the area. The region is poorly collected, and *H. buchii* can be expected to be found elsewhere in the Russian Far East. Characteristics of *H. buchii* are the straight deeply bifurcated leaves, with equally thick lobes, lobe apices blunt in appearance, and an indistinctive vitta that bifurcates near the base of the basal lamina.

TOTAL DISTRIBUTION (Fig. 3): As 1: Russia, Amur Region, known only from type.

Herbertus ceylanicus (Steph.) Abeyw. (Fig. 4)

Ceylon J. Sci. (Bio. Sci.) 2: 43. 1959 ('*Herberta ceylanica*'). — *Schisma ceylanicum* Steph., Spec. Hep. 4: 22. 1909. — TYPE: Sri Lanka. "Ins. Ceylon centr., Pamvilla in Monte Hantanna", 1300 m, 1898 *Fleischer*, Bryotheca E. Levier 5259 (lectotype G!, designated by Miller 1965: 309; isolectotype MANCH-10675!).

Plants medium-sized, dark or olive brown or greenish, 2–4 cm long. Stem cross-section oval or rounded, 0.2–0.45 mm × 0.15–0.3 mm. Leaves imbricate, ± straight and almost symmetrical, basal lamina somewhat expanded, in dorsal side 5–9 cells wide, leaf length 1–2.6 mm, width 0.4–0.6 mm, length–width ratio 1.8–2.5; bifid 2/3–3/4 of leaf length, lobes broad and straight, 12–19 cells wide at lobe base and 7–12 cells wide at point half way towards apex, lobe apex acute, with 2–3 uniseriate cells and 2–5 rows below apex two cells wide; leaf margin with sessile or up to 2 cells long stalked slime papillae; vitta quite strong in basal part, not grooved, extending only somewhat beyond half of lobe, vitta cells 11–20 μm × 28–80 μm in mid basal lamina, bifurcating in mid basal lamina, or even near base, 5–18 cells between sinus and vitta bifurcation point, 8–17 μm × 11–34 μm; basal lamina cells ca. 11–17 μm × 11–28 μm, with medium-sized trigones; underleaves smaller and symmetrical. Pouched male bracts in 3–6 pairs, bracteoles similar to bracts. Female plants not seen.

SELECTED ILLUSTRATIONS: Miller 1965: 349 (fig. 28), 351 (fig. 32).

The description of *Herbertus ceylanicus* by Miller (1965) fits well my own observations. The species can be identified based on straight leaves, acute broad lobes and relatively narrow basal lamina. The colour is often greenish or olive-brown. Miller (1965) assumed *H. ceylanicus* to grow on soil. However, all the specimens I have seen with the substrate given in the label data, were from tree trunks. *Herbertus ceylanicus* is distributed at elevations of 1200–2600 m in tropical Southeast Asia.

TOTAL DISTRIBUTION (Fig. 5): As 3: Sri Lanka, As 4: Indonesia, Malaysia.

REPRESENTATIVE SPECIMENS EXAMINED. — As 3: **Sri Lanka**. Nuwara Eliya District, on tree, 1978 *Ruinard 17/36* (L-0410294); Horton Plains, 1846 *Gardner*, hb. William Mitten 1906 no. 106, (NY). As 4: **Indonesia**. Sumatra, Bukit Besar, 1899 *Giesenhagen* (M-0025120!, det. Stephani as '*Schisma adunca*'); Flores, Manggarai Prov., Poco Rii mountain ridge, Ruteng, on isolated trees at margin between evergreen forest and slope grassland, sunny, open, dry, 1750 m, 1988 *Touw & Snoek 23294* (L-0410308). **Malaysia**. Peninsular Malaysia, Pahang, Genting Highlands, Gunung Ulu Kali, summit region, mossy forest, hanging down from small twigs, ca. 1.5 m above the forest floor, 1750 m, 1997 *Klazenga 111* (L-0094017).

Herbertus circinatus (Steph.) H.A. Mill. (Fig. 6)

J. Hattori Bot. Lab. 28: 318. 1965 ('*Herberta circinata*'). — *Schisma circinatum* Steph., Spec. Hep. 4: 25. 1909.

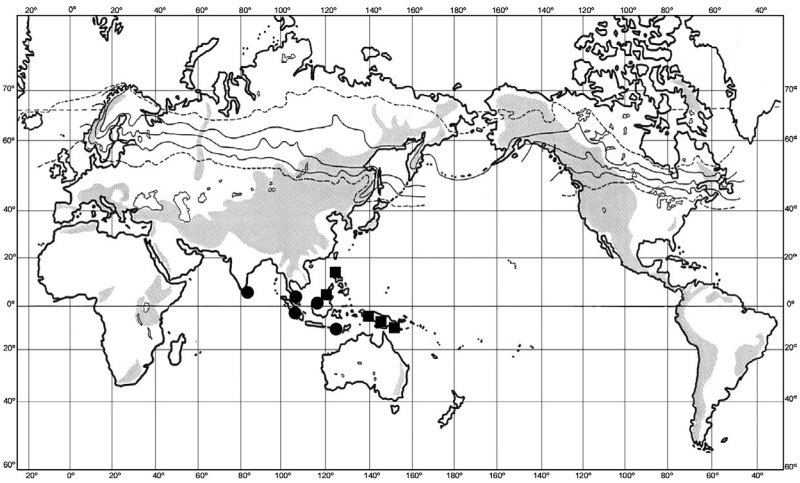

Fig. 5. Distribution of *Herbertus ceylanicus* and *H. circinatus*. Circles = *H. ceylanicus*, squares = *H. circinatus*.

— TYPE: Papua New Guinea. Summit Owen Stanley Range, *MacGregor 28*, F. v. Müller misit 1889 (lectotype G, selected by Miller 1965: 318).

Plants medium-sized to very large, reddish or orange brown, 8–13 cm long. Stem cross section oval, 0.4–0.6 mm × 0.3–0.4 mm. Leaves closely imbricate, strongly circinate, asymmetrical, basal lamina expanded, in dorsal side 8–25 cells wide, leaf length 2.7–3.5 mm, width 0.8–1.4 mm, leaf length–width ratio 1.9–4.0; bifid 1/2–2/3, lobes 17–29 cells wide at lobe base and 12–16 cells wide at point half way towards apex, lobe apex acuminate, with 2–6 uniseriate cells and 3–6 rows below apex two cells wide; leaf margins often with up to 8 cells long stalked slime papillae; vitta very strong, extending to apex of leaf, vitta cells 10–20 × 28–80 μm in mid basal lamina, bifurcating in ca. 2/3 basal lamina, 12–14 cells between sinus and vitta bifurcation point, 8–14 × 20–40 μm; basal lamina cells ca. 10–17 × 20–40 μm, with large trigones; underleaves smaller and symmetrical, not circinate. Sex organs not seen. So (2003) described terminal gynoecia surrounded by several whorls of bracts remarkably larger than lateral leaves.

SELECTED ILLUSTRATIONS: Miller 1965: 381 (fig. 87), 383 (fig. 94); Piippo 1984: 29 (fig. 7a–f).

Robust *Herbertus circinatus* is easily recognized by its strikingly circinate leaf lobes especially in Papua New Guinea. The plants that I have seen from Indonesia, Malaysia and the Philippines are not that robust. *Herbertus circinatus* grows mostly on tree trunks, branches and stumps, but sometimes on peaty soil. The altitude range of *H. circinatus* is from 1900 m to 3300 m, and up to 4500 m according to Grolle and Piippo (1984).

TOTAL DISTRIBUTION (Fig. 5): As 4: Indonesia, Malaysia, Papua New Guinea, the Philippines.

SELECTEC SPECIMENS EXAMINED. — As 4: **Indonesia**. New Guinea, Star Mts., Mt. Antares, camp 41, shrubby vegetation, at base of shrubs and terrestrial (peaty soil), 1959 *van Zanten 637* (H-3173893); Sulawesi, on branch, 2400 m, 1979 *Balgooy 3352* (L-0410309). **Malaysia**. Sabah, Above Kamborangah, Kinabalu, 8000–10 000 ft, 1963 *Richards* (BM-000661046 as *H. longispinus*). **Papua New Guinea**. Western Higlands, Mt. Hagen, 1979 *Lisowski* (B-300224262, B-300224565); Morobe Prov., in alluvial forest and on steep river cliffs along Wantoap River ca. 13 km NNW of Wantoat, on log, 1900–2100 m, 1981 *Norris 61064* (H-3173862). **The Philippines**. Luzon, Mt. Tabayoc Lake Latapugapus, 2320 m, 1968 *Jacobs B682* (B-300234531).

Herbertus dicranus (Taylor *ex* Gottsche *et al.*) Trevis.

Mem. Real. Ist. Lombardo Sci. Lett. Class. Sci. Mat. Nat., ser. 3, 4: 397. 1877 (‘*Herbertia dicrana*’). — *Sendtnera dicrana* Taylor *in* Gottsche *et al.*, Syn. Hep.: 239. 1845. — *Schisma dicranum* (‘*dicrana*’) (Taylor) Steph., Spec. Hep. 4: 24. 1909. — TYPE: Nepal. 1820 *Wallich* (lectotype FH!, designated by Miller 1965: 306).

Schisma juniperinum (‘*juniperina*’) Nees var. *sanguineum* (‘*sanguinea*’) Mont., Ann. Sci. Nat. ser. 17, 19: 15. 1842. — *Sendtnera juniperina* var. *sanguinea* (Mont.) Gottsche *et al.*, Syn. Hep.: 239. 1845. — *Herbertus san-*

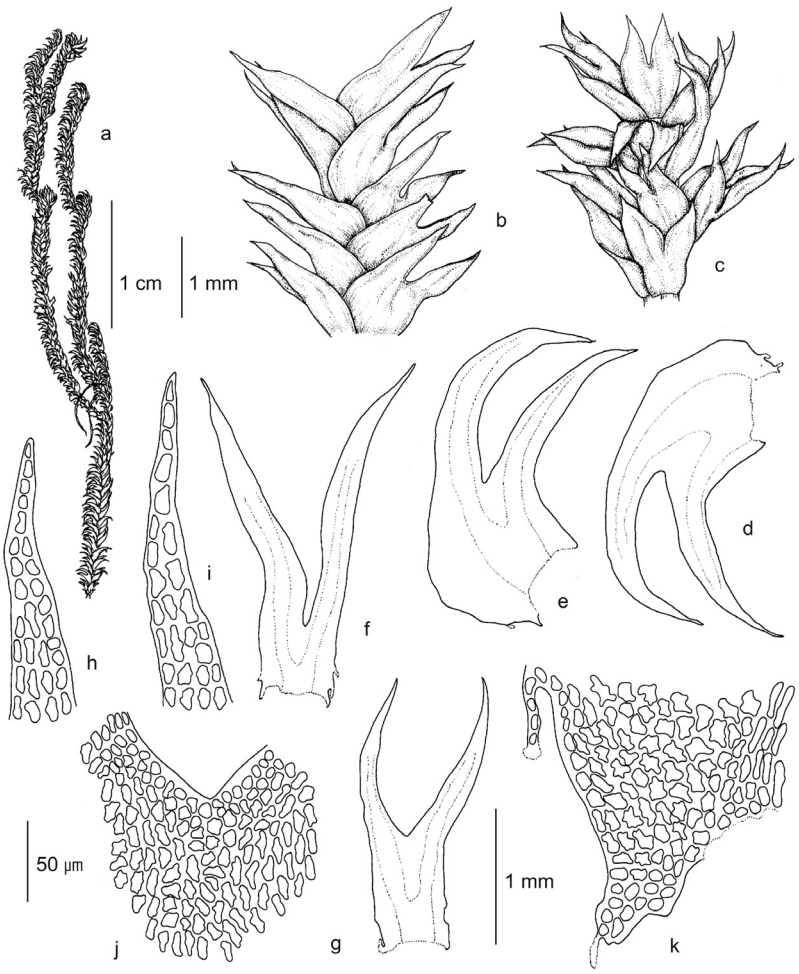

Fig. 6. *Herbertus circinatus* (from H-3173863). — **a**: Habit. — **b**: Part of the shoot, dorsal view. — **c**: Part of the shoot, ventral view. — **d** and **e**: Leaves. — **f** and **g**: Underleaves. — **h** and **i**: Leaf apices. — **j**: Cells in sinus. — **k**: Cells of basal lamina and vitta. Use the 1 cm scale for **a**, the shorter 1 mm scale for **b** and **c**, the longer 1 mm scale for **d**–**g**, and the 50 µm scale for **h**–**k**.

guineus (‘*Herberta sanguinea*’) (Mont.) Austin, Bull. Torrey Bot. Club 6: 302. 1879. — *Schisma sanguineum* (Mont.) Steph., Spec. Hep. 4: 27. 1909. — Type: India. [Tamil Nadu, Nilgiri Hills] Neelgherries, *Perrottet*, Herb. Montagne (lectotype PC!, designated by Miller 1965: 308; isolectotype S-B44720!). — Tentatively synonymized by Miller (1965: 328).

Herbertus (‘*Herberta*’) *chinensis* Steph., Hedwigia 34: 43. 1895. — *Schisma chinense* (Steph.) Steph., Spec. Hep. 4: 26. 1909. — Type: China. Yunnan, Tsang Yang Tschang, *Delavay* (lectotype PC!, here designated; isolectotype BM-000661079!; Miller (1965) erroneously referred to a specimen in G as a type). — Synonymized by Inoue (1977: 9).

Herbertus (‘*Herberta*’) *wichurae* Steph., Hedwigia 34: 45. 1895. — *Schisma wichurae* (Steph.) Steph., Spec. Hep. 4: 25. 1909. — Type: China. *Wichura 2752* (lectotype G!, designated by Miller 1965: 324, erroneously as *Wichura 2742*; isolectotypes BM-000661065!, G!, M-0025081!).— Synonymized by Juslén (2004: 398).

Schisma giraldianum Steph., Spec. Hep. 4: 22. 1909. — *Herbertus giraldianus* (‘*Herberta giraldiana*’) (Steph.) H.A. Mill., J. Hattori Bot. Lab. 28: 316. 1965. — Type: China. Shaanxi, “Schensi, in cacumine montis Kuan-tou-san, inter lichens”, 1894 *Giraldi*, Bryotheca E. Levier 934 (lectotype G-1488!, designated by Miller 1965: 316). — Synonymized by Feldberg & Heinrichs (2005b: 349).

Schisma perrottetii Steph., Spec. Hep. 4: 23. 1909. — *Herbertus* (‘*Herberta*’) *perrottetii* (Steph.) Abeyw., Ceylon J. Sci. (Bio. Sci.) 2: 43. 1959, *syn. nov.*— Type: Sri Lanka. “Ceylon”, *Perrottet* (lectotype G-1529!, designated by Miller 1965: 312).

Schisma sikkimense Steph., Spec. Hep. 4: 25. 1909. — *Herbertus* (‘*Herberta*’) *sikkimensis* (Steph.) W.E. Nicholson *in* Handel-Mazzetti, Symb. Sin. 5: 28. 1930. — Type: India. Sikkim, Himalayas, Herb. Brotherus (lectotype G-1548!, designated by Miller 1965: 307; isolectotype BM-000661084!). — Synonymized by Miller (1965: 328).

Schisma nilgerriense Steph., Spec. Hep. 4: 28. 1909. — *Herbertus* (‘*Herberta*’) *nilgerriensis* (Steph.) H.A. Mill., J. Hattori Bot. Lab. 28: 308. 1965. — Type: India. [Tamil Nadu, Nilgiri Hills] “Hindoustan, Nilgherris”, *Perrottet*, *ex* hb. Cardot 89 (lectotype G!, designated by Miller 1965: 308). — Synomymized by Miller (1965: 328).

Schisma sakuraii Warnst., Hedwigia 57: 69. 1915. —

Herbertus (‘*Herberta*’) *sakuraii* (Warnst.) S. Hatt., J. Hattori Bot. Lab. 2: 6. 1947. — Type: Japan. Prov. Kai, Mt. Komogatake, c. 2450 m an Felsen, 1910 *Sakurai 152* (lectotype MAK!, designated by Miller 1965: 320, antedating the lectotypification by Hodgetts 2001; isolectotype B-30000427!). — Synonymized by Hodgetts (2003: 140).

Schisma fleischeri Steph., Spec. Hep. 6: 358. 1922. — *Herbertus* (‘*Herberta*’) *fleischeri* (Steph.) H.A. Mill., J. Hattori Bot. Lab. 28: 307. 1965. — Type: India. West Bengal, Himalayas, Darjeeling, Tigerhill, 2800 m, 1909 *Fleischer* (lectotype S-B24656!, designated by Miller 1965: 307; isolectotypes F-1076373!, JE!, MO-5222667!, U-0033741!). — Synonymized by Inoue (1977: 9).

Schisma himalayanum Steph., Spec. Hep. 6: 359. 1922. — *Herbertus himalayanus* (‘*Herberta himalayana*’) (Steph.) H.A. Mill., J. Hattori Bot. Lab. 28: 319. 1965. — Type: India. West Bengal, Himalayas, Darjeeling, Thareg, 11 000 ft (3353 m), “1807” (error for 1907?) *Doi*, pro E. Long, Hb. Levier 6145 (lectotype G!, designated by Miller 1965: 320). — Synonymized with *H. sakuraii* by Inoue (1977: 5), and with *H. dicranus* by Hodgetts (2003: 140).

Schisma pinnatum Steph., Spec. Hep. 6: 361. 1922, *syn. nov.* — *Herbertus pinnatus* (‘*Herberta pinnata*’) (Steph.) H.A. Mill., J. Hattori Bot. Lab. 28: 313. 1965. — Type: India. Montes Nilgiri Doddabetta, 8765 p., 2670 m, 1907 *Lüthi*, *ex* herb. Levier (lectotype G!, designated by Miller 1965: 314).

Herbertus longifolius (‘*Herberta longifolia*’) Horik., J. Sci. Hiroshima Univ. ser. b, div. 2, 2: 208. 1934. — Type: Taiwan. Prov. Taihoku, Mt. Taiheizan (Mururoafukyôgetsu), 1932 *Iwamasa 3473* (holotype HIRO!). — Synonymized by Inoue (1977: 9).

Herbertus (‘*Herberta*’) *minima* Horik., J. Sci. Hiroshima Univ. ser. b, div. 2, 2: 208. 1934. — Type: Taiwan. “Formosa, Mt. Morrison” (top 3900 m), 1932 *Horikawa 9203* (holotype HIRO!). — Synonymized with *H. sakuraii* (Warnst.) S. Hatt. (= *H. aduncus* subsp. *aduncus*) by Hattori (1955: 81), but Miller (1965: 316) stated that it belongs to the real *H. sakuraii* (Warnst.) S. Hatt. Also Inoue (1977: 7) studied the type specimen and agrees it to be *H. sakuraii*. Synonymized with *H. dicranus* (as belonging to *H. sakuraii* (Warnst.) S. Hatt.) by Hodgetts (2003: 140).

Herbertus (‘*Herberta*’) *hutchinsiae* (Gottsche) A. Evans subsp. *schusteri* H.A. Mill. & E.B. Scott, Rev. Bryol. Lichénol. 29: 29. 1960. — *Herbertus aduncus* (‘*Herberta adunca*’) (Dicks.) Gray subsp. *schusteri* (H.A. Mill. & E.B. Scott) H.A. Mill., Nova Hedwigia 4: 366. 1962. — Type: Japan. Kumamoto, Mt. Ichifusa, ca. 1700 m, granitic bluffs, 1951 *Mayebara*, Hattori: Hep. Japon. Exs. 162 (isotype NICH-239299!). — Tentatively synonymized by Miller (1965: 314) with *H. aduncus* subsp. *aduncus*, *see* also Schuster (1966: 718).

Herbertus (‘*Herberta*’) *lonchobasis* H.A. Mill., J. Hattori Bot. Lab. 28: 306. 1965. — *Herbertus* (‘*Herberta*’) *lonchobasis* Herzog & W.E. Nicholson, Ann. Bryol. 12: 80. 1939, *nom. nud.* — Type: India. Himalaja, Tsomgo Lake zwischen Gangtok und Natu La, 3800 m, 1937 *Troll 17* (holotype JE!; isotype M-0025093!) — Synonymized by Juslén (2004: 399).

Herbertus (‘*Herberta*’) *mastigophoroides* H.A. Mill., J. Hattori Bot. Lab. 28: 324. 1965, *syn. nov.* — *H. mastigophoroides* Herzog & W.E. Nicholson, Ann. Bryol. 12: 80. 1939, *nom. nud.* — Type: India. West Bengal, Himalayas, Darjeeling, 1935 *Kerstan 3a* (holotype JE!).

Herbertus giraldianus (‘*Herberta giraldiana*’) (Steph.) H.A. Mill. var. *verruculosus* (‘verruculosa’) S. Hatt., Bull. Univ. Mus., Univ. Tokyo 2: 223. 1971. — Type: Bhutan. Nala–Tzatogang, 3400 m, *Abies* forest, 1967 *Kanai*, *Murata*, *Ohashi*, *Tanaka* & *Yamazaki* (holotype NICH-287292!). — Synonymized with *H. giraldianus* by Hattori (1975: 207) and with *H. dicranus* by Feldberg & Heinrichs (2005b: 349).

Herbertus pseudoceylanicus (‘*Herberta pseudoceylanica*’) S. Hatt., Bull. Univ. Mus. Univ. Tokyo 2: 225. 1971, *syn. nov.* — Type: Bhutan. Nala–Tzatogang, 3200–3400 m, 1967 *Hara*, *Murata*, *Ohashi*, *Tanaka* & *Yamazaki* (holotype NICH-287458!).

Herbertus millerianus (‘*Herberta milleriana*’) Del Ros., Philipp. J. Sci. 100: 227. 1971, *syn. nov.* — Type: The Philippines. Luzon, Benguet, Mt. Pulog, 2200–2800 m, mossy oak forest, 1965 *Miller 10566* (holotype PNH, not seen).

Herbertus hainanensis P.J. Lin & Piippo, Bryobrothera 1: 207, 1992, *syn. nov.* — Type: China. Hainan, Jianfengling Mts., on trunk, 1985 *Lin 4169* (*Wu*, *Li*, & *Lin* 85392) (holotype H-3205347!).

Herbertus (‘*Herberta*’) *nicholsonii* Herzog, Ann. Bryol. 12: 80. 1939, *nom. nud.* — Orig. coll.: India. Himalaja, Tsomgo Lake zwischen Gangtok und Natu La, 3800 m, 1937 *Troll 10* (JE!, MU!).

Plants highly variable, from thin and slender to very robust, green, olive, brown or distinctly red to reddish black, 4–13 cm long. Stem cross-section oval, 0.2–0.7 × 0.1–0.5 mm. Leaves imbricate, ± falcate and asymmetrical, with a ± strongly expanded dorsal lamina base (4–)6–20 cells wide, leaf length 0.6–6 mm, width 0.2–2.2 mm, leaf length–width ratio 1.8–3.7; bifid usually to ca. 3/5, lobes widely acute, 10–35 cells wide at lobe base and (6–)7–22 cells wide at point half way towards apex, lobe apex acute with 1–5(–6) uniseriate cells and 2–5 rows below apex two cells wide, leaf margins plane, entire or ± lobate, with few sessile or shortly-stalked basal slime papillae; vitta conspicuous, extending to 1/2–4/5 of lobe, vitta cells 12–15 × 30–68 μm in mid basal lamina, bifurcating usually well below or sometimes at mid basal lamina, 8–29 cells between sinus and vitta bifurcation point, 10–20 × 12–30 μm, basal lamina cells 10–13 × 12–25 μm, often with distinct nodulose trigones; underleaves somewhat smaller and ± symmetrical; pouched male bracts in 4–6 pairs, bracteoles similar, 6-laciniate perianth lobed to almost half, uppermost female bracts deeply plicate, bract lobe and basal lamina margins serrulate or denticulate. Sporophyte not seen.

SELECTED ILLUSTRATIONS: Inoue 1977: 4 (fig. 3, as *H. sakuraii*), 8 (fig. 5); Hodgetts 2001: 263 (fig. 1).

Herbertus dicranus is the most common species in Asia and extremely variable morphologically. At its one extreme it is relatively small, hardly falcate, with thin leaf lobes and little expanded basal lamina. That kind of *H. dicranus* is mostly found in Japan and China, and the plants are sometimes difficult to differentiate from *H. aduncus*, which has, however, no expansion of basal lamina, and no vitta bifurcation point in the upper part of the basal lamina. Its leaves are straight, and the leaf lobes have more numerous uniseriate cells (*see* also Juslén 2004). At the other extreme *H. dicranus* is robust, often red-coloured with falcate broad leaves, and with large basal lamina expansions. *Herbertus dicranus* grows on different substrates from tree trunks to banks and boulders at elevations from 800 m in the Japanese mountains up to 5000 m in the Himalayas.

I was able to study material from 11 provinces of China. The records from Guangxi, Henan, and Jiangxi are new for these provinces. The specimens studied from Hunan are listed in Juslén (2004). According to the checklist by Piippo (1990), *H. dicranus* occurs also in Xizang (Tibet), Fujian, and Zhejiang. Altogether *H. dicranus* is now known from 14 provinces of China.

Hodgetts (2001) lectotypified a *H. sakuraii* (Warnst.) S. Hatt. specimen in MAK. However, Miller (1965) examined the specimen from Sakurai herbarium, which is located in MAK. That is a valid lectotypification. During the course of the present study I was able to study a specimen from B, which contains the original notes and illustrations by Warnstorf. Apparently it is the original type of *H. sakuraii* (Warnst.) S. Hatt., that has been thought to be destroyed during World War II (*see* Hodgetts 2001). As Warnstorf did not specify the holotype, the specimen in B remains as an isolectotype.

Hattori (1984) restudied the type from B, and criticized the short description and original drawings by Warnstorf (1915). Hattori (1984) argued that basal discs are shown too narrow in Warnstorf's illustrations, and suggested that it might be due to imperfect separation of leaves from the shoots. Furthermore, Hattori (1984) estimated that photographic illustrations of *H. sakuraii* leaves in Miller's (1965) revision were not typical *H. sakuraii* but possibly from undeveloped or atypically small leaves. Hattori (1984) confirmed that in his publication from 1947, fig. 1 (p. 4) actually shows *H. sakuraii*, but the name *H. longifissa* was used. In the same paper, figs. 2 (p. 5) and 3 (p. 7) show *H. aduncus* even though it is given there as *H. sakuraii* (Hattori 1947). Hattori (1984) illustrated typical leaves of *H. sakuraii* from the type specimen in B. He stated that typical leaves of *H. sakuraii* can also be found in the Illustrations of Japanese Hepaticae (Inoue 1974). The description and illustrations of *H. sakuraii* by Hattori (1984) as well as the examination of the specimen in B well support the synomization of *H. sakuraii* with *H. dicranus* by Hodgetts (2003). Furthermore, the molecular phylogeny of Feldberg and Heinrichs (2005b) supports the inclusion of *H. sakuraii* within *H. dicranus*.

Schuster (1957) published a specimen from Japan as *Herbertus sakuraii* subsp. *sakuraii*. His identification was based on the prevailing concept of *H. sakuraii*. Miller and Scott (1960) studied a specimen from Sakurai's herbarium, which, however, was not the type. They discussed the identity of *H. sakuraii* (1960) and Miller (1962) the identity of *H. aduncus*. Furthermore, Proskauer (1962) published Dickson's type of *H. aduncus*. Schuster (1966) discussed the nomenclature and accepted the nomenclatural changes made by Miller and Scott (1960), Miller (1962), and Proskauer (1962). After all, *H. sakuraii* subsp. *sakuraii* R.M. Schust. ended up being called '*Herberta adunca*' (Dicks.) Gray subsp. *schusteri* (H.A. Mill. & E.B. Scott) H.A. Mill. Schuster (1966) reminded that the publications cited above did not deal with comparative taxonomy of the plants, but only speculated with nomenclatural points. According to my examination of a large amount of Asian and American specimens, the type specimen of '*Herberta adunca*' (Dicks.) Gray subsp. *schusteri* (H.A. Mill. & E.B. Scott) H.A. Mill. is *H. dicranus*. It is also very similar to the Japanese type specimen of *H. sakuraii* from B.

Herzog (1939) considered that six different species exist in the Himalayan area. He thought that none of the 'species' belong to *Herbertus dicranus*, which is one of the six species listed

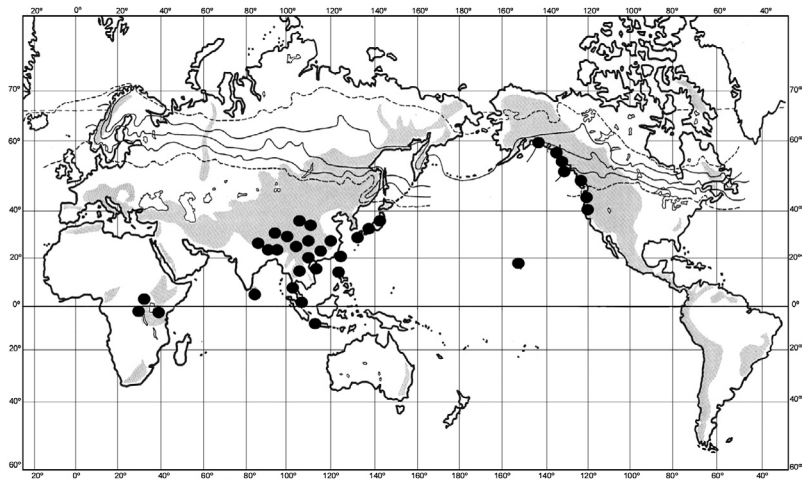

Fig. 7. Distribution of *Herbertus dicranus* based on examined specimens.

by Herzog. However, within the variation of *H. dicranus* in its whole distribution area, all of Herzog's six species are conspecific with *H. dicranus*, except *H. fragilis* that belongs to *H. aduncus*. Earlier, I synonymized *H. lonchobasis* H.A. Mill. including the herbarium names '*Herberta lonchobasis*' Herzog & W.E. Nicholson and '*Herberta nicholsonii*' Herzog (*see* Herzog 1939) with *H. dicranus* (Juslén 2004). One of Herzog's (1939) herbarium names described as a species by Miller (1965), *H. mastigophoroides* H.A. Mill., is now reduced under synonymy of *H. dicranus*. *Herbertus himalayanus* was earlier synonymized with *H. sakuraii* (Inoue 1977) and *H. sakuraii* with *H. dicranus* (Hodgetts 2003). I have not seen the type specimen of *H. millerianus*. However, the specimen I studied (Miller 10442, MO-4416272) was collected from the same area simultaneously with the type (Del Rosario 1971, 1975). Based on my study, although exceptionally robust, *H. millerianus* is conspecific with *H. dicranus*.

Most of the records of *Herbertus subdentatus* (Steph.) Fulford from Africa and South America were left without a name as the type specimen proved not to be similar to other records (*see* Hodgetts 2003). Hodgetts (2003) identified all specimens of *H. subdentatus non* (Steph.) Fulford as *H. dicranus*. However, Feldberg *et al.* (2004) in their molecular study showed that South American *H. subdentatus* specimens fall in the same clade with Austrian *H. sendtneri*. They named the South American *H. subdentatus* records as *H. sendtneri*. They also rejected the synonymy of *H. borealis* with *H. dicranus* based on their phylogenetic results, which showed *H. borealis* to be a sister to *H. stramineus*. A sample of African *H. subdentatus auct. non* (Steph.) Fulford was included in my phylogenetic study, and it belongs to the same unresolved clade with several species, e.g. *H. dicranus* from China (Juslén 2006).

Total distribution (Fig. 7): Am 1: Canada, USA; Afr 2: DR Congo, Kenya, Rwanda, Tanzania, Uganda (Wiggington & Grolle 1996); Afr 3: Madeira, Mauritius, Réunion (Grolle 1995); Oc: Hawaii, New Caledonia (Miller *et al.* 1983); As 2: China, Japan; As 3: Bhutan, India, Nepal, Sri Lanka, Thailand, Vietnam; As 4: Indonesia, Malaysia, the Philippines.

Representative specimens examined. — Afr2: **Uganda**. Ruwenzori Mts., Bukuku Valley, in cushions on grant heather, 10 000 ft, 1956 *Arnell 24238* (UC-1574335). **Tanzania**. 2780–2850m, *Ochyra 88123/D* (H-3174081). **Rwanda**. Pref. Ruhengeri, Gahinga, 3450 m, 1974 *De Sloover 19404* (H-3173906). **DR Congo**. Kivu, 3150 m, 1971 (H-3173904). Am 1: **Canada**. British Columbia. Glacial Lake, Cassiar Mt. Range, near Horn and Glacial Mts., seepy cliff ledge, 1977 *Schofield 65554* (UC-1723163, as *H. aduncus*). **USA**. Alaska. South East Alaska, Sitka, Baranof I., on rock, 800–1000 ft, 1968 *Worley & Hamilton 9435* (H, as *H. himalayanus*). Oregon. Clatsop County, Saddle Mt., shaded humid N facing slope, 1979 *Schofield & Lyford 72278* (UC-1571223 as *H. sakuraii*). Washington. On log, 50 m, 1997 *Norris 90330* (UC-1757819). Hawaii. Kauai, forest between Kawaikoi and Kilohana, 1938 *Cranwell et al.* (H-3174063). As 2: **China**. Anhui. Mt. Huang Shan, on rocks, 1200 m, 1982 *Chien 30484a* (MO-4440790); Guangdong. Sin-Fung district, Zhaoqinq, Ding-hu Shan, 1957 *Wu Han B270* (NICH-3730025, NY); Guangxi. Xing-An Pref., in the forest of *Tsuga*, on moist ground, 1980 *Hu 80201* (MO-2846847, det. Wu as *H. helleri* (Steph.) W.E. Nicholson); Hainan. Nanya Forestry Station, 1250 m, on trunk, 1962 *Chen et al. 415e* (paratype of *H. hainanensis* H-3205348); Henan. Luan-

Chuan, 1960 *Tu 3019* (H-3173861 as *H. chinensis*); Jiangxi. Yanshan Co., Wuyishan National Nature Reserve, warm temperate (subtropical) zone, on boulder, 1580 m, 1993 *Ji 4858* (H); Shaanxi. Tai-Bai-shan, on rock, 3100 m, 1957 *Lee 802* (H-3173909); Sichuan. 3600–3900 m, 1914 *Handel-Mazzetti* (FH as *H. sikkimensis*). Taiwan. Nantou, Along highway 14 just west of Yuanfeng near km post 24 between Wushe and Mt. Hohuan saddle, west of taroko National Park boundary, *Tsuga chinensis* forest with *Rhododendron*, on metamorphic rock, 2800 m, 1999 *Shevock 17905* (UC-1739888); Yunnan. On boulder, 2750 m, *Long 18965* (JE). **Japan**. Kyushu, Hondo, Shimotsuke, Nikko, pr. Catar. D. Kirifuri, rupicola, skiophila, 1933 *Sakurai* (UC-526944, as *H. longifissa*); Shikoku, Ehime-ken (Prov. Iyo), Mt. Onijago-Hazegamori, on dry rock, 800–960 m, 1931 *Iwasama 1525* (HIRO as *H. longifissa*); Honshu, on cliff, 1200 m, *Osada & Muramatsu* (UC-1600789). As 3: **Bhutan**. Sarbhang, on rock, 2150 m, *Long 10604* (JE). **India**. Tamil Nadu, Nilgheris, 2600 m, 1909 *Fleischer* (MANCH-CC10683); Sikkim, 1909 *André* (PC, as *H. pinnatus*); West Bengal, Darjeeling district, on trunk, 1990 m, 1992 *Long 22400* (H); Calcutta, *Milde* (H-SOL 2303009, H-SOL 2303027). **Nepal**. Between Chauki and Balu Khop, shady *Rhododendron* forest, on bank, ca. 2860 m, 1989 *Long 16483* (JE). **Sri Lanka**. Pidurutagala; 2200 m, 1906 *Herzog* (S-B49633, S-B49634, as *H. wichurae*, det. as *H. dicranus* by M. L. So). **Thailand**. Payap, Mt. Chiengdao, on trunk, 2150 m, *Touw 9396* 1965 (BM-000825678). **Vietnam**. Bach-Ma, 1962 *Tixier* (PC, as '*H. longifissum*'). As 4: **Indonesia**. Distrikt Bangli, Gunung (Berg) Abang, im oberen Bereich des Berges, *Casuarina*, 1900–2100 m, 1981 *E. & P. Hegewald* (F-1061622, MO-5223274). **Malaysia**. 1300 m, 1962 *Tixier* (PC, as *H. parisii*). **The Philippines**. Mt. Pulog, Mt. Prov., 5 km from Camp, on tree trunk, 1965 *Pancho 5143* (MO-4416270, as *H. handelii*).

Herbertus guangdongii P.J. Lin & Piippo (Fig. 8)

Bryobrothera 1: 206. 1992. — TYPE: China. Hainan, Jiangfengling Mts, Nanya Forestry Station, on trunk, 1360 m, 1962 *Chen et al. 652a* (holotype H-3205346!).

Plants medium-sized, rather robust, reddish brown, 3–7 cm long. Stem cross-section oval, ca. 0.25 × 0.2 mm. Leaves ± imbricate, somewhat falcate, basal lamina ± expanded, in dorsal side ca. 10 cells wide, leaf length 1.8–2 mm, width 0.7–0.8 mm, leaf length–width ratio 2.5; bifid ca. 2/3 of leaf length, lobes lanceolate, 10 cells wide at lobe base and 8 cells wide at point half way towards apex, lobe apex acuminate, with 2–7 uniseriate cells and ca. 3 rows below apex two cells wide; leaf margins rarely with slime papillae; vitta very indistinct, disappearing below half of lobe, vitta cells 14–17 × 50–60 μm in mid basal lamina, bifurcating above mid basal lamina, 6–7 cells between sinus and vitta bifurcation point, 8–17 × 17–28 μm; basal lamina cells ca. 14 × 28 μm, with large trigones; underleaves smaller and more symmetrical. Sex organs not seen.

SELECTED ILLUSTRATIONS: Lin *et al.* 1992: 205 (fig. 2f–k).

Herbertus guangdongii can be identified by very indistinctive vitta, slight constriction at the base of the leaf lobes, and leaf lobes abruptly narrowing at apices to 2–7 elongated uniseriate cells. I have seen only few specimens of *Herbertus* from Hainan and only the type specimen of *H. guangdongii*. In order to confirm the status of this species and its relationships with other species of the genus more specimens would be needed.

TOTAL DISTRIBUTION (Fig. 3): As 2: China, Hainan, known only from the type.

Herbertus kurzii (Steph.) R.S. Chopra (Fig. 8)

J. Indian Bot. Soc. 22: 247. 1943 ('*Herberta kurzii*'). — *Schisma kurzii* Steph., Spec. Hep. 4: 24. 1909. — TYPE: Himalayas, *Kurz* 106 (lectotype G!, designated by Miller 1965: 320).

Herbertus ('*Herberta*') *handelii* W.E. Nicholson in Handel-Mazzetti, Symb. Sin. 5: 28. 1930. — TYPE: China. Yunnan, between Haba and Dschungdien, 4350–4450 m, 1915 *Handel-Mazzetti 6923* (holotype S!). — Synonymized with *H. kurzii* (Steph.) H.A. Mill. by Hattori (1966: 503).

Herbertus imbricatus ('*Herberta imbricata*') Horik., J. Sci. Hiroshima Univ. ser. b, div. 2, 2: 207. 1934. — TYPE: Taiwan. "Formosa, Mt. Taiheizan, prov. Taihoku", 1932 *Horikawa 9380* (holotype HIRO!). — Synonymized with *H. kurzii* (Steph.) H.A. Mill. by Hattori (1966: 503).

Herbertus ('*Herberta*') *nepalensis* H.A. Mill., J. Hattori Bot. Lab. 28: 322. 1965, *syn. nov.* — TYPE: Nepal. Mahalangur Himal, "Khumbu Höhe westlich Lobuche", ± 5100 m, leg. 1962 *Poelt H77* (holotype MU-000000338!; isotypes JE!, M-0025088!, NICH-276953!).

Plants medium-sized to large, often robust, dark brown, blackish, often with deep purple, reddish or orange, 5–16 cm long. Stem cross-section oval, 0.2–0.45 × 0.2–0.35 mm. Leaves imbricate, falcate, basal lamina strongly expanded, in dorsal side 8–25 cells wide, leaf length 0.85–2.0 mm, width 0.5–1.2 mm, leaf length–width ratio 1.25–2.0; bifid 1/2–2/3 of leaf length, lobes lan-

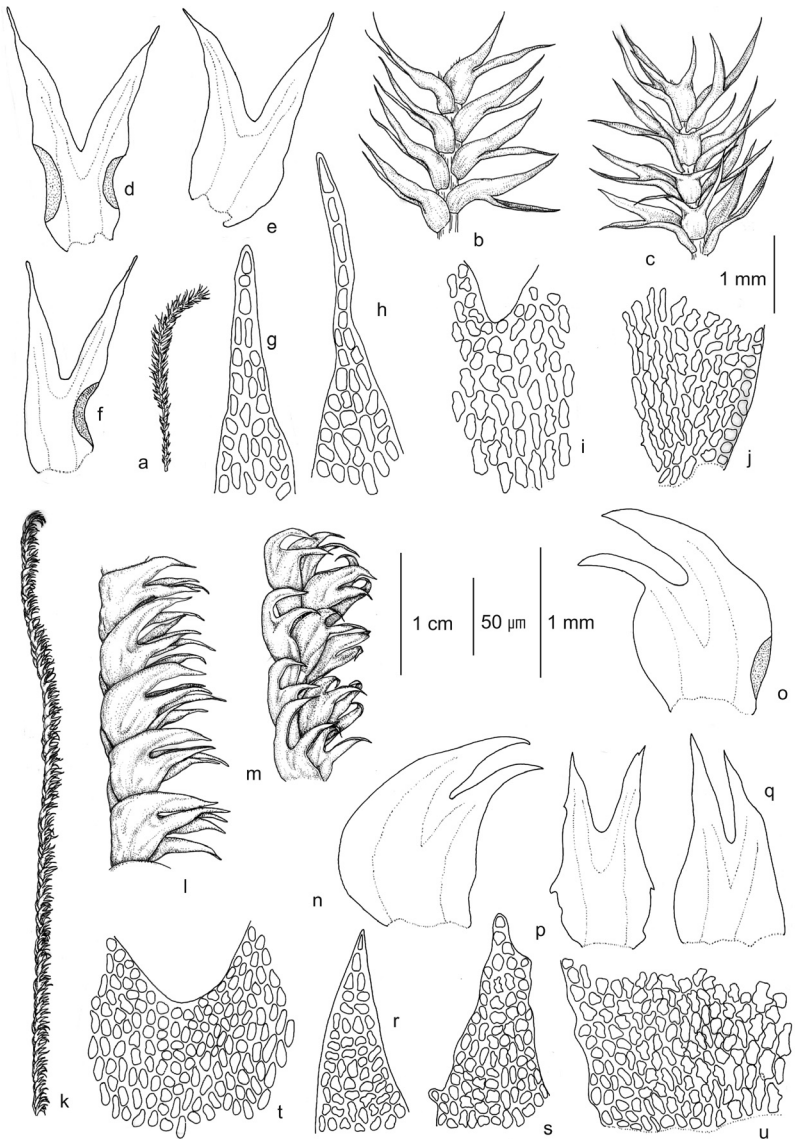

Fig. 8. — **a**–**j**: *Herbertus guangdongii* (from holotype H-3205346). — **a**: Habit. — **b**: Part of the shoot, dorsal view. — **c**: Part of the shoot, ventral view. — **d** and **e**: Leaves. — **f**: Underleaf. — **g** and **h**: Leaf apices. — **i**: Cells in sinus. — **j**: Cells of basal lamina and vitta. — **k**–**u**: *Herbertus kurzii* (**k**–**o**, **q**, **r**, **t**, and **u** from *Long 22651*, H; **p** and **s** from *Poelt H127*, JE). — **k**: Habit. — **l**: Part of the shoot, side view. — **m**: Part of the shoot, ventral view. — **n** and **o**: Leaves. — **p** and **q**: Underleaves. — **r** and **s**: Leaf apices. — **t**: Cells in sinus. — **u**: Cells of basal lamina and vitta. Use the 1 cm scale for **a** and **k**, the shorter 1 mm scale for **b**, **c**, **l**, and **m**, the longer 1 mm scale for **d**–**f** and **n**–**q**, and the 50 µm scale for **g**–**j** and **r**–**u**.

ceolate, 12–35 cells wide at lobe base and 7–20 cells wide at point half way towards apex, lobe apex broadly acute, with 1–4(–7) uniseriate cells and 1–5 rows below apex two cells wide; leaf margins with sessile or shortly stalked (1–2 cells long stalks) slime papillae, rarely without slime papillae; vitta strong below, grooved, extending below half or a little beyond half of lobe, vitta cells 10–28 × 40–85 μm in mid basal lamina, bifurcating in mid basal lamina, rarely near base, (6–)9–30 cells between sinus and vitta bifurcation point, 8–20 × 11–28 μm; basal lamina cells 8–17 × 14–36 μm, with medium-sized or large trigones; underleaves somewhat smaller and more symmetrical, lobe margins often toothed. Sex organs not seen.

SELECTED ILLUSTRATIONS: Miller 1965: 387 (figs. 99–102); Inoue 1977: 6 (fig. 4).

Herbertus kurzii was described from the Himalayas by Stephani (1909). Miller (1965) mentioned that it is known only from type specimen. I was able to study a large number of additional specimens from the Himalayas. Hattori (1966) synonymized *H. handelii* from Yunnan,

China and *H. imbricatus* from Taiwan with *H. kurzii*. The holotype of *H. kurzii* is badly fragmented, but the examination proved it to be conspecific with specimens of *H. nepalensis* described by Miller (1965). The type specimen of *H. nepalensis* shows particularly clearly the toothed or serrate upper margins of underleaves. In most specimens of *H. kurzii* underleaf margins are not serrate but only malformed or occasional teeth are visible in underleaf margins. However, in addition to serrate underleaf margins, *H. kurzii* is relatively easily identified by its deeply plicate leaves and relatively large leaves with small (< 2) lateral leaf length–width ratio. It has been collected both on tree trunks and on rocks, only from ca. 4000 m and even higher altitudes from the Himalayas. I have not seen additional specimens from Yunnan or Taiwan.

TOTAL DISTRIBUTION (Fig. 3): As 2: China; As 3: Bhutan, India, Nepal.

REPRESENTATIVE SPECIMENS EXAMINED. — As 3: **Bhutan**. Thimphu district, slope on S side of Jange Tsho, *Rhododendron aeruginosum* scrub, on branch of *Rhododendron*, ca. 3940 m, 1999 *Long 28864* (H, as *H. delavayi*). **India**. Sikkim, West District, Between Dzongri and Prek Chhu, open hillside with dwarf *Rhododendron*, on boulder, alt ca. 4000 m, 1992 *Long 22651* (H). **Nepal**. Tributary of Simbua Khola on S side of Yalung Glacier, steep rocky valley in mossy block scree, ca. 4400 m, 1989 *Long 17097* (JE).

Herbertus longispinus Jack & Steph. (Fig. 9)

Hedwigia 31: 15. 1892. — *Schisma longispinum* (Jack & Steph.) Steph., Spec. Hep. 4: 29. 1909. — TYPE: The Philippines. "Insulae Philippinae", 1870 *Wallis* (lectotype G!, designated by Miller 1965: 326).

Schisma angustissimum Herzog, Ann. Bryol. 5: 79. 1932, *syn. nov*. — *Herbertus* ('*Herberta*') *angustissimus* (Herzog) H.A. Mill., J. Hattori Bot. Lab. 28: 325. 1965.— TYPE: The Philippines. Mt. Puloglovo (Boutoc), 2000–2300 m, 1928 *Burgeff 8028* (lectotype JE!, designated by Miller 1965: 326; isolectotypes PC!, S-B44714!).

Plants medium-sized to large, sometimes robust, brown, reddish or orange brown, 8–13 cm. Stem cross-section oval or flattened oval, 0.25–0.5 mm × 0.2–0.35 mm. Leaves distant or imbricate, strongly falcate, squarrose or spreading, basal lamina hardly expanded, in dorsal side 3–11 cells wide, leaf length 1.6–4.0 mm, width 0.35–0.7 mm, leaf length–width ratio 4.1–5.9; bifid 2/3–5/6 of leaf length, lobes long linear, 10–17 cells wide at lobe base and 7–10 cells wide at point half way towards apex, lobe apex long, slender, piliferous, with 5–15 not elongated uniseriate cells and 3–17 rows below apex two cells wide; leaf margin with a few slime papillae; vitta quite strong, grooved, extending to apex of lobe, vitta cells 8–20 μm × 55–85 μm in mid basal lamina, bifurcating above or in mid basal lamina, 5–15 cells between sinus and vitta bifurcation point, 8–22 μm × 14–28 μm; basal lamina cells 11–17 × 11–28 μm, with small or medium-sized trigones; underleaves smaller and more straight; 6-laciniate perianth lobed to half of length, uppermost female bracts deeply plicate, bract lobe and basal lamina margins serrulate or denticulate. Male sex organs and sporophyte not seen.

SELECTED ILLUSTRATIONS: Miller 1965: 400 (fig. 125, as '*H. angustissima*', fig. 126), 404–405 (figs. 131–132).

The leaves of *Herbertus longispinus* are deeply bifid, the leaf lobes are extremely long, ending with 5–15 not very strongly elongated uniseriate cells, 2–3 times longer than wide, below that the lobe is up to 17 rows two cells wide; the basal lamina is hardly expanded. The type locality of both *Herbertus longispinus* and *H. angustissimus* are in the Philippines. Already So (2003) suspected them to be conspecific and *H. angustissimus* is now synomized with *H. longispinus*. All the leaf measurements of the taxa are very similar. Mostly, there is variation in density of leaves and falcatedness of leaves from imbricated, falcated (e.g. the type specimen of *H. longispinus*) to ± spreading and very sparse and brittle leaves (e.g. the type specimen of *H. angustissimus*). Based on the studied specimens the latter form seems to be more common. *Herbertus longispinus* grows both on trees and rocks, but the substrate does not seem to explain the variation. It occurs at elevations from 1200 m to 3000 m.

TOTAL DISTRIBUTION (Fig. 10): As 2: Taiwan; As 4: Indonesia, Malaysia, the Philippines.

REPRESENTATIVE SPECIMENS EXAMINED. — As 2: **China**. Taiwan, Chi-tou to Chi-ti, Nantou Co., on humus, 1200–1800 m, 1968 *Chuang & Schofield 492* (as *H. dicranus* det. by Lee) (NY). As 4: **Indonesia**. On cliff, 1963 *Iwatsuki 533* (H); 6500 ft, 1962 *Meijer B11697* (L-0410312); Flores, on bark,

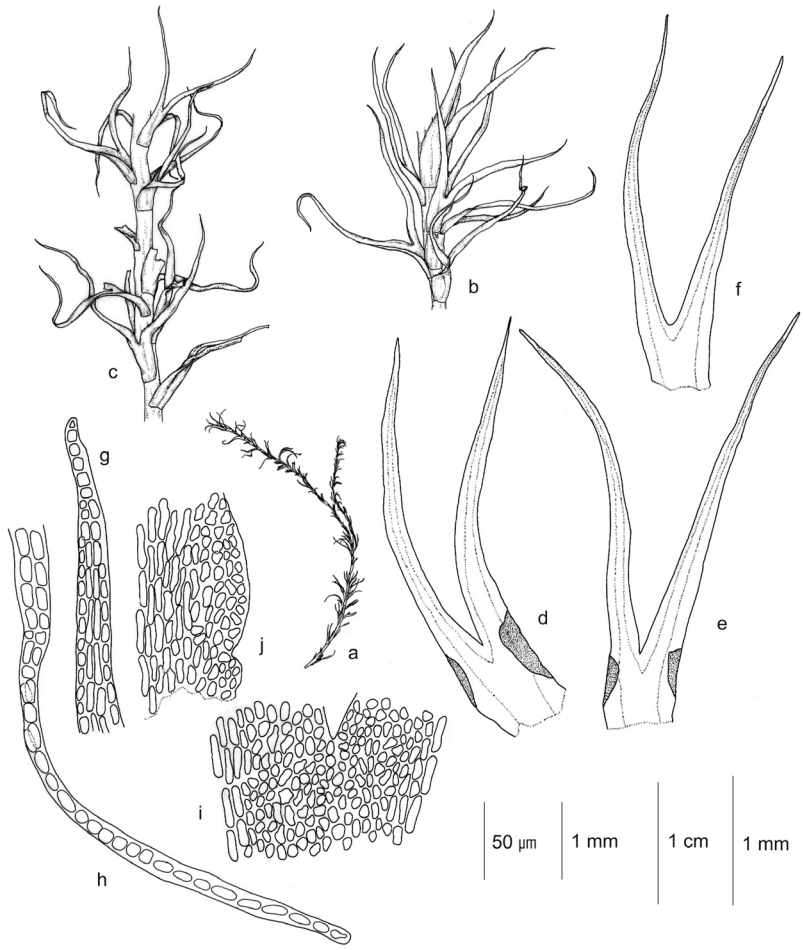

Fig. 9. *Herbertus longispinus* (**a**–**g**, **i** and **j** from lectotype, G; **h** from isolectotype PC). — **a**: Habit. — **b**: Part of the shoot, dorsal view. — **c**: Part of the shoot, ventral view. — **d** and **e**: Leaves. — **f**: Underleaf. — **g** and **h**: Leaf apices. — **i**: Cells in sinus. — **j**: Cells of basal lamina and vitta. Use the 1 cm scale for **a**, the shorter 1 mm scale for **b** and **c**, the longer 1 mm scale for **d**–**f**, and the 50 µm scale for **g**–**j**.

2050–2130 m, 1988 *Schmutz 6868* (L-0410306). **Malaysia**. Borneo, Mt. Kinabalu, eastern shoulder, 9400–10 000 ft, 1961 *Chew*, *Corner* & *Stainton 2053* (BM-000825727). **The Philippines**. Luzon, 1979 *Alvarez & Tandang 0-79416* (PNH-44292 as *H. angustissimus* det. Kamimura); Mt. Pulog, Benguet, mossy oak forest, 2200–2800 m, *Miller 10479* (MO-4416271); Mt. Banahao, on tree, *Pancho 3076* (PNH-44306).

Herbertus pilifer (Steph.) H.A. Mill. (Fig. 11)

J. Hattori Bot. Lab. 28: 327. 1965 ('*Herberta pilifera*'). — *Schisma piliferum* Steph., Spec. Hep. 4: 27. 1909. — *Herbertus pilifer* ('*Herberta pilifera*') Schiffn., Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 60: 252. 1892, *nom. inval*. — TYPE: Indonesia. Amboina, Salhoetoe, 1889 *Karsten* (lectotype G!, designated by Miller 1965: 327).

Plants medium-sized, orange or reddish brown, sometimes with greyish or deep purple colour, 3–8 cm. Stem cross-section oval, 0.25–0.35 × 0.2–0.25 mm. Leaves imbricate, somewhat falcate, basal lamina not much expanded, in dorsal side 5–8 cells wide, leaf length 1.7–2.6 mm, width 0.4–0.6 mm, length–width ratio 4.1–4.6; bifid 2/3–3/4 of leaf length, lobes narrowly lanceolate, 12–17 cells wide at lobe base and 5–9 cells wide at point half way towards apex, lobe apex piliferous, with 6–9 uniseriate strongly elongated cells, and 2–7 rows below apex two cells wide; leaf margin with stalked slime papillae, stalks up to 8 cells long, sometimes margins without slime papillae; vitta not strong in basal part, but extending to apex of lobe, vitta cells 14–20 μm × 55–80 μm in mid basal lamina, bifurcating below mid basal lamina, 8–16 cells between sinus and vitta bifurcation point, 14–20 μm × 14–20 μm; basal lamina cells ca. 14 μm × 14–40 μm, with large trigones; underleaves smaller and symmetrical. Sex organs not seen.

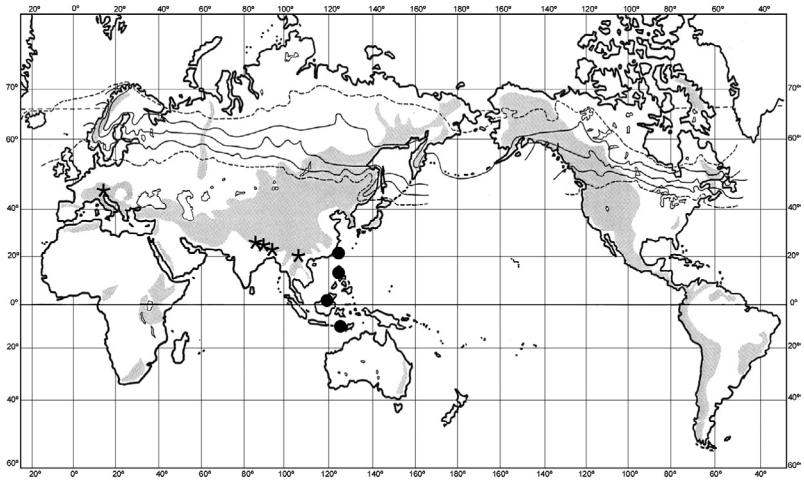

Fig. 10. Distribution of *Herbertus longispinus* and *H. sendtneri*. Circles = *H. longispinus*, asterisks = *H. sendtneri*.

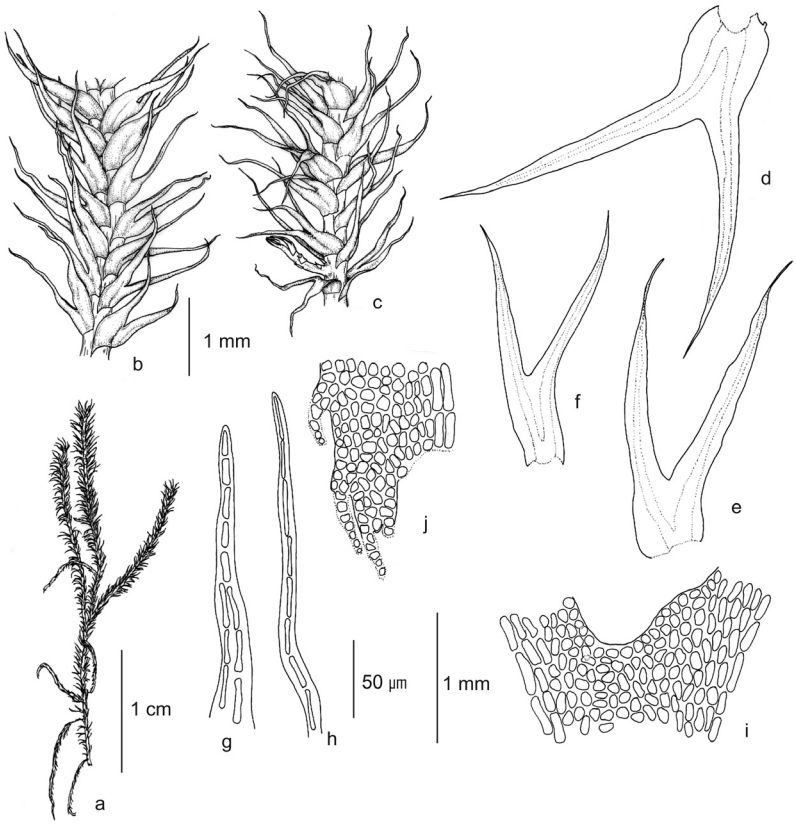

Fig. 11. *Herbertus pilifer* (**a**–**c**, **e**, **g**, **i** and **j** from *Kluiving 1453*, H; **d**, **f**, **h** from L-0410297). — **a**: Habit. — **b**: Part of the shoot, dorsal view. — **c**: Part of the shoot, ventral view. — **d** and **e**: Leaves. — **f**: Underleaf. — **g** and **h**: Leaf apices. — **i**: Cells in sinus. — **j**: Cells of basal lamina and vitta. Use the 1 cm scale for **a**, the shorter 1 mm scale for **b** and **c**, the longer 1 mm scale for **d**–**f**, and the 50 µm scale for **g**–**j**.

SELECTED ILLUSTRATIONS: Miller 1965: 409 (fig. 138); Piippo 1984: 28 (fig. 6).

Herbertus pilifer resembles *H. longispinus*, but it can identified by very piliferous leaf apices, which end in 6–9 very strongly elongated uniseriate cells, the uniseriate cells being 5–6 times longer than wide. In Meijer's specimens from Borneo, collected from ultrabasic area, the lumens of leaf apex cells are reduced to only narrow lines ca. 10 times longer than wide. The leaf apices of those plants are extreme as well, being very sharp in their appearance. Furthermore, the basal lamina of *H. pilifer* is even less expanded than that of *H. longispinus*. The substrates of *H. pilifer* are poorly indicated in

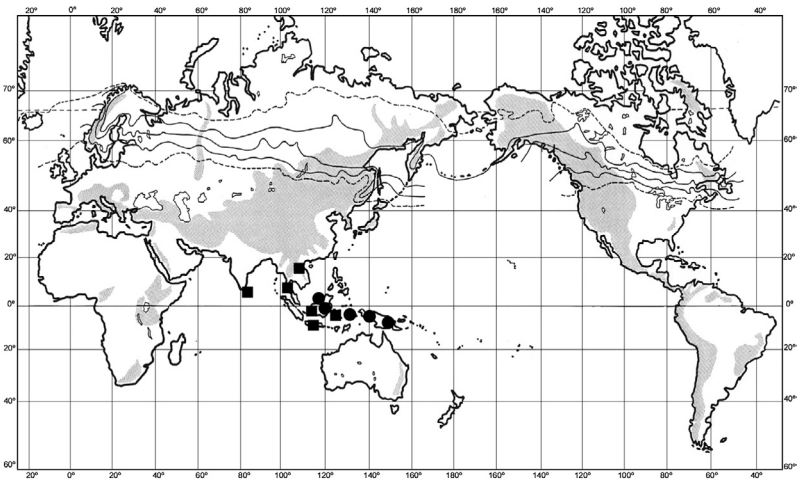

Fig. 12. Distribution of *Herbertus pilifer* and *H. ramosus*. Circles = *H. pilifer*, squares = *H. ramosus*.

the specimens that I have examined. The species grows at the elevations of 1000–3500 m.

TOTAL DISTRIBUTION (Fig. 12): As 4: Indonesia, Malaysia, Papua New Guinea.

REPRESENTATIVE SPECIMENS EXAMINED. — As 4: **Indonesia**. Amboina, *Teysmann* (BM-000661050); Borneo, ultrabasic area, 9000 ft, 1960 *Meijer B10240* (L-0410297). New Guinea, West Irian, Eipomek-Tal, 1600 m, 1976 *Hiepko & Schultze-Motel 2442* (B-300219630). **Malaysia**. Sarawak, Mt. Dulit, 1932 *Richards 2191*, (BM-000825728). **Papua New Guinea**. Western Higlands, Mt. Hagen, 1979 *Lisowski* (B-300224661); on forest floor, 3500 m, *McVean 268465* (H-298772).

Herbertus ramosus (Steph.) H.A. Mill. (Fig. 13)

J. Hattori Bot. Lab. 28: 314. 1965. ('*Herberta ramosa*') — *Schisma ramosum* Steph., Spec. Hep. 4: 23. 1909. — TYPE: Indonesia. Java, *Hasskarl* (lectotype G!, designated by Miller 1965: 314).

Schisma javanicum Steph., Spec. Hep. 4: 26. 1909. — *Herbertus javanicus* ('*Herberta javanica*') (Steph.) H.A. Mill., J. Hattori Bot. Lab. 28: 319. 1965. —TYPE: Indonesia. Java, 1870 *Hillebrandt* (holotype G!). — Synonymized by So (2003: 22).

Plants medium-sized to large, sometimes robust, brown, reddish or orange brown. Stem cross-section oval, 0.4–0.6 × 0.25–0.5 mm. Leaves imbricate, falcate, basal lamina strongly expanded, in dorsal side 8–24 cells wide, leaf length 1.0–2.8 mm, width 0.7–1.2 mm, leaf length–width ratio 1.5–2.5(–3.5); bifid 1/2–3/4 of leaf length, lobes broadly lanceolate, 15–34 cells wide at lobe base and 9–16 cells wide at point half way towards apex, lobe apex acute, with 4–8 uniseriate cells and 2–7 rows below apex two cells wide; leaf margins with sessile or shortly stalked (1–2 cells long stalks) slime papillae, rarely without slime papillae; vitta strong, grooved, extending to half or somewhat beyond half of lobe, vitta cells 11–20 μm × 28–87 μm in mid basal lamina, bifurcating below mid basal lamina or near base, 14–26 cells between sinus and vitta bifurcation point, 8–17 × 8–31 μm; basal lamina cells 11–17 × 11–34 μm, with large trigones; underleaves smaller and more symmetrical. Gynoecia terminal, with several pairs of female bracts, innermost bract bifid to its half, length ca. 3.5 mm, oblong; perianth ca. 4.5 mm long, mouth lobes acuminate. Sporophyte described by So (2003).

SELECTED ILLUSTRATIONS: Miller 1965: 384 (fig. 95, as '*H. javanica*'); So 2003: 16 (fig. 3).

So (2003) synonymized *Herbertus javanicus* (Steph.) H.A. Mill. with *H. ramosus* (Steph.) H.A. Mill. Both were originally described from Java, and my examination of holotypes of both *H. ramosus* and *H. javanicus* confirmed this synonymization.

Characteristic for *H. ramosus* are falcato-secund leaf lobes, the dorsal basal lamina often much wider than the ventral one, and broad lanceolate lobes. The leaves are often so wide that the leaf length–width ratio is smaller than in most of the Asian species. *Herbertus ramosus* is a common species in Indonesia extending to

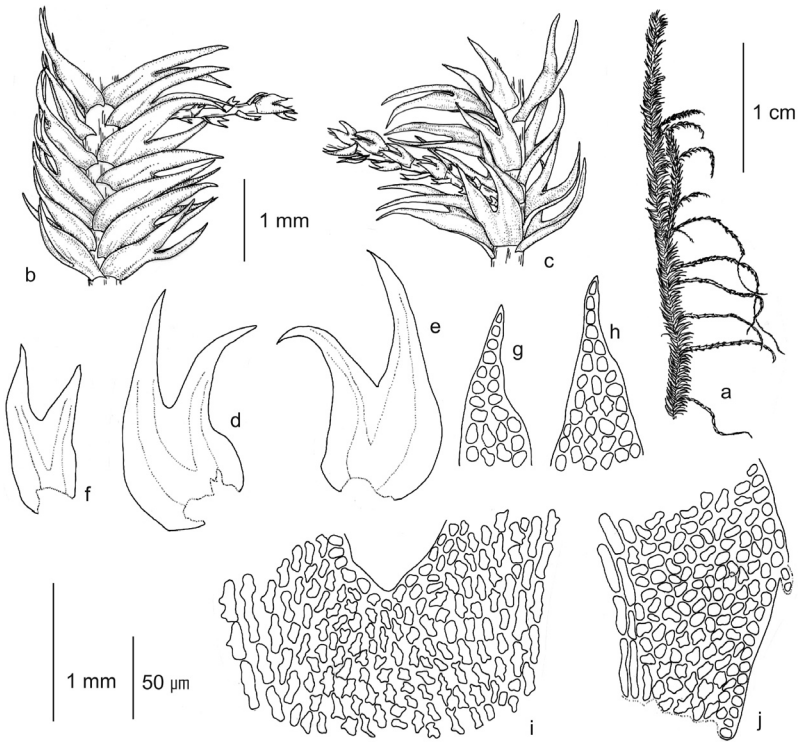

Fig. 13. *Herbertus ramosus* (from holotype of *H. javanicus*, G). — **a**: Habit. — **b**: Part of the shoot, dorsal view. — **c**: Part of the shoot, ventral view. — **d** and **e**: Leaves. — **f**: Underleaf. — **g** and **h**: Leaf apices. — **i**: Cells in sinus. — **j**: Cells of basal lamina and vitta. Use the 1 cm scale for **a**, the shorter 1 mm scale for **b** and **c**, the longer 1 mm scale for **d**–**f**, and the 50 µm scale for **g**–**j**.

New Guinea (So 2003). *Herbertus javanicus* is a common name in specimens due to Schiffner's large collections from 1893 and 1894, with duplicates in various herbaria under this name. Study of these specimens revealed that in addition to *H. javanicus* (= *H. ramosus*) they contain also *H. armitanus* and *H. ceylanicus*. I have examined specimens at elevations 1200–3300 m growing on tree trunks and roots, but So (2003) also reported specimens growing on peat and on ground at above 4000 m from West Irian, Indonesia, and from Papua New Guinea. One peculiar specimen collected by Harder *et al.* from Vietnam grew on limestone. The shoots are robust, the basal laminas of the leaves are largely expanded, the vitta poorly defined, and most conspicuously the lobes are often unequally divided to three lobes both in lateral and underleaves. I suspect that these peculiar features might be due to the substrate.

Total distribution (Fig. 12): As 3: Sri Lanka, Thailand, Vietnam; As 4: Indonesia, Papua New Guinea.

Representative specimens examined. — As 3: **Sri Lanka**. 1865 *Beccari* (L-0278232). **Thailand**. Mt. Luang, on trunk, 1650–1700 m, 1966 *Touw 11719* (BM-000745144). **Vietnam**. Ha Giang, Quang Ba District, Bat Dai Son, in primary forest on limestone with Biota sp., *Fraxinus*, *Quercus*, and *Pseudotsuga*, *Taxus* and *Acer* dominants, collections along ridge and below peak, and some on slopes with broadleaved, deciduous forest with some coniferous spp., 1100–1200 m, 2000 *Harder*, *Hiep & Averyanov 5093* (MO-5244366). As 4: **Indonesia**. Java, montis Pangerango, 2975 m, 9 May 1894 *Schiffner* (B-300230210); Sulawesi (Celebes), on trunk, 2360 m, 1981 *Johansson*, *Nybom & Riebe 452* (L-0410317); Borneo, *Korthals* (BM-000825739, H-SOL 2303013, H-SOL 2303024).

Herbertus sendtneri (Nees) Lindb. (Fig. 14)

in Lindberg & Lackström, Hep. Scand. Exs. 1: [13] No. IV. 1874. — *Schisma sendtneri* Nees Naturgesch. Eur. Leberm. 3: 575. 1838. — *Jungermannia sauteriana* Hübener & Genth, Deutschl. Leberm. 5: no. 108. 1839, *nom. nud.* — *Sendtnera sauteriana* Nees, in Gottsche *et al.*, Syn. Hep. 240. 1845, *nom. illeg. superfl.* — Type: Austria. Inzinger Berge, Ober-Innthal, 2300 m, *Sendtner* (lectotype S-B47275!, designated by Grolle 1975: 483).

Herbertus ('*Herberta*') *delavayi* Steph., Hedwigia 34: 43. 1895. — *Schisma delavayi* (Steph.) Steph., Spec. Hep. 4: 22. 1909. — Type: China. Yunnan, "Bois de Ma eul chan", 2500 m, 1889 *Delavay* (holotype PC; isotypes BM-000661074! G!) — Synonymized by Hattori (1966: 504).

Plants small to medium-sized, dark or orange brown, 2–6 cm long. Stem cross-section tri-

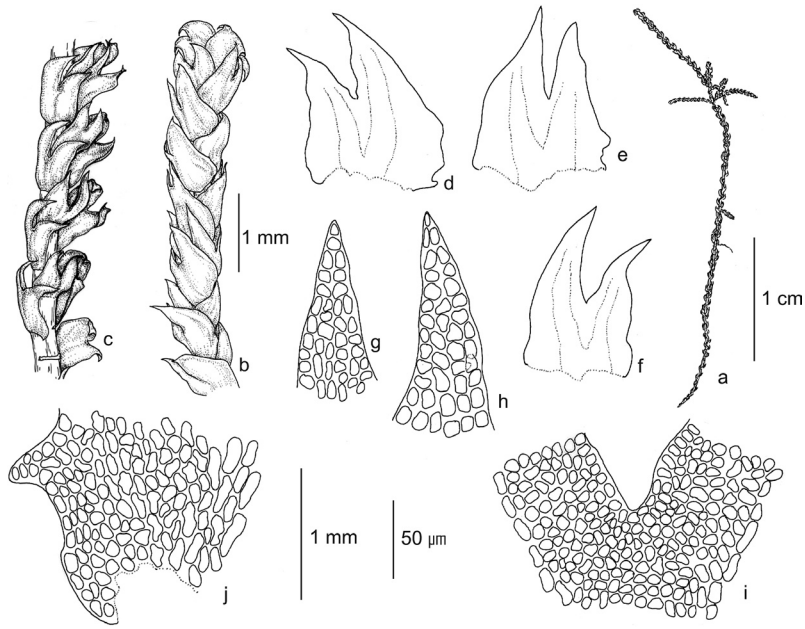

Fig. 14. *Herbertus sendtneri* (from isotype of *H. delavayi*, G). — **a**: Habit. — **b**: Part of the shoot, dorsal view. — **c**: Part of the shoot, side view. — **d** and **e**: Leaves. — **f**: Underleaf. — **g** and **h**: Leaf apices. — **i**: Cells in sinus. — **j**: Cells of basal lamina and vitta. Use the 1 cm scale for **a**, the shorter 1 mm scale for **b** and **c**, the longer 1 mm scale for **d**–**f**, and the 50 µm scale for **g**–**j**.

angular to somewhat rounded, 8–11(–14) cells wide and 8–12 cells high, 0.15–0.45 × 0.2–0.4 mm size. Leaves ± imbricate, erect, falcate or ± straight, asymmetrical, basal lamina expanded, in dorsal side 9–21 cells wide, size of those cells 3–5 × 3–6 μm, leaf length 0.7–2.5 mm, width 0.5–2.0 mm, leaf length–width ratio 1.0–1.3(–1.5); bifid 2/5–2/3; lobes from broad acute to triangular, 10–26 cells wide at lobe base and 9–20 cells wide at point half way towards apex, lobe apex quite blunt, with 1–4(–6) uniseriate cells and 1–3(–5) rows below apex two cells wide; leaf margins often with coarse appendages, slime papillae from sessile to stalked with two cells; vitta not strong or distinct only below, extending usually just to bifid part of leaf or to half of lobe, vitta cells 14–20 × 40–90 μm in mid basal lamina, bifurcating in mid basal lamina, 1/4–4/5 of length of basal lamina from sinus, (5–)7–15(–19) cells between sinus and vitta bifurcation point, 11–28 × 11–33, basal lamina cells 11–17 × 11–22 μm, often with distinctive trigones; underleaves smaller and more symmetrical. Sex organs not seen.

Selected illustrations: Miller 1965: 392 (fig. 109) as '*H. delavayi*'; Meinunger & Köckinger 2002: 40 (fig. 3).

The species is easily recognized by small length–width ratio of leaves, weakly falcate-secund leaves, with often coarse marginal appendages, very few uniseriate cells in the leaf lobe apices, the weak vitta, and triangular or somewhat rounded cross-section. Nees (1838) described *Schisma sendtneri* from the Austrian Alps, where the present European distribution is restricted. *Herbertus sendtneri* has not been found again from the old locality in Thuringian Forest, and is regarded as extinct in Germany (Meinunger & Köckinger 2002). In the Himalayas *H. sendtneri* is widely distributed: in Bhutan, India, and Nepal. Hattori (1966) synonymized Chinese *H. delavayi* with *H. sendtneri*. During the present study also additional localities for *H. sendtneri* were discovered from Yunnan. In Asia *H. sendtneri* occurs at high elevations, i.e. 2500–4900 m. It grows on rocks and boulders, banks and on tree trunks as well; often together with mosses. Miller (1965) cited the specimen 1471 in G as "type", and 1472 as paratype for *H. delavayi*. They were labeled as collected in 1889 by Delavay from the type locality. However, *H. delavayi* was described already in 1895 by Stephani who referred to "Herb. Paris" in his description. Therefore the specimen in PC is to be considered as a holotype of *H. delavayi* and a specimen in BM (000661074) as an isotype. The specimens in G are paratypes.

Morphology of *Herbertus sendtneri* seem to be quite identical in different parts of its scattered range. However, in the study based on nuclear ITS, and 5,8S sequences, Feldberg *et al*. (2004) showed that *H. sendtneri* from the Alps belongs to the same clade with *H. azoricus* (Steph.) Richards and a South American species earlier called *H. subdentatus* (*auct. non* (Steph.) Fulford; *see* also Hodgetts 2003). They synonymized *H. azoricus* with *H. sendtneri* and named South American *H. subdentatus auct. non* (Steph.) Fulford records as *H. sendtneri* as well. In my phylogenetic analysis based on nuclear ITS2, chloroplast *trn*L-F, and morphology *H. sendtneri* from the Himalayas and *H. subdentatus* from South America were resolved as sister species (Juslén 2006). Feldberg *et al*. (2004) accept a broad morphological definition for *H. sendtneri* as *H. azoricus* and *H. subdentatus auct. non* (Steph.) Fulford differ remarkably from Austrian, Himalayan, and Chinese *H. sendtneri* in their morphology. Recently they have added several South American *Herbertus* binomials under synonymy of *H. sendtneri* (Feldberg & Heinrichs 2005a).

Koponen (1992) discussed the disjunctive distributions between European and East Asiatic floras. She stated that such taxonomic connections are rare, but some examples exist. Koponen (1992) synonymized morphologically identical *Tayloria delavayi* and *T. rudolphiana* that occur disjunctly in Yunnan and in the Alps. Judging from the known disjunct distributions of liverworts, the range of *H. sendtneri* in Austria, the Himalayas, China, the Azores, and South America would be exceptional (*see* Schofield & Crum 1972, Koponen 1992). The species concept should be further tested with comprehensive sampling including Asian *H. sendtneri*.

TOTAL DISTRIBUTION (Fig. 10): As 2: China; As 3: Bhutan, India, Nepal; Eur: Austria.

REPRESENTATIVE SPECIMENS EXAMINED. — As 2: **China**. Yunnan, Yulong Shan, mountain ridge above Wo Tu Di, on mossy rocks in gully with *Rhododendron adenogynum*, 4000 m, 1990 *Long 19047* (JE). As 3: **Bhutan**. Haa district, summit of Chelai La, on boulder, 3890 m, 1999 *Long 28730* (H). **India**. Singalila Ridge, Tarupani, 4300 m, 1980 *Pradhan Rai 193* (B-300230827); Sikkim, on cliff, 4775 m, 1996 *Long 26630* (H as *H. delavayi*); on boulder, 3965 m, 1992 *Long 22568* (H). **Nepal**. Sinion La, exposed rocky ridge, amongst boulders, ca. 4525 m, 1989 *Long 16994* (JE). Eur: **Austria**. Innsbruck, Rosskogel, 2000 m, 1991 *Melick 910746* (H. Van Melick personal collection); Tirol, 2000 m, 1923 *Berger* (H-3174066).

Excluded taxa

Herbertus subrotundatus X. Fu & Y.J. Yi

in Yi, Fu & Gao, Acta Phytotax. Sin. 39: 89. 2001. — *Herbertus gymnocoloides* X. Fu, *nom. inval*., Fl. Yunnanica 17: 6. 2000. — TYPE: China. Xizang, Ridong, Bulaolong, on rock, 4000 m, 1982 *Zang 5075* (holotype HKAS; isotype NY!).

Herbertus subrotundatus does not belong to *Herbertus*. It lacks the trigonous cell walls and intermediate thickenings characteristic for the genus. Furthermore, the vitta is very indistinctive. The specimen available for this study is extremely small and fragile, and based on observations of the sole specimen I was not able to draw further conclusions about the identity of the species.

Herbertus gymnocoloides was introduced without a Latin description. I was not able to detect other references to *H. gymnocoloides*. The illustrations given for *H. gymnocoloides* are exactly similar as those for *H. subrotundatus* in Yi *et al*. (2001). Therefore, *H. gymnocoloides* is regarded as an invalid name of *H. subrotundatus*.

Taxa not available for study

Herbertus mehrae D. Kumar & N. Manocha, *nom. inval.*

Abstracts, World Conference of Bryology. January 23–30, 2002, Lucknow, India: 80. 2002.

Herbertus udarii D. Kumar & N. Manocha

Geophytology 29: 105. 2000. — TYPE: India. West Bengal, Darjeeling, Ray Ville Road. 1969 *Udar*, *Srivastava & Kumar* (holotype LWU-1400/69).

Discussion

Miller (1965) listed 47 species and one uncertain species from Asia, Australasia, and Pacific

Islands excluding Australia and New Zealand. So (2003) accepted eight species from Australasia and South Pacific including Australia and New Zealand. The present study covered Asia, but not Australasia, Pacific Islands, Australia or New Zealand; 12 species are accepted. Together, So (2003) and the present study recognize 16 species from Asia, Australasia and the South Pacific. This is in agreement with several statements that have predicted a mass reduction of species in *Herbertus* (Evans 1917, Schuster 1957, Gradstein 2001). Miller (1965) also proposed a division of *Herbertus* to five sections. However, my examination of Asian *Herbertus* gives no support to that proposal.

The ranges of *Herbertus aduncus* subsp. *aduncus*, *H. dicranus*, and *H. sendtneri* extend to other continents in addition to Asia. Four species, *H. armitanus*, *H. circinatus*, *H. pilifer*, and *H. ramosus*, occur in Australasia as well (So 2003). The distribution areas of five species, *H. buchii*, *H. ceylanicus*, *H. guangdongii*, *H. kurzii*, and *H. longispinus*, are restricted to Asia. Within the area covered by the present study, *Herbertus* is most extensively collected from the Himalayas, and the genus can be considered well known in the area. *Herbertus* flora is richest in the diverse tropical Indo-Malayan region. However, the collections still do not cover the area comprehensively.

Numerous specimens from Asia have been earlier named as *Herbertus longifissus*. However, *H. longifissus* is a species occurring only in Melanesia (So 2003). So (2003) mentioned that the range of Asian specimens named as *H. longifissus* revealed to be *H. sakuraii* (= *H. dicranus*), and I agree. Two Asian species, *H. buchii* from Amur, Siberia and *H. guangdongii*, from Hainan, China, are known only from the types. Gambaryan (1992) analyzed the hepatic flora of Russian Far East, including the collection locality of *H. buchii*, and found it unique in many respects. She also pointed out the irregular and insufficient study of this area. Lin *et al.* (1992) stated that also the bryoflora of the Hainan island still remains poorly known. Another example of rarely collected, but distinctive *Herbertus* species beyond the focus of this study is the New Caledonian endemic *H. leratii* (Steph.) H.A. Mill. It has been collected only twice in the early 1900s from Mt. Mou (So 2003). I was able to examine a recent collection from Mt. Panié, New Caledonia (1999 *van der Werff & McPherson 16020A*, MO-5224932), which is *H. leratii*.

Herbertus is known to be morphologically an extremely plastic genus. Feldberg and Heinrichs (2005b) discussed the problems of delimitation of the species. They especially pointed out the difficulties in circumscription of Asian and Holarctic species. Earlier taxonomists used narrow species concepts (Stephani 1895, 1898–1924, Miller 1965). I have applied a wider species concept as in accordance with more recent studies (Inoue 1977, So 2003). The sexual organs seem to be rare in *Herbertus* and their limited study did not offer new insights into species delimitation. I was not able to study material fresh enough to enable observation of the oil bodies. An additional character to be studied from Asian species is leaf cell surface structure as seen in the SEM micrographs used e.g. by So (2003), Feldberg *et al.* (2004), and Feldberg and Heinrichs (2005a). The lack of stable morphological characters obviously creates problems in identification of some intermediate forms. However, based on my experience, *Herbertus* species can be satisfactorily circumscribed by studying an extensive amount of specimens. In order to recognize monophyletic species, the species boundaries here presented are to be further tested by comparison of morphology and molecular topologies, and first of all, by combining evidence from all available sources.

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