

Grimmia ulaandamana (Grimmiaceae), a new moss species from China

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A new species of *Grimmia* (Grimmiaceae), *G. ulaandamana* J. Muñoz, C. Feng, X.L. Bai & J. Kou, from several localities in China, is described and illustrated. It is distinguished from all congeners in having 2–4(5)-stratose and V-shaped lamina, semi-terete to terete costa consisting of almost homogeneous cells and with four guide cells at mid-leaf, and a long plication in lower part on one or both sides of the leaf.

Grimmia is one of the largest genera of the moss family Grimmiaceae. The number of species accepted in the genus, as traditionally considered, ranges from 51 (Maier 2010) to 71 (Muñoz & Pando 2000) or 95 (Hastings & Greven 2007). Ochyra *et al.* (2003) divided *Grimmia* into several smaller genera, some of them supported by the DNA sequence data (Hernández-Maqueda *et al.* 2008a, 2008b), but that taxonomy has not yet been widely accepted. *Grimmia s. lato* species grow on all continents, and most species are drought-resistant mosses that can withstand very dry and cold climates. The genus was considered taxonomically difficult, although recent studies have shown that the characters of the costa as seen in cross-section are crucial for correct identification, while variation in hair-point length, or shape of distal leaf cells, widely used in the past, are not reliable (Deguchi 1978, Maier & Geissler 1995, Muñoz 1998, Nyholm 1998, Muñoz & Pando 2000, Maier 2002a, 2002b, 2010, Ignatova & Muñoz 2005).

During bryological work in China, we discovered several specimens of *Grimmia* different from any species previously reported from the area (Cao & Vitt 1986, Cao 2000, Cao *et al.* 2003). The specimens are characterized by 2–4(5)-stratose, strongly keeled leaves with a long plication in one or both sides of the lower half, a long, smooth and occasionally decurrent hair-point, and a semi-terete to terete costa consisting of almost homogeneous cells. Identical plants were found among collections kept in herbaria. These specimens do not match morphologically any described species.

Grimmia ulaandamana J. Muñoz, C. Feng, X.L. Bai & J. Kou, *sp. nova* (Figs. 1–2)

TYPE: People's Republic of China, Inner Mongolia, Ulaandam–Shipeng Ditch National Nature Reserve, Wanghuolou Mountain, 44°26'519"N, 118°45'955"E, on rocks, mixed with *Macromitrium japonicum*, 1967 m, 12 July 2011,

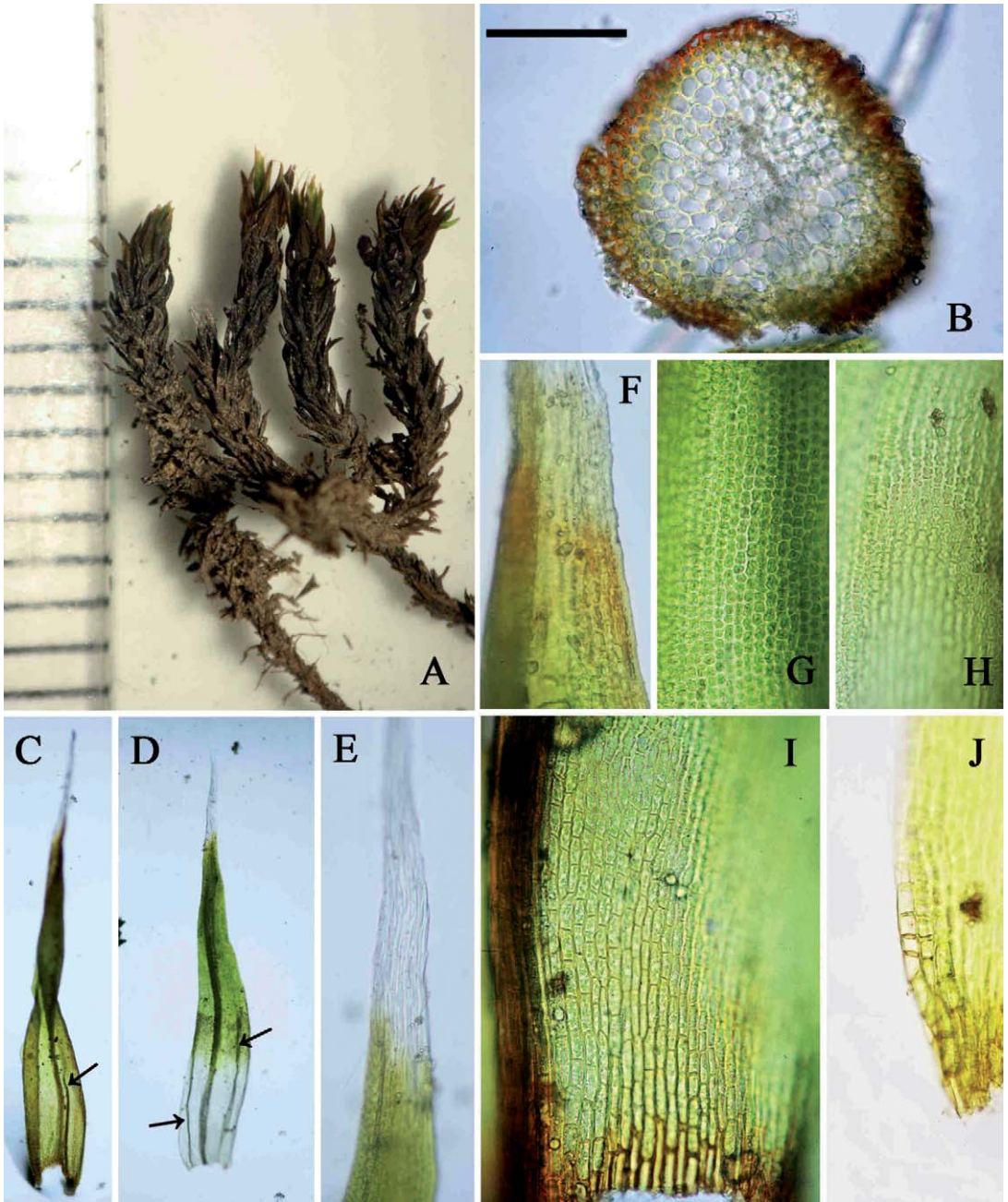


Fig. 1. *Grimmia ulaandamana* (from the holotype). — **A:** Plant when dry, the length for each frame is 1 mm. — **B:** Cross-section of stem. — **C** and **D:** Leaves (arrows: plicae in lower part of leaf). — **E:** Hair-points. — **F:** Apical part of leaf. — **G:** Upper-leaf cells. — **H:** Mid-leaf cells. — **I:** Basal juxtacostal cells. — **J:** Basal marginal cells. Scale bar (in **B**): 50 μm for **B**, **E** and **F–J**; 1 mm for **A**, **C** and **D**.

Chao Feng 2011527-2 (holotype HIMC; isotype MA-Musci 40053). — **PARATYPES:** China. Heilongjiang Province, Xin Ling Xian, 51°70'05"N, 124°40'05"E, *C. Gao* 13168 (ALTA); Inner Mongolia, Ulaan dam, the peak of Wanghuolou Mt., on rock, 12 July 2011 *Xue-Liang Bai* 2011485

(HIMC); Shaanxi Province, Hu Xian, Guang Tao Mts., 34°10'05"N, 108°60'05"E, *M. Wang* 462 (KUN); Hebei Province, Wuling Mt., 40°78'38"N, 117°50'05"E, *J.-X. Ji* C38 (ALTA); Yunnan Province, Lijiang Xian, Yu Loung Mts., 27°15'05"N, 100°20'05"E, *X.-J. Li* 80-147 (KUN).

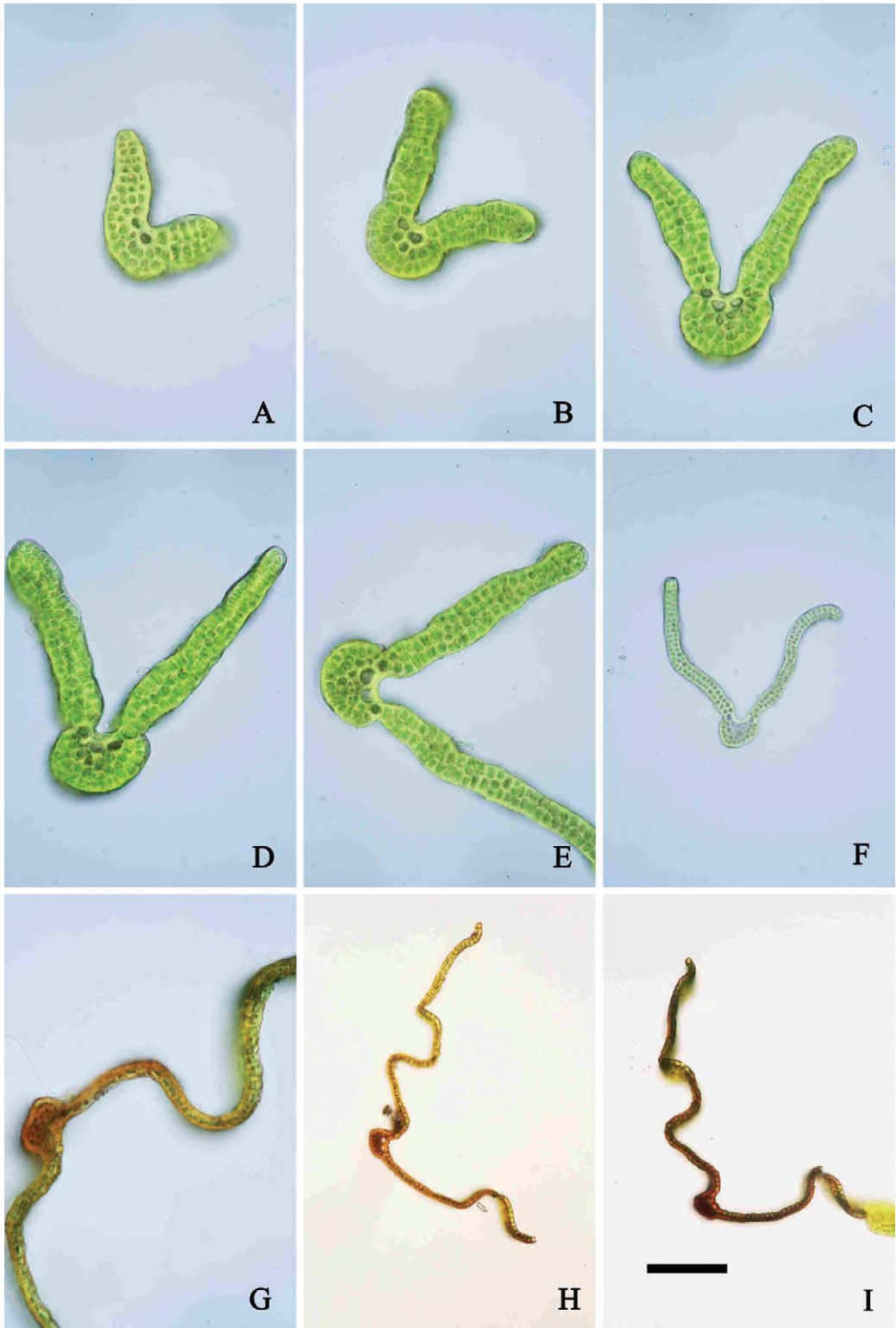


Fig. 2. *Grimmia ulaandamana* (from the holotype). — **A–G:** Cross-section of leaves, sequentially from apex to middle. — **H and I:** Cross-section of lower part of leaves. Scale bar (in **I**): 50 μm for **A–E** and **G**; 100 μm for **F**, **H** and **I**.

ETYMOLOGY. The specific epithet refers to one of the places where the new species was found, Ulaan dam.

Plants medium-sized, stiff and rigid, forming small loose or dense cushions, olive-, dark- to blackish green. Stems 1.5–4.0 cm long, erect or weakly ascending when long, usually scarcely and irregularly branched, in transverse section rounded, consisting of (1)2–3(5)-stratose epidermis of small, thick-walled and orange-colored cells, distinct from large, thin-walled, hyaline medullar cells arranged in 4–6 layers, and a distinct central strand of 15–25 small, thin-walled cells. Leaves erect, appressed to slightly flexuose when dry, erect, patent to slightly spreading, rigid and not flexuose when moist, lanceolate or with an ovate base extended into an acuminate apical part, strongly keeled along costa, most often with a strong and long plication in one or both sides at proximal half, $1.60\text{--}3.45 \times 0.30\text{--}0.75$ mm; costa smooth, percurrent, semi-terete to nearly terete, protruding from lamina and regularly curved in outline on dorsal surface, clearly delimited from lamina, in distal half consisting of almost undifferentiated cells in 4–5 layers, usually only ventral band, composed of 2 slightly larger cells, scarcely differentiated from remaining cells, which are not differentiated in bands, in central and lower parts 4–6 layers, ventral layer differentiated from 1–2 dorsal layers and a band of 3–4 layers of substereids, at insertion 2–4 layers with ventral layer clearly differentiated from others; margins entire, recurved on one or occasionally both sides, flat distally, in medial and distal leaf 2–4-stratose; leaf lamina smooth or occasionally weakly pseudopapillose, 3–4(5)-stratose in distal part, 2-stratose in medial part; laminal cells moderately thick-walled, in distal part ovate, isodiametric or oblate, esinuose, $7.2\text{--}8.0 \times 4.9\text{--}5.3$ μm ; in medial and basal parts rectangular, distinctly to strongly sinuose in broadest part of leaf, $9.1\text{--}12.5 \times 6.5\text{--}7.8$ μm ; basal marginal cells chlorophyllous, isodiametric to shortly rectangular, $9.1\text{--}13.0 \times 7.8\text{--}10.4$ μm , walls straight or more or less sinuose, transverse walls thicker than longitudinal walls; basal juxtacostal cells elongate to rectangular, $31.2\text{--}57.2 \times 6.5\text{--}13.0$ μm , with thin to slightly thick, weakly nodulose walls; hair-points terete or slightly flattened at base and then decurrent, straight, not flexuose, to 1.7 mm long, entire to

denticulate. Propagula lacking. Dioicous.

Unfortunately, only one sporophyte attached to the plant was available, and it was old and in such a poor condition that it was not valid for description. Another complete capsule was found among the debris of one specimen, but without connection to the gametophytes and without seta. That capsule differs from that of any other Chinese *Grimmia*, and it could belong to *G. ulaandamana*. It is 1.5×0.6 mm, smooth, with a compound and revoluble annulus of 2–3 rows of isodiametric cells, and with a long-rostrate operculum nearly 1 mm long.

HABITAT AND DISTRIBUTION. *Grimmia ulaandamana* occurs on rocks in white-birch forests or on exposed rocks in open habitats. It is scattered over a large area in China (Fig. 3), including Xin Ling Xian in Heilongjiang, Wanghuolou Range in Inner Mongolia, Hu Xian and Guang Tao Mts. in Shaanxi, Wuling Mountain in Hebei and Lijiang Xian and Yu Loung Mts. in Yunnan.

Grimmia ulaandamana is characterized by the regularly 2–4(5)-stratose upper leaf lamina, the strongly keeled leaves with recurved margins, the costa with a regularly curved dorsal outline and homogeneous cells except at the insertion, where it has two guide cells and lacks a ventral furrow, and the two plicae, one at each side of the costa, in the lower half of leaf. Among *Grimmia*, no species share this combination of characters (cf. Maier 2010). *Grimmia montana* and *G. elatior* share with *G. ulaandamana* the 2–4(5)-stratose lamina and the costa protruding dorsally from the lamina. *Grimmia montana* however differs from *G. ulaandamana* by its plane to incurved margins, and the costa with a clear band of hydroids in the lower half of leaf, that then become substereids for a short length, and disappear apically. *Grimmia elatior* also shares with *G. ulaandamana* the undifferentiated cells of the costa in cross-section; however, it is a much larger plant, reaching 8 cm long, it has long-rectangular juxtacostal cells with strongly nodulose walls, papillose median and distal cells, the costa is irregularly shaped dorsally, flattened and angulate, and at the insertion the costa has four or more guide cells and still has a narrow ventral furrow, lacking in *G. ulaandamana*.

Grimmia khasiana (considered synonymous with *G. longirostris* by Muñoz & Pando 2000,

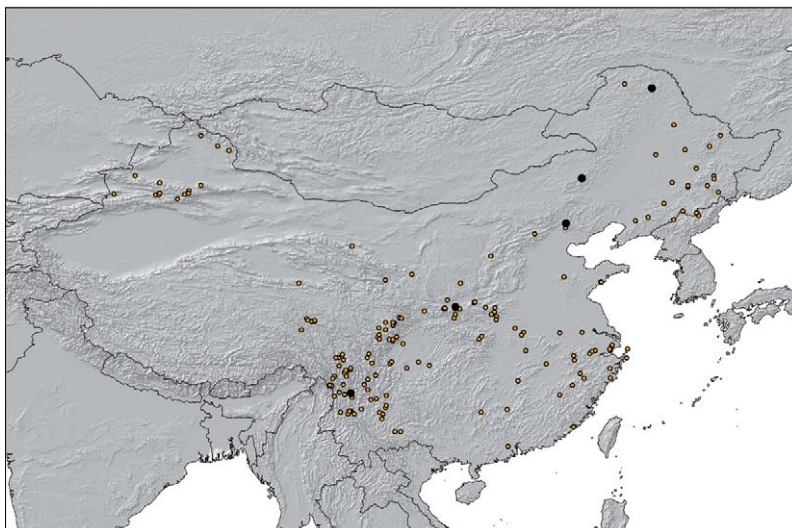


Fig. 3. Black dots: known localities of *Grimmia ulaandamana*. Yellow dots: localities from which *Grimmia* specimens have been studied by JM.

but treated as a distinct species by Maier 2010), *G. longirostris*, *G. ovalis* and *G. unicolor* are similar to *G. ulaandamana* in having a 2–4-stratose leaf lamina, but in those species the costa is wider, having more than four guide cells at the insertion, it does not protrude dorsally from the lamina as in *G. ulaandamana*, and in cross-section there is always a band of hydroids in the basal half of the leaf.

Grimmia ulaandamana is also characterized by having a distinctive plication on both sides in the leaf base (Figs. 1C, D and 2H, I), running up to mid-leaf. In *Grimmia*, only *G. alpestris*, *G. caespiticia* and *G. reflexidens* (treated as *G. sessitana* by Maier 2010) can have plicate leaves, but in those species, like in the plicate *Coscinodon*, the plications run from the medial part towards the apex (Hastings 1996, Hastings 2007), not to the base as in *G. ulaandamana*.

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