

Bryological Notes

Grimmia exquisita (Musci, Grimmiaceae), a new species from central Asia

The genus *Grimmia* is currently represented in the central Asian republics by 14 species: *G. alpestris*, *G. anodon*, *G. crinita*, *G. elatior*, *G. laevigata*, *G. longirostris*, *G. orbicularis*, *G. ovalis*, *G. pitardii*, *G. poecilostoma*, *G. pulvinata*, *G. reflexidens*, *G. tergestina* and *G. unicolor* (Muñoz & Pando, 2000). The number of species known per country is: Afghanistan (3), Kazakstan (10), Kyrgyzstan (7), Tajikistan (5), Turkmenistan (8), and Uzbekistan (6). Although low, those figures surely reflect under-collection, as all those countries harbour large areas suitable for the establishment of *Grimmia* species. Indeed, the area combines high mountain ranges, with a particular set of species (e.g. *G. alpestris*, *G. elatior*, *G. reflexidens* and *G. unicolor*), with extensive deserts, where a different set of species can be found (e.g. *G. anodon*, *G. crinita*, *G. orbicularis*, and *G. poecilostoma*). Among collections studied for a world revision of the genus, two specimens from desertic areas in eastern Turkmenistan and contiguous southwestern Tajikistan did not match the concept of any of the species known in the genus, and are consequently described as a new species, *G. exquisita*.

Grimmia exquisita J. Muñoz, *sp. nov.* (Figs 1–2.)

TYPE: Turkmenistan. Chardzhou Oblast: South Eastern Karakumy, Kelifskij Uzboj, 18 Sep. 1957, *Il'in s.n.* (holotype, MA; isotypes, LE, MHA, MO).

Grimmia orbicularii gametophyto similis sed cellulis basalibus marginalibus parietatis tenuis et foliae perichaetaliae valde ab aliis diversa. *Grimmia tergestina* sporophyto similis, capsula inclusa et calyptrae cucullata.

Cladautoicous. Plants yellowish green. Stems erect, to 2 cm, with central strand. Leaves erect and appressed when dry, erect to patent when moist, 1.3–2.0 × 0.5–0.7 mm, lingulate to elliptic, obtuse to acute, keeled, not plicate; margins recurved from 1/3 to 1/2–2/3 the leaf length on both sides; costa semi-terete, differentiated from the lamina, ventral epidermis two cells wide in cross-section; lamina 1-stratose, not pseudopapillose; distal cells 12–20 µm long, mostly rectangular, but isodiametric cells also present, not bulging, not papillose, walls sinuous; proximal juxtacostal cells 50–90 × 12–14 µm, rectangular (3.5–7.5:1), walls thin and straight to medium-thick and nodulose; proximal marginal cells 30–50 × 8–12 µm, rectangular (3–6:1), the walls thin and straight, all alike; hyaline hair-points terete, rigid, erect, to 1.8 mm, smooth to weakly denticulate. Perichaetial leaves

2.5–3.5 × 1.0–1.2 mm, convolute, hyaline and filmy, scarcely discernible, larger than vegetative leaves (3.0–3.5:1). Androecia terminal. Setae erect and straight both when dry and wet, 0.9–1.0 mm long. Capsules immersed, ovoid, symmetric, smooth, stramineous, with stomata at the base; exothecial cells 50–80 × 14–26 µm, rectangular (3.0–3.5:1), thin-walled; annulus compound and revoluble, with 3–4 layers of hyaline, inflated, rectangular cells (affinis type); peristome teeth 80–100 µm wide at the mouth, cribose throughout and irregularly cleft at apex, outer surface nearly smooth below and papillose above, inner surface papillose throughout, orange, contrasting in colour with the capsule; opercula conical to mammillate; calyptrae cucullate; spores 10–15 µm in diameter, smooth.

The specific epithet for this new species refers to the beauty and singularity of the plant, which makes it immediately recognizable.

Additional specimens seen (paratypes): Tajikistan. Northern slope of Koyni-Tau, Ayvadh surroundings, 800 m a.s.l., *Soskina s.n.* (MA, MHA).

Grimmia exquisita is characterized by its autoicous sexuality, lingulate to elliptic leaves with recurved margins, basal marginal cells hyaline with thin walls all similar and nearly indistinguishable, strongly differentiated perichaetial leaves which are almost completely hyaline and filmy, and immersed capsules on straight setae. It shows similarities with two unrelated groups of species. The gametophyte strongly resembles *G. orbicularis* Wilson or *G. pulvinata* (Hedw.) Sm. because of the autoicous sexuality, leaf shape, mainly unistratose lamina, distinct costa, and recurved margins at the medial part. However, the basal marginal cells of both *G. orbicularis* and *G. pulvinata* have thicker walls, with the transverse walls always distinctly thicker than the longitudinal walls. Moreover, the capsules in *G. orbicularis* and *G. pulvinata* are exserted, ribbed, and the setae are curved. In contrast, *G. exquisita* perichaetial leaves and sporophytes are identical to those observed in *G. tergestina* Bruch & Schimp., which, however, shows no gametophytic similarity with the new species.

The holotype specimen of *G. exquisita* was the basis for Abramova & Abramov's (1988) report of *G. mesopotamica* Schiffn. (a synonym of *G. capillata* De Not.) in Turkmenistan, and the specimen from Tajikistan was identified as *G. crinita* Brid. Both taxa have almost identical gametophytes and macroscopically are similar to the new *G. exquisita*. However, the two former have shorter basal marginal cells with transverse walls

thicker than the longitudinal ones, whereas in *G. exquisita* these are rather long and have very thin walls that are all alike. Moreover, the leaves are larger in the new species (1.3–2.0 mm long in *G. exquisita* vs. 0.8–1.1 mm long in *G. capillata* and *G. crinita*).

Grimmia exquisita is known from only two collections made less than 300 km apart (Fig. 3). In the Turkmenistan site it was collected on gypsiferous sandstone rocks, whereas the information on the other site only states "sunny rocks".

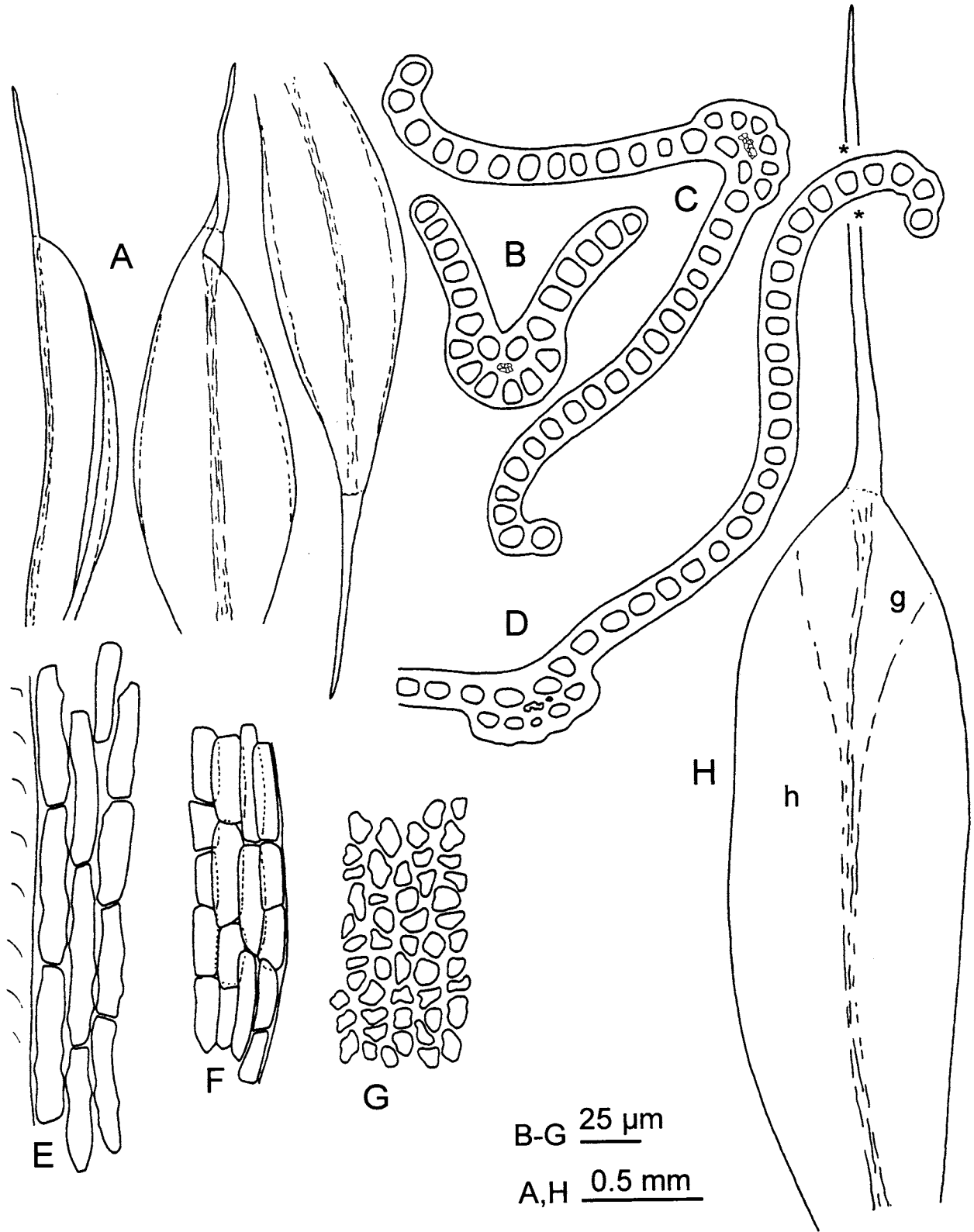


Figure 1. *Grimmia exquisita*: A, leaves; B–D, transverse sections from distal to proximal part of leaf; E, proximal juxtacostal leaf cells; F, proximal marginal leaf cells; G, distal leaf cells; H, perichaetial leaf: g, green area; h, hyaline area covering most of the leaf. (*Il' in s.n.*, MA, holotype).

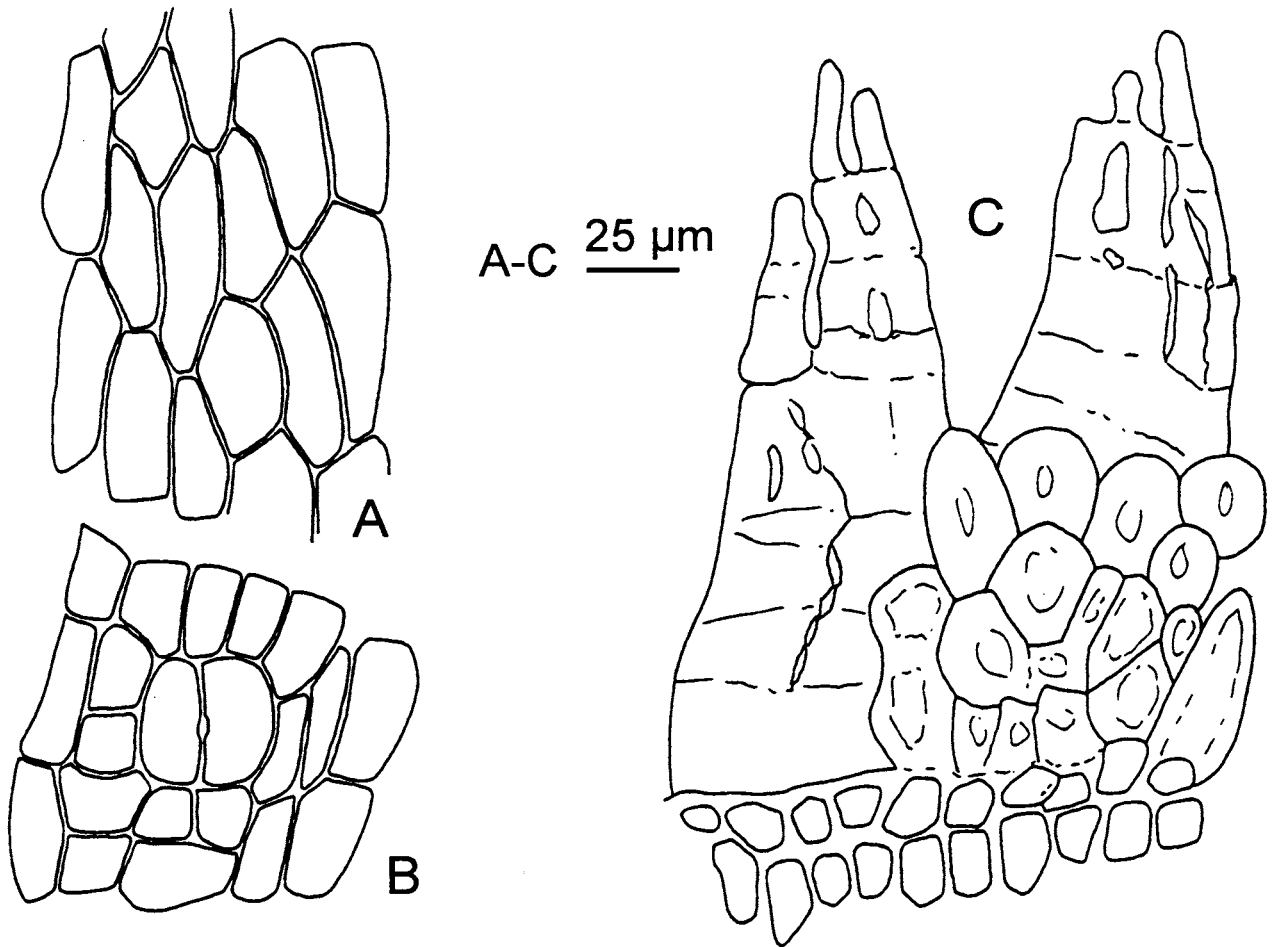


Figure 2. *Grimmia exquisita*: A, medial exothecial cells; B, basal exothecial cells and stoma; C, peristome teeth and annulus. (*Il'in s.n.*, MA, holotype)

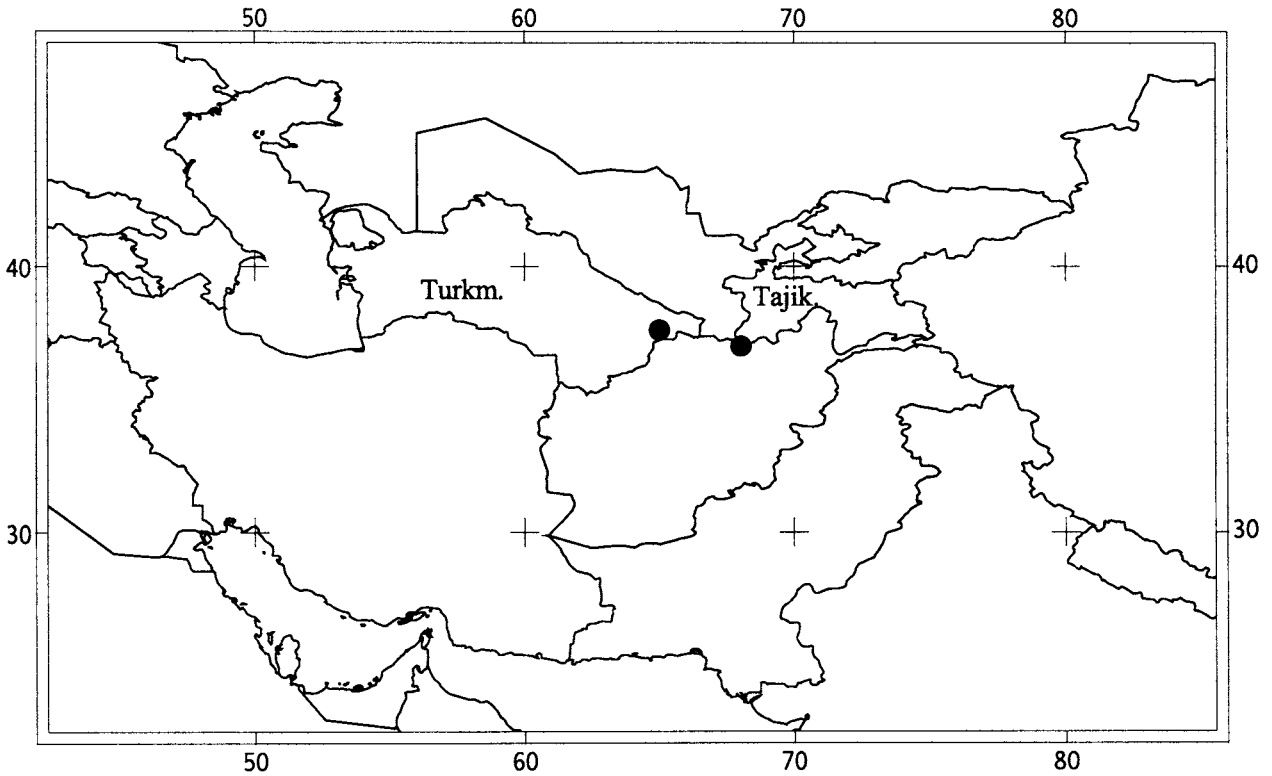


Figure 3. Distribution of *Grimmia exquisita* in central Asia.

I thank Olga M. Afonina (LE) and Elena I. Ignatova for making available to me the interesting and rich collections of *Grimmia* kept in their respective herbaria.

TAXONOMIC ADDITIONS AND CHANGES: *Grimmia exquisita* J. Muñoz, sp. nov.

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SEM study of the sporoderm pattern of the hornwort *Folioceros assamicus* Bharad.

The genus *Folioceros* Bharad. was established by Bharadwaj (1971) to include the species of *Aspiromitus* and *Anthoceros* with long vermiform, thick-walled, dark and dented-lumened elaters and spinose spores. The type species of the genus, *F. assamicus* Bharad., was described from Guwahati-Shillong Road (Bharadwaj, 1971). Later, this author described some Asian, African and Indo-Pacific species of *Folioceros* (Bharadwaj, 1972, 1973). Subsequently, 13 species of *Anthoceros* and *Aspiromitus* were transferred to the genus *Folioceros* by Bharadwaj (1975), and he later provided a morphological and taxonomic account of some Indian species of *Folioceros* (Bharadwaj, 1978). In addition to this, some valuable contributions (Hasegawa, 1984a, b, 1986, 1988; Hassel de Menendez, 1988) have also appeared on Asian taxa of the genus *Folioceros*. The genus is represented in India by twelve species (Asthana & Srivastava, 1991). The distributional patterns of the Indian species in relation to altitude and climatic factors have been described by Asthana & Nath (1999). These species have been grouped into three major categories: 1. Species with bacculate (laevigate) spores and longish thalli, having spongy bodies or detachable lobules, 2. Species having bacculate (dentate) spores, with longish and usually pinnate thalli, 3. Species having spinulate or mamillate spores, with expansive thalli.

Recently, during a bryological exploration of the Khasi Hills, Meghalaya, specimens of *F. assamicus*, the type species of the genus, were found growing luxuriantly on the way to Dawki from Shillong at Langkyrdem (altitude ca 1600 m) on soil-covered rocks. A detailed morphological investigation has been carried out on these plants, and their details are illustrated here. As the sporoderm pattern of this taxon is very interesting, it has been investigated under the SEM, to reveal micromorphological details that were not clearly visible under the light microscope. Most importantly, the details of the ornamentation pattern of the sporoderm in *F. assamicus*, as revealed under SEM, are reported for the first time. A description of the plants follows.

***Folioceros assamicus* Bharad.**, *Geophytology* 1 (1): 10 (1971) (Figs 1 & 2)

REFERENCES

- Abramova AL, Abramov II. 1988. De speciebus generis *Grimmia* Hedw. ex Asia media. *Novosti Sistematiki Nizshikh Rastenii* 25: 157–169.
Muñoz J, Pando F. 2000. A world synopsis of the genus *Grimmia* (Musci, Grimmiaceae). *Monographs in Systematic Botany of the Missouri Botanical Garden* 83: 1–133.

Plants dioecious. Female thalli (Fig. 1) longish-strap shaped 14–15 mm × 4–5 mm branched into short strap-shaped branches of varying length, broader at distal end, margins deeply and more or less pinnately lobed; lobes with irregular and dentate margin, spongy, thallus surface smooth. Involucre 2.5–3.5 mm long, cavernous, outer surface with small lamellate outgrowths. Epidermal layer of capsule wall stomatiferous, each stoma about 50 µm long and 25 µm wide, sparsely distributed, epidermal cells longer (105–315 µm) than broad. Spores light brown to dark, 33–39 µm in diameter, bacculate (dentate), proximal face with an area enclosed by thin tortuous ridge, triradiate mark rarely seen. Elaters 300–460 µm long vermiform, brown, thick-walled enclosing a dark lumen of variable width, beaded in some places, usually 3–4 celled, not fragile.

The air-dried thoroughly cleaned capsules were taken through an ethanol series to critical-point dry them, and non-acetolysed spores were dusted over double-sided adhesive tape and stuck to stubs. After coating with platinum–palladium, spores were examined using a Philips (Model XL-20) SEM.

Under the SEM (Fig. 2), the spores can be seen to have a bacculate sporoderm, bearing variously shaped baculae, which are ca 2 µm high and 1.2–1.5 µm wide, with a broad head possessing a denticulate margin. These projections are moderately distributed all over the sporoderm. The proximal face of the spore is usually devoid of distinct triradiate mark and it is marked with a depression bordered with bacculate projections.

Specimens examined: INDIA. MEGHALAYA. Khasi hills, Langkyrdem (alt ca 1600 m), 07.11.1998, Leg. V. Nath, A.K. Asthana & A.P. Singh, 206093, 206094, 206096, 206101 (LWG); Jaintia hills, on way to Jarain (alt. ca 1340 m), Leg. V. Nath, A.K. Asthana & A.P. Singh, 10.11.1998, 207938, 207941 (LWG), Det.: A.K. Asthana & V. Nath.

Plants were found growing luxuriantly on copiously moist, soil-covered rocks of hill slopes.

Folioceros assamicus Bharad. closely approaches *F. satpurensis* (Sriv.) Bharad. et Sriv., *F. indicus* Bharad., *F. glandulosus* (L. & L.) Bharad. and *F. kashyapii* Sriv. & Asthana in having an elongated thalloid gametophyte. However, it can be