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DIDYMODON RIGIDULUS VAR. *SUBULATUS* (THÉR. & BARTRAM *EX* E.B. BARTRAM) R.H. ZANDER, NEW TO THE MOSS FLORA OF MONGOLIA AND ASIA

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In the 1970s, extensive botanical exploration was made to collect moss specimens from Mongolia (Abramov and Abramova, 1983; Abramova and Abramov, 1976, 1978, 1983; Abramova and Tsegmed, 1987, 1989, 1994; Tsegmed, 1988, 2001). Based on these collections, Tsegmed *et al.* (2010) published Moss Flora of Mongolia, in which 20 species of *Didymodon* Hedw. were recorded. In 2013, the first and third authors of this paper were invited by Dr. Tsegmed to visit the bryophyte herbarium at the Academy of Science of Mongolia, and had the opportunity to study specimens of *Didymodon*. Two of the specimens labelled as *D. vinealis* (Brid.) R.H. Zander attracted their attention. After studying numerous specimens of *D. vinealis* from Spain, Mongolia and China, and consulting the relevant literature (e.g. Saito, 1975; Magill, 1981; Zander, 1993, 2007; Bai, 1997, 2010; Li *et al.*, 2001; Jiménez *et al*., 2005; Jiménez, 2006; Zhao *et al.*, 2013, 2014), it was concluded that the samples do not correspond to *D. vinealis*, but to *D. rigidulus* var. *subulatus* (Thér. & Bartram *ex* E.B. Bartram) R.H. Zander, representing a new addition to the Asian moss flora. This Mongolian record is floristically and phytogeographically important as it extends the known distribution of *D. rigidulus* var. *subulatus* and represents a bridge between East Asia and the Americas. The present paper describes and illustrates the taxa and discusses its relationship with related taxa.

Didymodon rigidulus var. **subulatus** (Thér. & E.B. Bartram *ex* E.B. Bartram) R.H. Zander, Cryptog. Bryol. Lichénol. 2: 395 (1981). *Didymodon mexicanus* var. *subulatus* Thér. & E.B. Bartram *ex* E.B. Bartram, Bryologist 29: 1. pl. 1 (1926) (**Figs 1 & 2**).

Type: United States. Arizona: Pima, 28 Jan 1925, *E. B. Bartram 174* (MO).

Plants 0.5–1.0 cm high, growing in dense turfs, green. Stems erect, simple or branched, without hyalodermis, central strand differentiated. Rhizoidal tubers absent. Leaves monomorphic, appressed when dry, erect-patent to spreading when moist, ovate-lanceolate, gradually narrowed to the apex, not keeled, 1.1–1.7 mm long; lamina 2-stratose in distal 1/2, with bistratose patches in the upper middle of the leaf; apex acuminate, not deciduous; margins entire, plane, sometimes lightly recurved in the lower middle of the leaf, bistratose in distal, unistratose or bistratose in the upper middle of the leaf. Costa long-excurrent in a subula, not spurred, ventral cells of the costa, in the upper middle of the leaf, rectangular to subquadrate, smooth, without a band of translucent cells below the apex, dorsal cells of the costa, in the upper middle of the leaf, rectangular, smooth; in transverse section at midleaf, semicircular; with 3 or 4 guide cells in 1 layer, 0 or 1 layer ventral stereids, 1–3 layers of dorsal stereids, without hydroids, ventral epidermis differentiated, not bulging, smooth, dorsal epidermis differentiated, smooth. Upper and middle laminal cells round,

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quadrate or oblate, 5.2–7.8 × 2.6–5.2 µm, smooth, lightly thick-walled; basal cells weakly differentiated medially, rectangular, 7.8–26.0 × 5.2–10.4 µm, not hyaline, smooth, thick-walled, not pitted. Gemmae absent. Dioeicous. Sexual condition unknown. Sporophyte unknown.

Specimens examined: Mongolia. Khovd Province: Bulgan Sum, 14 Jul 1984, *Ts. Tsegmed 8655* (HIMC, NY, UBA,). Möst Sum, 15 Jul 2004, *Ts. Tsegmed 13691* (HIMC, UBA).

Distribution and habitat: Bolivia (Churchill *et al.*, 2009), Mexico (Zander, 1994), Peru (Churchill *et al.*, 2000), United States of America (Bartram, 1926; Zander, 2007). New record to Mongolia. The sub-species grows together with *Carex* L. on wet soil near a rivulet in the Altai mountain range of Khovd Province in Mongolia.

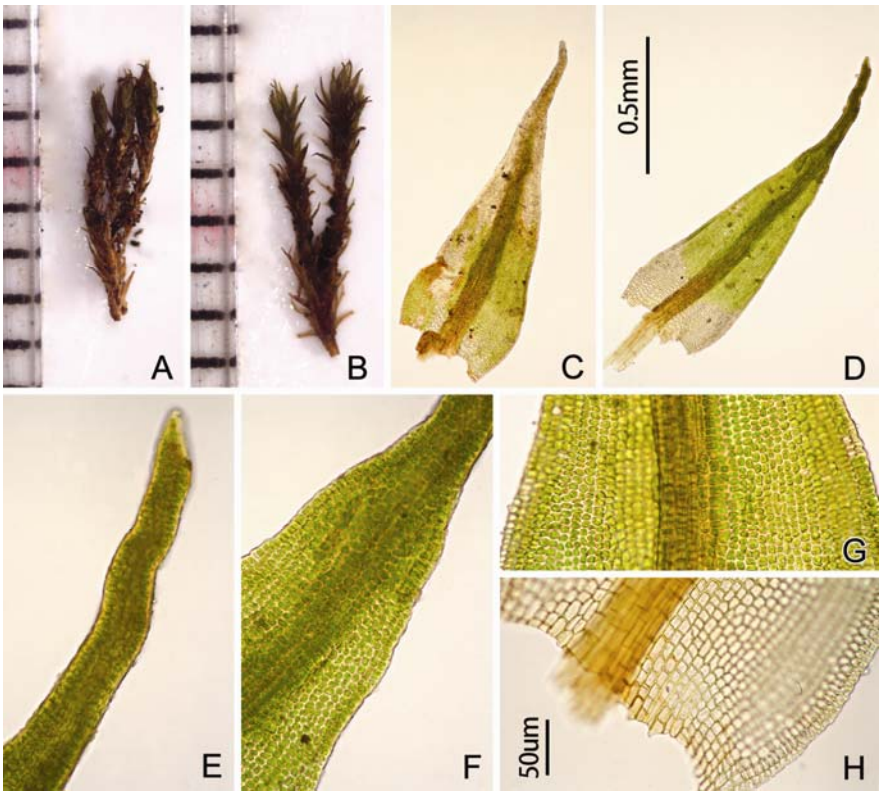

Fig. 1. *Didymodon rigidulus* var. *subulatus* A. Plant when dry; B. Plant when moist; C & D. Leaves; E. Leaf apex; F. Upper laminal cells and ventral cells of the costa; G. Middle laminal cells; H. Basal cells. Scale bar: A & B = ruler scale in mm; C & D = 0.5 mm (as in D); E–H = 50 µm (as in H)

Notes: *Didymodon rigidulus* var. *subulatus* has long been considered endemic to North America until recently reported from Peru and Bolivia. The presence of this variety in Mongolia is probably most likely due to the long distances dispersal of spores (Crum, 1972). However, the migratory route is currently unknown; so the collection of more specimens and molecular phylogenetic analysis would be of interest. The outstanding features of the variety from Mongolia are the same as that from the Americas. The features include ovate-lanceolate leaves (Figs 1C, D), costa excurrent into a smooth, more or less flexuose subula (Fig. 1E), upper laminal cells bistratose in distal 1/2 (Fig. 2B), and guide cells in 1 layer (Fig. 2D).

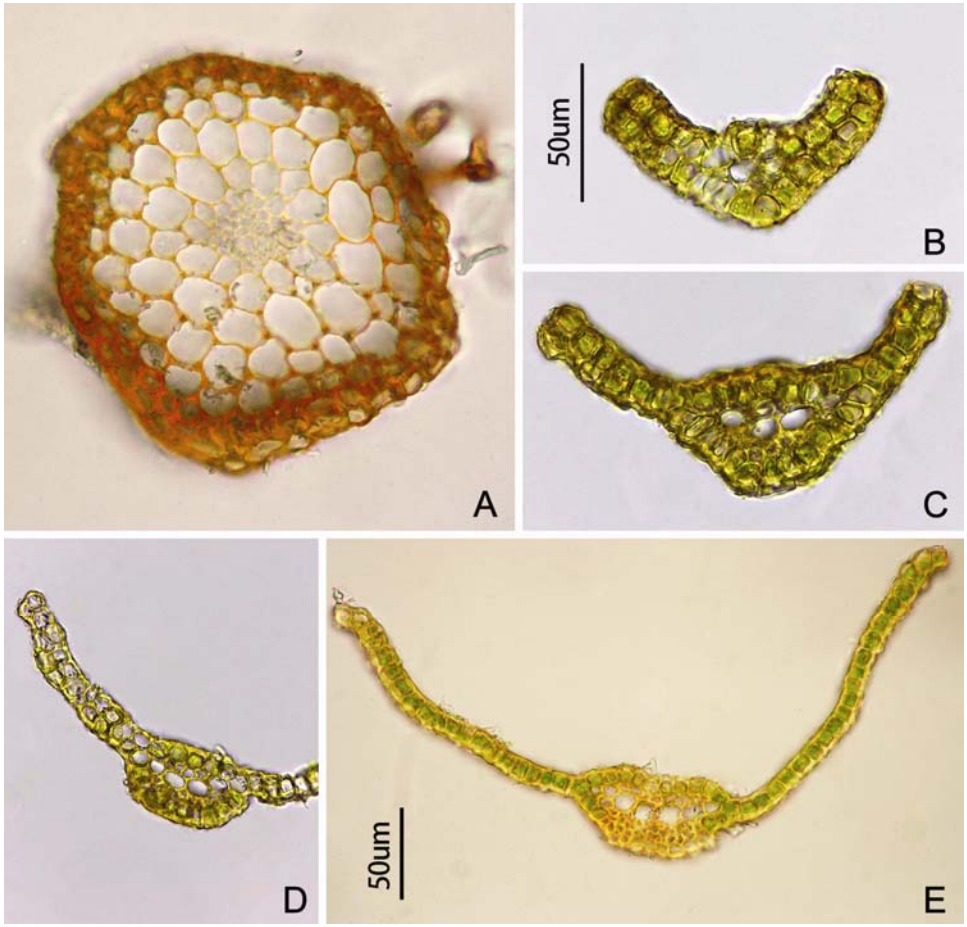

Fig. 2. *Didymodon rigidulus* var. *subulatus* A. Transverse section of stem; B. Transverse section at the leaf apex; C. Transverse section at the upper leaf; D. Transverse section at midleaf; E. Transverse section near leaf base. Scale bar: A−C = 50 μm (as in B); D & E = 50 μm (as in E)

The variety *subulatus* differs from *Didymodon rigidulus* Hedw. var. *rigidulus* in the longer subula, ovate-lanceolate leaves and bistratose patches in the upper middle of the leaf. Among the species that occur in Mongolia Plateau, namely *D. baii* D.P. Zhao, J.N. Wang & X.D. Zhao, *D. ditrichoides* (Broth.) X.J. Li & S. He and *D. icmadophilus* (Schimp. *ex* Müll. Hal.) K. Saito, resemble the variety in having similar leaf shape and long-excurrent subula. Nevertheless, the variety *subulatus* can be separated readily from them by its bistratose lamina and margins in the upper leaf, and smooth laminal cells.

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