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On Acaulon triquetrum and Didymodon hedysariformis (Musci, Pottiaceae), two new xeric moss records from China

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Abstract – Two new xeric moss records, *Acaulon triquetrum* and *Didymodon hedysariformis*, are reported from China. Species descriptions based on Chinese specimens and a discussion of the distinctions and habitat preferences of the two species are provided.

Chinese mosses / Pottiaceae / steppe / xeric mosses / Acaulon / Didymodon

INTRODUCTION

During a recent investigation of the species diversity of mosses binding the soil crust of fixed sand dunes in Tengger Desert in Ningxia Province of China, we encountered a specimen belonging to the genus *Acaulon*. After careful study, we came to the conclusion that the species is *A. triquetrum* (Spruce) Müll.Hal., a genus and species of Pottiaceae new to the Chinese moss flora.

Likewise, another uncommon xeric moss in the Asiatic boreal region, *Didymodon hedysariformis* T. Otn., was discovered from exposed soil over rocks in forest-steppe vegetation in Inner Mongolia Province and in Mulan Weichang Nature Reserve in Hebei Province. This, too, is a new species record of Pottiaceae for the Chinese moss flora.

Both specimens are deposited in the herbaria of Inner Mongolia University in Hohhot (HIMC) and Hebei Normal University (HBNU), with duplicates in the herbarium of National University of Singapore (SINU). Since the two moss species are both new records for the country, a separate description was prepared for the two taxa based on the Chinese plant materials collected.

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Fig. 1. Acaulon triquetrum (Hedw.) Müll. Hal. 1. Plant (\times 36). 2. Capsule and perichaetial leaf (\times 36). 3. Calyptra (\times 36). 4. Perichaetial leaves showing the keeled habit (\times 36). 5. Spores (\times 360). 6. Vegetative leaves showing the prominent costa and stout mucro (\times 36). 7. Cells at leaf apex (\times 360). 8. Cells near leaf base (\times 360).

1. Acaulon triquetrum (Spruce) Müll.Hal.

Fig. 1

Plants minute, 1-2 mm high, gemmate, yellow-brown, loosely caespitose. Stems simple, short, to 0.5 mm in length, 0.1-0.15 mm in diameter, round in transverse section, central strand absent, sclerodermis absent. Leaves strongly appressed, broadly-ovate, deeply concave and keeled, $0.9-1.5 \times 0.6-0.9$ mm; apex broadly acute and somewhat cuspidate, recurved at the tip; margins recurved and subentire to irregularly dentate or incised-dentate near the apex; costa excurrent in a sharp apiculus or stout mucro. Upper cells rounded-quadrate or oblong rhombic, $15-13 \times 13-18 \mu m$, walls evenly thickened, smooth, smaller and shorter at the margins; basal cells rectangular, slightly wider than upper cells, $35-88 \times 14-19 \mu m$, walls thin, smooth. Dioicous. Perichaetia terminal, inner leaves somewhat

enlarged. Seta short, 0.3-0.4 mm long, slightly curved; capsules deeply immersed, sphaerical, apiculus lacking, 0.4-0.5 mm in diameter, yellow-brown, smooth, cleistocarpous. Spores shortly ellipsoid, 26-32 μ m in diameter, brown, densely papillose. Calyptra minute, ca. 0.35 mm long, often lobed, smooth. Leaves with red KOH color reaction.

Specimen examined. CHINA. Ningxia Province, southeastern margin of Tengger Desert, Gantang (37°24'N, 104°30'E), 1500 m elev., on soil in *Caragana korshinskii* shrub community, 10 Nov 2003, *J. Xu 03003* (HIMC, SINU).

Acaulon is a genus with about 15 species in the world (Zander 1993), growing in open and dry sites. It has an ephemeral life cycle. Its main distribution center is in the Mediterranean region with scattered localities in western and central Europe, central Asia, and disjunctively in North America, northern Africa and Australia (Casas de Puig *et al.*, 1990; Sergio, 1992; Stone, 1989; Zander, 1993).

In China, Acaulon triquetrum was collected from the soil crust of fixed dunes in steppified desert, growing together with Didymodon vinealis (Brid.) Zander, Aloina rigida (Hedw.) Limpr. and Aloina brevirostris (Hook. & Grev.) Kindb. The species has been reported from Europe, Asia (Siberia, central Asia), North America and northern Africa (Zander, 1993; Ignatov, 1992). Like all reports of its occurrences in Europe and North America, the Chinese population of Acaulon triquetrum grows on bare soil in grassland vegetation.

Acaulon triquetrum can be confused with A. muticum (Hedw.) Müll.Hal. and the characters separating the two species are not always apparent. In many floras (Crum & Anderson, 1981; Ignatov & Ignatova, 2003; Smith, 1978), Acaulon triquetrum is differentiated from A. muticum in having angular foliation, conspicuously keeled leaves with a stout mucro that often, but not always, becomes recurved, and a longer seta that is curved. The best illustration of the angular foliation and recurved leaf apices of A. triquetrum is shown by Crum and Anderson (1981), although these two important diagnostic characters are not fully expressed in all leaves. On the other hand, the long and curved seta of Acaulon triquetrum is emphasized and illustrated by Smith (1978) to separate it from A. muticum. The latter, with a julaceous foliation and very short apiculate leaves, is excellently illustrated by Ignatov and Ignatova (2003).

2. Didymodon hedysariformis T. Otn.

Fig. 2

Plants in dense tufts, 6-10 mm high, dark-green above, brown to redbrown below. Stems 5-8 mm long, branched, round in transverse section, 0.7-0.8 mm in diameter; hyalodermis absent, but with 2-3 rows of sclerodermis, central strand distinct. Rhizoids present, more abundant below. Leaves often crowded, appressed-incurved when dry, spreading when moist, lanceolate or longlanceolate, 1-1.5 to 2 mm long, excluding the tip, 0.4-0.5 mm wide; margins revolute in the lower 1/2-2/3, plain near the apex, entire, becoming variably truncate, at times notched and partially fractured. Leaf apices irregularly and repeatedly notched, forming deciduous propagules consisting of a fragment of costa and part of the lamina. Costa reddish-brown, straight, gradually narrowing towards the apex; ovate in transverse section, with two stereid bands; dorsal stereid band strong, cells 6-8 in 2-3 layers, epidermis not differentiated; ventral stereid band usually apparent, cells 2-4 in 1-2 layers, epidermis somewhat differentiated; guide cells 2-4 in 1 layer. Upper leaf cells quadrate or shortrectangular, $10-15 \times 10-13 \,\mu\text{m}$, unistratose, thin-walled, smooth; in young leaves often with low papillae seen only in cross section; lower leaf cells shortrectangular or rectangular, $13-36 \times 7-13 \mu m$, thin-walled, smooth, slightly reddish



Fig. 2. *Didymodon hedysariformis* T. Otn. 1. Plant (\times 12). 2. Leaves (\times 30). 3. A fragile piece of tip of leaf (\times 30). 4. Axillary hair (\times 240). 5. Stem cross section (\times 240). 6. Cells near leaf base (\times 240). 7. Upper leaf cells (\times 240). 8. Cells near leaf apex (\times 240). 9. Cells at leaf apex (\times 240). 10. Cross section of upper part of leaf (\times 240). 11. Cross section of leaf near middle (\times 240).

brown. Asexual reproduction by segmented leaf apices varying in shape and size, 0.1-0.5 mm long. Lamina with reddish brown KOH color reaction. Inflorescences and sporophytes not seen in Chinese collections.

Specimens examined: CHINA. Inner Mongolia Province, Balinzuoqi (44°0'N,119°18'E), 1300 m elev., on dry exposed rock, 12 Jul 1991, *X.-L.Bai 4113* (HIMC); Linxi Co. (43°36'N, 118°0'E), 1200 m elev., on exposed soil over rock, 1 Aug 2000, *X.-L.Bai 717* (HIMC, SINU); Nincheng Co. (41°36'N, 119°18'E), 1300 m elev., on exposed soil over rock, 24 June 2000, *X.-L.Bai 141, 142* (HIMC); Hebei Province, Weichang Co., Mulan Weichang Nature Reserve, *Huang S. L030860* (HBNU).

Didymodon hedysariformis was only recently described from the Tuva Republic of South Siberia (Otnyukova, 1998). It was reported subsequently from Mt. Altai and East Siberia (Ignatov *et al.*, 2001) and also from several localities in

Mongolia (Tsegmed, 2001). This note represents the first verified report of *D. herysariformis* from China.

The species is superficially similar to another xeric moss species found in Qinghai province, *D. gaochenii* B.C. Tan & Y. Jia, in having notched or fragmented leaf apices. However, *D. hedysariformis* differs from the latter in producing broadly fractured pieces of leaf apex that are irregular in shape and consist of unistratose lamina with 2-6 rows of cells and the thick costa (see Otnyukova 1998), whereas the fragmented pieces of leaf apex of *D. gaochenii* have a very narrow and unistratose lamina consisting of only one row of cells and the thick costa. In addition, the leaf apical propagules of *D. gaochenii* are square or rectangular in shape (see Tan & Jia, 1997).

In China, *D. hedysariformis* can be confused also with *D. johansenii* (Williams) Crum and *D. anserinocapitatus* (X. J. Li) Zander in having propaguloid leaf apices. However both of the latter two species are characterized by having rather long, deciduous leaf apices, bearing only costa, that are abruptly differentiated from the rest of the leaf as swollen, thickened, and fleshy disseminules.

In Inner Mongolia Province, *Didymodon hedysariformis* appears to be not uncommon on exposed soil over rock in forest-steppe vegetation, a transitional zone between forest and grassland, from the southern Great Khingan Mts. to northern Yanshan Mts. It grows in mixture with *Lindbergia brachyptera* (Mitt.) Kindb., *L. sinensis* (Müll. Hal.) Broth., *Bryoerythrophyllum gymnostomum* (Broth.) P.C. Chen, and *Leucodon sciuroides* (Hedw.) Schwaegr. In Hebei Province, the species grows on basaltic stones and sandstone rocks near the spring and river and on disturbed soil as well. The local habitats are both cold and moist. None of the Chinese populations of *D. hedysariformis* bear sporophytes, but reproduce by the leaf apical propagula.

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