

## The rare moss *Acaulon schimperianum* (Pottiaceae) in East Asia

Gui-Quan Tian<sup>1</sup>, Xue-Liang Bai<sup>2</sup> and Dong-Ping Zhao<sup>2,3</sup>

<sup>1</sup>College of Life Science and Technology, Inner Mongolia Normal University, Hohhot 010022, China;

<sup>2</sup>Department of Biology, Inner Mongolia University, Hohhot 010021, China

<sup>3</sup>author for correspondence: topalizdp@aliyun.com

### Abstract

The rare moss *Acaulon schimperianum* (Sull.) Sull., formerly known only from North America, is reported from China and represents a new record to East Asia. Distinctive features of this *Acaulon* species are the presence of teeth on the margin of the upper leaves and the laminal cells are strongly papillose abaxially. In China this species was found on exposed dry soil, a microhabitat similar to that of the known North American occurrences of the species.

### Introduction

During a recent bryological excursion in Inner Mongolia of China, we collected a special species of *Acaulon*, which later proved to be a rare moss in Loess Hilly region of China. The plants do not belong to any of the known East Asian species of the genus. Crum and Anderson (1965) described *Acaulon schimperianum* (Sull.) Sull. in North America, which was found to be similar to our plant in many aspects. After a comparison of North American specimens with our collections, it was confirmed that our plant is *A. schimperianum*, representing a new addition to the East Asian moss flora. This Chinese record is floristically and phytogeographically important as it extends the known distribution of *A. schimperianum* and represents a 'bridge' between East Asia and North America.

*Acaulon schimperianum* (Sull.) Sull., in Sull. & Lesq., *Musci Boreali-Americani*, edition 1, 26 (1856).

*Phascum schimperianum* Sull. in Gray, *A Manual of the Botany of the Northern United States*, edition 2, 615 (1856).

**Type:** United States of America: Prope San Marcos in Texas, *Charles Wright s.n.* (MO)

Plants minute, 1–1.5 mm high, gemmate, yellow-brown, loosely caespitose. Stems unbranched, very short, to 0.5 mm long, 0.1–0.19 mm diam., round in transverse section, without central strand. Leaves few, strongly appressed, ovate or broadly oblong-ovate, deeply concave and keeled, inner leaves larger than outer, 0.9–1.2 × 0.5–0.6 mm; margin recurved, unevenly serrate on upper half or less, with teeth spreading or somewhat recurved and slightly forked at tips; apex broadly acute, 0.2–0.4 mm long, with awn brown; costa filling awn, weak and lacking near leaf base; upper cells rhombic, slightly concave, 31.2–41.6 × 13–15.6 µm, walls evenly thickened, smaller and shorter at margin and apex, bearing one low or fairly stout, blunt, laminal cells papillose abaxially; basal cells rectangular, slightly wider than upper cells, 57.2–117 × 13–23.4 µm, walls thin, smooth. Dioicous. Perichaetia terminal, inner leaves somewhat enlarged. Seta very short, slender, 0.2–0.3 mm

long, 40–45  $\mu\text{m}$  diam., slightly curved; capsules deeply immersed, sphaerical, apiculus lacking, 0.4–0.5 mm diam., yellow–brown, smooth, cleistocarpous. Spores spherical, 33.8–39  $\mu\text{m}$  diam., brown, densely and finely papillose. Calyptra not seen.

**Specimen examined:** CHINA: Inner Mongolia Province: Junger Banner, (39°34.003' N; 111°21.947' E.), elev.: 1263 m, *Tian 2012026*, 10 Jun 2012 (HIMC, NMTC, NY). UNITED STATES OF AMERICA: Arizona: Tucson Mountains: on ground under shrub along dry wash, *Haring 3014*, 5 Dec 1944 (NY); near Old Tucson, on ground in desert, under palo verde, *Haring 3419*, 11 Apr 1945 (NY); San Xavier Mission near Tucson, on ground under creosote bush along wash, *Haring 3529*, 13 Jan 1945 (NY); foothills, on ground along ravine, *Haring & Phillips 3535*, 6 Jan 1945 (NY); east side, along dry wash under bushes, *Haring & Haskell 3536*, 22 Dec 1944 (NY); E. foothills, on ground among shrubs along wash, *Haring & Phillips 3549*, 6 Jan 1940 (NY); Santa Catalina Mountains, on soil, *Phillips & Haring 2335*, 1 Jul 1941 (NY).

**Distribution** (Fig.1.): United States of America (Zander 2007), Mexico (Crum and Anderson 1965), China.

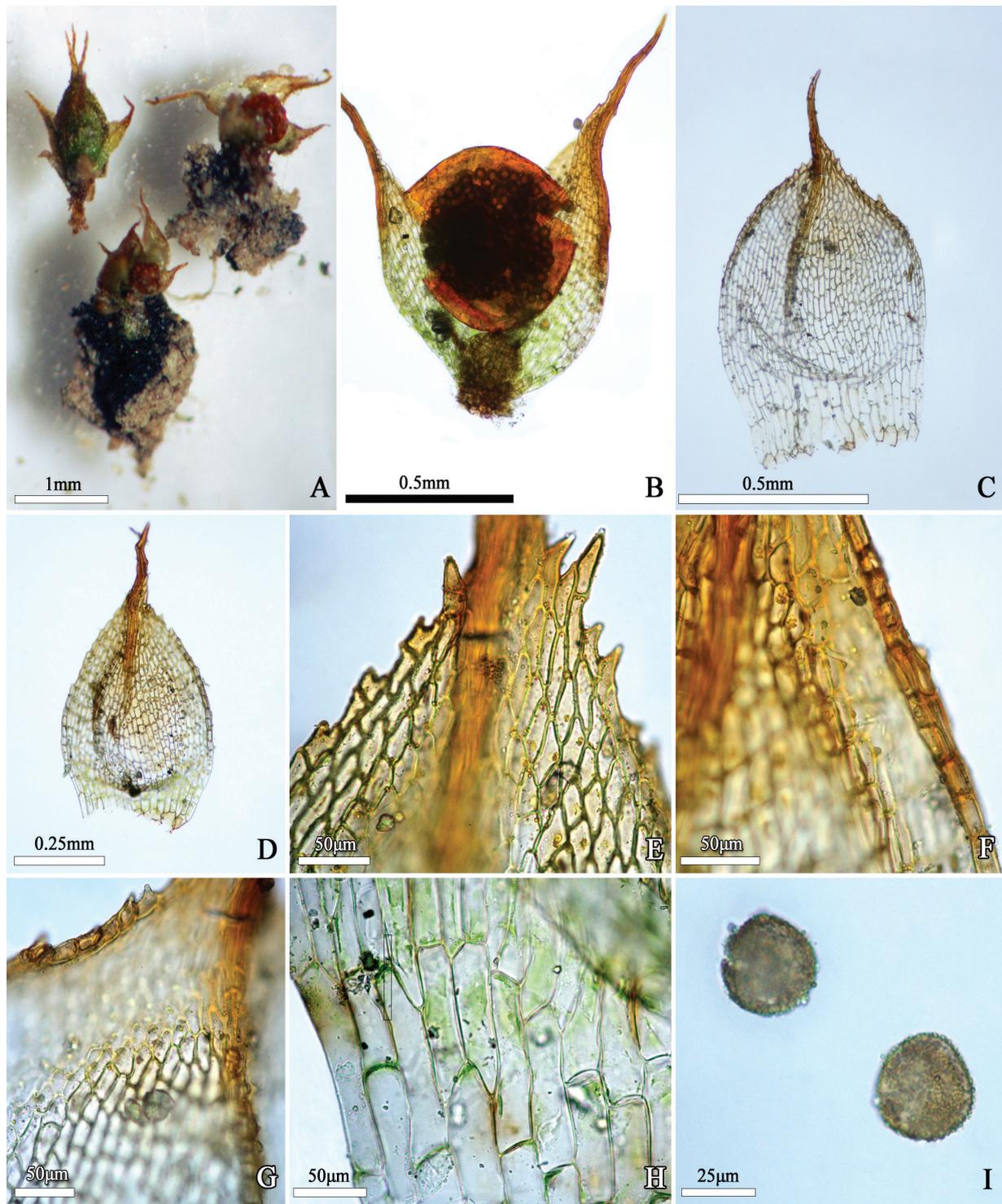
**Ecology:** In China, *Acaulon schimperianum* occurs in the Junger Loess Hilly region in a semi-arid continental climate with typical *Stipa bungeana* Trin. steppe vegetation (Liu *et al.* 1998). It grows mixed with *Didymodon vinealis* (Brid.) Zand., *Crossidium crassinerve* (De Not.) Jur., *Microbryum davallianum* (Sm.) Zand., *Barbula unguiculata* Hedw., *Bryum argenteum* Hedw. and *B. bicolor* Dicks. Based on data provided by the meteorological stations, the local average annual temperature is 5–7°C; mean annual precipitation is 300–450 mm and relative humidity is 30–45%. The locality where the species were collected had been used for agricultural development in the past, and the *S. bungeana* vegetation has become a *Leymus chinensis* (Trin.) Tzvel. community after natural restoration and reconstruction of abandoned farmland. Here the soil is relatively dry, with a high clay content. According to Crum and Anderson (1965, 1981), the Chinese locality has the same basic habitat characteristics of exposed dry soil in old agricultural fields, as that in North America. *Acaulon schimperianum* is characterized as a short-lived shuttle species that grows as pioneer mosses in occasionally moistened and disturbed habitats (During 1992).

*Acaulon schimperianum* has long been considered endemic to North America, and the presence of this species in China is probably mostly 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 strong bryofloristic links between East Asia and North America have been well discussed by Ando (1972), Iwatsuki (1972), Iwatsuki and Sharp (1967, 1968), Ochi (1972), Schuster (1983) and Wu *et al.* (2001). The new Chinese records of *Acaulon* provide more evidence for the close phytogeographic relationship between East Asia and North America.

**Note:** The outstanding features of *A. schimperianum* from China are the same as that from North America. The features include yellow-brown leaves (Fig. 2A), costa weak and lacking near the leaf base (Fig. 2D), unevenly serrate in the upper half (Fig. 2E), subcentral papillae on the abaxial leaves (Fig. 2F, 2G), and spores



**Fig. 1.** Distribution of *Acaulon schimperianum*



**Fig. 2.** *Acaulon schimperianum*. A. Plant with sporophyte. B. Sporophyte with perichaetial leaves. C, D. Leaves. E. Apical leaf cells. F, G. Median leaf cells. H. Basal marginal leaf cells. I. Spores.

with densely and finely papillose (Fig. 2I). *Acaulon schimperianum* bears some resemblance to the European *A. casasianum* Brugués & H.A.Crum (Brugués and Crum 1984). The latter differs in the following aspects: It has leaves that are whitened on the leaf tip and margin; the marginal serrations are larger, consisting of the projecting ends of adjoining cells and thus appearing double, often ending in a branched papilla; and the spores are smaller (22–26 µm). It is quite different from *A. triquetrum* (Spruce) Müll. Hal., another Chinese member of the genus, which has smooth cells in the upper leaves and dentate only near the apex (Bai *et al.* 2006).

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