Postprint of New Records of Bryophytes from Shandong

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Abstract

Through identification of bryophyte specimens collected from Shandong, Dichodontium pellucidum (Hedw.) Schimp. and Fauriella tenuis (Mitt.) Cardot were recorded in Shandong for the first time. This also represents the first record of the family Aongstroemiaceae, genus Dichodontium Schimp., and genus Fauriella Besch. in Shandong. This paper provides detailed descriptions of the morphological characteristics of both species, presents line drawings, and includes corresponding discussions.

Full Text

New Additions to the Bryophyte Flora of Shandong Province, China

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Abstract: *Dichodontium pellucidum* (Hedw.) Schimp. and *Fauriella tenuis* (Mitt.) Cardot are reported as new records for Shandong Province, China. Simultaneously, the family Aongstroemiaceae and the genera *Dichodontium* Schimp. and *Fauriella* Besch. are documented from Shandong Province for the first time. Detailed morphological descriptions and ink drawings of *D. pellucidum* and *F. tenuis* are provided, along with relevant discussions.

Key words: bryophytes, *Dichodontium pellucidum*, *Fauriella tenuis*, new records, Shandong Province

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Since 2007, our team has conducted a new round of field surveys and specimen collection of bryophyte resources in Shandong Province. Based on this research and contributions from other scholars on Shandong bryophytes, *Bryophyte Flora of Shandong* (Ren et al., 2016) was published in May 2016. Although this flora has been published, some blind spots remain in our understanding of Shandong' s bryophyte resources, particularly in the foothills and branch ranges of major mountain systems such as Mengshan, Taishan, Kunyushan, and Laoshan. To more clearly understand baseline resources, improve the bryophyte flora of Shandong, and provide fundamental data and scientific evidence for various bryophyte studies, we have continued our field investigations.

In August 2016, the authors conducted a five-day field survey of bryophytes in the Kunyushan National Nature Reserve in Yantai, Shandong. Through identification and study, we discovered a new genus record and a new species record for Shandong: *Fauriella* Besch. and *Fauriella tenuis* (Mitt.) Cardot. Additionally, in 2017, while sorting specimens, we discovered a box of over 200 specimens collected from Mengshan in Mengyin County in 2012 that had been overlooked and not promptly identified. Upon examination, these specimens contained a new family record, a new genus record, and a new species record for Shandong: the family Aongstroemiaceae, the genus *Dichodontium* Schimp., and *Dichodontium pellucidum* (Hedw.) Schimp. Voucher specimens are deposited in the Herbarium of Shandong Normal University (SDNU).

1. Aongstroemiaceae

1.1 *Dichodontium* Schimp.

Plate I

Dichodontium pellucidum (Hedw.) Schimp., Coroll. Bryol. Eur. 12. 1856.

The plants are small, yellowish-green, and grow in dense tufts. Stems are erect, mostly simple, rarely branched at the apex, with differentiated central strands. Asexual gemmae are long-elliptical, fusiform, or subglobose. Leaves are ligulate or lanceolate to broadly lanceolate, often twisted when dry, squarrose when moist, with obtuse or acute apices. Leaf margins are plane or slightly involute below, with irregular teeth on the upper portion. The costa is stout, extending to the leaf apex, with papillae on the dorsal surface at the tip. Upper and middle leaf cells are rounded-quadrate with distinct papillae, while basal cells are rectangular and smooth. Sporophytes were not observed.

Specimen examined: Mengshan, Lengyu, Mengyin County, Shandong Province, on soil-covered rocks under forest, altitude 500 m, Zhaojie Ren & Mengmeng Guo R123260 (SDNU).

Geographic distribution: China (Heilongjiang, Inner Mongolia, Hebei, Shandong, Xinjiang, Yunnan, Taiwan), Bhutan, Japan, Pakistan, and Russia (Siberia), Europe and North America (Gao, 1993; Jia et al., 2013).

Note: A. Plant; B. Portion of plant; C. Portion of cross section of stem; D, E, F, G, H, J. Leaves; K. Apical leaf cells; L. Median marginal leaf cells; M. Basal leaf cells; N. Portion of cross section of leaf; O. Gemmae (Drawn by REN Zhaojie & TIAN Yaxian). Scale bars: A=2 cm, B=1 mm, C=100 m, D-J=830 m, K-O=83 m.

Plate I. *Dichodontium pellucidum* (Hedw.) Schimp.

The genus *Dichodontium* Schimp. was established in 1856 and currently comprises four species worldwide, with two species reported from China (Gao, 1993; Jia et al., 2013). This genus is similar to *Oreas* Brid., but differs in that its peristome teeth are split 2–3 times from the apex to the middle or lower portion, whereas *Oreas* has undivided peristome teeth. It is also similar to *Cynodontium* Schimp., but differs in having smooth capsules and leaves that are mostly ligulate, ligulate-lanceolate, or broadly lanceolate and relatively short, while *Cynodontium* has capsules with distinct longitudinal ridges that form grooves when dry, and leaves that are mostly narrow-lanceolate to linear-lanceolate and relatively long (Gao, 1993; Frahm et al., 1998). The genus has long been placed in the family Dicranaceae (Gao, 1993; Frahm et al., 1998). Based on molecular phylogenetic evidence, it is now placed in the family Aongstroemiaceae (Frey et al., 2009), representing the first report of this family from Shandong Province.

2. *Fauriella* Besch.

Plate II

Fauriella tenuis (Mitt.) Cardot in Broth., Nat. Pflanzenfam. (ed. 2), 11: 282, f. 633. 1925.

The plants are small, slender, green, and dull, forming dense cushion-like tufts. Stems are prostrate, irregularly branched, with slender branches of unequal length and relatively blunt apices. Leaves are imbricately arranged, ovate to long-ovate, concave, with acuminate apices. Leaf margins are mostly plane, rarely involute, with fine teeth. The costa is absent or rarely present as a very short and weak structure. Leaf cells are rounded-rhomboidal, approximately 18–25 m × 3.3–5 m, with slightly thickened walls, each cell bearing a single distinct tall papilla on the dorsal surface. Apical leaf cells are slightly longer and mostly smooth, while alar cells are quadrate. Sporophytes were not observed.

Specimen examined: Kunyushan National Nature Reserve, Muping District, Yantai City, Shandong Province, on soil-covered rocks under *Pinus densiflora* forest outside Shenqing Temple, altitude 260 m, Zhaojie Ren & Limei Yan R16573 (SDNU).

Geographic distribution: China (Jilin, Shandong, Anhui, Zhejiang, Hunan,

Chongqing, Guizhou, Taiwan) and Japan (Wu, 2002; Jia et al., 2013).

Note: A. Portion of plant; B, C, D, E. Stem leaves; G, F. Branch leaves; H. Apical leaf cells; I. Median marginal leaf cells; J. Basal leaf cells (Drawn by REN Zhaojie). Scale bars: A=0.83 mm, B-G=330 m, H-J=83 m.

Plate II. *Fauriella tenuis* (Mitt.) Cardot

The genus *Fauriella* Besch. was established in 1893, and its systematic position has long been controversial. It has been placed in various families including Theliaceae, Thuidiaceae, Heterocladiaceae, Pylaisiadelphaceae, and Plagiotheciaceae (Wu, 2002; Frey et al., 2009; Li et al., 2013). This study adopts Frey' s classification and places the genus within Heterocladiaceae (Frey et al., 2009). Currently, three genera are reported in Heterocladiaceae worldwide: *Fauriella*, *Heterocladium* Bruch & Schimp., and *Iwatsukiella* W. R. Buck & H. A. Crum (Frey et al., 2009; Jia et al., 2013), with the latter two already reported from Shandong (Ren et al., 2016). This represents the first report of *Fauriella* from Shandong. The genus contains relatively few species, with five currently reported, mainly distributed in temperate and subtropical regions of Asia, as well as tropical high mountain areas (Frey et al., 2009; Jia et al., 2013).

Based on topography and geomorphology, Shandong can be broadly divided into three regions: the central and southern mountainous and hilly area, the eastern peninsular low mountainous and hilly area, and the western and northern plain area. The central and southern mountainous and hilly area is surrounded on its western, southern, and northern sides by the western/northern Shandong Plain and the northern Jiangsu Plain, while the eastern low mountainous and hilly area is bordered by sea on its eastern, southern, and northern sides. These two regions are connected by the Weihe-Shuhe River valley (Zhang, 2014), thus forming an isolated geographic unit relative to the mountainous areas of surrounding provinces. This geographic unit represents the region richest in bryophyte species and resources in Shandong (Ren et al., 2016). Its location near the Qinling-Huaihe line, China' s north-south geographical boundary, makes it an important site for the convergence of northern and southern flora. Therefore, the discovery of *Dichodontium pellucidum* and *Fauriella tenuis* not only enriches and improves the bryophyte flora of Shandong, but also provides fundamental data and evidence for studying the natural geographic distribution, dispersal routes, and systematic positions of these species and their respective taxonomic groups.

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Note: Figure translations are in progress. See original paper for figures.