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BRYOPHYTE MOLECULAR BARCODING RECORDS. 2

БРИОЛОГИЧЕСКИЕ НАХОДКИ ПО РЕЗУЛЬТАТАМ ДНК-МАРКИРОВАНИЯ. 2

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Abstract

DNA-barcoding revealed/confirmed the taxonomic placement and/or range extension of the following bryophytes: *Campylostelium laegerae*, *Leptopterigynandrum austro-alpinum* (taxonomic identity of South American and Asian), *Scleropodium touretii* (newly found in Crimea), *Taxiphyllum taxiphylloides* (from the Russian Far East).

Резюме

ДНК-маркирование позволило выявить или подтвердить таксономическое положение и/или расширение ареала для следующих видов мхов: *Campylostelium laegerae*, *Leptopterigynandrum austro-alpinum* (установлена таксономическая идентичность южноамериканских и азиатских растений), *Scleropodium touretii* (впервые найден в Крыму), *Taxiphyllum taxiphylloides* (найден на Российском Дальнем Востоке).

KEYWORDS: mosses, new records, molecular markers, nrITS, Russia

Introduction

This paper continues the series of brief reports of new findings revealed in the course of the bryophyte DNA studies. It presents various findings where the sequencing either confirms species identities, which are ambiguous for various reasons, or discloses their affinities, or supports generic placements of certain taxa that have never been investigated for molecular markers before, or have never been barcoded previously, or have been barcoded from different parts of the world. Being obtained in the course of screening rather than special studies of a particular group, such data may remain unsubmitted to DNA databases and stay neglected and not searchable among published materials.

1. ***Campylostelium laegerae*** Brinda, D.R. Toren & Shevock

Contributors: V.E. Fedosov, A.V. Fedorova & J.C. Brinda

Specimen: USA, California, Inyo Co., BLM California Desert District, Nopah Range Wilderness, northern Nopah Range, along an unnamed wash southwest of Pahrump Peak, 36.0952198°N, 116.1518738W°, 1193.5 m, 31 March 2015, Brinda 7339 (Holotype MO, dupl. MW).

DNA: isolate OK2552, Genbank # MT769777 (Intron of mitochondrial nad5 gene) and MT769778 (plastid rps4 gene and trnS-rps4 spacer).

Distribution: *Campylostelium laegerae* was recently described from the southwestern United States (Brinda *et al.*, 2016) and so far, is only known from a few collections from that area. Here we report the first molecular data for this rare species. New *nad5* and *rps4* sequences obtained from the type specimen were included in the datasets compiled by Fedosov *et al.* (2017) with a focus on the genera *Campylostelium* and *Brachydontium*. Bayesian analyses were performed with settings as specified in Fedosov *et al.* (2017) excepting that in the *nad5* based analysis indels were coded using the simple indel coding approach (Simmons & Ochoterena, 2000) in SeqState (Müller, 2005). Topologies inferred from these sequences indicate the rather close affinity of *C. laegerae* with a central Asian specimen of *Campylostelium pitardii* (PP=1). Both are xeric-adapted species, which occur sympatrically in North America, but sequences of *C. laegerae* noticeably differ from those of *C. pitardii*, although rather slowly evolving markers were used.

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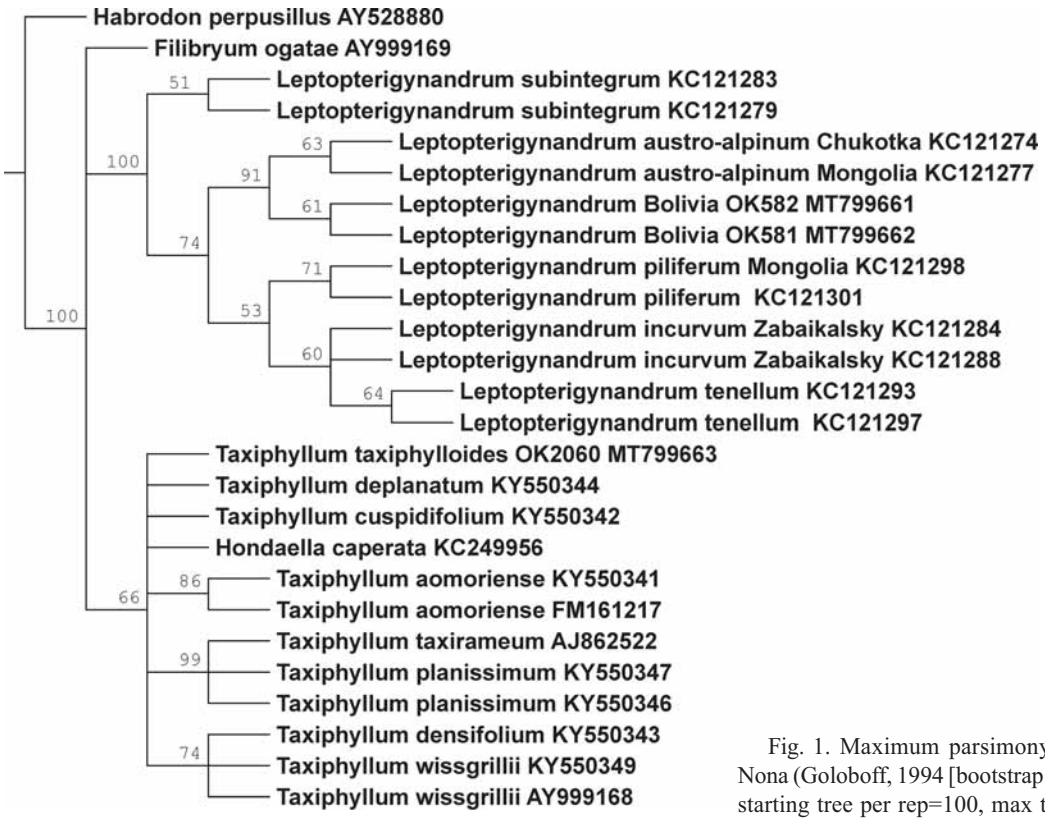

Fig. 1. Maximum parsimony bootstrap tree from Nona (Goloboff, 1994 [bootstrap 1000, N searches 100, starting tree per rep=100, max tree =100, do max]),

2. **Scleropodium touretii** (Brid.) L.F. Koch

Contributors: V.E. Fedosov, O.I. Kuznetsova

Specimen: Crimea autonomous Republic, vicinity of Partenit Settl., slope of Ayu-Dag Mt. (44.56°N, 34.34°E, ca. 150 m. alt.), in dry *Caprinus* & *Ruscus* dominated forest, on soil. 3.V.2019, coll. V. Fedosov & E. Fedosov, 9130369 (MW, dupl. MHA).

DNA: isolate OK2599, GenBank # MT799664 (nuclear internal transcribed spacer region).

Distribution: This species has a Mediterranean disjunction between western region of Palearctic (Mediterranean region of Europe, West Asia, North Africa and Macaronesia) and western North America. The easternmost localities in Europe are in Bulgaria (Hodgetts & Lockhart, 2020), and in Asia it occurs in Cyprus, Turkey, Syria, Lebanon, Israel and Jordan (Ros *et al.*, 2013).

The species is polymorphic morphologically (four infraspecific taxa described from Europe) and heterogeneous molecularly. Shaw *et al.* (2003) suggested and Carter (2012) in general confirmed the North American origin of the *S. touretii*, with subsequent spreading to Old World. Collections from South Europe and West Asia formed a separate cluster in Carter (2012) study, of altogether 50 samples of *S. touretii*. Crimean collection is molecularly most closely related to a specimen from Greece.

3. **Leptopterigynandrum austro-alpinum** Müll. Hal.

Contributors: E.A. Ignatova, O.I. Kuznetsova

Specimen 1: (as *Leptopterigynandrum tenuicaule* (R.S. Williams) S. He), Bolivia, Cochabamba, Cercado, Area Andrada Cañón, Km 8-10. 17°20'S, 066°08'W, 3580 m alt. Parque Nacional Tunarí. Bosque de *Alnus acuminata* al lado de quebrada, y plantacón de *Pinus* y *Eucalyptus*. 17 Nov 1999 coll. S.P. Churchill 19938 (MO).

DNA: isolate OK581 GenBank # MT799662 (nuclear internal transcribed spacer region).

Specimen 2: Bolivia, Cochabamba, Canton Quillacollo. Camino antigue a Morochata, algunas kms abajo de San Miguel (20 km norte de Quillacollo). Bosque de *Polylepis*, semi-seco. 17°18'S, 066°19'W, 3700 m alt., Coll. 28 Jun 2001 S.P. Churchill 20615 (MO, dupl. BOLV, USZ).

DNA: isolate OK582 GenBank MT799661 (nuclear internal transcribed spacer region).

Leptopterigynandrum austro-alpinum was described from South America (northern Argentina). Its presence in the Northern Hemisphere (U.S.A., Colorado and Alaska) was first revealed by Buck (1980) nearly after a century after its description. Shortly after that Abramova & Abramov (1983) discovered it in Asia, in Chukotka and Mongolia (Abramov & Abramova, 1983), and afterwards the species has been found in many areas of Siberia (Altai, Transbaikalia, *etc.*). Later He (2005) recognized more species in Siberia, and after molecular phylogenetic analysis of Ignatov *et al.* (2012), *L. austro-alpinum* s.str.

appeared again to be rare in Asia, while most so-named collections were referred to several other species. Many species of the genus also appeared to have a limited distribution, thus the identity of Asian and South American plants became a subject to test.

Embedding of the Bolivian sequences (OK582) in *Leptopterigynandrum* alignment resulted in the confirmation of the species identity between plants from Chukotka, Mongolia, and South American plants. The analysed South American plants originate from the area less than 1000 km from locus classicus of *L. austro-alpinum* (Fig. 1). Although not an absolute proof of identity between the sequenced plants and the type of *L. austro-alpinum*, the genetic similarity at such distances is remarkable. Another Bolivian specimen, referred to *L. tenuicaule* was found in the same clade, although any conclusions on its identity require additional comparison with other *L. tenuicaule* specimens.

4. **Taxiphyllum taxiphylloides** (Ando & Higuchi) Higuchi

Contributors: M.S. Ignatov, J. Kučera, O.I. Kuznetsova, V.E. Fedosov

Specimen 1: Russia, Russian Far East, Primorsky Territory, Lat. 43.34791°N, Lon 133.65648°E, alt. 1620 m a.s.l. Olkhovaya Mt., Rocks, in crevices. Leg. V Ya Cherdantseva 04 Oct 2006. Det. M. Higuchi (VBGI52668, dupl. MHA).

DNA: Isolate OK2060; GenBank #MT799663 (nuclear internal transcribed spacer region).

Specimen 2: Russia, Far East, Primorsky Krai, Dalnegorsk Town Distr., Dalnegorsk, Partizanskaya Pad' valley ca 3.4 km NNW of the town centre, E-facing valley slope 150 m above (W of) the track, 730 m NW of railway tunnel portal at Verkhniy Rudnik, WGS-84 44.583427°N, 135.549690°E (UTM 53T 543637 4936823), 340 m a.s.l., broad-leaved wood on limestone; humus over a ledge of shaded limestone rock, 16.9.2019 coll. J. Kučera 21874 (CBFS).

DNA: Isolate: Ta1894; GenBank # MT799993 (nuclear internal transcribed spacer region).

This species was described in the genus *Gollania*, and later Higuchi transferred it to *Taxiphyllum* (Higuchi & Bakalin, 2013). The delimitation of the latter genus remains rather indefinite, while its wider affinities among 'hypnoid' pleurocarps were only disclosed following a molecular study (Ignatov *et al.*, 2012).

The sequences of *Taxiphyllum taxiphylloides* show closest affinities to widespread pantropical *Taxiphyllum taxirameum* (AJ862522) and *T. planiusculum* KY550346 and KY550347 (the latter species is often treated as a synonym of the former) using the BLAST search (https://blast.ncbi.nlm.nih.gov/Blast.cgi). As *T. taxirameum* is the type of genus *Taxiphyllum*, the assignation of *Taxiphyllum taxiphylloides* to this genus is confirmed.

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