

### BRYOPHYTE MOLECULAR BARCODING RECORDS. 3

#### БРИОЛОГИЧЕСКИЕ НАХОДКИ ПО РЕЗУЛЬТАТАМ ДНК-МАРКИРОВАНИЯ. 3

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Abstract

DNA-barcoding revealed/confirmed the range extension of the following bryophytes: *Solenostoma rossicum* (newly found in Urals) and *Hypnum andoi* (confirmed in Black Sea coastal area of Caucasus and Karelia).

Резюме

По данным ДНК-маркирования выявлено произрастание печеночника *Solenostoma rossicum* на Урале и подтверждена встречаемость *Hypnum andoi* в Карелии и на черноморском побережье Кавказа.

KEYWORDS: mosses, new records, molecular markers, nrITS, Russia, *Hypnum*, *Solenostoma*

#### INTRODUCTION

This paper continues the series of brief reports of new findings in the course of the bryophyte DNA studies. It presents various finding where the sequencing either confirms species identities, which are ambiguous by various reasons, or disclose their affinities, or support generic placements of certain taxa that have never been investigated for molecular markers earlier, 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 projects of a particular group, such data may remain unsubmitted to DNA databases and stay neglected and not searchable among published materials.

#### 1. *Solenostoma rossicum* Bakalin et Vilnet

Contributors: Konstantinova, N.A., A.A. Vilnet, E.D. Lapshina

Specimen: Khanty-Mansi Autonomous Province (Yugra), Berezovo District, Khulga river basin in its upstream, on the eastern slope of Subpolar Urals, 3 km to the northwest of Balbanty Lake (65.21085N, 61.97035E), the plateau on the mountain pass, *Betula nana* dominated tun-

dra, on loamy mud boils, 14.VII.2018 Lapshina E.D. YSU-MH-00504 #071-18 (KPABG, YSU).

The species was found in small clusters or as individual shoots adjacent to small clusters of *Marsupella sprucei* (Limpr.) Bernet, *Prasanthus suecicus* (Gottsche) Lindb. and scattered plants of *Sphenolobus minutus* (Schreb.) Berggr., *Anthelia juratzkana* (Limpr.) Trevis., *Isopaches bicrenatus* (Schmidel ex Hoffm.) H.Buch. Most plants of this species in the specimen are sterile, a few ones are with perianth, that allow the species to be assigned to *Solenostoma* while the exact identification of the species based on morphological features at hand is difficult mainly due to the incredible complexity of interpretation of small Arctic forms of *Solenostoma*.

DNA: Genbank accession numbers MW341215 (for *trnL-F* cpDNA) and MW341216 (for *trnG*-intron cpDNA). Phylogenetic estimation with maximum likelihood approach (Guindon *et al.*, 2010) was provided for a number of *Solenostoma* species based on accessions published in Bakalin & Vilnet (2012) according to the described procedure. The tested specimen from Khanty-Mansi Autonomous Province was found in a clade with 5 specimens of *S. rossicum* from Yakutiya Republic and Khabarovsk Territory. The diver-

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Fig. 1. Phylogram obtained in a maximum likelihood analysis of *trnL-F+trnG*-intron for the genus *Solenostoma*, GenBank accession numbers are provided, bootstrap support values more than 50% are indicated.

gence of this specimen from the other consists of 0.2-0.7% in *trnL-F*, while *trnG*-intron among all specimens is stable as calculated in Mega 5.1 (Tamura *et al.*, 2011).

The studied plants are quite consistent with the description of the species (Bakalin & Vilnet, 2012; Bakalin, 2014), with the exception of the color of the ventral side of shoots, that is rather brown. They have 1) the color of leaves, which are light green, but partially with a peculiar red-colored border; 2) red colored perianth mouth, 3) marginal leaf cells that are equal to midleaf cells. We were unable, however, to find out whether the species is parocious or heterocious.

The species is phylogenetically and morphologically very similar to both *S. sphaerocarpum* and *S. confertissimum*. Rather soon after the description *S. rossicum* was synonymized with *Solenostoma sphaerocarpum* (Hook.) Steph. (Vána *et al.*, 2013). Bakalin (2014) disagreed and explained his position in details in defence of *S. rossicum*, but the species was nevertheless not included in World Check list of Hornworts and Liverworts (Söderström *et al.*, 2016). The discovery of the species in the Khanty-Mansi Autonomous Province, several thousand kilometers to the West from its previously known range, confirms its status of independent species. However, further studies of the taxa closely related to *Solenostoma sphaerocarpum* are needed to clarify the scope of species variability in this group.

**Distribution.** The distribution of the species is described by Bakalin (2014) as Boreal East Asian (circum-Okhotian endemic) where it “almost everywhere vicariously replaces *Solenostoma sphaerocarpum*”. The present record suggests that most likely *Solenostoma rossicum* is a circumpolar arctic-montane species, which is

either omitted from collections due to its very small size and often occurring as single shoots, or is identified as *Solenostoma sphaerocarpum* or *S. confertissimum*. Judging by the description, a specimen from Southern Greenland similar to *S. rossicum* was described by Schuster (1988) as *S. confertissimum*.

## 2. *Hypnum andoi* A.J.E Smith

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**Specimens:** (1) Karelia, Medvezhjegorsk District, Elmozero Lake, S of Vengigora Village, 63°33'N – 22°06'E. Acid bedrock cliff 5-8 m height on W exposition under pine and birch canopy. Lithosoil on surface of rocks. 11 Aug. 2000 Maksimov & Maksimova 6-253 (LE). Isolate OK2639. (2) Krasnodar Territory, Sochi, Khosta *Taxus* & *Buxus* Wood, 43°31'46"N °52'30"E, slope of Opolznevaya ravine, boxwood forest with *Ruscus colchicus*, at base of yew trunk. 6 Oct. 2015 Bezgodov 22 (LE). Isolate OK2643.

**DNA:** Genbank accession numbers for nrITS: MW403927 (OK2639, Karelia), MW403928 (OK2643, Krasnodar Territory, Khosta).

Phylogenetic analysis with Genbank accessions that were found closely related in BLAST search was conducted in by Maximum Likelihood (ML) methods using RaxML 8.2.12 (Stamatakis, 2014), with 1000 independent searches. Simple indel coding was applied (Simmons & Ochoterena, 2000). Resulting tree is shown in Fig. 2, confirming position of two Russian samples within this species.

*Hypnum andoi* was for a long time treated as a variety of *H. cupressifome* (e.g. Ando, 1987), while current-

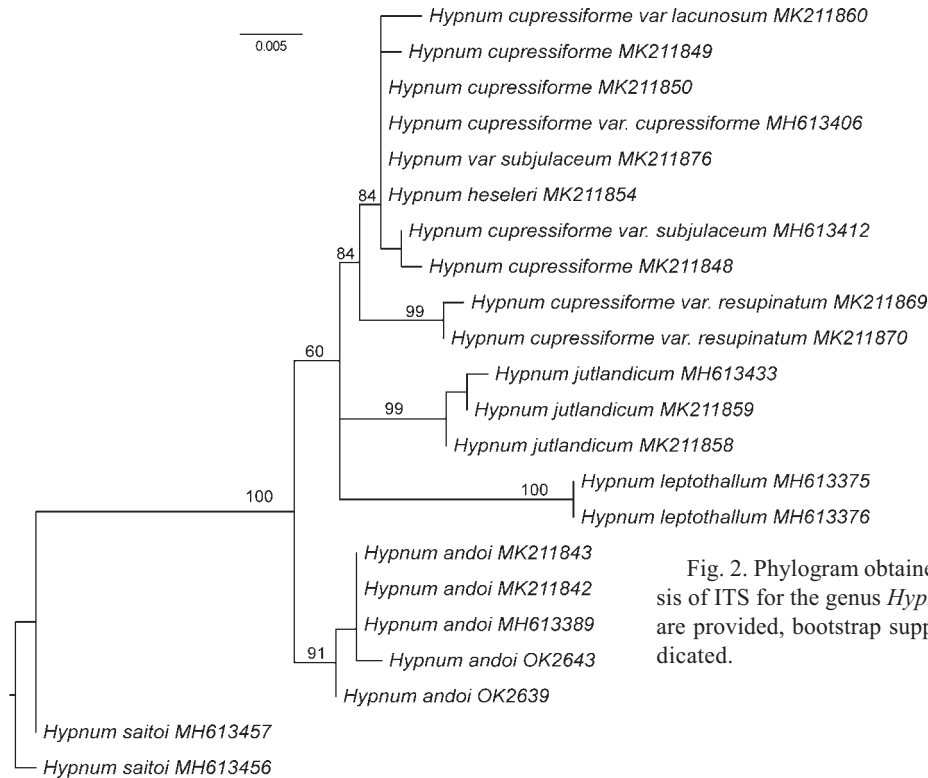


Fig. 2. Phylogram obtained in a maximum likelihood analysis of ITS for the genus *Hypnum*, GenBank accession numbers are provided, bootstrap support values more than 50% are indicated.

ly European bryologists usually accept it as a good species. Hedenäs *et al.* (2014) reported *H. andoi* as a common species in southern part of Sweden, thus its total absence in Russia (Ignatov *et al.*, 2006) looked strange. However, it is obviously a rare species in Russia: we were able to confirm so far only two specimens that fit *H. andoi* by ITS.

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