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BRYOPHYTE MOLECULAR BARCODING RECORDS. 8

БРИОЛОГИЧЕСКИЕ НАХОДКИ ПО РЕЗУЛЬТАТАМ ДНК-МАРКИРОВАНИЯ. 8

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Abstract

DNA-barcoding revealed/confirmed the range extension of the following bryophytes: *Merceya ligulata* (Primorsky Territory), *Bryoerythrophyllum rubrum* (Khanty-Mansi Autonomous District), and *Fissidens curvatum* (Yakutia). *Rauiella thuidioides*, known before only from the type locality is reported from Ussurijsky State Reserve. Taxonomic position of *Scopelophila ligulata* is considered based on brief phylogenetic reconstruction inferred from *trn*S-*trn*F sequences; arguments towards resurrection of the genus *Merceya* Schimp. for this species are provided.

Резюме

С помощью ДНК-баркодинга выявлены или подтверждены находки за пределами основного ареала следующих видов мохообразных: *Merceya ligulata* (Приморский край), *Bryoerythrophyllum rubrum* (Ханты-Мансийский Автономный округ), *Fissidens curvatus* (Якутия). *Rauiella thuidioides*, ранее известная только из типового местонахождения, приводится для Уссурийского заповедника. На основании реконструкции филогении рассмотрено таксономическое положение *Scopelophila ligulata*; приводятся аргументы в пользу восстановления рода *Merceya* Schimp.

KEYWORDS: mosses, new records, molecular markers, nrITS, trnS-trnF, Russia

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. ***Merceya ligulata*** (Spruce) Schimp. (*Scopelophila ligulata* (Spruce) Spruce

Contributors: M.A. Kolesnikova, O.I. Kuznetsova, E.A. Ignatova, V.E. Fedosov

Specimen: Russia, Primorsky Territory, Terneysky District, Sikhote-Alin Nature Reserve, 45°13'N –136°30', field station Yasnoe, left bank of Zabolochennaya creek, mixed valley forest, cliff crevices. 2.X.2019, coll. M.A. Kolesnikova 19-186a (MHA).

DNA: isolate OK3444, GenBank # OR478623 (plastid trnS-F).

Previously this rare species was known from Russia only from two reports, collection by Bardunov & Cherdantseva in 1977 (specimen in VLA, duplicates in MHA and MW), in Primorsky Territory, Olga District (Bardunov & Cherdantseva, 1982) and in Tunkinskaya valley in Buryatia (Bardunov, 2008).

Comparison of the obtained sequence with the data available in GenBank showed high similarity with two rps4 sequences obtained from North American specimens (99-100%), rather low (although still highest) similarity with trnLF sequence of European specimen and surprisingly low similarity to trnSF sequences of *Scopelopila cataractae* (even rather conservative rps4 yielded similarity of 94%, while for full-length trnSF it was below 92%, The latter encouraged the brief phylogenetic study of affinities of these two species based on

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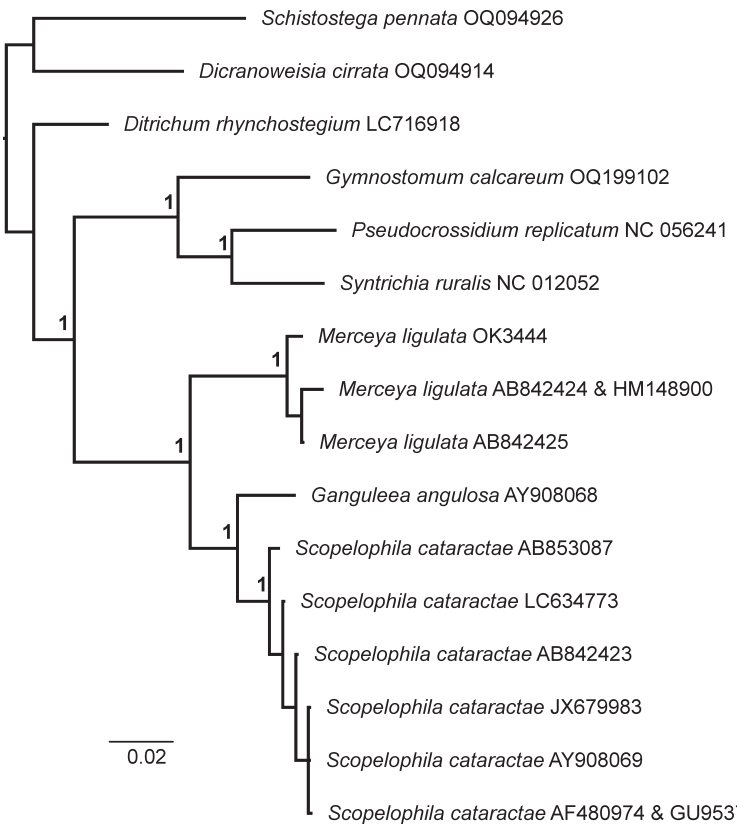

Fig. 1. Bayesian phylogenetic tree of *Scopelophila* and related taxa based on plastid trnSF sequences. Baiesian posterior probabilities >0.9 are shown above branches.

data available in GenBank. Seventeen sequences downloaded from GenBank were aligned manually, indels were coded using simple indel coding technique. Tree was built in MrBayes v. 3.2.7 (Ronquist et al., 2012) with 1 000 000 generations, when average deviation of split frequencies reached 0.002 and ESSR exceeded 2000. In the obtained reconstruction (Fig. 1) three terminals of *Scopelophila ligulta* and six terminals of *S. cataractae* form maximally supported clades, however these clades do not form a *Scopelophila* clade; instead, *S. cataractae* clade forms a maximally supported clade with a single available in GenBank accession of *Ganguleea angulosa* (Broth. & Dixon) R.H. Zander. The latter species has disjunctive distribution in Asian and Neotropics; morphologically it resembles *S. cataractae* in absence of stem central strand, narrowed proximally strong rounded stereid band in transverse leaf section and eperistomate capsules, but differs from it in incurved leaf margins, monoicous sexual condition and sporophytes developing on a short branch, like it occurs in *Anoectangium* and *Molendoa* (for details see Zander, 1989). Taking into account difference between the three species (see Zander, 2007) and remarkably high molecular divergence (quite distinctive genera of Pottiaceae in the adjacent clade have comparable degree of divergence) we suggest that considering *S. ligulata* in a separate genus, i.e. *Merceya* Schimp. would be more correct solution then combining all-three within broader circumscribed *Scopelophila*.

2. ***Bryoerythrophyllum rubrum*** (Jur. ex Geh.) P.C. Chen

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

Specimen: Russia, Khanty-Mansi Autonomous District, Subpolar Urals, Puiva, on fine soil on limestone outcrops in mountain tundra, 64°29'N–59°40' E, 788 m elev., 1.VIII.2015, coll. E.D. Lapshina 05/8, (YSU#0818, dupl. MW [primarily identified as *B. latinervium*]).

DNA: isolate OK1141, GenBank OR466077 (nuclear ITS).

The poorly developed plants of *Bryoerythrophyllum*, as well as many other small Pottiaceae are easy to confuse, and this specimen is one of those kind. Molecular phylogenetic results however unequivocally put it in proximity with other specimens of *B. rubrum*, as it was delimited in analysis of Fedosov & Ignatova (2009). These authors confirmed the presence of *B. rubrum* in Russia only in high mountains of Caucasus and in Arctic part of Taimyr Peninsula.

3. ***Fissidens curvatus*** Hornsch.

Contributors: M.S. Ignatov, E.A. Ignatova, O.I. Kuznetsova

Specimen: Russia, Yakutia, Tomponsky District, Kuranakh River (East Khandyga tributary), small tributary of Kuranakh on steep slope on its right bank, on soil in small cave, 63°00' N – 138°28' E, 700 m alt., 21.VII.2015, coll. Ignatov & Ignatova #15-748 (MHA9102015). An identical specimen was collected

nearby on fine soil above rock outcrops in *Larix* forest (coll. Ignatov & Ignatova, 15-769, MHA9102012). Originally both specimens were identified as *F. gracilifolius*.

DNA: isolate OK3570, GenBank OR466076 (nuclear ITS).

This is the first record of this species in Yakutia, and surprisingly it was found in a very cold area, less that 500 km from Oimyakon, the coldest area in Russia, while the species has pantropical distribution and it was discovered in Russia rather recently in the Russian Far East (Ignatov et al., 2000). Later it was found in several other parts of Primorsky and Khabarovsk Territories and Amurskaya Province, extending northwards to Kamchatka Peninsula (Czernyadjeva, 2012). The species occurs in West Europe mostly in the Mediterranean regions, extending eastwards to Caucasus where it was revealed (with confirmation from DNA study) by Ignatov et al. (2023). Sequence, obtained from the Yakutian specimen was found similar to several sequences from the Russian Far East, those from Caucasian specimens (Ignatov et al., l.c.), and also one sequence available in GenBank for specimen from Cabo Verde (originally studied by Guerra et al., 2021).

4. ***Rauiella thuidioides*** Jan Kučera & Ignatova

Contributors: V.E. Fedosov, A.V. Fedorova

Specimen: Russia, Primorsky Territory, Shkotovsky Distr., Ussurijsky State Nature reserve, upper course of Komarovka River basin , 43.64906N, 132.49162E, 222 m alt., the road towards the pass to Artyomovka River walley, mixed forest, on boulder near the road, 17 VIII 2022 Fedosov s.n. (MW).

DNA: isolate ThF93, GenBank OR478760 (nuclear ITS).

This species was recently described based on several specimens, collected by different bryologist in the same locality, in Elomovsky Klyuch Creek valley, Lazo Distr. of Primorsky Territory (Kučera et al., 2021) and remained known only from where until the expedition to Ussurijsky Territory brought several additional specimens. Molecular data for one of these specimens, identical to one, published by Kučera et al. (2021) arrived too late to be included in the paper, specifically dealing with new and otherwise interesting moss records from that area (Ishchenko et al., 2022), so it is considered here. The species was collected several times in different places on shaded rocks. Remarkably, the area where the species was newly found is assigned to a different biome from that where it was described from, indicating wider possible distribution of this poorly known Russian endemic, proved here by DNA barcoding. Its occurrence in broad leaved forests of Russian Far East, suggests its wider distribution in temperate East Asia including probable presence in adjacent areas of Korea and China.

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