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Contribution to the *Antrodiella americana* species complex (Basidiomycota, *Polyporales*)

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Two recently described polypores, *Antrodiella niemelaei* and *A. chinensis*, are newly reported from the Russian Far East and the first of them also from the Czech Republic, Central Europe. The correctness of the identification of both species was confirmed by sequencing of ribosomal DNA. *Antrodiella chinensis* is reported as a record new to Russia. *Antrodiella niemelaei* was collected on dead fruitbodies of *Hymenochaete intricata* and *H. tabacina*. Photographs of both species are presented.

Key words: polypores, Basidiomycota, taxonomy, ecology.

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Outkovečky *Antrodiella niemelaei* a *A. chinensis* jsou nově zaznamenány z ruského Dálného východu a první z nich také z České republiky. Správnost určení obou druhů byla potvrzena sekvenováním ribozomální DNA. *Antrodiella chinensis* je novým druhem pro Rusko. *Antrodiella niemelaei* byla sbírána na odumřelých plodnicích kožovek *Hymenochaete intricata* a *H. tabacina*. Jsou prezentovány fotografie obou druhů.

INTRODUCTION

Antrodiella niemelaei Vampola & Vlasák and *A. chinensis* H.S. Yuan belong to the *A. americana* complex and have been separated from *Antrodiella americana* Ryvarden & Gilb. recently (Vampola & Vlasák 2011, Yuan 2013). The whole group of species around *A. americana* is characterised by their ecology. They all belong to so-called successor species (Niemelä et al. 1995, Piątek 2001) inhabiting wood decayed by some other fungi, in this case specifically of the family *Hymenochaetaceae*. Three geographically separated species are recognised: *Antrodiella* *americana* in North America, *A. chinensis* in East Asia, and *A. niemelaei* in Europe (Gilbertson & Ryvarden 1986, Vampola & Vlasák 2011, Yuan 2013).

In this article, we present new records of *A. niemelaei* and *A. chinensis* from the Russian Far East and the first one also for the first time from the Czech Republic (Central Europe). Our identifications were supported by ribosomal DNA analysis.

MATERIAL AND METHODS

The specimens of *Antrodiella niemelaei* and *A. chinensis*, collected in the Czech Republic and Russia, are deposited in the Botanical Museum, University of Helsinki (H), Mycological Department of the National Museum, Prague (PRM), as well as the Mycological Herbarium of the Department of Biology, University of West Bohemia, Pilsen, Czech Republic (abbreviated KBI here) and the private herbarium of J. Vlasák (abbreviated JV). For acronyms of public herbaria, see Thiers (on-line).

A microscopic study was made in Cotton Blue and Melzer's reagent using an Olympus BX 51 light microscope. We measured the pore size values of 2 specimens of *Antrodiella americana* (CFMR specimens), 2 specimens of *A. chinensis* (Spirin 5088, 6612) and 7 specimens of *A. niemelaei* (Ryvarden 28822, Toresson 19980911, holotype, Parmasto 154386, Spirin 5839, 4828, 4870); 20 measurements from each specimen in total.

For DNA methods, see Vlasák & Kout (2011). The phylogram analysis was carried out as presented in Vampola & Vlasák (2011); *A. semisupina*, *A. pallescens* and *A. romellii* were used as outgroup (specimens used for the DNA study, see Tab. 1). There were a total of 586 positions in the final alignment, of which 85 were variable and 74 parsimony informative.

RESULTS AND DISCUSSION

Antrodiella niemelaei was described based on specimens from Northern Europe (Vampola & Vlasák 2011), but here it is reported from the Czech Republic, Central Europe and also from the Russian Far East, Asia. The locality in the Czech Republic, Petrovka Nature Reserve, is a protected site in a humid alder valley, where the *Alnus*-dominated communities have a cooler climate than the surrounding pine forests. In the Russian Far East (Khabarovsk Reg.) *Antrodiella niemelaei* occurs in mixed forests in Bolshoi Khekhtsir Nature Reserve (highland areas, alt. 800–1000 m), occupying dead basidiocarps of *Hymenochaete intricata* (Lloyd) S. Ito on dead branches of *Acer ukurunduense*.

Tab. 1. Specimens used in phylogenetic relationships.
(The first two GenBank records of *Antrodiella americana* have probably not been published. Other GenBank numbers without reference are published in this paper, see Specimens examined.)

Species	Country	Herbarium specimen/culture	GenBank	Reference
Antrodiella americana	USA	L 3468	EU232185	
Antrodiella americana	USA	HHB 4100-Sp	EU232186	
Antrodiella americana	USA	JV 0109/37	JN592510	Vampola & Vlasák (2011)
Antrodiella chinensis	China	Dai 8874	JX110843	Yuan (2013)
Antrodiella chinensis	China	Dai 9019	JX110844	Yuan (2013)
Antrodiella chinensis	Russia	SP 6612	KF963616	
Antrodiella niemelaei	Finland	Renvall 3218	AF126876	Johannesson et al. (2000)
Antrodiella niemelaei	Finland	Haikonen 14727	AF126877	Johannesson et al. (2000)
Antrodiella niemelaei	Sweden	KH Larsson 11949	JN710509	Miettinen et al. (2012)
Antrodiella niemelaei	Czech Republic	KBI 0903/13	KF963615	
Antrodiella niemelaei	Russia	SP 4828	KF963610	
Antrodiella niemelaei	Russia	SP 4870	KF963611	
Antrodiella niemelaei	Russia	SP 5839	KF963612	
Antrodiella niemelaei	Russia	SP 6625	KF963614	
Antrodiella niemelaei	Russia	SP 6565	KF963613	
Antrodiella pallescens	Finland	Miettinen 12611	FN907921	Miettinen & Larsson (2011)
Antrodiella romellii	Finland	Saarenoksa 24293	AF126901	Johannesson et al. (2000)
Antrodiella romellii	Finland	Renvall 3501	AF126902	Johannesson et al. (2000)
Antrodiella semisupina	Canada	Labrecque & Labbé 372	JN710521	Miettinen et al. (2012)

Antrodiella chinensis is reported here as new to Russia. It was found in the Russian Far East, where also its close relative *Antrodiella niemelaei* occurs (at the same locality). *Antrodiella americana* remains limited to the North American continent (Vampola & Vlasák 2011), nevertheless we expect other *Antrodiella* species there as well (e.g. on fruitbodies of *Hydnochaete* genus).

Six sequences of rDNA ITS regions of *Antrodiella niemelaei* specimens were generated during this study to confirm our identifications. We demonstrated high sequence similarity (99–100% concordance) of *A. niemelaei* specimens from Fennoscandia, Central Europe and East Asia, as well as its close affinity to *A. americana*, which shows, however, much higher sequence diversity (Fig. 1). More North American specimens are needed to study this unexpected variability. *Antrodiella chinensis* forms a rather distant clade, belonging, nevertheless, to the *Hymenochaete*-successor subclade. Typical *Antrodiella* species (not connected to *Hymenochaete*-colonised wood) – *A. semisupina*, *A. pallescens* and *A. romellii* – are clustered separately from the *Hymenochaete*-successor subclade of *Antrodiella* species.

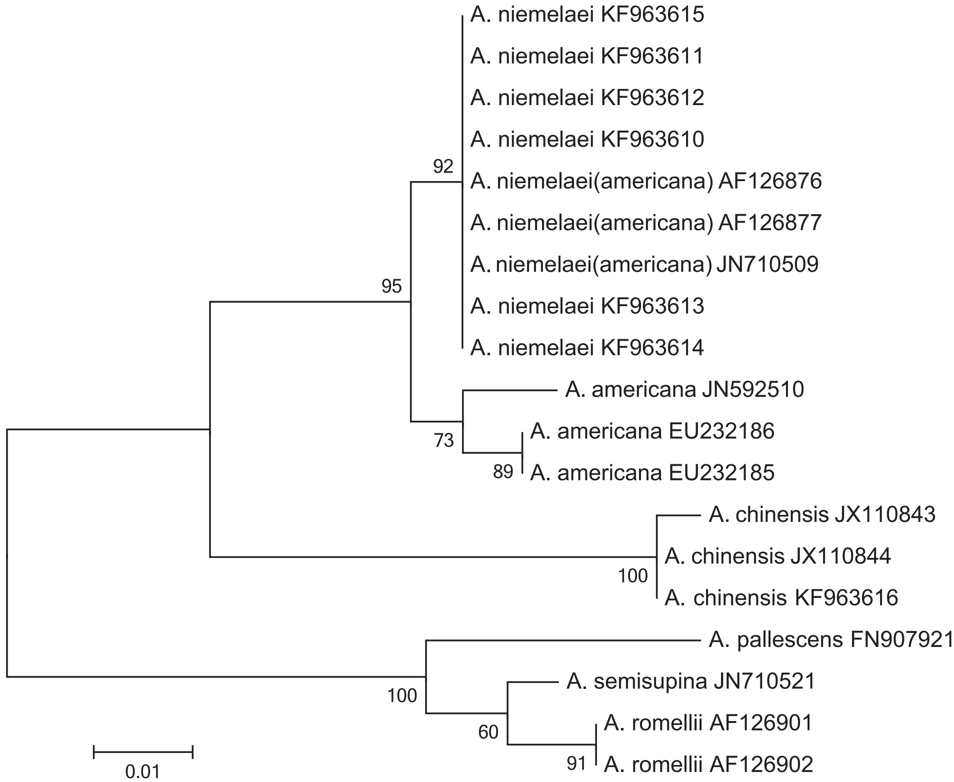

Fig. 1. Phylogenetic relationships of 19 *Antrodiella* specimens from 6 allied taxa inferred from ITS rRNA sequences. Topology from maximum likelihood (ML) analysis. Support values along branches from ML bootstrap (1000 replicates). Branch lengths are drawn proportional to the number of substitutions per site. GenBank numbers indicate sequences retrieved from GenBank; other GenBank numbers in Specimens examined.

In addition to geographic distribution and rDNA sequences, pore size is a good species character in the *A. americana* complex (Figs. 2–4), which was already stated in some earlier publications (Vampola & Vlasák 2011, Yuan 2013). *Antrodiella niemelaei* has small pores, approx. 4 per mm, *A. americana* medium pores 1–3 per mm, and *A. chinensis* has large pores, 1–2 per mm in our specimens, but 0.5–1.5 per mm in the original description (Yuan 2013). The above pore size values are measured in young and well-developed basidiocarps. In the case of drying and older fruitbodies disruption or deformation of the pores can sometimes occur, which may alter the measured values.

Photographs of fresh basidiocarps of *A. chinensis* and *A. niemelaei* are presented in Figs. 5 and 6.

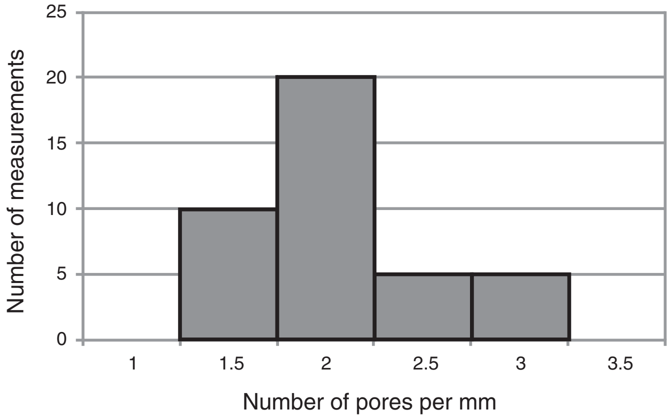

Fig. 2. Pore density in *Antrodiella americana*.

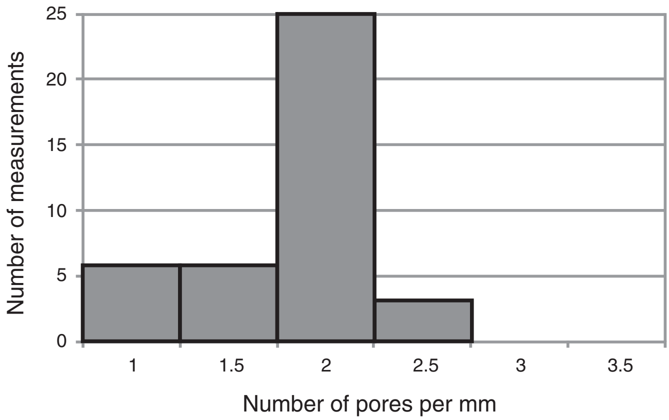

Fig. 3. Pore density in *Antrodiella chinensis*.

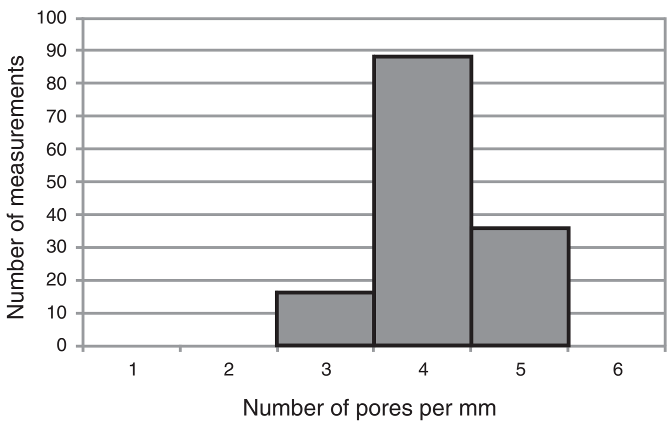

Fig. 4. Pore density in *Antrodiella niemelaei*.

Fig. 5. *Antrodiella chinensis*, Russia (Khabarovsk Reg.), on *Betula lanata*, 3 Sept. 2013 (Spirin 6612). Bar = 1 cm. Photo by V. Spirin.

Fig. 6. *Antrodiella niemelaei*, Russia (Leningrad Reg.), on *Salix caprea* and *Hymenochaete tabacina*, 28 July 2012 (Spirin 4828). Bar = 1 cm. Photo by V. Spirin.

Specimens examined

***Antrodiella americana*:**

U S A. Michigan: Gogebic County, Ottawa Nat. Forest, angiosperm wood, 13–23 Aug. 1997, leg. D.L. Lindner (DLC97-307, DLC97-1151 in CFMR). – Pennsylvania: Skippack, Evansburg State Park, angiosperm wood, 3 Aug. 2001, leg. J. Vlasák (JV0109/37, GenBank JN592510).

***Antrodiella chinensis*:**

Russia. Khabarovsk Reg.: Khabarovsk Dist., Bol'shoi Khekhtsir Nat. Res., *Betula lanata*, 3 Sept. 2013, leg. Bukharova & Spirin (Spirin 6612 in H, GenBank KF963616). – Ilga, *Salix schwerinii*, 9 Aug. 2012, leg. V. Spirin (Spirin 5088 in H). – Ulika, *Tilia amurensis*, 13 Aug. 2012, leg. V. Spirin (Spirin 5200 in H). – Solnechnyi Dist., Gorin, *Acer ukurunduense*, 12 Aug. 2011, leg. V. Spirin (Spirin 4095 in H). – Primorie Reg.: Krasnoarmeiskii Dist., Melnichnoe, *Corylus mandshurica*, 23 Aug. 2013, leg. V. Spirin (Spirin 6279 in H).

***Antrodiella niemelaei*:**

Czech Republic. Western Bohemia: Petrovka Nat. Res. near Pilsen, NW part, 380 m a.s.l., on dead fruitbodies of *Hymenochaete tabacina* and wood of willow shrub (*Salix* sp., attached branch), 9 Mar. 2013, leg. J. Kout (KBI 0903/13, GenBank KF963615); ibid., 26 Apr. 2013, leg. J. Kout (PRM 922462), 30 May 2013, leg. J. Kout (KBI 3005/13).

Norway. Oslo: Songsvann, *Prunus padus*, 14 Oct. 1990, leg. L. Ryvarden (Ryvarden 28822, H ex O).

Sweden. Uppland: Rö, Beateberg, *Corylus avellana* + *H. tabacina*, 11 Sept. 1998, leg. H.-G. Toresson (Toresson 19980911 in H).

Finland. Uusimaa: Helsinki, Viikki, *Salix caprea* + *H. tabacina*, 23 Oct. 2012, leg. V. Spirin (Spirin 5893 in H). – Vantaa, Mustavuori, *Prunus padus* + *H. tabacina*, 29 June 1985, leg. T. Niemelä & R. Saarenoksa (Niemelä 3223; holotype in PRM, isotype in H).

Estonia. Jõgevamaa: Alam-Pedja Nat. Res., *Populus tremula* + *H. tabacina*, 10 Oct. 1996, leg. E. Parmasto (H ex TAA 154386).

Russia. Leningrad Reg.: Boksitogorsk Distr., Radogoshch, *Salix caprea* + *H. tabacina*, 26 Sept. 2012, leg. V. Spirin (Spirin 5839 in H, GenBank KF963612). – Tikhvin Distr., Gorodokskoe, *S. caprea* + *H. tabacina*, 28 July 2012, leg. V. Spirin (Spirin 4828 in H, GenBank KF963610). – Khabarovsk Reg.: Khabarovsk Distr., Bolshoi Khekhtsir Nat. Res., *Acer ukurunduense* + *Hymenochaete intricata*, 3 Sept. 2013, leg. V. Spirin (Spirin 6565, GenBank KF963613; Spirin 6575 in H; Spirin 6625 in H, GenBank KF963614). – Malyi Niran, *Corylus mandshurica* + *H. intricata*, 5–7 Aug. 2012, leg. V. Spirin (Spirin 4870 in H, GenBank KF963611; Spirin 4993 in H).

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