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Studies in the bark-dwelling species of *Hymenochaete* (Hymenochaetales, Basidiomycota) reveal three new species

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Abstract – Three new species of *Hymenochaete* from Russian Far East are described based on morphological and ITS rDNA data. *Hymenochaete adhaerens* sp. nov. is a resupinate species closely related to *H. macrospora*, from which it differs in having longer basidiospores and setae. The basidiocarps of *H. cupulata* sp. nov. are effused-reflexed, resembling those of the European *H. ulmicola*, from which it differs in having setae inflated at the basal part and shorter basidiospores. Both *H. adhaerens* and *H. cupulata* inhabit bark of living elm trees (*Ulmus* spp.). *H. manshurica* sp. nov. is resupinate and morphologically similar to the North American *H. corticolor*, from which it differs in having narrower setae and basidiospores; it has been collected from bark of living *Tilia manshurica*.

Basidiomycetes / ITS / polypores / Russia / taxonomy

INTRODUCTION

Hymenochaete Lév. is the type genus of the *Hymenochaetales*. It encompasses more than 200 species worldwide, all inhabiting woody hosts. A few species have been reported as growing on bark of living angiosperm trees. Two of them, *H. carpatica* Pilát and *H. ulmicola* Corfixen & Parmasto, were described from Europe (Pilát, 1931; Corfixen & Parmasto, 2005) but later reported also from other regions of the temperate northern hemisphere (Parmasto, 2001; He & Li, 2013). In addition, *H. macrospora* Y.C. Dai was described from the northern part of China (Dai *et al*., 2000). However, morphological and phylogenetic investigations of newly collected material reveal a more complicated picture. Three new species from temperate East Asia are here described, and one older species, *H. corticolor*, is reinstated.

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MATERIAL AND METHODS

Morphological protocols. The basidiocarp anatomy is described according to Parmasto (2001) while the microscopic routine followed Niemelä (1972) and Miettinen *et al*. (2006). Colour names and codes are given according to Maerz & Paul (1950). At least 20 setae and hyphae, as well as 30 basidiospores from each specimen were measured. Microscopic structures were studied and measured with Leitz Diaplan microscope (×1250 magnification). Measurements were done in Cotton Blue using phase contrast illumination and oil immersion (with a subjective accuracy of 0.1 μm – Miettinen *et al*., 2006). The following abbreviations are used in the species descriptions: SI – setal index (ratio of mean length to mean width of setae), L' – spore length, L – mean spore length, W' – spore width, W – mean spore width, Q' – length / width ratio, Q – mean length/width ratio. For presenting a variation of setae and spore size, 5% of measurements have been excluded from each end of the range, and are given in parentheses.

Molecular protocols. DNA was extracted from dried basidiocarps and the ITS rDNA regions were sequenced applying the protocols described by Tamm & Põldmaa (2013). Sequencing was performed at Estonian Biocenter, University of Tartu. The sequences were edited and assembled with Sequencher 5.1 (Gene Codes, Ann Arbor, MI, USA) and deposited in GenBank. Further, all publicly available rDNA ITS sequences from species closely related to *H. ulmicola* Corfixen & Parmasto, *H. macrospora* Y.C. Dai and *H. carpatica* Pilát in the so-called *H. rubiginosa* clade (He & Dai, 2012; Parmasto *et al*., 2014) were included in the analysis. A sequence of *Hymenochaete adusta* (Lév.) Hariot & Pat., obtained from GenBank, was used as the outgroup. The datamatrix was aligned with Mafft 7 online version (Katoh & Toh, 2008) identifying ambiguously aligned regions to be excluded from the subsequent analysis with Gblocks (Castresana, 2000). RaxML-HPC BlackBox 8.0.9 at the CIPRES Science Gateway (www.phylo.org) was used for the maximum likelihood analysis, run wihout the invariant sites and with 1000 bootstrapping replicates.

Sampling. Specimens from herbaria H, TAAM, NY and FH were studied and sequenced. Herbarium acronyms are given according to Index Herbariorum (Thiers, 2014). All collections are from bark of living trees unless otherwise indicated. Specimens sequenced for this study are marked by asterisk (*), GenBank accession numbers are given in parentheses.

– *H. adhaerens*. Russia. Khabarovsk Reg.: Khabarovsk Dist., Malyi Niran, *Ulmus laciniata*, 7 August 2012, Spirin 4994* (H) (GenBank KM017411), Khabarovsk, Arboretum, *Ulmus pumila*, 13 August 2014, Spirin 7280 (H). Primorie Reg.: Krasnoarmeiskii Dist., Melnichnoe, *U. laciniata*, 22 August 2013, Spirin 6246* (H – holotype, see below) (GenBank KM017412).
– *H. australis*. Argentina. Tierra del Fuego: Fregosini, *Nothofagus pumilio*, 3 December 1995, Greslebin 145* (TAAM 171362 – holotype) (GenBank KM017414).
– *H. carpatica*. Austria. Steiermark: Wolfsgraben, *Acer pseudoplatanus*, 7 November 1998, Maurer (H ex GZ). Germany. Bayern: Allach, *A. pseudoplatanus*, 23 May 2000, Beeneken (H).
– *H. cervina*. Cuba. No locality indicated, "on bark of tree in wood, February", Wright 213 (FH – holotype, see Parmasto, 2001: 140).
– *H. corticolor*. USA. Maryland: Takoma Park, *Quercus alba*, December 1901, Shear 1103 (H ex herb. E.A. Burt). New York: Scarsdale, *Q. alba*, 26 July 1914,

Wilson (NY); Green Lake, *Q. alba*, 3 September 1914, Wilson (NY); Glasco, *Q. alba*, 25 August 1914, Wilson (NY). South Carolina, *Q. alba*, Ravenel (H ex Fungi Caroliniani Exsiccati 3: 30, 1855, as *Corticium corticola*).

– *H. cupulata*. Russia. Khabarovsk Reg.: Khabarovsk Dist., Bolshoi Khekhtsir Nat Res., Bychikha, *U. laciniata*, 5 September 2013, Spirin 6700* (H) (GenBank KM017416), Khabarovsk, Arboretum, *U. pumila*, 13 August 2014, Spirin 7278 (H); Solnechnyi Dist., Sonakh, *U. laciniata*, 15 August 2014, Spirin 7324, 7328 (H). Primorie Reg.: Krasnoarmeiskii Dist., Melnichnoe, *U. laciniata*, 22 August 2013, Spirin 6245* (H – holotype, see below) (GenBank KM017417), Iman', *U. laciniata*, 22 August 2013, Spirin 6249* (H) (GenBank KM017418).
– *H. macrospora*. China. Jilin Prov.: Antu Co., Changbaishan Nat. Res., *Acer* sp., 13 July 1993, Dai 488* (H – holotype) (GenBank KM017413).
– *H. manshurica*. Russia. Primorie Reg.: Lazo Dist., Lazo Nat Res., Amerika, *Tilia manshurica*, 12 August 1986, Parmasto (TAAM 107605 – holotype, H – isotype, see below).
– *H. senatoumbrina*. Russia. Primorie Reg.: Khasan Dist., Ryazanovka, *Quercus mongolica* (fallen branches), 23 July 1979, Saar (TAAM 118276 – holotype).
– *H. ulmicola*. Finland. Uusimaa: Lohja, Torhola, *Ulmus laevis*, 29 July 2013, Spirin 5935* (H) (GenBank KM017415). Russia. Nizhny Novgorod Reg.: Lukoyanov Dist., Razino, *U. laevis*, 8 August 2014, Spirin 7218* (H) (GenBank KP677334), Spirin 7254 (H).
– *Hymenochaete* sp. Russia. Khabarovsk Reg.: Khabarovsk Dist., Malyi Niran, *Actinidia kolomikta* (dry branch), 8 August 2012, Spirin 5063* (H) (KM017419); Solnechnyi Dist., Gorin, *Acer ukurunduense* (bark of fallen log), 13 August 2011, Spirin 4132 (H).

RESULTS

The ITS dataset included sequences from 30 specimens, of which 10 were generated in this study, and consisted of 639 characters. Maximum likelihood analysis resolved two new species described below, in addition to those known earlier (Fig. 1). *Hymenochaete adhaerens* sp. nov. appears to be closely related to *H. macrospora*, yet differing from this species in 15 characters of the ITS rDNA. *Hymenochaete cupulata* sp. nov. forms a strongly supported clade together with *H. ulmicola*, differing from the latter at 17 positions. Sequence data could not be obtained from the specimen of *Hymenochaete manshurica* sp. nov.

Hymenochaete adhaerens sp. nov. Figs 2-3

Holotype: Russia. Primorie Reg.: Krasnoarmeiskii Dist., Melnichnoe, *Ulmus laciniata*, 22 August 2013, Spirin 6246 (H) (GenBank KM017412).

MycoBank: MB 810880.

Basidiocarps perennial, resupinate, first orbicular, later fusing together, leathery to soft-corky, 5-10 mm in widest dimension, 0.1-0.3 mm thick. **Margin** adherent, sterile, first almost white and up to 0.5 mm wide, in older basidiocarps evidently disappearing. **Hymenial surface** smooth, first Cocoa Brown to New Bronze (15C11-15E11), later fading to Maple Sugar or Medal Bronze (14J8-14J7).

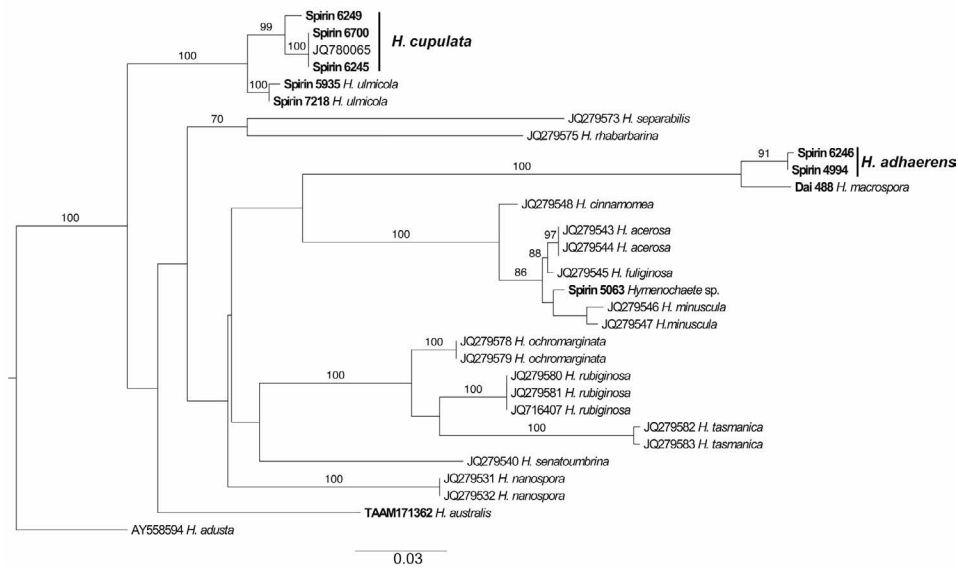


Fig. 1. Phylogenetic tree inferred from the maximum likelihood analysis of ITS rDNA sequences of the studied and closely related *Hymenochaete* species. Sequences obtained and species described in this study are presented in bold. Bootstrap values > 70% are presented above the branches. The scale bar indicates substitutions per nucleotide position.

Tomentum and cortex absent. **Hyphal layer** poorly visible, whitish to very pale brown, 30-50 µm thick; **setal layer** indistinctly stratified, sepia-brown or tawny, 50-200 µm thick; hymenial layer a bit paler, 30-50 µm thick.

Hyphal structure monomitic; hyphae simple-septate, hyaline to pale brown, abundantly encrusted, thin- to slightly thick-walled, in hyphal layer horizontally oriented and almost invisible, in setal and hymenial layers vertically arranged and richly branched, 3-4 µm in diam. **Setae** mostly sharp-pointed, evenly outlined, (56.4) 63.2-96.8 (111.4)× (7.8) 8.3-10.4 (10.7) µm (n = 40/2), SI = 7.99-9.56, projecting up to 20-50 µm above hymenial layer, usually assotiated with simple hyphidia 1-2 µm in diam. **Basidia** suburniform, 14.2-21.9× 4.2-5.2 µm, with the basal parts and some subtending hyphae covered by brownish amorphous matter. **Basidiospores** hyaline, thin-walled, thick cylindrical to narrowly ellipsoid, occasionally ovoid, (5.7) 5.9-7.2 (7.4)× (3.7) 3.8-4.3 (4.5) µm (n = 60/2), L = 6.44, W = 4.03, Q = 1.56-1.65.

Distribution and ecology: East Asia, on bark of living elm trees.

Notes: This species is easily recognizable in the field due to the whitish margin contrasting with the darker hymenial surface. It produces resupinate basidiocarps on bark of living elm trees (*Ulmus laciniata* and *U. pumila*). Morphologically, *H. adhaerens* is similar to two East Asian species, *H. macrospora* Y.C. Dai and *H. senatoumbrina* Parmasto. *Hymenochaete senatoumbrina* grows on fallen branches of decidouous trees (*Fraxinus manshurica*, *Quercus* spp. – Parmasto, 1986), not on bark of living trees, and it has distinctly smaller setae (Table 2) and a well developed hyphal layer consisting of horizontally and loosely arranged hyphae. *Hymenochaete macrospora* was reported as growing on bark of *Acer* and *Ulmus* in China (Dai *et al*., 2000); however, its description seems to be based on mixed

Table 1. Spore measurements of 10 *Hymenochaete* species

Species/specimen	*L'*	*L*	*W'*	*W*	*Q'*	*Q*	*n*
H. adhaerens	**(5.7)5.9–7.2(7.4)**	**6.44**	**(3.7)3.8–4.3(4.5)**	**4.03**	**(1.4)1.5–1.8(1.9)**	**1.61**	**60**
Spirin 6246*	(5.8)6.2–7.2(7.4)	6.67	(3.7)3.8–4.3(4.5)	4.06	(1.5)1.6–1.8(1.9)	1.65	30
Spirin 4994	(5.7)5.9–6.7(6.8)	6.21	(3.7)3.8–4.2(4.3)	3.99	(1.4)1.5–1.6(1.7)	1.56	30
H. carpatica	**(4.6)4.8–6.1(6.2)**	**5.32**	**(3.3)3.4–4.1(4.2)**	**3.69**	**(1.2)1.3–1.6(1.7)**	**1.45**	**60**
Beeneken 2000	(4.9)5.0–6.1(6.2)	5.47	(3.3)3.4–3.9(4.0)	3.63	(1.3)1.4–1.6(1.7)	1.51	30
Maurer 1998	(4.6)4.8–5.8(6.0)	5.17	(3.3)3.4–4.1(4.2)	3.75	(1.2)1.3–1.4(1.5)	1.38	30
H. cervina	**(5.0)5.2–7.0(7.1)**	**6.10**	**(3.5)3.7–4.5(4.6)**	**4.10**	**(1.3)1.4–1.7(1.8)**	**1.49**	**30**
Wright 213*	(5.0)5.2–7.0(7.1)	6.10	(3.5)3.7–4.5(4.6)	4.10	(1.3)1.4–1.7(1.8)	1.49	30
H. corticolor	**(4.7)4.8–6.3(6.4)**	**5.44**	**(3.0)3.1–3.8(3.9)**	**3.29**	**(1.4)1.5–1.8(1.9)**	**1.66**	**60**
Wilson 3.IX.1914	(5.0)5.1–6.3(6.4)	5.59	(3.0)3.1–3.8(3.9)	3.31	(1.5)1.6–1.8(1.9)	1.69	30
Wilson 26.VII.1914	(4.7)4.8–6.2(6.3)	5.29	(3.0)3.1–3.6(3.8)	3.26	(1.4)1.5–1.8(1.9)	1.62	30
H. cupulata	**(4.8)5.0–6.3(7.1)**	**5.58**	**(2.9)3.1–4.1(4.2)**	**3.45**	**(1.3)1.4–1.8(1.9)**	**1.72**	**90**
Spirin 6245*	(5.0)5.1–6.2	5.58	3.1–3.8(4.0)	3.36	(1.4)1.5–1.8(1.9)	1.66	30
Spirin 6249	(4.8)5.1–6.2(6.4)	5.55	(2.9)3.1–3.7(4.0)	3.30	(1.4)1.5–1.8(1.9)	1.68	30
Spirin 6700	(4.8)5.0–6.3(7.1)	5.62	(3.1)3.2–4.1(4.2)	3.68	(1.3)1.4–1.8(1.9)	1.83	30
H. macrospora	**(4.9)5.1–6.0(6.1)**	**5.36**	**(3.3)3.4–4.3(4.4)**	**3.98**	**(1.2)1.3–1.5(1.6)**	**1.35**	**30**
Dai 488*	(4.9)5.1–6.0(6.1)	5.36	(3.3)3.4–4.3(4.4)	3.98	(1.2)1.3–1.5(1.6)	1.35	30
H. manshurica	**(5.1)5.2–6.4(7.3)**	**5.64**	**(2.8)2.9–3.3(3.6)**	**3.08**	**(1.6)1.7–2.2(2.3)**	**1.83**	**30**
TAAM 107605*	(5.1)5.2–6.4(7.3)	5.64	(2.8)2.9–3.3(3.6)	3.08	(1.6)1.7–2.2(2.3)	1.83	30
H. senatoumbrina	**(5.4)5.6–7.1(7.2)**	**6.61**	**(3.3)3.4–4.1(4.2)**	**3.75**	**(1.5)1.6–2.1(2.2)**	**1.77**	**30**
TAAM 118276*	(5.4)5.6–7.1(7.2)	6.61	(3.3)3.4–4.1(4.2)	3.75	(1.5)1.6–2.1(2.2)	1.77	30
H. ulmicola	**(5.6)5.9–7.5(7.7)**	**6.52**	**(3.0)3.1–4.1(4.3)**	**3.45**	**(1.6)1.7–2.2(2.4)**	**1.90**	**60**
Spirin 5935	(5.9)6.0–7.3(7.7)	6.66	(3.2)3.3–3.8(3.9)	3.51	(1.6)1.7–2.1(2.2)	1.90	30
Spirin 7218	(5.6)5.8–7.5(7.6)	6.38	(3.0)3.1–4.1(4.3)	3.39	(1.6)1.7–2.2(2.4)	1.89	30
Hymenochaete sp.	**(5.0)5.1–7.2(8.1)**	**5.62**	**(2.5)2.6–3.3(3.4)**	**2.93**	**(1.6)1.7–2.4(2.5)**	**1.92**	**30**
Spirin 5063	(5.0)5.1–7.2(8.1)	5.62	(2.5)2.6–3.3(3.4)	2.93	(1.6)1.7–2.4(2.5)	1.92	30

* – holotypes.

material. We studied the type (specimen Dai 488, H) collected from bark of *Acer*: it has rather short setae (Table 2), comparable with those of *H. senatoumbrina*, but its basidiospores are shorter and a bit wider than in *H. senatoumbrina* (Table 1). Moreover, its tramal hyphae are very densely arranged and abundantly encrusted, and no distinct hyphal layer was observed. Another specimen of *H. macrospora* (Dai 656, not available for this study) was reported from bark of *Ulmus* (Dai *et al*., 2000), and it may belong to *H. adhaerens*.

Analysis of the ITS sequence obtained from the holotype of *H. macrospora* suggests it to be the sister species of *H. adhaerens*, while *H. senatoumbrina* is not closely related (Fig. 1).

Hymenochaete cupulata sp. nov. Figs 2-3

Holotype: Russia. Primorie Reg.: Krasnoarmeiskii Dist., Melnichnoe, *Ulmus laciniata*, 22 August 2013, Spirin 6245 (H) (GenBank KM017417).

MycoBank: MB 810881.

Basidiocarps perennial, effused-reflexed, cupulate to umbonate, imbricate, leathery, 5-15 mm in diam., reflexed part 2-5 mm wide, 0.4-0.7 mm thick. **Surface**

of the reflexed part dark gray to almost black, slightly paler at marginal areas, indistinctly sulcate, first finely floccose, then almost smooth. **Margin** of the reflexed part even or slightly undulate, sharp, in intensively growing basidiocarps yellowish to ochraceous, sterile, in senescent specimens concolorous with hymenial surface, fertile; margin of resupinate parts similar to the reflexed one, easily detaching from an underlying substrate. **Hymenial surface** smooth or indistinctly tuberculate, Teakwood to Olive Wood (15C9-15E10), later fading to Deer or Drab (14B6-14B5).

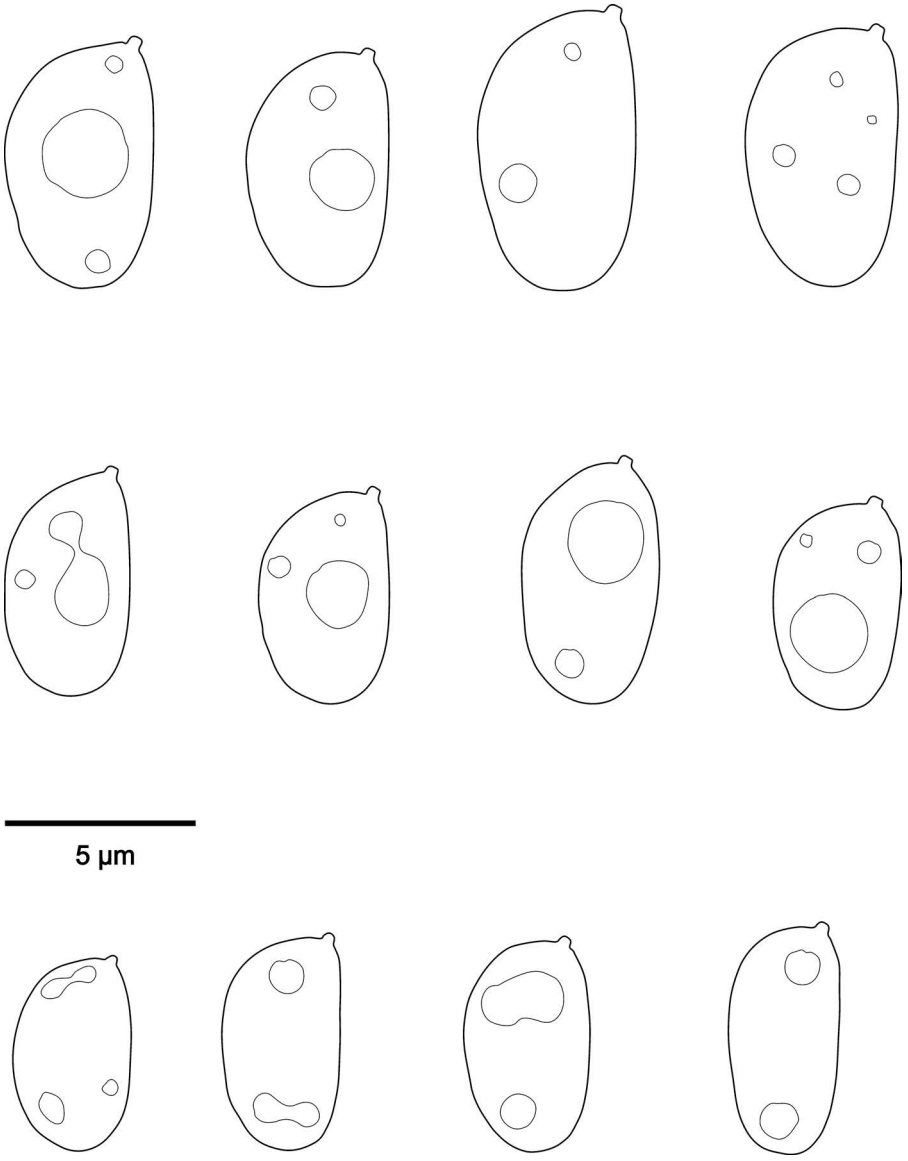


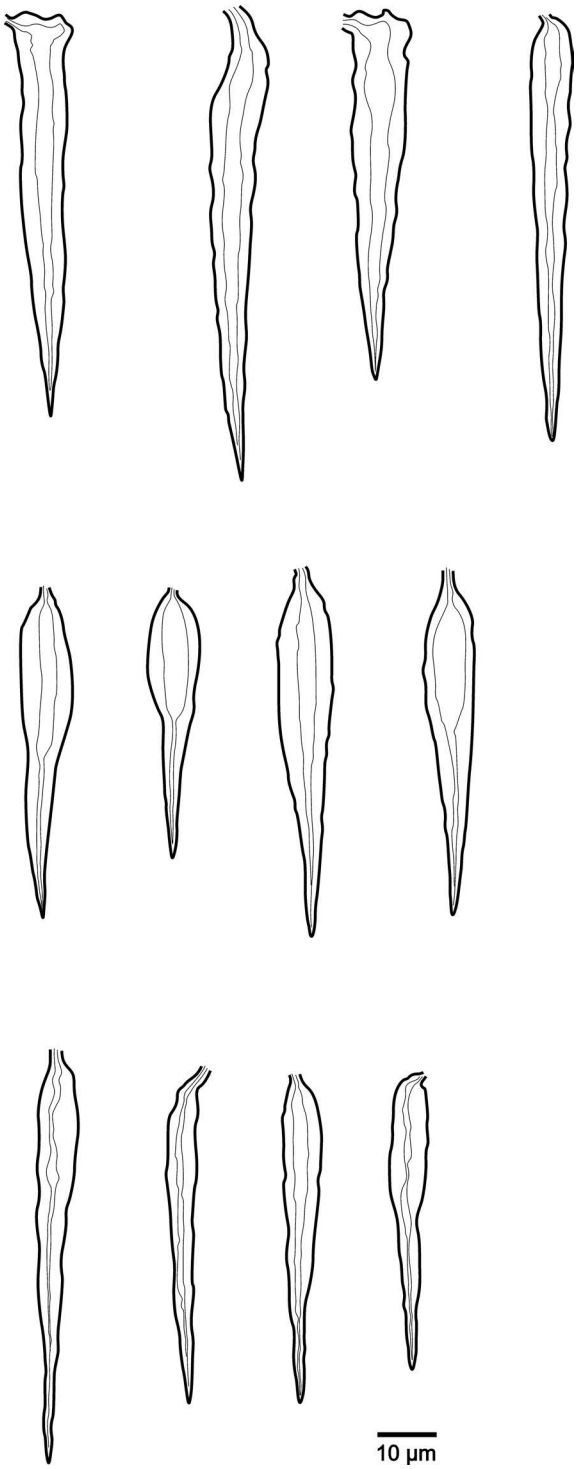
Fig. 2. Basidiospores of 3 *Hymenochaete* species (from top to bottom): *H. adhaerens*, *H. cupulata* and *H. manshurica.*

Tomentum present in young and actively growing basidiocarps, fluffy, up to 30 µm thick; **cortex** very dark brown to almost black, 30-60 µm thick; **hyphal layer** mostly indistinct; **setal layer** stratified, consisting of 2-6 layers 40-80 (100) µm thick; **hymenial layer** 40-70 (80) µm thick.

Hyphal structure monomitic; hyphae simple-septate, hyaline to brown, abundantly encrusted, thin- to distinctly thick-walled, in cortex and hyphal layer horizontally oriented, in setal and hymenial layers vertically oriented and richly branched, 2.5-4.5 (5) µm in diam.; setal hyphae rarely present in uppermost parts of hyphal and setal layers. **Setae** sharp-pointed, clearly inflated at the base, (40.8) 51.2-81.3 (86.2)× (6.5) 6.9-12.6 (15.2) µm (n = 55/3), SI = 6.07-8.09, projecting

Table 2. A comparison of the bark-dwelling *Hymenochaete* species

Species	*Distribution/ substrate*	*Basidiocarp*	*Setae*	*Basidiospores*
H. adhaerens	East Asia; Ulmus spp., bark	resupinate	(56.4) 63.2-96.8 (111.4)× (7.8) 8.3-10.4 (10.7) µm, SI = 7.99-9.56	thick cylindrical to narrowly ellipsoid, (5.7) 5.9-7.2 (7.4)× (3.7) 3.8-4.3 (4.5) µm
H. carpatica	Central Europe; Acer pseudoplatanus, bark	resupinate	(74.4) 76.0-103.1 (107.4)× (6.1) 6.2-9.5 (10.7) µm, SI = 11.20-12.29	ellipsoid to broadly ellipsoid, (4.6) 4.8-6.1 (6.2)× (3.3) 3.4-4.1 (4.2) µm
H. cervina	Cuba (type locality); angiosperm, bark	resupinate	(73.0) 73.2-89.0 (95.4)× (7.1) 7.2-9.7 (10.4) µm, SI = 9.63	ellipsoid, (5.0) 5.2-7.0 (7.1)× (3.5) 3.7-4.5 (4.6) µm
H. corticolor	North America; Quercus alba, bark	resupinate	(41.3) 41.4-79.0 (83.4)× (6.2) 6.3-9.3 (9.4) µm, SI = 7.37-8.59	narrowly ellipsoid to ellipsoid, (4.7) 4.8-6.3 (6.4)× (3.0) 3.1-3.8 (3.9) µm
H. cupulata	East Asia; Ulmus spp., bark	effused-reflexed	(40.8) 51.2-81.3 (86.2)× (6.5) 6.9-12.6 (15.2) µm, SI = 6.07-8.09	ellipsoid to ovoid, (4.8) 5.0-6.3 (7.1)× (2.9) 3.1-4.1 (4.2) µm
H. macrospora	East Asia; Acer sp., bark	resupinate	(43.0) 45.0-74.3 (75.6)× (6.1) 6.2-8.2 (8.3) µm, SI = 8.25	broadly ellipsoid, (4.9) 5.1-6.0 (6.1)× (3.3) 3.4-4.3 (4.4) µm
H. manshurica	East Asia; Tilia manshurica, bark	resupinate	(56.2) 59.5-78.4 (79.0)× (5.2) 5.4-7.3 (7.8) µm, SI = 10.49	thick cylindrical to narrowly ellipsoid, (5.1) 5.2-6.4 (7.3)× (2.8) 2.9-3.3 (3.6) µm
H. senatoumbrina	East Asia; fallen angiosperm branches	resupinate	(39.3) 45.0-74.3 (77.3)× (5.1) 5.5-9.2 (9.4) µm, SI = 7.77	cylindrical to narrowly ellipsoid, (5.4) 5.6-7.1 (7.2)× (3.3) 3.4-4.1 (4.2) µm
H. ulmicola	Europe; Ulmus spp., bark	effused-reflexed	(67.3) 69.8-104.5 (110.3)× (7.2) 7.4-10.3 (10.5) µm, SI = 9.28-9.61	thick cylindrical to ovoid, (5.6) 5.8-7.5 (7.7)× (3.0) 3.1-4.1 (4.3) µm
Hymenochaete sp.	East Asia; dry angiosperm branches	resupinate	(65.1) 69.8-110.3 (113.8)× (6.0) 6.2-8.9 (11.2) µm, SI = 12.65	cylindrical, (5.0) 5.1-7.2 (8.1)× (2.5) 2.6-3.3 (3.4) µm



up to 20-40 µm above hymenial layer, usually assotiated with simple hyphidia 1-1.5 µm in diam. **Basidia** suburniform, 12.0-18.6× 4.0-5.3 µm. **Basidiospores** hyaline, thin-walled, ellipsoid to ovoid, (4.8) 5.0-6.3 (7.1)× (2.9) 3.1-4.1 (4.2) µm (n = 90/3), L = 5.58, W = 3.45, Q = 1.66-1.83.

Distribution and ecology: Russian Far East (Khabarovsk and Primorie Regions) and North-East China (He & Li, 2013, as *H. ulmicola*). It prefers old elm trees growing in open sunny places.

Notes: *H. cupulata* produces small-sized, effused-reflexed basidiocarps on bark of living elm trees (*U. laciniata* and *U. pumila*). Its European counterpart is *H. ulmicola* (Corfixen & Parmasto, 2005) which differs in having longer, mostly obtuse and evently outlined setae and longer basidiospores (see Tables 1, 2). These species are also distinguished by their ITS rDNA sequences (Fig. 1).

***Hymenochaete manshurica* sp. nov. Figs 2-3**

Holotype: Russia. Primorie Reg.: Lazo Dist., Lazo Nat. Res., Amerika, *Tilia manshurica*, 12 August 1986, Parmasto (TAAM 107605, isotype – H).

MycoBank: MB 810882.

Fig. 3. Setae of 3 *Hymenochaete* species (from top to bottom): *H. adhaerens*, *H. cupulata* and *H. manshurica*.

Basidiocarps perennial, resupinate, first orbicular, later fusing together, leathery to soft-corky, 5-30 mm in widest dimension, 0.2-0.6 mm thick. **Margin** adherent, sterile, first almost white and radially fibrillose, up to 0.3 mm wide, in older basidiocarps evidently disappearing. **Hymenial surface** smooth or irregularly tuberculate, in older parts occasionally cracking, Oakbuff to Toast (13D7-13F8). **Tomentum and cortex** absent. **Hyphal layer** well visible, whitish, up to 200 µm thick; **setal layer** indistinctly stratified, pale brown, 150-350 µm thick; **hymenial layer** slightly paler, about 30 µm thick.

Hyphal structure monomitic; hyphae simple-septate, hyaline to pale brown, abundantly encrusted, thin- to slightly thick-walled, in hyphal layer irregularly and rather loosely arranged, in setal and hymenial layers vertically oriented and richly branched, 2.8-4 µm in diam., a few hyphae occasionally inflated up to 5 µm. **Hyphoid setae** few, deeply embedded in setal layer, 80-100× 4-5 µm. **Tramal setae** rather sharp- pointed, more rarely evenly obtuse, outlined, (56.2) 59.5-78.4 (79.0)× (5.2) 5.4-7.3 (7.8) µm (n = 15/1), SI = 10.49, projecting up to 30-40 µm above hymenial layer, assotiated with uncommon simple hyphidia 1-2 µm in diam.; short setae present in hymenium, 27.8-50.2× 4.9-7.2 µm (n = 10/1). **Basidia** suburniform, 14.6-23.8× 3.8-5.1 µm; basal parts of mature basidia often slightly thick-walled and brownish. **Basidiospores** hyaline, thin-walled, narrowly ellipsoid (young spores) to thick cylindrical, (5.1) 5.2-6.4 (7.3)× (2.8) 2.9-3.3 (3.6) µm (n = 30/1), L = 5.64, W = 3.08, Q = 1.83.

Distribution and ecology: So far *H. manshurica* is known only from its type locality, on bark of a living lime tree (*Tilia manshurica*).

Notes: This species was reported by Parmasto (2001) from Russian Far East as *H. carpatica*. However, the latter species differs from *H. manshurica* in having wider basidiospores and longer setae (Tables 1, 2). Moreover, *H. carpatica* is distributed in Europe and it has been found exlusively on bark of *Acer pseudoplatanus* (Baici & Léger, 1988; Tomšovský, 2001).

Morphological differences of *H. manshurica* from the North American *H. corticolor* Berk. & Ravenel are more subtle. *Hymenochaete corticolor* has slightly wider setae and basidiospores (Table 1, 2), and it is found growing on bark of *Quercus alba*. The identity of the latter species has been a point of controversy. Léger (1998) and Parmasto (2001) stated that the original specimen of *H. corticolor* (from Ravenel's Fungi Caroliniani Exsiccati 3: 30, 1855 – see Berkeley, 1873) represents *H. cervina* Berk. & M.A. Curtis, previously described from Cuba (Berkeley & Curtis, 1868). At the same time, Parmasto (2001) reidentified specimens of *H. corticolor* from New York and Maryland (NY) as *H. carpatica*. We studied both the type collection of *H. corticolor* from South Carolina and the aforementioned specimens from the American North-East. In our opinion, these collections belong to the same species which is certainly different from *H. cervina sensu stricto* (type from FH was studied; see Tables 1, 2). Thus, *H. manshurica* from East Asia seems to have *H. corticolor* and *H. carpatica* as its counterparts in North America and Europe, respectively. The DNA-based reevaluation of *H. corticolor*, *H. cervina* and their close relatives from North America is needed to confirm their identity and phylogenetic relationships.

An unnamed species of *Hymenochaete* from Russian Far East (specimens Spirin 4132, 5063) appears morphologically similar to *H. manshurica*. They share similar basidiospores and sharp-pointed setae although they are clearly longer in the former species (Table 2). Moreover, *Hymenochaete* sp. has rather thin, floccose basidiocarps, and it inhabits dry branches and recently fallen logs of angiosperm trees and lianas. According to the ITS rDNA sequence, it belongs to the *Hymenochaete*

cinnamomea group (Fig. 1). However, we postone introducing a new species until a thorough revision of that species complex will be undertaken.

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REFERENCES

BAICI A. & LÉGER J.C., 1988 — *Hymenochaete carpatica* Pilát collected in Switzerland. *Mycologia Helvetica* 3: 89-98.

BERKELEY M.J. & CURTIS M.A., 1868 — Fungi Cubenses (Hymenomycetes). *Botanical Journal of the Linnean Society* 10: 280-341.

BERKELEY M.J., 1873 — Notices on North American Fungi. *Grevillea* 1: 161-166.

CASTRESANA J., 2000 — Selection of conserved blocks from multiple alignments for their use in phylogenetic analysis. *Molecular Biology & Evolution* 17: 540-552.

CORFIXEN P. & PARMASTO E., 2005 — *Hymenochaete ulmicola* sp. nov. (Hymenochaetales). *Mycotaxon* 91: 465-469.

DAI Y.C., ZHANG X.Q. & ZHOU T.X., 2000 — Changbai wood-rotting fungi 12. Species of *Hymenochaete* (Basidiomycota). *Mycotaxon* 86: 445-450.

HE S.H. & DAI Y.C., 2012 — Taxonomy and phylogeny of *Hymenochaete* and allied genera of *Hymenochaetaceae* (Basidiomycota) in China. *Fungal Diversity* 56: 77-93.

HE S.H. & LI H.J., 2013 — *Hymenochaete* in China 3. Three species new to China from Guangxi Autonomous Region and Jilin Province. *Mycosystema* 32: 202-207.

KATOH K. & TOH H., 2008 — Recent developments in the MAFFT multiple sequence alignment program. *Briefings in Bioinformatics* 9: 286-298.

LÉGER J.C., 1998 — Le genre *Hymenochaete* Léveillé. *Bibliotheca Mycologica* 171: 1-319.

MAERZ A. & PAUL M.R., 1950 — A dictionary of color. 2nd edition. New York, London, Toronto, McGraw-Hill, 208 p.

MIETTINEN O., NIEMELÄ T. & SPIRIN W., 2006 — Northern *Antrodiella* species: the identity of *A. semisupina* and type studies of related taxa. *Mycotaxon* 96: 211-239.

NIEMELÄ T., 1972 — On Fennoscandian polypores. 2. *Phellinus laevigatus* (Fr.) Bourdot and Galzin and *P. lundellii* Niemelä, n. sp. *Annales Botanici Fennici* 9: 41-59.

PARMASTO E., 1986 — New species and a new combination in the genus *Hymenochaete*. *Mikologia i Fitopatologia* 20: 374-377.

PARMASTO E., 2001 — Hymenochaetoid fungi (Basidiomycota) of North America. *Mycotaxon* 79: 107-176.

PARMASTO E., SAAR I., LARSSON E. & RUMMO S., 2014 — Phylogenetic taxonomy of *Hymenochaete* and related genera (Hymenochaetales). *Mycological Progress* 13: 55-64.

PILÁT A., 1931 — Monographie der europäischen Stereaceen. *Hedwigia* 70: 10-132.

TAMM H. & PÕLDMAA K., 2013 — Diversity, host associations and phylogeography of temperate aurofusarin-producing *Hypomyces/Cladobotryum* including causal agents of cobweb disease of cultivated mushrooms. *Fungal Biology* 117: 348-367.

THIERS B., 2014 [continuously updated] — Index Herbariorum: a global directory of public herbaria and associated stuff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih [accessed 20 May 2014].

TOMŠOVSKÝ M., 2001 — Remarks on the distribution of *Hymenochaete carpatica* in Central and Eastern Europe. *Czech Mycology* 53: 141-148.