Ann. Bot. Fennici 39: 257–265 ISSN 0003-3847
Helsinki 11 December 2002

Changbai wood-rotting fungi 13. *Antrodia sensu lato*

Yu-Cheng Dai[1] & Tuomo Niemelä[2]

[1)] *Institute of Applied Ecology, Chinese Academy of Sciences, Wenhua Road 72, Shenyang 110016, China*
[2)] *Botanical Museum, P.O. Box 47, FIN-00014 University of Helsinki, Finland*

Received 8 March 2002, accepted 24 May 2002

Dai, Y. C. & Niemelä, T. 2002: Changbai wood-rotting fungi 13. *Antrodia sensu lato*. — *Ann. Bot. Fennici* 39: 257–265.

This paper deals with the species of *Antrodia* (Basidiomycota) in northeastern China. Seventeen species are found in the area, and a key was compiled for the species so far recorded. Statistical variations of spore dimensions are included in the key. A new species, *Antrodia leucaena* Y.C. Dai & Niemelä, collected on *Populus davidiana*, is described and illustrated. It is characterized by resupinate to effused-reflexed basidiocarps, and white to cream colour of pore surface, turning brownish when drying. The hyphal structure is dimitic with clamps on generative hyphae, spores are cylindric, and rhomboid or irregular crystal clusters are common in its context and trama. In addition, a non-fertile hymenium has thin-walled hyphidia with apical encrustations. The species seems to be living exclusively on *Populus*. The closest relatives are *A. serialis* (Fr.) Donk (having different spores, different set of colours, and growing on conifers), *Antrodia macra* (Sommerf.) Niemelä (a resupinate species), and *A. pulvinascens* (Pilát) Niemelä (producing pseudopilei). Five other *Antrodia* species are briefly discussed.

Key words: *Antrodia*, Basidiomycota, China, taxonomy, wood-rotting fungi

Introduction

The genus *Antrodia* P. Karst. was established 120 years ago, when poroid Basidiomycetes with effused-reflexed growth habit were included in it by Karsten (1880). The original species turned out to be rather distantly related according to the modern taxonomic criteria: some are now included in *Datronia* Donk (*D. mollis* (Sommerf.) Donk, *D. stereoides* (Fr. : Fr.) Ryvarden), *Daedalea* Pers. : Fr. (*D. quercina* L. : Fr.), *Phellinus* Quél. (*P. viticola* (Schwein. : Fr.) Donk) or *Dichomitus* D.A. Reid (*D. campestris* (Quél.) Domański & Orlicz). *Polyporus serpens* Fr. (= *Antrodia albida* (Fr. : Fr.) Donk, according to the neotypification by Ryvarden 1991) was selected as the type by Donk (1960), who thus fixed the current concept of the genus. Donk (1966), Ryvarden (1977) and Niemelä (1978) improved the delimitation of the genus, and its modern definition was outlined by Gilbertson and Ryvarden (1986–1987).

All the species in the genus share a resupinate to effused-reflexed growth habit, white or pale colour of the context, and they all are brown-rot fungi. Although basidiospores are variable in size, typical spores are thin-walled, negative in IKI and CB, and cylindric, very narrow ellipsoid or fusiform in shape. However, there is a small group of species in which the spores are more or less truncate, rather thick-walled and slightly but distinctly cyanophilous; they are sometimes separated into another genus, *Fibroporia* Parmasto (*F. vaillantii* (DC. : Fr.) Parmasto, *F. gossypium* (Speg.) Parmasto etc.). The hyphae of some species are amyloid, but mostly not; they are acyanophilous. A dimitic hyphal system is characteristic to the genus, and all the species seem to bear clamp connections on generative hyphae.

Antrodia is a relatively well known and speciose genus among poroid wood-rotting fungi, and 40 species have been recognized so far. The highest number of species are found in temperate and boreal forests, e.g., 29 species are known in Europe (Ryvarden & Gilbertson 1993, Bernicchia & Ryvarden 2001), 21 species have been listed from North America (Gilbertson & Ryvarden 1986–1987), and 18 species were recorded in East Asia (Núñez & Ryvarden 2001). While being rich in species in temperate and boreal northern hemisphere, *Antrodia* has fewer species in the tropics. From tropical East Africa, for instance, Ryvarden and Johansen (1980) list only nine species and even some of them seem to be alien decayers of exotic coniferous trees in forest plantations. Quanten (1997) mentioned just three species in her polypore flora of Papua New Guinea. Recently 22 species were reported from whole America (Lodge *et al*. 2001); *A. gossypium* and *A. vaillantii* were not included in that count.

Some species of *Antrodia* were reported from China by Zhao (1998) and Dai (2000), but there are still gaps in our knowledge of the genus there. In an earlier paper of Dai (1996), a couple of collections from NE China were tentatively identified as *A.* cf. *macra*; after studying additional, new material it turned out that the Chinese specimens differ from the European *A. macra* (Sommerf.) Niemelä, and a new species, *A. leucaena* Y.C. Dai & Niemelä, is described in this paper. Linked with this study, the whole material of *Antrodia* collected from NE China by the authors was reexamined, and especially the spore dimensions of each species were measured. A key for the 17 species is given here, and the data of spores of each species are included.

Material and methods

Most of the material for the present study was collected by the author YCD during field trips to China in 1993, 1995, 1997, 1998 (with TN) and 1999, and some specimens were collected from the Fenglin Nature Reserve of NE China by Reijo Penttilä in 2000. The collections are deposited at the Botanical Museum of the University of Helsinki (H); duplicates will be deposited in a Chinese mycological herbarium (IFP) later. Some specimens from Europe and North America, especially from Finland, were studied to support our results. All the studied specimens are listed. Specific colour terms in the description are after Anonymous (1969). The microscopic routine used in the study is as presented by Dai (1996). Spore dimensions derive mostly from the Chinese material. In the text the following abbreviations are used: L = mean spore length (arithmetical mean of all spores), W = mean spore width (arithmetical mean of all spores), Q = variation in the L/W ratios between the specimens studied (quotients of the mean spore length and the mean spore width; smallest and biggest value given), n = the number of spores measured from given number of specimens. In presenting the variation in the size of spores, 5% of the measurements were excluded from each end of the range, and are given in parentheses; IKI stands for Melzer's reagent, KOH for 5% potassium hydroxide, and CB is the abbreviation of Cotton Blue. CB+ means cyanophilous and CB– acyanophilous; IKI+ means amyloid and IKI– means both inamyloid and indextrinoid.

Taxonomy

Key to species of *Antrodia* from northeastern China

1. Basidiospores narrow, < 2 μm in width 2
1. Basidiospores wide, > 2 μm in width 4

2. Basidiocarps usually annual; pores 2–4 per mm, irregular, dissepiments lacerate ..... *A. sinuosa* (Romell) P. Karst. (4–)4.5–6(–7) × (1–)1.2–1.8(–2) μm, *L* = 5.43 μm, *W* = 1.56 μm, *Q* = 3.33–3.67 (*n* = 92/3)
2. Basidiocarps usually perennial; pores 4–7 per mm, regular, dissepiments entire 3
3. Pores white or yellow both when fresh and dry; basidiospores < 1.5 μm in width .. *A. xantha* (Fr. : Fr.) Ryvarden (3.8–)4–5(–5.2) × (1.1–)1.2–1.5(–1.6) μm, *L* = 4.45 μm, *W* = 1.34 μm, *Q* = 3.32–3.35 (*n* = 60/2)
3. Pores cream to pale sordid brown when dry; basidiospores > 1.5 μm in width ..... *A. sitchensis* (Baxter) Pouzar & Vampola (4–)4.4–5.4(–5.8) × (1.3–)1.5–2(–2.2) μm, *L* = 4.88 μm, *W* = 1.76 μm, *Q* = 2.77 (*n* = 30/1)
4. Pores 1–2 per mm 5
4. Pores > 3 per mm 7
5. Basidiospores > 12 μm in length ..... *A. macrospora* Bernicchia & De Dom (11–)12–14(–15) × (4–)4.5–5.5(–5.6) μm, *L* = 12.50 μm, *W* = 4.97 μm, *Q* = 2.52 (*n* = 29/1)
5. Basidiospores < 12 μm in length 6
6. On gymnosperms; basidiocarps light brown when dry, dissepiments split to dentate ..... *A. heteromorpha* (Fr. : Fr.) Donk (7.8–)8–12(–12.5) × (3.2–)3.6–4.8(–5) μm, *L* = 9.45 μm, *W* = 4.14 μm, *Q* = 2.28 (*n* = 31/1)
6. Mostly on angiosperms; basidiocarps cream when dry, dissepiments entire or slightly dentate ..... *A. albida* (Fr. : Fr.) Donk (6.8–)7–8.8(–9) × (2.8–)3–4.2(–5) μm, *L* = 8.03 μm, *W* = 3.46 μm, *Q* = 2.32 (*n* = 30/1)
7. Skeletal hyphae strongly IKI+ ..... *A. carbonica* (Overh.) Ryvarden & Gilb. (5.5–)6–7.5(–8) × (2.7–)2.8–3.8(–4) μm, *L* = 6.63 μm, *W* = 3.22 μm, *Q* = 2.06 (*n* = 30/1)
7. Skeletal hyphae IKI– or weakly IKI+ 8
8. Basidiospores ellipsoid 9
8. Basidiospores cylindrical to slightly fusiform 11
9. Basidiocarps waxy when fresh, becoming brittle when dry; generative hyphae dominating in trama ..... *A. gossypium* (Speg.) Ryvarden (4.3–)4.4–5.4(–5.9) × (2.1–)2.2–2.6(–2.9) μm, *L* = 4.89 μm, *W* = 2.37 μm, *Q* = 2.06 (*n* = 30/1)
9. Basidiocarps not waxy when fresh, becoming corky or chalky when dry; skeletal hyphae dominant in trama 10
10. Rhizomorphs present, basidiocarps annual, corky when dry ..... *A. vaillantii* (DC. : Fr.) Ryvarden (4–)4.3–6.3(–7) × (2.8–)3–3.4(–3.6) μm, *L* = 5.21 μm, *W* = 3.05 μm, *Q* = 1.71 (*n* = 30/1)
10. Rhizomorphs absent, basidiocarps perennial, chalky when dry ..... *A. crassa* (P. Karst.) Ryvarden (5.3–)5.5–7(–7.2) × (2.5–)2.7–3.3(–3.5) μm, *L* = 6.40 μm, *W* = 2.94 μm, *Q* = 2.18 (*n* = 20/1)
11. Pore surface pale brown when fresh 12
11. Pore surface white to cream when fresh 13
12. On angiosperms; pores regular, round to angular; basidiospores mostly < 8.5 μm in length ..... *A. malicola* (Berk. & M.A. Curtis) Donk (6.5–)7–8.5(–9) × (2.8–)3–4(–4.1) μm, *L* = 7.65 μm, *W* = 3.42 μm, *Q* = 2.24 (*n* = 38/1)
12. On gymnosperms; pores irregular, sinuous to daedaleoid; basidiospores mostly > 8.5 μm in length ..... *A. variiformis* (DC. : Fr.) Ryvarden (8–)8.2–10(–10.5) × (3–)3.1–4(–4.2) μm, *L* = 9.14 μm, *W* = 3.74 μm, *Q* = 2.44 (*n* = 34/1)
13. Basidiospores slightly fusiform with tapering apex 14
13. Basidiospores cylindrical 15
14. Basidiocarps leathery to tough when fresh, becoming corky when dry; skeletal hyphae dominant in all tissues ..... *A. serialis* (Fr.) Donk (6–)6.3–8(–8.2) × (2–)2.2–3.3(–3.5) μm, *L* = 7.57 μm, *W* = 2.96 μm, *Q* = 2.56 (*n* = 30/1)
14. Basidiocarps soft when fresh, becoming fragile when dry; generative hyphae dominant in all tissues ..... *A. infirma* Renvall & Niemelä (4.2–)5–6.2(–7) × (2–)2.2–2.5(–3) μm, *L* = 5.36 μm, *W* = 2.18 μm, *Q* = 2.8–2.66 (*n* = 60/2)
15. On gymnosperms; hyphal system trimitic, generative hyphae dominant in subiculum ..... *A. primaeva* Renvall & Niemelä (6–)6.5–7.5(–7.8) × (2.2–)2.5–3(–3.2) μm, *L* = 6.57 μm, *W* = 2.67 μm, *Q* = 2.46 (*n* = 30/1)
15. On angiosperms; hyphal system dimitic, skeletal hyphae dominant in subiculum 16
16. Basidiocarps resupinate, pores yellowish when dry ..... *A. pulvinascens* (Pilát) Niemelä (6–)6.5–8(–8.5) × 2.3–3(–3.2) μm, *L* = 7.00 μm, *W* = 2.60 μm, *Q* = 2.69 (*n* = 30/1)
16. Basidiocarps resupinate to effused-reflexed, pores wood coloured or dirty brownish when dry ..... *A. leucaena* Y.C. Dai & Niemelä (6–)6.4–9(–10.5) × (2.6–)2.8–3.7(–4.1) μm, *L* = 7.31 μm, *W* = 3.18 μm, *Q* = 2.21–2.39 (*n* = 180/5).

Antrodia leucaena Y.C. Dai & Niemelä, *sp. nova* (Figs. 1–2)

Carpophorum annuum, resupinatum vel effuso-reflexum. Pori rotundi, 2–4 per mm. Systema hypharum dimiticum, hyphae generatoriae fibulatae, hyphae skeletales subiculi 3–4.5 μm in diam. Sporae pallidae, cylindricae, 6.4–9 × 2.8–3.7 μm.

Holotype: China. Jilin Prov., Antu County, Changbaishan Nat. Res., alt. 1100 m, mixed old forest, on a fallen decorticated trunk of *Populus davidiana*, 14.IX.1998 *Dai 2190a* & *Niemelä* (H, isotypes IFP, NMNS).

Etymology. — *leuce* (Greek, adj.): white; also referring to *Populus* sect. *Leuce*.

Basidiocarps annual, mostly effused-reflexed, sometimes resupinate, tightly attached on wood, leathery when fresh, corky and light-weight when dry, with sharp antiseptic smell when fresh,

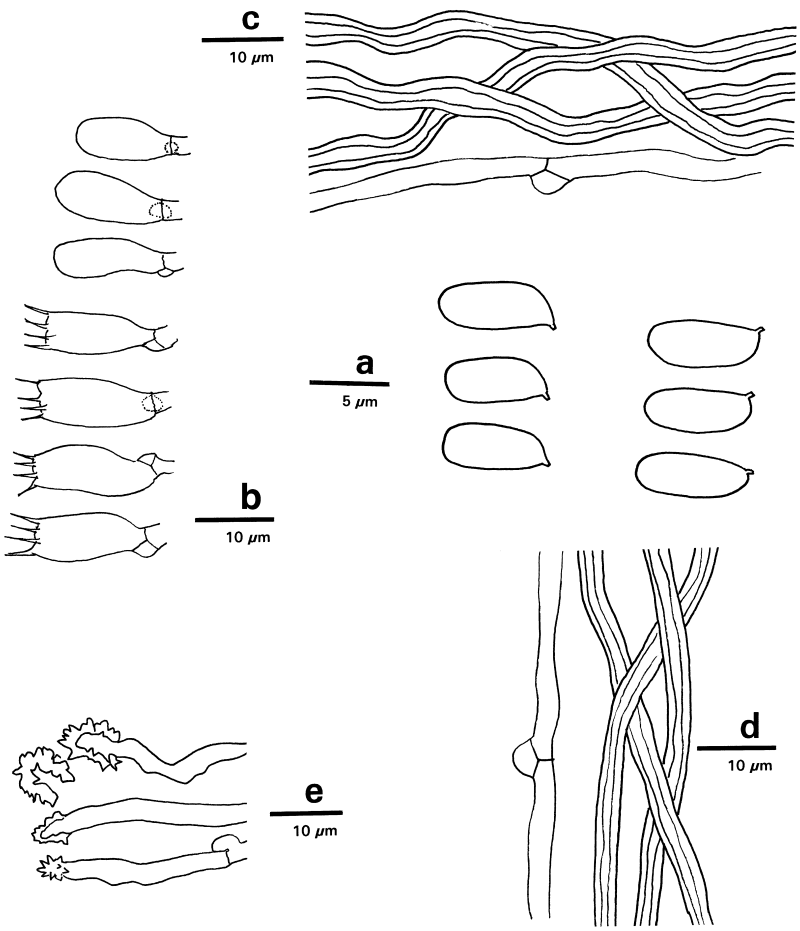

Fig. 1. Microscopical structures of *Antrodia leucaena* Y.C. Dai & Niemelä (drawn from the holotype). — **a**: Basidiospores. — **b**: Basidia and basidioles. — **c**: Hyphae from context. — **d**: Hyphae from trama. — **e**: Cap-like, granular encrustations on cystidioles.

pileus projecting up to 1 cm, resupinate part up to 15 cm long and 4 cm wide. Pileal surface cream and with rusty flecks when fresh, becoming wood coloured to dull brownish when dry, matted to glabrous, margin obtuse. Pore surface white or cream-coloured when fresh, becoming wood coloured or dirty brownish when dry (colour change clear), bruised parts darkening to sepia or date brown; pores round, (2–)3–5 per mm (n = 60/5), dissepiments thin, entire. Context and subiculum cream-coloured, corky, contrasting with tubes by paler hues. Tubes cream to pale wood coloured, corky, up to 2 mm long.

Hyphal system dimitic, generative hyphae with clamp connections, skeletal hyphae IKI–, CB–, unchanged in KOH.

Context and subiculum. — Basal layer next to substrate almost monomitic, changing gradually into subiculum proper. Generative hyphae frequent, hyaline, thin-walled, occasionally branched, frequently septate with clamp connections, 2.5–4 μm in diam.; skeletal hyphae dominant, thick-walled with a narrow lumen, flexuous, unbranched, 3–4.5 μm in diam. Irregular, angular crystals frequently present in between the hyphae.

Tubes. — Trama dominated by skeletal hyphae; generative hyphae common, hyaline, thin-walled, frequently clamped and branched, 2–3.5 μm in diam.; skeletal hyphae thick-walled with a narrow to medium lumen, rarely branched, flexuous, loosely subparallel along the tubes, 2.5–4.3 μm in diam. Subhymenium indistinct. Cystidioles of two kinds: some resembling basidioles, but having a long, finger-like neck (common especially in non-fertile hymenium), others narrow, fusoid cystidioles (hyphidia), soon collapsing, some of them with conspicuous, cap-like, granular encrustations. Basidia

Fig. 2. *Antrodia leucaena* Y.C. Dai & Niemelä. A fresh, pileate basidiocarp, specimen *Dai 2190a*. Photograph Y.C.D., *in situ*, ×1.

short clavate, bearing four sterigmata and a basal clamp, 15–18 × 5–6.5 μm, basidioles in shape similar to basidia, but smaller. Large, rhomboid or irregular crystals frequently present in trama.

Spores. — Basidiospores cylindrical, hyaline, thin-walled, smooth, IKI–, CB–, (6–)6.4–9(–10.5) × (2.6–)2.8–3.7(–4.1) μm, L = 7.31 μm, W = 3.18 μm, Q = 2.21–2.39 (n = 180/5).

Additional specimens examined (paratypes). — **China.** Jilin Prov., Antu County, Changbaishan Nat. Res., on a fallen decorticated trunk of *Populus*, 1.IX.1993 *Dai 966 & 968* (H), 14.IX.1995 *Dai 2093* (H), 14.IX.1998 *Niemelä 6355a, 6365* (H). Wangqing County, Lanjia, on a fallen decorticated trunk of *Populus,* 11.IX.1993 *Dai 1201* (H).

Discussion

The small, cap-like encrustations seem to be characteristic to this species. They cover the apices of the fragile hyphidia in hymenium, and remain visible after the cells have collapsed.

In a new book by Núñez and Ryvarden (2001) this species will key out as *A. primaeva*, *A. ramentacea* (Berk. & Broome) Donk or *Diplomitoporus* sp. which all are very different species. As mentioned in a previous publication (Dai 1996), *Antrodia leucaena* is somehow intermediate between *A. macra* and *A. pulvinascens*. Especially in a young and resupinate condition *A. leucaena* resembles *A. macra*, which, however, has larger pores (2–3 per mm), and its basidiocarps are smaller, thinner and never pileate; its spores are larger than in the new species, (7–)8.2–10(–11.1) × (3–)3.1–3.6(–4) μm, L = 8.94 μm, W = 3.28 μm, Q = 2.66–2.80 (n = 60/2). Furthermore, tramal skeletal hyphae of *A. macra* are subsolid and strongly interwoven, and no crystals are present in its context, trama or hymenium. *Antrodia macra* has not been found in China.

Antrodia pulvinascens resembles *A. leucaena*. The former species produces perennial fruit bodies, its pores become yellowish with age or upon drying, and the upper surface of its pseudopilei gets honey-yellow or amber colours and zones. *Antrodia leucaena* has true, albeit small, pilei. Spores of *A. pulvinascens* are ellipsoid and smaller (6–7 × 2.7–3.2 μm, Niemelä 1978)

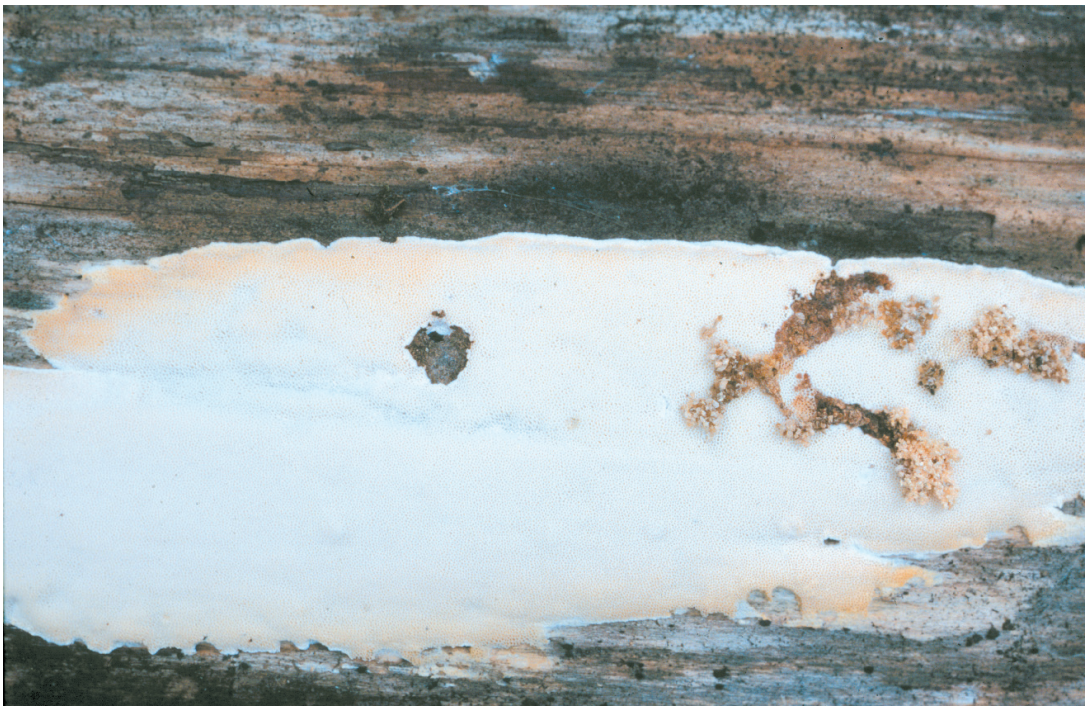

Fig. 3. *Antrodia leucaena* Y.C. Dai & Niemelä. A fresh, resupinate basidiocarp, specimen *Dai 2093*. Photograph Y.C.D. *in situ*, ×1.2.

than in the new species; no crystals are present in its tissues, but oily substances are abundant, and tramal skeletals of *A. pulvinascens* are often amyloid, purple-grey in IKI. It usually inhabits luxuriant and moist forests, and its basidiocarps may extend to 0.5–1 m along fallen aspen trunk. On the contrary, *A. leucaena* has more compact and annual fruit bodies, and its pores remain cream-coloured or become wood coloured or dirty brownish when dry; its spores are basically cylindrical; no oily substances are present in its tissues, but large, rhomboid or irregular crystals characterize its context, trama and hymenium; it usually lives in open areas of forests.

After all it is *Antrodia serialis* that seems to be the closest relative of the new species. The two have fairly similar outlook, especially in fresh condition. They have true pilei with matted upper surface; in *A. serialis* upper colours are warm ochraceous yellow and darker brown in the oldest parts close to substrate only, while in *A. leucaena* no yellow is seen, but more cold hues of tan, rust, or fulvous. *Antrodia serialis* tends to be perennial, even though persisting a few years only. Both species have white pore surface when fresh; in *A. serialis* the colour does not change when drying, while in *A. leucaena* it becomes distinctly brownish, and even dark brown in bruised parts. In the microscope the general structure is similar, but in the new species generative hyphae are much commoner and even dominant at basal layer. Spores are rather similar, too, but shorter in *A. leucaena*; however, spore length varies greatly in both species. The peculiar hymenial encrustations are seen both in *A. serialis* and *A. leucaena*, but in the former species they are more robust, made up of bigger crystal units. It seems that such crystal caps on the tips of the hyphidia are rare in fertile hymenium, but increase when the sporulation is over. *Antrodia serialis* is almost exclusively confined to gymnosperm hosts, but this character alone is of course inadequate in separating the two species. In Finland we know recent cases when, for instance, *Antrodia serialis*, *Phellinus viticola* (Schwein. : Fr.) Donk, *P. nigrolimitatus* (Romell) Bourdot & Galzin, *Fomitopsis rosea* (Alb. & Schwein. : Fr.) P. Karst., *Gloeophyllum sepiarium* (Wulfen : Fr.) P. Karst., *Leptoporus mollis* (Pers. : Fr.) Quél.,

Trichaptum abietinum (Pers. : Fr.) Ryvarden and *Ischnoderma benzoinum* (Wahlenb. : Fr.) P. Karst. were collected on fallen aspen trunks, although they are primarily living on coniferous trees.

Both *Antrodia leucaena* and *A. serialis* are frequently infested, and finally eaten up, by larvae of some microlepidoptera (*see* Figs. 2 and 3). This feature is so regular that it can even be used as an aid in identification.

Notes on some species of *Antrodia*

Antrodia crassa

Antrodia crassa was found in the Changbaishan Nature Reserve of Jilin Province, and the Fenglin Nature Reserve of Heilongjiang Province, and evidently it is a rare species in China. Spores are scanty in most of the Chinese material, and the species may have its sporulation maximum in spring or early summer. Old specimens of *A. crassa* sometimes remind *A. sitchensis*, which has smaller spores (4.4–5.4 × 1.5–2 μm in *A. sitchensis* vs. 5.5–7 × 2.7–3.3 μm in *A. crassa*). Skeletal hyphae of *A. crassa* dissolve in KOH (those of *A. sitchensis* do not) and remain unchanged in IKI, while skeletals of *A. sitchensis* are amyloid.

Antrodia gossypium

Antrodia gossypium is a rare species in East Asia: so far it was only found in two localities in NE China, and in Hokkaido island of Japan (Núñez & Ryvarden 2001). The species is characterized by when fresh waxy basidiocarps, almost monomitic hyphal structure of its trama, and truncate ellipsoid, thick-walled and slightly cyanophilous basidiospores. The spelling "*Antrodia gossypina*" appears in most publications dealing with this species. However, the correct name should be *Antrodia gossypium*: Spegazzini (1899) described the fungus as *Poria gossypium* Speg., i.e. the species name is a noun, not adjective. Therefore it retains its own termination irrespective of the gender of the generic name (Code, Art. 23.5). Also Donk (1974: p. 320) treated the epithet as a noun. The situation differs from that of the corticiaceous fungus *Hyphodontia gossypina* (Parmasto) Hjortstam, whose species name is an adjective, and becomes inflected according to the genus.

Antrodia infirma

Antrodia infirma was described from Finnish Lapland (Renvall & Niemelä 1992). This soft, white-coloured species is characterized by resupinate basidiocarps, abundant generative hyphae with scattered skeletals only (although hyphal structure is dimitic), tapering basidiospores, and by its growth on fallen decorticated *Pinus* trunks. Five Chinese specimens are included here in *A. infirma* although their spores are smaller than those in the European material (5–6.2 × 2.2–2.5 μm vs. 6.3–8.5 × 2.2–3 μm, Renvall & Niemelä 1994). The Chinese material has almost the same hyphal structure as in the type material, and all the specimens were collected on fallen trunks or rotten wood of *Pinus*. The Chinese collections of the species are its first records outside Europe.

Antrodia sinuosa

Some specimens of *A. sinuosa* were treated as *Antrodia* sp. 1 (Dai 1996) because of their smaller pores (3–5 per mm). After studying more material it turned out that the pore size of the species is variable in China: sometimes there are 1–3 pores per mm, and sometimes up to 5 per mm, and the transitions are present even in single collections. Similar variability was found in other species, for instance, the range of pore size is very wide in *Phellinidium ferrugineofuscum* (P. Karst.) Fiasson & Niemelä.

Antrodia sitchensis

Antrodia sitchensis occurs as a rare species both in Europe and North America. Reijo Penttilä collected it repeatedly in the Fenglin Nature Reserve of Heilongjiang Province. Although it can locally be fairly common, the fungus is still a rarity in China, up to now not found elsewhere

in the country. Changbaishan Nature Reserve is the largest protected forest in NE China; extensive field inventories were carried out there, but *Antrodia sitchensis* was not found a single time.

SPECIMENS STUDIED. — *Antrodia albida*. **China.** Beijing, Baihuashan, *Populus*, 1993 *Dai 1853*; *Quercus*, 1993 *Dai 1820*. Jilin Prov., Antu County, Changbaishan Nat. Res., *Acer*, 1997 *Dai 2412*, 1998 *Dai 3004 & Niemelä*; *Abies*, 1993 *Dai 1065*; *Pinus*, 1993 *Dai 1030*; *Tilia*, 1993 *Dai 1026*. Baoma, *Quercus*, 1993 *Dai 1177*; *Phellodendron*, 1993 *Dai 1150*. Huinan County, Hongqi, *Fraxinus*, 1993 *Dai 1541*. Wangqing County, Lanjia, *Betula*, 1993 *Dai 1029*. Heilongjiang Prov., Yichun, Fenglin Nat. Res., *Betula*, 2000 *Penttilä 13066*, 2000 *Penttilä 13373*. — *A. carbonica*. **China.** Jilin Prov., Antu County, Changbaishan Nat. Res., *Pinus*, 1993 *Dai 992*. Fushong County, Shuguang, *Larix*, 1993 *Dai 642*. U.S.A. Washington, Olympic Peninsula, 1957 *Lowe 8104*, *Gilbertson & Griffin*. — *A. crassa*. **China.** Jilin Prov., Antu County, Changbaishan Nat. Res., *Pinus*, 1993 *Dai 931*. Heilongjiang Prov., Yichun, Fenglin Nat. Res., *Picea*, 2000 *Penttilä 13040, 13078 & 13079*, 2000 *Penttilä 13203*, 2000 *Penttilä 13508 & 13510*. **Finland.** Sompion Lappi, Sodankylä, Luosto, *Pinus*, 1998 *Dai 2770 & Niemelä*. Pelkosenniemi, Pyhälampi, *Pinus*, 1998 *Dai 2873 & Niemelä*. — *A. gossypium*. **China.** Liaoning Prov., Shenyang, Beiling Park, *Pinus*, 1998 *Dai 3037, 3038 & Niemelä*. Heilongjiang Prov., Yichun, Fenglin Nat. Res., *Picea*, 2000 *Penttilä 13205*. — *A. heteromorpha*. **China.** Jilin Prov., Antu County, Changbaishan Nat. Res., *Larix*, 1998 *Dai 2189 & Niemelä*. Huinan County, Hongqi, *Picea*, 1993 *Dai 1571*. **Finland.** Etelä-Häme, Lammi, Sudenpesänkangas old forest, *Picea*, 1998 *Dai 2897 & Niemelä*. **Canada.** Québec, Poste-de-la-Baleine, 1982 *Niemelä 2589*. — *A. infirma*. **China.** Jilin Prov., Antu County, Huangshongpu, *Pinus*, 1993 *Dai 867*. Huinan County, Hongqi, *Pinus*, 1993 *Dai 466 & 766*. Heilongjiang Prov., Yichun, Fenglin Nat. Res., *Pinus*, 2000 *Penttilä 13107 & 13199*. **Finland.** Pohjois-Karjala, Lieksa, Patvinsuo Nat. Park, *Pinus*, 1989 *Penttilä 1235* (holotype). Sompion Lappi, Sodankylä, Luosto, *Pinus*, 1998 *Dai 2791 & Niemelä*. Kittilän Lappi, Kolari, Ylinenoja, *Pinus*, 1999 *Dai 3160, 3195 & Niemelä*. — *Antrodia macra*. **Finland.** Uusimaa, Vantaa, Vestra, *Populus*, 2001 *Dai 3379 & Niemelä*; Helsinki, Viikki, *Salix*, 1984 *Niemelä 2951*, 1984 *Saarenoksa 6384*. Keski-Pohjanmaa, Nykarleby, *Populus*, 1997 *Jakobsson 2411 & Risunen*. Brahestad, *Populus*, 1995 *Jakobsson 1338*. **Russia.** Bashkortostan, Uchaly Dist., Ikhsanovo, Verkhne-Belskoe, *Populus*, 2001 *Dai 3349*. — *A. macrospora*. **China.** Jilin Prov., Antu County, Changbaishan Nat. Res., *Quercus*, 1998 *Dai 3026 & Niemelä*; 1997 *Dai 2482 & 2517*. Huinan County, Hongqi, *Quercus*, 1993 *Dai 1476*. Wangqing County, Lanjia, *Quercus*, 1993 *Dai 1240*. Liaoning Prov., Kuandian County, Guanshui, *Quercus*, 1995 *Dai 2178*. — *A. malicola*. **China.** Beijing, Baihuashan, *Salix,* 1993 *Dai 1768*; *Populus,* 1993 *Dai 1757*; *Betula*, 1993 *Dai 1787*. Summer Palace, *Acer*, 1993 *Dai 1406*. Tianjin, Baodi, *Salix*, 1993 *Dai 884*. Jilin Prov., Antu County, Changbaishan Nat. Res., *Tilia*, 1993 *Dai 1095*; *Populus*, 1993 *Dai 1103*; *Tilia*, 1995 *Dai 2012*. Fushong County, Shongjianghe, *Acer*, 1993 *Dai 542*. Huadian County, Dongxing, *Juglans,* 1993 *Dai 1640*. Huinan County, Hongqi, *Tilia,* 1993 *Dai 1459*; *Acer*, 1993 *Dai 385*. Wangqing County, Wangqing, *Salix,* 1993 *Dai 315*; *Populus,* 1993 *Dai 1206*. **Germany.** Rheinland-Pfalz, *Fagus*, 1976 *Gorholt*. — *A. primaeva*. **China.** Jilin Prov., Antu County, Changbaishan Nat. Res., *Abies*, 1993 *Dai 801*, *813 & 815*; gymnosperm, 1997 *Dai 2348 & 2373*. **Finland.** Sompion Lappi, Sodankylä, Keski-Luosto, *Pinus*, 1998 *Dai 2864 & Niemelä*. Savukoski, Urho Kekkonen Nat. Park, *Pinus*, 1988 *Renvall 1372* (holotype). — *A. pulvinascens*. **China.** Beijing, Xiangshan, *Prunus*, 1993 *Dai 1384 & 1388*. **Finland.** Uusimaa, Vantaa, Mustavuori, *Populus*, 1997 *Dai 2722 & Niemelä*. Kittilän Lappi, Kittilä, Aakenus, Vasalaki, *Populus*, 1999 *Dai 3147 & Niemelä*. **Russia.** Bashkortostan, Uchaly Dist., Ikhsanovo, Verkhne-Belskoe, *Populus*, 2001 *Dai 3347*. — *A. serialis*. **China.** Jilin Prov., Antu County, Changbaishan Nat. Res., *Abies*, 1993 *Dai 929*, 1995 *Dai 2037*; *Pinus*, 1993 *Dai 1067*. Huadian County, Dongxing, *Picea*, 1993 *Dai 1567b*. Huinan County, Hongqi, *Picea*, 1993 *Dai 1555, 1565 & 1581*. Wangqing County, Lanjia, *Abies*, 1993 *Dai 1307*. Heilongjiang Prov., Yichun, Fenglin Nat. Res., *Picea*, 2000 *Penttilä 13043*; *Pinus*, 2000 *Penttilä 13214*. **Finland.** Uusimaa, Vantaa, Vestra, *Picea*, 1995 *Dai 1941*. Helsinki, Arabia, *Picea*, 1996 *Dai 2352*. — *A. sinuosa*. **China.** Jilin Prov., Antu County, Changbaishan Nat. Res., gymnosperm, 1993 *Dai 817*, 1998 *Dai 2923 & Niemelä*; *Abies*, 1995 *Dai 2088*. Wangqing County, Lanjia, gymnosperm, 1993 *Dai 1243*. Heilongjiang Prov., Yichun, Fenglin Nat. Res., *Abies*, 2000 *Penttilä 13159*; *Picea*, 2000 *Penttilä 13252*. **Estonia.** Pärnumaa County, Koonga Dist., Veelikse, *Pinus*, 1996 *Dai 2224 & Niemelä*. **Finland.** Sompion Lappi, Pelkosenniemi, Luosto, Kapusta, *Pinus*, 1998 *Dai 2844 & Niemelä*. **Russia.** Bashkortostan, Uchaly Dist., Ikhsanovo, Verkhne-Belskoe, *Larix*, 2001 *Dai 3320*; *Pinus*, 2001 *Dai 3362*; *Picea*, 2001 *Dai 3298*. — *A. sitchensis*. **China.** Heilongjiang Prov., Yichun, Fenglin Nat. Res., *Picea*, 2000 *Penttilä 13012*, *13049*, *13106*, *13131*, *13209*, *13233*, *13342 & 13449*. — *A. vaillantii*. **China.** Jilin Prov., Antu County, Changbaishan Nat., Res., *Pinus*, 1997 *Dai 1274*. Wangqing County, Lanjia, *Larix*, 1993 *Dai 1274*. Heilongjiang Prov., Yichun, Fenglin Nat. Res., *Pinus*, 2000 *Penttilä 13446*. **Canada.** Québec, Poste-de-la-Baleine, 1982 *Niemelä 2573*. — *A. variiformis*. **China.** Jilin Prov., Fushong County, Shuguang, *Abies*, 1993 *Dai 695*. — *A. xantha*. China. Beijing, Baihuashan, *Acer*, 1993 *Dai 1859*. Jilin Prov., Antu County, Baoma, *Pinus,* 1993 *Dai 700, 743 & 746*; Changbaishan Nat. Res., *Abies*, 1993 *Dai 803*, 1993 *Dai 2082*; *Pinus*, 1993 *Dai 869*, 1993 *Dai 976*, *977 & 979*; gymnosperm, 1993 *Dai 956*. Fushong County, Shuguang, *Pinus,* 1993 *Dai 649*, *659 & 651*. Huadian County, Dongxing, *Pinus*, 1993 *Dai 1677*. Wangqing County, Lanjia, *Acer*, 1993 *Dai 1197*. Heilongjiang Prov., Yichun, Fenglin Nat. Res., *Pinus*, 2000 *Penttilä 13198 & 13249*; angiosperm, 2000 *Penttilä 13309*. **Finland.** Pohjois-Karjala, Lieksa, Koli Nat. Park, *Picea*, 1995 *Dai 1966 & Niemelä*. Sompion Lappi, Sodankylä, Luosto, *Picea*, 1998 *Dai 2771 & Niemelä*.

Acknowledgements

We thank Prof. Teuvo Ahti (H, Finland) for helping with the preparation of the Latin description. Special thanks are due to Mr. Reijo Penttilä, M.Sc. (Helsinki) for forwarding his collections from NE China.

References

Anonymous 1969: *Flora of British fungi, colour identification chart*. — Royal Bot. Garden, Edinburgh. 6 pp. (unnumbered).

Bernicchia, A. & Ryvarden, L. 2001: A new *Antrodia* species (Coriolaceae, Basidiomycetes). — *Mycotaxon* 79: 57–66.

Dai, Y. C. 1996: Changbai wood-rotting fungi 7. A checklist of the polypores. — *Fungal Sci*. 11: 79–105.

Dai, Y. C. 2000: A checklist of polypores from Northeast China. — *Karstenia* 40: 23–29.

Donk, M. A.1960: The generic names proposed for Polyporaceae. — *Persoonia* 1: 173–302.

Donk, M. A. 1966: Notes on European polypores 1. — *Persoonia* 4: 337–343.

Donk, M. A. 1974: Checklist of European polypores. — *Verhand. Kon. Nederl. Akad. Wetensch. Naturk*., Ser. 2, 62: 1–469.

Gilbertson, R. L. & Ryvarden, L. 1986–1987: *North American polypores* 1–2. — Fungiflora, Oslo. 885 pp.

Karsten, P. 1880: Symbolae ad Mycologiam Fennicam 6. — *Meddel. Soc. Fauna Flora Fennica* 5: 15–46.

Lodge, D., Ryvarden, L. & Perdomo, O. P. 2001: Studies in neotropical polypores 11. *Antrodia aurantia*, a new species from the Dominican Republic, Greater Antilles. — *Mycotaxon* 80: 261–266.

Niemelä, T. 1978: On Fennoscandian polypores 6. *Antrodia plicata* n. sp. — *Karstenia* 18: 43–48.

Núñez, M. & Ryvarden, L. 2001: East Asian polypores 2. Polyporaceae s. lato. — *Synopsis Fungorum* 14: V + 170–522.

Quanten, E. 1997: The polypores (Polyporaceae s.l.) of Papua New Guinea. — *Opera Bot. Belgica* 11: 1–352.

Renvall, P. & Niemelä, T. 1992: Basidiomycetes at the timberline in Lapland 3. Two new boreal polypores with intricate hyphal systems. — *Karstenia* 32: 29–42.

Ryvarden L. 1977: *The Polyporaceae of North Europe* 1. *Albatrellus to Incrustoporia*. — Fungiflora, Oslo. 214 pp.

Ryvarden, L. 1991: Genera of polypores. Nomenclature and taxonomy. — *Synopsis Fungorum* 5: 1–363.

Ryvarden, L. & Gilbertson, R. L. 1993: European polypores 1. — *Synopsis Fungorum* 6: 1–387.

Ryvarden, L. & Johansen, I. 1980: *A preliminary polypore flora of East Africa*. — Fungiflora, Oslo. 636 pp.

Spegazzini, C. L. 1899: Fungi argentini novi vel critici. — *Anal. Mus. Nac. Buenos Aires* 6: 81–367.

Zhao, J. D. 1998: *Flora fungorum sinicorum* 3, *Polyporaceae*. — Sci. Press, Beijing. 455 pp. [In Chinese].