

Tsutomu Hattori

Wrightoporia (Basidiomycota, Hericiales) species and their allies collected in Japan

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Abstract I report seven species of *Wrightoporia*, including one undetermined species and one *Taiwanoporia* sp., collected in Japan. The following species are newly described: *Wrightoporia aurantipora*, *W. labyrinthina*, *W. straminea*, and *Taiwanoporia roseotincta*. *Wrightoporia avellanea* and *W. lenta* are newly reported for Japan. A detailed description is also provided for *W. japonica*, a poorly known species described from Japan. *Wrightoporia aurantipora* is characterized by the resupinate basidiocarp, orange-tinted pores, skeletal hyphae with restricted dextrinoid reaction, and lack of gloeoplerous hyphae. *Wrightoporia labyrinthina* is characterized by the resupinate basidiocarps, labyrinthiform hymenophore, and abundant gloeoplerous hyphae. *Wrightoporia straminea* is characterized by the resupinate basidiocarps, the skeletal hyphae with restricted dextrinoid reaction, and SV+ cystidia. *Taiwanoporia roseotincta* is characterized by the sappy and pinkish-white basidiocarps and monomitic hyphal system without clamp connections.

Key words New species · Polypore · *Taiwanoporia* · Temperate Asia · *Wrightoporia*

Introduction

Wrightoporia is a genus described by Pouzar (1966), typified by *W. lenta* (Overh. & J. Lowe) Pouzar. Generic characters defined by the original description are (1) annual, resupinate, and soft basidiocarps with poroid hymenophore, (2) dimitic hyphal system with clamped generative hyphae and dextrinoid skeletal hyphae, and (3) shortly elliptical basidiospores with strongly amyloid warts or ridges. Johansen and Ryvar den (1979) and Ryvar den (1982) added some species with pileate basidiocarps and/or with rigid perennial

basidiocarps and/or with skeletal hyphae lacking dextrinoid reaction. Corner (1989) considered that morphology of the hymenophore is not a sufficiently important character to distinguish a genus and put *Wrightoporia* into synonymy of *Stecchericum* Reid (Reid 1963), where hydroid species with similar basidiospores had been accommodated.

Amylosporus Ryvar den is a genus described by Ryvar den (1973), typified by *A. graminicola* (Murrill) Ryvar den [= *A. campbellii* (Berk.) Ryvar den fide Ryvar den and Johansen (1980)]. The type species has stipitate to sessile basidiocarps, and its generic characters in the original description are (1) generative hyphae with both simple septa and clamps and (2) amyloid basidiospores. David and Rajchenberg (1987) defined its hyphal characters as having narrow simple-septate generative hyphae, wider hyphae with verticillate clamps, branched skeletal hyphae, and gloeoplerous hyphae. Then, they added some resupinate species with similar microscopic characters into the genus, but Ryvar den (1991) emphasized that resupinate species should be excluded from the genus.

Ryvar den (1975) described *Amylonotus* Ryvar den (type species: *A. africanus* Ryvar den) to accommodate species with similar basidiospores, but this genus has (1) golden-brown skeletal hyphae, (2) basidiocarps with light consistency, and (3) a dimitic hyphal system with nondextrinoid skeletal hyphae and clamped generative hyphae. Johansen and Ryvar den (1979) also described *Rigidoporopsis* I. Johans. & Ryvar den (type species: *R. amylospora* I. Johans. & Ryvar den) to accommodate species with similar basidiospores but with a monomitic to pseudodimitic hyphal system with simple-septate generative hyphae. However, David and Rajchenberg (1987) concluded that the former genus should be included in *Wrightoporia* because the nondextrinoid reaction is masked by colored hyphae in *A. africanus* and because the genus is otherwise similar to *Wrightoporia*. They considered that the hyphal system is not an important character to distinguish genera in this group, and redefined *Wrightoporia* as (1) having small, asperulate, and amyloid basidiospores; (2) most species have simple-clamped generative hyphae; (3) most species have gloeoplerous hyphae; and (4) most species have a dextrinoid reaction in the

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skeletal hyphae. They reexamined the isotype of *R. amylospora*, and accommodated this species in *Amylosporus* because its hyphal characters are identical with those in *Amylosporus*, in contrast to the original description (David and Rajchenberg 1987).

Recently, Chang and Chou (2003) described *Taiwanoporia* typified by *T. amylospora* T.T. Chang & W.N. Chou. It has a monomitic hyphal system without clamp connections and similar basidiospores, although the warts on the basidiospores are not seen under the light microscope.

Núñez and Ryvar den (1999) reported *Wrightoporia japonica* Núñez & Ryvar den and *W. iobapha* (Pat.) Ryvar den from Japan. Later, Núñez and Ryvar den (2001) suggested occurrences of *W. africana* I. Johans. & Ryvar den, *W. cinnamomea* Ryvar den, and *W. tropicalis* (Cooke) Ryvar den in Japan without citation of voucher specimens. However, there are still several specimens of other *Wrightoporia* spp. and its allies collected in Japan, including those not keyed out in the key given by Stalpers (1996) and distinct from those described after that. In this study, detailed descriptions are given for *Wrightoporia* spp. and their allies collected in Japan. I also reexamined some of the voucher specimens of records from Japan. A key to the *Wrightoporia* species hitherto reported from Asia is provided.

Materials and methods

I examined specimens of *Wrightoporia* spp. and one related species collected in Japan. I also examined some specimens from overseas for comparison with the Japanese materials. The colors of basidiocarps are given according to the Munsell System.

Microscopic characters were observed for dried specimens mounted in 5% (w/v) KOH solution after being stained with 1% (w/v) phloxine solution, in Melzer's reagent, and in sulphovanillin (Largent et al. 1977). The following abbreviations are used for chemical reactions: IKI-, non-amyloid and nondextrinoid; SV+, reddish to brownish with sulphovanillin; SV-, no reaction with sulphovanillin.

Basidiospore measurements were made mounted in Melzer's reagent. Length of the spore protuberances is not included in the measurements. The following abbreviations are used for spore measurements: L = mean spore length, W = mean spore width, Q = L/W ratio, (q₁-q₂) = range of spore length:width ratio, and (n = n₁/n₂) means n₁ spores from n₂ specimens were measured.

All Japanese material examined here was deposited in the Mycological Herbarium of FFPRI (TFM).

Taxonomy

Wrightoporia aurantipora T. Hatt., sp. nov. Fig. 1

Basidiocarpi resupinata, annua. Pori angulares vel sinuosi, 4–6/mm. Facies pororum pallide aurantia vel brunneo-aurantia. Tubi suberosi vel fibroso-suberosi. Systema hypharum dimiticum vel trimiticum. Hyphae gen-

erativae fibulatae. Hyphae skeletales in contextu non dextrinoideae, in trama prope faciem pororum valde dextrinoideae. Basidiosporae perlate ellipsoideae, hyalinae, echinulatae, valde amyloideae, 3–4.2 × 2–3 μm.

Holotypus: F-19004 (TFM, see below.)

Etymology: Latin, with orange-colored pores, referring to the color of the pore surface.

Basidiocarps resupinate, annual to biennial. Pores angular to sinuous, occasionally elongated on sloping substrates, usually 4–6/mm (6–8/mm in one specimen), dissepiments thin, entire to partly eroded; pore surface light orange (10YR8/8) to brownish-orange (10YR7/8), shining, partly nodulous, and uneven. Marginal sterile zone indistinct. Context grayish-orange (10YR8/4) to brownish-orange (10YR7/4), partly light brown (10YR6/4), up to 1 mm thick, without a crust. Tubes corky to fibrous-corky, grayish-orange, up to 5 mm deep in each layer.

Hyphal system di-trimitic. Tramal generative hyphae branched, with clamp connections, hyaline, 1.5–2.5 μm wide; tramal skeletal hyphae unbranched, sinuous, thick-walled, covered with granules near the tip, hyaline to yellow, strongly dextrinoid near the pore mouth, otherwise IKI-, weakly SV+ (pink) to SV-, 2.5–6 μm wide; gloeoplerous hyphae absent. Contextual generative hyphae 2–4 μm wide; contextual skeletal hyphae 3–8 μm wide, IKI-; contextual binding hyphae sparse to abundant, frequently branched, thick walled to solid, IKI-, up to 3.5 μm wide. Cystidia none.

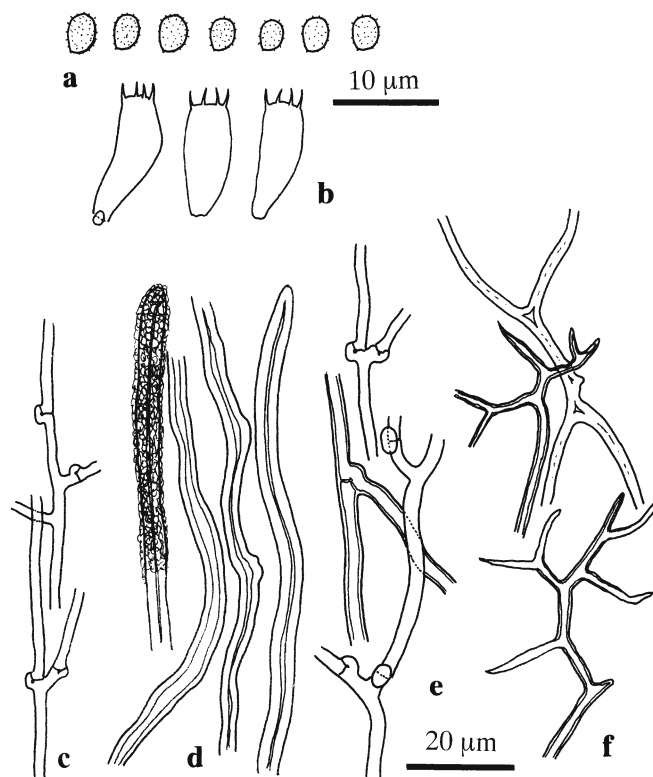


Fig. 1. *Wrightoporia aurantipora* (holotype). a Basidiospores. b Basidia. c Generative hyphae from trama. d Skeletal hyphae from trama (left, encrusted hyphal tip). e Generative hyphae from context. f Binding hyphae from context

Basidia oblong ellipsoid to clavate, 4-sterigmate, $10\text{--}15 \times 4\text{--}5\ \mu\text{m}$. Basidiospores broadly ellipsoid, echinulate, hyaline, strongly amyloid, $3\text{--}4.2 \times 2\text{--}3\ \mu\text{m}$, $L = 3.5\ \mu\text{m}$, $W = 2.5\ \mu\text{m}$, $Q = 1.39$ ($1.2\text{--}1.6$) ($n = 42/2$).

Specimens examined: JAPAN: Ibaraki Pref., Iwase, Tomiya-san, alt. 200m, on hardwood, leg. T. Hattori, 22 Oct. 1998 (holotype; TFM, F-19004); Kagoshima Pref., Amami Is., Kinsakubaru, on hardwood, leg. T. Hattori, 26 Oct. 1989 (F-15252, small-pored form); Chiba Pref., Sakae, on hardwood, leg. T. Hattori, 28 Sept. 1999 (F-16323); Chiba Pref., Kimitsu, Fudago, on hardwood, leg. T. Hattori, 7 Dec. 1991 (F-16472); Okinawa Pref., Iriomote Is., riverside of Urauchi R., on hardwood, leg. T. Hattori, (F-16614); Ibaraki Pref., Tsuchiura, Shishitsuka, on hardwood, leg. T. Hattori (F-21344).

Decay type: Associated with a white rot.

Remarks: This species is common in warm temperate and subtropical areas in Japan. It is similar to *W. brunneo-ochracea* A. David & Rajchenb., *W. gillesii* A. David & Rajchenb., and *W. japonica* by lack of gloeoplerous hyphae and localized dextrinoid reaction in skeletal hyphae. It is distinct from *W. brunneo-ochracea* by always resupinate basidiocarps, the orange-tinted pore surface, and mostly regular pores (basidiocarps are effused-reflexed, pore surface is brownish, and pores are irregular in *W. brunneo-ochracea*; David and Rajchenberg 1985), from *W. gillesii* and *W. japonica*, by always resupinate basidiocarps, orange-tinted and uneven pore surface, larger pores, and slightly larger basidiospores (basidiocarps are frequently pileate, pores are beige or buff, usually $>6\text{mm}$, and basidiospores are usually $<3.5\ \mu\text{m}$ in the two species; David and Rajchenberg 1987; Núñez and Ryvarden 1999).

Wrightoporia avellanea (Bres.) Pouzar, *Česká Mykol.* 20:173, 1966. Fig. 2

Basidiocarps resupinate, annual. Pores angular, elongated to irregular, $(1\text{--}2\text{--}3\text{mm})$, dissepiments thin and lacerate; pore surface white to pale orange (10YR9/3, 10YR9/4). Context membranous, very thin. Tubes fibrous, sordid white to pale orange, up to 2mm deep. White rhizoids present mainly within the substrates.

Hyphal system dimitic. Tramal generative hyphae branched, with clamp connections, hyaline, $1.5\text{--}2.5\ \mu\text{m}$ wide; tramal skeletal hyphae unbranched, sinuous, thick walled, partly covered with lipid droplets dissolving in KOH solution, hyaline, strongly dextrinoid, $1.2\text{--}3\ \mu\text{m}$ wide; gloeoplerous hyphae abundant in trama, hyaline, SV+ (brown), unbranched to occasionally branched, up to $10\ \mu\text{m}$ wide. Contextual hyphae as in tramal hyphae. Cystidia none. Basidia mostly collapsed, cylindrical, 4-sterigmate, $15\text{--}25 \times 4\text{--}5\ \mu\text{m}$. Basidiospores broadly ellipsoid, smooth to slightly echinulate, hyaline, strongly amyloid, $3.2\text{--}4 \times 2.5\text{--}3\ \mu\text{m}$, $L = 3.7\ \mu\text{m}$, $W = 2.8\ \mu\text{m}$, $Q = 1.30$ ($1.21\text{--}1.43$) ($n = 41/2$).

Specimens examined: JAPAN, Ibaraki Pref., Satomi, Sankomuro, alt. 700m, on well-decayed wood of *Cryptomeria japonica*, leg. T. Hattori, 13 Sept. 2004 (TFM, F-21069), the same place, on well-decayed wood of *C. japonica*, 14 Sept. 2004 (F-21114); Iwate Pref., Mt. Iwate-san, alt. 600m, on conifer, leg. T. Hattori, 19 Oct. 2003 (F-21343); USA:

Colorado, Uncompahgre National Forest, alt. 10900ft, on conifer log, leg. J.L. Lowe & R.L. Gilbertson, 27 Aug. 1956 (TFM, ex Lowe 6778).

Decay type: Unknown.

Remarks: This species was first described from Brazil and widely reported on hardwoods in tropical and subtropical areas (Lowe 1966; Ryvarden and Johansen 1980). It is curious that this tropical species is recorded on conifers in cool temperate and/or mountainous areas in Japan and the United States. Cui and Dai (2006) also reported this species on conifers in cool temperate area of China. Those on conifers in temperate areas possibly represent a distinct species, and further studies are needed to discern their identity.

Wrightoporia japonica Núñez & Ryvarden, *Fungal Diversity* 3: 119, 1999. Fig. 3

Basidiocarps resupinate, effused-reflexed to sessile, annual. Pileus elongated to semicircular, up to $30 \times 15\ \text{mm}$; pileus surface glabrous to matted, sulcate or azonate, light yellowish brown to light brown (10YR5/8), often darker

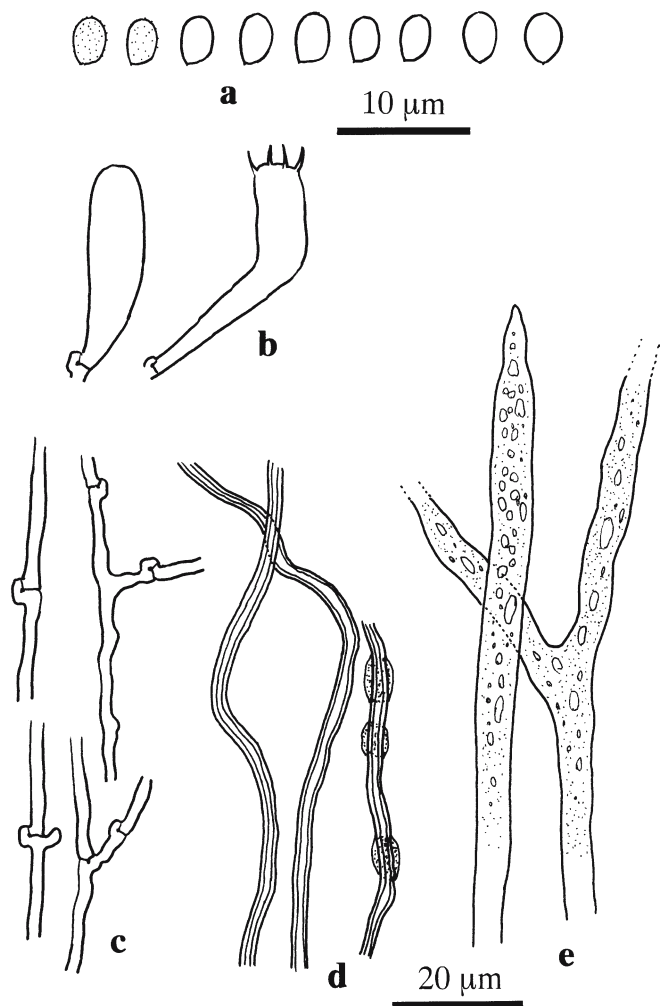


Fig. 2. *Wrightoporia avellanea* (F-21069). a Basidiospores. b Basidia (left, unripe basidium). c Generative hyphae from trama. d Skeletal hyphae from trama (right, skeletal hyphae with lipid droplets). e Gloeoplerous hyphae from trama

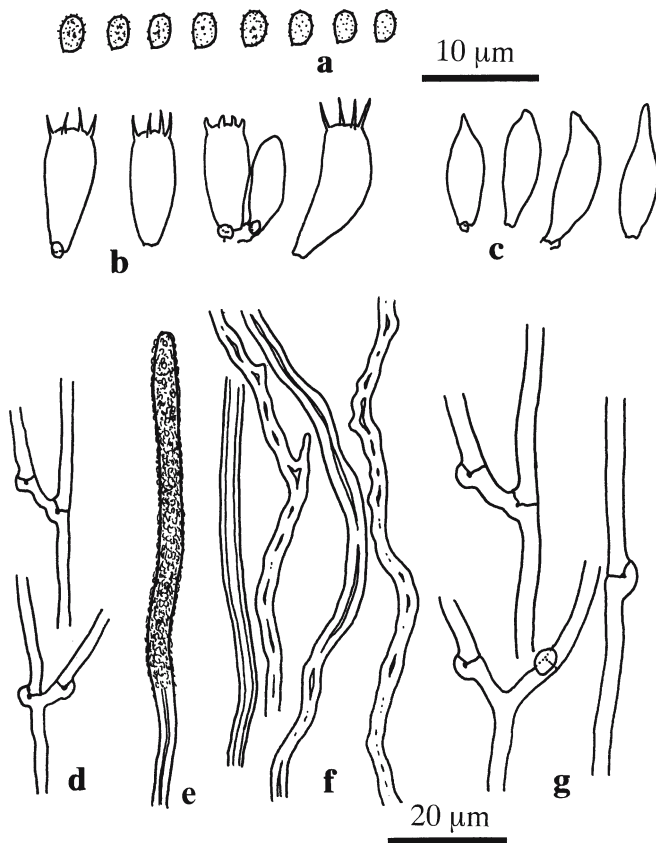


Fig. 3. *Wrightoporia japonica* (a, c, d, f, g isotype, b, e F-16446). a Basidiospores. b Basidia. c Hymenial cystidioles. d Generative hyphae from trama. e Encrusted tip of skeletal hypha. f Skeletal hyphae from trama. g Generative hyphae from context

(10YR4/4) near the base; pileus margin dull, entire. Pores angular to round, pore size variable according to the portion and specimens, 5–7/mm to 8–12/mm, often larger in pileate parts, dissepiments thin and entire; pore surface even, pale orange (10YR9/4) to grayish-orange (10YR8/4). Context felty-corky, pale orange near the tubes, light brown (5YR5/8) near the pileus surface, up to 3 mm thick, without a crust. Tubes leathery to felty-corky, pale orange, to 2 mm deep.

Hyphal system dimitic. Tramal generative hyphae thin-walled, branched, with clamp connections, hyaline, 1–2.5 µm wide; tramal skeletal hyphae sinuous, unbranched to occasionally branched, thick walled to almost solid, some hyphae covered with granules but not conspicuous, hyaline to yellowish, strongly dextrinoid near the pore mouth, otherwise IKI–, SV–, 2–5 µm wide. Contextual generative hyphae 1.5–3.5 µm wide; contextual skeletal hyphae IKI–, without granules. Cystidia none, but fusoid cystidioles scattered to abundant in the hymenia of some specimens. Basidia oblong ellipsoid to clavate, 4-sterigmate, 8–12 × 3.5–4 µm. Basidiospores broadly ellipsoid, finely echinulate, hyaline, strongly amyloid, 2.2–3.3 × 1.5–2.3 µm, L = 2.8, W = 2.0, Q = 1.44 (1.28–1.67) ($n = 60/3$).

Specimens examined: JAPAN, Okinawa Pref., Iriomote Is., riverside of Shiira R., on hardwood, leg. M. Núñez,

19 June 1994 (isotype; TFM, F-17868, sessile form); Okinawa Pref., Iriomote Is., riverside of Nakama R., on hardwood, leg. T. Hattori, 10 Nov. 1997 (F-18036, effused-reflexed form); Okinawa Pref., Kunigami, Yonaha-dake, on hardwood, leg. T. Hattori, 3 Oct. 2005 (F-21345, sessile form; F-21346, resupinate form; F-21347, resupinate form); Kochi Pref., Tosayama, Kuishiyama, on hardwood, leg. T. Hattori, 14 Nov. 1999 (F-16446, effused-reflexed form); Ibaraki Pref., Mt. Tsukuba, on hardwood, leg. T. Hattori, 13 Oct. 1998 (F-18988, resupinate to effused-reflexed form); Ibaraki Pref., Kitaibaraki, Ogawa, on hardwood, leg. T. Hattori, 30 Sept. 2003 (F-20723, effused-reflexed and larger-pored form); the same place, 9 Oct. 2003 (F-20749, F-20752; both are effused-reflexed and larger-pored form).

Type of rot: Associated with a white rot.

Remarks: Detailed description is given here because the original description made by Núñez and Ryvardeen (1999) was based on a single specimen. This species is very similar to *W. gillesii* described from Africa and is possibly conspecific.

***Wrightoporia labyrinthina* T. Hatt., sp. nov.** Fig. 4

Basidiocarpia resupinata, annua. Hymenophorum labyrinthinum. Facies hymenophori pallide aurantia vel cinereo-aurantia. Tubi suberosi vel fibroso-suberosi. Systema hypharum dimiticum. Hyphae generativae fibulatae. Hyphae skeletales non vel vix dextrinoideae. Hyphae gloeoplerosae abundae in trama, haud ramosae. Basidiosporae ellipsoideae, hyalinae, echinulatae, valde amyloideae, 3.5–4.5 × 2.5–3.5 µm.

Holotypus: F-20724 (TFM, indicated below)

Etymology: Latin, labyrinthiform, referring to the shape of the hymenophore.

Basidiocarps resupinate, annual. Pores irregular, elongated to daedaleoid, partly poroid, 1(–2)/mm at poroid part, up to 5 mm long at irregular part, dissepiments thick, entire to partly lacerate; pore surface pale orange (10YR9/4) to grayish-orange (10YR8/4). Marginal sterile zone felty-membranous, without rhizoids, pale orange, up to 2 mm wide. Context membranous, brownish-orange (5YR6/8), up to 0.5 mm thick. Tubes leathery, brownish-orange, up to 1.5 mm deep.

Hyphal system dimitic. Tramal generative hyphae branched, with clamp connections, hyaline, 2–3.5 µm wide; tramal skeletal hyphae unbranched, sinuous, thick walled, yellowish, IKI– to weakly dextrinoid in mass, 2–4.5 µm wide; gloeoplerous hyphae abundant in trama, unbranched, hyaline, SV+ (brown), up to 8 µm wide. Contextual skeletal hyphae more straight than tramal hyphae, 2.5–6 µm wide, otherwise as in tramal hyphae. Cystidia none. Basidia mostly collapsed, short cylindrical, 4-sterigmate, 12–15 × 3–3.5 µm. Basidiospores ellipsoid, echinulate, hyaline, strongly amyloid, 3.5–4.5 × 2.5–3.5 µm, L = 4.3, W = 3.1, Q = 1.39 (1.27–1.50) ($n = 20/1$).

Type of rot: Associated with a white rot.

Specimen examined: JAPAN, Ibaraki Pref., Kitaibaraki, Ogawa, on twig of hardwood, 30 Sept 2003 (holotype; TFM, F-20724).

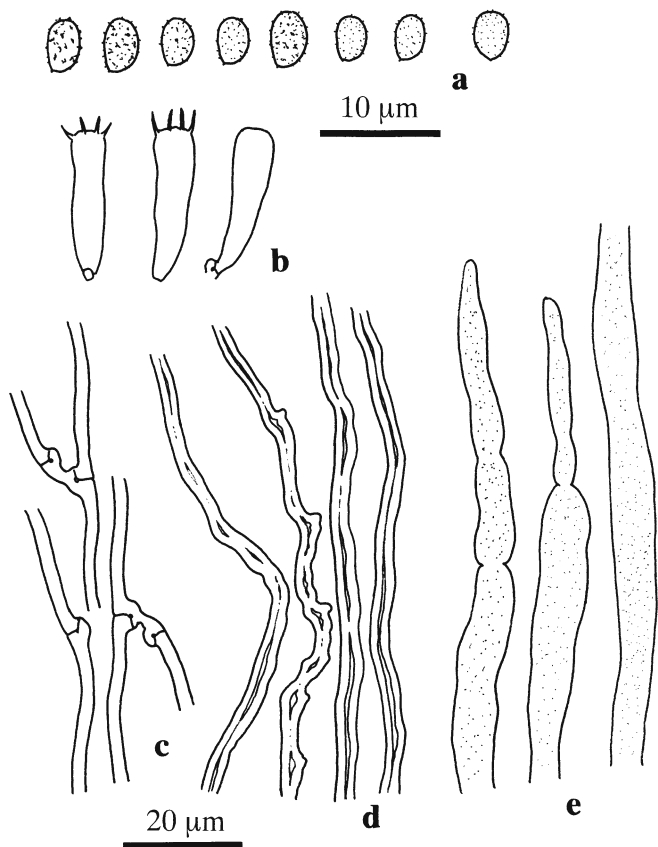


Fig. 4. *Wrighttoporia labyrinthina* (holotype). **a** Basidiospores. **b** Basidia (right, unripe basidium). **c** Generative hyphae from trama. **d** Skeletal hyphae from trama. **e** Gloeoplerous hyphae from trama

Remarks: This is similar to *W. gyropora* (Corner) Stalpers with large and irregular pores, but is distinct by the leathery and tough tubes and the gloeoplerous hyphae.

Wrighttoporia lenta (Overh. & J. Lowe) Pouzar, Česká Mykol. 20: 173, 1966. Fig. 5

Basidiocarps resupinate, annual, light in weight. Pores angular to round, 2–3(–4)/mm, dissepiments thin and entire; pore surface white when fresh, becoming pale orange (10YR9/2) when dried. Context fibrous to membranous, white, very thin. Tubes fibrous to spongy, white to pale orange, up to 6 mm deep. White rhizoids present in the substrates.

Hyphal system dimitic. Tramal generative hyphae branched, with clamp connections, hyaline, 1.5–2.5 μm wide; tramal skeletal hyphae unbranched, sinuous, thick walled, hyaline, strongly dextrinoid, 1.5–2.5 μm wide; gloeoplerous hyphae sparse, occasionally branched, SV+, 3–6 μm wide. Contextual hyphae as in tramal hyphae. Cystidioles fusiform, 18–30 \times 5–6.5 μm . Basidia clavate, 4-sterigmate, 15–25 \times 5–6.5 μm . Basidiospores subglobose to broadly ellipsoid, echinulate, hyaline, strongly amyloid, 4.8–6 \times 4–5 μm , $L = 5.3$, $W = 4.5$, $Q = 1.18$ (1.13–1.25) ($n = 20/1$).

Specimens examined: JAPAN, Gifu Pref., Takane, Hiwada, alt. 1400 m, on *Abies*, 12 Aug. 1999 (TFM, F-

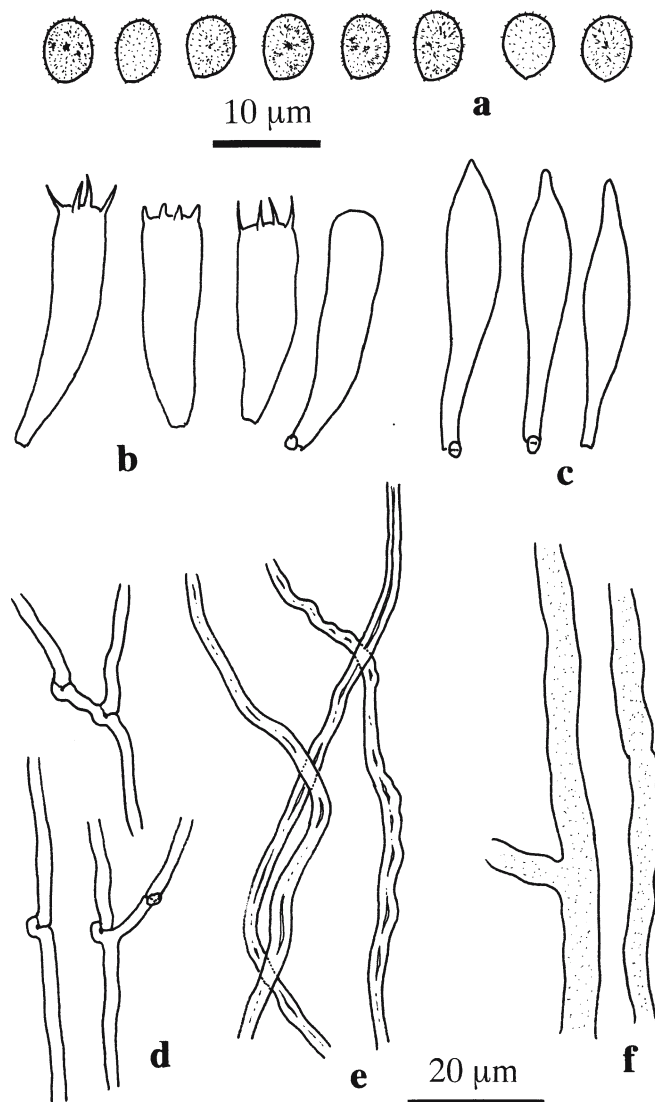


Fig. 5. *Wrighttoporia lenta* (F-21073). **a** Basidiospores. **b** Basidia (right, unripe basidium). **c** Hymenial cystidioles. **d** Generative hyphae from trama. **e** Skeletal hyphae from trama. **f** Gloeoplerous hyphae from trama

19277); Ibaraki Pref., Satomi, Sankomuro, alt. 700 m, on bark of *Cryptomeria japonica*, 13 Sept. 2004 (F-21073).

Type of rot: Associated with a brown rot according to Lowe (1966), but indistinct in Japanese specimens.

Remarks: This species is peculiar by the larger basidiospores than the other species within the genus. It is common on bark of huge living or recently cut stumps of *C. japonica* in Satomi, a cool temperate area of Japan.

Wrighttoporia straminea T. Hatt., sp. nov. Fig. 6

Basidiocarpi resupinata vel effuso-reflexa, annua. Pori angulares vel rotundi, 6–8/mm. Facies pororum flavo-brunnea vel brunneo-aurantia. Tubi coacti-suberosi. Systema hypharum dimiticum. Hyphae generativae fibulatae. Hyphae skeletales in contextu non dextrinoideae, in tramate prope faciem pororum valde dextrinoideae. Cys-

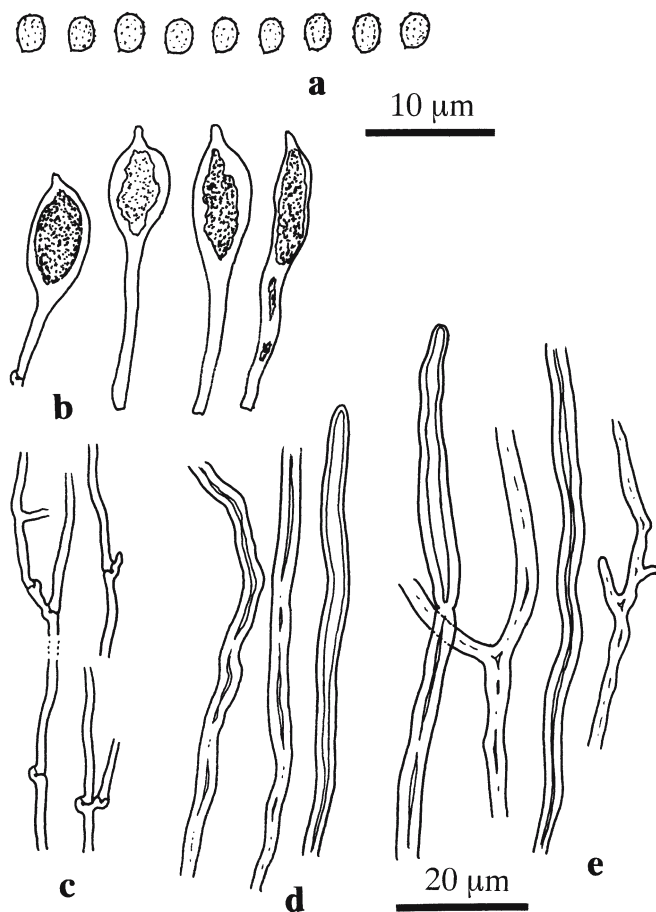


Fig. 6. *Wrighttoporia straminea* (holotype). **a** Basidiospores. **b** Hymenial cystidia. **c** Generative hyphae from trama. **d** Skeletal hyphae from trama. **e** Skeletal hyphae from context

tidia hymenii abundantia, SV+. Basidiosporae perlate ellipsoideae, hyalinae, echinulatae, valde amyloideae.

Holotypus: F-16387 (TFM, indicated below).

Etymology: Latin, straw colored, referring to the color of the pore surface.

Basidiocarps resupinate to slightly effused with a narrow pileus, annual. Pileus elongated, glabrous to matted, yellowish-brown (10YR6/4) to brownish-orange (10YR7/4), up to 2 mm wide. Pores angular to round, 6–8/mm, pore surface grayish-orange (10YR8/4), shining, even, dissepiments thin, entire. Marginal sterile zone felty, grayish-orange, up to 1 mm wide. Context felty, grayish-orange, up to 0.2 mm thick in effused part, without a crust. Tubes felty-corky, grayish-orange, up to 1 mm deep.

Hyphal system dimitic. Tramal generative hyphae branched, with clamp connections, hyaline, 1.5–2.5 µm wide; tramal skeletal hyphae unbranched, sinuous, thick walled, hyaline to yellow, dextrinoid near the pore mouth, otherwise IKI–, SV–; gloeoplerous hyphae absent. Contextual generative hyphae 1.5–3 µm wide; contextual skeletal hyphae unbranched to occasionally branched, 2–6 µm wide, IKI–. Cystidia abundant in the hymenium, ventricose, clavate to cylindrical with a long stalk, thin walled, SV+ (brown). Basidia not seen. Basidiospores broadly ellipsoid,

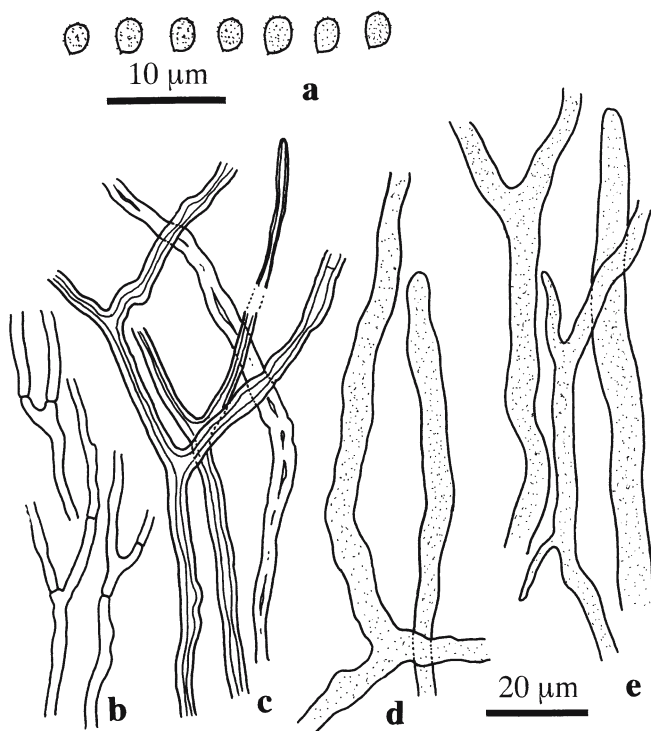


Fig. 7. *Wrighttoporia* sp. (F-17883). **a** Basidiospores. **b** Generative hyphae from trama. **c** Skeletal hyphae from trama. **d** Gloeoplerous hyphae from trama. **e** Gloeoplerous hyphae from context

echinulate, hyaline, strongly amyloid, 2.8–3.5 × 1.9–2.6 µm, L = 3.0, W = 2.2, Q = 1.39 (1.25–1.50) ($n = 30/1$).

Specimen examined: JAPAN: Shiga Pref., Kutsuki, Asou, on hardwood, leg. T. Hattori, 3 Nov. 1991 (holotype; TFM, F-16387).

Type of rot: Associated with a white rot.

Remarks: Macroscopically, this is very similar to resupinate form of *W. japonica*, but distinct by SV+ cystidia and slightly wider basidiospores. This is also a member of *W. brunneo-ochracea* comp. with restricted dextrinoid reaction and lack of gloeoplerous hyphae.

Wrighttoporia sp.

Fig. 7

= *Wrighttoporia iobapha* (Pat.) Ryvarden auct. non Patouillard: Núñez and Ryvarden in *Fungal Diversity* 3:119, 1999.

Basidiocarps resupinate. Pores angular to round, 5–7/mm, dissepiments thin and entire; pore surface pale orange (10YR9/4) in young parts, violet-brown (5R5/4) to dark brown (10R4/4) in old parts. Marginal sterile zone membranous, pale brown, up to 2 mm wide. Context corky, light brown (5YR7/4, 5YR8/4), up to 2 mm thick, without a crust. Tubes stratified in one specimen, cartilaginous-corky, light brown (5YR6/4) in old tubes, pale orange in young tubes, up to 4 mm deep in each layer.

Hyphal system di-trimitic. Tramal generative hyphae branched, without clamp connections, hyaline, 1.5–2.5 µm wide; tramal skeletal-binding hyphae unbranched to moderately branched, sinuous, thick walled, hyaline to yellow,

IKI-, 2–8 µm wide; gloeoplerous hyphae scattered to abundant, occasionally branched, hyaline, SV+ (red), up to 8 µm wide. Contextual generative hyphae mostly collapsed; contextual skeletal-binding hyphae similar to tramal hyphae; contextual gloeoplerous hyphae moderately branched, up to 15 µm wide. Cystidia none. Basidia not seen. Basidiospores broadly ellipsoid, echinulate, hyaline, strongly amyloid, 2.5–3.6 × 2–2.8 µm, L = 3.2, W = 2.4, Q = 1.34 (1.20–1.52) (*n* = 40/2).

Specimens examined: JAPAN: Okinawa Pref., Iriomote Is., riverside of Shiira R., leg. M. Núñez, 19 June 1994 (TFM, F-17867, as “*W. iobapha*” by M. Núñez); the same place, 19 June 1994 (F-17883, as “*W. cf. tropicalis*” by M. Núñez).

Type of rot: Unknown.

Remarks: This species is peculiar with the small pores, generative hyphae without clamp connections, moderately branched skeletal hyphae without dextrinoid reaction, and branched gloeoplerous hyphae seen in trama and context. *Wrightoporia rubella* Y.C. Dai (isotype, ex Dai 1339!) described from China also has generative hyphae without clamp connections and occasionally branched skeletal hyphae, but it has larger basidiospores (4–6 × 3–4.2 µm) and less conspicuous gloeoplerous hyphae and is apparently a distinct species. The present species may be an undescribed species of *Wrightoporia*, but here I prefer to leave this as *Wrightoporia* sp. because both the specimens examined are in poor condition.

Núñez and Ryvarden (2001) suggested the occurrence of *W. tropicalis* (Cooke) Ryvarden in Japan without citation of a voucher specimen. F-17883 is the only traced specimen suggesting *W. tropicalis* from Japan determined by M. Núñez, and this is probably their voucher of *W. tropicalis* from Japan. Therefore, occurrences of both *W. iobapha* and *W. tropicalis* in Japan are hitherto dubious.

Taiwanoporia roseotincta T. Hatt., sp. nov.

Fig. 8

Basidiocarpia sessilia vel effusoreflexa, saepe imbricata, annua. Pilei dimidiati vel elongati, glabri, tomentosi vel strigosi, albi vel pallide rosei. Pori angulares vel rotundi, 5–7/ mm. Contextus succidus, albus. Tubi subsuccidi. Systema hypharum monomiticum. Hyphae generativae afibulatae. Cystidiola fusiformia. Basidiosporae perlate ellipsoideae, hyalinae, echinulatae, valde amyloideae, 3.8–4.6 × 2.8–3.3 µm.

Holotypus: F-19302 (TFM, indicated below).

Etymology: Latin, rose-tinted, referring to the color of the basidiocarps.

Basidiocarps annual, sessile to effused-reflexed, often imbricate, annual. Pileus dimidiate to elongated, triquetrous to convex, up to 8 × 5 × 1.5 cm in single pileus; pileus surface tomentose to strigose near the base, glabrous to tomentose near the margin, often more distinctly tomentose after dried, white to pinkish-white (10R9/2) when fresh, drying into brownish-orange (10YR7/8) to yellowish-brown (10YR5/8); pileus margin acute to dull, wavy, almost entire. Pores angular to round, 5–7/mm, dissepiments thin and entire; pore surface concolorous with the pileus surface. Context sappy and somewhat brittle when fresh, drying corky near the tubes and fibrous-corky near the pileus

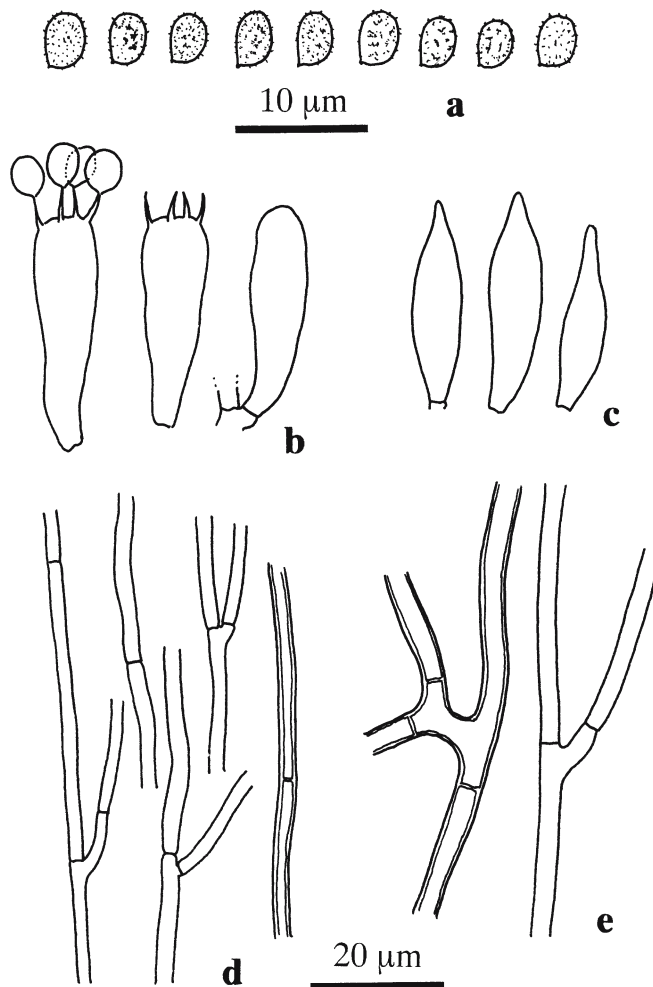


Fig. 8. *Taiwanoporia roseotincta* (holotype). **a** Basidiospores. **b** Basidia (left, basidium bearing basidiospores; right young basidium). **c** hymenial cystidioles. **d** Generative hyphae from trama. **e** Generative hyphae from context

surface, white when fresh, drying brownish-orange, without a crust, up to 10 mm thick. Tubes sappy when fresh, becoming cartilaginous when dried, up to 5 mm deep.

Hyphal system monomitic. Tramal generative hyphae branched, without clamp connections, thin- to slightly thick walled, hyaline, IKI-, SV- but slightly reddish in mass, 2–3.5 µm wide; gloeoplerous hyphae absent. Contextual generative hyphae 2.5–6 µm wide, otherwise similar to tramal hyphae. Cystidioles scattered to abundant, fusoid, 10–16 × 4–5.5 µm. Basidia clavate, 4-sterigmate, 13–18 × 4.5–6 µm. Basidiospores broadly ellipsoid, echinulate, hyaline, strongly amyloid, 3.8–4.6 × 2.8–3.3 µm, L = 4.1, W = 3.1, Q = 1.34 (1.25–1.43) (*n* = 20/1).

Specimens examined: JAPAN: Gunma Pref., Katashina, Mt. Hotaka, on *Fagus crenata*, leg. T. Hattori, 17 Sept. 1999 (holotype; TFM, F-19302); Gifu Pref., Takane, Hiwada, on hardwood, leg. T. Hattori, 11 Sept. 1994 (F-17211); Aichi Pref., Inada, Iyama, leg. S. Honda, 17 Sept. 1994 (F-17216); Ibaraki Pref., Kitaibaraki, Oshoyama, on *Fagus crenata*, leg. T. Hattori, 26 Aug. 2004 (F-21043).

Type of rot: Associated with a white rot.

Remarks: *Taiwanoporia* is characterized by soft and whitish basidiocarps, poroid hymenophore, monomitic hyphal system with simple septa, basidiospores that are tear shaped to subglobose, smooth, hyaline and amyloid, and a white rot (Chang and Chou 2003). The present species also show similar characters except for the fine warts on basidiospores. However, basidiospores of *T. amylospora* T.T. Chang & W.N. Chou, the type species of the genus, are finely warted under SEM (Chang and Chou 2003), and smooth basidiospores are not a principal character for the genus. Therefore, I conclude that *Taiwanoporia* is the proper genus to accommodate the present species.

Macroscopically, it looks like a pinkish *Tyromyces* sp. with sappy and whitish basidiocarps. Microscopically, it is characterized by amyloid and echinulate basidiospores and monomitic hyphal system without clamp connections.

Discussion

The core morphological characters of the genus *Wrightoporia* may be summarized as follows: (1) basidiospores are subglobose to ellipsoid, echinulate and strongly amyloid, (2) hyphal system is dimitic to trimitic, (3) generative hyphae are with simple clamp connections, (4) skeletal hyphae are strongly dextrinoid, and (5) gloeoplerous hyphae are present. The following species show the foregoing characters: *W. africana*, *W. avellanea*, *W. dimidiata* A. David & Rajchenb., *W. lenta*, *W. pouzarii* A. David & Rajchenb., *W. ramosa* A. David & Rajchenb., and *W. subbrutillans* (Murrill) Ryvar den (David and Rajchenberg 1987; Johansen and Ryvar den 1979; Lowe 1966; Ryvar den 1982).

The following species have similar basidiospores and generative hyphae, but have skeletal hyphae whose dextrinoid reaction is restricted to parts of the trama, mainly near the pore surface, and lack gloeoplerous hyphae: *W. aurantipora*, *W. brunneo-ochracea*, *W. gillesii*, *W. japonica*, *W. neotropica* Ryvar den (?), *W. solomonensis* (Corner) T. Hatt. and *W. straminea* (David and Rajchenberg 1985; Hattori 2003; Ryvar den 2000). They also share yellowish context, and probably constitute a natural group. Three Japanese species are always associated with white rots whereas *W. lenta*, the type species of the genus, was reported to be associated with a brown rot (Lowe 1966). The shape of the basidia is usually oblong ellipsoid to short clavate in this group, although the type species and some of other *Wrightoporia* spp. have clavate to cylindrical basidia.

Wrightoporia cremea Ryvar den, *W. gyropora*, *W. luteola* B.K. Cui & Y.C. Dai, and *W. micropora* P.K. Buchanan & Ryvar den are mostly similar to the core group but lack gloeoplerous hyphae (Buchanan and Ryvar den 2000b; Cui and Dai 2006; Hattori 2003; Ryvar den 1987). *Wrightoporia labyrinthina*, *W. ochrocrocea* (Henn. & Nyman) Ryvar den and *W. trametoides* (Corner) T. Hatt. are distinct from the core group only by lack of dextrinoid reaction in the skeletal hyphae according to my observation. *Wrightoporia cinnamomea* Ryvar den, *W. isabellina* (Corner) Stalpers, and

W. roseocontexta Ryvar den & Iturr. lack both gloeoplerous hyphae and dextrinoid reaction in the skeletal hyphae (Corner 1989; Ryvar den 1982; Ryvar den and Iturriaga 2003). *Wrightoporia flava* (Ryvar den) A. David & Rajchenb., *W. novaezealandiae* Rajchenb. & A. David, and *W. porilacerata* C.L. Leite, A.L. Gerber & Ryvar den are distinguished by the monomitic hyphal system (Loguercio-Leite et al. 1998; Rajchenberg and David 1990; Ryvar den 1975).

Wrightoporia casuarinicola Y.C. Dai & B.K. Cui, *W. efibulata* I. Lindblad & Ryvar den, *W. rubella* Y.C. Dai, *W. tropicalis* (Cooke) Ryvar den, and *Wrightoporia* sp. described in this article have similar basidiospores and dimitic hyphal system but have generative hyphae with simple septa. Dextrinoidity in the skeletal hyphae and occurrence of gloeoplerous hyphae vary among them (Dai 1995; Dai and Cui 2006; Lindblad and Ryvar den 1999; Lowe 1966).

Microscopically, the morphology of the basidiospores is the most important character in *Wrightoporia*. However, as already shown, *Wrightoporia* hitherto includes species with various hyphal characters, i.e., with or without clamp connections, di-trimitic or monomitic hyphal system, with or without gloeoplerous hyphae, and with or without dextrinoid reaction in skeletal hyphae. The color of the context also varies from white or yellow to brownish or pinkish, and at least several species are white rot fungi while the type species is reported to be associated with a brown rot. Many of these characters are used to separate genera within polypores (Ryvar den 1991). Larsson and Larsson (2003) showed that *W. lenta*, *W. avellanea*, and *W. tropicalis* are phylogenetically not related within the russuloid basidiomycetes and suggested that the genus is not monophyletic. For the time being, I keep *Wrightoporia* as a single genus, but further studies are needed to reveal principal characters to define further genera.

The distribution center of *Wrightoporia* lies in tropical areas, and many of its species were described from the tropics (Corner 1989; David and Rajchenberg 1985, 1987; Ipulet and Ryvar den 2005; Johansen and Ryvar den 1979; Lindblad and Ryvar den 1999; Loguercio-Leite et al. 1998; Ryvar den 1975, 1987, 2000; Ryvar den and Johansen 1980; Ryvar den and Iturriaga 2003). In temperate to boreal areas, no species are hitherto recorded from Europe, 4 are known from North America, and 3 from New Zealand and Australia (Buchanan and Ryvar den 2000a; Gilbertson and Ryvar den 1987; May et al. 2003; Ryvar den and Gilbertson 1993). On the other hand, the following 12 species are reported from temperate areas in Asia, excluding *W. subadusta* Z.S. Bi & G.Y. Zheng and *W. tenuis* (Z.S. Bi & G.Y. Zheng) Stalpers described by Zheng and Bi (1987), which are not true members of this genus (Cui and Dai 2006): *W. aurantipora*, *W. cinnamomea*, *W. avellanea*, *W. casuarinicola*, *W. japonica*, *W. labyrinthina*, *W. lenta*, *W. luteola*, *W. rubella*, *W. straminea*, *W. tropicalis*, and *W. unguiformis* (Cui and Dai 2006; Dai and Cui 2006; Núñez and Ryvar den 1999). Among the 4 species known in North America, 2 species were also reported from other continents while 9 of 12 species are hitherto unknown from other continents outside Asia. Perhaps *Wrightoporia* is not a monophyletic

genus, but its high diversity in Asia may suggest that at least several of the species originated in Asia.

Taiwanoporia is characterized by more or less echinulate and amyloid basidiospores and a monomitic hyphal system without clamp connections. In *Wrightoporia*, both species with monomitic hyphal system and those without clamp connections are included in the present concept. Therefore, one may take *Taiwanoporia* spp. as members of *Wrightoporia*. However, the combination of monomitic hyphal system and clampless generative hyphae as well as sappy context is unknown in the genus. I prefer not to broaden the generic concept of *Wrightoporia* further, and I conclude to accept *Taiwanoporia* as distinct from *Wrightoporia*.

A number of *Wrightoporia* spp. were recently described from East Asia (Cui and Dai 2006; Dai 1995; Dai and Cui 2006). A key to the *Wrightoporia* spp. hitherto reported from Asia is provided below.

A key to the species of *Wrightoporia* reported from Asia

- | | | | |
|--|----|---|------------------------|
| 1. Generative hyphae without clamp connections | 2 | 8. Basidiocarps annual, resupinate. | 9 |
| 1. Generative hyphae with clamp connections | 4 | 9. Pores light brown, 2–3/mm; gloeoplerous hyphae branching candelabrum-like toward the apex; basidiospores 4–4.5 × 3–3.3 μm. Known from Singapore. | <i>W. ramosa</i> |
| 2. Skeletal hyphae IKI–, gloeoplerous hyphae present; basidiocarps resupinate; pores pale orange to violet-brown; 5–7/mm; basidiospores 2.5–3.6 × 2–2.8 μm. Known from one subtropical area in Japan. <i>Wrightoporia</i> sp. | | 9. Pores white to light brown, 2–3/mm; gloeoplerous hyphae unbranched to sparsely branched; basidiospores 3.2–4 × 2.5–3 μm. Known from temperate areas in Asia, tropical and temperate areas in America. <i>W. avellanea</i> | |
| 2. Skeletal hyphae dextrinoid, gloeoplerous hyphae absent to sparse; pores larger. | 3 | 9. Pores buff-yellow, 5–8/mm; gloeoplerous hyphae unbranched; basidiospores 2.8–3.7 × 2–2.9 μm. Known from temperate to subtropical areas in China. | <i>W. luteola</i> |
| 3. Basidiocarps perennial, resupinate; pores lilac when fresh, 3–4/mm; gloeoplerous hyphae absent; basidiospores 3.5–3.9 × 2.7–3.2 μm. Known from one subtropical area in China. <i>W. casuarinicola</i> | | 10. Basidiocarps annual, resupinate; pores pale orange to light brown, irregular, 1–2/mm; basidiospores broadly ellipsoid, 3.5–4.5 × 2.5–3.2 μm. Known from Malaysia and Brunei. | <i>W. gyropora</i> |
| 3. Basidiocarps annual, resupinate to effused-reflexed; pores cream to pinkish, 2–4/mm; gloeoplerous hyphae present; basidiospores 4–6 × 3–4.2 μm. Known from one temperate area in China. <i>W. rubella</i> | | 10. Basidiocarps perennial, sessile; pores pale brown, 1–3/mm; basidiospores broadly ellipsoid to subglobose, 4.3–5.1 × 3.8–4.3 μm. Known from one subtropical area in China. | <i>W. unguliformis</i> |
| 4. Basidiocarps perennial, resupinate, woody hard; pores cream to pale brown, 6–8/mm; skeletal hyphae dextrinoid; thick-walled cystidia and thin-walled gloeocystidia present; basidiospores 3.2–4.2 × 2.5–3.4 μm. Known from tropical areas. <i>W. tropicalis</i> | | 11. With gloeoplerous hyphae in the trama. | 12 |
| 4. Basidiocarps annual or perennial; without thick-walled cystidia. | 5 | 11. Without gloeoplerous hyphae in the trama. | 14 |
| 5. All part of skeletal hyphae strongly dextrinoid. | 6 | 12. Basidiocarps resupinate; pores pale orange to light brown, irregular, 1–2/mm; hyphal system dimitic in the context; gloeoplerous hyphae SV+; basidiospores 3.5–4.5 × 2.5–3.5 μm. Known from a temperate area in Japan. <i>W. labyrinthina</i> | |
| 5. Contextual skeletal hyphae IKI– to weakly dextrinoid. | 11 | 12. Basidiocarps sessile to effused-reflexed; pores yellow to light orange, regular to irregular, 4–6/mm; hyphal system monomitic in the context; gloeoplerous hyphae SV–. | 13 |
| 6. With gloeoplerous hyphae in the trama. | 7 | 13. Basidiocarps sessile to effused-reflexed, context spongy, up to 5 mm thick; pores regular to almost irpicoid; gloeoplerous hyphae abundant; basidiospores 3–3.5 × 2–2.5 μm. <i>W. ochrocrocea</i> | |
| 6. Without gloeoplerous hyphae in the trama. | 10 | 13. Basidiocarps sessile, context felted-corky, up to 10 mm thick; pores regular, 4–5/mm; gloeoplerous hyphae sparse; basidiospores 2.8–3.8 × 2–3 μm. Known from Malaysia. [Amyloid gloeoplerous hyphae suggested by Hattori (2003) were not observed at reexamination of the holotype. Perhaps a distinctly pileate form of <i>W. ochrocrocea</i> .] <i>W. trametoides</i> | |
| 7. Basidiospores 4.8–6 × 4–5 μm; basidiocarps resupinate; pores white to cream, 2–3/mm. Known from temperate areas in Asia and America. <i>W. lenta</i> | 8 | 14. Tramal hyphae IKI–; basidiocarps resupinate; pores dark cream to pale cinnamon, 6–8/mm; basidiospores 3–4 × 2.5–3 μm. Known from Thailand. <i>W. cinnamomea</i> | |
| 7. Basidiospores up to 5 μm long. | 8 | 14. Tramal hyphae partly dextrinoid; basidiocarps sessile to resupinate; pores cream, yellowish to orange. | 15 |
| 8. Basidiocarps perennial, substipitate; pores white to ochraceous, 3–4/mm; basidiospores 3.5–4 × 3 μm. Known from Singapore. <i>W. dimidiata</i> | | 15. With SV+ gloeocystidia in hymenium; basidiocarps resupinate to effused-reflexed; pores grayish-orange to yellow-buff, 6–8/mm; basidiospores 2.8–3.5 × 1.9–2.6 μm. Known from one temperate area in Japan. <i>W. straminea</i> | |
| | | 15. Without gloeocystidia. | 16 |
| | | 16. Basidiocarps resupinate. | 17 |
| | | 16. Basidiocarps effused-reflexed to sessile. | 18 |
| | | 17. Pores light orange to brownish-orange, partly nodulous and uneven, 4–6/mm; basidiospores 3–4.2 × 2–3 μm. | |

Known from temperate to subtropical areas in Japan.

W. aurantipora

17. Pores grayish-orange to yellow-buff, 5–7 to 8–12/mm; basidiospores $2.2\text{--}3.3 \times 1.5\text{--}2.3$. Known from temperate to subtropical areas in Japan.

W. japonica

18. Basidiocarps usually resupinate to effused-reflexed, rarely sessile, up to 1.5 cm wide; basidiospores $2.2\text{--}3.3 \times 1.5\text{--}2.3$ μm .

W. japonica

18. Basidiocarps distinctly pileate, up to 3.5 cm wide; pores brownish-orange, 9–10/mm; basidiospores $2.8\text{--}3.5 \times 2\text{--}2.8$ μm . Known from Solomon Is.

W. solomonensis

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