

## ***Coltricia* (Basidiomycota, Hymenochaetaceae) in China**

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The paper summarises the knowledge on *Coltricia* species in China, where 11 species have been found. A key to the Chinese species of *Coltricia* is given, in which the statistical variation of the dimensions of at least 30 basidiospores is included. *Coltricia minor* Y.C. Dai, *C. subperennis* Y.C. Dai and *C. weii* Y.C. Dai are described as new to science. Illustrations of the micromorphological characters are given.

Key words: *Coltricia minor*, *C. subperennis*, *C. weii*, polypore, taxonomy

*Coltricia* Gray is characterised by annual, stipitate, yellowish to rust-brown basidiomata, mostly poroid hymenophores, a monomitic hyphal structure, simple septate generative hyphae, and smooth, slightly to distinctly thick-walled basidiospores. Some species grow on decayed wood, others on soil. The latter are thought to form a mycorrhizal association with pines and bearberry (Danielson 1984, Tedersoo *et al.* 2008).

Eight species of *Coltricia* were recorded from China previously (Zhao & Zhang 1992, Dai & Niemelä 2006, Dai *et al.* 2008). During a study on the hymenochaetaceous fungi from central and southern China, three undescribed species in *Coltricia* were found which are described within this paper. The descriptions are supplemented by illustrations of micromorphological characters. Additionally, specimens from all *Coltricia* species known from China have been studied. Based on these observations an identification key to Chinese *Coltricia* species is provided.

### **Materials and methods**

Specimens are deposited either at the herbarium of the Institute of Applied Ecology, Chinese Academy of Sciences (IFP) or the herbarium of Beijing Forestry University (BJFC). For light microscopy a Nikon

Eclipse E600 microscope (phase contrast) was used. Drawings were made with the aid of a drawing tube. Microscopic features, measurements and drawings were made from slide preparations stained with Cotton Blue and Melzer's reagent. Basidiospores were measured from sections cut from the tubes, when presenting large variation in the size of the spores, 5% of measurements were excluded from maximum and minimum the range, and are given in parentheses. In the text the following abbreviations are used: IKI = Melzer's reagent, IKI- = negative in Melzer's reagent, KOH = 5% potassium hydroxide, CB = Cotton Blue, CB+ = cyanophilous, CB(+) = weakly cyanophilous, L = mean spore length (arithmetic average of all spores), W = mean spore width (arithmetic average of all spores), Q = variation in the L/W ratios between the specimens studied, n = number of spores measured from given number of specimens. Special colour terms are from Petersen (1996) and Anonymous (1969).

### Taxonomy

*Coltricia minor* Y.C. Dai, **sp. nov.** (Fig. 1)  
(Mycobank number: MB 515565)

*Carpophorum* annuum, stipitatum; facies pororum cinnamomeum vel avellaneum; pori rotundi vel angulati, 2–3 per mm. Systema hypharum monomiticum, hyphae septatae sine fibulis, hyphae contexti 4–9  $\mu$ m in diametro. Sporae oblonge-ellipsoideae, IKI-, CB+, 5.5–6.8  $\times$  3.5–4  $\mu$ m.

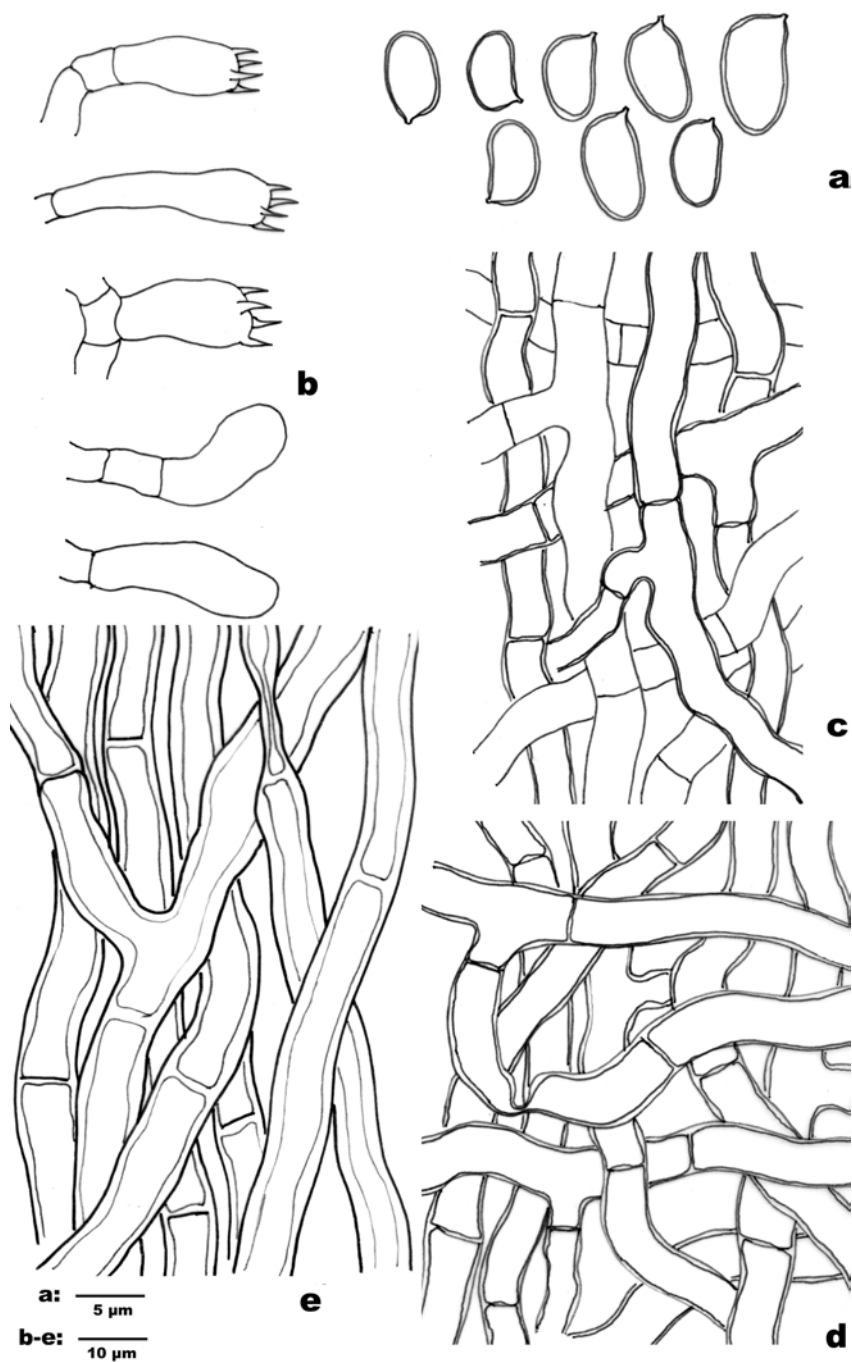
*Holotype*. — China. Hunan Prov., Chenzhou County, Mangshan Nature Reserve, on rotten angiosperm wood, 24.VI.2007 Li 1760 (IFP).

Other specimen (paratype) examined. — China. Hunan Prov., Chenzhou County, Mangshan Nature Reserve, on rotten angiosperm wood, 24.VI.2007 Li 1785 (IFP).

*Etymology*. — *minor* (Lat.), referring to the small basidiomes.

*Basidiomata* annual, laterally stipitate, without odour or taste when fresh, becoming soft corky upon drying. Pilei more or less fan-shaped to spatulate or semicircular, less than 0.5 cm in largest dimension, and less than 1 mm thick. Pileal surface umber when dry, velutinate to glabrous, azonate; margin thin, sharp, sometimes lobed, curving downwards or upwards when dry. Pores cinnamon to clay buff when dry; pores round to angular, 2–3 per mm; dissepiments thin, entire or slightly lacerate. Context cinnamon and soft corky when dry, up to 0.5 mm thick. Tubes concolorous with pore surface, fragile when dry, up to 0.5 mm long. Stipe umber brown, corky to brittle when dry, finely velutinate to glabrous, up to 5 mm long, 1 mm thick.

Hyphal system monomitic; all septa without clamp connections; tissue darkening but otherwise unchanged in KOH. Contextual hyphae yellowish-brown, thin- to fairly thick-walled with a wide lumen, occasionally branched, with frequent simple septa, flexu-



**Fig. 1.** Microscopic structures of *Coltricia minor* Y.C. Dai (drawn from the holotype). a: Basidiospores. b: Basidia and basidioles. c: Hyphae from the hymenophore. d: Context Hyphae. e: Hyphae from stipe.

ous, interwoven, 4–9  $\mu\text{m}$  diam.; hyphae of the pileipellis thin-walled, hyphal tips unbranched; hyphae in the stipe golden brown, thick-walled with a wide lumen, occasionally branched, with frequent simple septa, more or less constricted at the septa, regularly arranged, sometimes collapsed, 8–14  $\mu\text{m}$  diam. Hyphae in the hymenophore pale yellowish to yellowish-brown, thin- to slightly thick-walled with a large lumen, frequently branched and simple septate, loosely interwoven, 4–8  $\mu\text{m}$  diam. Basidia barrel-shaped to clavate, mostly with four sterigmata and a simple septum at the base,  $10\text{--}15 \times 6\text{--}7.5 \mu\text{m}$ ; basidioles similar in shape to basidia, but slightly smaller. Basidiospores mostly oblong-ellipsoid, some ellipsoid, slightly curved, variable, hyaline to very pale yellowish, thin to fairly thick-walled, smooth, IKI–, CB+,  $(5\text{--})5.5\text{--}6.8\text{--}(7.5) \times (3.4\text{--})3.5\text{--}4\text{--}(4.5) \mu\text{m}$ ,  $L = 6.04 \mu\text{m}$ ,  $W = 3.79 \mu\text{m}$ ,  $Q = 1.58\text{--}1.61$  ( $n = 60/2$ ).

*Coltricia minor* differs from other species of the genus in its tiny basidiomata and growth on angiosperm wood. The size of its basidiospores is variable, but their shape is usually consistent. Juvenile *Coltricia cinnamomea* is similar to *C. minor*, but the former has a central stipe (Gilbertson & Ryvarden 1986, Niemelä 2005). The tiny basidiomata of *Coltricia minor* resembles *Coltriciella pusilla* (Imazeki & Kobayasi) Corner, which occurs in East Asia (Corner 1991, Hattori & Ryvarden 1994), but it is distinguished from the former by its verrucose basidiospores.

***Coltricia subperennis* Y.C. Dai, sp. nov. (Fig. 2)**

(Mycobank number: MB 515566)

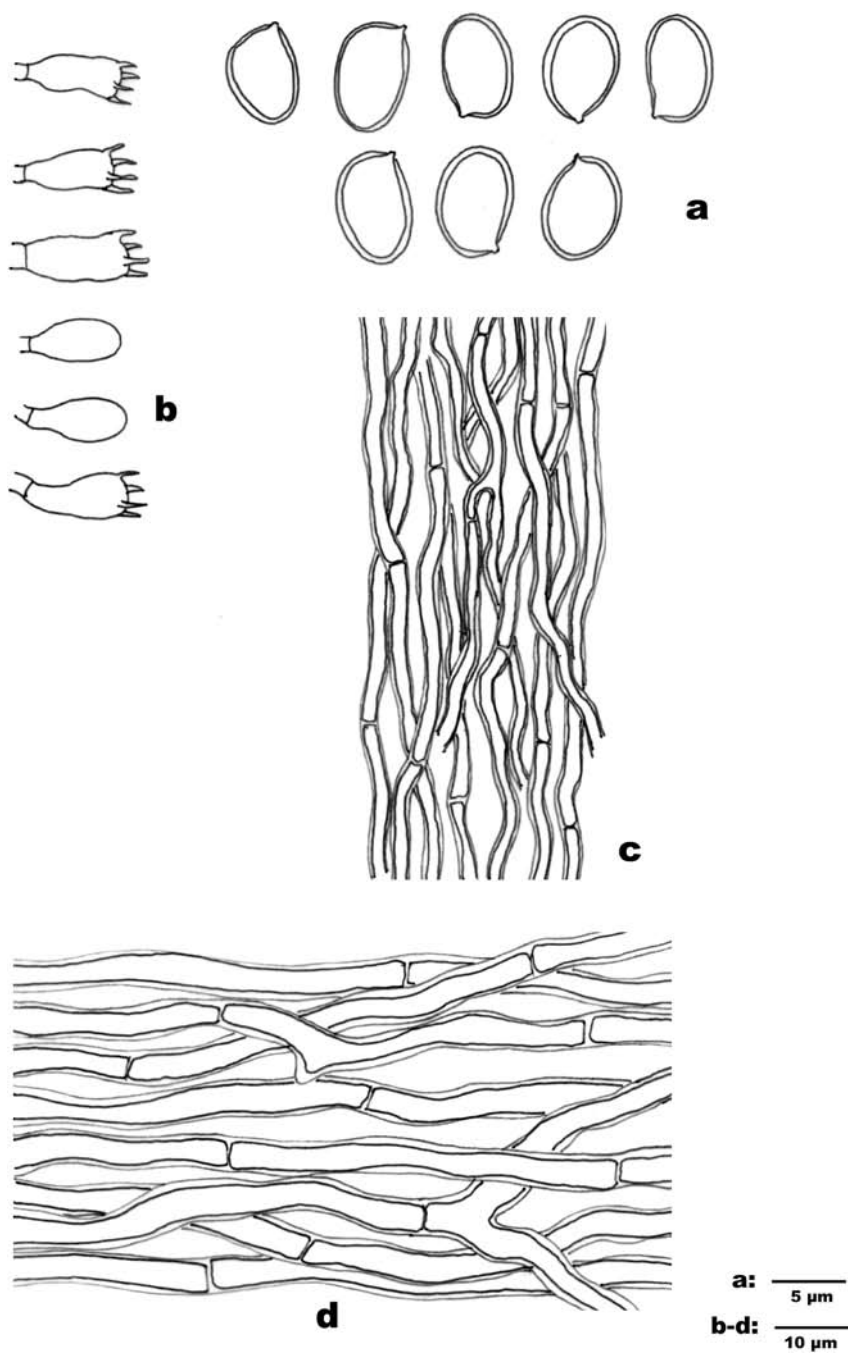
*Carpophorum annuum*, *stipitatum*; *facies pororum umbrinum*; *pori angulati vel rotundi*, 3–5 per mm. *Systema hypharum monomiticum*, *hyphae septatae sine fibulis*, *hyphae contexti* 4–6  $\mu\text{m}$  in diametro. *Sporae perlate ellipsoideae*, IKI–, CB(+),  $7.8\text{--}9 \times 5.3\text{--}6.1 \mu\text{m}$ .

Holotype. — China. Hainan Prov., Changjiang County, Bawangling Nature Reserve, on rotten angiosperm wood, 13.XI.2007 Yang 259 (IFP).

Other specimen (paratype) examined. — China. Yunnan Prov., Baoshan County, Gaoligongshan Nature Reserve, alt. 1800 m, 16.X.2003 Knudsen 03.557 (C-F-65135).

Etymology. — *subperennis* (Lat.), resembling *Coltricia perennis*.

Basidiomata annual, centrally stipitate, without odour or taste when fresh, becoming corky when dry. Pilei more or less circular to infundibuliform, up to 4 cm diam., 3 mm thick at centre. Pileal surface snuff brown to umber when dry, with distinctly concentric zones, finely velutinate to glabrous; margin thin, sharp, slightly curving downwards when dry. Pores umber when dry, shining; mostly angular, some round, not decurrent on stipe, 3–5 per mm; dissepiments thin, lacerate. Context umber and corky when dry, less than 1 mm thick. Tubes concolorous with pore surface, corky to slightly brittle when



**Fig. 2.** Microscopic structures of *Coltricia subperennis* Y.C. Dai (drawn from the holotype). a: Basidiospores. b: Basidia and basidioles. c: Hyphae from the hymenophore. d: Context Hyphae.

dry, up to 2.5 mm long. Stipe dark brown and hard corky when dry, velutinate, up to 6 cm long, 4 mm diam., stipe base sometimes swollen up to 6 mm. Hyphal system monomitic; all septa without clamp connections; tissue darkening but otherwise unchanged in KOH. Contextual hyphae golden-yellow, thick-walled with a wide lumen, rarely branched, with frequent simple septa, more or less straight, loosely interwoven, 4–6  $\mu\text{m}$  diam.; hyphae of the pileipellis thick-walled, unbranched at the top; hyphae in the stipe golden-brown, thick-walled with a wide lumen, rarely branched, with frequent simple septa, loosely interwoven, 5–10  $\mu\text{m}$  diam. Hyphae in the hymenophore brown, thick-walled with a distinct lumen, occasionally branched, frequently simple septate, straight, subparallel along the tubes or loosely interwoven, 3–4  $\mu\text{m}$  diam. Basidia more or less barrel-shaped, 10–14  $\times$  5–6.5  $\mu\text{m}$ ; basidioles pear-shaped, slightly smaller than basidia. Basidiospores broadly ellipsoid, yellowish, thick-walled, smooth, some collapsed, IKI–, CB(+), (7.5–)7.8–9(–9.5)  $\times$  (5–)5.3–6.1(–6.5)  $\mu\text{m}$ ,  $L = 8.25 \mu\text{m}$ ,  $W = 5.7 \mu\text{m}$ ,  $Q = 1.42\text{--}1.47$  ( $n = 60/2$ ).

*Coltricia subperennis* is characterised by a central stipe, undercurrent pores, narrow tramal hyphae, broadly ellipsoid basidiospores, and is a subtropical species. Macroscopically it is similar to *Coltricia perennis* as both species have similar pores. However, *Coltricia perennis* has wider tramal hyphae (5–10  $\mu\text{m}$  diam., Dai & Niemelä 2006); ellipsoid basidiospores, mostly less than 5  $\mu\text{m}$  in wide while *Coltricia subperennis* has narrower tramal hyphae; broadly ellipsoid basidiospores, mostly wider than 5  $\mu\text{m}$ . *Coltricia perennis* is a species from gymnosperm forests in temperate regions (Gilbertson & Ryvarden 1986, Ryvarden & Gilbertson 1993, Núñez & Ryvarden 2000), while *Coltricia subperennis* occurs in angiosperm forests in the subtropics.

***Coltricia weii* Y.C. Dai, sp. nov.** (Fig. 3)

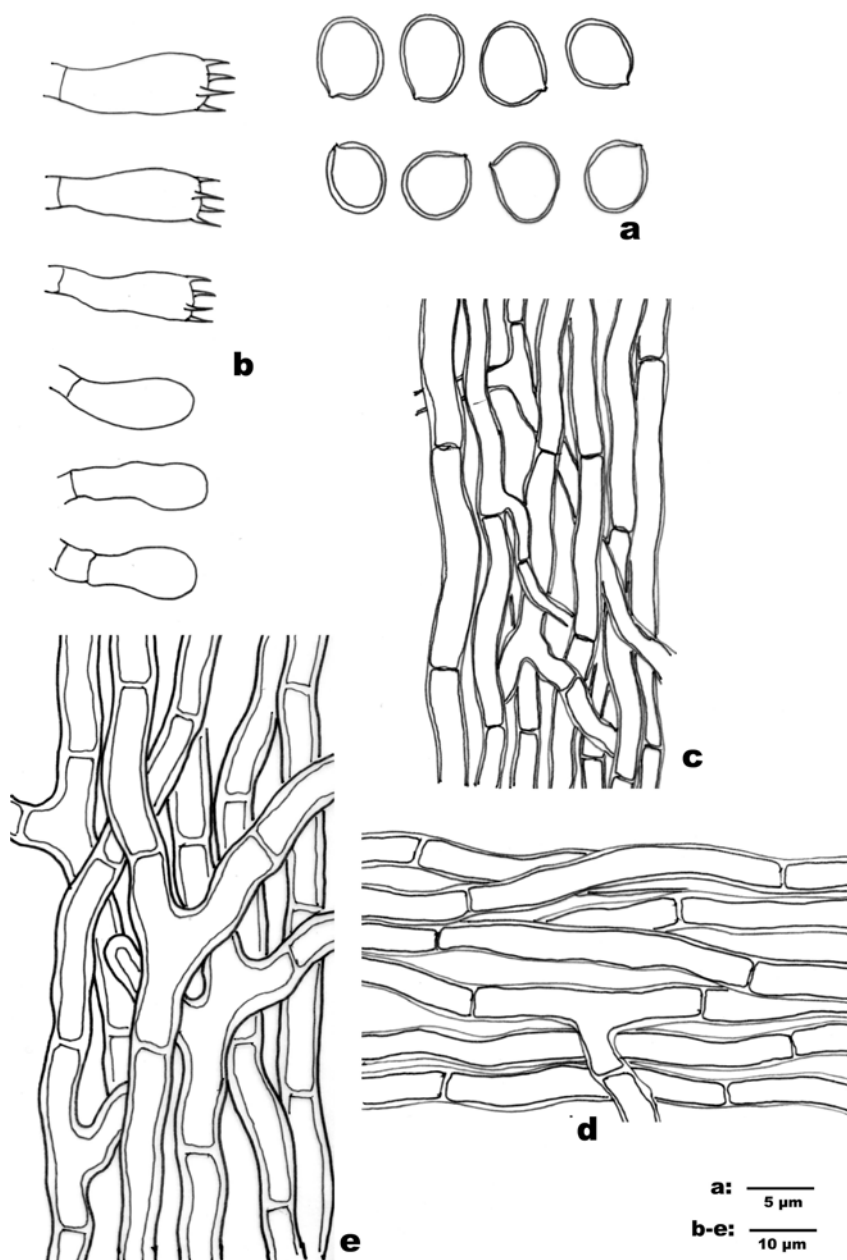
(Mycobank number: MB 515567)

*Carpophorum annuum, stipitatum; facies pororum melleum vel umbrinum; pori rotundi vel angulati, 3–4 per mm. Systema hypharum monomiticum, hyphae septatae sine fibulis, hyphae contexti 4–7  $\mu\text{m}$  in diametro. Sporae perlate ellipsoideae, IKI–, CB(+), 5.6–7.2  $\times$  4.3–5.5  $\mu\text{m}$ .*

Holotype. — China. Hunan Prov., Chenzhou County, Mangshan Nature Reserve, on ground in angiosperm forest, 26.VI.2007 Dai 8142 (IFP).

Other specimens (paratypes) examined. — China. Henan Prov., Nanyang County, Baotianman Nature Reserve, on ground in angiosperm forest, 22.VIII.2006 Li 957 & 959 (IFP). Qixingtian, on ground in mixed forest, 30.VIII.2005 Li 412 (IFP). Hunan Prov., Chenzhou County, Mangshan Nature Reserve, on ground in angiosperm forest, 26.VI.2007 Dai 8117 & 8143 (IFP); on ground in mixed forest, 24.VI.2007 Li 1721, 1723, 1748 & 1984 (IFP). Yunnan Prov., Chuxiong County, Zijixishan Nature Reserve, on ground in angiosperm forest, 2.VIII.2005 Yuan 1313 (IFP).

Etymology. — *Weii* (Lat.), Wei, in honor of the Chinese lichenologist and mycologist, Professor Wei, Jiang-Chun.



**Fig. 3.** Microscopic structures of *Coltricia weii* Y.C. Dai (drawn from the holotype).  
 a: Basidiospores. b: Basidia and basidioles. c: Hyphae from the hymenophore. d: Context Hyphae. e: Hyphae from stipe.



Basidiomata annual, centrally stipitate, without odour or taste when fresh, becoming corky when dry. Pilei circular to infundibuliform, up to 3 cm diam., 1.5 mm thick at centre. Pileal surface rust-brown when actively growing, becoming dark reddish-brown with age, umber when dry, with distinctly concentric zones, finely velutinate, sometimes lobed; margin cream when actively growing, thin, sharp, curved downwards when dry. Pores cinnamon-buff when actively growing, becoming umber with age or when dry; round to angular, slightly decurrent on stipe, 3–4 per mm; dissepiments thin, entire to slightly lacerate. Context umber and corky when dry, less than 0.5 mm thick. Tubes clay-buff, distinctly paler than pore surface, corky to slightly brittle when dry, up to 1 mm long. Stipe dark brown to umber and hard corky when dry, velutinate, up to 1.5 cm long, 2.5 mm diam.; stipe base sometimes swollen up to 3 mm. Hyphal system monomitic; all septa without clamp connections; tissue darkening but otherwise unchanged in KOH. Contextual hyphae golden-yellow, slightly thick-walled with a wide lumen, occasionally branched, with frequent simple septa, loosely interwoven, 4–7  $\mu\text{m}$  diam.; hyphae of the pileipellis in parallel bundles, thin to fairly thick-walled, sometimes with short double branching at the top; hyphae in stipe golden-brown, thick-walled with a wide lumen, frequently branched, with frequent simple septa, regularly arranged to loosely interwoven, 5–8  $\mu\text{m}$  diam. Hyphae of the hymenophore brownish, slightly thick-walled with a wide lumen, occasionally branched and frequently simple septate, loosely interwoven, 4–7  $\mu\text{m}$  diam. Basidia more or less barrel-shaped, 17–23  $\times$  7–8  $\mu\text{m}$ ; basidioles in shape similar to basidia, but slightly smaller. Basidiospores broadly ellipsoid, hyaline when juvenile, pale yellowish and thick-walled when mature, smooth, IKI–, CB(+), (5.2–)5.6–7.2(–7.6)  $\times$  (3.9–)4.3–5.5(–6)  $\mu\text{m}$ ,  $L = 6.36 \mu\text{m}$ ,  $W = 4.98 \mu\text{m}$ ,  $Q = 1.22\text{--}1.35$  ( $n=180/6$ ).

*Coltricia weii* is similar to *C. cinnamomea*. The latter species has larger pores (2–3 per mm) and basidiospores (China: 6.8–8.2  $\times$  5–6.2  $\mu\text{m}$ ,  $L = 7.66 \mu\text{m}$ ,  $W = 5.45 \mu\text{m}$ , North Europe: 6.9–8.1  $\times$  5.5–6.4  $\mu\text{m}$ ,  $L = 7.7 \mu\text{m}$ ,  $W = 6 \mu\text{m}$ , Niemelä 2005). Hyphae of the pileipellis are unbranched in *C. cinnamomea*, but dichotomously branched in *C. weii*. Besides, the two species have a different ecology: *C. cinnamomea* is species of mull soil in herb-rich forests (Niemelä 2005), while *C. weii* usually occurs in sandy soil in less herb-poor forests. *Coltricia confluens* P.J. Keizer, described from Europe (Keizer 1997) is closely related to *C. cinnamomea*, and somewhat similar to *C. weii*, but it has larger pores (1–2 per mm) and longer basidiospores 8–8.5  $\times$  5–5.5  $\mu\text{m}$ , Niemelä 2005). *Coltricia salpincta* (Cooke) G. Cunn., originally described from New Zealand has 3–5 per mm pores and 6–8  $\times$  4–5  $\mu\text{m}$  basidiospores of (Cunningham 1965). Corner (1991) indicated that basidiospores in the type were 7–8.5  $\times$  5–6.5  $\mu\text{m}$ . The species was found in Southeast Asia, and several varieties were proposed by Corner (1991). *Coltricia weii*



resembles *C. salpincta* in having similar pores and pilei, but the latter has a lateral stipe, shorter basidia ( $12\text{--}16 \times 5\text{--}6\text{ }\mu\text{m}$  (Cunningham 1965), larger basidiospores and less branched hyphae in the stipe (Corner 1991). *Coltricia strigosipes* Corner was described from Indonesia (Corner 1991), and it shares some similarities with *C. weii*. However, it has a larger and strigose stipe (45 mm long and 2–12 mm diam.), and its basidiospores are broader than those of *C. weii* ( $6\text{--}7.5 \times 5\text{--}6\text{ }\mu\text{m}$  vs.  $5.6\text{--}7.2 \times 4.3\text{--}5.5\text{ }\mu\text{m}$ ).

#### Key to species of *Coltricia* from China (with spore dimensions)

1. Hymenophore more or less concentrically lamellate.  
Spores  $(8.8\text{--})9\text{--}12(\text{--}12.7) \times (5\text{--})5.4\text{--}7(\text{--}7.7)\text{ }\mu\text{m}$ ,  $L = 10.58\text{ }\mu\text{m}$ ,  
 $W = 5.97\text{ }\mu\text{m}$ ,  $Q = 1.73\text{--}1.81$  ..... *C. montagnei* (Fr.) Murrill
- 1\*. Hymenophore more or less poroid ..... 2
2. Basidiocarp laterally stipitate, mature pileus < 0.5 cm diam.  
Spores  $(5\text{--})5.5\text{--}6.8(\text{--}7.5) \times (3.4\text{--})3.5\text{--}4(\text{--}4.5)\text{ }\mu\text{m}$ ,  $L = 6.04\text{ }\mu\text{m}$ ,  
 $W = 3.79\text{ }\mu\text{m}$ ,  $Q = 1.58\text{--}1.61$  ..... *C. minor* Y.C. Dai
- 2\*. Basidiocarp centrally stipitate, mature pileus  
> 0.5 cm diam ..... 3
3. Pores 1–2 per mm; basidiospores oblong-ellipsoid ..... 4
- 3\*. Pores 2–5 per mm; basidiospores ellipsoid, broadly ellipsoid  
or subglobose ..... 5
4. Dissepiments lacerate; basidiospores < 5.5  $\mu\text{m}$  wide  
Spores  $(7.5\text{--})8\text{--}10(\text{--}11) \times (3.8\text{--})4\text{--}5(\text{--}5.5)\text{ }\mu\text{m}$ ,  $L = 8.63\text{ }\mu\text{m}$ ,  
 $W = 4.6\text{ }\mu\text{m}$ ,  $Q = 1.8\text{--}1.97$  ..... *C. focicola* (Berk. & M.A. Curtis) Murrill
- 4\*. Dissepiments entire; basidiospores mostly > 5.5  $\mu\text{m}$  wide  
Spores  $(8.2\text{--})8.5\text{--}11.9(\text{--}13.2) \times (5.2\text{--})5.6\text{--}6.9(\text{--}7)\text{ }\mu\text{m}$ ,  $L = 9.62\text{ }\mu\text{m}$ ,  
 $W = 6.31\text{ }\mu\text{m}$ ,  $Q = 1.51\text{--}1.54$  ..... *C. tsugicola* Y.C. Dai & B.K. Cui
5. Basidiospores basically subglobose  
Spores  $(5.2\text{--})5.5\text{--}6.7(\text{--}7) \times (4.5\text{--})4.8\text{--}6(\text{--}6.2)\text{ }\mu\text{m}$ ,  $L = 6.25\text{ }\mu\text{m}$ ,  
 $W = 5.32\text{ }\mu\text{m}$ ,  $Q = 1.22\text{--}1.23$  ..... *C. sideroides* (Lév.) Teng
- 5\*. Basidiospores basically ellipsoid ..... 6
6. Basidiospores mostly > 9  $\mu\text{m}$  long  
Spores  $(8.9\text{--})9\text{--}10.3(\text{--}10.5) \times (5.5\text{--})5.7\text{--}6.8(\text{--}7)\text{ }\mu\text{m}$ ,  $L = 9.63\text{ }\mu\text{m}$ ,  
 $W = 6.08\text{ }\mu\text{m}$ ,  $Q = 1.58$  ..... *C. duportii* (Pat.) Ryvarden
- 6\*. Basidiospores mostly < 9  $\mu\text{m}$  long ..... 7
7. Growing in gymnosperm forests; basidiospores ellipsoid  
Spores  $(6\text{--})6.5\text{--}9(\text{--}10) \times (4\text{--})4.1\text{--}5(\text{--}6)\text{ }\mu\text{m}$ ,  $L = 7.41\text{ }\mu\text{m}$ ,  
 $W = 4.69\text{ }\mu\text{m}$ ,  $Q = 1.49\text{--}1.67$  ..... *C. perennis* (L.:Fr.) Murrill
- 7\*. Growing in angiosperm forests; basidiospores broadly  
ellipsoid ..... 8
8. Pores not decurrent on stipe; tramal hyphae 3–4  $\mu\text{m}$  diam.  
Spores  $(7.5\text{--})7.8\text{--}9(\text{--}9.5) \times (5\text{--})5.3\text{--}6.1(\text{--}6.5)\text{ }\mu\text{m}$ ,  $L = 8.25\text{ }\mu\text{m}$ ,  
 $W = 5.7\text{ }\mu\text{m}$ ,  $Q = 1.42\text{--}1.47$  ..... *C. subperennis* Y.C. Dai
- 8\*. Pores decurrent on stipe; tramal hyphae 4–9  $\mu\text{m}$  diam ..... 9

9. Basidiospores < 4 µm wide  
Spores (4.2–)4.7–5.8(–6.6) × (3.3–)3.4–4 µm, L = 5.2 µm,  
W = 3.82 µm, Q = 1.36 (n=30/1) ..... *C. pyrophila* (Wakef.) Ryvarden
- 9\*. Basidiospores > 4 µm wide ..... 10
10. Pores 2–3 per mm; upper hyphae of cap surface non-branched  
Spores (6.3–)6.8–8.2(–8.4) × (4.5–)5–6.2(–6.9) µm, L = 7.66 µm,  
W = 5.45 µm, Q = 1.39–1.42 ..... *C. cinnamomea* (Jacq.) Murrill
- 10\*. Pores 3–4 per mm; upper hyphae of cap surface double branched  
Spores (5.2–)5.6–7.2(–7.6) × (3.9–)4.3–5.5(–6) µm, L = 6.36 µm,  
W = 4.98 µm, Q = 1.22–1.35 ..... *C. weii* Y.C. Dai

Eleven *Coltricia* species have been found in China so far, among them *C. focicola* was previously reported in North and Central America (Gilbertson & Ryvarden 1986), and present Chinese collections (Dai 3105, Yuan 3162, Yuan 3179 in IFP) are the first record of the species outside of America. *Coltricia duportii* was reported only for the neotropics (Ryvarden 2004), and the same case of *C. pyrophila*, which was known from Africa only (Ryvarden & Johansen 1980). These two species were recently found in China (Dai *et al.* 2008), and the authentic specimens of them are deposited at the herbarium of the Institute of Applied Ecology, Chinese Academy of Sciences (IFP).

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