

## Two new species of dematiaceous hyphomycetes from Hubei, China

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A field trip was made to Houhe National Nature Reserve in Wufeng County, Hubei, China in August 2008. Among the fungal specimens collected were two undescribed species of dematiaceous hyphomycetes, *Scolecobasidium houhense* sp. nov. with conidia fusiform, minutely verruculose, brown, 3-septate, 26–31 × 4.5–5.5 µm and *Spadicoides wufengensis* sp. nov. with two kinds of conidia: 1-celled conidia, ventricose or ovoid, brown, smooth, 5.5–9 × 3–4.5 µm, and 3-celled conidia of synanamorph, obovoid, smooth, brown, truncate at base, 8.5–12 × 3.5–5 µm. The new fungal taxa are described and illustrated.

Keywords: anamorphic fungi, Houhe, Nature Reserve, taxonomy, type

Houhe National Nature Reserve (110° 22' E - 110° 52' E, 29° 59' N - 30° 10' N) is located in Wufeng Tujia Autonomous County, Hubei, China and covers an area of 40 964.9 ha (Song and Liu 1999, Li *et al.* 2005). It is at the eastern section of the Wuling Mountains and adjacent to Hupingshan National Nature Reserve in Hunan. This area is in the intermediate zone between the Central Asiatic tropical area and North subtropical area. Also, due to the minimal effect of Quaternary glaciation, the reserve is a refuge area for some species which are only native to China (Dang *et al.* 2004, Li *et al.* 2005). The reserve is rich in biodiversity and relic and rare species. There are at least 2292 species of vascular plants belonging to 233 families and 852 genera in the reserve. Among these plant species, 29 species are endangered species, such as *Davidia involucrata* Baillon, the dove tree (Song and Liu 1999, Li *et al.* 2005).

Fungi have rarely been investigated in the area (Zhuang *et al.* 2007), so a field trip was made to the Reserve to collect hyphomycetes in August 2008. Two new species were discovered and described.

### Materials and Methods

Conidiophores and conidia of the fungi were mounted in lactofuchsin (0.1 g acid fuchsin, 100 mL 85 % lactic acid) (Carmichael 1955).

Microscopic observations were made under an Olympus BX 40 compound microscope equipped with phase contrast and Nomarski differential interference contrast optics. Measurements of the fungal structures were statistically analyzed with Microsoft Office Excel 2007 with 95 % confidence interval of means and presented as mean  $\pm$  standard deviation. 'Q' is length/width ratio. Photomicrographs were taken with an Olympus Microfire digital camera (Goleta, CA). Herbarium acronyms follow Index Herbariorum (Holmgren & Holmgren 1998).

### Taxonomy

*Scolecobasidium houhense* D. W. Li & Jingyuan Chen, anam. **sp. nov.**  
– Figs. 1 – 6.

Mycobank no.: MB 515104

Teleomorph. – unknown.

Conidiophora simplicia, solitaria, erecta, nonramosa, erecta vel flexuosa, 1-septata, laevia, pallide brunnea, (11)  $22 \pm 2.0$  (35)  $\mu\text{m}$  longa, (2.5)  $3.1 \pm 0.1$  (3.5)  $\mu\text{m}$  crassa. Cellulae conidiogenae in conidiophoris connatae, polyblasticae aliquando monoblasticae, cylindricae, pallide brunneae, denticulatae, laeviae. Conidia acropseudogena, singularia, fusiformia, pallide brunnea, inconspicue verruculosa, 3-septata, leviter, constricta ad septa media, (26)  $28 \pm 2.3$  (31)  $\mu\text{m}$  longa, (4.5)  $5.2 \pm 0.03$  (5.5)  $\mu\text{m}$  crassa. Teleomorphosis ignota.

Holotypus. – BPI 880188 (= WF 08275), in folium mortuum, Houhe, Wufeng, Hubei Provincia, Sina, coll. 28 Aug 2008.

Description – Conidiophores distinct, solitary, determinate, erect, unbranched, -flexuous or straight, smooth, pale brown, 1-septate, (11–)  $22 \pm 2.0$  (–35)  $\times$  (2.5–)  $3.1 \pm 0.1$  (–3.5)  $\mu\text{m}$  ( $n = 11$ ) (Figs. 1 – 4). – Conidiogenous cells polyblastic or monoblastic, terminal, integrated, denticulate, (10–)  $19.5 \pm 5.9$  (–31)  $\times$  (2.5–)  $3.1 \pm 0.3$  (–3.5)  $\mu\text{m}$  ( $n = 11$ ), bearing 1–5 denticles; denticles long, narrow cylindrical, (0.5–)  $1.4 \pm 0.1$  (–1.9)  $\times$  (1–)  $1.1 \pm 0.03$  (–1.2)  $\mu\text{m}$  ( $n = 11$ ) (Figs 1 – 4). – Conidia apical and lateral, fusiform, minutely verruculose, brown, 3-septate, two central cells darker than the end cells; bearing a dark denticle on basal end, (26–)  $28 \pm 2.3$  (–31)  $\times$  (4.5–)  $5.2 \pm 0.03$  (–5.5)  $\mu\text{m}$ ,  $Q = (5.0\text{--}) 5.4 \pm 0.1$  (–6.0) ( $n = 30$ ), slightly constricted at median septum (Figs. 4 – 6).

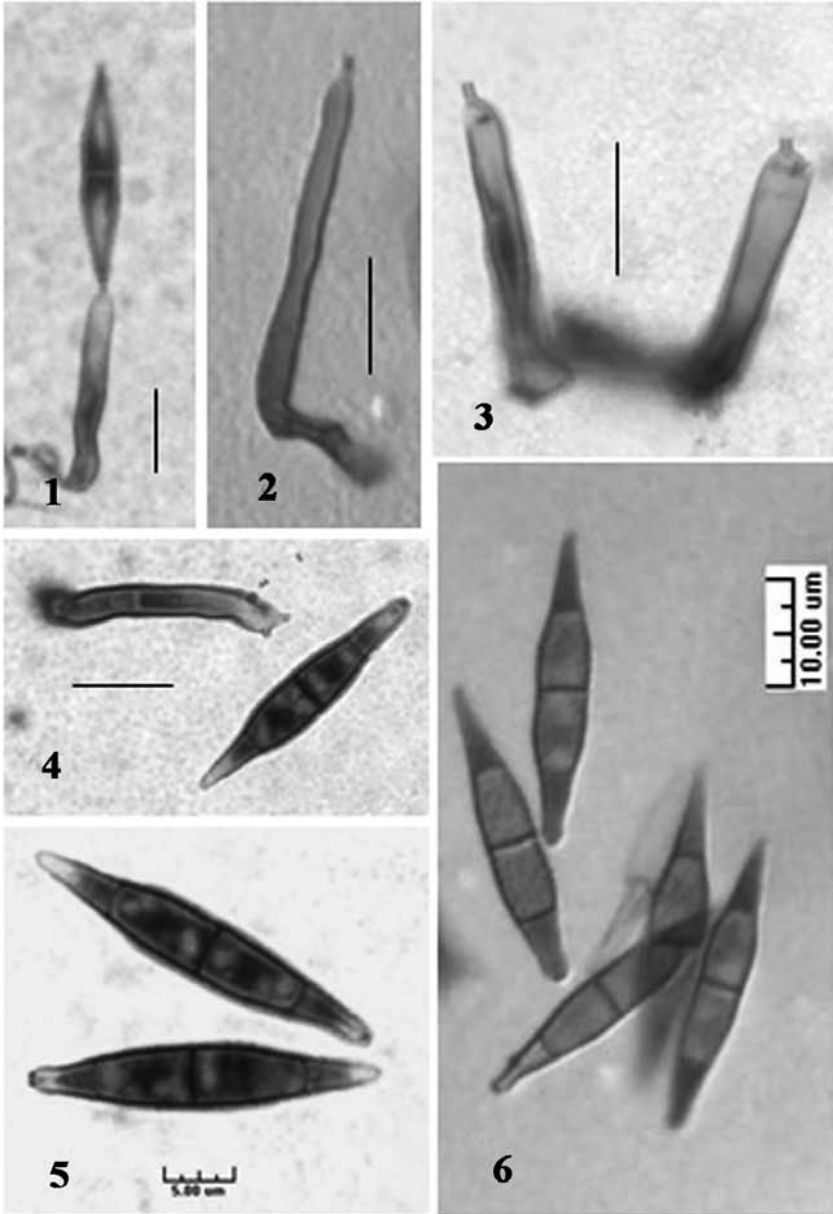
Etymology. – Referring to place where the holotype was collected.

Habitat or Host plant. – Saprobic on fallen leaves of (?) *Sycopsis sinensis* Oliver.

Distribution. – Houhe, Wufeng, Hubei, China.

Material examined. – *Scolecobasidium houhense* D. W. Li & Jingyuan Chen: CHINA, Hubei, Wufeng, Houhe National Nature Reserve, 28 Aug 2008, *leg. et det.* De-Wei Li, holotype (BPI 880188) (= WF 08275).

Holotypus. – BPI 880188 (= WF 08275), on the lower side of dead leaf of (?) *Sycopsis sinensis* Oliver, Houhe, Wufeng, Hubei, China, coll. 28 Aug 2008.



**Figs. 1–6.** – *Scolecobasidium houhense* (holotype): **1.** Conidiophore and young conidium. **2.** Monoblastic conidiophore. **3.** Polyblastic conidiophores. **4.** Polyblastic conidiophore with a septum and a mature conidium. **5–6.** Verruculose conidia. Figs. 1–4, 6: bars = 10 µm; Fig. 5: bar = 5 µm.

***Spadicoides wufengensis*** D. W. Li & Jingyuan Chen, **anam. sp. nov.** – Figs. 7 – 17.

MycoBank no.: MB 515105

Teleomorph. – unknown.

Conidiophora macronemata, mononematica, solitaria, determinata, erecta, simplicia, 112  $\mu\text{m}$  longa, (4.2–)  $5.8 \pm 0.3$  (–6.8)  $\mu\text{m}$  lata, multi-septata, levia, brunnea; cellulae conidiogenae polytreticae, terminals et intercalares, integrata, poris manifestis praeditae. Conidia solitaria, ventricosea vel ovoidea, pallide brunnea, levia, nonseptata, (5.5–)  $6.8 \pm 0.1$  (–9)  $\times$  (3–)  $3.8 \pm 0.1$  (–4.5)  $\mu\text{m}$ . Synanamorphosis: conidia obovoidea, levia, 2-septata, (8.5)  $10.0 \pm 0.2$  (12)  $\times$  (3.7)  $4.2 \pm 0.1$  (5.1)  $\mu\text{m}$ . Teleomorphosis ignota.

Holotypus. – BPI 880187 (= WF 08240), superficie in ligno, Houhe, Wufeng, Hubei Provincia, Sina, coll. 28 Aug 2008.

Description – Conidiophores distinct, solitary, determinate, erect, unbranched, straight, smooth, multiseptate, thick-walled, dark brown, up to 112  $\mu\text{m}$  tall, (4–)  $5.8 \pm 0.3$  (–7)  $\mu\text{m}$  wide at the middle, fertile at upper portion, predominantly 4 conidiogenous cells at apical portion (Figs. 7 – 13). – Conidiogenous cells integrated, polytretic, terminal and intercalary, with minute pores visible after conidial secession (Figs. 8 – 13). – Conidia apical and lateral, 1-celled, ventricose or ovoid, brown, smooth, thick-walled, developed in a whorl of 3–5 cells at distal end of conidiogenous cell, (5.5–)  $6.8 \pm 0.1$  (–9)  $\times$  (3–)  $3.8 \pm 0.1$  (–4.5)  $\mu\text{m}$ ,  $Q = (1.5\text{--}) 1.7 \pm 0.05$  (–2.5) ( $n = 30$ ) (Figs. 7 – 11, 14 – 15). Synanamorph: developed on a conidium, solitary, obovoid, smooth, thick-walled, brown, truncate at base, (8.5–)  $10 \pm 0.2$  (–12)  $\times$  (3.5–)  $4.2 \pm 0.1$  (–5)  $\mu\text{m}$ ,  $Q = (2.0\text{--}) 2.4 \pm 0.04$  (–3) ( $n = 30$ ), 2- or occasionally 3-septate, with a proximal euseptum and a distal distoseptum, slightly constricted at median septum (Figs. 7, 14, 16 – 17).

Etymology. – Referring to the county where the holotype was collected.

Habitat or Host plant. – Saprobic on partially decayed wood of an unknown tree.

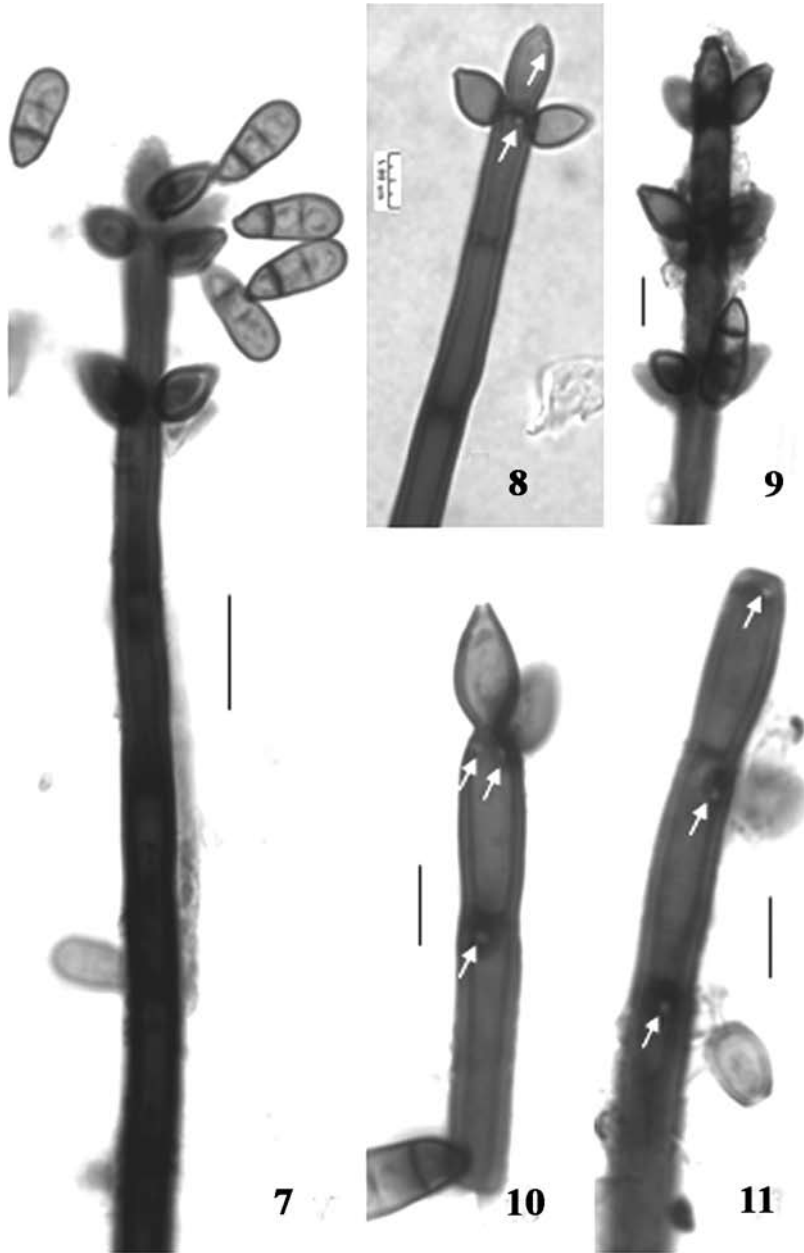
Distribution. – Houhe, Wufeng, Hubei, China.

Material examined. – ***Spadicoides wufengensis*** D. W. Li & Jingyuan Chen: CHINA, Hubei, Wufeng, Houhe National Nature Reserve, 28 Aug 2008, *leg. et det.* De-Wei Li holotype (BPI 880187) (= WF 08240).

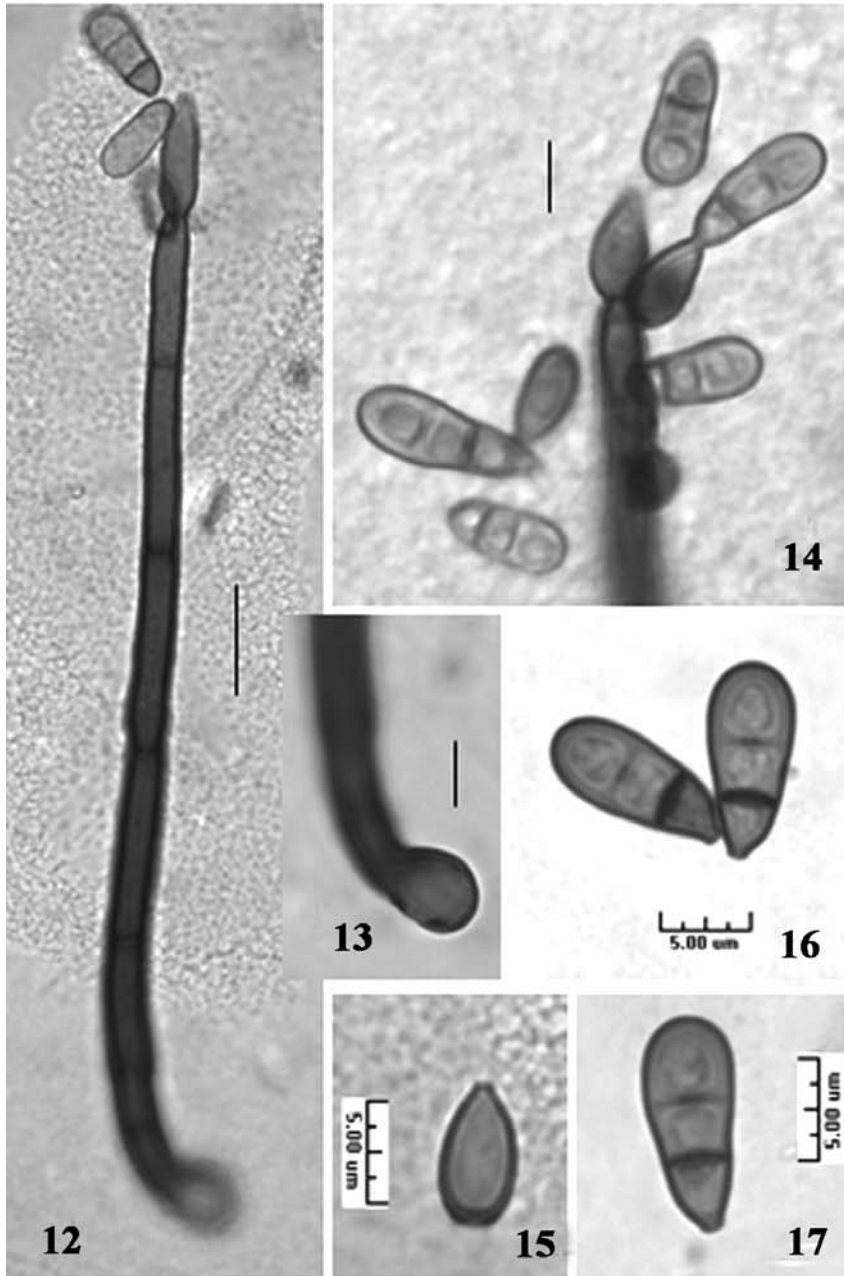
Holotypus. – BPI 880187 (= WF 08240), on partially decayed wood, Houhe, Wufeng, Hubei, China, coll. 28 Aug 2008.

## Discussion

*Scoleobasidium* was erected by Abbott (1927) and is characterized by rhexolytic conidial separation, denticulate, and pigmented conidia (Abbott 1927, De Hoog 1985). De Hoog and von Arx (1973) proposed a new genus, *Ochroconis*, to accommodate the species of *Scoleobasidium* which develop conidia in shapes other than trilobate. They



**Figs. 7–11.** – *Spadicoides wufengensis* (holotype): **7.** Conidiophore and conidia of synanamorphs. **8.** Apical portion of a conidiophore bearing conidia and pale colored conidiogenous pores (arrowed). **9.** Apical portion of a conidiophore bearing three whorls of conidia. **10.** Apical portion of a conidiophore showing polytretic conidiogenous cells, conidia, and conidiogenous pores (arrowed). **11.** Apical portion of a conidiophore with conidiogenous pores (arrowed). Fig. 7: bars = 10 µm; Fig. 8–11: bar = 5 µm.



**Figs. 12–17.** – *Spadicoides wufengensis* (holotype): **12.** Conidiophore and conidia. **13.** Basal portion of a conidiophore. **14.** Apical portion of a conidiophore with synanamorphic conidia. **15.** 1-celled conidium. **16.** 3-celled conidia of synanamorph showing a proximal euseptum and a distal distoseptum. **17.** 3-celled conidium of synanamorph. Fig. 12: bars = 10 µm; Figs. 13–17: bar = 5 µm.

restricted *Scolecobasidium* to the species with only trilobate conidia for practical reasons, not natural relationships (De Hoog 1985). A study using SSU and ITS regions of rDNA on 47 strains of *Scolecobasidium* spp. and *Ochroconis* spp. failed to clarify whether separating *Ochroconis* from *Scolecobasidium* is justified due to the fact that the type culture of *Sc. terreum* (CBS 203.27) is sterile (Horrè *et al.* 1999). *Scolecobasidium terreum* (CBS 203.27) was remarkably different from all remaining strains. However, three other strains of *Sc. terreum* CBS 423.64, 536.69 and IMI 102118 were closely related to *O. constricta* (CBS 202.27), the type species of *Ochroconis*. The sterile type culture of *Sc. terreum* (CBS 203.27) makes it impossible to examine morphological characters of conidia in comparison with the trilobate conidia of the other three strains of *Sc.-terreum*-like fungi. Since *Scolecobasidium* is the earlier name, in the opinion of the authors *Scolecobasidium* should be used for the new taxon until the segregation of *Ochroconis* from *Scolecobasidium* is proved to be justified with further studies on phylogenetic relationships of the two genera.

Similar to *Scolecobasidium houhense*, *Sc. acanthacearum* (Cooke) M. B. Ellis, *Sc. curvisporum* Matsush., *Sc. obovatum* Matsush., *Sc. flagellisferum* Matsush. (1993), and *Sc. variabile* Barron & Busch, all develop brown and 4-celled conidia (Matsushima 1971, 1993). *Scolecobasidium houhense* can be differentiated from these species by morphological characters of conidia. *Scolecobasidium acanthacearum* conidia are slightly curved, lighter color (hyaline to very pale brown), smaller size (10–18 × 3–4 µm), and non-rostrate (Ellis 1976). The curved conidia of *Sc. curvisporum*, obovoid to cylindrical conidia of *Scolecobasidium obovatum*, cylindrical to ellipsoid conidia of *Sc. variabile*, and conidia with a flagelliform apical cell of *Sc. flagellisferum* are delineating characters in comparison with the fusiform conidia of *Sc. houhense* (Ellis 1971; Matsushima 1971, 1993). *Scolecobasidium fusiforme* Matsush. has brown, rough, and fusiform conidia. However, the key character to differentiate the two species is the 2-celled conidia of *Sc. fusiforme* (Matsushima 1991) and 4-celled conidia of *Sc. houhense*. *Scolecobasidium tricladiatum* Matsush. develops 4-celled conidia on b/c culture (Modified CMA with banana leaf tissue) and stauroform (tricladiate) on natural substrate, but its 4-celled conidia are not pointed at the ends (Matsushima 1971). In addition to the differences in conidial morphology, *Sc. tricladiatum* develops irregularly branched, moniliform conidiophores (Matsushima 1971), while *Sc. houhense* has unbranched, non-moniliform conidiophores.

Four new taxa, *Scolecobasidium ellipticum* H.M. Liu & T.Y. Zhang, *Scolecobasidium microsporum* H.M. Liu & T.Y. Zhang, *Scolecobasidium laeve* Y.L. Jiang & T.Y. Zhang, and *Scolecobasidium tuberculatum* Y.M. Wu & T.Y. Zhang, were discovered and described from China recently (Liu and Zhang 2006, Jiang and Zhang 2008, Wu and Zhang 2008). Among the four, only *Scolecobasidium ellipticum* devel-

ops (0–) 3-septate conidia, but its smaller and ellipsoid conidia separate it from *Sc. fusiforme*.

The key character of *Spadicoides wufengensis* is that this species develops synanamorphs. This species is differentiated from the other synanamorph-producing species of *Spadicoides heterocolorata* (R.F. Castañeda, Guarro & Cano) Goh & K.D. Hyde and *Sp. obclavata* Kuthub. & Nawawi by the morphology of the two kinds of conidia. The synconidia (i.e., dimorphic conidia developed on the same conidiophore with the conidia developed first to serve as conidiogenous cells on which synanamorphic conidia are developed) of both *Sp. heterocolorata* and *Sp. obclavata* are *Selenosporella*-like microconidia, while synconidia of *Sp. wufengensis* are 2-septate, thick walled, and pale brown (Kuthubutheen and Nawawi 1991, Castañeda *et al.* 1997, Goh and Hyde 1999). Both *Sp. wufengensis* and *Sp. hodgekissa* W.H. Ho, Yanna & K.D. Hyde develop conidia with a proximal euseptum and a distal distoseptum and similar in shape. However, the latter does not develop synanamorphs (Ho *et al.* 2002).

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