Orbiliaceous fungi from Tibet, China

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Liu, B., Liu, X.Z., Zhuang, W.Y. and Baral, H.O. (2006). Orbiliaceous fungi from Tibet, China. Fungal Diversity 22: 107-120.

Eight species of the *Orbiliaceae* are reported for the first time from Tibet. Among them, *Orbilia bomiensis* sp. nov. and *Orbilia milinana* sp. nov. are new species and *O. coccinella* (s. auct. = *O. alnea*), *O. rectispora* and *O. scolecospora* are new records to China. Detailed illustrated descriptions are given for the new species and for some of the newly recorded species. For *O. scolecospora*, it is also the first record since the original description. A key for Chinese species of *Orbiliaceae* is provided.

Key words: new Chinese records, *Orbilia bomiensis*, *Orbilia milinana*, Orbiliaceae, taxonomy

Introduction

The family *Orbiliaceae* was established by Nannfeldt and is characterized by small, waxy, light-colored and semi-translucent apothecia. *Orbilia* and *Hyalorbilia* are the only genera currently accepted in the family (Baral, 1994; Kirk *et al*., 2001). The family has rarely been studied in China. Only six taxa, *viz*. *Orbilia auricolor* (A. Bloxam ex Berk. & Br.) Sacc., *O. sarraziniana* Boud., *O. delicatula* (P. Karst.) P. Karst., *O. inflatula* (P. Karst.) P. Karst. (= *Hyalorbilia inflatula* (P. Karst.) Baral & G. Marson), *O. luteorubella* (Nyl.) P. Karst. and *Orbilia epipora* (Nyl.) P. Karst. (re-examination of specimens previously reported as *O. xanthostigma* (Fr.) Fr.) were previously recorded from China before our systematic study (Teng, 1939; Zhuang and Korf, 1989; Zhuang, 1997, 1999; Zhuang and Wang, 1998a,b; Zhuang and Hyde, 2001). We have been surveying the orbiliaceous fungi throughout the country since 2002. Recently, two new species were found and described from Beijing, *viz*. *Hyalorbilia brevistipitata* and *Orbilia querci*, their anamorphs

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were assigned to *Dactylella* and *Dactylellina* separately, and named as *Dactylella brevistipitata* and *Dactylellina querci* (Liu *et al.* 2005a,b). So far, to our knowledge, the anamorphs of *Orbiliaceae* have been founded in about twelve hyphomycetous genera, including nematode-trapping fungi and other related fungi (Pfister 1994, 1997; Kohlmeyer *et al*. 1998; Mo *et al*., 2005).

Tibet is located in the Qinghai-Tibet Plateau in the southwest of China. The Plateau is well-known for its rich and special biological diversity. During the survey of the orbiliaceous fungi from Tibet in the summer of 2004, seven species of *Orbilia* and one of *Hyalorbilia* were identified. Among them, *Orbilia bomiensis* and *O. milinana* are described as new species. *Orbilia coccinella* (Sommerf.) P. Karst. s. auct. (= *O. alnea* Velen.), *O. rectispora* (Boud.) Baral and *O. scolecospora* (Beaton) Baral are reported for the first time from China. All these species are reported for the first time from Tibet.

Materials and methods

Methods used for specimen collection, anamorph isolation from fresh specimen and examination of apothecia are given in Liu *et al*. (2005a,b). The living ascospores were observed according to Baral (1992). Living ascospores are indicated as "living state", which are recognized by the visibility and refractivity of the spore body, and the disappearance of the spore body when influenced by lethal mountants or by heating over a flame. Living asci are recognizable by the ample vacuolar water around the spores, and by their shrinkage when adding lethal mountants or when heating. Observations, measurements, and photographs were taken with a Nikon 80i microscope of differential interference contrast (DIC). All specimens studied are deposited in the Mycological Herbarium, Institute of Microbiology, Chinese Academy of Sciences (HMAS). The anamorph cultures of the species were attempted, but no cultures were obtained.

Results

Hyalorbilia inflatula (P. Karst.) Baral & G. Marson, Micologia 2000: 44 (2001).

≡ *Orbilia inflatula* (P. Karst.) P. Karst., Notiser ur Sällskapets pro Fauna et Flora Fennica Forhändlinger 11: 248 (1870).

Specimens examined: CHINA, Tibet, Bomi, on rotten wood and bark of an unidentified plant, altitude 3100m, B. Liu & X.Z. Liu, 16 July 2004, HMAS 96797; Linzhi, on rotten wood and bark of an unidentified plant, altitude 3100m, B. Liu & X.Z. Liu, 13 July 2004, HMAS 96826; Bomi, on rotten wood of *Quercus aquifolioides*, altitude 3100m, B. Liu & X.Z. Liu, 16 July 2004, HMAS 96789; Bomi, on rotten wood of an unidentified plant, altitude 3500m, B. Liu & X.Z. Liu, 17 July 2004, HMAS 96806; Bomi, Lulang, on bark of an unidentified plant,

altitude 3200m, B. Liu & X.Z. Liu, 18 July 2004, HMAS 96788; Bomi, Lulang, on rotten wood of an unidentified plant, altitude 3200m, B. Liu & X.Z. Liu, 18 July 2004, HMAS 96783.

Notes: This is a species widely distributed in China. Baral & G. Marson transferred it from *Orbilia* to *Hyalorbilia* according to their new taxonomic treatments (Baral and Marson, 2001). Teng (1939) reported the first Chinese species of *Orbilia*, viz. *O. sinuosa* Penz. & Sacc., is a synonym of *H. inflatula*.

Orbilia auricolor (Blox. ex Berk.) Sacc. Syll. Fung. 8: 625 (1889).

Specimen examined: CHINA, Tibet, Bomi County, Lulang, on rotten wood of unidentified plant, altitude 3500m, B. Liu & X.Z. Liu, 18 July 2004, HMAS 96824.

Notes: *Orbilia auricolor* have been connected to four different *Arthrobotrys* species (Pfister, 1994, 1997; Mo *et al*., 2005). We also isolated three different species of *Arthrobotrys* from *O. auricolor* specimens collected from Anhui, Beijing, Heilongjiang and Yunnan. These evidences show that *O. auricolor* is a species complex, which is difficult to distinguish by morphological characters of teleomorph. Re-examination of specimens previously reported as *O. curvatispora* Boud and *O.* cf. *fimicola* from China (Zhuang and Korf, 1989; Zhuang and Wang, 1998a), both of them are morphologically indistinguishable from *O. auricolor*, and they are treated as synonym of *O. auricolor*.

Orbilia bomiensis B. Liu, X.Z. Liu & W.Y. Zhuang, **sp. nov.** (Fig. 1)

MycoBank number: MB500931.

Etymology: The specific epithet refers to the collection site of the fungus.

Apothecia 0.5-2 mm diam., superficialia, dispersa, sessilia, translucentia, aurantio-aurea, disco plano vel concavo, margine disci refractive dentataque. *Asci* (in statu emortuo) 38.1-45(-63.2) × (3.1-)3.5-4.7 µm, 8-spori, anguste cylindrico-clavati, basi angustati, apice rotundati. *Ascosporae* hyalinae, nonseptatae, valde sigmoideae, apice acutae, basi semper curvatae, 10-13.4 × 1.5-1.7 µm (in statu vivo), intus ad apicem versus cum corpusculo globoso refringente, 0.7-0.9 µm diam. *Paraphyses* hyalinae, filiformes, 1.5-2 µm diam., apice usque 2-2.5 µm diam.

Apothecia superficial, scattered, flat or slightly concave, translucent, bright orange when fresh, reddish-orange when dry, 0.5-2 mm diam., broadly sessile or with a short stipe 150 × 150 µm at the base; margin finely dentate with hyaline, more or less conglutinate and glassy hairs; hairs with a strongly refractive solid part (15-)40-70 × 3-5 µm, cohering to form irregular denticulations. *Medullary excipulum* of textura angularis to textura intricata, 15-25 µm thick. *Ectal excipulum* of *textura globulosa* to *textura angularis*, 20-150 µm thick near base and 20 µm near margin; cells hyaline, 5.5-15 × 3.5-8 µm. *Asci* (dead state) 38.1-45.0(-63.2) × (3.1-)3.5-4.7 µm, 8-spored, cylindrical-clavate, apex rounded or truncate, tapered below, sometimes T-or L-shaped at base. *Ascospores* hyaline, non-septate, 10-13.4 × 1.5-1.7 µm (living state in situ), strongly helicoid, S-shaped in side view, with one end

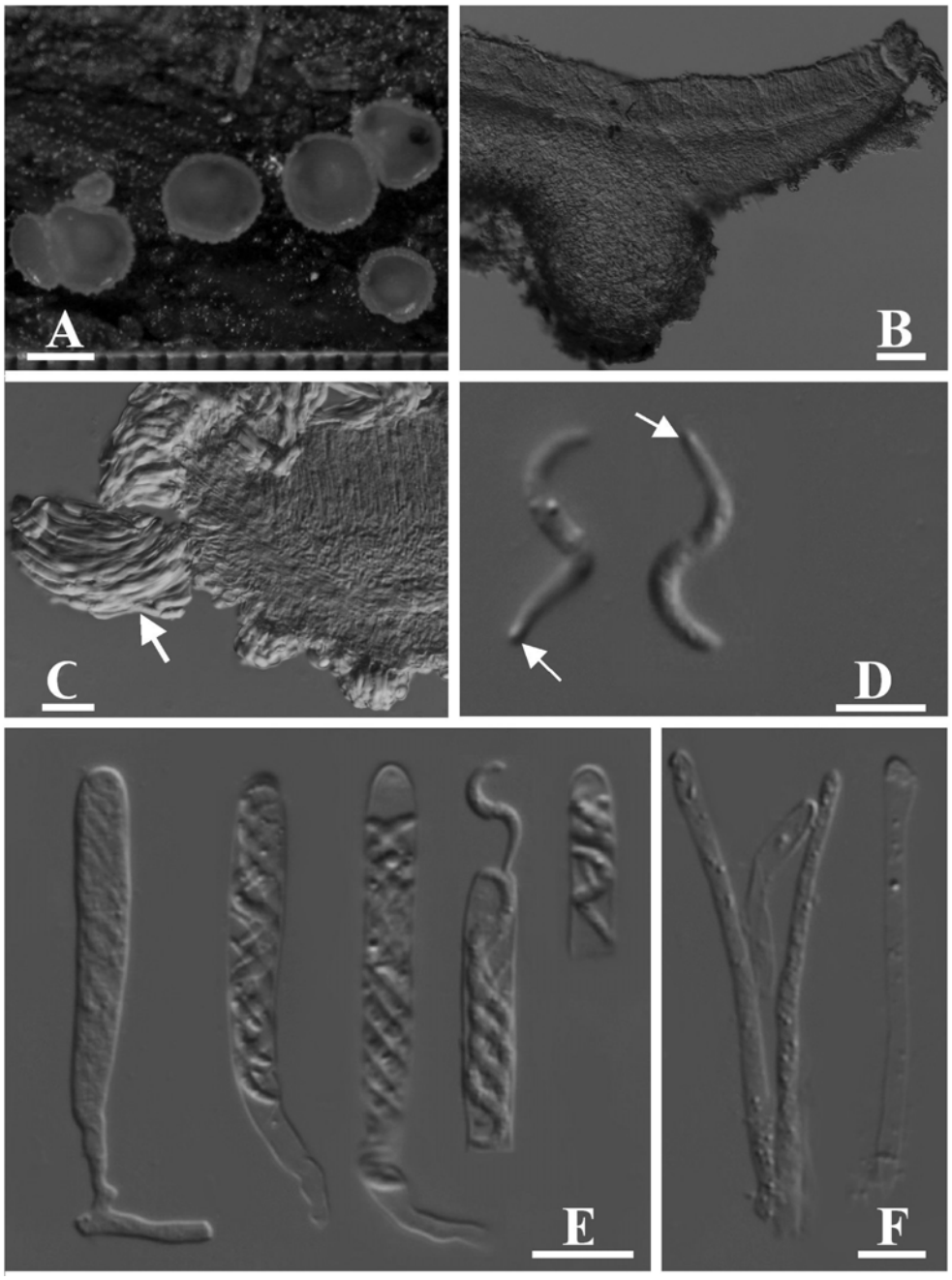

Fig. 1. *Orbilia bomiensis* (from holotype, HMAS 96790) **A**. Fresh apothecia. **B, C.** Vertical sections of apothecia, arrow indicating marginal hairs. **D.** Living ascospores, arrow indicating the spore body. **E.** Asci. **F.** Paraphyses. Bars A = 1 mm; B = 50 μm; C= 20 μm; D= 5 μm; E = 10 μm; F = 5 μm.

obtuse and curved, and one acute and more straight, strongly spirally twisted within asci as well as outside, the four upper spores oriented to ascus apex with their obtuse end, the lower four with their acute end; spore body (SB) globose, 0.7-1 µm diam., situated in the acute end of the spore. *Paraphyses* hyaline, filiform, 1.5-2 µm in diam., not or slightly enlarged to 2-2.5 µm at apex (dead state).

Holotype: CHINA, Tibet, Bomi, on rotten wood of an unidentified broad-leaved tree, lying on moist ground, altitude 3100m, B. Liu & X.Z. Liu, 16 July 2004, HMAS 96790.

Notes: Among the known species of *Orbilia*, very few possess strongly curved ascospores like *Orbilia crystallina* (Quélet) Baral and *O. scolecospora*. *Orbilia bomiensis* differs from them in larger asci, in comparison 24-34(-37) × (2.9-)3.2-3.8 µm in *Orbilia crystallina* (living state, Baral ined.) and 24.5-32.8 × 3.1-4 µm in *Orbilia scolecospora* (dead state, HMAS 132094), larger ascospores than in *Orbilia crystallina* (7-8.5(-9) × 0.6-0.9 µm, Baral ined.) and *Orbilia scolecospora* (7.8-10.4 × 1-1.3 µm, HMAS 132094), and a more strongly helicoid spore shape. In his unpublished world monograph of the *Orbiliaceae*, Baral used the term "inversely oriented" to define the spore oriented within ascus. An inversely oriented spore is oriented to ascus base with that spore end which contains the spore body and which may somewhat inexactly be called the upper end. Following his definition, the four upper spores are inversely oriented within the asci in *O. bomiensis*, and this feature also distinguishes the new species from both *O. crystallina* and *O. scolecospora*.

Orbilia coccinella (Sommerf.) P. Karst., Mycologia Fennica 1: 98 (1871), s. auct. (Fig. 2)

= *Orbilia alnea* Velen.; Monogr. Discom. Bohem.: 93, tab. 11, fig. 9 (1934)

Apothecia scattered or gregarious, superficial, sessile, flat, smooth, dull orange-brown, 0.2-1.2 mm diam. *Asci* 8-spored, 29.9-33.3 × 3-3.3 µm (dead state), cylindric-clavate, tapered below and sometimes forked at the base, apex usually truncate and slightly thickened. *Ascospores* 2.7-3.3 × 1.6-2 µm (living state), ellipsoid, with a small globose spore body and a few minute lipid bodies at one end, uniseriate, or irregularly arranged. *Paraphyses* hyaline, slender, filiform, 1.5-1.8 µm diam., abruptly enlarged to 3-4.5 µm diam. at the apex.

Specimens examined: CHINA, Tibet, Milin, Nanyi, on rotten wood of *Pinus* sp. lying on the ground, altitude 3000m, B. Liu & X.Z. Liu, 21 July 2004, HMAS 96812; Tibet, Linzhi, on rotten bamboo on the ground, altitude 3000m, B. Liu & X.Z. Liu, 13 July 2004, HMAS 96823.

Notes: Except for Tibet, we also collected specimens of this species from Heilongjian, Hunan, Qinghai and Taiwan, and isolated *Dicranidion* anamorphs from these specimens, but the Tibetan collections failed to produce anamorph in culture, the probable reason is that the great difference in temperature

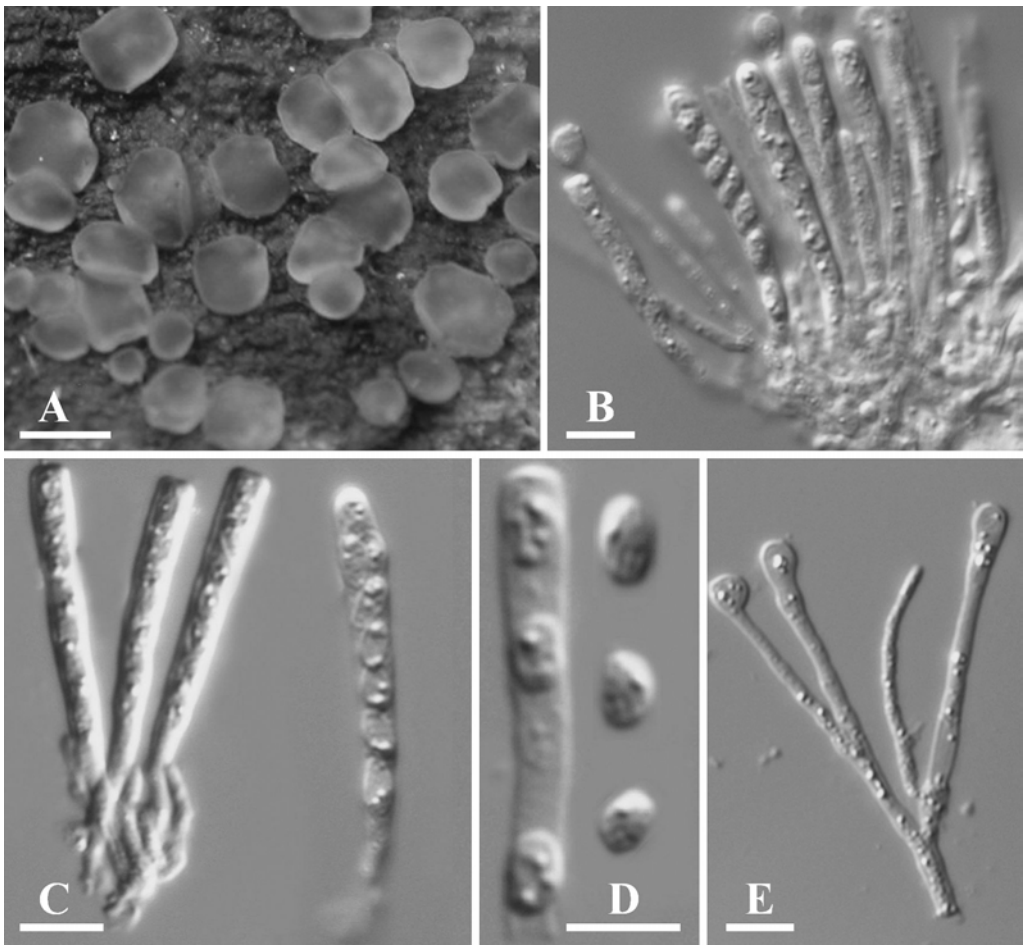

Fig. 2. *Orbilia coccinella* **A.** Fresh apothecia. **B, C.** Asci and paraphyses **D.** Living Ascospores. **E.** Paraphyses. Bars A = 1 mm; B-E= 5 μm.

between day and night in Tibet, which make atmospheric moisture condense to droplets on the inner surface of Petri-dished, and then prevent the ascospores discharge on to the medium. This species is a new record for China.

Orbilia delicatula (P. Karst.) P. Karst., Notiser ur Sällskapets pro Fauna et Flora Fennica Förhandlingar 11: 248 (1870).

Specimens examined: CHINA, Tibet, Linzhi, Bomi County, on rotten wood of unidentified plant, altitude 3100m, B. Liu & X.Z. Liu, 17 July 2004, HMAS 96802; Milin County, on rotten wood of *Pinus* sp., altitude 2950m, B. Liu & X.Z. Liu, 21 July 2004, HMAS 96820.

Notes: The reniform ascospores with minute warts on dorsal side are diagnostic for this species (Spooner, 1987). The colour of apothecia varied

greatly among specimens of the fungus. In the two reported collections the apothecia are yellow or orange.

Orbilia milinana B. Liu, Z.X. Liu, W.Y. Zhuang & Baral, **sp. nov.** (Fig. 3)

MycoBank number: MB500932.

Etymology: The specific epithet refers to the collection site of the fungus.

Apothecia superficialia, dispersa, sessilia, translucentia, pallide flava vel rosea, disco plano, 0.3-1 mm diam, margine laeve, non elevata. *Asci* (in statu emortuo) 30-49 × 3-4 µm, 8-spori, anguste cylindrico-clavati, basi pedicellati, apice rotundati vel modice truncati. *Ascosporae* hyalinae, nonseptatae, apice acutae vel acuminatae, basi fortiter flexuosae et uncinatae, 7.5-10.5 × 0.9-1.3 µm (in statu vivo), intus ad apicem versus cum corpusculo refringente, ovoideo vel elongato-lacrimiforme, 2.5-3 × 0.5-0.9 µm. *Paraphyses* hyalinae, filiformes, 1.2-2 µm diam. (in statu emortuo), apice clavatae vel capitatae, 2.5-5 µm diam., exsudato incrustatae.

Holotype: CHINA, Tibet, Milin, on rotten wood of *Juglans regia* L., lying on ground, altitude 3000m, B. Liu & X.Z. Liu, 21 July 2004, HMAS 96813.

Further collection referred here: THAILAND, Surin Bay, Phuket, near coastline, on rotten wood and bark of still-attached twig of indet. deciduous tree, in c. 0.5 m above ground, altitude 15 m, C. Peller, 10 March 1996, H.B. 5434.

Apothecia superficial, scattered, sessile on a broad base, flat, margin smooth, not protruding, translucent, pale yellow or cream-reddish when fresh, orange-buff or rose-red when dry, 0.3-1 mm diam., 0.1-0.17 mm high. *Medullary excipulum* of textura intricata with many inflated cells, 15-30 µm thick. *Ectal excipulum* of textura globulosa-angularis from base to margin, 40-60 or 80-100 µm thick near base and 15-30 µm thick at the margin, cells hyaline, thin-walled, 5.5-13.2 × 4.1-11.5 µm (near base 12-18 × 10-18 µm), marginal cortical cells elongated, oriented at a high angle, 6-12(-15) × 3-6 µm, without glassy processes, never freely projecting. Anchoring hyphae abundant, 2-2.5(-3.2) µm wide, thin-walled. *Asci* (30-)33-45(-49) × (3-)3.4-4 µm (dead state), 8-spored, cylindric-clavate, with a short to long, slender, flexuous stalk, with or without small fork at the base (Y- to T-shaped), apex rounded or medium truncate (depending on side of view, partly slightly widened). *Ascospores* hyaline, smooth, non-septate, (7.5-)8-9.2(-10.5) × 0.9-1.3 µm (living state), 7.5-9.5 × 0.8-1 µm (dead state), cylindric-fusoid, with one end strongly acute and the other obtuse, upper c. 3/4 of spore length slightly curved (sickle-shaped), lower 1/4 to 1/5 abruptly strongly geniculate, here more or less constricted, basal end forming a short strongly hooked tail, 2-4-seriate within dead ascus, the four upper spores oriented to ascus apex with their obtuse end, the lower with their acute end; spore body situated in the acute end, divided into a long ovoid body 2.4-2.9 × 0.7-0.9 µm and a filiform upper part, or elongated tear-shaped, 2.5-3 × 0.5-0.7 µm. *Paraphyses* hyaline, filiform, 1.2-2 µm diam. (dead state), enlarged to 2.5-3 or (2.5-)3.5-4.5(-5) µm diam. at the

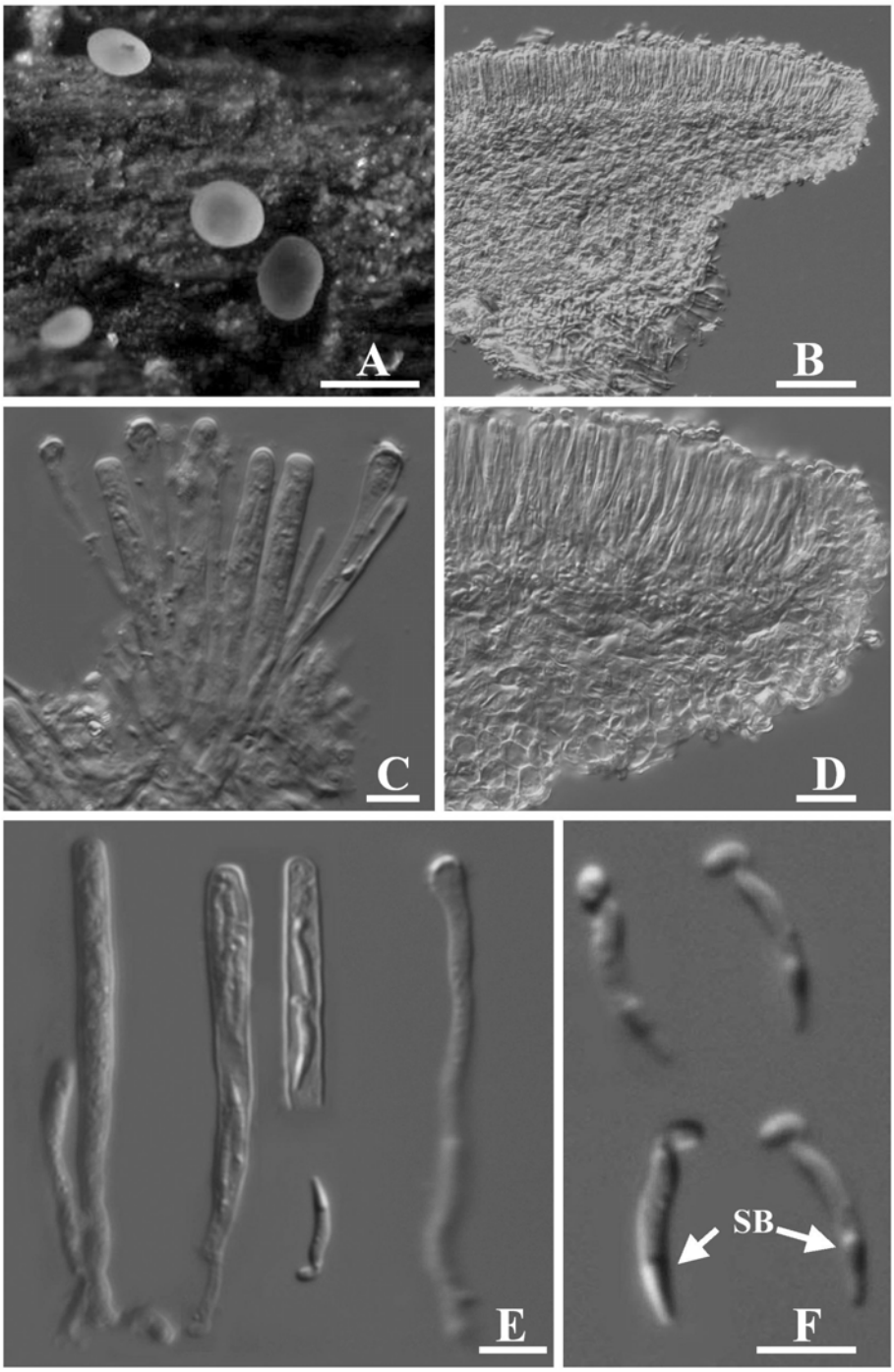

Fig. 3. *Orbilia milinana* (from holotype, HMAS 96813) **A.** Fresh apothecia. **B, D.** Vertical sections of apothecia. **C, E.** Asci and paraphyses. **G.** Living ascospores, arrow indicating the spore body. Bars A = 1 mm; B = 50 μm; C = 5 μm; D = 20 μm; E, F = 5 μm.

clavate to capitate apex, terminal cells distinctly longer than cells below, sometimes branched at upper septum. Apices of paraphyses and marginal excipular cells covered by firmly attached warted exudate 0.2-1 µm thick.

Notes: The collection from Thailand differs slightly from the one from Tibet in having paraphyses with broader apices (3.5-4.5 vs. 2.5-3.1), narrower spores (0.9-1 vs. 1-1.3 µm), and narrower, less divided spore bodies (0.5-0.7 vs. 0.7-0.9 µm wide). The apothecia in the collection from Thailand were more rose-coloured and smaller. They grew on a branch exposed to the drying atmosphere, whilst the holotype was collected on a branch lying on the ground and protected from drying.

The peculiar ascospores of *Orbilia milinana* are almost identical with those of *O. abutilonis* Cash (Cash, 1938), except for the appendage-like basal part which is mostly not curved in the latter species. However, *O. abutilonis* clearly differs from *O. milinana* in having septate hyphoid hairs at the margin, paraphyses with beaked apices, and distinctly larger apothecia. Following a re-examination of the holotype (Baral *et al.*, pers. observ.), the ascospores of *O. abutilonis* were misleadingly described in the protologue as allantoid to nearly spherical, 2 × 1.5-1.7 µm. Cash (1938) obviously observed the spores only within the asci and there discerned only the basal spore appendage by overlooking the long upper part of the spore.

Orbilia milinana is also similar to *Orbilia aurantiorubra* Boud. (Baral *et al*., pers. observ.) in the strongly geniculate ascospores at the lower part, but differs from the latter in smaller asci (dead state: 33-45 × 3.4-4 µm vs. 45-70 × 4-4.5 µm), shorter ascospores with much more narrowed base without basal constriction (living state: 8-9.2 × 0.9-1.3 µm vs. 11-14.5 × 1.2-1.4 µm), and the spore arrangement within asci (in *O. aurantiorubra* the four lower spores are oriented with their spore bodies towards ascus base). *Orbilia milinana* is also similar to *O. bomiensi*s in having strongly curved ascospores and the four upper spores inversely oriented, but easily distinguished from the latter in size and shape of ascospores, absence of marginal glassy processes, and smaller and paler apothecia.

Orbilia querci B. Liu, X.Z. Liu & W.Y. Zhuang, FEMS Microbiology Letters 249: 101 (2005).

Specimen examined: CHINA, Tibet, Gongbujiangda County, on rotten wood of *Pinus* sp., 21 July 2004, HMAS 138526.

Notes: The asci and ascospores (including the spore bodies) of the Tibet collection fit quite well the holotype, but the Tibet collection has larger apothecia which occur on rotten wood of *Pinus* sp. instead of *Quercus* sp.

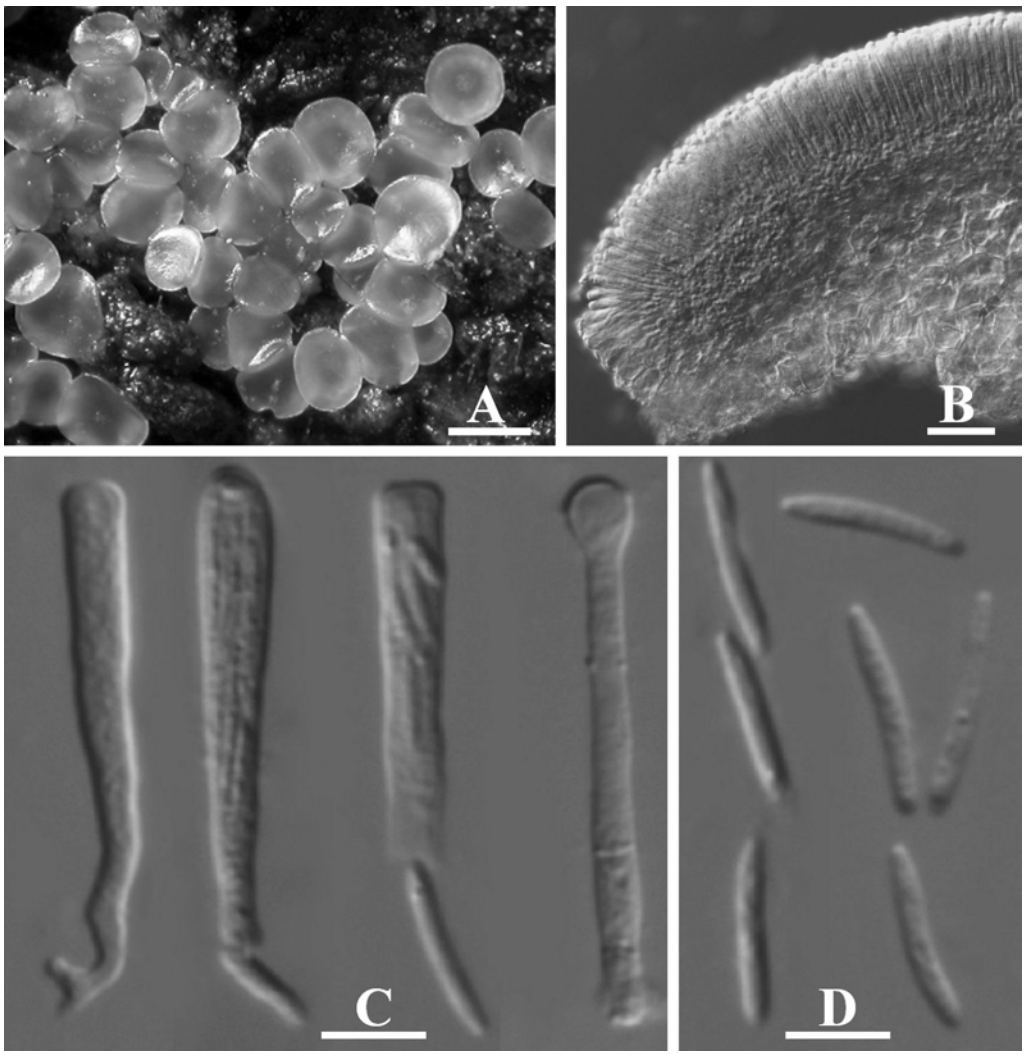

Fig. 4. *Orbilia rectispora* **A.** Fresh apothecia. **B.** Vertical sections of an apothecium. **C, D.** Asci. E. Paraphyses. **F, G.** Ascospores. Bars A = 1 mm; B = 20 µm; C-F = 5 µm.

Orbilia rectispora (Boud.) Baral, **comb. nov.** (Fig. 4)

MycoBank number: MB500933.

Basionym: *Hyalinia rectispora* Boud.**,** Histoire et Classfication des Discomycetes d'Europe p 103. 1907 (see also Boudier, Icones Mycologicae Pl. 467. 1909).

Apothecia whitish to pale yellow, scattered or gregarious, superficial, sessile, flat, smooth, 0.2-1.2 mm in diam. *Asci* cylindrical-clavate, tapered towards the base, apex truncate to rounded, asci 26.7-32.4 × 3-4.1 µm (dead state). *Ascospores* hyaline, cylindrical to very slightly clavate, straight or sometimes slightly curved, non-septate, 7-9.9 × 0.9-1.2 µm (living state), spore

body globose, present in one end. *Paraphyses* filiform with a clavate to capitate apex, hyaline, 1.8-2.2 µm wide below and 2-3 µm wide at apex.

Specimens examined: CHINA, Tibet, Bomi County, Lulang, on rotten wood of *Abies* sp., altitude 3500m, B. Liu & X.Z. Liu, 18 July 2004, HMAS 96782; Linzhi, Laohu mountain, on rotten wood of unidentified plant, altitude 3100m, B. Liu & X.Z. Liu, 13 July 2004, HMAS 96802.

Notes: This species shows variable spore shape and size among collections. The globose spore body in one end of the living ascospore is one of the main diagnostic features. The new combination *Orbilia rectispora* is here proposed since the genus *Hyalinia* was included in synonymy with *Orbilia* by Baral (1994).

Orbilia sarraziniana Boud., Revue Mycologique (Toulouse) 7: 221 (1885).

Specimens examined: CHINA, Tibet, Bomi County, Lulang, on rotten wood of unidentified plant, altitude 3500m, B. Liu & X.Z. Liu, 18 July 2004, HMAS 96784.

Orbilia scolecospora (Beaton) Baral, **comb. nov.** (Fig. 5)

MycoBank number: MB500934.

Basionym: *Hyalinia scolecospora* Beaton in Beaton & Weste, Transactions of the British mycological Society 70: 77 (1978)

Apothecia 0.3-1 mm diam., gregarious, sessile, superficial, whitish when fresh, concave, margin dentate with 9 hyaline teeth-like protuberances, 100-150 µm wide at the base, single glassy hair (solid part) 28.5-53.5 × 2.3-4 µm. *Ectal excipulum* composed of thin-walled angular cells, 4.5-13.5 × 4-11 µm, 30-70 µm thick (near margin as well as near base). *Asci* 24.5-32.8 × 3.1-4 µm (dead state), 8-spored, cylindric-clavate and tapered below, apex rounded or truncate, stalk flexuous, L-shaped or bifurcate. *Ascospores* hyaline, helicoid (sickle-shaped in side view), 7.8-10.4 × 1-1.3 µm (living state), distinctly narrowed towards one end, spirally twisted within asci, the four lower spores inversely oriented. Spore body situated in the broader, obtuse end, tear-shaped, 1-1.8 × 0.4-0.6 µm. *Paraphyses* hyaline, filiform, terminal cell 13-20 × 1.5-2.6 µm, the apex slightly enlarged and with fragments of epithecium.

Specimen examined: CHINA, Tibet, Linzhi, Bomi County, on rotten wood of *Quercus* sp., altitude 3100m, B. Liu & X.Z. Liu, 16 July 2004, HMAS 132094

Notes: The so far only known collection of *Orbilia scolecospora* was described and illustrated by Beaton and Weste (1978) and Spooner (1987). The characteristics of our collection are identical with the holotype. We observed, in detail, the ascospore arrangement within asci and found that the four lower spores are inversely oriented. In this character, *O. scolecospora* is not distinct from the very closely related *O. crystallina*. It differs from the latter species in its longer and broader spores. The new combination *Orbilia scolecospora* is proposed following the taxonomic treatment of *Hyalinia* by Baral (1994).

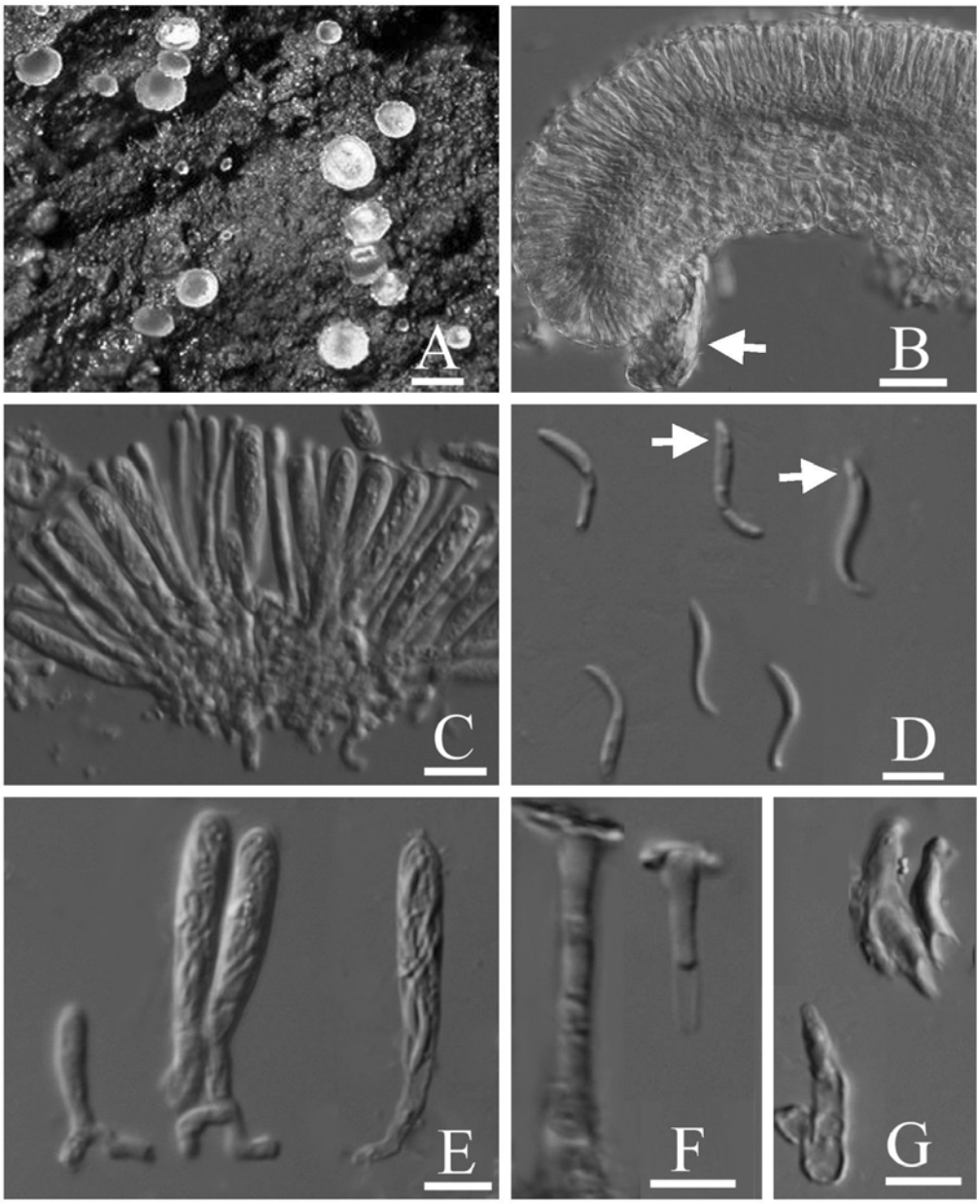

Fig. 5. *Orbilia scolecospora* **A.** Fresh apothecia. **B, C.** Vertical sections of an apothecium, arrow indicating margin hairs. **D.** Living ascospores, arrow indicating the spore body. **E.** Asci. **F.** Paraphyses. **G.** Marginal hairs. Bars A = 1 mm; B = 50 μm; C-G = 5 μm.

Key to known Chinese species of *Orbiliaceae*

1. Asci arising from croziers, hymenial elements strongly coherent.....(*Hyalorbilia*) 2
1. Asci arising from simple septa, hymenial elements not coherent .....(*Orbilia*) 3

2. Ascospores subglobose, 1.5-2 × 1.5-2 µm..... *H. brevistipitata*
2. Ascospores cylindrical to slightly fusoid, 5-8 × 0.8-1.2 µm.....*H. inflatula*

3. Ascospores cylindrical to clavate.....5
3. Ascospores not cylindrical to clavate.....4

4. Ascospores reniform, with minute warts on dorsal side ..... *O. delicatula*
4. Ascospores globose to ellipsoid.....*O. coccinella*

5. Ascospores strongly curved.....11
5. Ascospores not strongly curved.....6

6. Ascospores sickle-shaped, base attenuated, 6-12.5 × 0.8-1.5 µm ..... *O. auricolor*
6. Ascospores straight to slightly curved 7

7. Paraphyses strongly capitate at apex, spore body filiform to long tear-shaped.....10
7. Paraphyses not strongly capitate at apex, spore body globose or tear-shaped.....8

8. Ascospores 5-6 × 0.8-1.2 µm, with tear-shaped spore body .....*O. querci*
8. Ascospores with globose spore body 9

9. Ascospores shorter than 5 µm, 2.7-4.5 × 0.8-1.3.....*O. epipora*
9. Ascospores longer than 5 µm, 7-9.9 × 0.9-1.2 µm.....*O. rectispora*

10. Ascospores clavate, upper spores inversely oriented in asci.....*O. sarraziniana*
10. Ascospores fusoid, lower spores inversely oriented in asci .....*O. luteorubella*

11. Apothecial margin dentate.....12
11. Apothecial margin smooth, ascospores strongly geniculate at base..... *O. milinana*

12. Ascospores strongly helicoid, S-shaped.....*O. bomiensis*
12. Ascospores slightly helicoid, sickle-shaped.....*O. scolecospora*

Acknowledgements

The authors would like to thank Prof. Kevin D. Hyde for critical review of this manuscript and valuable suggestions. This project is supported by the National Natural Science Foundations of China (nos. 30460002, 30230020 and 30270007).

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(Received 5 February 2006; accepted16 April 2006)