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## New species and records of *Orbilina* (*Orbiliaceae*, *Ascomycota*) from China

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We recently collected and examined more than 300 samples belonging to the genus *Orbilina* from 21 regions in Yunnan Province, China. Among these samples, we identified three new species *Orbilina falciformis*, *O. brevicauda* and *O. umbilicata*. In addition we report *O. alba*, *O. caudata*, *O. aff. comma*, *Orbilai* cf. *euonymi* and *Orbilai* cf. *neglecta* as new to China. All eight species are described and illustrated in detail.

**Keywords:** *Orbilina falciformis*, *Orbilina brevicauda*, *Orbilina umbilicata*, new Chinese records, taxonomy

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### Introduction

The genus *Orbilina* Fr. is characterized by easily separable asci and paraphyses, asci arising from an often long-stalked furcate base without croziers, a thin-walled excipulum on the flanks consisting of globose to angular cells, and living ascospores possessing a very striking refractive spore body. Recently, the advantage of living over dead cells in the taxonomy of ascomycetes has received increasing attention (Baral, 1992). Within the *Orbiliomycetes*, the spore body has been recognized as the key characteristic in species classification. *Orbilina* species have received more attention partly in recent years because some of them can produce various anamorphs capable of trapping nematodes (Pfister, 1994, 1995; Webster *et al.*, 1998; Liu *et al.*, 2005; Mo *et al.*, 2005) and exist in both terrestrial and semi-aquatic habitats. Therefore, we systematically studied the taxonomic diversity of *Orbilina* species in China in order to further exploit the important fungal resources with bio-control potential and to confirm their position in fungal systematics and adaptive evolution.

Fifteen species of *Orbilina* have been recorded from China, with nine reported by

authors other than Zhang and coworkers. These were recently reviewed by Liu *et al.* (2006). Additionally, in the same paper, two new species were reported and described from Tibet: *Orbilina bomiensis* B. Liu, Xing Z. Liu & W.Y. Zhuang and *O. milinana* B. Liu, Xing Z. Liu, W.Y. Zhuang & Baral. The other four species were described and reported by Zhang and coauthors: *O. bannaensis* Ying Zhang, Z.F. Yu & K.Q. Zhang, *O. orientalis* (Raitv.) Baral, *O. vermiformis* Baral, Z.F. Yu & K.Q. Zhang and *O. dorsalia* Ying Zhang, Z.F. Yu & K.Q. Zhang (Yu *et al.*, 2006; Zhang *et al.*, 2006; Yu *et al.*, 2007a,b). Furthermore, among these four species, the anamorph of *O. orientalis* was found capable of trapping nematodes by constricting rings.

Yunnan Province is located in the Yunnan-Guizhou plateau in southwestern China and has diverse types of climate and environment, so it is considered as one of the biodiversity hotspots in the world. In our previous survey of orbiliaceous fungi in Yunnan Province, a special taxon with morphological characteristics different from the two existing genera, *Orbilina* and *Hyalorbilina* Baral & G. Marson within the family *Orbiliaceae* was reported as a new

genus *Pseudorbilia* Ying Zhang, Z.F. Yu, Baral & K.Q. Zhang (Zhang *et al.*, 2007). Since 2003, we have collected *Orbilia* specimens from 21 regions with subtropical and tropical climates and altitudes ranging from 553 m to 2365 m. We identified 34 species in these collections, including three new species and five new records in China.

## Materials and methods

The fresh specimens were collected from Yunnan Province, China from 2003 to 2006. The methods used for observing and measuring the apothecia followed those described previously by Zhang *et al.* (2007). Characteristics of asci and ascospores were described in either living state or dead state according to the methods in Baral (1992). Fungal herbarium specimens with substrate fragments were deposited in Key Laboratory of Industrial Microbiology and Fermentation Technology of Yunnan, Kunming, P. R. China (abbreviation: YMFT) and the personal herbarium of H.O. Baral (H.B.). Holotypes are deposited in the Botanische Staatssammlung München, Germany (M).

Anamorph isolation was attempted from all species following Yu *et al.* (2006).

## Results

### New species

*Orbilia falciformis* Z.F. Yu, Baral & K.Q. Zhang, **sp. nov.** (Fig. 1)  
MycoBank: 511511.

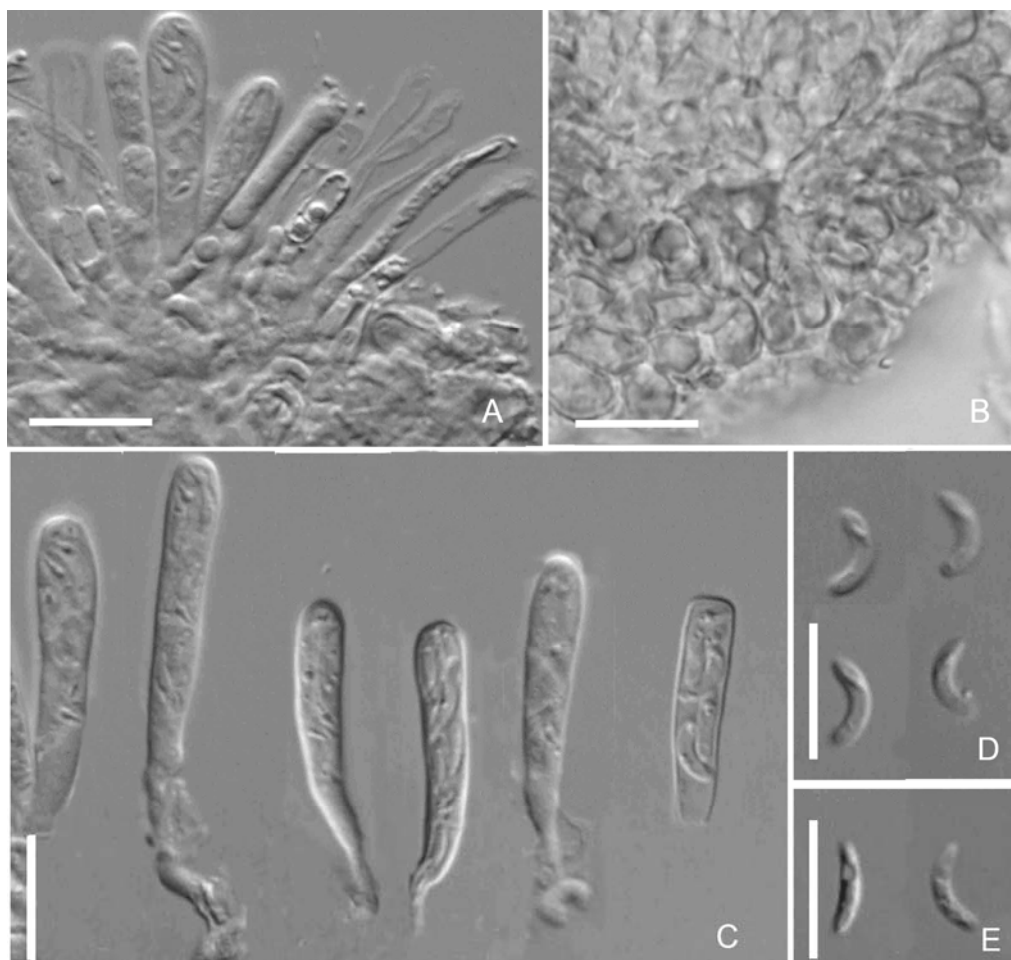
*Etymology*: named after the sickle-shaped ascospores.

*Apothecia* 0.15-0.3 mm diam., sessilia, superficialia, gregaria vel dispersa, aurantiaca, disco plano vel concavo. *Excipulum ectale* textura angulare, cellulis tenuiter tunicatis. *Asci* 8-sporei, 25.5-35.5 × 4.1-4.3 µm in statu emortuo, cylindrico-clavati, apice rotundati vel truncati, tenui-tunicati, basi angustati, furcati. *Ascosporae* hyalinae, non-septatae, 6.0-6.7 × 1.3-1.8 µm in statu vivo, falcatae, apice obtusae, ad apicem cum vacuola refringente filiforme vel bacillare, 1.2-2.6 × 0.5-0.8 µm. *Paraphyses* hyalinae, apice vix vel valde inflatae, 2.2-3.0 µm diam..

*Apothecia* superficial on rotten bark of an unidentified plant, waxy, translucent, light to bright orange when fresh; disc concave to flat, not protruding, smooth, sessile, superficial, moist 0.2-0.3(-0.5) mm diam., rehydrated 0.15-

0.2 mm diam., 0.1-0.12 mm high, smooth, rehydrated light amber-yellowish-orange, medium translucent, round, scattered to medium gregarious. *Ectal excipulum* composed of vertically oriented textura angularis(-prismatica) from base to margin, 30 µm thick near base, with thin or only slightly thickened walls, often containing pale brown pigment, hyaline at base, (6-)7-10.3 × 3.8-7 µm diam., light orange-ochre on flanks and margin, 15 µm thick near margin, of *textura globulosa-prismatica* oriented at a 60-80° angle to the surface, marginal cortical cells elongated, with swollen and rounded apices, without glassy processes. *Medullary excipulum* approximately 20-50 µm thick, very pale yellowish-ochraceous, of dense *textura intricata-angularis*, medium sharply delimited from ectal excipulum. *Asci* 8-spored, cylindrical-clavate, spores 3-4-seriate, ca. 3-4 lower spores inverted (partly mixed), 29-35(-40) × (3.8-)4.1-4.3(-5) µm in dead state; apex truncate, hemispherical in side view, thin-walled; tapered at the lower part, forked at the base, with short to long, ± thin, flexuous stalk, T- to L-shaped. *Ascospores* hyaline, non-septate, broadly sickle-shaped, (5.5-)6-6.7(-7.4) × 1.3-1.8 µm in living state and 5.5-6.5(-7.3) × 1.1-1.2(-1.5) µm in dead state, cylindrical- to fusoid-clavate, apex obtuse to subacute, base slightly to strongly attenuated (sometimes tail-like), medium to very strongly curved (both living and dead state); SBs straight to slightly curved, (1-)1.2-2.6(-3.5) × (0.4-)0.5-0.8 µm, elongated tear-shaped to subulate, apically attached by a small point, straight to slightly curved, partly obliquely oriented, sometimes containing 1-2 globose lipid bodies in lower part of spore. *Paraphyses* hyaline, cylindrical, apically slightly to strongly clavate-capitate, terminal cell 12.5-15.5 × 2.2-3 µm (dead state), lower cells 3.5-6(-7) × 1.3-1.8 µm, never branched at upper septum; vacuolar bodies (VBs) in living paraphyses large, refractive, globose to long-cylindrical, in cortical ectal excipulum pale brown, exudate over paraphyses 0.2-0.8(-1.3) µm thick, granular, hyaline, easily detaching, over margin and flanks 0.2-0.5(-1) µm thick, rough-granular, pale yellow. *Anchoring hyphae* medium abundant at base, 2-3 µm wide, walls 0.2 µm thick.

*Anamorph*: unknown.



**Fig. 1.** *Orbilia falciformis* (from holotype). A. Cluster of asci and paraphyses. B. Ectal excipulum cells. C. Dead asci. D. Living ascospores with SBs. E. Dead ascospores. Bars: A-E = 10 µm.

**Habitat:** On corticated branch of an unidentified angiosperm tree, medium decayed, strongly blackened outer face of bark, no algae, lying on the moist ground in a shady subtropical forest. Associated with an unidentified Dothideomycete. Xerotolerance: unknown (possibly drought-intolerant).

**Known distribution:** Yunnan Province of China.

**Material examined:** PR CHINA, Yunnan Province, Ning'er County, Xiaoheijiang Forest Park, alt.1320 m, on 4 May 2005, collected by Min Qiao. **holotype:** ex H.B. 8696 (M), **isotype:** YMFT030.

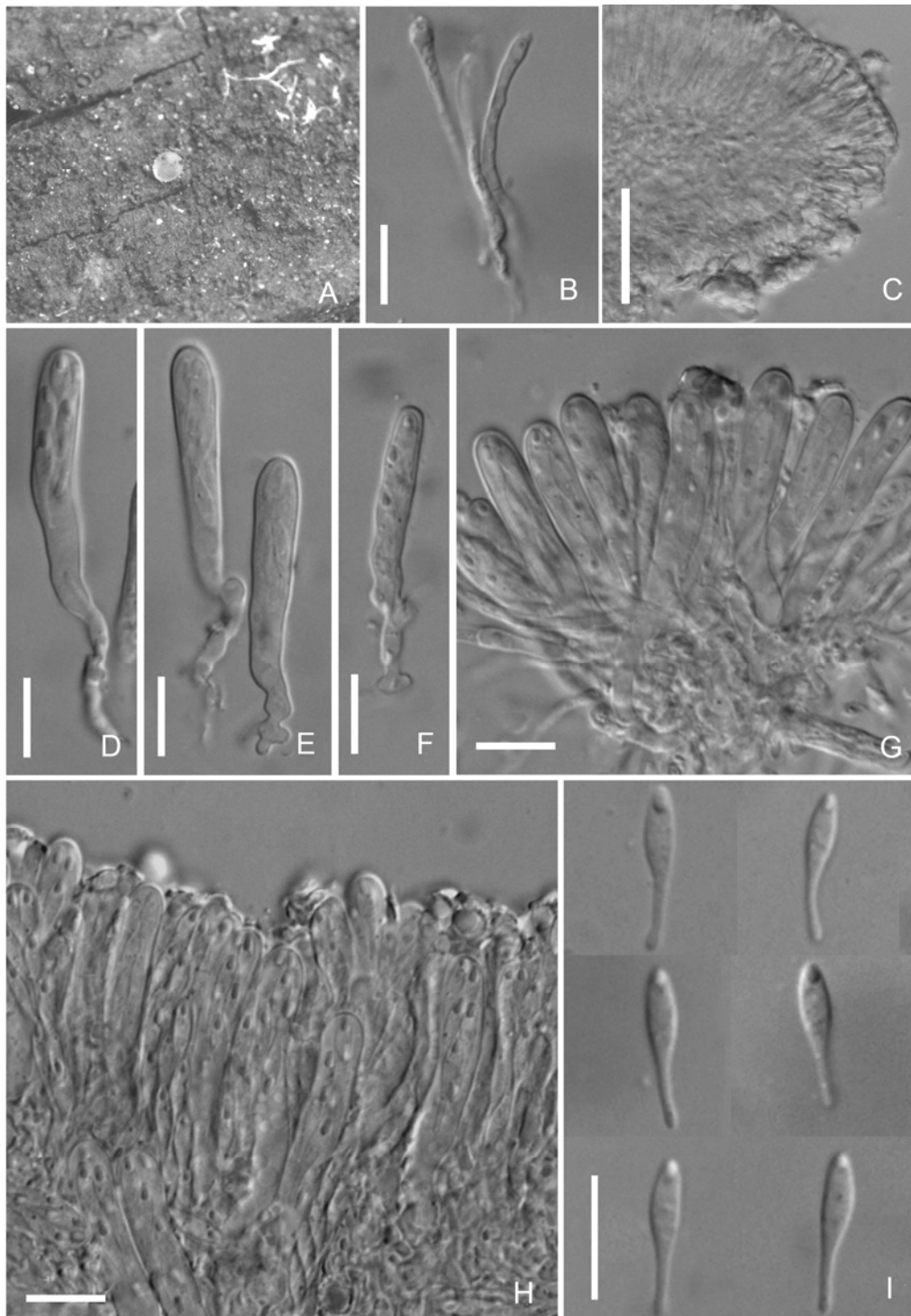
**Notes:** The broadly sickle-shaped ascospores with partly obliquely oriented, elongated tear-shaped to subulate spore bodies in the living state is very remarkable among the known species of *Orbilia*. *Orbilia falciformis* appears to be very closely related to an unpublished Australian collection (Queensland, Daintree Forest, on wood of still-attached branch of *Schefflera actinophylla*, H.B. 8578c), e.g. in the ochraceous-orange vacuolar pigment. This collection differs mainly by

straight spores and a more xeric habitat. Concerning the elongated spore bodies, the two collections are very similar to the xerotolerant species *O. luteorubella* (Nyl.) P. Karst. and *O. sarraziniana* Boud. with more or less straight ascospores. In the dead state the spores of *O. falciformis* were found to be considerably narrower and partly distinctly more tapered at the base.

***Orbilia brevicauda*** Ying Zhang, Baral & K.Q. Zhang, **sp. nov.** (Fig. 2)  
Mycobank: 511512.

**Etymology:** named after the short-tailed ascospores.

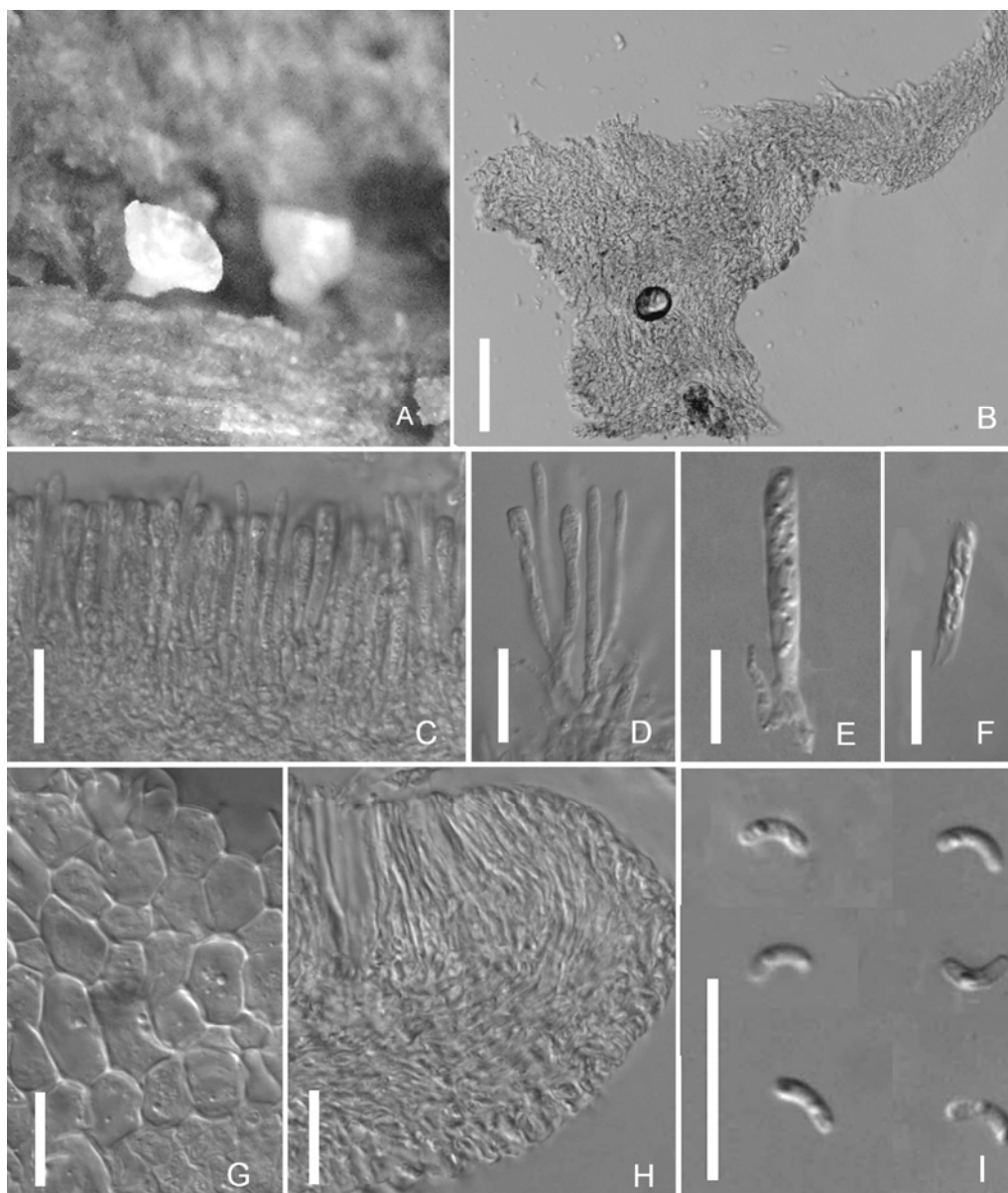
**Apothecia** 0.4-1.0 mm diam., superficialia, sessilia, gregaria, translucencia, margine crenulata. **Excipulum ectale** textura prismatica vel textura angulari, ad marginem cum processis vitreis. Asci 8-spori, 36-50 × 5.2-5.4 µm in statu vivo, cylindrico-clavati, apice rotundati, crasse-tunicati, basi angustati, furcati. **Ascospores** hyalinae, non-septatae, 11.5-13.5 × 2-2.2 µm in statu vivo, caput anguste ellipsoideo-naviculare, cauda cylindrico-clavata, inclusione lacrimiforme vel ovata, 1.6-2.2 × 0.7-0.9 µm. **Paraphyses** filiformes, apice vix inflatae.



**Fig. 2.** *Orbilia brevicauda* (from holotype). A. Fresh apothecium. B. Paraphyses. C. Vertical section of an apothecium. D, E. Living asci. F. Dead ascus. G, H. Cluster of asci and paraphyses. I. Living ascospores. Bars: B, D-I = 10  $\mu$ m, C = 25  $\mu$ m.

*Apothecia* scattered, 0.4-1.0 mm diam., superficial on inner face of rotten bark, centrally attached, margin crenulate; disc translucent, waxy, light cream-yellow to orange when fresh, irregularly convex or undulating when dry. *Ectal excipulum* of *textura globulosa-angularis* from base to flanks, cells 6-11  $\mu$ m diam., marginal cortical cells +/- elongated and

thin-walled, without or with 6-16  $\mu$ m long glassy processes. *Medullary excipulum* of *textura intricata*, 15-30  $\mu$ m thick. *Asci* cylindrical-clavate, 8-spored, 1-2 of the basal spores inversely oriented, apex rounded to slightly truncate, with 0.3-1  $\mu$ m thick apical thickening, irregularly inflated at lower part, tapered and forked to a T-, L- or Y-shape at the base, 36-50



**Fig. 3.** *Orbilia umbilicata* (from the Chinese specimen). A. Fresh apothecia. B, H. Vertical section of an apothecium. C. Cluster of asci and paraphyses. D. Paraphyses and dead asci. E, F. Asci. G. Ectal excipulum cells. I. Living ascospores. Bars: B = 50  $\mu\text{m}$ , H = 25  $\mu\text{m}$ , C-G, I = 10  $\mu\text{m}$ .

$\times 5.2\text{-}5.4$   $\mu\text{m}$  in living state and  $(30\text{-})35\text{-}40 \times (4.2\text{-})4.5\text{-}5(-5.3)$   $\mu\text{m}$  in dead state. *Ascospores* hyaline, aseptate,  $11.5\text{-}13.5 \times 2\text{-}2.2$   $\mu\text{m}$  in living state and  $10.8\text{-}12.5 \times 1.7\text{-}1.9$   $\mu\text{m}$  in dead state, head narrowly ellipsoid-naviculiform, tail 3-5  $\mu\text{m}$  long, basal end of tail rarely slightly bulbous; spore bodiless tear-shaped to elongated rod-shaped, affixed to the inner wall of spore apex,  $1.6\text{-}2.2 \times 0.7\text{-}0.9$   $\mu\text{m}$ . *Paraphyses* hyaline, cylindrical, not or moderately inflated (clavate to spatulate) at the apex, 2.0-2.5  $\mu\text{m}$  diam. (dead state), containing globose or ellipsoid medium refractive inclusions at the apex or lower part, often with a thin layer of exudate, septate at the lower part, about 1.0-1.7  $\mu\text{m}$  wide.

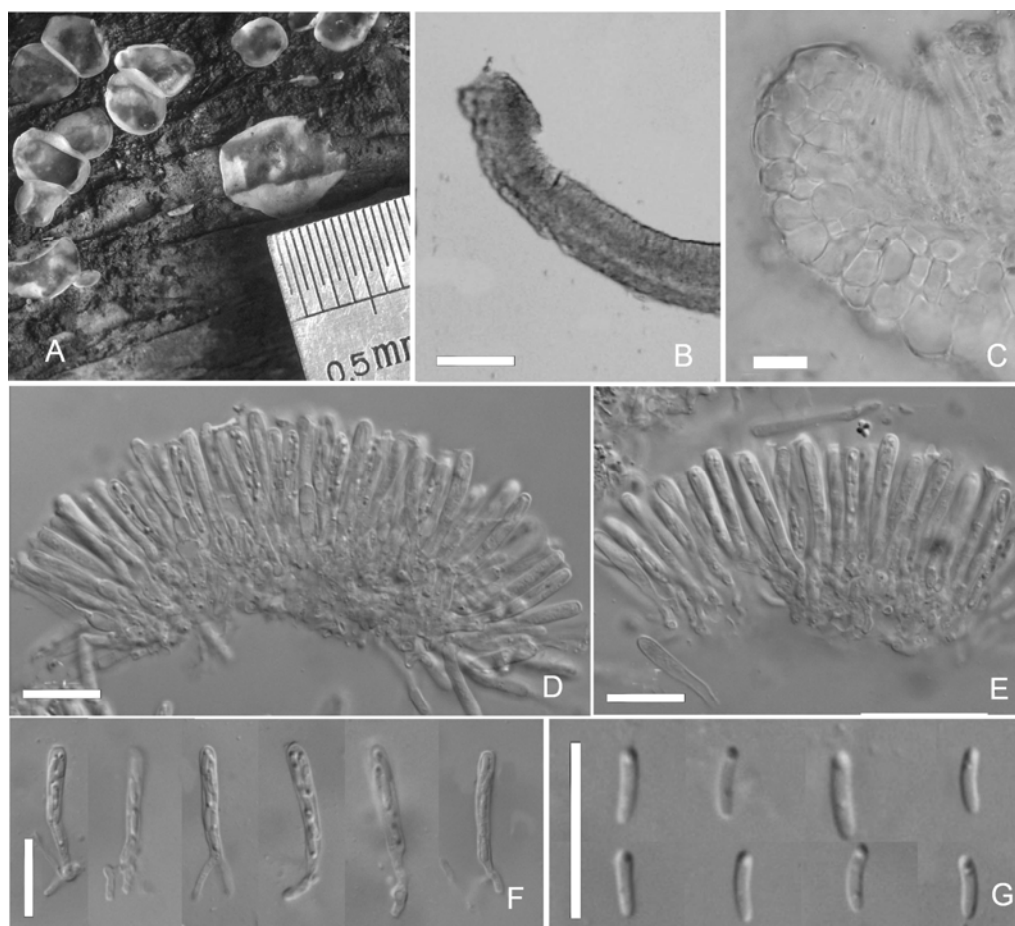
*Anamorph*: non-sporulating culture.

*Habitat*: On detached bark of about 10 cm thick branch or trunk of unidentified angiosperm tree lying on moist ground in a shady subtropical forest, on medium decayed inner face of bark, strongly greyed (blackened), no algae. Xerotolerance: unknown (probably xerotolerant).

*Known distribution*: Yunnan Province, China.

*Material examined*: PR CHINA, Yunnan Province, Yimen County, Longkou Forest Park, alt. 2000 m, on 1 July 2006, collected by ZeFen Yu. **holotype**: ex H.B. 8715 (M).

*Notes*: This is the first *Orbilia* species with thin-tailed ascospores as well as asci with an apical wall thickening seen in China, while



**Fig. 4.** *Orbilia alba* A. Rehydrated apothecia. B, C. Vertical section of an apothecium. D, E. Cluster of asci and paraphyses. F. Dead asci. G. Living ascospores. Bars: B = 50 µm, C-G = 10 µm.

those are rather frequently collected in Europe, but also known to occur in Australia (Baral & G. Marson ined.) and North America. Apothecia of these species grouped around *Orbilia occulta* (Rehm) Sacc. are orange to rose-red colored and xerotolerant, and possess a more or less distinctly denticulate margin made up of glassy processes, while apothecia of our collection deviate by having a more pale yellowish colour and were found on the moist ground. *Orbilia brevicauda* is similar to *Orbilia occulta* or *O. aristata* (Velen.) Velen. in spore shape but differs from these two species by smaller, especially narrower ascospores [ $11.5-13.5 \times 2-2.2 \mu\text{m}$  vs.  $10-12 \times 3-3.4 \mu\text{m}$  (*O. occulta*) or  $15-22 \times 2.7-3.3 \mu\text{m}$  (*O. aristata*)], and smaller sporebodies [ $(1.6-2.2 \times 0.7-0.9 \mu\text{m}$  vs.  $1.8-2.5 \times 1.1-1.2 \mu\text{m}$  (*O. occulta*) or  $(2.7-3.2-4.2 \times 1-1.3 \mu\text{m}$  (*O. aristata*)].

*Orbilia aristata* was found to be connected with an anamorph comprising differently shaped conidia referable to *Curucispora*, *Dwayaangam* and *Trinacrium* (E. Weber, Baral & G. Marson, pers. comm.). In a

previous study, *Orbilia junci* Kohlm. *et al.* was found to produce a *Dwayaangam* anamorph (Kohlmeyer *et al.*, 1998). The culture isolated from our fungus did not sporulate.

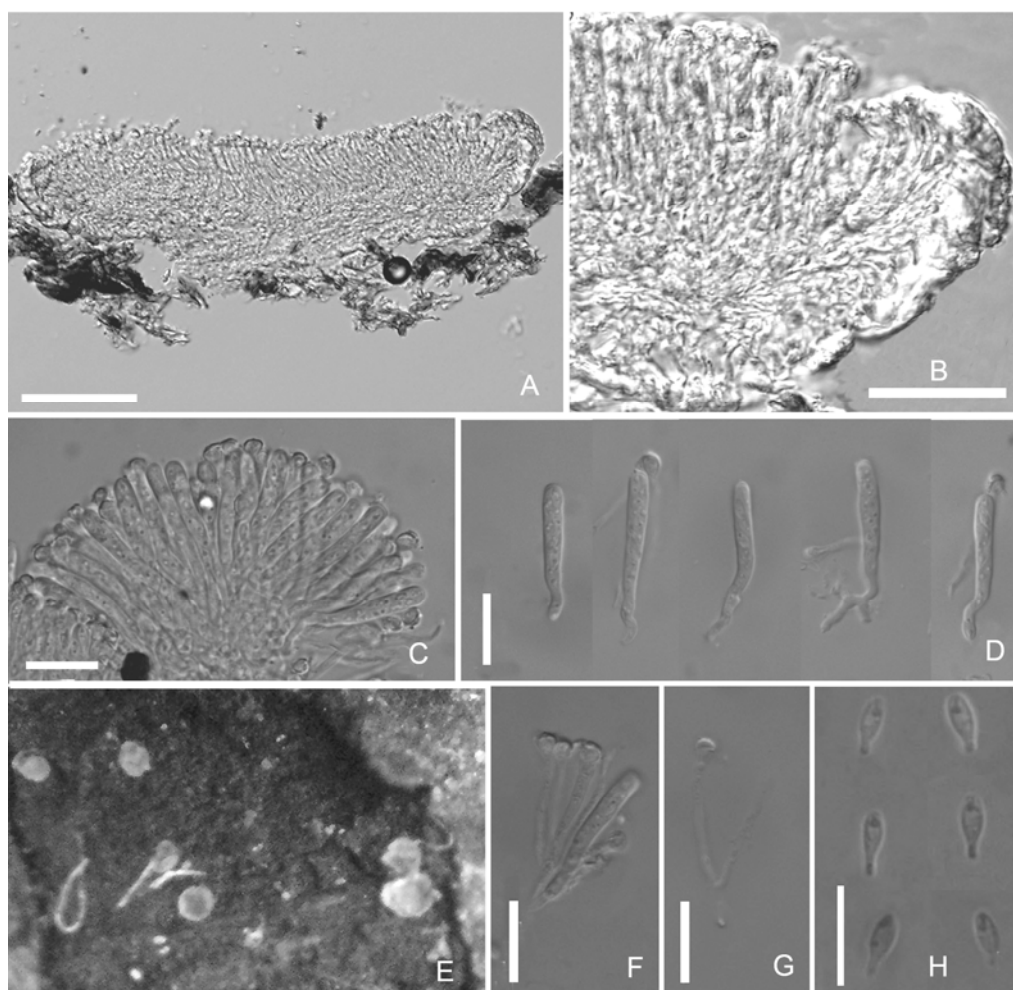
***Orbilia umbilicata*** Baral, Ying Zhang & K.Q. Zhang, **sp. nov.** (Fig. 3)

Mycobank: 511513.

*Etymology*: named after the centrally depressed (cupulate) apothecial disc.

*Apothecia* gregaria vel dispersa, superficialia, translucencia, stipite 100-150 µm longo, disco 0.2-1.3 mm diam., cremicolor. *Excipulum* ectale textura prismatica vel textura angulari. *Asci* 8-spore, 25-35 × 2.8-3.5 µm in statu emortuo, cylindrico-clavati, apice rotundati, basi angustati. *Ascosporeae* hyalinae, non septatae, 3.5-4.5 × 1-1.2 µm in statu vivo, allantoideae, polis rotundatis, inclusione refringente, globosa, 0.3-0.6 µm diam. ad apicem. *Paraphyses* filiformes, apice vix inflatae, anguste lanceolatae, 1.5-2.8 µm diam.

*Apothecia* gregarious or scattered on rotten wood, whitish to light cream-yellow when fresh, often with an obconical stipe about 100-150 µm long and 350-500 µm wide, not broadly attached; disc 0.2-1.3 mm diam., concave with inrolled smooth margin, centrally



**Fig. 5.** *Orbilia caudata* A, B. Vertical section of an apothecium. C, F. Cluster of asci and paraphyses. D. Dead asci. E. Fresh apothecia. G. Paraphysis. H. Living ascospores. Bars: A = 50 µm, B-D, F-H = 10 µm.

partly depressed. *Ectal excipulum* composed of angular to subangular cells from base to margin,  $10\text{-}30\text{-}(40) \times (7\text{-})10\text{-}20\text{-}(25)$  µm near base, thin-walled,  $4\text{-}13 \times 2.5\text{-}6$  µm at margin, lacking glassy processes. *Medullary excipulum* of a sharply delimited, loose or dense *textura intricata*. *Anchoring hyphae* forming a thick gelatinized layer at the base of stipe. *Asci* cylindrical-clavate, 8-spored, straight or sometimes slightly curved,  $25\text{-}35 \times 2.8\text{-}3.5\text{-}(3.8)$  µm in dead state, apex rounded or truncate, thin-walled, tapered and forked at the base (sometimes H-shaped). *Ascospores* hyaline, non-septate, cylindrical, allantoid (crescent-shaped), rounded at both ends,  $(3\text{-})3.5\text{-}4.5 \times 1\text{-}1.2\text{-}(1.4)$  µm in living state,  $3\text{-}4 \times 1$  µm in dead state, containing 1 globose SB situated in apices of ascospores,  $0.3\text{-}0.6$  µm diam., with 1-3 small globose lipid bodies,  $0.2\text{-}0.6$  µm diam.. *Paraphyses* hyaline, narrowly lanceolate at the apex,  $1.5\text{-}2.8$  µm wide in middle part (dead state), also filiform with a clavate apex which is

$1.5\text{-}2.3$  µm wide, projecting beyond dead asci for  $2\text{-}4\text{-}(5)$  µm, no exudate.

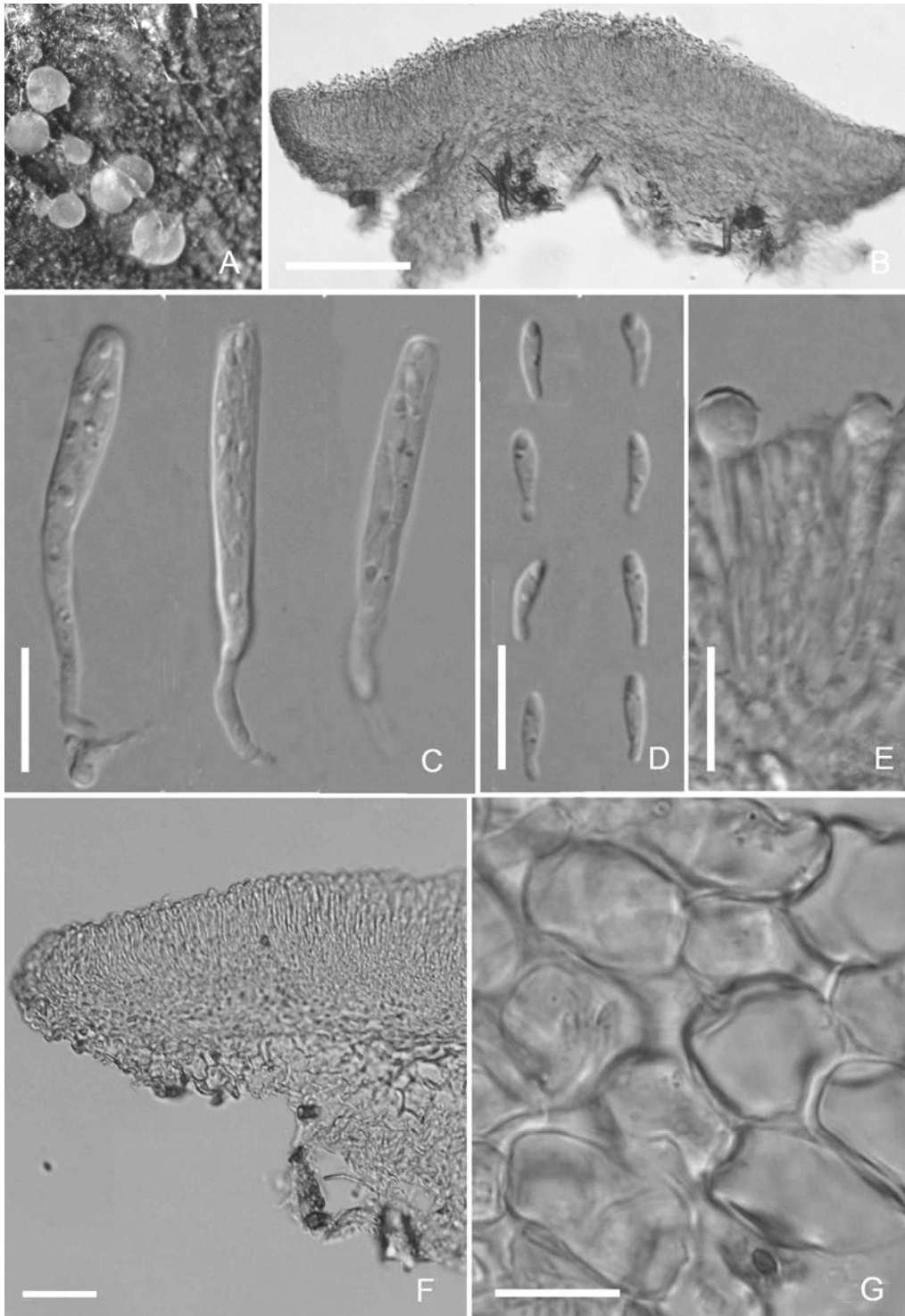
*Anamorph*: not seen.

*Habitat*: On decorticated rotten wood of unidentified broad-leaved trees lying on the moist ground in shady subtropical forests.

*Known distribution*: Nagano prefecture of Honshu (Japan), Yunnan Province of China.

*Material examined*: JAPAN, Nagano pref., Sanada-machi, Sugadaira, Kakuma valley, on rotten wood of angiosperm tree on the wet ground, 13.VIII.1997, collected by W. Gams, **holotype**: ex H.B. 5903 (M). PR CHINA, Yunnan Province, Yongping County, Jinguangsi Nature Reserve, alt. 863 m, on 14 July 2006, collected by Ying Zhang (YMFT031 & H.B. 5903).

*Notes*: This species is characterized by apothecia with a distinct short stipe, narrowly lanceolate paraphyses, and small, cylindrical, medium curved (allantoid), smooth ascospores, rounded at both ends. With its cylindrical ascospores, rounded at both ends, *Orbilia umbilicata* closely resembles *O. epipora* (Nyl.)



**Fig. 6.** *Orbilia* aff. *comma*. A. Fresh apothecia. B, F. Vertical section of an apothecium. C. Dead asci. D. Living ascospores. E. Cluster of asci and paraphyses. G. Ectal excipulum cells. Bars: B = 100  $\mu$ m, C-E, G = 10  $\mu$ m, F = 20  $\mu$ m.

*P. Karst.* and *O. pilosa* (Dennis) Baral as reexamined from the type material by one of us (Baral), but differs from them in the spores being curved. Although the apothecia of *O. pilosa* are stipitate and the apices of paraphyses are (sub)lanceolate similar as in our fungus, *O. pilosa* possesses distinct, septate, thick-walled hairs while our fungus is hairless.

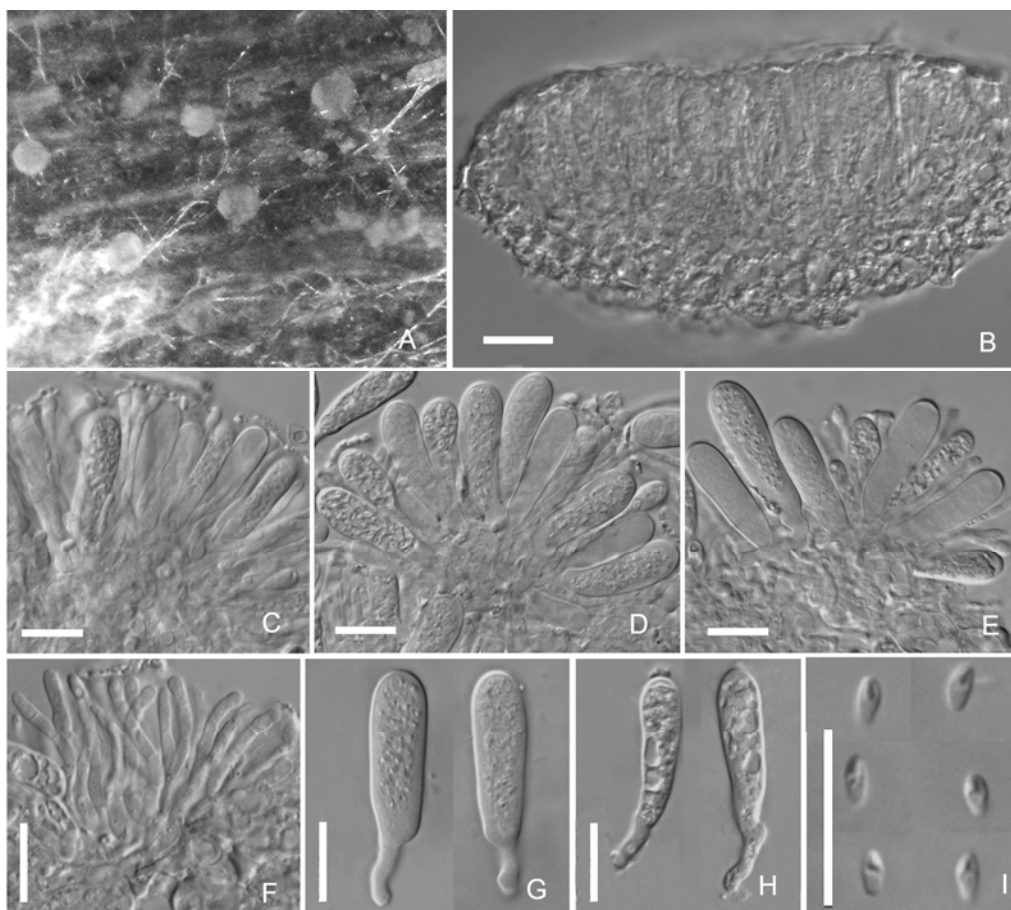
***New records for China***

***Orbilia alba*** Dennis Kew Bull. 9: 295, 1954.

(Fig. 4)

*Apothecia* gregarious, broadly sessile, whitish when fresh, strongly translucent, round to somewhat undulating, flat, very thin, margin even, slightly raised, superficial on rotten wood, 2-6 mm diam.. *Ectal excipulum* on base





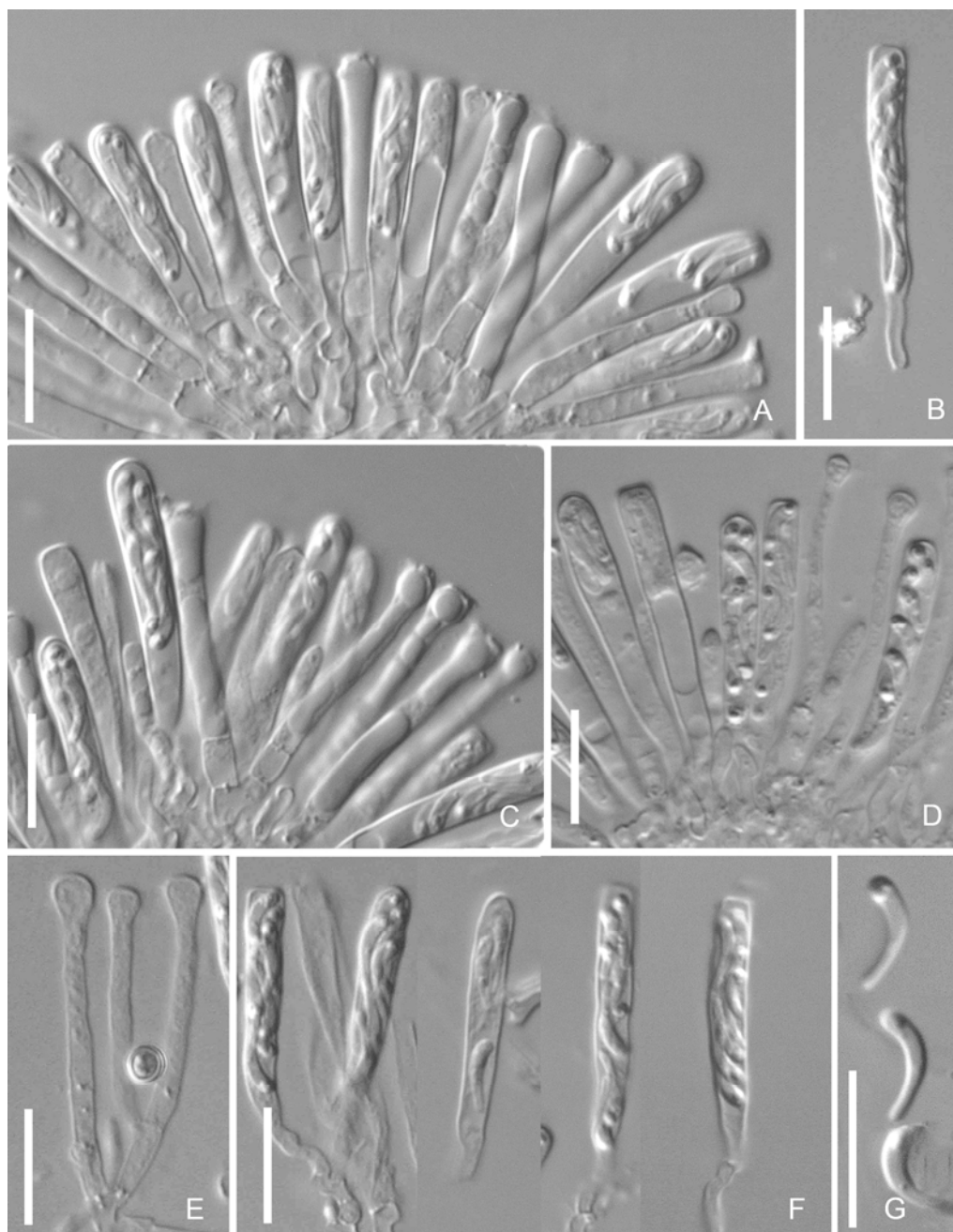
**Fig. 7.** *Orbilia* cf. *euonymi* A. Fresh apothecia. B. Vertical section of an apothecium. C-E. Cluster of asci and paraphyses. F. Paraphyses. G. Living asci. H. Dead asci with apical thickening. I. Living ascospores. Bars: B = 20  $\mu$ m, C-I = 10  $\mu$ m.

and flanks composed of angular or subglobose cells, (7-)10-20(-24)  $\times$  (5-)10-15(-18)  $\mu$ m. *Medullary excipulum* strongly gelatinized. *Anchoring hyphae* 3-6  $\mu$ m wide. *Asci* 8-spored, (20.6-)26.2-33.8  $\times$  3.4-3.8(-4.4)  $\mu$ m in living state, 22-31  $\times$  2.7-3.2  $\mu$ m in dead state, 8-spored, 4 of the spores inversely oriented (especially the lower ones), cylindric-clavate, tapered and often forked at the base, apex medium truncate to rounded, thin-walled. *Ascospores* hyaline, non-septate, rod-shaped, one end obtuse and the other slightly tapered (especially in dead state), 3.6-5(-6.5)  $\times$  0.7-1  $\mu$ m in living state, 3.5-4.5  $\times$  0.7-1  $\mu$ m in dead state; spore bodies globose, approximately 0.5  $\mu$ m diam., fully filling the obtuse apex of ascospore at upper end, attached to the inner apical wall. *Paraphyses* hyaline, subcylindrical to sublanceolate or spatulate with obtuse tips, 1.5-2.7  $\mu$ m wide in dead state, slightly protruding, some paraphyses with capitate-clavate, 2.5-6  $\mu$ m wide tip in dead state, sometimes covered with a layer of exudate about 1-1.3  $\mu$ m thick.

*Material examined:* PR CHINA, Yunnan Province, Wenshan County, on exterior of decayed bark of a branch of unidentified broad-leaved tree lying on the ground in a subtropical forest in karst region, alt. 1272 m, on 30 June 2006, collected by Zefen Yu, YMFT1.01858 & H.B. 8312 (bark fragment), Reexamination of the holotype by one of us (H.O. Baral).

*Notes:* Our collection is well characterized by extraordinarily large and thin apothecia with partly somewhat undulating margin. Such an apothecial size is uncommonly seen in *Orbilia* species. The microscopic characters fit very well to the reexamined holotype from Central America, except for slightly shorter and basally less attenuated spores in the Chinese specimen. Also the capitate paraphyses and the gel in the medullary excipulum were not observed in the holotype.

*Orbilia caudata* Starbäck Bih. Kongl. Svenska Vetensk.-Akad. Handl., Afd. 3, 25(1): 8, 1899. (Fig. 5)



**Fig. 8.** *Orbilia* cf. *neglecta* A, C. Cluster of living asci and paraphyses. B. Living ascus. D. Cluster of dead asci and paraphyses. E. Dead paraphyses. F. Dead asci. G. Living ascospores. Bars: A-G = 10  $\mu$ m.”

*Apothecia* 0.15-0.2 mm diam., scattered or gregarious, superficial on rotten corticated twig of unidentified broad-leaved tree, centrally attached, margin slightly crenulate and protruding, hairless; disc translucent, waxy, light cream-yellow to orange when fresh, watery at the center, flat to irregularly convex or undulating. *Ectal excipulum* of *textura globulosa-angularis* from base to flanks, cells 6-10  $\times$  5-9  $\mu$ m diam., marginal cortical cells elongated, forming a slightly inrolled margin, oriented at a high angle to the surface, terminated by low-refractive glassy processes 6-10  $\times$  2.5-3  $\mu$ m. *Medullary excipulum* of *textura*

*intricata* with many inflated cells, 11-20  $\mu$ m thick. *Asci* cylindric-clavate, 8-spored, apex rounded or strongly truncate, thin-walled, tapered and forked at the base, 32-40  $\times$  3.6-4  $\mu$ m in dead state. *Ascospores* hyaline, aseptate, heteropolar, ca. 5-6.5  $\times$  1.9-2.1  $\mu$ m in living state, (4.5-)5.3-5.8  $\times$  1.8-2  $\mu$ m in dead state, head broadly ellipsoid, tail rather short, 1-1.5(-2)  $\mu$ m long; Spore bodies ampulliform, with a globose or sometimes ovoid lower part and a much thinner upper part, 1-1.8  $\times$  0.5-0.7  $\mu$ m, some of the spores (mainly the lower ones) inversely oriented within the asci. *Paraphyses* hyaline, cylindrical, moderately to strongly

inflated to a globose apex, 2.5-3.8  $\mu\text{m}$  diam., mostly covered by a thin layer of rough exudate, septate at the lower part, 1.4-1.8  $\mu\text{m}$  wide.

*Material examined:* PR CHINA, Yunnan Province, Yimen County, Longkou Forest Park, on corticated rotten twig of unidentified broad-leaved tree lying on the moist ground in a shady subtropical forest, alt. 1892 m, on 27 June 2006, collected by Ying Zhang, YMFT033 & H.B. 8732 (twig fragment). Reexamination of the holotype of *O. caudata* by one of us (H.-O. Baral).

*Notes:* The specimen fits quite well to the revised holotype which was collected in Brasil. There are a few differences between our collection and the type specimen. In our material the marginal cortical cells possess glassy processes which evoke the crenulate apothecial margin, while these are absent in the holotype in which the margin is smooth, also the asci are shorter (45-53  $\times$  3.5-4.2  $\mu\text{m}$  in the holotype, dead state) and the apothecia smaller (0.3-1 mm in holotype). Despite these differences, the characters of our collection fit so closely to the holotype that we assume conspecificity for the time being.

***Orbilina aff. comma*** Graddon. Trans. Br. Mycol. Soc. 69: 265, 1977. (Fig. 6)

*Apothecia* sessile, gregarious, superficial, 0.5-0.9 mm diam, concave, margin smooth, translucent, pale orange to yellow when fresh. *Ectal excipulum* composed of globose or subglobose cells, with thin or only slightly thickened walls, (6.4-)7.4-13.6(-14.4)  $\times$  (5.1-)5.6-10.8(-11.5)  $\mu\text{m}$ . *Asci* 8-spored, (28.5-)31.8-36.7(-41)  $\times$  3-4.3  $\mu\text{m}$  in dead state, cylindric-clavate, tapered below and usually forked at the base, with a truncate to rounded, thin-walled apex. *Ascospores* hyaline, non-septate, (5.8-)6.2-7.4(-7.6)  $\times$  1.4-1.7  $\mu\text{m}$  in living state, 5-7  $\times$  1.2-1.5  $\mu\text{m}$  in dead state, clavate-fusoid, tapered at lower part to form a sometimes slightly curved basal tail, with slightly bulbous end, bearing a refractive spore bodies at the broad end, globose to tear-shaped, 1.3-1.8  $\times$  0.7-1  $\mu\text{m}$ ,  $\pm$  fully filling the apex of the spore, sometimes with 1-3 lipid bodies at middle or lower part of spore, globose, about 0.3-0.5  $\mu\text{m}$  diam.. *Paraphyses* hyaline, with globose or bulliform refractive vacuoles, strongly enlarged at the apex up to 3.6-5.4  $\mu\text{m}$  diam., lower part filiform, 1.8  $\mu\text{m}$  wide.

*Material examined:* PR CHINA, Yunnan Province, Xishuangbanna County, Greenstone Forest

Park, on exterior of decayed bark of a branch of an unidentified broad-leaved tree lying on the ground in a tropical forest, alt. 553 m, on 3 August 2005, collected by Min Qiao, YMFT012 (wood fragment).

*Notes:* *Orbilina comma* is a European species confined to bark of *Ulmaceae*. Its somewhat wider ascospores are helicoidally twisted and more strongly tapered at the base. Moreover, the paraphyses of *O. comma* are devoid of refractive vacuoles and the apothecia xerotolerant (in the Chinese specimen the tolerance to drying is unknown).

***Orbilina cf. euonymi*** Velen., Monogr. Discom. Bohemiae p. 95, tab. 11 fig. 14, 1934. (Fig. 7)

*Apothecia* 0.15 - 0.8 mm diam., superficial, sessile on a broad base, gregarious on decayed bark, margin even; disc flat to slightly convex, translucent, pale yellow to watery-whitish when fresh, margin somewhat inrolled when dry, outline circular or somewhat lobed. *Ectal excipulum* of *textura globulosa-angularis* from base to margin, cells hyaline, thin-walled, horizontally oriented; 15-25  $\mu\text{m}$  on lower flanks and 10.5-15  $\mu\text{m}$  thick at the margin, marginal cortical cells slightly elongated and thick walled. *Medullary excipulum* poorly developed. *Asci* 27.5-30  $\times$  5.5-7.5  $\mu\text{m}$  in living state and 23-27.5  $\times$  5.5  $\mu\text{m}$  in dead state, 64-spored, cylindric-clavate, apex hemispherical, never truncate, apical wall distinctly thickened (in dead state about 0.9-1.3  $\mu\text{m}$ ), slightly inflated at middle part, strongly tapered to a stipe about 6.4-9.7  $\times$  1.8-2.5  $\mu\text{m}$ , not forked at the base (L-shaped). *Ascospores* hyaline, non-septate, smooth, 2.7-3.4  $\times$  1.4-1.8  $\mu\text{m}$  in living state, ellipsoid-cylindrical, both ends obtuse, irregularly oriented and overlapping in asci; Spore bodies tear-shaped to somewhat ampulliform, 1.3-1.7  $\times$  0.6-0.8  $\mu\text{m}$ , affixed to the inner apical wall of one end. *Paraphyses* hyaline, filiform, septate, not or only slightly inflated (capitate-clavate) at the apex, apices hemispheric, equal or slightly higher than the asci, their apices somewhat agglutinated and partly encrusted by medium thick clods of exudate.

*Material examined:* PR CHINA, Yunnan Province, Yimen County, on exterior of decayed wood of an unidentified broad-leaved tree lying on the ground in a subtropical forest, Longkou Forest Park, alt. 1892 m, on 27 June 2006, collected by Ying Zhang, YMFT004 (wood fragment). Reexamination of the holotype by one of us (H.O. Baral).

*Notes:* All orbiliaceous fungi so far collected in China have been described to possess 8-spored asci, this species is the first multi-spored *Orbilia* found in China. *Orbilia euonymi* was described and illustrated by Velenovský (1934) as 8-spored while the reexamination of the holotype proved that the asci are 32-spored and also have a pronounced apical thickening. *Orbilia euonymi* is a common, plurivorous and wide-spread species which has been overlooked due to its minute, xerotolerant apothecia which usually grow on still-attached, periodically dry branches. It was mainly recorded in Europe but a few times also in N-America and Mongolia (Baral *et al.*, unpublished). The species was found to vary among the collections mainly in spore size, showing a range of (2.2-)2.8-4.3(-5.5) × (1.5-)1.7-2.1(-2.3) μm (living state). The Chinese collection was first believed to be 32-spored, but judging from the photos 64 spores seem more probable.

***Orbilia cf. neglecta*** Penz. & Sacc., Malpighia 15: 219 (1902) (Fig. 8)

*Apothecia* sessile, waxy, gregarious on rotten bark, 0.2-1.5 mm diam., pale orange to whitish, irregularly convex or undulating, smooth, with an even margin. *Ectal excipulum* of globose or subglobose cells, with thin or only slightly thickened walls. *Asci* 8-spored, cylindric, rounded or truncate at the thin-walled apex, gradually tapered and forked at the base, 35-38 × 3.6-4 μm in living state and 25.6-30.3 × 3.1-3.6(-3.8) in dead state. *Ascospores* hyaline, sickle-shaped, with one end strongly tapered and the other obtuse, 6.8-7.5 × 1.3-1.5 μm, usually intertwined within ascus; SBs globose to slightly ellipsoid, 0.6-0.8(-1) μm diam. *Paraphyses* filiform, 1.5-2.6 μm wide and inflated to 2.6-3.5 μm diam. at the apex, in living state with subglobose refractive vacuoles, not encrusted.

*Material examined:* PR CHINA, Yunnan Province, Binchuan County, Jizu Mountain, on exterior of decayed bark of an unidentified broad-leaved tree lying on the ground in a subtropical forest, associated with *Bisporella* sp., alt.1438 m, on 1 September 2005, collected by Ze-fen Yu. Reexamination of the holotype by one of us (H.-O. Baral).

*Notes:* The ascospores in the Chinese specimen strongly resemble in their shape those in the holotype of *O. neglecta*, a species described from Java growing on a

monocotyledonous plant (*Elettaria* sp.). However, they differ in having thicker tails and partly only tail-like or gradually attenuated bases. Further, the apothecia are larger and thicker and grow on wood instead of leaves. The Chinese specimen is also similar to *Orbilia terrestris* Raitv. & Faizova as reexamined from the holotype. However, the spores in the latter are distinctly longer (9-11 × 1.4-1.7 μm), also the asci much larger (40-53 × 4.2-5.8 μm, both in dead state), and the apothecia were described as orange-red when fresh, and grew on clayey-sandy soil with a few organic particles (parts of bark) at the bottom of a gorge in Tadschikistan.

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