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Three New Records of the Genus *Chaetomium* (Chaetomiaceae) in Taiwan

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ABSTRACT: Three species of *Chaetomium*, *C. ampullare*, *C. fusiforme*, and *C. longicolleum* are described and illustrated. They are all new to Taiwan. A key to the 24 species of *Chaetomium* recorded from Taiwan is also provided.

KEY WORDS: Chaetomiaceae, *Chaetomium*, Taiwan.

INTRODUCTION

The genus *Chaetomium* (Chaetomiaceae) is characterized by setulose or hairy perithecia and evanescent asci (Arx et al., 1986). In the past, 27 species of *Chaetomium* were recorded in Taiwan (Liou and Chen, 1979; Hu, 1996; Wang et al., 1999). Among them, *C. angustispirale*, *C. olivaceum*, *C. congoensis*, *C. caprinum*, *C. microcephalum*, *C. dolichotrichum*, and *C. reticulopilum* have been reduced as synonyms under 5 different species (Arx et al., 1986; Doveri, 2004). Three newly recorded species of *Chaetomium* are described and illustrated in this paper. The specimens are deposited at the herbarium of National Museum of Natural Science, Taichung, Taiwan (TNM). A key to the 24 *Chaetomium* species recorded from Taiwan is also provided.

TAXONOMIC TREATMENTS

Key to species of *Chaetomium* from Taiwan

1. Asci narrowly cylindrical, ascospores uniseriate …….. 2
1. Asci clavate, obovate or fusiform ……..…….. 3
2. Not thermophilic; terminal hairs spirally coiled; ascospores ovate, bilaterally flattened, 6.5-8.5 × 4.5-6.5 µm ….. ..... *C. brasiliense*
2. Thermophilic; terminal hairs dichotomously branched; ascospores globose to irregular subglobose, 8-10 × 7-9 µm .... …… *C. thermophile*
3. Ascospores with 2 germ pores ….....…….. 4
3. Ascospores with a single germ pore ….....…..…... 8
4. Terminal hairs sinuous to loosely coiled; ascospores spherical, 12-15 × 10-12 µm ……..... ..…..… *C. megalocarpum*
4. Terminal hairs arcuate; ascospores ellipsoid or fusiform 5
5. Colonies with red exudates ……..... …… 6
5. Colonies without red exudates ……..... …… 7
6. Ascospores 9-11 × 5-7 µm ……..... ….. *C. aureum*
6. Ascospores 12-16 × 5-6 µm …..... ….. *C. fusiforme*
7. Colonies with yellowish-green exudates; terminal hairs incurved at tips ..... *C. gracile*
7. Colonies with orange exudates; terminal hairs with circinate tips ..... *C. flavigenum*
8. Germ pore of the ascospores subapical or lateral; ascospores broadly ellipsoid, 11-16 × 7-11 µm ..... ….. *C. gangligerum*
8. Germ pore of ascospores apical ……..... ….. 9
9. Perithecium elongate, vase-shaped, or cylindrical …… 10
9. Perithecium ovoid, globose, or subglobose ……..... 15
10. Perithecium barrel-shaped or subpyriform; terminal hairs with spiral coils ..…..... 11
10. Perithecium vase-shaped or with a more or less elongated neck 12
11. Perithecium barrel-shaped; lateral hairs with 3-4 coiled ends ..... ….. *C. subspirale*
11. Perithecium obclavate or subpyriform; lateral hairs straight or curved with curved tips …..... ……..… *C. robustum*
12. Terminal hairs straight, apically often branched or circinate; ascospores lemon-shaped …….....…… 13
12. Terminal hairs straight, unbranched …….....….. 14
13. Perithecium 630-660 × 250-260 µm, with straight elongated neck hairs; perithecial hairs obscurely branched above …….. ..... *C. ampullare*
13. Perithecium 240-345 × 125-200 µm, with a conic ostiolar beak; perithecial hairs branched or circinate ……. *C. homopilatum*
14. Terminal hairs over 1 mm long; perithecium with a long beak composed of fused setae ……..……... *C. longicolleum*
14. Terminal hairs short, sparse; perithecium with short conic ostiole, without such a beak …….....….. *C. seminudum*
15. Terminal hairs sinuous to loosely coiled; ascospores 6-8.5 µm wide …..... 16
15. Above characters not combined ……..... ……... 18
16. Ascospores ellipsoid-fusiform, 14-15 × 7.5-8.5 µm …..... … ..... *C. succineum*
16. Ascospores lemon-shaped, usually biapiculate, bilaterally flattened ….....…..…… 17
17. Perithecium less than 280 µm long; homothallic, phialoconidia absent ….....…….. *C. globosum*
17. Perithecium more than 280 µm long; heterothallic, phialoconidia present ….....…… *C. subaffine*

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18. Terminal hairs spirally coiled; ascospores ovoid ……..…... 19
18. Above characters not combined ……..……. 20
19. Perithecium not more than 200 μm wide; terminal hairs straight below, regularly spirally coiled above with about 7-8 close coils, a few obscure branched; ascospores 5-7 × 5-6 μm …… ..... *C. botrychodes*
19. Perithecium more than 200 μm wide; terminal hairs straight below, becoming undulate to loosely coiled to tightly coiled with about 6 close coils; ascospores 6.5-8.5 × 4.5-6.5 μm ….. ..... *C. convolutum*
20. Terminal hairs dichotomously branched; ascospores ovate to ellipsoid .....…… 21
20. Above characters not combined ……..……. 22
21. Unbranched terminal hairs present at maturity in addition to dichotomously branched hairs, conspicuous, usually projecting beyond mass of branched hairs; ascospores 6-7.5 × 4-5 μm ……..…… *C. funicola*
21. Unbranched terminal hairs absent at maturity; ascospores 4.5-6 × 3-4.5 μm …..... *C. indicum*
22. Terminal hairs flexed to long undulate; ascospores 5-6 × 4-5 μm ..... *C. nigricolor*
22. Terminal hairs arcuate curving towards the center, recurved tips with coils; lateral hairs at the apex with 1-2 coils; ascospores 7.5-11 μm long .....…… 23
23. Perithecial hairs red or copper colored in reflected light …… ..... *C. cupreum*
23. Perithecial hairs yellowish-brown to olivaceous-brown in reflected light …..... *C. chiversii*

Chaetomium ampullare Chivers, Proc. Amer. Acad. Arts & Sci. 48: 86. 1912. Figs. 1A-B & 2A-D

Perithecia gregarious, superficial, black, sometimes covered by sparse aerial hyphae, large, flask-shaped, 630-660 × 250-260 μm, with an elongated neck. Terminal hairs brown, straight, septate, long-tapering, becoming pale brown or hyaline towards pointed tips, 160-250 μm long, 3-4 μm wide near base, with a swollen basal cell ca. 6 μm in diam., punctulate or nearly smooth, alternate cells collapsed, usually ending in two thread-like, wavy, collapsed branches. Lateral hairs similar but unbranched, few. Peridium brown, pseudoparenchymatous, membranous, consisting of angular cells, 10-12.5 × 5-7.5 μm. Asci evanescent, not observed. Ascospores pale olivaceous brown, lemon-shaped, 6-10 × 6-7 μm, strongly umbonate at both ends, extruded in irregular clusters, often collecting at ends of terminal hairs.

Specimens examined: Nantou Co.: Meifeng, on soil, *Jong S18*, Feb. 13, 2007 (TNM F20939); *Jong S24*, May. 7, 2007 (TNM F20940).

Chaetomium ampulliellum seems to be closely related to this species, but differs in having much smaller perithecia (160-260 × 65-130 μm) (Wang and Zheng, 2005). This species is characterized by a flask-shaped perithecium with straight terminal hairs, obscurely branched above, and the lemon-shaped ascospores (Skolko and Groves, 1953). The walls of the asci were not observed; they are evanescent at maturity breaking down to free the ascospores into the perithecial cavity.

Chaetomium fusiforme Chivers, Proc. Am. Acad. Arts Sci. 48: 87. 1912. Figs. 1C-E & 3

Chaetomium minimum van Beyma, Antonie van Leeuwenhoek 10: 41. 1945.

Perithecia gregarious, superficial, olivaceous-brown to dark brown, ostiolate, globose to subglobose, 100-105 × 60-90 μm. Terminal hairs yellowish-brown to olivaceous-brown, 100-112.5 μm long, 2-2.5 μm wide near base, with a swollen basal cell ca. 4 μm in diam., arcuate, unbranched, septate, coarsely roughened, tip blunt. Lateral hairs light brownish, short, straight or curved at top, unbranched, septate, smooth. Peridium brown, translucent, pseudoparenchymatous, membranous, consisting of globose to angular cells, 7-8 × 5-6 μm. Asci 8-spored, clavate, with a short stipe, 30-37.5 × 12.5-15 μm, evanescent. Ascospores arranged irregularly tending to be biseriate, initially hyaline, then becoming olivaceous-brown, ellipsoid or fusiform, 12-16(-17) × 5-6 μm, smooth, bluntly apiculate at both ends. Germ pores small, ca. 1 μm wide, apical at both ends.

Colonies on MEA medium spreading slowly. Mycelium pinkish-red; pinkish-red on reverse, mainly submerged, margin smooth, reaching 1.6-2.0 cm in diam. in 5 days at room temperature. Hyphae 1-2 μm wide, branched, hyaline, septate. Aerial mycelium white, abundant, perithecia formed within aerial mycelium. Perithecia gradually appearing, superficial in agar, numerous. Anamorph not observed.

Specimen examined: Taipei: Yangmingshan National Park, Chingtienkang, on soil, *Jong S26*, May 17, 2007 (TNM F20942).

Chaetomium fusiforme is distinguished by its fusiform ascospores, colonies with red exudates, and arcuate perithecial hairs. The arcuate hairs with circinate tips described by Skolko and Groves (1953) were not observed in this specimen. *Chaetomium aureum* is close to this species, but differs in having larger perithecia (125-150 × 105-135 μm) and smaller ascospores (8.5-11 × 4.5-5.5 μm) (Skolko and Groves, 1953).

Chaetomium longicolleum Krzemien. & Badura, Acta Soc. Bot. Poloniae 23: 748. 1954. Figs. 1F-G & 2E-H

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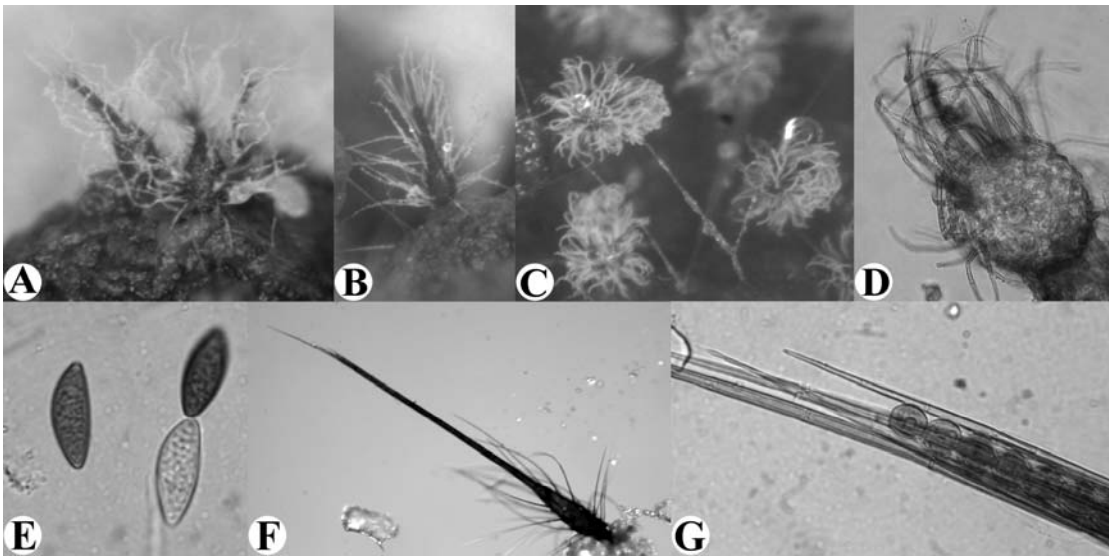


Fig. 1. A-B: Perithecia of *Chaetomium ampullare*. C-E. *Chaetomium fusiforme*. C-D: Perithecia.. E: Young and mature ascospores. F-G. *Chaetomium longicolleum*. F: A perithecium. G: Terminal portion of the perithecium. Scale bar: A-B = 250 μm, C & F = 100 μm, D = 20 μm, E = 6 μm, G = 12 μm.

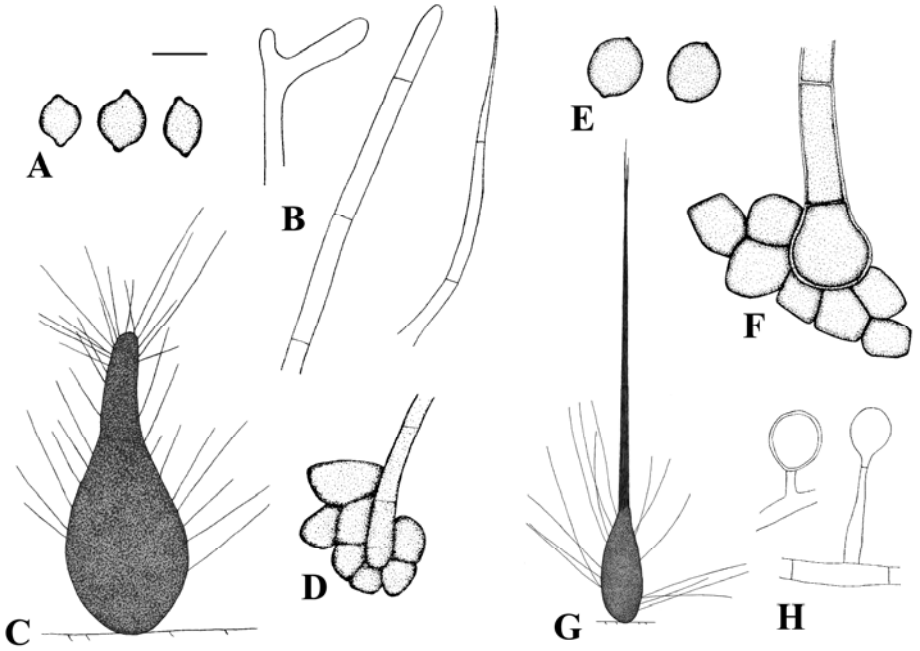


Fig. 2. A-D. *Chaetomium ampullare*. A: Ascospores. B: Terminal hairs. C: A perithecium. D: Origin of lateral hair. E-H. *Chaetomium longicolleum*. E: Ascospores. F: Origin of lateral hair. G: A perithecium. H: Chlamydospores. Scale bar: A = 8 μm, B & E = 9 μm, C = 100 μm, D = 12 μm, F = 5 μm, G = 100 μm, H = 14 μm.

Chaetoceratostoma longirostre Farrow, Mycologia 47: 418. 1955.
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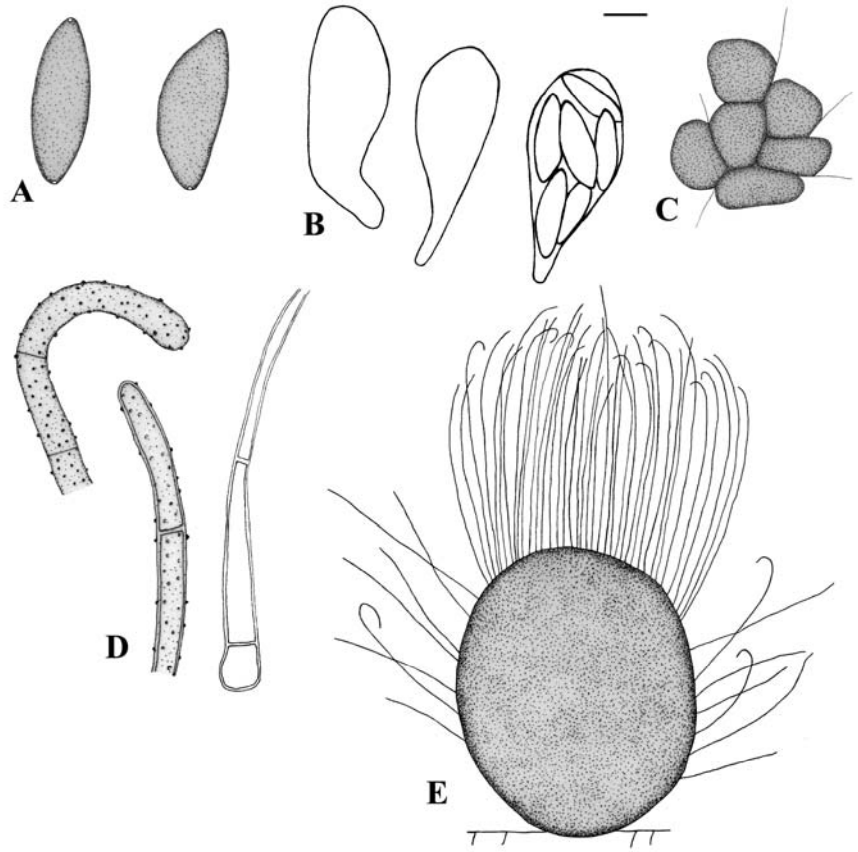


Fig. 3. *Chaetomium fusiforme*. A: Ascospores. B: Asci. C: A part of peridium. D: Detail of perithecial hairs. E: A perithecium. Scale bar: A, C & D = 4 μm, B = 6 μm, E = 15 μm.

Perithecia gregarious, superficial, dark brown to black, ovate, 200-230 × 50-70 μm. Terminal hairs brown, slender, straight, unbranched, originating around ostiole, often forming a bundle with a beaked appearance, separated at tip and with irregular lengths, over 1 mm long, septate, smooth-walled, tapering to pale, pointed tip. Lateral hairs similar but shorter, brown, 205-350 μm long, 2.5-5.0 μm wide near base, with a swollen basal cell ca. 7.5 μm in diam. Peridium brown, pseudoparenchymatous, membranous, semitransparent, of angular or irregularly shaped cells. Asci evanescent, not observed. Ascospores olivaceous-brown, subglobose, 10-12 × 9-10 μm, smooth, subapiculate at both ends, often collecting at terminal hairs.

Colonies on MEA medium spreading slowly. Mycelium gray; gray or yellowish white on reverse, mainly submerged, margin smooth, reaching 3.4-4.0 cm in diam. in 5 days at room temperature. Hyphae 2-4 μm wide, branched, hyaline, septate. Aerial mycelium white, sparse. Chlamydospores abundantly produced, borne on the side branches of hyphae, pale yellowish, globose to subglobose, 11-14 μm in diam., smooth, thick-walled.

Specimens examined: Taichung Co.: Tantzu, Jusingshan, Fengdongshi walking trails, on soil, *Jong S17*, Feb. 8, 2007 (TNM F20938). Chiayi Co.: Alishan, Sanmei Village, Danayiku, on soil, *Jong S27*, Aug. 21, 2007 (TNM F20943).

This collection was recognized mainly by the characters of terminal hairs and ascospores. Members of *Farrowia* were shown to be closely related to the beaked species of *Chaetomium* by molecular analyses (Untereiner et al., 2001). Hence, *F. longicollea* is assigned as a synonym of *C. longicolleum* here in this paper.

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臺灣產毛殼菌屬的三種新紀錄種

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摘　　要

本文描述三個臺灣產毛殼菌 (*Chaetomium*) 的新紀錄種，分別為 *C. ampullare*、*C. fusiforme* 以及 *C. longicolleum*，並提供 24 種臺灣已紀錄毛殼菌屬種類的檢索表。

關鍵詞：毛殼菌科、毛殼菌屬、臺灣。

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