

Myxomycetes of Taiwan (XIX): The Order Echinosteliales

Chin-Hui Liu^(1,2), Jong-How Chang⁽¹⁾ and Ya-Fen Chen⁽¹⁾

(Manuscript received 24 July, 2006; accepted 16 October, 2006)

ABSTRACT: Six taxa in the order Echinosteliales are reported from Taiwan. Of the six taxa, *Echinostelium apitectum* Whitney, *E. arboreum* Keller & Brooks, and *E. paucifilum* Whitney are newly recorded, which are all collected from moist-chamber cultures. Keys to the families of Echinosteliales, and to the species of *Clastoderma* and *Echinostelium* recorded in Taiwan are also provided.

KEY WORDS: *Clastoderma*, Echinosteliales, *Echinostelium*, Myxomycetes, Taiwan, True slime molds.

INTRODUCTION

The order Echinosteliales contains a group of minute myxomycete organisms with sporangiate and stipitate fructifications. The sporangia which are generally globose contain either light- or dark-colored spores, and bear capillitia or not at all. The peridium of the sporangium are generally early evanescent except for a minute collar left at the base of the sporangium. The stipe usually protrudes into the sporangium to form a columella except in few species. Two families and three genera are recognized in this order (Martin et al., 1983).

In this paper we report six taxa, four in the genus *Echinostelium* of the family Echinosteliaceae and two in the genus *Clastoderma* of the family Clastodermataceae. Of them three are new records to Taiwan and thus are described and illustrated, based on our specimens collected in Taiwan.

TAXONOMIC TREATMENTS

Echinosteliales G. W. Martin, Mycologia 52: 127. 1961.

Key to the families of Echinosteliales from Taiwan (inspired by Martin et al., 1983)

1. Spores brown in mass; peridium persistent as a whole or in fragments which remain attached to the tips of capillitial threads Clastodermataceae
1. Spores white or pale in mass; peridium delicate, evanescent at an early stage, though often leaving a collar at the base of the sporangium Echinosteliaceae

Clastoderma A. Blytt, Bot. Zeit. 38: 343. 1880.

1. Institute of Plant Biology, National Taiwan University, 1, Sec. 4, Roosevelt Rd., Taipei 106, Taiwan.
2. Corresponding author. Email: huil4951@ntu.edu.tw

Orthotricha Wingate, J. Myc. 2: 125. 1886.

Wingina Kuntze, Rev. Gen. Pl. 1: 875. 1891.

Fruiting body sporangiate. Sporangium globose, stipitate. Peridium delicate, breaking up at maturity into small fragments which remain attached to the tips of capillitial threads. Columella often present. Capillitium arising from the tip of the columella, consisting of branching and anastomosing threads. Spores medium to dark brown in mass.

Key to the species of *Clastoderma* from Taiwan

1. The peridial fragments smooth, not reticulate; total height more than 1 mm *C. debaryanum*
1. The peridial fragments reticulate; total height usually less than 1 mm *C. debaryanum* var. *imperatorium*

Clastoderma debaryanum A. Blytt, Bot. Zeit. 38: 343. 1880.

Orthotricha microcephala Wingate, J. Myc. 2: 125. 1886.

Wingina microcephala (Wingate) Kuntze, Rev. Gen. Pl. 1: 875. 1891.

Clastoderma dictyosporum Lakh. & Muk., Norw. J. Bot. 23: 110. 1976.

Description and illustration: C.-H. Liu, in *Taiwania* 28: 93, 114 (1983).

Distribution: Cosmopolitan.

Clastoderma debaryanum var. *imperatorium* Emoto, Bot. Mag. Tokyo 43: 169. 1929.

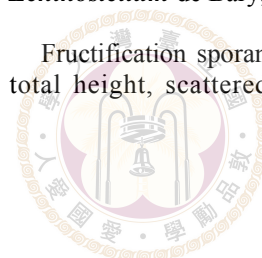
Description and illustration: Chung and Liu, in *Taiwania* 42: 276-277 (1997).

Distribution: Asia (China, Japan, Taiwan), Europe, Hawaii, North America.

Echinostelium de Bary, in Rostaf., Versuch 7. 1873.

Figs. 1-3

Fructification sporangiate minute, 20-550 µm in total height, scattered to gregarious. Sporangia



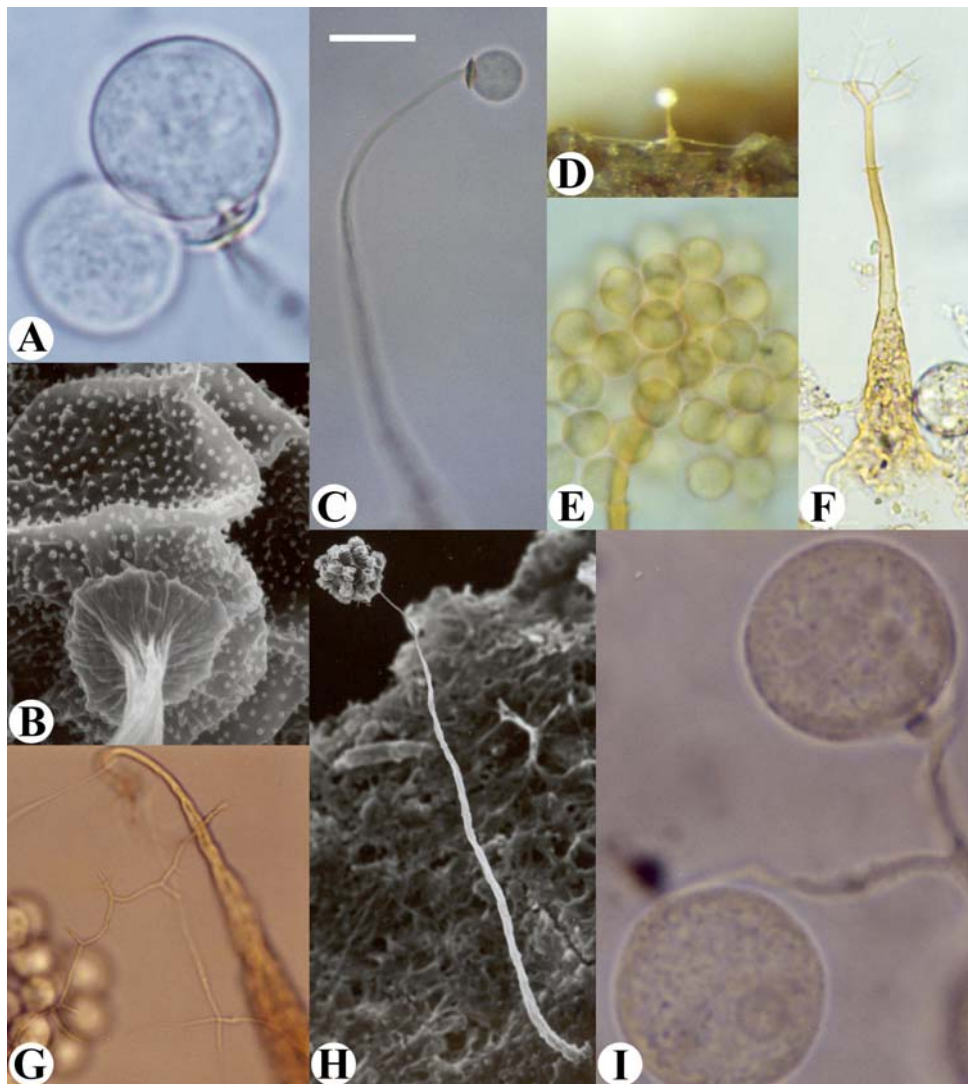


Fig. 1. A-C: *Echinostelium apitectum*. A: Spore and columella at the apex of the stalk. B: Spores and collar, by SEM. C: One fruiting body. D-F: *E. arboreum*. D: One fruiting body. E: Spores. F: Dehisced sporangium, showing the capillitial threads, columella, and collar. G-I: *E. paucifilum*. G: Dehisced sporangium, showing the branched capillitial threads. H: One fruiting body, by SEM. I: Spores. Scale bars: A & I = 5 μ m, B & F = 2.5 μ m, C, E, G = 12 μ m, D = 170 μ m, H = 42 μ m.

stipitate, white to pale in color, globose, often less than 70 μ m in diameter except in *E. cribrariodes* (up to 120 μ m in diameter). Peridium early evanescent, but often leaving a collar at the base of the sporangium around the stipe. Capillitium present as solid threads or absent. Columella present in most species. Spores pale in mass, often with articular surface markings.

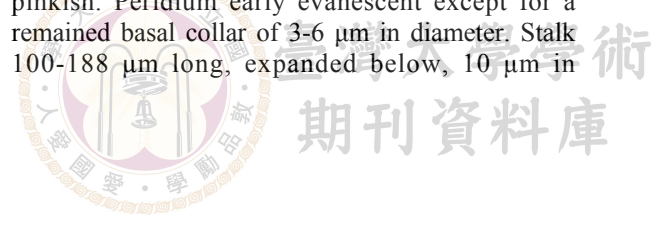
Key to the species of *Echinostelium* from Taiwan (inspired by Whitney, 1980)

- 1. Capillitium present 2
- 1. Capillitium absent; columella flattened to elongate, minute, contained within a spore-like covering *E. apitectum*
- 2. Columella cylindrical, tapering, or fusiform, pale tan to dark brown; spores 12.5-15 μ m in diameter *E. paucifilum*

- 2. Columella cylindrical, conical, or irregular, usually hyaline, occasionally pale yellow brown; spores less than 9 μ m in diameter 3
- 3. Columella stout, cylindrical; peridium persistent; total height less than 130 μ m *E. arboreum*
- 3. Columella conical or irregular, occasionally elongate, but never stout; peridium early evanescent; total height 175-500 μ m *E. minutum*

Echinostelium apitectum Whitney, Mycologia 72: 954. 1980. Figs. 1A-C

Fructification sporangiate, scattered to gregarious, more than 150 μ m in total height. Sporangium stipitate, globose, 50-63 μ m in diameter, white to pinkish. Peridium early evanescent except for a remained basal collar of 3-6 μ m in diameter. Stalk 100-188 μ m long, expanded below, 10 μ m in



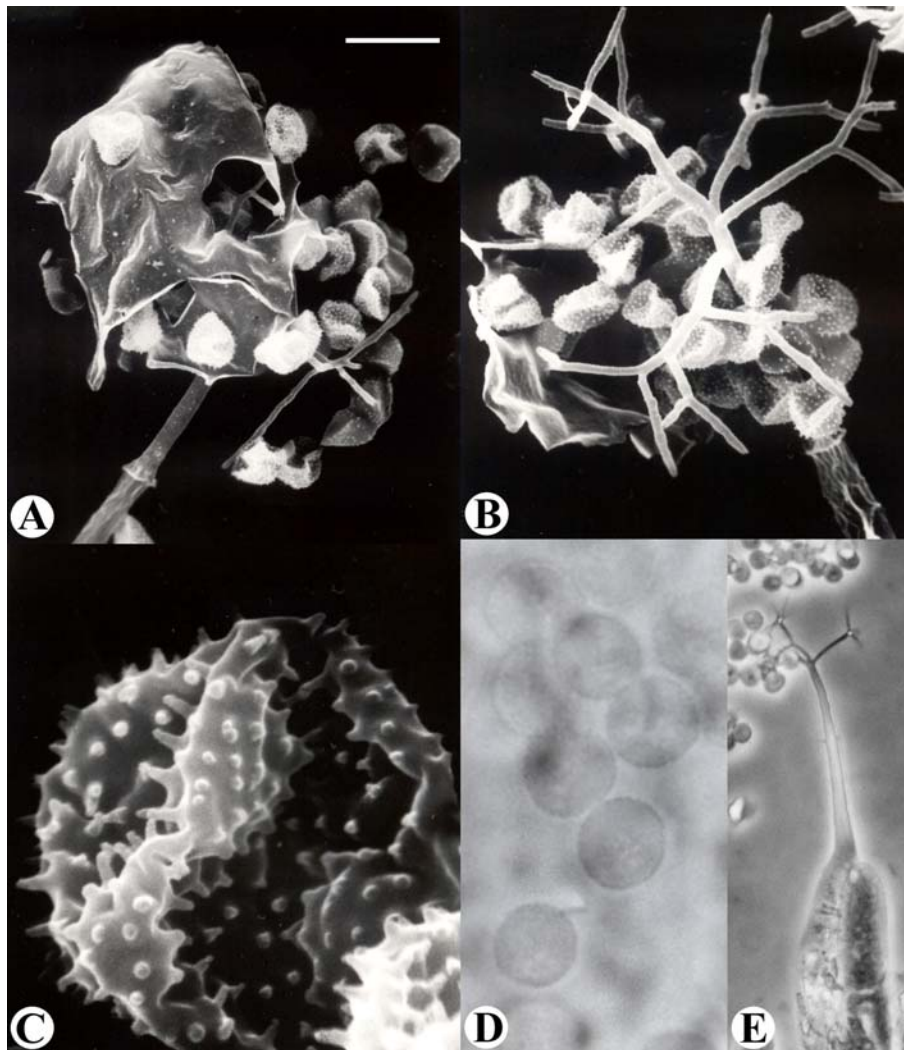


Fig. 2. *Echinostelium arboreum*. A: Dehiscent sporangium, showing the persistent peridium. B: Capillitial threads and spores, by SEM. C: Surface markings of spore, by SEM. D: Spores. E: Sporangium, showing the capillitial threads, columella and collar. Scale bar: A = 11 μ m, B = 7 μ m, C = 1 μ m, D = 4 μ m, E = 17 μ m.

diameter, filled with granular debris at the lower portions, tapering to a narrow apex ca 1 μ m in diameter. Columella present, conical or elongate, 1-3 μ m in length, contained within a spore-like covering of 9.0-14.5 μ m in diameter at the tip of the stalk. Capillitium absent. Spores white to pink in mass, colorless or very pale by transmitted light, globose, 8-12 μ m in diameter, minutely roughened under LM, minutely and evenly warted or echinulate under SEM. Plasmodium not observed.

Specimens examined: Pingtung Co.: Wanlitè Mt., *Y.F. Chen* 66, Aug. 8, 1995 (moist-chamber culture: 8/8/1995-8/23/1995), on bark of *Ilex lonicerifolia* var. *matsudai* Yamamoto; *Y.F. Chen* 144, Jan. 4, 1996 (moist-chamber culture: 1/4/1996-1/29/1996), on bark of *Cyclobalanopsis longinux* (Hayata) Schottky; *Y.F. Chen* 177, Feb. 9, 1996 (moist-chamber culture: 2/9/1996-2/22/1996), on bark of *Helicia formosana* Hemsl.

Distribution: Africa, Asia (China, Japan, Taiwan), Australia, Europe, North America.

This species is distinct in bearing a minute columella contained in a spore-like covering. Other characters are the lack of capillitium and spore surface markings, which are nearly smooth or minutely roughened under LM but prominently warted or echinulate under SEM, and without articular surface markings (thickenings at points of spore-to-spore contact).

Echinostelium arboreum Keller & Brooks, *Mycologia* 68: 1207. 1976. Figs. 1D-F & 2

Fructification sporangiote, scattered to gregarious, (100-) 150-167 μ m in total height. Sporangium white or pale brownish, globose, 32-62 μ m in diameter, stipitate, erect. Stalk 125 μ m long, transparent above, often filled with refuse matter below, subulate, 25



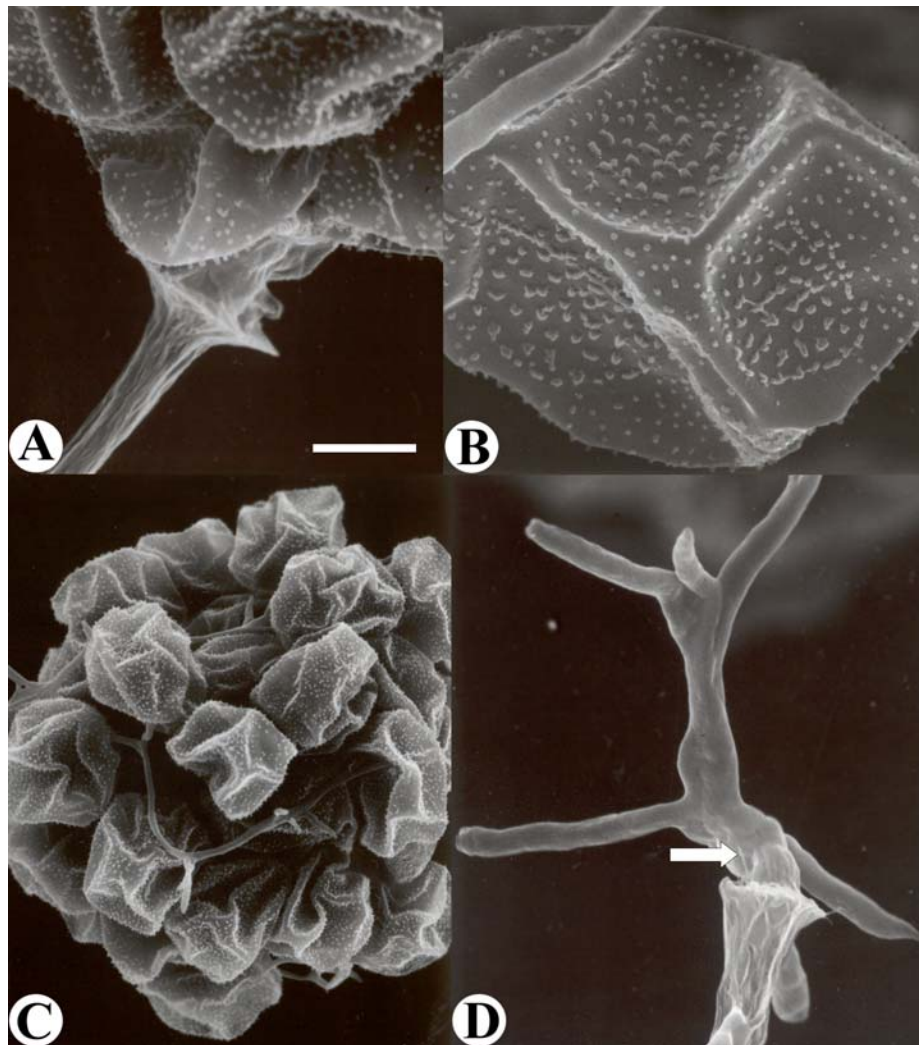


Fig. 3. *Echinostelium paucifilum*, by SEM. A: Spores and the collar at the base of the sporangium. B: Spore, showing the surface markings. C: Capillitial threads and spores. D: The columella (arrow) at the top of the stalk, branching into capillitial threads. Scale bars: A & D = 2.5 μ m, B = 6.5 μ m, C = 7 μ m.

μ m thick at the broadest base. Peridium membranous, hyaline, shiny, left as a minute collar at the base of the sporangium, and persistent by hanging at the top of sporangium after dehiscing. Columella present, cylindrical, extending nearly to the center of the sporangium, 14-28 μ m long. Capillitium consisting of straight and smooth capillitial threads, with 3 main branches arising from the tip of the columella, hyaline, dichotomously branched 1-4 times at wide angles, without anastomosing. Spores whitish to pale yellow in mass, hyaline by transmitted light, globose, 7.0-7.5 μ m in diameter, prominently and evenly warted, without articular surface markings.

Specimens examined: Nantou Co.: Hsitou, CHL B870b, Aug. 2, 1991, on dead wood. Pingtung Co.: Nanjenshan Mt., CHL B1588, Feb. 2, 1999 (moist-chamber culture: 2/4/1999-2/24/1999), on bark.

Distribution: Asia (Japan, Taiwan), Europe, North America.

The distinct characteristic of this species is the cylindrical columella which is stout and long. It is also characterized by the persistent peridium, the dichotomously branched capillitial threads and prominently warted spores.

Echinostelium minutum de Bary, in Rostaf., Mon. 215. 1874.

Description and illustration: C.-H. Liu, in *Taiwania* 28: 93, 97 (1983).

Distribution: Cosmopolitan.

Echinostelium paucifilum Whitney, *Mycologia* 72: 974. 1980. Figs. 1G-I & 3

Fructification sporangiate, solitary, scattered, up to 0.35 mm in total height. Sporangium globose pale



pinkish white to pale pink, 42-73 μm in diameter. Peridium evanescent except for a basal collar of 2-5 μm in diameter. Hypothallus inconspicuous. Stalk erect, filiform, up to 0.3 mm long, ca 17 μm in diameter at the base, tapering toward the apex of 1-2 μm in diameter, filled with amorphous matter from base to below the apex. Columella cylindrical, 6-15 μm in length, then forking to give rise to capillitium. Capillitium arising from the apex of the columella, and dividing (after a long interval) up to four or five times but not anastomosing. Spores pinkish in mass, pale to colorless by transmitted light, globose, 12-15 μm in diameter, nearly smooth even under oil lens, apparently warted under SEM, with clusters of larger warts forming circular patches spreading on the wall surface.

Specimens examined: Pingtung Co.: Wanlitê Mt., Y.F. Chen 134, Jan. 4, 1996 (moist-chamber culture: 1/4/1996-1/20/1996), on living twigs of *Syzygium buxifolium* Hook. & Arn.; Y.F. Chen 168, Feb. 9, 1996 (moist-chamber culture: 2/9/1996-2/27/1996), on bark of living tree of *Ilex uraiensis* Mori & Yamamoto.

Distribution: Asia (Japan, Taiwan), Europe, Hawaii, North America.

This species superficially resembles *Echinostelium minutum* but can be separated from it by spores. Spores in *E. paucifilum* are much larger (12-15 μm) than those in *E. minutum* (6-8 μm), but the surface markings of spores in both species are alike.

LITERATURE CITED

- Chung, C.-H. and C.-H. Liu. 1997. Myxomycetes of Taiwan VIII. *Taiwania* **42**: 274-288.
 Liu, C.-H. 1983. Myxomycetes of Taiwan IV. Corticolous Myxomycetes. *Taiwania* **28**: 89-116.
 Martin, G. W., C. J. Alexopoulos and M. L. Farr. 1983. The Genera of Myxomycetes. Univ. Iowa Press, Iowa City, U.S.A. 102pp.
 Whitney, K. D. 1980. The myxomycete genus *Echinostelium*. *Mycologia* **72**: 950-987.

臺灣黏菌 (十九)：刺絲黏菌目

劉錦惠^(1,2)、張仲豪⁽¹⁾、陳雅芬⁽¹⁾

(收稿日期：2006年7月24日；接受日期：2006年10月16日)

摘 要

本篇報導六個刺絲黏菌目的成員，其中三種是臺灣的新紀錄種，包括頂覆刺絲黏菌 (*Echinostelium apitectum* Whitney)、樹形刺絲黏菌 (*E. arboreum* Keller & Brooks)、寡絲刺絲黏菌 (*E. paucifilum* Whitney)，所有子實體都以濕室培養方法獲得。另外內文並提供臺灣所紀錄的刺絲黏菌目內之各科之檢索表，以及碎皮黏菌屬 (*Clastoderma*) 與刺絲黏菌屬 (*Echinostelium*) 內物種檢索表。

關鍵詞：碎皮黏菌屬、刺絲黏菌目、刺絲黏菌屬、黏菌綱、臺灣、真黏菌。

1. 國立臺灣大學生命科學院植物科學研究所，106 台北市羅斯福路 4 段 1 號，臺灣。

2. 通信作者。Email: huil4951@ntu.edu.tw

