

The Genus *Hemitrichia* (Myxomycetes) in Taiwan

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Abstract. Four species of the genus *Hemitrichia* have been reported from Taiwan. In this paper, two additional records, *H. leiotricha* (Lister) G. Lister and *H. pardina* (Minakata) Ing and an unknown species are described and illustrated. A key to the *Hemitrichia* species of Taiwan is also provided.

Key words: *Hemitrichia*, Myxomycetes, Taiwan, Trichiaceae.

INTRODUCTION

The genus *Hemitrichia* (Trichiaceae, Trichiales) is characterized by having tubular capillitial threads which are entangled more or less completely into an elastic net, and are marked with 2~5 spiny or smooth spiral bands (Martin and Alexopoulos, 1969; Ing, 1999). Previously five species of *Hemitrichia* were recorded in Taiwan (Nakazawa, 1929; Liu, 1980, 1982, 2005; Wang *et al.*, 1981; Liu, *et al.*, 2002). Among them, the species *H. leiocarpa* (Nakazawa, 1929) has been transferred to the genus *Arcyria*, due to its spore ornamentation that is similar to the spore profile of other *Arcyria* species (Illana *et al.*, 1999). In this paper we reported two new records, *H. leiotricha* and *H. pardina*, and an unknown species. Voucher specimens are deposited at the herbarium of the National Museum of Natural Science, Taichung, Taiwan (TNM).

TAXONOMY

Key to species of *Hemitrichia* of Taiwan. (inspired by Lister, 1925 and Martin and Alexopoulos, 1969).

1. Fructifications sporangiate.....2
 - Fructifications plasmodiocarpous in a branched and reticulate pattern; spores coarsely and prominently reticulate.....*H. serpula*

2. Spores spinulate-reticulate; capillitium 5~7 μm in diameter3
 - Spores spinulate; capillitium (usually) less than 5 μm in diameter.....4
3. Sporangia broadly clavate to obpyriform; stalk gradually blending into the deep calyculi *H. clavata*
 - Sporangia turbinate or obpyriform, sharply delimited from the usually slender stalks *H. calyculata*
4. Spores clustered, 5~12 spores in a cluster *Hemitrichia* sp.
 - Spores free5
5. Peridium bearing prominent warts or peg-like protuberances *H. pardina*
 - Peridium not bearing protuberances6
6. Peridium dark brown, mottled with yellow lines *H. velutina*
 - Peridium clay yellow, unmarked *H. leiotricha*

Hemitrichia calyculata (Speg.) M. L. Farr, Mycologia 66: 887. 1974.

≡ *Hemiarcyria calyculata* Speg., Anal. Soc. Cie. Argent. 10: 152. 1880.

= *Hemiarcyria stipitata* Masee, J. Roy. Microsc. Soc. Lond. 1889: 354. 1889.

= *Hemitrichia stipitata* (Masee) T. Macbr., North American Slime-Moulds 207. 1899.

= *Arcyria stipitata* (Masee) Masee, Monogr. 163. 1892.

= *Hemiarcyria plumosa* Morgan, J. Cincinnati

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Soc. Nat. Hist. 16: 23. 1893.

= *Hemitrichia clavata* var. *stipitata* (Massee) Torrend, Broteria 7: 50. 1908.

≡ *Hemitrichia clavata* var. *calyculata* (Speg.) Y. Yamam., in Nakaike and Malik, Crypt. Fl. Pakist. 2: 28. 1993.

≡ *Hyporhamma calyculatum* (Speg.) Lado, Cuad. Trab. Fl. Micol. Iber. 16: 47. 2001.

Description and illustration: C.H. Liu, in *Taiwania*, 27: 65-66, 81 (1982).

Hemitrichia clavata (Pers.) Rostaf., in *Fuckel, Jahrb. Nass. Ver. Nat.* 27-28: 75. 1873.

≡ *Trichia clavata* Pers., *Neues Mag. Bot.* 1: 90. 1794.

= *Trichia erythropus* I.G. Borshch., *Fungi Ingr.* 1857.

≡ *Hemiarcyria clavata* (Pers.) Rostaf., *Monogr.* 264. 1875.

≡ *Arcyria clavata* (Pers.) Massee, *Monogr.* 165. 1892.

= *Hemiarcyria funalis* Morgan, *J. Cincinnati Soc. Nat. Hist.* 16: 26. 1893.

= *Hemiarcyria ablata* Morgan, *J. Cincinnati Soc. Nat. Hist.* 16: 24. 1893.

= *Hemitrichia clavata* var. *altaica* Lavrov, *Sist. Zametki Mater. Gerb. Krylova Tomsk. Gosud. Univ. Kujbyseva* 4-5: 2. 1929.

≡ *Hyporhamma clavatum* (Pers.) Lado, *Cuad. Trab. Fl. Micol. Iber.* 16: 47. 2001.

Description and illustration: C.H. Liu, in *Taiwania*, 27: 65-66 (1982).

Hemitrichia leiotricha (Lister) G. Lister, in *Lister, Mycet. ed.* 2. 224. 1911.

(Fig. 1A~D)

≡ *Hemitrichia intorta* var. *leiotricha* Lister, *Monogr. Mycetozoa* 176. 1894.

≡ *Hyporhamma leiotrichum* (Lister) Lado, *Cuad. Trab. Fl. Micol. Iber.* 16: 48. 2001.

Fructifications sporangiate, erect, scattered, sometimes 2 or 3 connected at the lower parts of stalks forming a cluster, 0.8~1.1 mm in total height. Sporangia stipitate, subglobose, clay-yellow or olivaceous and slightly shiny, 0.3~0.8 mm in diameter. Peridium double, the outer layer opaque, with deposition of amorphous matter, the inner layer translucent, membranous, closely adhering to the outer layer. Stalk dark brown or black, stout, 0.3~0.6 mm long. Capillitium yellow to dull-yellow, composed of sparsely branched and smooth threads, 3~4 μm in diameter, marked with

3~5 loosely wound spiral bands, with rounded or long pointed free ends. Spores olivaceous yellow in mass, yellowish by transmitted light, globose to subglobose, 10~12 μm in diameter, spinulate. Plasmodium not observed.

Specimens examined: Taipei County: Shih-ting, Wenshan Botanical Gardens of National Taiwan University, on plant litter, CHL B2196 (TNM F19861), Aug. 15, 2000; CHL B2185 (TNM F19862), Aug. 24, 2000; CHL B2391 (TNM F19863), May. 15, 1999. Taipei City: Yangmingshan National Park, on fallen twigs and leaves, CHL B2167 (TNM F19860), June 26, 2001.

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

The distinct characters of this species are the ochraceous yellow sporangia with stout stalks and smooth capillitial threads. The stout stalks were recorded short, 0.1~0.4 mm long (Lister, 1925; Martin and Alexopoulos, 1969; Lado and Pando, 1997). Apparently our specimen is a form with longer stalks (0.3~0.6 mm). Most of the capillitial threads in our specimens are loosely wound by smooth spiral bands; in a few of the threads, the spiral bands are not discernable except for minute warts which are spirally arranged on the surface.

Hemitrichia pardina (Minakata) Ing, *Myxomyc. Br. Irel.* 132. 1999.

(Figs. 1E~K, 2)

≡ *Hemitrichia minor* var. *pardina* Minakata, in G. Lister, *Trans. Br. Mycol. Soc.* 5: 82. 1915.

≡ *Perichaena minor* var. *pardina* (Minakata) Hagelst., *Mycologia* 35: 131. 1943.

≡ *Hyporhamma pardinum* (Minakata) Lado, *Cuad. Trab. Fl. Micol. Iber.* 16: 48. 2001.

Fructifications sporangiate, solitary, scattered, 0.27~1.0 mm in total height. Sporangia stipitate, globose to subglobose, dull or bright yellow to pale olive-brown, 0.16~0.60 mm in diameter, spotted with scattered dark brown or violaceous-brown outgrowth on the peridium. Stalk dark, blackish, cylindrical, stout, 0.12~0.7 mm long, longitudinally wrinkled or roughened, arising from brown hypothallus. Peridium appearing single, membranous, translucent, yellowish, papillose within, dotted with dark-brown or violaceous-brown low protuberances on the outer peridium, dehiscence irregular. Capillitium yellow to dull yellow, composed of a loose network of capillitial threads, the threads 2.5~4.0 μm in diameter, with

conspicuous free ends, bearing 3~5 spiral bands, spinulate or faintly spinulate, with occasional bulbous expansions. Spores yellow in mass, pale yellow by transmitted light, globose or subglobose, 7.5~10.0(~11.5) μm in diameter, with minute warts on the surface. Plasmodium not observed.

Specimens examined: Taipei County: Shih-ting, Wenshan Botanical Gardens of National Taiwan University, on plant litter, CHL B2169 (TNM F19865), Aug. 16, 2000; CHL B2190 (TNM F19866), Oct. 6, 2000. Pintung County: Nanjenshan forest, on bark, CHL B1579 (TNM F19864), Dec. 12, 1998 (moist-chamber culture: Dec. 12, 1998~Feb. 1, 1999); Wanliteshan, on bark of *Helicia formosana* Hemsl., Y.F. Chen 63 (TNM F18040), Oct. 3, 1995 (moist-chamber culture: Oct. 4~Oct. 30, 1995); Y.F. Chen 372 (TNM F18065), May 13, 1996 (moist-chamber culture: May 15~June 4, 1996); Y.F. Chen 378 (TNM F18066), June 18, 1996 (moist-chamber culture: June 19~July 2, 1996); Y.F. Chen 390 (TNM F18068), June 18, 1996 (moist-chamber culture: June 19~July 11, 1996).

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

The yellow and globose sporangia with scattered dark protuberances or dots on the peridium are distinct characters not found in other species of *Hemitrichia*. Other distinct characters of our specimens are the sporangia always being stipitate, and the capillitial threads in some specimens (CHL B2169, CHL B2190) being smooth under a high dry lens and slightly spinulate by scanning electron microscopy (SEM). These threads also have conspicuous acute free ends from which protrude a long, spine-like tip, up to 15 μm long.

Hemitrichia serpula (Scop.) Rostaf., In Lister, Monogr. Mycetozoa 179. 1894.

≡ *Mucor serpula* Scop., Fl. Carn. ed. 2. 2: 493. 1772.

≡ *Trichia serpula* (Scop.) Pers., Tent. Disp. Fung. 10. 1797.

≡ *Hemiarcyria serpula* (Scop.) Rostaf., Monogr. 266. 1875.

≡ *Arcyria serpula* (Scop.) Masee, Monogr. 164. 1892.

≡ *Hyporhamma serpula* (Scop.) Lado, Cuad. Trab. Fl. Micol. Iber. 16: 48. 2001.

= *Lycoperdon lumbricale* Batsch, Elench. Fung.

Contin. 1: 259. 1786.

= *Stemonitis lumbricalis* (Batsch) J.F. Gmel., Syst. Nat. 2: 1470. 1791.

= *Trichia spongioides* Vill., Hist. Pl. Dauph. 1061. 1789.

= *Trichia reticulata* Pers., Tent. Disp. Meth. Fung. 10. 1797.

= *Hyporhamma reticulatum* (Pers.) Corda, Icon. Fung. 6: 13. 1854.

= *Trichia venosa* Schum., Enum. Pl. Saell. 2: 207. 1803.

= *Trichia retiformis* Payer, Bot. Crypt. fig. 574. 1850.

= *Hemitrichia serpula* var. *tubiglabra* Y. Yamam. & Nann.-Bremek., in Nann.-Bremek. & Yamam., Proc. Kon. Ned. Akad. Wetensch. C. 93: 283. 1990.

= *Hemitrichia serpula* var. *piuiensis* Cavalcanti & Mobin, Acta Bot. Bras. 15: 134. 2001.

Description and illustration: C.H. Liu, in *Taiwania*, 25: 144, 146-147 (1980).

Hemitrichia velutina Nann.-Bremek. & Y. Yamam., Proc. Kon. Ned. Akad. Wetensch. C. 89: 233. 1986.

≡ *Hyporhamma velutinum* (Nann.-Bremek. & Y. Yamam.) Lado, Cuad. Trab. Fl. Micol. Iber. 16: 48. 2001.

Description and illustration: C.H. Liu *et al.*, in *Taiwania*, 47: 99-101 (2002).

***Hemitrichia* sp.**

(Figs. 1L~Q, 3)

Fructifications sporangiate, compactly clustered on a common dark-brown hypothallus, about 1.0~1.13 mm in total height. Sporangia brownish-yellow, faintly mottled by darker dots, globose, subglobose, or often laterally compressed from mutual pressure, 0.37~0.88 mm in diameter, shortly stipitate. Stalk stout, short, to 0.2 mm long, brown. Peridium double, the outer layer opaque, smooth, yellowish-brown, of amorphous refuse matter, the inner layer translucent, closely adherent to the outer layer, dehiscence irregular above. Capillitium an open network of sparsely branched, entangled brownish-yellow threads, 4~6 μm in diameter, bearing 2 or 3 loose spiral bands, with scant spines which either faint or prominent, the inflated or rounded free end bearing a sharp spine. Spores clustered, 5~12 in a cluster, clay-yellow in mass, pale brown by transmitted light, subglobose or turbinate, 10~12 μm in diameter,

with minute warts on the exposed surface of the cluster, nearly smooth elsewhere. Plasmodium not observed.

Specimen examined: Hsinchu County: Kuanwu, on bark of *Chamaecyparis formosensis* Matsum., BY1284 M320, Apr. 12, 1992 (moist-chamber culture: Apr. 13~May 4, 1992).

The unique characters of this specimen are the compactly clustered sporangia which are shortly stipitate, and the clustered spores. It resembles *Hemitrichia abietina* in outer appearance (color, shape and size of sporangia) and in the microscopic characters of the capillitial threads (diameter and spiral bands) (Lado and Pando, 1997). Nevertheless, this unknown species is distinct in having clustered spores, a character not found in other species of *Hemitrichia*. The voucher specimen from a moist chamber culture growing on *Chamaecyparis formosensis* has disappeared but the characters are fully recorded and documented.

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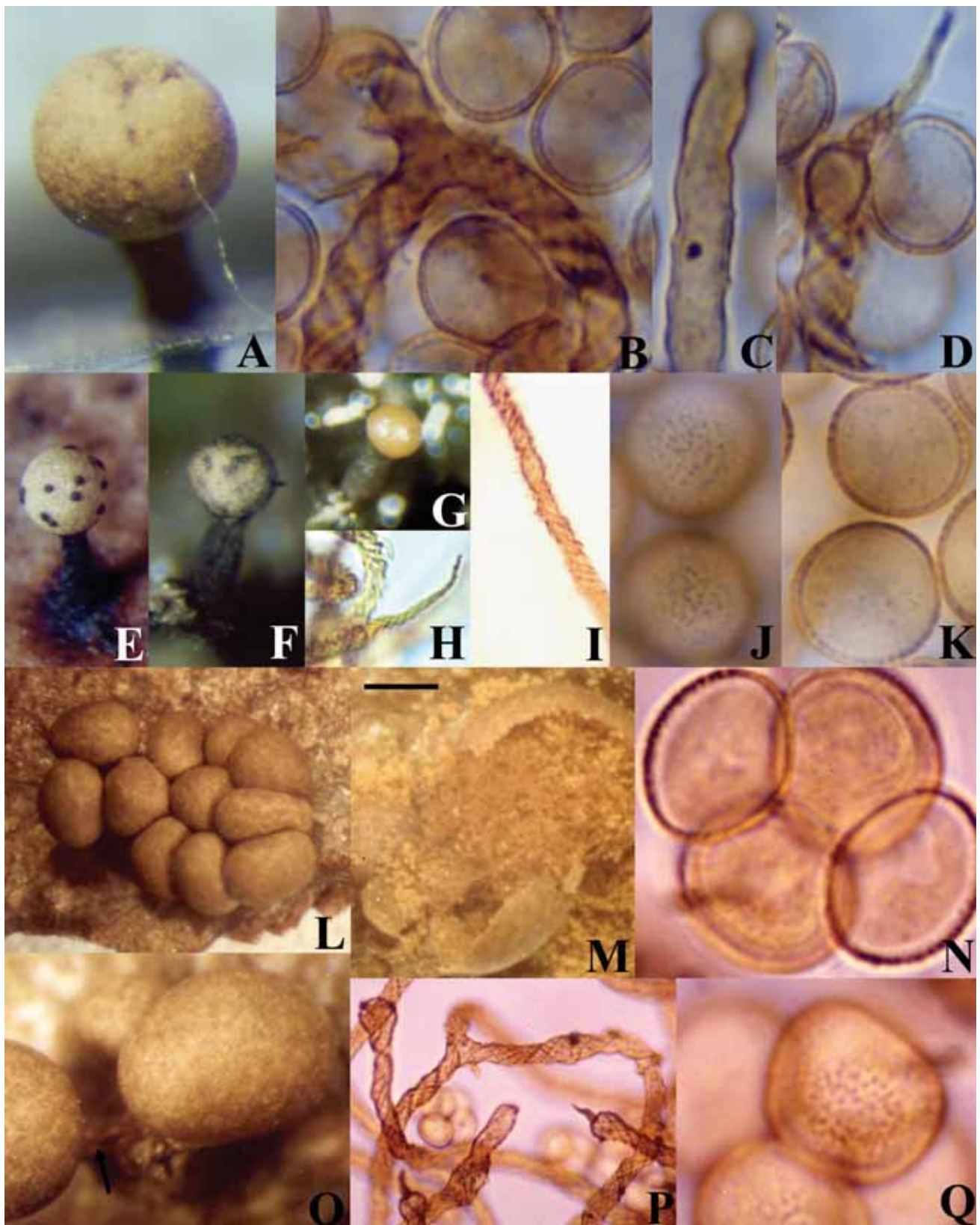


Fig. 1. A~D. *Hemitrichia leiotricha*. A. Fruiting body; B. Capillitium and spores; C~D. Ends of capillitium, showing the rounded (C) and long pointed (D) free ends. E~K. *Hemitrichia pardina*. E~F. Fruiting bodies; G. Young fruiting body; H~I. Capillitium; J. Surface view of spores; K. Marginal view of spores. L~Q. *Hemitrichia* sp. L. Fruiting bodies; M. Dehiscent sporangium; N. Marginal view of exposed surface of clustered spores; O. Sporangia with short stalk (arrow); P. Capillitium; Q. Surface view of exposed surface of clustered spores. Scale bar: A = 125 μ m, B-D, J-K, N, Q = 5 μ m, E-G, M, O = 200 μ m, H-I = 10 μ m, L = 500 μ m, P = 18 μ m.

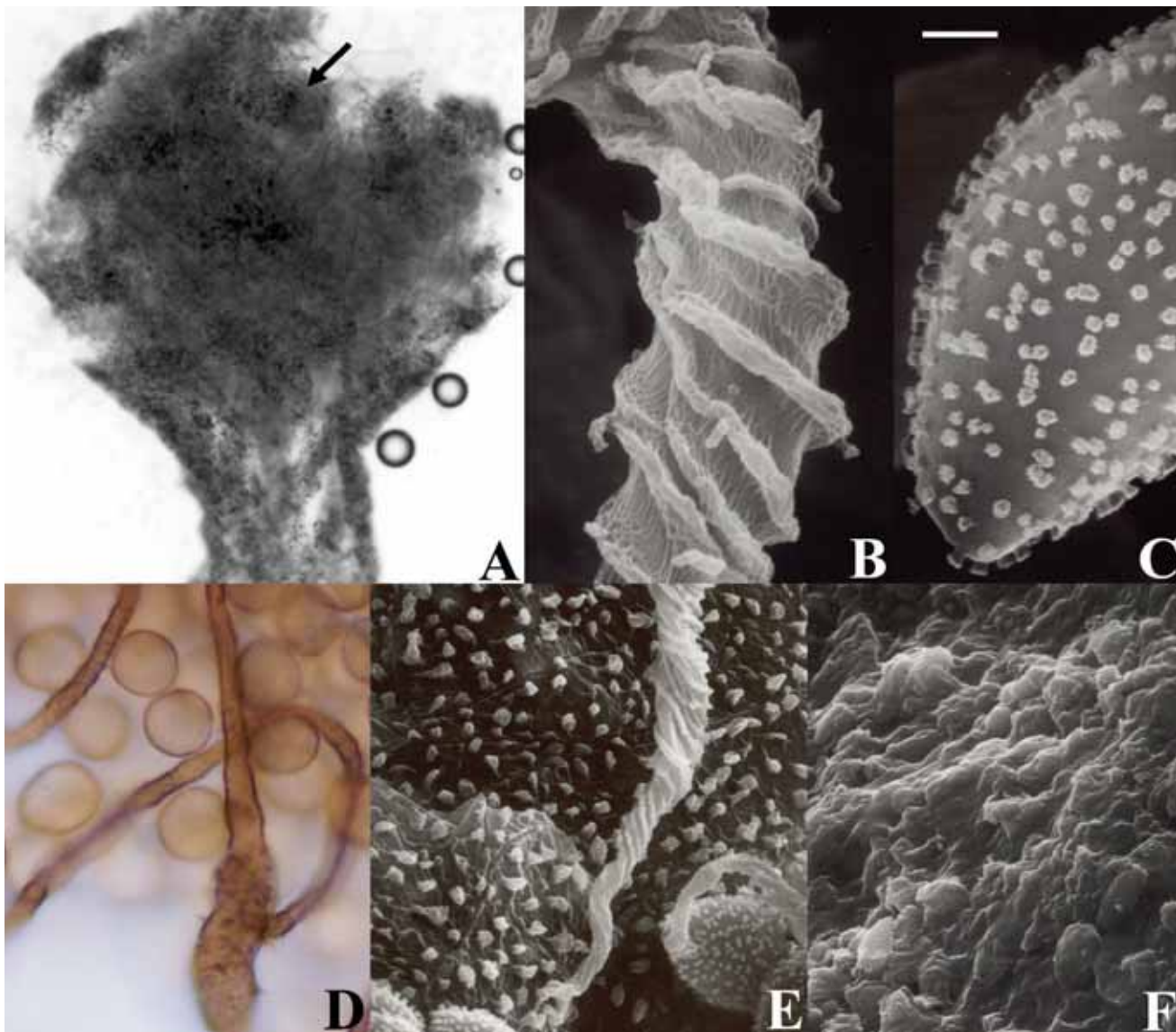


Fig. 2. *Hemitrichia pardina*. A. Fruiting body, showing the spotted warts on the sporangium (arrow); B. SEM of capillitium; C. SEM of spore, showing the surface markings. D. Capillitium with bulbous expansions; E. Inside surface of inner peridium and tip of capillitium; F. Outer peridium. Scale bar: A= 100 μm , B-C = 1.2 μm , D = 10 μm , E = 4 μm , F = 3 μm .

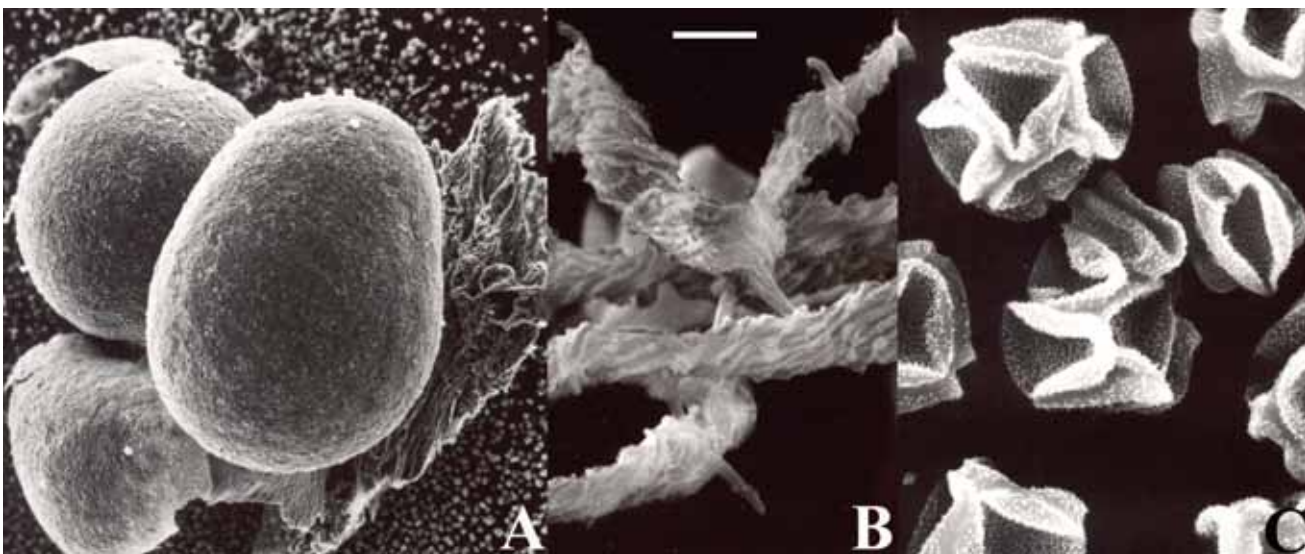


Fig. 3. SEM of *Hemitrichia* sp. A. Fruiting bodies, top view; B. Capillitium; C. Clustered, collapsed spores. Scale bar: A= 170 μm , B = 5 μm , C = 7 μm .

臺灣黏菌：半網黏菌屬

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半網黏菌屬在臺灣已紀錄有4種，本篇所報導的滑絲半網黏菌 (*H. leiotricha*) 與豹紋半網黏菌 (*H. pardina*) 為兩種臺灣新紀錄之黏菌；另外 *Hemitrichia* sp. 疑為世界新種，內文並提供臺灣所有紀錄的半網黏菌屬種類之檢索表。

關鍵詞：半網黏菌屬，黏菌綱，臺灣，團毛黏菌科。