

## MYXOMYCETES OF TAIWAN II

CHIN-HUI LIU<sup>(1)</sup>

(Received for publication Feb. 3, 1981)

**Abstract:** Eleven species of Myxomycetes are reported from Taiwan. Among them *Stemonitis virginensis* Rex is reported for the first time from Taiwan. Other genera included are *Comatricha*, *Dictydiaethalium*, *Lamproderma*, *Reticularia* and *Tubifera*.

## INTRODUCTION

After the previous paper on the Myxomycetes of Taiwan I. (Liu, 1980) a lot more specimens have been collected. They were found mainly on the bed logs for growing Shiitake mushrooms, *Lentinus edodes* (Berk.) Sing., or on the sawdust substratum for growing ear fungus, *Auricularia auricula-judae* (Bull. ex Fr.) Quéf. In this paper, eleven species distributing in Reticulariaceae and Stemonitaceae are discussed. The color of sporangia and of the spore mass described are based on Ridgway's "Color Standards and Color Nomenclature" (1912). Nomenclature follows that of Martin and Alexopoulos (1969). All the specimens reported here are deposited in the Mycology Herbarium, Department of Botany, National Taiwan University, Taipei, Taiwan, R. O. C. TAI.

## SPECIES STUDIED

## RETICULARIACEAE

1. *Tubifera microsperma* (Berk. & Curt.) Martin, Mycologia 39: 461, 1947. (Pl. I, Figs. 1-2)

Sporangia cylindrical, sessile, closely compacted into a pseudoaethalium, pseudoaethalium globose or hemispherical, fawn color, 2.8-3.0 mm tall, 5-12 mm in diameter, on a dark brown or red-brown hypothallus which raises slightly as a very short and stout stalk, peridium delicate, persistent, dehiscent apically, or when the sporangia are closely compacted, by breaking away of their rounded apices, warty or papillate inside; capillitium lacking; spores orange-cinnamon to mikado brown in mass, light yellow by transmitted light, globose, minutely reticulate over most of the surface, the remaining smooth, 4.5-5.0 (-7)  $\mu$  in diameter.

Habitat: On dead wood of cajuput-tree (*Melaleuca leucadendron* Linn.).

Specimen examined: Taipei city, Roosevelt Rd., National Taiwan Univ. campus: CHLM 55, May 21, 1980.

This differs from *Tubifera ferruginosa* mainly in the smaller spores. Although the stalk-like hypothallus on which the pseudoaethalium sits is another character to separate this species from *T. ferruginosa*, Martin and Alexopoulos (1969) found this character variable. In some cases both sessile and stalked clusters occur in the same group. Our specimen sits on a hypothallus only slightly raised as an inconspicuous stalk.

2. *Dictydiaethalium plumbeum* (Schum.) Rost. in Lister, Mycet. 157, 1894. (Pl. I, Figs. 3-4)

Fructification a pseudoaethalium, flattened, resembling an aethalium at maturity, about 0.5-0.6 mm tall, smooth looking, iridescent, with lead-colored metallic shining, the peridium opaque, in hexagonal areolation; sporangia cylindrical, closely compacted to form an aethalium-like fructification, six-sided more or less, having at the corners long thread-like strands which

(1) 劉錦惠, Department of Botany, National Taiwan University, Taipei, Taiwan, Rep. of China.

extend from apex to base, the threads and the base and apex of the peridium persistent, the other portion evanescent; hypothallus prominent, usually extending well beyond the margins of the fructification, silvery white, capillitium lacking; spores red-ferruginous in mass, pale by transmitted light, globose, appearing thick-walled, minutely or sparsely verrucated, 10–12  $\mu$  in diameter.

Habitat: On the bark of hard wood.

Specimen examined: Taipei Hsien, Wu-Lai Hsiang: CHLM 78, Feb. 26, 1980.

A very distinct species. At maturity after the spores are shed, the threads of the peridium look like a capillitium, the rest of the peridium disappearing, leaving the arcuate sporangial apex and the bases of the pseudoaethalium. The sporangia dehisce by breaking the individual caps and separating from the persistent shining base of the fructification.

Our specimen is very close to, if not identical with, *Dictydiaethalium ferrugineum* Nann.-Brem. *D. ferrugineum* was said to be distinct by having rusty-red colored spore mass (in Martin and Alexopoulos, 1969). In addition, it differs from *D. plumbeum* also in having larger spores with shorter spinules, and in the much smaller caps of the sporangia. Our spores are also rusty-red colored in mass, larger than the average size (9–10  $\mu$ ) of *D. plumbeum* (Martin & Alexopoulos, 1969), and our individual sporangium-cap is also quite minute, about 0.2 mm in diameter. Martin and Alexopoulos (1969) found all of these characters in their specimens of *D. plumbeum*, thus considered *D. ferrugineum* as a synonym of *D. plumbeum*. More collections and a careful study of the type are necessary before the further status of this specimen can be ascertained. It seems more proper now to place it under the name *D. plumbeum*.

3. *Reticularia lycoperdon* Bull., Hist. Champ. Fr. 95, 1791. (Pl. I, Figs. 5–6)

Aethalium pulvinate, broad, 0.8–3.0 cm broad, cartridge buff with silvery shining, becoming umber in color, smooth looking, seated on a white hypothallus which forms a conspicuous margin around the base, dehiscence by breaking away the upper part of the peridium, or by bursting parts of the peridium forming minute irregular openings; peridium delicate, membranous, thin, shining, persistent, pseudocapillitium arising as erect plates from the sporangial walls, branching to form slender, thread-like strands which are flexuous, free from the cortex at maturity or adhered by spores, brown in color; spores cinnamon brown in mass, light brown by transmitted light, globose, or somewhat turbinate, reticulate on one side over about two-third of the surface, the remaining part minutely warted, mostly 7  $\mu$  (6–7  $\mu$ ) in diameter.

Habitat: On dead wood of cajuput-tree (*Melaleuca leucadendron* Linn.).

Specimen examined: Taipei city, Roosevelt Rd., National Taiwan Univ. campus: CHLM 57, May 21, 1980; CHLM 180, Jan. 30, 1981.

The aethalium resembles a puff-ball, solitary and usually large. The light-colored aethalium and the branching pattern of the pseudocapillitium are the distinct characters of this species.

#### STEMONITACEAE

4. *Stemonitis fusca* Roth var. *papillosa* Meyl., Bull. Soc. Vaud. Sci. Nat. 58: 322, 1935.

(Pl. II, Fig. 1)

Sporangia stipitate, cylindrical, obtuse above, tufted, chestnut brown to fuscous, 9–15 mm in total height; stalk 2–4 mm long (about one-fourth of the total height), black, shining; hypothallus membranous, brownish; columella dark, reaching nearly to the apex of the sporangium; capillitium in a intricate network, the surface net small-meshed; spores fuscous, or dark brown in mass, palid by transmitted light, densely papillate or warted, 7.5–10  $\mu$  in diameter.

Habitat: On decaying wood.

Specimen examined: Nan-T'ou Hsien, Hsin-Yi Hsiang, Ho-Shë Ts'un: CHLM 167, Nov. 19, 1980.

The distinct characteristics of this variety has been reassured by Kowalski (1975) from his

reexamination of the holotype. He said the only difference between these two varieties (var. *fusca*, and var. *papillosa*) is in the spores. In *S. fusca* var. *fusca* the spores are minutely spinulose and the spinules are arranged in a distinct reticulate pattern. In *S. fusca* var. *papillosa* they are spinose, the spines are randomly scattered, not in a reticulate pattern. Our spores are warted or papillate, the warts are scattered randomly. Other characters of this specimen are identical with our other collections by the name of *S. fusca* (Liu, 1980) which, accordingly, becomes *S. fusca* var. *fusca*.

5. *Stemonitis herbatica* Peck, Ann. Rep. N. Y. State Mus. 26: 75, 1874. (Pl. II, Figs. 3-4)

Sporangia cylindrical, obtuse, erect or bending in some, stipitate, prout's brown to mummy brown, in scattered tufts of small or large clusters which often aggregate to form extensive fruitings, on a very inconspicuous hypothallus, 2.5-5.5 mm in total height; stalk short, 0.3-1.5 mm long (less than one-third of the total height), black; columella extending from the stalk, attenuating, reaching quite close to the apex, tortuous at the top portion, dark; capillitium arising from all parts of the columella, forming a dense network of large meshes in size, the surface nets made up of small meshes, palid or transparent in color; spores prout's brown to dark ferruginous in mass, yellowish brown or light-colored by transmitted light, minutely warted on the surface, rounded, 7-9  $\mu$  in diameter.

Habitat: On dead bamboo stem, dead vines, or sawdust.

Specimen examined: Hsin-Chu Hsien, Tou-Lun Ts'un: CHLM 75, 76, 77, June 11, 1980.

The short and tufted sporangia, the prout's brown color, the short stalk, the warted spores and the small-meshed surface net are the distinct characters of this species.

In the field, the tufted sporangia are either scattered on the surface of the substratum along the plasmodium stream (or line), or packed on the plasmodium forming string as a long strand hanging down in the space. They were found abundantly on the sawdust for growing ear fungus, under quite damp condition.

6. *Stemonitis nigrescens* Rex. Proc. Acad. Phila. 43: 392, 1891. (Pl. II, Figs. 5-6)

Sporangia stipitate, erect, cylindrical, apex obtuse, gregarious in clusters of short, and small or large size upon a common, brownish transparent, membranous hypothallus, total height 3.5-6 mm, clove brown to fuscous, becoming mummy brown after the spores are shed; stalk black, shining, short, 0.3-1.5 mm long (up to one-fourth of the total height); columella dark as stalk, attenuating, reaching nearly to the apex; capillitium bright brown, arising from all parts of the stalk, branching and anastomosing to form a network of large meshes, the ultimate branches fusing with small-meshed surface nets which usually incomplete or disappearing in the upper portion; spores globose, subglobose, conspicuously warted or spiny, the spines or warts arranged in a small-meshed reticulate pattern, averaging 8-9  $\mu$  in diameter, clove brown or darker in mass, olive-buff or brownish by transmitted light.

Habitat: On the bark of dead or decaying hard wood, or on the sawdust heaps.

Specimen examined: Hsin-Chu Hsien, Nei-Wan Ts'un: CHLM 81a, 86, Sept. 4, 1980.

This species is distinct by its dark-colored and short fructification, the comparatively short stalks, and by its very spiny-reticulate spores under oil immersion lens. SEM pictures of the spores by Rammeloo (1975) show that the spore surface is banded reticulate, with conspicuous

### Plate I

Figs. 1-2. *Tubifera microsperma* (CHLM 55). 1. Spores,  $\times 1023$ ; 2. Optical section of spores showing the edge view,  $\times 1023$ .

Figs. 3-4. *Dictydiaethalium plumbeum* (CHLM 78): 3. Floor of aetholium with the base of the sporangia,  $\times 84$ ; 4. Spores,  $\times 2077$ .

Figs. 5-6. *Reticularia lycoperdon* (CHLM 57). 5. Spores,  $\times 1023$ ; 6. Optical section of spores showing the edge view.

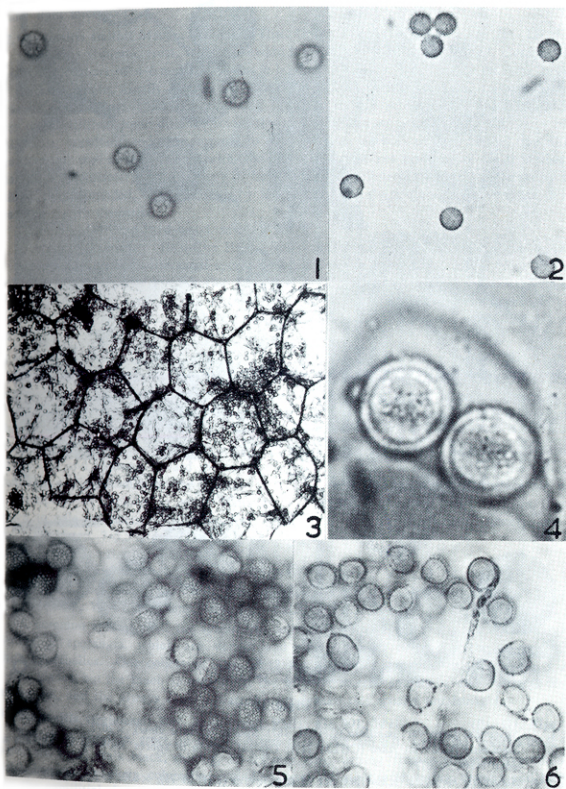
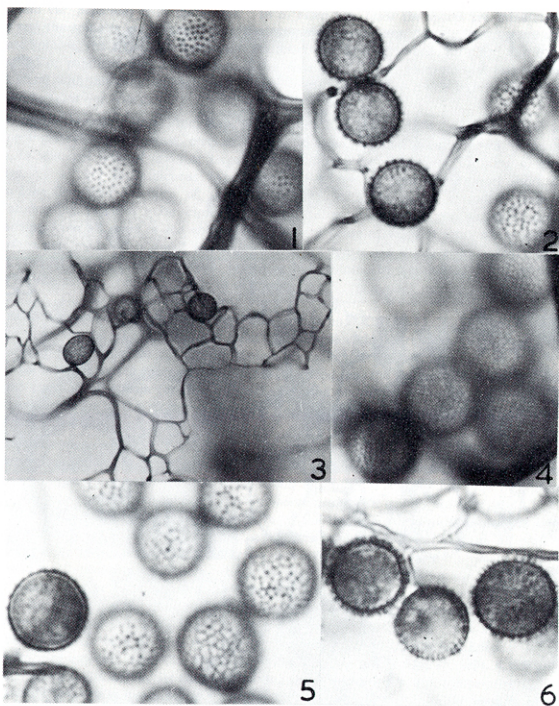


Plate I



## Plate II

- Fig. 1. *Stemonitis fusca* var. *papillosa* (CHLM 167). Spores (surface view),  $\times 2077$ .  
 Fig. 2. *Stemonitis fusca* var. *fusca* (CHLM 113): Optical section of spores showing the surface and edge view,  $\times 2077$ .  
 Figs. 3-4. *Stemonitis herbatica*. 3. Surface net of capillitium (CHLM 75),  $\times 830$ . 4. Spores, showing the warts on the surface (CHLM 159),  $\times 2010$ .  
 Figs. 5-6. *Stemonitis nigrescens*. 5. Surface view of spores (CHLM 86),  $\times 2077$ . 6. Optical section of spores, the spines are clearly shown along the margins (CHLM 81a),  $\times 2077$ .

pillars surpassing the bands. The bands are perforated, very thin that it probably beyond the resolving power of the light microscope, thus only the pillars are observed as spines or warts under light microscope.

7. *Stemonitis smithii* Macbr., Bull. Nat. Hist. Univ. Iowa 2: 381, 1893. (Pl. III, Fig. 1)

Sporangia stipitate, erect, tapering toward the base, apex slightly narrowed, closely grouped into small clusters of 4-6 mm tall, russet to bone brown; stalk short, rarely reaching two-fifths of the total height, usually shorter, black, shining, arising from a common, transparent, membranous hypothallus; columella extending from the stalk, tapering toward the apex, dissolving into the capillitium some distance below the apex; capillitium arising from all parts of the columella, branching and anastomosing to form an inner network of large meshes, the ultimate branches of the threads fusing with the delicate surface net made up of small meshes (less than  $20\mu$  in diameter); spores russet or brown in mass, yellowish or nearly colorless by transmitted light, rounded, nearly smooth by the margins, faintly scattered with verrucae, 5 rarely reaching  $6\mu$  in diameter.

Habitat: On dead hard wood, sawdust heaps.

Specimen examined: Hsin-Chu Hsien, Nei-Wan Ts'un: CHLM 81b, 108, Sept. 4, 1980.

This specimen has quite small spores which are nearly smooth. It differs from *S. axifera* in having smaller spores and shorter fructification in small clusters. The inconspicuous verrucae of the surface markings are discernible under oil immersion lens. The sporangia of the specimen CHLM 108 appears bright colored (russet) while the other specimen CHLM 81b much darker (bone brown).

8. *Stemonitis splendens* Rost., Mon. 195, 1874. (Pl. III, Figs. 2-3)

Sporangia quite long, cylindrical, erect or bending, stipitate, usually clustered to form a large cluster of chestnut brown to bistre or darker as blackish brown in color, becoming drab or light drab after spores are shed, on a common membranous hypothallus which are silvery white in color; stalk black, shining, short, 1-4.7 mm long (up to one-third of the total height), columella extending from the stalk, reaching nearly to the apex, often, especially at the upper part, coiled and tortuous toward the apex; capillitium arising from all parts of the columella, branching and anastomosing, the ultimate branches joining the large-meshed surface net which is incomplete or lacking in some sporangia; spores bistre to carob brown in mass, lilaceous brown to pale ochraceous-salmon by transmitted light, globose, subglobose, densely and prominently warted, 7-9.5  $\mu$  in diameter.

Habitat: On the bark of hard wood.

Specimen examined: Hsin-Chu Hsien, Nei-Wan Ts'un: CHLM 84, 85, Sept. 4, 1980;

Nan-T'ou Hsien, Yü-Ch'ih Hsiang: CHLM 124, 125, 126, Sept. 15, 1980; Nan-T'ou

Hsien, Yü-Ch'ih Hsiang, Sun-Moon Lake: CHLM 158, 171, Nov. 19, 1980.

A common species. All the specimens collected are distinguished at sight by the large-size clusters of sporangia, which are slender and elegantly appeared, and by the common silver-white hypothallus. One collection (CHLM 125) with shorter sporangia might suggest *S. fusca* at first glance, but the much shorter stalk, the brighter-colored sporangia, and the large-meshed surface net, and the always densely warted spores make this species unmistakable.

9. *Stemonitis virginienensis* Rex, Proc. Acad. Phila. 43: 391, 1891. (Pl. III, Figs. 4-7)

Sporangia stipitate, erect, in small clusters of 4.0-5.5 mm tall, appearing fuscous after most spores are shed; stalk black, shining, 1.5-2.0 mm long, arising from a common hypothallus of reddish brown in color; columella extending from the stalk, attenuating, ceasing and blending into the capillitium some distance below the apex; capillitium arising from all parts of the stalk, branching and anastomosing to form a large-meshed inner network, tips of the ultimate branches united with the rather small-meshed surface net (less than  $15\mu$  in diameter);

spores umber brown in mass, pale lilac brown by transmitted light, rounded, surface reticulated, the bands connected with prominent warts, 7-8  $\mu$  in diameter.

Habitat: On hard wood.

Specimen examined: Hsin-Chu Hsien, Nei-Wan Ts'un: CHLM 106, Sept. 4, 1980.

This is a new record of Taiwan. The specimen collected is quite limited in amount. The delicate surface net makes it reasonably distinctive although its sporangium size and the capillitial branching -call *Comatricha typhoids* (Bull.) Rost. However, the long stalk (one-third, or longer, of the total height) and the strongly marked verrucose-reticulate spores make this species recognizable.

**10. Lamproderma arcylonema** Rost., Mon. 208, 1874. (Pl. IV, Figs. 1-3)

Sporangia scattered, longly stipitate, erect, globose, 0.3-0.6 mm in diameter, dark, within the range of 1-1.85 mm in total height; stalk slender, blackish, shining, widest at the base, tapering, 1.7-1.4 mm long (more than one-half, about two-third, of the total height), peridium membranous, the base persistent as a collar on the stalk after the upper part has broken away; columella slender, cylindrical, reaching  $\frac{1}{2}$ - $\frac{2}{3}$  of the height of the sporangium and there dividing into few primary branches, these branches further dividing repeatedly and anastomosing to form a intricate network made up of slender, flexuous, brown capillitial threads, often with free ends; spores black, violaceous gray by transmitted light, globose, oblong, or triangle more or less, minutely and faintly warted, 7.5-10  $\mu$  in diameter.

Habitat: On dead hard wood.

Specimen examined: Hsin-Chu Hsien, Nei-Wan Ts'un: CHLM 98, 107, Sept. 4, 1980;

Nan-T'ou Hsien, Yü-Ch'ih Hsiang: CHLM 111a, Sept. 15, 1980.

The old and weather collections may be mistaken as *Comatricha lurida* A. Lister. But the persistent collar on the stalk and the very faintly and minutely warted spores separate this species from *C. lurida* of which the spores are distinctly warted.

**11. Comatricha longa** Peck, Ann. Rep. N. Y. State Mus. 43: 70, 1890. (Pl. IV, Figs. 4-6)

Sporangia stipitate, usually flexuous, weak, and depressed, or pendant, crowded in dense mass, fuscous to blackish brown in color, becoming clove brown after spores are shed; peridium evanescent; stalk short, 0.5-1.7 mm long, blackish, shining, arising from the common hypothallus which are membranous, transparent and whitish, columella reaching nearly to the apex, slender, attenuating, zigzag at the summit, dark in color; capillitium arising from all parts of the columella, anastomosing in some places to form few large meshes next to the columella, the ultimate branches free, slender, and dichotomously branched at an acute angle, spores dusty, blackish brown in mass, brown by transmitted light, distinctly verrucose-reticulate, 7.5-10  $\mu$  in diameter.

Habitat: On the bark of hard wood.

Specimen examined: Taipei Hsien, Wu-Lai Hsiang: CHLM 80, Feb. 26, 1980; Nan-T'ou

Hsien, Yü-Ch'ih Hsiang: CHLM 128, Sept. 15, 1980.

A very remarkable species. The open capillitial network without any surface net distinguished this species from a *Stemonitis*. Our specimens are very close to *C. longa* in every aspect except that the length of our sporangia is much shorter, probably due to the weathered sporangia collected. They are measured 5-7 mm in total height. The sporangia of this species

**Plate III**

Fig. 1. *Stemonitis smithii* (CHLM 108). Spores,  $\times 1023$ .

Figs. 2-3. *Stemonitis splendens* (CHLM 124). 2. Optical Section of spores, showing the surface and edge view,  $\times 2010$ . 3. Surface net of capillitium,  $\times 201$ .

Figs. 4-7. *Stemonitis virginiensis* (CHLM 106). 4. Surface net of capillitium,  $\times 409$ ; 5-7 Spores, 5.  $\times 409$ . 6 & 7.  $\times 1023$ .

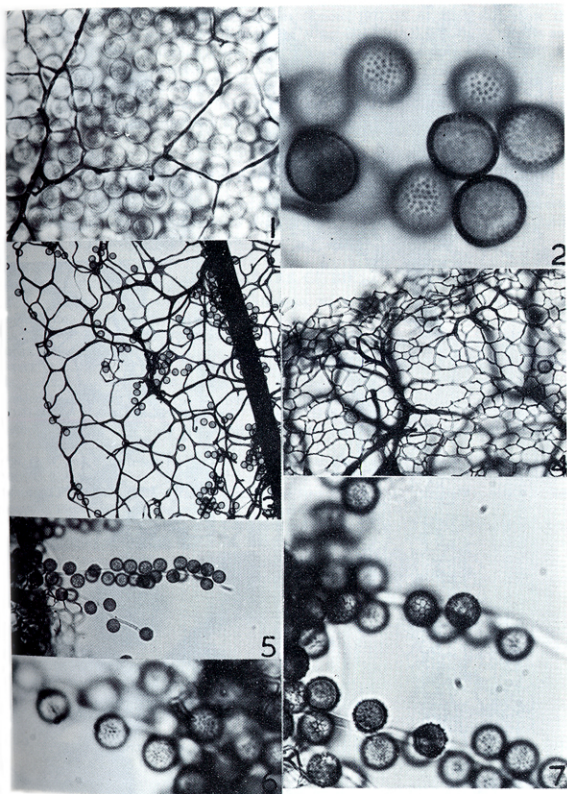


Plate III



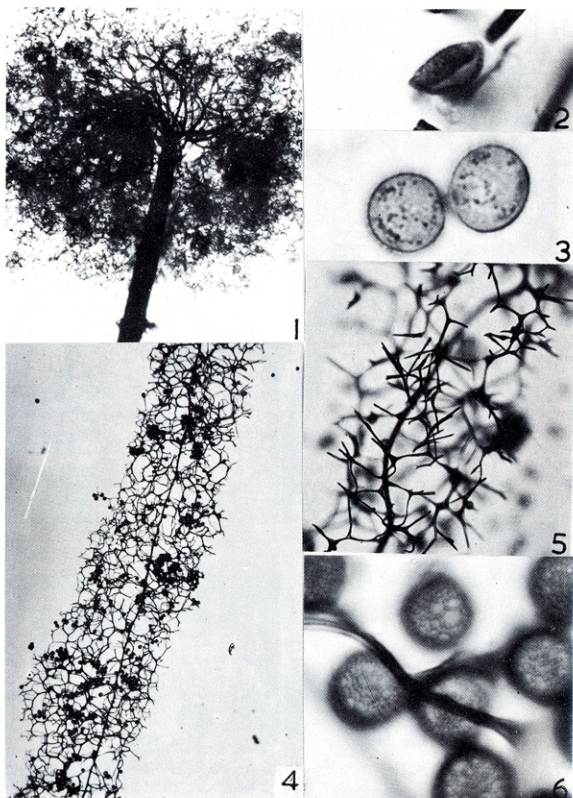


Plate IV

are generally described as remarkable in their great length, 20–50 mm (Macbride, 1922; Lister, 1925; Martin and Alexopoulos, 1969). Emoto (1942, 1977), however, in the description of this species, wrote that the sporangia 2–5 mm long. This must be an error of using the wrong unit of length, since the figures of this species (Emoto, 1977, Pl. 61, Figs. 6–7) show the sporangia quite long and similar to those in the other literatures (Lister, 1925; Martin and Alexopoulos, 1969). The hypothallus is also clearly shown as white in Emoto's figures (1977, Pl. 61, Figs. 6–7) though it is described as dark by Martin and Alexopoulos (1969). And our specimen also has white hypothallus. Based on the following constant characters: short stalk, long capillitial free ends which fork at an acute angle, and verrucose-reticulate spores of 7.5–10  $\mu$  in diameter, our specimen is in general agreement with *C. longa*, and is identified as this.

### ACKNOWLEDGEMENT

The author is grateful to Dr. Zuei-ching Chen for his kindly providing the myxomycete, specimens of his collection. This research is partly supported by The National Science Council Taiwan, under the project 70-0201-B002-08.

### LITERATURE CITED

- EMOTO, Y., 1942. Myxomycetes. In *Nova Flora Japonica*, No. 8, 238pp. Ed. T. Nakai and M. Honda. Sanseido Co., Ltd. Tokyo & Osaka.
- EMOTO, Y., 1977. The Myxomycetes of Japan. xiv+263pp. Sangyo Tosho Publishing Co., Ltd. Tokyo, Japan.
- KOWALSKI, D. T., 1975. The Myxomycete Taxa Described by Charles Meylan. *Mycologia* 67: 448–494.
- LISTER, A., 1925. A Monograph of the Mycetozoa. 3rd ed., revised by G. Lister. Brit. Mus. Nat. Hist., London, xxxii+296pp. 222pl., two to a page, numbered separately.
- LIU, C.-H., 1980. Myxomycetes of Taiwan I. *Taiwania* 25: 141–151.
- MACBRIDE, T. H., 1922. The North American Slime-Moulds. . . . ed. 2. xviii+299pp., pl. 1–23. Macmillan and Co., London.
- MARTIN, G. W. and C. J. ALEXOPOULOS, 1969. The Myxomycetes. ix+477pp. Univ. Iowa Press, Iowa City, U. S. A.
- RAMMELOO, J., 1975. Structure of the Epispore in the Stemonitales (Myxomycetes) as seen with the Scanning Electron Microscope. *Bull. Nat. Plantentuin. Belg.* 45: 301–306.
- RIDGWAY, R., 1912. Color Standards and Color Nomenclature. . . . iv+44pp., pl. 53. Washington, D. C.

### Plate IV

- Figs. 1–3, *Lamproderma arcyrionema*. 1. Columella and capillitium (CHLM 98b),  $\times 207$ , 2. Spores (collapsed), showing the faint warts on the surface,  $\times 2077$ . 3. Optical section of spores, edge view,  $\times 2077$ .
- Figs. 4–6, *Comatricha longa*. 4. Capillitium and columella (CHLM 128),  $\times 83$ , 5. Capillitium, enlarged, showing the forked free ends (CHLM 80),  $\times 207$ , 6. Spores,  $\times 2077$ .