

## Myxomycetes of Taiwan IX. The genus *Diderma* (Physarales)

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**ABSTRACT:** Eight species and two varieties of Myxomycetes in the genus *Diderma* from Taiwan are described with brief discussions on their substrate relationship, monthly appearance, and geographical distribution in each county of Taiwan. Among them, *D. spumarioides* and *D. testaceum* are reported as new to Taiwan. A key to the taxa is provided.

**KEY WORDS:** *Diderma*, Myxomycetes, Physarales, Taiwan.

### INTRODUCTION

The genus *Diderma* was erected in 1794 by Persoon to accommodate species with two-layered peridia. Currently there are more than 60 species, characterized by having granular peridial lime deposition, non-calcareous capillitium, and dark spores. Former reports on this genus from Taiwan (Chiang and Liu, 1991; Liu, 1983; Nakazawa, 1928; Wang *et al.*, 1981; Wei and Liu, 1989) have only mentioned the cosmopolitan *D. hemisphaericum*, with some misidentified records of *D. effusum*-*D. platycarpum* complex. In this report, we summarized the results of our survey of the genus *Diderma* from Taiwan conducted since 1993. *D. spumarioides* and *D. testaceum* are reported as new to Taiwan.

### MATERIALS AND METHODS

Forays were conducted in various parts of Taiwan. Specimens of *Diderma* deposited in the Mycology Laboratory, Department of Botany, National Taiwan University, were also reexamined. Specimens were examined directly under light microscopes after collecting from the fields or after incubation in the moist chambers for about 7 - 35 days to let the Myxomycetes profuse. The protocol for moist chamber culture process was adapted from Chiang and Liu (1991). Measurements of the myxomycete sporocarps were made under a stereomicroscope attached with an ocular micrometer. For light microscopic observation, sporocarps were prewetted with 95% ethanol and mounted in 2% KOH. Examination of the details of the spore ornamentation and measurement of the diameter of the spores was

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performed by using oil lens ( $\times 1000$ ). Ornamentation of the spores was excluded when measuring the spore size. For SEM micrographs, sporocarps were coated with gold and examined with Hitachi S-800 or S-2400 Scanning Electron Microscope. All specimens examined are deposited in Mycology Laboratory, Department of Botany, National Taiwan University. Binominal of vascular plants associated with the Myxomycetes refers to the Flora of Taiwan (Li *et al.*, 1975-1979). For synonymy of the taxa treated in this communication, please refer to the work of Martin and Alexopoulos (1969).

## TAXONOMIC TREATMENT

**Diderma** Persoon, Neues Mag. Bot. 1: 89. 1794.

**Sporocarps** sporangiate to plasmodiocarpous. **Peridium** single, double or triple; the outer layer calcareous or cartilaginous, with granular lime deposition; the inner layer membranous, free or closely attached to the outer layer; dehiscence irregular or along the performed ridges. **Columella** conspicuous or reduced to a thickened base. **Capillitium** non-calcareous, branching and anastomosing. **Spores** dark brown in mass, pale purple brown to pale violaceous brown in transmitted light.

The genus *Diderma* is somewhat intermediate between Physaraceae and Didymiaceae, as it possesses granular lime deposition, which is similar with the genera of Physaraceae, and non-calcareous capillitium, which is similar with the other genera of Didymiaceae. Lister (1925) emphasized the importance of granular lime deposition and included *Diderma* and *Physarina* in Physaraceae. However, this was not followed by Martin *et al.* (1983) and others.

### Key to the genus *Diderma* of Taiwan

1. Outer wall of peridium calcareous, fragile, dehiscence rarely stellate.....2
1. Outer wall of peridium cartilaginous, tough.....9
2. Sporocarps stalked, or, if sessile, usually associated with stalked sporangia ; sporophores depressed, disc-like to hemisphaerical.....4 *D. hemisphaericum*
2. Sporocarps always sessile.....3
3. Peridium double, smooth, polished, shining, porcelain-like.....8 *D. testaceum*
3. Peridium not porcelain-like.....4
4. Sporocarps sharing a common, white, limy hypothallus.....7 *D. spumarioides*
4. Hypothallus not as above.....5
5. Sporocarps on bryophytes, spores usually more than 12  $\mu\text{m}$  in diam.....1 *D. chondrioderma*
5. Sporocarps rarely associated with bryophytes, spores smaller.....6
6. Sporocarps sporangiate to plasmodiocarpous, usually more than 0.2 mm thick.....7
6. Sporocarps effuse plasmodiocarpous (as perforated plates), less than 0.1 mm thick.....8
7. Capillitium hyaline.....2a *D. effusum* var. *effusum*
7. Capillitium dark brown, with bead-like thickenings.....2b *D. effusum* var. *pachytrichon*
8. Spores 10 - 11  $\mu\text{m}$  in diam.....5a *D. platycarpum* var. *platycarpum*
8. Spores 6 - 8  $\mu\text{m}$  in diam.....5b *D. platycarpum* var. *berkeleyanum*
9. Peridium double, dehiscence stellate.....3 *D. floriforme*
9. Peridium single, reticulately wrinkled, breaking into preformed platelets.....6 *D. rugosum*

1. **Diderma chondrioderma** (de Bary & Rostafinski) G. Lister, A Monograph of the Mycetozoa, ed. 3: 258. 1925. Fig. 1 角形雙皮黏菌

**Sporocarps** white, sessile, flattened plasmodiocarpous; plasmodiocarps irregularly shaped, up to 1 mm wide. **Hypothallus** indistinct. **Peridium** double, the outer layer white, calcareous, crustose; the inner layer membranous, distinct from the outer layer; dehiscence irregular. **Columella** reduced to a darkened base, not prominent. **Capillitium** varying from dark brown to almost colorless, coarse, stout, sparsely branched, paler and with many membranous expansions at axils. **Spores** blackish brown in mass, brown in transmitted light, globose, 10 - 15  $\mu\text{m}$  in diam., minutely warted. **Plasmodium** not observed.

**Taipei Metropolis.** main campus of the National Taiwan University, C.-H. Chung M1173, 1 IV 1996, on bryophytes and lichenized fungi upon bark of *Liquidambar formosana*; C.-H. Chung M1300, 22 VII 1996, ditto; campus of the Nankang Elementary School, C.-H. Chung M1862, 4 VII 1997, on algae and bryophytes upon bark of *Bischofia javanica*; **Taipei County.** Hsintien City, Kueishan, C.-H. Chung M995, 2 VI 1996, on bryophytes growing on the concrete walls along the roadside.

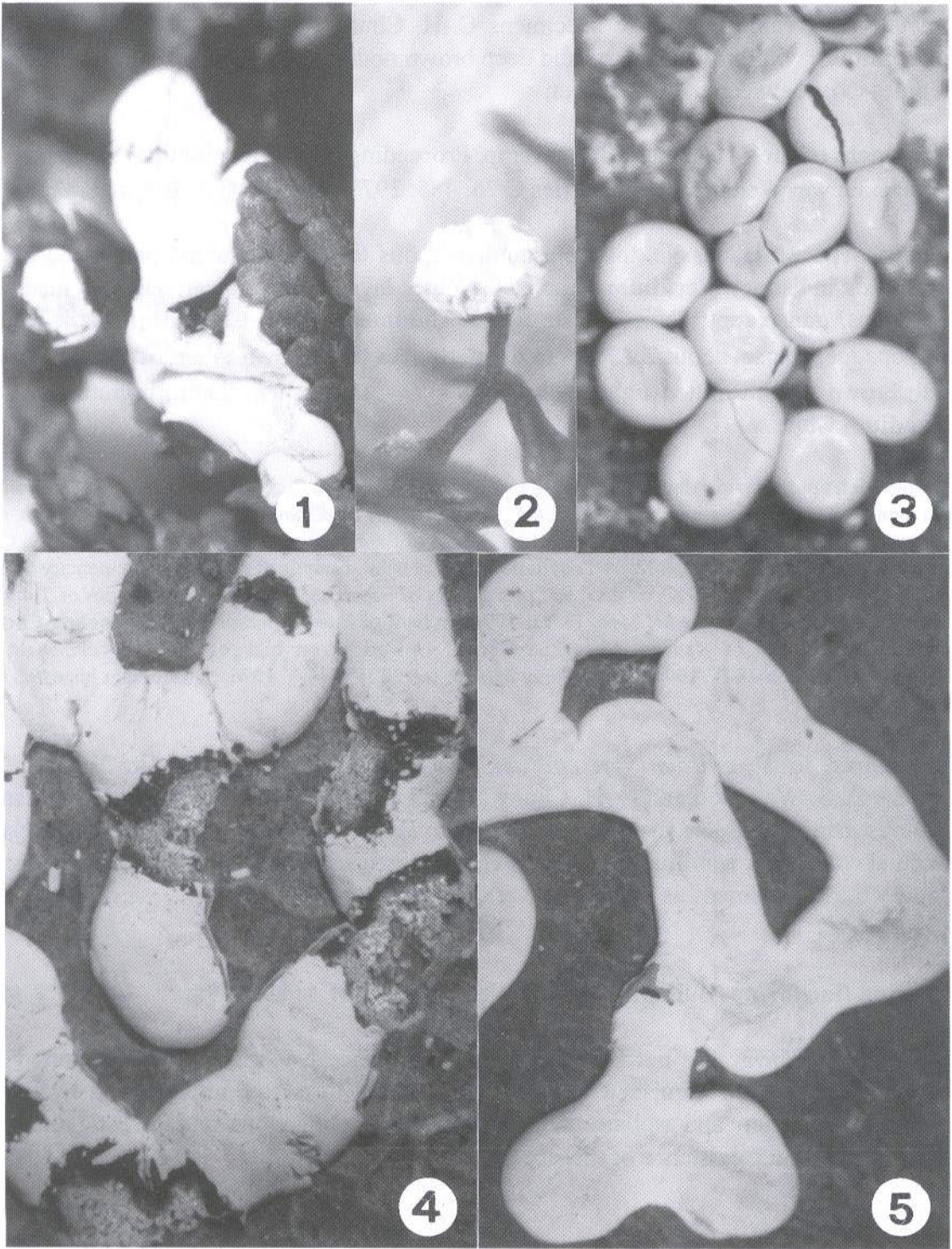
2. **Diderma effusum** (Schweinitz) Morgan, Journal of Cincinnati Society of Natural History 16: 155. 1894.

2a. var. **effusum**

Fig. 4 墊形雙皮黏菌

**Sporocarps** white, sessile, sporangiate to plasmodiocarpous, the plasmodiocarps may be short or long and netted, 0.5 - 1.2 mm wide, about 0.2 - 0.3 mm thick. **Hypothallus** indistinct. **Peridium** double, the outer layer white, calcareous, smooth, like an egg shell; the inner layer membranous; dehiscence irregular. **Columella** reduced to a broad, pulvinate or flattened yellowish brown base. **Capillitium** hyaline, branching and interconnecting, sometimes minutely roughened and/or with brownish parts and deep brown nodules. **Spores** violaceous brown in mass, pale brown in transmitted light, globose or occasionally elliptical, 7.5 - 9 (- 10)  $\mu\text{m}$  in diam., minutely warted. **Plasmodium** not observed.

**Taipei Metropolis.** main campus of the National Taiwan University, C.-H. Chung M502, 17 XI 1993, on dead angiospermous leaves; C.-H. Chung M581, 30 XI 1993, on dead angiospermous leaves; C.-H. Chung M515, 18 XII 1993, on dead angiospermous leaves; C.-H. Chung M539, 20 XII 1993, on dead angiospermous leaves; C.-H. Chung M545, ditto except on dead twigs; C.-H. Chung M546, C.-H. Chung M550, 25 XII 1993, on dead angiospermous leaf; C.-H. Chung M551, ditto except on dead grass leaves; C.-H. Chung M595, 10 I 1994, on plant debris; C.-H. Chung M663, 19 IV 1994, on dead angiospermous leaves; W. C. Leong 40, 14 VI 1993, on dead angiospermous leaf; W. C. Leong 116, 5 XI 1993, on dead herbaceous debris; W. C. Leong 237, 3 XII 1993, on dead angiospermous leaves; W. C. Leong 286, 10 XII 1993, on dead twigs; W. C. Leong 296, 24 XII 1993, on dead leaves; **Taoyuan County.** Luchu, campus of Shanchiao Elementary School, C.-H. Chung M1891, 17 VII 1997, on dead leaves of *Eucalyptus robusta* and a species of Fabaceae; **Taichung County.** Wuling Farm, Mt. Tao, C.-H. Chung M603, II 1994, on dead leaves; **Changhua County.** Chinsuiyien, C.-H. Chung M1015, 27 IV 1996, on dead angiospermous leaf; **Tainan City.** campus of National Tainan Teachers' College, Y.-H. Liu 27, 12 III 1995, on dead angiospermous leaves in dry gutter; **Tainan County.** near Tzengwen Reservoir, C.-H. Chung M1493, 13 XI 1996, on plant debris; **Pingtung County.** eastern edge of Mt. Wanlite, Y.-F. Chen 86, developed from a moist chamber (harvested 6 XII 1995) containing bark of *Castanopsis stellatospina*; Y.-F. Chen 111a, developed from a moist chamber (harvested 23 XII 1995) containing bark of *Syzygium buxifolium*.



Figs. 1-5. Light microscopy of sporocarps of *Diderma* spp. Fig. 1. *D. chondrioderma*, ca. 30X; Fig. 2. *D. rugosum*, ca. 50X; Fig. 3. *D. testaceum*, ca. 30X; Fig. 4. *D. effusum* var. *effusum*, ca. 30X; Fig. 5. *D. effusum* var. *pachytrichon*, ca. 20X;

*Diderma effusum* var. *effusum* was described as possessing colorless capillitium (Lakhanpal and Mukerji, 1981), and var. *pachytrichon* are delimited from it by having completely dark capillitium. The specimens C.-H. Chung M595 and C.-H. Chung M663 have capillitium with brownish parts and deep brown nodules, suggesting intermediate forms sometimes exist between these two taxa.

2b. var. **pachytrichon** Nannenga-Bremekamp, Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen, Series C 76: 485. 1973 Fig. 5 墊形雙皮黏菌暗絲變種

**Sporocarps** white, sessile, long plasmodiocarpous to being flattened perforated plates. **Hypothallus** indistinct. **Peridium** double; the outer layer white, calcareous; the inner one membranous, transparent; dehiscence irregular. **Columella** none. **Capillitium** dark reddish brown, opaque, coarse, about 2 - 3  $\mu\text{m}$  in diam. **Spores** dark brown to almost black in mass, reddish brown in transmitted light, globose, (8 -) 9 - 10.5  $\mu\text{m}$  in diam., minutely warted. **Plasmodium** white.

**Taipei Metropolis.** main campus of the National Taiwan University, D. S. Wei 3866, 5 V 1988, developed from a moist chamber containing bark of *Celtis formosana*; C.-H. Chung M523, 18 XII 1993, on dead angiospermous leaves; campus of the Affiliated High School of the National Taiwan Normal University, C.-H. Chung M1440, 30 X 1996, on plant litter; **Taoyuan County.** Luchu, campus of Shanchiao Elementary School, C.-H. Chung M1890b, 17 VII 1997, on dead leaf of a species of Fabaceae; **Hsinchu City.** campus of Tungmen Elementary School, C.-H. Chung M1244a, 13 VII 1996, on bark of *Bombax malabarica*; **Changhua County.** Changhua City, campus of National Changhua Normal University, on bark of *Livistona chinensis* var. *subglobosa* collected on 28 IV 1996, C.-H. Chung M1089, mc 30 IV - 16 V 1996, plasmodium appeared on 5 V 1996.

In contrast to *D. effusum* var. *effusum*, this taxon is less common in Taiwan. The specimens D. S. Wei 3866 and C.-H. Chung M1089 possess flattened plasmodiocarps and a corticolous habitat, which make them close to *D. platycarpum*. However, their white plasmodial color, dark capillitium and other characteristics suggest that it is more appropriate to identify these specimens as *D. effusum* var. *pachytrichon*.

3. **Diderma floriforme** (Bulliard) Persoon, Neues Mag. Bot. 1: 89. 1794. 花形雙皮黏菌

*Diderma floriforme* has not been collected again since Nakazawa (1929) reported this species. It is readily distinguished from the taxa treated in this communication by having cartilaginous peridium and stellate dehiscence. Further collections and investigations are needed to confirm the existence of this species in Taiwan.

4. **Diderma hemisphaericum** (Bulliard) Hornemann, Flora Danica 33: 13. 1829.

半圓雙皮黏菌

**Sporocarps** sporangiate, stalked; sporophores white, disc-like, usually depressed above, up to 1.5 mm in diam. **Stalk** stout, flesh-colored or dark, sometimes frosted with lime, often

containing large lime crystals in the basal part. **Hypothallus** membranous. **Peridium** double, the outer layer white, calcareous, closely appressed to the inner layer, often broken at margins; the inner layer membranous, grayish; lime globules ca. 2  $\mu\text{m}$  in diam.; dehiscence irregular. **Columella** reduced to a broad base, pinkish brown or with orange tints, sometimes not distinct. **Capillitium** hyaline, occasionally with brownish parts, about 1  $\mu\text{m}$  wide, branching and interconnecting. **Spores** black brown in mass, pale yellowish brown in transmitted light, (7 -) 8 - 10  $\mu\text{m}$  in diam., evenly- or patchy-warted. **Plasmodium** not observed.

**Taipei Metropolis.** main campus of the National Taiwan University, C.-H. Chung M440, 28 V 1993, on dead leaves; W. C. Leong 30, 3 VI 1993, on dead angiospermous leaves; W. C. Leong 44, 14 VI 1993, on plant litter; W. C. Leong 311, 11 III 1994, on dead angiospermous leaves; Liu CHLB55, 18 III 1982, on plant debris; Liu CHLB503, 26 III 1985, on dead leaves; campus of the Affiliated High School of the National Taiwan Normal University, T.-C. Chang s. n., 22 VIII 1994, on dead leaf of *Cinnamomum camphora*; Mucha, Changhu, Liu CHLB431, 18 X 1984, on dead grass; **Taipei County.** Hsintien City, Wenhua Road, T.-C. Chang s. n., 29 VII 1994, on dead leaves in flower plot; Wulai, Hsinhsien, C.-H. Chung M742, 28 IX 1994, on plant debris; **Taoyuan County.** Chungli City, campus of the National Central University, C.-H. Chung M1894, 17 VII 1997, on dead leaves of *Ficus microcarpa* and *Acacia confusa*; **Taichung County.** Wuling Farm, Mt. Tao, C.-H. Chung M607, II 1994, on dead leaves; **Changhua County.** Changhua City, campus of National Changhua Normal University, C.-H. Chung M1025, 28 IV 1996, J.-H. Wu 63, 28 III 1995, both on dead angiospermous leaves; Paoshan campus of National Changhua Normal University, C.-H. Chung M1387, 9 IX 1996, on dead leaves of an unidentified monocot; **Tainan City.** Kuangfu campus of National Chengkung University, C.-H. Chung M1078, 19 V 1996, on dead angiospermous leaves; campus of National Tainan Teachers' College, Y.-H. Liu 20a, Y.-H. Liu 26a, both 5 III 1995, Y.-H. Liu 37, 12 III 1995, all on dead angiospermous leaves in dry gutter; **Pingtung County.** Kenting Park, Liu CHLB 742, Liu CHLB 746, 1 VII 1987, on plant debris; Liu CHLB744a, 1 VII 1987, on dead twigs; **Ilan County.** Sanhsing Hsiang, Chinshui Lake, around Lanyang Power Station, C.-H. Chung M1926, 23 VII 1997, on dead inflorescence of palm.

This species is commonly encountered on plant litter.

5. **Diderma platycarpum** Nannenga-Bremekamp, Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen, Series C 69: 359. 1966.

5a. var. **platycarpum**

Fig. 7 扁果雙皮黏菌

*Diderma* sp. sensu Wei & Liu, (1989: 48). pro part.

**Sporocarps** white, effused, being perforated plates or depressed long plasmodiocarps, very thin, usually about 0.1 mm thick. **Hypothallus** indistinct. **Peridium** double or appearing single, the outer layer white, calcareous; the inner layer membranous; lime globules fine, mostly less than 1  $\mu\text{m}$  in diam.; dehiscence irregular. **Columella** none. **Capillitium** usually hyaline, sometimes with brownish parts or rarely pale brown (C.-H. Chung M1884), coarse, branching and interconnecting. **Spores** dark brown in mass, pale brown in transmitted light, globose, 10 - 11 (-14)  $\mu\text{m}$  in diam., minutely warted, the warts usually evenly distributed. **Plasmodium** not observed.

**Taipei Metropolis.** main campus of the National Taiwan University, Y.-C. Chiang BY44M26, developed from a moist chamber (3 IV 1989 - 11 IV 1989) containing bark of *Callicarpa formosana*; W. C. Leong 201, 202, 1 XII 1993, plant debris on roof (3F); Liu CHLB115, 14 VI 1982, on bark of *Bischofia javanica*; D. S. Wei 4008, 31 V 1988, developed from a moist chamber containing bark of *Crescentia alta*; campus of the Affiliated

High School of the National Taiwan Normal University, *T.-C. Chang* 40, 2 X 1994, on bark of *Bischofia javanica*; *C.-H. Chung* M1444, 31 X 1996, on dead leaves of angiosperms; **Taoyuan County**. Chungli City, campus of the National Central University, *C.-H. Chung* M1884, 16 VII 1997, on bark of *Bischofia javanica*; Lungtan, Nantien Temple, *C.-H. Chung* M1913, 19 VII 1997, on bark of *Bischofia javanica*; **Kaohsiung Metropolis**. Tsuoying, *C.-H. Chung* M1426, 4 IX 1996, on bark of *Bischofia javanica*; **Kaohsiung County**. Luchu, Luchu Elementary School, *C.-H. Chung* M1969a, 10 VIII 1997, on bark of *Podocarpus* sp.

The distinctness of *Diderma platycarpum* and its variety has been questioned by Martin and Alexopoulos (1969) and Lakhanpal and Mukerji (1981), because these taxa are very similar to *D. effusum* in having white plasmodiocarps, minutely warted spores, and these taxa even share overlapping habitats (all can be found from plant litter). The combined morphological characters, especially the form of sporocarps (the tendency to form extremely flattened and often perforated plates) and constantly larger spores, make this species distinct from *D. effusum*. The specimens *C.-H. Chung* M1884 and *C.-H. Chung* M1913 have unevenly-warted spores, which are 11 - 13  $\mu\text{m}$  and 14  $\mu\text{m}$  in diam., respectively. In addition, the former varies from typical *D. platycarpum* by having pale brown capillitium. These specimens are tentatively identified as *D. platycarpum* var. *platycarpum*.

5b. var. **berkeleyanum** Nannenga-Bremekamp, Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen, Series C 69: 359. 1966.

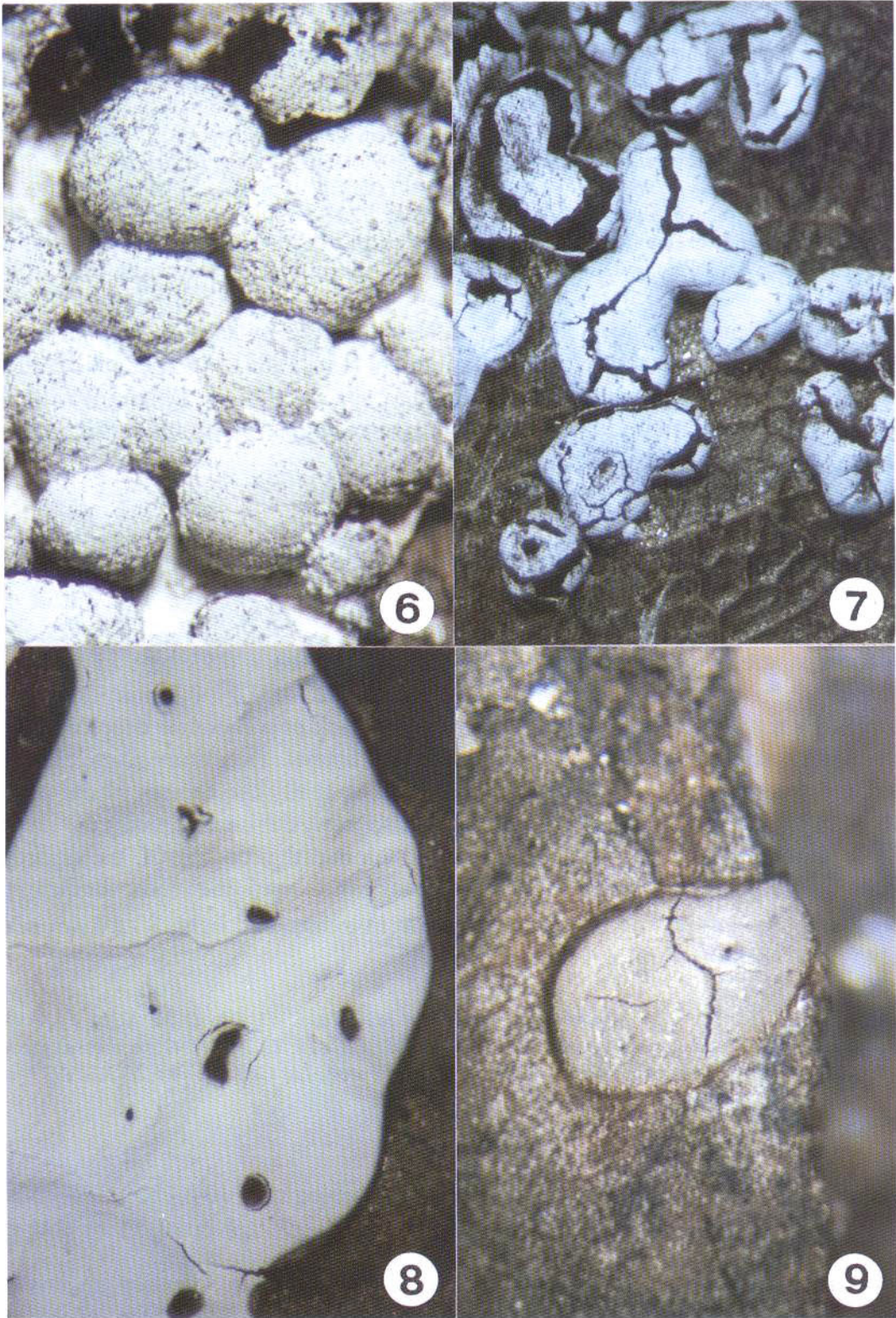
Figs. 8, 9 扁果雙皮黏菌柏氏變種

*Diderma effusum sensu auct. non* (Schweinitz) Morgan: Liu, (1983: 109); Chiang & Liu, (1991: 251).

*Diderma* sp. *sensu* Wei & Liu, (1989: 48). *pro part.*

**Sporocarps** white, effuse plasmodiocarpous, the plasmodiocarps usually perforated, occasionally accompanied with long plasmodiocarps and sporangia, white or rarely grayish brown due to the paucity of lime. **Hypothallus** indistinct. **Peridium** appearing single, lime globules (when present) about 1 - 1.5  $\mu\text{m}$  in diam. **Columella** none. **Capillitium** coarse, ca. 1  $\mu\text{m}$  wide, hyaline for most part with occasionally pale brownish portions (especially at joint points). **Spores** dark brown in mass, pale brown in transmitted light, (6 -) 7 - 8.5 (- 12)  $\mu\text{m}$  in diam., almost smooth to minutely warted. **Plasmodium** not observed.

**Taipei Metropolis**. main campus of the National Taiwan University, *C.-H. Chung* M503, 17 XI 1993, on dead leaves; *W. C. Leong* 39, 14 VI 1993, on dead angiospermous leaves; *W. C. Leong* 67, 27 IX 1993, on dead angiospermous leaf; *W. C. Leong* 135, 21 XI 1993, on dead inflorescence of *Livistona chinensis* var. *subglobosa*; *W. C. Leong* 198, 1 XII 1993, dead leaves of *Melaleuca leucadendra* on roof (3F); *W. C. Leong* 344, 1 I 1995, on dead leaves; *Liu* CHLB 380, 8 VI 1984, on bark of *Acer* sp.; *D. S. Wei* 3869, 18 V 1988, developed from a moist chamber containing bark of *Ficus* sp.; Erhtzupin, *Y.-C. Chiang* BY453M97, developed from a moist chamber (17 XI 1989 - 1 XII 1989) containing bark of *Pinus thunbergii* collected on 17 XI 1989; **Taipei County**. Shihliufentzu, *Y.-C. Chiang* BY466M99, *Y.-C. Chiang* BY477M106, developed from a moist chamber (4 XII 1989 - 23 I 1990) containing bark of *Pinus taiwanensis* collected on 4 XII 1989; *Y.-C. Chiang* BY469M101, *Y.-C. Chiang* BY476M105, *ditto* except fruiting bodies developed on 16 I 1990; *Y.-C. Chiang* BY480M107, developed from a moist chamber (4 XII 1989 - 16 I 1990) containing bark of *Pinus luchuensis* collected on 4 XII 1989; *Y.-C. Chiang* BY487M109, *ditto* except fruiting bodies developed on 14 I 1990; *Y.-C. Chiang* BY488M110, developed from a moist chamber (4 XII 1989 - ? I 1990) containing bark of *Pinus luchuensis* collected on 4 XII 1989; Wulai, *Liu* CHLB 155, developed from a moist chamber (22 VII 1982 - 13 IX 1982) containing unidentified bark collected on 25 II 1982; around Linkou Golf Course, *C.-H. Chung*



Figs. 6-9. Light microscopy of sporocarps of *Diderma* spp. Fig. 6. *D. spumarioides*, ca. 30X; Fig. 7. *D. platycarpum* var. *platycarpum*, ca. 20X; Fig. 8. *D. platycarpum* var. *berkeleyanum*, ca. 30X; Fig. 9. *D. platycarpum* var. *berkeleyanum*, limeless form, ca. 30X



.M1787, 29 VI 1997, on bark of *Acacia confusa*; Taishan Forest Recreation Area, C.-H. Chung M1804, 6 VII 1997, on dead bark; **Hsinchu City**. campus of the National Chinghua University, Y.-C. Chiang BY809M249, developed from a moist chamber (5 VII 1990 - 20 VIII 1990) containing bark of *Pinus elliottii* collected on 5 VII 1990; **Miaoli County**. Mt. Huoyen, Y.-C. Chiang BY1011M238, Y.-C. Chiang BY951M240, Y.-C. Chiang BY991M242, Y.-C. Chiang BY1002M244, Y.-C. Chiang BY1041M245, Y.-C. Chiang BY969M246, Y.-C. Chiang BY962M253, Y.-C. Chiang BY1016M263, developed from a moist chamber (9 VII 1990 - 16 VIII 1990) containing bark of *Pinus massoniana* collected on 9 VII 1990; Y.-C. Chiang BY1057M239, Y.-C. Chiang BY1068M241, Y.-C. Chiang BY968M247, Y.-C. Chiang BY1062M250, Y.-C. Chiang BY1010M251, Y.-C. Chiang BY1056M252, Y.-C. Chiang BY976M255, Y.-C. Chiang BY953M259, Y.-C. Chiang BY1035M260, Y.-C. Chiang BY1015M261, ditto except fruiting bodies developed on 20 VIII 1990; Y.-C. Chiang BY958M254, Y.-C. Chiang BY1055M256, Y.-C. Chiang BY1070M257, ditto except fruiting bodies developed on 23 VIII 1990.

This variety seems to be very common on bark of *Pinus* in Taiwan. The specimen Liu CHLB 155 was recorded to have a white plasmodium (Liu, 1983). Another specimen, Y.-C. Chiang BY1041M245, has limeless sporocarps. The specimen Y.-C. Chiang BY1015M261 presumably fruited abnormally. It has effuse plasmodiocarps, partly-brownish capillitium, and aberrant spores 7 - 10 (some 10×11)  $\mu\text{m}$  in diam.

6. **Diderma rugosum** (Rex) Macbride, The North American Slime-Moulds: 105. 1899.

Fig. 2 皺雙皮黏菌

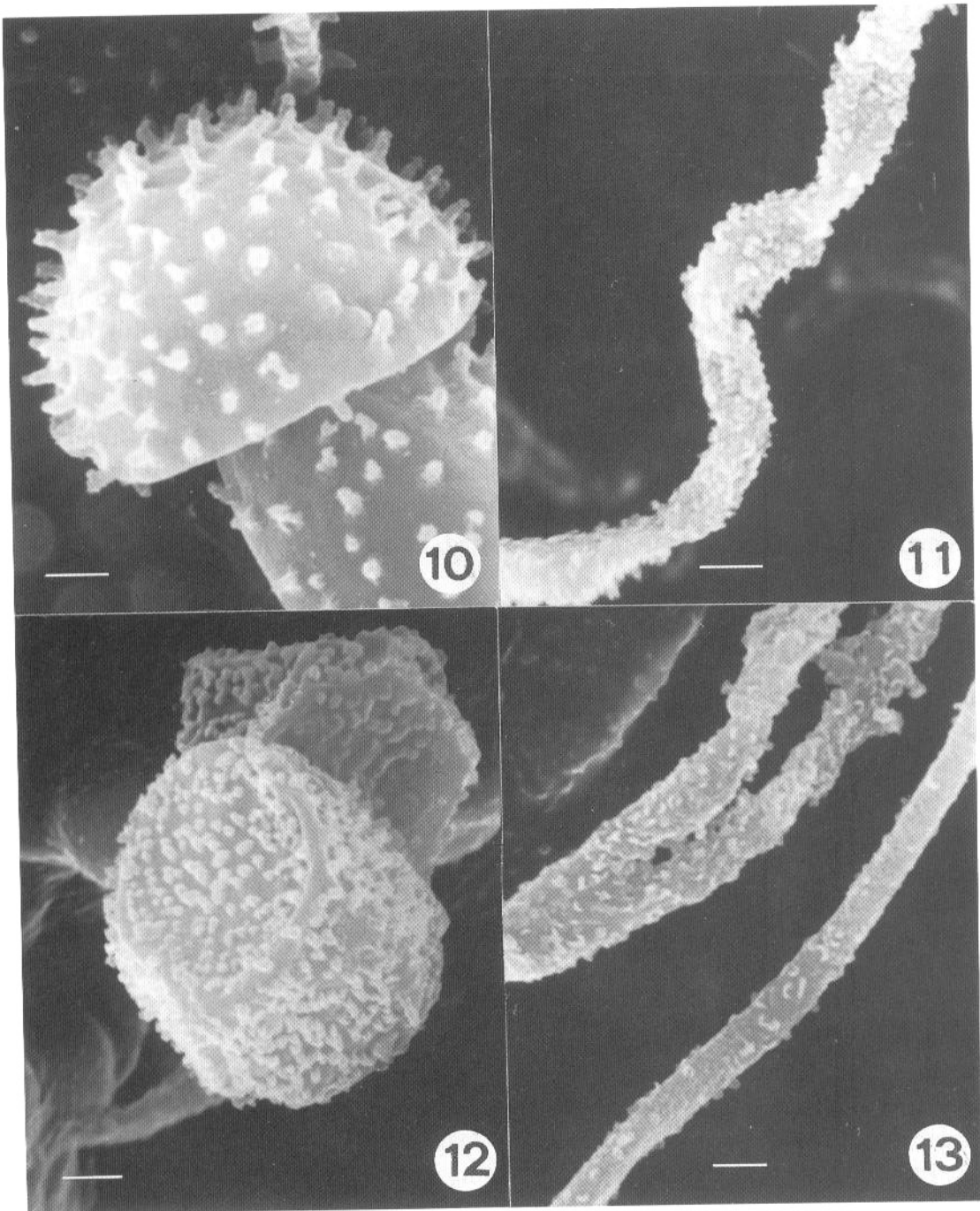
**Sporocarps** gregarious, sporangiate, stalked, (0.6 -) 0.8 - 0.95 mm in total height; sporophores white with a brownish base, subglobose, (0.25 -) 0.4 - 0.5 mm in diam. **Stalk** longitudinally striate, attenuating toward sporophore, black or sometimes deep brown on the upper half. **Hypothallus** concolorous with stalk, not distinct. **Peridium** single, reticulately wrinkled and forming polygonal platelets, white (occasionally the centers of the polygonal platelets with ochraceous tints), scantily charged with lime; dehiscence along the preformed ridges. **Columella** clavate, ochraceous, limy, attaining the center of the sporophore. **Capillitium** pale brown, varying to almost colorless toward the ends, branching and interconnecting. **Spores** brown in mass, pale brown in transmitted light, 8 - 10  $\mu\text{m}$  in diam., minutely warted. **Plasmodium** not observed.

**Taipei County**. Hsintien City, Kueishan, C.-H. Chung M2022a, C.-H. Chung M2023a, 7 IX 1997, on saxicolous bryophytes; Wulai, around Wulai Bus Station, Liu CHLB1279, 23 VIII 1997, on mosses growing on the concrete walls along the roadside; Nantou County. Huisun Forest, Liu CHLB1362a, 20 XII 1997, on dead wood.

7. **Diderma spumarioides** (Fries) Fries, Systematis Mycologici 3: 104. 1829.

Figs. 6, 10, 11 聯壁雙皮黏菌

**Sporocarps** white, sporangiate, sessile, less than 1 mm in diam., densely gregarious on a common hypothallus. **Hypothallus** conspicuous, white, limy. **Peridium** white, rough, appearing single; lime globules mostly 1.5 - 2  $\mu\text{m}$  in diam. **Columella** reduced to a broad base with pinkish tint. **Capillitium** almost colorless to violaceous brown, 1 - 2 (- 4)  $\mu\text{m}$  wide, thicker in lower part of sporangium, almost smooth except some very minute warts,



Figs. 10, 11. Ultrastructure of *D. spumarioides* under SEM. Fig. 10. Spores, bar = 1  $\mu\text{m}$ ; Fig. 11. Capillitium, bar = 1  $\mu\text{m}$ .

Figs. 12, 13. Ultrastructure of *D. testaceum* under SEM. Fig. 12. Spores, bar = 1  $\mu\text{m}$ ; Fig. 13. Capillitium, bar = 1  $\mu\text{m}$ .

sometimes containing crystal-like substances as nodules. **Spores** dark brown in mass, dark brown in transmitted light, distinctly spinose, (9 -) 10 - 12 (- 15)  $\mu\text{m}$  in diam. **Plasmodium** not observed.

**Taipei County.** Wulai, around Miaohsin Temple, C.-H. Chung M836, 6 XII 1994, on dead angiospermous leaf.

8. **Diderma testaceum** (Schrad.) Persoon, Synopsis Methodica Fungorum: 167. 1801.

Figs. 3, 12, 13 瓦雙皮黏菌

**Sporocarps** sessile sporangiate to short plasmodiocarpous, always depressed, in small groups, rounded (0.4 - 0.7 mm in diam.) or angular by pressure. **Hypothallus** indistinct. **Peridium** double, distant or closely adhered; outer layer porcelain-like, fragile, shining, white or with bluish tints; inner layer membranous; lime globules large, (1 -) 2 - 3 (- 4)  $\mu\text{m}$  in diam. **Columella** prominent, convex or reduced to a thickened, brownish orange or pinkish base. **Capillitium** hyaline, branching and interconnecting, often with brownish, fusiform swellings. **Spores** grayish brown in mass, pale brown in transmitted light, globose, 8 - 9  $\mu\text{m}$  in diam., almost smooth to minutely warted. **Plasmodium** not observed.

**Pingtung County.** Kenting Park, Liu CHLB 146, 15 II 1982, on dead angiospermous leaf; Liu CHLB 1109, Liu CHLB 1111, 23 VIII 1988, on dead angiospermous leaves and twigs.

Our specimens differ from typical *D. testaceum* in having white inner surface of outer peridium, however, other characteristics are in common to this species.

## DISCUSSION

The general patterns of geographical distribution, monthly appearance, and substrate relationship of each taxon are not evident from the specimens cited. Following is the brief discussion on the status in these aspects.

### Geographical Distribution in Taiwan (Table 1)

Specimens examined in this study were primarily collected in northern and western parts of Taiwan. The following counties completely lack records of *Diderma*: Chiayi, Yunlin, Hualien, Taitung and Penghu. Further investigations in these regions are needed.

Generally speaking, myxomycete collectors in Taiwan did not record the elevation of the collecting sites, neither on the specimen boxes nor in their field notebook. Efforts were made to estimate the elevation of these collecting sites by checking from local map. All the collecting localities are under altitude 1000m, except Mt. Tao at Wu-ling Farm (Taichung County), which is around 2000m in elevation. This clearly indicates that our present understanding of *Diderma* of Taiwan is largely based on lowland collections.

Table. 1. The distribution of *Diderma* spp. in Taiwan.

	TM	TP	TY	HC	ML	TC	CH	NT	CY
<i>D. chondrioderma</i>	•	•							
<i>D. effusum</i>	•		•	•*		•	•		
v. <i>effusum</i>									
<i>D. effusum</i>	•		•	•			•		
v. <i>pachytrichon</i>									
<i>D. hemisphaericum</i>	•	•	•			•	•		
<i>D. platycarpum</i>	•		•						
v. <i>platycarpum</i>									
<i>D. platycarpum</i>	•	•		•	•				
v. <i>berkeleyanum</i>									
<i>D. rugosum</i>		•						•	
<i>D. spumarioides</i>		•							
<i>D. testaceum</i>									
taxa known	6	5	4	2	1	2	3	1	0

Table. 1. Continued.

	YL	TN	KM	KS	PT	IL	HL	TT	PH
<i>D. chondrioderma</i>									
<i>D. effusum</i>		•			•				
v. <i>effusum</i>									
<i>D. effusum</i>									
v. <i>pachytrichon</i>									
<i>D. hemisphaericum</i>		•			•	•			
<i>D. platycarpum</i>			•	•					
v. <i>platycarpum</i>									
<i>D. platycarpum</i>									
v. <i>berkeleyanum</i>									
<i>D. rugosum</i>									
<i>D. spumarioides</i>									
<i>D. testaceum</i>					•				
taxa known	0	2	1	1	3	1	0	0	0

\* Based on Wang *et al.* (1981).

TM: Taipei Metropolis, KM: Kaohsiung Metropolis, TP: Taipei County, TY: Taoyuan, HC: Hsinchu, ML: Miouli, TC: Taichung, CH: Changhua, NT: Nantou, CY: Chiayi, YL: Yunlin, TN: Tainan, KS: Kaohsiung, PT: Pingtung, IL: Ilan, HL: Hualien, TT: Taitung, PH: Penghu.

### Monthly Appearance (Table 2)

A great majority of collections were recorded in lowland, where the phenological conditions are comparable, we thus tabulate the monthly appearance of *Diderma* of Taiwan for comparison. As indicated in Table 2, the sporocarps of *D. hemisphaericum* are absent from winter and *D. chondrioderma* appears in warmer seasons. *Diderma effusum* and *D. platycarpum* seem to fruit throughout the year. The emergence of other species within a year are randomly or irregularly in different seasons, which makes it difficult to distinguish any seasonal preferences.

Table. 2. Monthly occurrence of *Diderma* spp. in Taiwan.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
<i>D. chondrioderma</i>				•		•	•					
<i>D. effusum</i>	•	•*	•	•		•	•		•		•	•
v. <i>effusum</i>												
<i>D. effusum</i>				•			•			•		•
v. <i>pachytrichon</i>												
<i>D. hemisphaericum</i>		•*	•	•	•	•	•	•	•	•		
<i>D. platycarpum</i>				•	•	•	•	•	•	•		•
v. <i>platycarpum</i>												
<i>D. platycarpum</i>	•	•			•	•	•				•	•
v. <i>berkeleyanum</i>												
<i>D. rugosum</i>								•	•			•
<i>D. spumarioides</i>												•
<i>D. testaceum</i>		•						•				

\*: From localities higher than 1000m.

**Substrate relationship** (Table 3)

Most of the species in the genus *Diderma* collected in this work are mainly from plant litter, but *D. platycarpum* and *D. effusum* have extended their niches to living bark of trees. Most specimens of *D. platycarpum* var. *berkeleyanum* were harvested from living bark of *Pinus* incubated in moist chamber cultures. The specimens collected and identified as *D. effusum* by Chiang and Liu (1991) might be conspecific with *D. platycarpum* var. *berkeleyanum*. *Diderma chondrioderma* is known primarily from corticolous moss and lichenized fungi (Lister, 1925; Martin and Alexopoulos, 1969). Bryophytes can also serve as the habitat of *D. rugosum* (Martin and Alexopoulos, 1969).

Table. 3. Substrate relationship of *Diderma* spp. in Taiwan.

	associated with bryophytes	plant litter	bark of gymnosperms	bark of angiosperms	dead wood
<i>D. chondrioderma</i>	•				
<i>D. effusum</i>		•		•	
v. <i>effusum</i>					
<i>D. effusum</i>		•		•	
v. <i>pachytrichon</i>					
<i>D. hemisphaericum</i>		•			
<i>D. platycarpum</i>		•	•	•	
v. <i>platycarpum</i>					
<i>D. platycarpum</i>		•	•	•	
v. <i>berkeleyanum</i>					
<i>D. rugosum</i>	•				•
<i>D. spumarioides</i>		•			
<i>D. testaceum</i>		•			

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## 臺灣黏菌(九)：雙皮黏菌屬(絨泡黏菌目)

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### 摘 要

本文報導臺灣產雙皮黏菌屬八種兩變種並附檢索表。皺雙皮黏菌、聯壁雙皮黏菌與瓦雙皮黏菌為首次發現。此外對臺灣產雙皮黏菌屬的基質關係，出現月份與在臺灣各縣份的地理分佈作了討論。

關鍵詞：絨泡黏菌目，黏菌，臺灣，雙皮黏菌屬。

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